Università degli Studi di Ferrara

Ph.D. Course
in
Economics and Management of
Innovation and Sustainability

In cooperation with Università degli studi di Parma

CYCLE XXXV

Coordinator Prof. Emidia Vagnoni

Industrial Policy and Structural Change Sustainability

Theories and Practices in the Contemporary International Context

Scientific/Disciplinary Sector (SDS) SECS-P/06

Candidate
Dott. Prodi Elena

Supervisor
Prof. Di Tommaso Marco R.

TABLE OF CONTENTS

INTRODUCTION ..... *v*

PAPER 1 – Industry 4.0 policy from a sociotechnical perspective: the case of German competence centers 26

Published in: ***Technological Forecasting and Social Change****,* 2022, doi: *https://doi.org/10.1016/j.techfore.2021.121341*

PAPER 2 – Structural change and industrialization policy in Ethiopia: Lessons from the agro-industrial parks initiative *55*

Published in: ***L'Industria - Rivista di Economia e Politica Industriale****, 2021, doi: 10.1430/100323*

PAPER 3 – Local public spending, electoral consensus, and sustainable structural change *84*

Published in: ***Structural Change and Economic Dynamics****, 2022, doi: https://doi.org/10.1016/j.strueco.2022.06.013*

PAPER 4 – Do informal institutions matter for the economic resilience of European regions? A study of the post-2008 shock *128*

Published in: ***Economia Politica,*** *2023, https://doi.org/10.1007/s40888-022-00293-5*

PAPER 5 – Conceptualizing and measuring "industry resilience": Composite indicators for postshock industrial policy decision-making *165*

Published in: ***Socio-Economic Planning Sciences,*** *2022, doi: https://doi.org/10.1016/j.seps.2022.101448*

PAPER 6 – Does industry resilience matter for postshock industrial policy? A focus on tourism-related industries *207*

Published in: ***Tourism Economics***, 2023, *https://doi.org/10.1177/13548166231154314*

FINAL REMARKS *246*

INTRODUCTION

This thesis represents a three-year work – conducted also on-field – on industrial policy. Specifically, the results produced over this period of intense research and study are presented in this thesis and are articulated in six different papers, four of which have been published in highly reputed journals.

The thesis is organized as follows: the Introduction section frames the academic debate and the international context on which this thesis is grounded. In particular, I have presented the common theoretical ground shared by the six papers and highlighted potential research gaps in it. Then, I have detailed the general research questions to which the papers attempt to provide early answers. Finally, I have briefly presented each paper in order of appearance and specified which general answer each paper addresses.

The six papers follow.

Final remarks conclude the thesis. In this section, I have highlighted major results emerging from this work and attempted to link them to the academic debate and the theoretical framework presented in the Introduction. I have also highlighted future avenues of research.

Industrial policy debate in contemporary times

This thesis deals with industrial policies in contemporary times. Industrial policies identify government interventions that, by targeting specific industries, aim at governing the complex process of structural change affecting our economies and societies and steering it towards desired socioeconomic objectives, such as promoting productivity, innovation, inclusive and balanced growth, competitiveness, good jobs creation, territorial rebalancing, reducing dependence from foreign technology and environmental sustainability (Chang 1994, Chang et al. 2013; Cimoli et al. 2009; Stiglitz and Lin 2013; Bianchi et al. 2011; Di Tommaso and Schweitzer 2013; Lall and Teubal 1998; Barbieri et al. 2019; Tassinari 2019; Di Tommaso et al 2020a; Di Tommaso et al. 2020b; Ferrannini et al. 2021).

Since the late 1970s, the academic and political debates revolving around countries' economic policy had been dominated by a consensus over free-market principles. It is only in the aftermath of the 2008 global financial crisis that the interest of scholars and international organizations for industrial policy as a mean to reshape the structure of the economic activities and of the society as a whole has eventually revamped (Bang 2010; Mazzucato 2013; Di Tommaso and Schweitzer; Jewell et al. 2016; Bailey et al. 2019; Cardinale 2019; Aiginer and Rodrik 2020; Bailey et al. 2022). A variety

of trends - some of them representing a lingering effect of the financial crisis itself - have contributed to bring industrial policy back on the academic and political agenda: for instance, the continuing decline in manufacturing employment in the USA and Western European countries, coupled with disruptive technological change, has eroded political and academic consensus around the market-fundamentalist approach and pushed demand for greater government involvement in the economy. Moreover, Western markets and economies have started to fear the increasing competitive threat posed by China as well as its dominant position in some pivotal markets, such as the electric vehicle batteries and semi-conductors. China moving up the supply chain has thus pushed US and European economies to take steps to preserve their role as industrial powers. For instance, in March 2019, the European Council invited the Commission to present a new "assertive industrial policy allowing the EU to remain an industrial power": a call for action to which the Commission has responded by presenting a Communication on "A New Industrial Strategy for Europe" in March 2020.

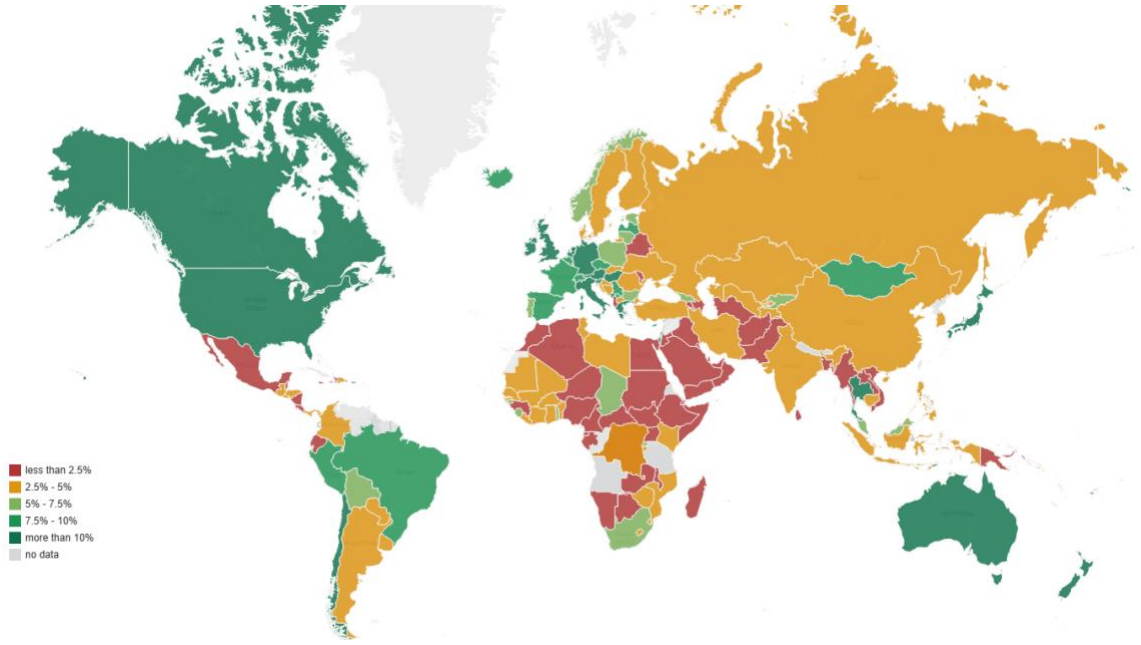
In the same vein, developing countries in Sub-Saharan Africa and Latin America have experience unsatisfactory rates of growth and of quality jobs in manufacturing as a consequence of Washington-consensus based economic recipes: in those context, industrial policy has thus started to be seen as a way to overcome potential issues arising along the trajectory of a developing economy, such as middle-income traps, failure to diversify the economy and premature deindustrialization (Rodrik 2016).

In addition, a growing body of research on real-word industrial policy practices has contributed to draw further attention on this topic, since studies have documented that several countries had made a conspicuous use of industrial policy (see e.g. Stiglitz and Lin 2013; Rodrik 2010; OECD 2011b; Mazzucato 2013; Pianta 2014, 2015; Aghion et al. 2011; Bianchi et al. 2011; Wade 2012; Chang et al. 2013; O'Sullivan et al. 2013; Warwick 2013; Di Tommaso et al. 2017). Main examples can be found across East Asian Economies, which have experienced a unprecedent growth over the past decades: China, for instances, has made massive use of industrial policy to select strategic industrial targets for the five years industrial plans (Petti, 2012; Petti et al., 2017; Lv and Spigarelli, 2016; Di Tommaso et al., 2013; Barbieri et al., 2019). Similar examples can also be found looking at Vietnam (Masina, 2012; Di Tommaso and Angelino, 2015; Angelino et al., 2020), Thailand (Natsuda and Thoburn 2013; Pollio and Rubini, 2015), South Korea (Cardinale, 2019; Tassinari et al., 2019) and many other newly industrialized countries. Actually, even the United States – in spite of the conventional wisdom that the U.S. "doesn't do industrial policy" (Bradford 2020) – has engaged in industrial policies for promoting the growth and competitiveness of its industries (Block 2008; Mazzucato, 2013; Di Tommaso and Schweitzer, 2013; Di Tommaso et al., 2017, 2019; Tassinari, 2019).

Hence, even if industrial policy has never really left the political agenda of several countries, the debate on their role has gained *momentum* only in the aftermath of the 2008 crisis, and even more after the outbreak of the COVID-19, when greater government involvement in the economy, including by means of an active industrial policy, has been acknowledged – and even invoked – by politicians, practitioners, scholars and the general public alike (Terzi et al. 2022).

In the early months of the pandemic – dramatically characterized by the loss of human lives – governments across the world have immediately responded to the spread of the COVID-19 disease through border closures, lockdown strategies and physical confinement measures to contain contagion. However, in the coronavirus pandemic, health, economic, social, environmental, and human crises have soon converged. Indeed, multiple waves of Covid-19 have unprecedently challenged not only public health systems, but also threatened food systems sustainability, disrupted trade linkages, and exposed the workforce to the risk of losing their livelihoods in developed and developing economies alike (IMF 2020). In this context, many countries have soon witnessed a growing role of the State into domestic economies (Prodi and Di Tommaso 2022): different types of supports, mainly in the forms of fiscal stimulus packages and industrial policy have been deployed worldwide (Figure 1) (IMF 2020; Ercolano and Alfano 2020).

Figure 1 - Additional Spending and Forgone Revenue in Response to the COVID-19 Pandemic *(Percent of 2020 GDP)*. Budgetary fiscal support to people and firms has varied widely across countries.



Source: IMF, 2020

For instance, in Europe, the «Next Generation EU» – a stimulus package of economic measures – has been deployed to support the recovery of the member States: conspicuous investments have been allocated to strengthen the industrial independence of the European countries by supporting industrial digitalization and ecological transition in production (Prodi and Di Tommaso 2022).

Overall, the pandemic seems to have laid bare the fragilities of the socio-economic systems built upon neoliberal economic recipes that, albeit being championed for decades in academic and political environments, has proved ineffective to deliver long-run, inclusive and sustainable prosperity (Dimakou et al. 2021; Bailey et al., 2015) as well as economic resilience face to unexpected shock (Martin and Sunley 2015).

In such a context of uncertain economic recovery and profound structural changes, to which currently adds up the geopolitical tensions and the energetic crisis related to the Ukraine-Russia war, countries and regions worldwide will have to tackle dramatic transformations related to the green transition, the digitalization of manufacturing and the reduction of foreign technology dependence, to mention a few. Moreover, international organizations and scholars (Beck 1986; OECD 2011a; Tiraboschi 2020, Hynes et al. 2020; World Economic Forum 2022) have warned governments that they should get used to tackle unexpected shocks of different nature in the upcoming years. Indeed, the Covid-19 pandemic cannot be considered an isolated event: other similar challenges in the near future will probably threat our economies and societies, due to the global interconnection of political, economic and commercial relations (OECD 2011a; Hynes et al. 2020). In general, government and scholars alike should start considering economic shocks as events that do not represent an exception to regular time anymore (OECD 2011a; Hynes et al. 2020).

Against this background, industrial policies are increasingly being acknowledged as the way forward not only for economic recovery, but also to anticipate and govern in a sustainable way the upcoming challenges threatening production dynamics and the underpinning economic systems and societies (Pianta and Lucchese 2020; Ferrannini et al. 2021; Prodi and Di Tommaso 2022; Terzi et al. 2022).

Industrial policy, structural change sustainability and societal goals

The recent debate around industrial policy emerging from the increasingly complex and interconnected scenario depicted in the previous paragraph has departed from standard industrial policy views. Classical rationales for industrial policy intervention were primarily grounded on fixing market failures, i.e., on the idea that industrial policy intervention should be limited to public goods provision, the management of externalities and to lowering risks associated to imperfect and

asymmetric information in the markets (Bator 1958). In this context, industrial policy was foremost conceived as interventions targeting industrial production to fix such alleged market failures, with the ultimate role of enhancing industrial productivity and competitiveness (Peneder, 2017).

These days, a growing body of studies contend that new priorities and rationales should drive industrial policy design and implementation, since, in the dynamic context of our globalized economies, mainstream economic assumptions seem ill-defined and not able to fully capture the complexity of contemporary production systems (Di Tommaso and Schwitzer 2013; Aiginger and Rodrik, 2020). Industrial policy should shift its attention away from what failures it must rectify and reorient its focus towards what aims it should be achieved instead (Di Tommaso and Schweitzer 2013). The debate on green industrial policy is a trailblazer in this field, for it has allowed societal and environmental issues to enter the industrial policy realm: indeed, decoupling industrial and economic development from resources depletions, pollution and waste production requires governments to engage also with the interrelated social and environmental aspects (Aiginger 2013; Rodrik 2014; Altenburg and Assmann 2017; Ercolano and Romano 2017; Aiginger and Rodrik 2020), in an attempt to overcome potential trade-offs.

Such a change in industrial policy perspective has found increasing support in light of the Agenda 2030 for Sustainable Development adopted by the United Nations in 2015 (UN, 2015): the latter is articulate din 17 Sustainable Development goals (SDGs) balancing the three dimensions of sustainable development – economic, social and environmental. It advocates for building a healthier, safer, fairer and a more prosperous world (UN, 2020). Also in view of this, a growing body of scholars contends that industrial policy goals in contemporary times should incorporate a normative perspective, i.e., a one that envisions new industrial policy objectives, targets and tools able to steer the evolution of the economy and the society ‘‘towards activities that are desirable in economic terms (improving efficiency), in social terms (addressing needs and reducing inequality), in environmental terms (assuring sustainability and preventing climate change)” (Pianta and Lucchese, 2016, p. 6; Ferrannini et al. 2021).

In this view, the scope of industrial policy should expand as well to unprecedently encompass all elements of contemporary production dynamics (including, for instance, agriculture and services and their interdependencies with the industrial sector): it is not limited anymore to manufacturing production, but it embraces a systemic perspective, holistically integrated with education and training, research and innovation policy, health policy, employment policy, trade policy, etc. (Aiginger, 2007).

From this theoretical advancements, a novel role emerges for industrial policy in contemporary times: industrial policy is not limited anymore to industrial productivity and competitiveness enhancement (Peneder, 2017); rather, as mentioned in the first lines of the Intruduction, it is tasked

with governing the process of structural change affecting contemporary production systems towards desired societal goals — such as inclusive growth and equal opportunities, poverty reduction, environmental protection, reduced inequality in the distribution of income and wealth, territorial rebalancing (Ferrannini et al., 2021; Sen, 2009, 2013; Myrdal, 1970)

In light of this, and for the sake of industrial policy design and implementation, further considerations and reflections should be done on the nature of the processes of structural change that industrial policy should govern.

Structural change is a multi-dimensional, open-ended process of economic adjustment characterized by shifts in the relative proportions of productive sectors and in the transformation of the underlying socio-economic features (Pasinetti, 1981,1993; Ocampo, 2020). In the presence of structural change dynamics, some sectors aim to expand and capture higher added value, profits, and market shares, while others seek to maintain their market positions or protect themselves from potential downsizing (Scazzieri, 2018; Cardinale and Scazzieri, 2018). From these premises, it derives that structural change is a conflictual process by nature and that it is neither a neutral process nor a zero-sum game: incompatible sectors' claims and interests in limited resources represent a significant source of conflict (in-between or within sectors) which might open new lines of disagreement or compromise in the socioeconomic realm or revive old cleavages.

However, conflictual interests and interdependence can be accommodated within the economic system only to a certain degree, beyond which the system's viability and sustainability are endangered and, eventually, seriously compromised (Lin, 2012, 2017; Di Tommaso et al., 2020a). Earlier contributions on this topic have mostly focused on the economic sustainability of structural change, contending that the system is economically sustainable to the extent that the investment in and maintenance of certain "stocks" to reproduce the inputs used in production are ensured and a production surplus is generated. (Hawkins-Simon 1949; Cardinale and Landesmann, 2017, 2020): i.e., until it demonstrates the ability to grow economically.

However, the economic dimension is not the only one that needs to be considered when speaking of sustainability of structural change (Di Tommaso et al., 2020a). Scholars and international organisations have pointed out that a plurality of interconnected dynamics exists in the context of structural change, encompassing the social and ecological realms and equally conditioning the sustainability of the system.

Studies on ecological sustainability have identified conflicting interests between actors and groups over access to natural resources, the burden of pollution, and the societal distribution of environmental benefits and costs (Ercolano et al. 2014; Mi et al., 2017; Liu et al., 2018). From an ecological standpoint, the sustainability of structural change is threatened by intensive energy

consumption in industrial processes and production-based carbon emissions, which are increasingly generating negative environmental externalities that might result in new waves of crises and system collapse (Worm et al., 2006; Tomlinson and Bailey 2022).

Recent contributions suggest that equal attention should be placed on the notion of social sustainability — broadly defined as a set of conditions that allow for improvements to the living conditions of current and future generations (Böstrom, 2012; Barbieri et al., 2020). It is undeniable that transformations in productive structures, coupled with the worsening economic conditions after the recession and the imposition of austerity policies, have entailed radical changes to the living conditions and rights of individuals and the aggregate demand for goods and services in the communities to which people belong (Pianta and Gerbaudo, 2015). In this context, the collective mobilisation for social rights and the pursuit of decent work for all have drawn scholarly attention, given the capacity of these phenomena to alleviate social tension (Della Porta and Portos, 2020; Rodrik and Sabel, 2019; Palestini and Pignataro 2022). Accordingly, these topics have been the focus of international strategies targeting sources of inequality and economic exclusion (European Commission, 2010; UNIDO, 2017). Further exacerbation of dualism in the labour market and social conflicts might deteriorate the social fabric, which underpins the economic prosperity of a country in the long run.

Overall, the process of structural change reveals a multifaceted nature of structural conflicts affecting the economic, environmental and social realms that, as a few scholars has recently pointed out (Ferrannini et al. 2021; Di Tommaso et al. 2020a) should be acknowledged by policy-making and reconciled through industrial policy to prevent the exacerbation of tensions across these reals and the system collapse.

In this perspective, a more complete conceptualization of industrial policy accounting for all of the aspects stated above – and thus a one that we adopt in this paper – envisions industrial policy as a public intervention governing the processes of structural change affecting contemporary production systems towards desired societal goals, while ensuring, in parallel, that such transformations are economically, socially and environmentally sustainable (Di Tommaso et al. 2020b; Di Tommaso et al. 2021; Ferrannini et al. 2021).

In the upcoming years, industrial policy will have to tackle major structural dynamics, namely: rapid economic growth and diversification of the economic system (which is particularly experienced by emerging economies, such as China after joining WTO in 2000); disruptions in production systems derived from severe global shocks (such as the 2007-2008 financial crisis and the emergence of the Covid-19 pandemic in 2020, and also geopolitical tensions related to the Ukraine-Russia war); the globalisation process itself, reshaping the configuration of global value chains and transforming the

division of labour at the international level (Bianchi and Labory, 2019; Pietrobelli and Rabellotti, 2011); disruptive technological changes such as the automation and digitalisation of production systems through the Internet of things, so called "Industry 4.0" (Barzotto et al. 2020; Tomlinson 2020; Prodi et al. 2022) and climate change transformations. All of these dynamics are characterized by idiosyncratic conflicts and juxtaposed interests that will require to be properly addressed and reconciled through policy actions oriented towards a sustainable structural change in order to reach desired societal goals.

Contemporary industrial policy: old critiques, novel solutions

The increasing popularity that industrial policies are experiencing these days, as well as their novel conceptualization, entails a huge test to governments' capacities to act for the public interest (Mazzucato and Kattel 2020); this unprecedent effort that is being done (and that will be done) by governments around the world has revamped traditional criticisms and fears surrounding industrial policy. Indeed, industrial policies have always attracted criticisms from a body of scholars pointing out typical circumstances and practices that could affect the efficiency and the effectiveness of government policies, ultimately leading to the failures of government interventions (Krueger, 1990; Le Grand, 1991; Chang, 1994, 2011; Buigues and Sekkat, 2009; Di Tommaso and Schweitzer, 2013; Schuck, 2014). The literature on "government failures" has highlighted that the design and implementation of a policy could suffer from internal and external pressures: indeed, a multitude of actors and stakeholders are in the position of influencing the process of target selection (Hirschman, 1970; Cardinale, 2017 ; Scazzieri et al., 2015). In this view, two major kinds of "failures" might arise in the stage of policy design, i.e. during the process of industry/sector selection, and implementation, ultimately leading governments to promote policy goals that represent particular interests rather than the general interest of a community (Krueger, 1990 ; Le Grand, 1991 ; Chang, 1994 ; Di Tommaso and Schweitzer, 2013):

1) Internal failures might arise since governments are complex organizations exposed to the lack of competences, scarce and asymmetric information, self-serving bureaucrats, internal competition and overlapping of competences, which might easily push policies away from the expected desired outcomes. Politicians or bureaucrats could themselves be potential internal sources of government failures by seeking prestige, power, higher salaries, or office perks, even when it implies acting to the disadvantage of the social output (Di Tommaso and Schweitzer, 2013, p. 36). Such behaviors might have an impact on how sectors are actually selected by governments, defining priorities and

preferential policies that have limited justification if confronted with those goals declared as the real rationales of the intervention.

2) External failures might arise since governments might be potentially vulnerable to the pressures coming from the most influential groups of the society or rent seekers: the latter know how to organize themselves, demand and obtain special policy attention and eventually divert resources for the general interest from the public budget to pursue their particular interests. Such behaviours nurture rent-seeking activities, clientelism, corruption, insane exchange of political consensus with policy intervention (see, e.g., Hirschman, 1970; Cardinale, 2017; Scazzieri et al., 2015). Hence, these dynamics might have an impact on how targets are chosen, making (since the very beginning), the policy process inefficient and ineffective.

Hence, external or internal pressures could favour "particular" interests over more general ones during the process of industry/sector selection. It follows that industrial policy might be better benefitted by those companies, territories and sectors that are more able to understand the advantage from the policy intervention and able to organize their capabilities to benefit from it. This means that policy support might be offered to those who do not actually or urgently need it. In this case, governments risk to support only the strongest and best organized interests, while leaving other targeted policy beneficiaries to lag behind if they are not able to recognize their latent needs and make them explicit.

In a nutshell, the literature on "government failures" has long questioned policy intervention since, for the above-mentioned reasons, it might distort market dynamics by "picking the winners" or "saving the losers".

The current debate on industrial policy, and the general emphasis attached to its use, seems to have partly overlooked this standard line of criticism. Even if the idea that industrial policy comes with a certain risk is an old one, it still holds these days. As detailed in the previous paragraph, structural change is, by its nature, characterized by idiosyncratic conflicts between juxtaposed interests: while patterns of interest group affiliations contribute to shape industrial dynamics at all levels (Andreoni et al., 2019), they can also have (more often than not) conflictual interests over different realms, included with respect to potential public budget allocation and interventions.

Moreover, even without the interference of internal and external stakeholders over the policy process, a good industrial policy does not rely on government's omniscience. Mistakes are an inevitable and necessary part of a well-designed industrial programme, especially those that deals with structural transformations, whose trajectory might not be a deterministic one and thus not known *a priori* (Rodrik 2014; Scazzieri 2018).

The ultimate implication of this argument is that transparent and rigorous frameworks guiding public action in promoting societal goals – while ensuring structural change sustainability – are needed (The Economist, 2010; Di Tommaso et al. 2020a). Indeed, while it is true that industrial policy, by definition, has to favour some industries or societal groups over others, government decision of favouring some groups over others should be a conscious and coherent one linked to the specific pursue of some societal goal in the public interest (Di Tommaso et al. 2020b). Hence, having mechanisms in place that recognise potential mistakes or shortcomings in policy design and implementation – allowing to adapt and rectify the policies accordingly – are keys to avoid side effects and to make sure that the policy goals set are reached.

A first attempt in this direction has been recently made by few studies that have proposed new conceptual frameworks and analytical tools to make government intervention more effective, efficient, and oriented towards a sustainable structural change (Ferrannini et al. 2021; Di Tommaso et al. 2020a). However, such issue is being overlooked in the contemporary debate on industrial policy, whereas it would deserve further considerations.

Research question, design and originality of the contribution

The previous paragraphs have framed the debate in which the present collection of paper is grounded. Specifically, I have highlighted that, considering the complex global scenario and the related challenges ahead, the contemporary debate on industrial policy ought to invest more in developing novel analytical tools and conceptual frameworks oriented towards structural change sustainability. In this perspective, such analytical tools and conceptual frameworks should be considered as a novel *modus operandi* for the design and implementation of contemporary industrial policy (Di Tommaso et al 2020a; Di Tommaso et al. 2021). From a political economy perspective, such *modus operandi* could support policymakers to overcoming potential information asymmetries affecting policymaking processes as well as to communicate – both to internal and external actors and stakeholders – why some sectors could be preferable over other, thus mitigating the rise of potential government failures, while increasing policy transparency and social accountability. In this view, by providing policymakers with reliable information on how different targets express different capacities to achieve certain desired policy objective, such analytical tools and conceptual frameworks could better link policy intervention with the desired policy goals and orient it towards a sustainable structural change.

Considering this research gap in the contemporary industrial policy debate, the collection of papers presented in this thesis explores, both from a theoretical and an empirical angle, how contemporary real-world industrial policy practices tackling structural changes can overcome the rise of potential government failures in order to eventually reach desired policy goals while ensuring structural change sustainability.

Specifically, the papers attempt to provide an answer to the following research questions (RQs):

1) How do industrial policy practices in the contemporary context govern structural change processes towards desired goals? How they ensure structural change sustainability?

2) Which are the potential advancements on the nexus industrial policy-structural change sustainability-government failures?

   2a) Specifically, what novel conceptual frameworks might guide policymakers in identifying how different targets express different capacities to achieve certain desired policy goals?

   2b) Specifically, what analytical tools might embody a novel *modus operandi* for industrial policy design and implementation to make government intervention better linked to the desired policy and oriented towards a sustainable structural change?

Overall, the collection of papers here presented provide preliminary answers to these research questions, in an attempt to push forward the debate on contemporary industrial policy design and implementation, especially in the light of the global context and of new theoretical angles sketched in the previous paragraphs. Clearly, they provide neither exhaustive answers to the research questions stated above, nor they aspire to this. These papers represent only a small piece of a larger and more complex puzzle that needs the contribution and reflections of more scholars in the futures.

The research design used to investigate the abovementioned general questions (further articulated and detailed in each one of the sixth papers presented) combines quantitative and qualitative methods.

Specifically, qualitative methods in the form of case study research (Yin 2014) have been used in the paper 1 (Industry 4.0 policy from a sociotechnical perspective: the case of German competence centers) and paper 2 (Structural Change and Industrialization in Ethiopia: Lessons from the Agro-Industrial Parks Initiative) to explore how industrial policy practices in the contemporary context govern structural change processes towards desired goals and how they ensure structural change sustainability (RQ1).

Quantitative methods in the form of econometric analysis are used in paper 3 (Local public spending, electoral consensus, and sustainable structural change) and 4 (Do informal institutions matter for the economic resilience of European regions? A study of the post-2008 shock) where novel conceptual frameworks are developed and tested as a mean for policymakers to identify how different targets express different capacities to achieve certain desired policy goals (RQ2a).

Quantitative methods in the form of composite indicators (CIs) building are used in paper 5 (Conceptualizing and measuring "industry resilience": composite indicators for postshock industrial policy decision-making) and 6 (Does Industry Resilience matter for postshock Industrial Policy? A focus on tourism related industries). The latter develop and apply novel analytical tools that decision-makers could incorporate in industrial policy design and implementation to make government intervention better linked to the desired policy and oriented towards a sustainable structural change (RQ2b).

Based on these premises, this collection of papers is structured as follows:

The first paper ("Industry 4.0 policy from a sociotechnical perspective: the case of German competence centers") deals with RQ1. It presents the illustrative case of a policy initiative deployed in Germany, named "Mittelstand 4.0: digital production and work processes" launched in 2015 and still ongoing, targeting the creation of a number of intermediary organisations tasked with supporting SMEs to adopt Industry 4.0 solutions and, more broadly, engage with manufacturing digitalisation.

Industry 4.0 (also called "The Fourth Industrial Revolution") represents a major process of structural change associated with the emergence of a new manufacturing model characterized by the adoption of "a host of new technologies changing the organisation of production as well as modes of productions and consumption" (Bailey et al., 2018, p. 1571). Modern digital technologies are often considered to be the main drivers of this change in industrial production (Schwab, 2016; Reischauer, 2018; Culot et al., 2020). Nevertheless, a growing body of literature suggests that Industry 4.0 cannot and should not be reduced to technical aspects, but it should be considered as a "sociotechnical" transformation, since idiosyncratic aspects related to the workforce and to the social realm exist and should not be overlooked but rather acknowledged and accounted for in policy initiatives for Industry 4.0.

This paper explores how the policy initiative – relying on intermediary organizations – has enabled across German SMEs such complex sociotechnical transition characterized by dynamic interactions between human actors, institutions and technologies. Empirical insights on Industry 4.0 policy design and implementation are presented. Finally, more general policy implications and principles are drawn

and discussed with the aim of fueling industrial policy debate and providing a tentative answer to RQ1.

The second paper ("Structural Change and Industrialization in Ethiopia: Lessons from the Agro-Industrial Parks Initiative") deals with RQ1 as well. The article analyses the process of the design and implementation of the Integrated Agro-Industrial Parks Initiative, which the Ethiopian Government has identified as one of the main pillars to achieve agricultural modernization, rural industrialization and ultimately the structural transformation of the economy and society in the country. The experience of the Integrated Agro-Industrial Parks, launched in 2009 and still ongoing, is a telling case of the Ethiopian political economy, which has long been characterized by a dirigiste developmental state deploying top-down policy initiatives. The article adopts a political economy perspective and highlights how a change in the political regime occurred in 2018 opened a window of opportunity for more policy stakeholders to enter the phase of policy implementation and thus partially correct the policy trajectory, which was showing major criticalities since its inception due to partial interests and rent seeking behavior influencing the policy design phase. The entering of new policy stakeholders, intentionally excluded from the policy design phase, has made the policy initiative to depart from its dirigiste, top-down approach and shift towards a multi-stakeholder and participatory initiative for the benefit of the targeted beneficiaries. Policy lessons and remarks are drawn in the conclusions.

The third paper ("Local public spending, electoral consensus, and sustainable structural change") deals with RQ2a. The article explores more in depth the idea that, to govern structural change in a sustainable way, policy initiatives should reconcile juxtaposed interests, to avoid the exacerbation of tensions and system's collapse. In particular, the paper frames the public spending – electoral consensus nexus and shows that it should be considered as a relevant one for policymakers that intend to govern structural change in a way that is sustainable for economies and societies.

The extent to which conflictual interests are reconciled can be measured via voting behaviors: the latter, can be influenced in turn by local public spending, which represent a channel to garner electoral consensus given its proximity and visibility to the final beneficiaries (Soss and Schram 2007; Pignataro and Prarolo 2020). In this view, local public spending represents a channel through which policymakers can reconcile juxtaposing interests and promote structural change sustainability.

We apply this framework to the case of Italy. Results yield insights for scholarly debate and implications for policymakers to garner the electoral consensus they need for governing structural change in a sustainable way.

The fourth paper ("Do informal institutions matter for the economic resilience of European regions? A study of the post-2008 shock") deals with RQ2a. The paper approaches the topic of "resilience", which has drawn considerable attention from scholars in the fields of regional economics and economic geography since the 2008 Great Recession. It has been used to explain why territories behave heterogeneously in the face of disruptive recessionary shock.

"Resilience" is a multifaceted term that has been used in several disciplines. In economic studies, it defines "*the capacity of a regional or local economy to withstand or recover from a shock to its developmental growth path, if necessary by undergoing adaptive changes to its economic structures and its social and institutional arrangements, to maintain or restore its previous developmental path, or transit to a new sustainable path characterised by a fuller and more productive use of its physical, human and environmental resources"* (Martin and Sunley 2015, p. 13).

In this paper, we have explored in depth how resilience has been conceptualized and applied in economic studies, in order to understand whether "resilience" could be a conceptual framework relevant also for industrial policy studies, particularly to guide policymakers in identifying how different targets express different capacities to achieve certain desired policy goals.

While conducting this investigation, we have identified that the relationship between informal institutions and resilience represents a potential research gap in the economic field. Thus, we have worked to fill this gap and investigated such a relationship across EU regions in the years following the 2008 Great Recession. Policy implications have been drawn from the results and discussed.

The fifth paper ("Conceptualizing and measuring "industry resilience": composite indicators for postshock industrial policy decision-making") deals with RQ2a and with RQ2b. The paper specifically deals with the question: can resilience be a relevant concept also for industrial policy? While this concept has caught the attention of regional economics researchers seeking to understand the different patterns behind regional recovery after a disruption, it is increasingly acknowledged that resilience can have policy-relevant conceptual applications in many other regards. In this paper, we apply "resilience" to industries and define the "industry resilience" concept and measurements. Our contribution is twofold. Theoretically, we frame industry resilience as a useful conceptual framework for policy-making to support the selection of industrial policy targets that are more capable of recovering after unexpected shocks.

Methodologically, we develop a composite indicator-based methodology supporting policy-makers in visualizing sectoral performances dynamically and multidimensionally and can be used to compare each sector both to other sectors and to its counterfactual performance. We have applied

such methodology to the US post-2008 shock and discussed the results by drawing policy implications.

The intuition on which this paper is grounded is that, from the perspective of structural change sustainability, postshock industry resilience can be both a valuable concept and a relevant analytical tool to inform decision-makers on how different sectors react to unforeseen shocks. In our view, policy-makers should be aware of such differences, especially given that industrial policy de facto, whether explicitly or not, targets specific sectors.

The sixth paper ("Does Industry Resilience matter for postshock Industrial Policy? A focus on tourism related industries") deals with RQ2a and with RQ2b and follows up the results produced by paper 5. This paper fine tunes the definition of industrial resilience sketched in paper 5, contending that *postshock industry resilience* represents a desirable societal goal, and thus an equally desirable policy goals, for it values the ability of an industry to withstand a shock and recover in its aftermath, thus preserving or even improving the economic and social conditions of the system.

In this view, we have further developed and applied the composite indicators-based methodology to the Italian case to measure *industry resilience,* showing to what extent sectors have reacted heterogeneously to the 2008 shock. In line with paper 5, we contend that "industry resilience", both as a novel conceptual framework and as an analytical tool, is not only crucial for framing industrial policy ensuring structural change sustainability, but it also contribute to mitigate the rise of potential government failures by increasing policy transparency and social accountability.

To conclude, the "Final remarks" section resumes the main arguments and results offered by this collection of papers in an attempt to answer the general research questions stated above and to contribute the international debate on contemporary industrial policy for structural change sustainability. Moreover, they acknowledge the general limits of the research conducted in these papers and highlight future potential trajectories for this line of research.

References

Aghion, P. , Boulanger, J. , Cohen, E. (2011). Rethinking industrial policy. Bruegel Policy Br. no. 4 .

Aiginger, K. (2007). Industrial policy: A dying breed or a re-emerging phoenix. Journal of Industry, Competition and Trade, 7, 297–323.

Aiginger, K. (2013). The ‘‘Greening” of industrial policy, headwinds and a possible symbiosis. WIFO Working Papers, 450/2013.

Aiginger, K., & Rodrik, D. (2020). Rebirth of industrial policy and an agenda for the Twenty-First century. Journal of Industry, Competition and Trade, 20, 189–207.

Altenburg, T., & Assmann, C. (Eds.) (2017). Green industrial policy. concept, policies, country experiences. Geneva, Bonn: UN Environment; German Development Institute / Deutsches Institut für Entwicklungspolitk (DIE).

Andreoni, A., Chang, H. J., and Scazzieri, R. (2019). Industrial policy in context: Building blocks for an integrated and comparative political economy agenda. *Structural change and economic dynamics*, *48*, 1-6.

Bailey, D., Cowling, K., & Tomlinson, P. (Eds.). (2015). New perspectives on industrial policy. Oxford: Oxford University Press.

Bailey, D., Clark, J., Colombelli, A., Corradini, C., De Propris, L., Derudder, B., ... & Usai, S. (2020). Regions in a time of pandemic. *Regional Studies*, *54*(9), 1163-1174.

Bailey, D., Pitelis, C., & Tomlinson, P. R. (2022). Place-Based Industrial and Regional Strategy–Levelling the Playing Field. *Regional Studies*.

Bailey, D. J., Glasmeier, A., Tomlinson, P. R., & Tyler, P. (Eds.). (2019). *Industrial Policy Back on the Agenda: New Technologies and Transformative Innovation Policies*. Oxford University Press

Bailey, C. Corradini, L. De Propris, (2018) Home sourcing’ and closer value chains in mature economies: the case of Spanish manufacturing, Cambridge J. Econ., 42(6) 1567 1584.

Bang, G. (2010). Energy security and climate change concerns: Triggers for energy policy change in the United States?. *Energy policy*, *38*(4), 1645-1653.

Barbieri, E., Di Tommaso, M.R., Tassinari, M., Marozzi, M., (2019). Selective industrial policies in China: investigating the choice of pillar industries. International Journal of Emerging Markets

Barbieri, E., Di Tommaso, M.R., Pollio C., Rubini, L., (2020). Getting the specialization right. Industrialization in Southern China in a sustainable development perspective, World Dev. 126, 104701

Barzotto, M., Corradini, C., Fai, F., Labory, S., & Tomlinson, P. R. (2020). Smart specialisation, Industry 4.0 and lagging regions: some directions for policy. *Regional Studies, Regional Science*, *7*(1), 318-332.

Bator, F. M. (1958). The anatomy of market failure. Quarterly Journal of Economics, 72
(3), 351–379.

Beck, U. 2013 [1986]. La società del rischio. Verso una seconda modernità. Roma: Carocci.

Bianchi, P. , Labory, S. (2011). Industrial Policies after the Crisis. Seizing the Future. E. Elgar, Cheltenham.

Bianchi, P., Labory, S. (2019). Industrial policy for the manufacturing revolution: Perspectives on digital globalisation. Edward Elgar Publishing, Cheltenham

Block, F. (2008). Swimming against the current: The rise of a hidden developmental state in the United States. Politics & Society, 36(2), 69–206.

Böstrom, M. (2012). A missing pillar? Challenges in theorizing and practicing social sustainability: Introduction to the special issue. Sustain.: Sci. Pract. Policy 8(1), 3–14

Bradford, A. (2020), The Brussels Effect, Oxford: Oxford University Press.

Buigues, P.A., Sekkat, K. (2009). *Industrial Policy in Europe. Japan and the USA. Amounts, Mechanisms and Effectiveness*. Palgrave Macmillan.

Canova, F., Coutinho, L., and Kontolemis, Z. G. (2012). *Measuring the macroeconomic resilience of industrial sectors in the EU and assessing the role of product market regulations* (Vol. 112). Publications Office of the European Union.

Cardinale, R., (2019). Theory and practice of State intervention: Italy, South Korea and stages of economic development. Struct. Change Econ. Dyn. Volume 4p, pp, 206–216 .

Cardinale, I., Scazzieri, R., (2018). Explaining structural change: actions and transformations. Struct. Change Econ. Dynam. 51, 393–404.

Cardinale, I. Landesmann, M., (2017). Exploring Sectoral Conflicts of Interest in the Eurozone: A Structural Political Economy Approach, in: Cardinale, I. D. Coffman, D., Scazzieri R. (Eds), The Political Economy of the Eurozone. Cambridge University Press, Cambridge, pp. 284–336

Cardinale, I., Landesmann, M., (2020). Generalising the Political Economy of Structural Change: A Structural Political Economy Approach. Struct. Change Econ. Dynam. https://doi.org/10.1016/j.strueco.2020.07.001

Cardinale, I. , (2017). Sectoral interests and 'systemic' interest: towards a structural po- litical economy of the Eurozone. In: Cardinale, I., Coffman, D., Scazzieri, R. (Eds.), The Political Economy of the Eurozone. Cambridge University Press, Cambridge, pp. 216–237 .

Chang, H.-J. (1994). The political economy of industrial policy. New York: St. Martin's Press.

Chang, H.-J. , Andreoni, A. , Kuan, M.L. , (2013). International industrial policy experi- ences and the lessons for the UK, policy report for the London: UK foresight future of manufacturing project. UK Gov. Off. Sci.

Cimoli, M., (2009). Industrial policy and development. In: Dosi, G., Stiglitz, J. (Eds.), The Political Economy of Capabilities Accumulation. Oxford University Press, Oxford.

Culot, G. Nassimbeni, G. Orzes, M. Sartor, (2020), The future of manufacturing: a Delphi-based scenario analysis on Industry 4.0, Technol Forecast. Soc. Change, 157 Article 120092. DOI: https://doi.org/10.1016/j.techfore.2020.120092

Della Porta, D., Portos, M., (2020). Social movements in times of inequalities: Struggling against austerity in Europe. Struct. Change Econ. Dynam. 53, 116–126

Di Tommaso, M.R. , Schweitzer, S.O., (2013). Industrial policy in America. Industrial policy in America. Breaking the Taboo, Cheltenham, UK and Northampton. Ed- ward Elgar, MA, USA.

Di Tommaso M.R., Angelino A. (2015), Hanoi tra Washington e Pechino. La crescita industriale vietnamita tra export - led growth e pianificazione selettiva, in "L'industria, Rivista di economia e politica industriale" 3/2015, pp. 351 -380

Di Tommaso, M.R. , Tassinari, M. , Bonnini, S. , Marozzi, M. (2017). Industrial policy and manufacturing targeting in the US: new methodological tools for strategic poli- cy-making. Int. Rev. Appl. Econ. 31 (no. 5) .

Di Tommaso, M. R., Tassinari, M., Barbieri, E., & Marozzi, M. (2020a). Selective industrial policy and 'sustainable' structural change. Discussing the political economy of sectoral priorities in the US. Structural Change and Economic Dynamics, 54, 309–323.

Di Tommaso, M.R. , Tassinari, M. , Ferrannini, A., (2020b). Industrial policy and societal goals. In: Pressman, S. (Ed.), A new look at the American case (from Hamilton to Obama and Trump). How Social Forces Impact the Economy, Routledge ISBN 9780367439002 .

Di Tommaso, M.R. , Tassinari, M. , Ferrannini, A. , (2019). Industry and government in the long-run: on the true story of the American model. In: Bianchi, P., Ruiz Duran, C., Labory, S. (Eds.), Transforming industrial policy for digital age: production, territories, and structural change. Edward Elgar Publishing, Cheltenham.

Di Tommaso, M.R., L. Rubini, E. Barbieri e M. Tassinari. (2021). Economia e politica industriale. Organizzazione della produzione, innovazione e politiche di interesse pubblico. Bologna: Il Mulino.

Dimakou, O., Romero, M. J., & Van Waeyenberge, E. (2021). Never let a pandemic go to waste: turbocharging the private sector for development at the World Bank. *Canadian Journal of Development Studies/Revue canadienne d'études du développement*, *42*(1-2), 221-237.

Ercolano, S., & Romano, O. (2018). Spending for the environment: General government expenditure trends in Europe. *Social indicators research*, *138*(3), 1145-1169.

Ercolano, S., Gaeta, G. L., & Romano, O. (2014). Environmental tax reform and individual preferences: An empirical analysis on European micro data. *Journal of Behavioral and Experimental Economics*, *51*, 1-11.

Ercolano S., Alfano V. (2020). Don't stop me now? Misure di lockdown e contenimento della pandemia. Econmia e Politica, ISSN: 2281-5260

European Commission, (2010). An integrated industrial policy for the globalisation era putting competitiveness and sustainability at centre stage. COM: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Brussels

Ferrannini, A., E. Barbieri, M. Biggeri e M.R. Di Tommaso. (2021). Industrial Policy for Sustainable Human Development in the post-Covid19 era, in World Development. Elsevier, vol.137.

Fromhold-Eisebith, M. (2015). Sectoral resilience: Conceptualizing industry-specific spatial patterns of interactive crisis adjustment. *European Planning Studies, 23*(9), 1675-1694

Hawkins, D., Simon, H.A., (1949). Note: Some conditions of macroeconomic stability. Econometrica 17, 245–248

Hirschman AO (1958) The strategy of economic development. Yale University Press, New Haven

Holm, J. R., and Østergaard, C. R. (2015). Regional employment growth, shocks and regional industrial resilience: a quantitative analysis of the Danish ICT sector. *Regional Studies, 49*(1), 95-112.

Hynes, W., Trump, B., Love, P., & Linkov, I. (2020). Bouncing forward: a resilience approach to dealing with COVID-19 and future systemic shocks. *Environment Systems and Decisions*, *40*(2), 174-184.

International Monetary Fund [IMF]. (2021). Fiscal monitor: Database of country fiscal measures in response to the COVID-19 pandemic.

Krueger, A. O. (1990). Government Failures in Development. in Journal of Economic Perspectives. 4 (3): 9-23.

Lall, S. , Teubal, M., (1998). 'Market-Stimulating' technology policies in developing countries: a framework with examples from East Asia. in World Development 26 (8), 1369–1385 .

Le Grand, J. (1991). The theory of government failure. *British journal of political science*, *21*(4), 423-442.

Lin, J. Y. (Ed.). (2012). New structural economics. A framework for rethinking development and policy. Washington: The World Bank.

Lin, J. Y. (2017). Industrial policies for avoiding the middle-income trap: A new structural economics perspective. Journal of Chinese Economic and Business Studies, 15(1), 5–18.

Liu, Z., M. Adams, R.P. Cote, Y. Geng e Y. Li. (2018). Comparative study on the pathways of industrial parks towards sustainable development between China and Canada. In Resources, Conservation and Recycling. Vol. 128.

Lv, P., Spigarelli, F., (2016). The determinants of location choice: Chinese foreign direct investments in the European renewable energy sector. Int. J. Emerg. Markets 11 (3), 333–356 .

Martin, R., and Sunley, P. (2015). On the notion of regional economic resilience: Conceptualization and explanation. Journal of Economic Geography, 15(1), 1–42.

Masina, P. , 2012. Vietnam between developmental state and neoliberalism –the case of the industrial sector. In: Chang, K.S., Fine, B., Weiss., L. (Eds.), Developmental Politics in the Neoliberal Era and Beyond: Critical Issues and Comparative Cases. Palgrave, London.

Mazzucato, M. (2013). *The Entrepreneurial State. Debunking Public vs. Private Sector Myths*. London and New York: Anthem Press

Mazzucato M., Kattel R. (2020), COVID-19 and Public-sector Capacity. UCL Institute for Innovation and Public Purpose, Working Paper Series (IIPP WP 2020-12), available at: https://www.ucl.ac.uk/bartlett/public-purpose/wp2020-12.

Mi, Z., Wei, Y.-M., Wang, B., Meng, J., Liu, Z., Shan, Y., Liu, J., Guan, D., (2017). Socioeconomic impact assessment of China's CO2 emissions peak prior to 2030. J. Clean. Prod. 142, 2227–2236

Natsuda, K., Thoburn, J., (2013). Industrial policy and the development of the auto- motive industry in Thailand. J. Asia Pacific Econ. 18 (3), 413–437. doi: 10.1080/ 13547860.2012.742690 .

O'Sullivan, E. , Andreoni, A. , López-Gómez, C. , Gregory, M., (2013). What is new in the new industrial policy? A manufacturing systems perspective. Oxford Econ. Rev. Econ. Policy 29 (2), 232–462 .

Ocampo, J.A. 2020. Industrial Policy, Macroeconomics and Structural Change. CDEP-CGEG WP No. 81, Columbia | SIPA, Center on Global Economic Governance.

OECD, (2011a). Future global shocks: Improving risk governance. *OECD Reviews of Risk Management Polices*.

OECD, (2011b). Towards Green Growth: A Summary for Policy Makers. OECD, Paris . Ohno, K. , 2009. "Avoiding the middle-income trap: renovating industrial policy for- mation in Vietnam. ASEAN Econ. Bull. 26 (1), 25–43.

OECD, (2021). *Strengthening Economic Resilience Following the COVID-19 Crisis: A Firm and Industry Perspective*, OECD, Publishing, Paris, https://doi.org/10.1787/2a7081d8-en.

Palestini, A., & Pignataro, G. (2022). Inequality assessment in a dynamic framework with heterogenous agents. Economia Politica, 1-26.

Pasinetti L.L., (1981). Structural Change and Economic Growth: A Theoretical Essay on the Dynamics of the Wealth of Nations. Cambridge University Press, Cambridge

Pasinetti, L.L., (1993). Structural Economic Dynamics: A Theory of the Economic Consequences of Human Learning. Cambridge University Press, Cambridge

Peneder, M. (2017). Competitiveness and industrial policy: From rationalities of failure towards the ability to evolve. Cambridge Journal of Economics, 41, 829–858.

Petti, C. , (2012). Technological Entrepreneurship in China. How Does It Work?. Edward Elgar, Cheltenham, UK and Northampton, MA, USA .

Petti, C. , Rubini, L. , Podetti, S., (2017). Government support and R&D investments ef- fectiveness in Chinese SMEs: a complex relationship. Asian Econ. Papers 16 (1), 201–226 .

Pianta, M. (2014). An industrial policy for Europe. *Seoul Journal of Economics*, *27*, 277-305.

Pianta, M., (2015). What is to be produced? The case for industrial policy. "Interecon. –Rev. Eur. Econ. Policy"50 (3), 139–145 N .

Pianta, M., Gerbaudo, P., 2015. In search of European alternatives: anti-austerity protests in Europe, in: Kaldor, M., Selchow, S. (Eds.), Subterranean Politics in Europe. Palgrave Macmillan, Basingstoke, pp. 31–59

Pianta, M., Lucchese, M., & Nascia, L. (2016). What is to be produced? The making of a new industrial policy in Europe. In Rosa-Luxemburg-Stiftung (Eds.), Progressive industrial policy for the EU? Outmanoeuvring neoliberalism, Brussels: Rosa-Luxemburg-Stiftung.

Pianta, M., & Lucchese, M. (2020). Rethinking the European Green Deal: An industrial policy for a just transition in Europe. *Review of Radical Political Economics*, *52*(4), 633-641.

Pietrobelli, C., Rabellotti, R., (2011). Global value chains meet innovation systems: are there learning opportunities for developing countries? World Dev. 39(7), 1261–1269

Pignataro, G., & Prarolo, G. (2020). Learning, proximity and voting: theory and empirical evidence from nuclear referenda. *Social Choice and Welfare*, *55*(1), 117-147.

Pollio, C., Rubini, L., (2015). Le contraddizioni delle politiche industriali selettive. Il caso dell'automotive in Tailandia, in L'industria, Rivista di economia e politica industriale. 3/2015 381–402. doi: 10.1430/81868 .

Prodi, E., Tassinari, M., Ferrannini, A., & Rubini, L. (2022). Industry 4.0 policy from a sociotechnical perspective: the case of German competence centers. in Technological Forecasting and Social Change, Volume 175, February 2022, 121341

Prodi, E. e M.R. Di Tommaso, (2022). Next Generation EU: azioni di politica industriale in tempi di pandemia. Rivista Economica del Mezzogiorno, n.1-2/2022

Rajesh, R. (2018). On sustainability, resilience, and the sustainable–resilient supply networks. *Sustainable Production and Consumption, 15,* 74-88.

Reischauer, W. Güttel, E. Schüßler, (2021) Aligning the Design of Intermediary Organisations with the Ecosystem, Ind. Innov., 28 (5) 594 619. DOI: https://doi.org/10.1080/13662716.2021.1879737

Rodrik, D., Sabel, C., (2019). Building a Good Jobs Economy. Harvard Kennedy School Faculty Research, Working Paper N° RWP20-001

Rodrik, D. (2004) Industrial policy for the twenty-first century CEPR Discussion Paper no 4767

Rodrik, D. 2010. The Return of Industrial Policy, http://www.project-syndicate.org/ commentary/rodrik42/English

Rodrik, D. (2016). Premature deindustrialization. *Journal of economic growth*, *21*(1), 1-33.

Scazzieri, R., 2018. Structural dynamics and evolutionary change. Struct. Change Econ. Dynam. 46, 52–58

Scazzieri, R. , Baranzini, M. , Rotondi, C. , (2015). 'Resources, scarcities and rents: technological interdependence and the dynamics of socio-economic structures'. In: Baranzini, M., Rotondi, C., Scazzieri, R. (Eds.), Resources, Production and Structural Dynamics. Cambridge University Press, Cambridge, pp. 427–484 .

Scazzieri, R., (2021). Decomposability and Relative Invariance: the Structural Approach to Network Complexity and Resilience. *Networks and Spatial Economics*

Schuck, P., (2014). *Why government fails so often and how it can do better.* Princeton University Press, Princeton.

Schwab, (2016). *The Fourth Industrial Revolution*. World Economic Forum, Geneva.

Sen, A. K., (2009). *The idea of Justice.* Cambridge, MA: The Belknap Press of Harvard University Press.

Sen, K., (2013). The political dynamics of economic growth. World Development, 47, 71–86.

Soss, J., Schram S.F., (2007). A Public Transformed? Welfare Reform as Policy Feedback. Am. Polit. Sci. Rev. 101(1), 111–127.

Stiglitz, J.E., Lin, J.Y. (Eds.), (2013). *The Industrial Policy Revolution I: The Role of Government Beyond Ideology*. Palgrave Macmillan, New York.

Tassinari, M., (2019). Capitalizing Economic Power in the US. Industrial Strategy in the Neoliberal Era, International Political Economy Series. Palgrave Macmillan, Cham

Tassinari, M., Barbieri, E., Morleo, G., Di Tommaso, M.R., (2019). Targeted industrial policy and government failures: insights from the South Korean experience. International Journal of Emerging Markets

Terzi, A., Singh, A., & Sherwood, M., (2022). Industrial Policy for the 21st Century Lessons from the Past (No. 157). Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

The Economist, (2010). The global revival of industrial policy, picking winners, saving losers: industrial policy is back in fashion. Have governments learned from past failures? 5 August 2010.

Tiraboschi, M., (2020). L'emergenza sanitaria da Covid-19 tra codici ATECO e sistemi di relazioni industriali: una questione di metodo. In M. Tiraboschi e F. Seghezzi (a cura di), Welfare e lavoro nella emergenza epidemiologica. Contributo sulla nuova questione sociale, volume V. Le sfide per le relazioni industriali. Adapt University Press, 1-26.

Tomlinson, P. R., & Bailey, D. (2022). Energy price freezes and business support are sticking plasters –here's how to protect UK families and companies from future crises.

Tomlinson, P. R., (2020), Industry 4.0, Regional Disparities and Transformative Industrial Policy. In *Revitalising Lagging Regions*, pp. 67-78. Routledge, 2020.

UN, (2015). Transforming our world: the 2030 Agenda for Sustainable Development. Resolution adopted by the General Assembly of the United Nations (A/RES/70/1), 25 September 2015.

UN, (2020). Shared responsibility, global solidarity: Responding to the socioeconomic impacts of COVID-19. United Nations Sustainable Development Group, March 2020.

UNIDO (United Nations Industrial Development Organization), (2017). Structural change for inclusive and sustainable industrial development. United Nations Industrial Development Organization, Wien

Wade, R.H. , (2012). Return of industrial policy? International Review of Applied Economics, 26 (2), 223–239 .

Warwick, K., (2013). Beyond Industrial Policy: Emerging Issues and New Trends, in OECD Science, Technology and Industry Policy Papers, no. 2. OECD Publishing http://dx.doi.org/10.1787/5k4869clw0xp-en .

World Economic Forum, (2022). Inflation: How are rising food and energy prices affecting the economy? Available online at:https://www.weforum.org/agenda/2022/09/inflation-rising-food-energy-prices-economy

Worm, B., (2006). Impacts of biodiversity loss on ocean ecosystem services. Science 314, 787-790 .

Yin, R.K. (2014). *Case study research: design and methods*. SAGE. Fifth edition

PAPER 1 – Industry 4.0 policy from a sociotechnical perspective: the case of German competence centers

Paper published as:

Prodi, E., Tassinari, M., Ferrannini, A., & Rubini, L. (2022). Industry 4.0 policy from a sociotechnical perspective: the case of German competence centers. in Technological Forecasting and Social Change**,** Volume 175, February 2022, 121341

Doi: https://doi.org/10.1016/j.techfore.2021.121341

Abstract

A growing body of literature suggests that Industry 4.0 is the result of complex interactions and coordination between technical and social aspects in pursuit of the digital transformation of production processes. Policy solutions and instruments adopted by governments at various levels of the system contribute to catalysing the sociotechnical changes underpinning Industry 4.0. However, the role of intermediary organisations in changing sociotechnical systems and overcoming ecosystem limitations remains largely unexplored. This paper aims at addressing this research gap.
Through extensive fieldwork, we explore the case of German competence centres created by the national government for supporting the digitalisation of SMEs to provide a greater understanding of how intermediary organisations operate in the context of a sociotechnical transition.
Specifically, we characterize the role of intermediary organisations in supporting innovation ecosystem participants in engaging with the sociotechnical changes underpinning the Industry 4.0 production system. We suggest the term *systemic meta-intermediary* for describing a network of intermediary organisations incorporating multiple and heterogeneous competences, with the ultimate goal of facilitating and shaping the transition of a complex sociotechnical system. Actionable insights into how intermediaries can accelerate sociotechnical transitions and extend the benefits generated within Industry 4.0 innovation ecosystems are offered.

Keywords:

Industry 4.0; Sociotechnical system; Intermediary organisations; Germany; SMEs; Competence Centres

JEL classifications:

O25, O33, O38, R11

1. Introduction

Industry 4.0 is associated with the emergence of a new manufacturing model characterized by the adoption of "a host of new technologies changing the organisation of production as well as modes of productions and consumption" (Bailey et al., 2018, p. 1571). Modern digital technologies are often considered to be the main drivers of this change in industrial production (Schwab, 2016; Reischauer, 2018; Culot et al., 2020). Nevertheless, a growing body of literature suggests that Industry 4.0 cannot and should not be reduced to technical aspects, as it is rather the result of complex interactions and coordination between technical and social aspects in pursuit of the digital transformation of production processes (Davies et al., 2017; Sony and Naik, 2020). Most studies on Industry 4.0 primarily address its technical aspects, the consequences for SMEs ensuing from the industrial usage of digital technologies, and the rationales and principles on which Industry 4.0 policy interventions should be grounded (Nazarov and Klarin, 2020; Li, 2018; Sung, 2018). In contrast, whether the policy solutions and instruments adopted by governments contribute to catalysing the sociotechnical changes underpinning Industry 4.0 has not been fully elucidated. In this view, intermediary organisations have recently received increasing scholarly attention (Kivimaa 2014; Edmondson et al. 2018; Matschoss and Heiskanen, 2018) for the pivotal role they can play in enabling the transitions of complex sociotechnical systems characterized by dynamic interactions between human actors, institutions and technologies. Intermediaries can undertake a set of heterogeneous roles across different system levels that Kanda et al. (2020), among others, have attempted to conceptualize based on the entities in between which operations occur. However, empirical studies on the role of intermediary organisations in changing sociotechnical systems are limited. In particular, how intermediaries overcome ecosystem limitations by expanding their knowledge base when it is related to complex sociotechnical transitions remains largely unexplored. Thus, this paper aims to address this research gap in the context of the profound sociotechnical changes associated with "Industry 4.0" that industrial production systems are experiencing.

By crossing the strand of literature on intermediary organisations and innovation ecosystems with the recent academic work on sociotechnical transitions and Industry 4.0, we aim to explore the following research question: how do intermediaries support innovation ecosystem participants in engaging with the sociotechnical changes underpinning Industry 4.0 production systems? More specifically, how can intermediaries favour the emergence of synergies across different system levels with the purpose of facilitating and shaping Industry 4.0 sociotechnical transition?

In view of this, we investigate the case of the German *"Mittelstand 4.0: digital production and work processes*" policy targeting the creation of a number of intermediary organisations tasked with

supporting SMEs to adopt Industry 4.0 solutions and, more broadly, engage with manufacturing digitalisation.

The contribution of our study is twofold. From a theoretical angle, we enrich the understanding of how intermediary organisations operate in the context of a sociotechnical transition. In particular, unlike prior studies, the use of a case study allows us to account for intermediaries' adaptive behaviours as a way of overcoming ecosystem limitations and expanding their knowledge base to reach the desired ecosystem outputs. Drawing from our findings, we suggest the term *systemic meta-intermediary* for describing a network of intermediary organisations incorporating multiple and heterogeneous competences that allow it to operate across different system levels (as well as to activate synergies between them), with the goal of facilitating and shaping the transition of a complex sociotechnical system.

From the perspective of policy-makers and intermediaries' managers, our contribution offers actionable insights not only on how intermediaries can accelerate sociotechnical transitions but also on how to scale up and extend the benefits generated within Industry 4.0 innovation ecosystems to digital laggards. Furthermore, the study informs policy-makers on how to appreciate and address the interdependencies among technological, organisational and human elements within the design of Industry 4.0 government interventions.

The remainder of the paper is structured as follows. Section 2 addresses the strands of literature upon which the research sits. Section 3 introduces the materials and methods adopted. Section 4 presents our findings, and Section 5 concludes by discussing the main theoretical and actionable insights gleaned, study limitations and implications for future research.

2. Background literature

2.1 Industry 4.0: a sociotechnical transition in the making

In the sociotechnical transition literature, a system is shaped by the dynamic interactions between human actors (including individual agents, organisations, social groups and networks), rules/institutions (cognitive, normative and formal/regulative) and technologies (including their production, diffusion, use and functionality) that coherently intertwine to fulfil societal functions (Geels, 2004). In this regard, industrial production systems are no exception. Recently, studies in the spectrum of this literature have highlighted that the complex and multifaceted interactions between technical and social aspects embedded in production systems are evolving in a novel industrial production paradigm triggered by the use of digital technologies in manufacturing processes (Butera, 2017; Sony and Naik, 2020). The label "Industry 4.0" encompasses these transformations, which have

attracted considerable scholarly attention (Pfeiffer, 2016; Bianchi, 2018; De Propris, 2016; Seghezzi, 2017; Schwab, 2016). Studies on the emerging sociotechnical configuration of the Industry 4.0 production system posit the disruption of conventional industrial organisations resulting from the emergence of new technological niches and the destabilisation of established regimes (i.e., relatively stable configurations of technologies, practices and rules/institutions) (Kivimaa et al., 2019; Robinson and Mazzucato, 2019). Specifically, Beier et al. (2020) organized most of the empirical scholarship produced on the subject into a systematic review: studies converge around the fact that the industrial usage of Industry 4.0 solutions is profoundly changing the way in which technological, organisational and human aspects combine within current production systems.

Concerning technological changes, embedding advanced digital solutions such as cyber-physical systems, the Internet of Things (IoT) and big data in production allows efficiency boosting and flexibility gains via sensible automation (Heng, 2014), real-time machine-to-machine interaction (Forschungsunion, 2013) and networked components of the supply chain, such as factory floors, production facilities, workers, suppliers and customers. Nevertheless, Industry 4.0 embraces a wider array of modern technologies (e.g., additive manufacturing, green technologies, wearable technologies, cloud computing, robotics, autonomous vehicles, biotech and nanotechnologies) that cut across sectors and complement the use of digital devices. The unprecedented fusion and networking of all these technologies enable "smart manufacturing" and customized mass production (Bianchi and Labory 2018; Beier et al., 2020, p. 10). In this context, firms' capability to adapt to changing standards and technology requirements enables organisational flexibility, which, in turn, supports business model evolution and new strategies for value creation (Bailey et al., 2018). In particular, the flattening of vertical production hierarchies and the shifts from centralized factory control systems towards decentralized decision-making are considered to favour the emergence of user-oriented, value-adding services attached to goods and to spur information integration across value chains (Corò et al., 2017), thus shortening distances between producers, suppliers and the market base. Human work is also experiencing profound changes in terms of roles performed and task reconfigurations (Goos et al., 2014; Arntz et al., 2016; Frey and Osborne, 2017). The likely upcoming trends envisioned by the literature relate to i) the intensification of human-machine interactions; ii) the phasing out of routines and repetitive tasks, thus requiring less physical/executive work but more cognitive and creative efforts (Helmrich et al., 2019); iii) the rise of new ergonomic principles; and iv) the growing importance of soft skills, life-long learning and on-the-job training (Tiraboschi, 2016).

Altogether, these sociotechnical changes in the configuration of current, relatively stable production systems alter numerous and interdependent mechanisms, resulting in a plurality of possible and unpredictable trajectories (Lombardi, 2017). Pioneering research on this subject

(Dallasega et al., 2018; Mittal et al., 2018; Sevinc et al., 2018; Raj et al., 2020) has shown that the complexity of these changes might discourage entrepreneurs and managers, especially in SMEs, from engaging with the digitalisation of industrial production. Indeed, the application of Industry 4.0 solutions is foremost firm-specific, thus challenging enterprises' capacities to access, absorb, recombine and apply a broad range of information, knowledge, and skill sets.

Additionally, recent academic work argues that firms struggle to autonomously address such challenges, suggesting that collaborative efforts among businesses, governments, R&D organisations, universities, labour unions and employer associations might sustain companies by identifying collective solutions to common problems and aggregating technology users and producers (Davies et al., 2017; Colombo et al. 2019).

In particular, Benitez et al. (2020) contend that sociotechnical transformations in production systems benefit from the consolidation of "Industry 4.0 innovation ecosystems", which the authors broadly describe as local collaborative networks particularly suited to allow SMEs to integrate complex resources and cocreate Industry 4.0 solutions. Innovation ecosystems may thus provide a suitable setting to enable SMEs to move towards Industry 4.0. Indeed, the complexity of this transition and the inherent interdependencies among technological, organisational and human components call for a systemic and multi-layered policy approach to promote and consolidate transformative processes at both the enterprise and ecosystem levels (Lombardi, 2017). However, limited empirical insights have been provided concerning how intermediaries enable sociotechnical change in the context of Industry 4.0 innovation ecosystems.

2.2 Intermediary organisations and sociotechnical transitions

The established literature in the spectrum of innovation systems and innovation diffusion has long conceived intermediary organisations as entities fulfilling brokerage roles addressing knowledge flows, network formation, resource mobilisation and information dissemination between suppliers and potential users to accelerate the rate and pace of adoption of innovation (Boon et al., 2011; Klerkx and Leeuwis, 2009). In this context, the seminal work by Van Lente et al. (2003) elaborated on the conventional bilateral approach to intermediary organisations and pioneered the idea of "systemic intermediaries" as "a new type of intermediary organisation, which functions at the system or network level" (p. 1). This construct was grounded on the acknowledgement that innovation processes were becoming increasingly complex due to the growing participation of heterogeneous actors and institutions as well as to the faster pace of technology advancements. This context, therefore, required complementing conventional one-to-one intermediation activities with further systemic tasks aimed at fixing system failures (e.g., the lack of cooperation, coordination or interaction between

stakeholders, resources and skills due to high transaction costs, information asymmetries or communication problems). This body of scholarship pointed out that no "ideal type" intermediary exists and that "each must be tailored to its innovation environment" (De Silva et al. 2018, p.74), thus identifying different kinds of intermediaries (Kivimaa et al., 2019). Such intermediaries exist in multiple systemic contexts, within which they develop their intermediary characteristics and shape the domains in which they operate.

A complementary line of research on the roles and activities of intermediary organisations has recently emerged in the spectrum of studies revolving around the concept of innovation ecosystems (Beaudry et al. 2021; Good et al. 2019). Innovation ecosystems tend to be organized by "keystone actors" (Mars et al. 2012, p. 279), such as system integrators or intermediary organisations, which "shape the interactions of ecosystem participants and govern the innovation processes in that ecosystem" (Reischauer et al. 2021, p.597). Specifically, intermediaries represent a key open governance mechanism whose activities (e.g., monitoring, membership, ownership, and knowledge search, production and diffusion between ecosystem participants) shape the knowledge base of an innovation ecosystem (Brenner 2007), creating internal and external value to ensure long-term ecosystem survival (De Silva et al. 2018). However, while this growing body of scholarship is leading to a better understanding of the supporting role of intermediaries in innovation ecosystems, a few research gaps need to be addressed. Particularly in the context of the rise of digital technologies and smart manufacturing, how companies innovate as participants in ecosystems remains a challenge to be surmounted. Indeed, especially in the presence of complex sociotechnical transformations, it is still necessary to shed more light on the role of intermediaries to support ecosystem participants in reaching ecosystem output (e.g., digitalisation of manufacturing). Likewise, few academic studies seem to have addressed the issue of how the structure of intermediaries aligns with contextual demands to better support ecosystem participants' search for knowledge and solutions (Kolodny, 2001; Reischauer et al. 2021).

More recently, systemic activities of intermediaries have increasingly received scholarly attention in relation to sociotechnical systems' transitions (Kivimaa et al. 2019). Indeed, the literature on sustainable transitions embraces a broad view of innovation, conceived as a change in existing sociotechnical systems, e.g., production systems, systems for energy, mobility and agri-food (Kant and Kanda 2019), where dynamic interactions between actors, networks, institutions and material infrastructure occur and constantly evolve within and in between niches (i.e., protected spaces in which radical innovation and experimentation take place), regimes and landscapes (the macro level of the aggregations) (Geels, 2002). In this view, innovation entails achieving systemic transformations and deep structural shifts encompassing system-related technologies, scientific knowledge, business practices, markets, and policies, as well as the underlying social organisation,

cultural values, and living standards. Recent studies have adopted this lens and have acknowledged that intermediary organisation functions have actually broadened over time (Howells, 2006; Kivimaa, 2014, Edmondson et al. 2018), thus contributing to such systemic transitions through multiple instruments. This evidence brought Kivimaa et al. (2019 p. 1068) to further elaborate on the concept of intermediaries, which they frame as key actors operating at the niche, regime, and landscape levels, "promoting an explicit transition agenda and taking the lead in aiming for change on the whole system level". Overall, intermediaries potentially contribute to sociotechnical system transitions by taking a normative stance towards niche creation and regime (de)stabilisation (Matschoss and Heiskanen, 2018). In this context, the frequently used term "system level" broadly refers to levels of aggregation within an innovation system at which systemic intermediation activities can occur. It must be remarked that the different levels of systemic actions that many kinds of intermediaries undertake still seem to have received little academic attention. A pioneering effort in this direction has been realized by Kanda et al. (2020), who conceptualize the levels at which intermediary operations are located according to the entities in between which the operations occur. In particular, they identified one comparative nonsystemic level of intermediation (intermediation in between individual entities) and three system levels: 1) intermediation in between entities in a network; 2) intermediation in between networks of different entities; and 3) intermediation in between actors, networks, and institutions.

This contribution is relevant for the present study because it shows that the heterogeneity of intermediation roles across different system levels and the intermediation activities between multiple networks and towards institutions are crucial to support sociotechnical system transitions. In other words, for intermediaries to contribute to sociotechnical transitions, their actions need to reach different systems levels going beyond individual entities. In this context, a relevant research gap to address is in precise regard to how intermediaries achieve sociotechnical systems' transitions by acting beyond individual firms and entities to reach the different system levels.

Our attempt to cross the strands of literature discussed above has allowed us to formulate the following empirical questions: how do intermediaries support innovation ecosystem participants in engaging with the sociotechnical changes underpinning Industry 4.0 production systems? More specifically, how can intermediaries favour the emergence of synergies across different system levels, as defined by Kanda et al. (2020), with the purpose of facilitating and shaping Industry 4.0 sociotechnical transition?

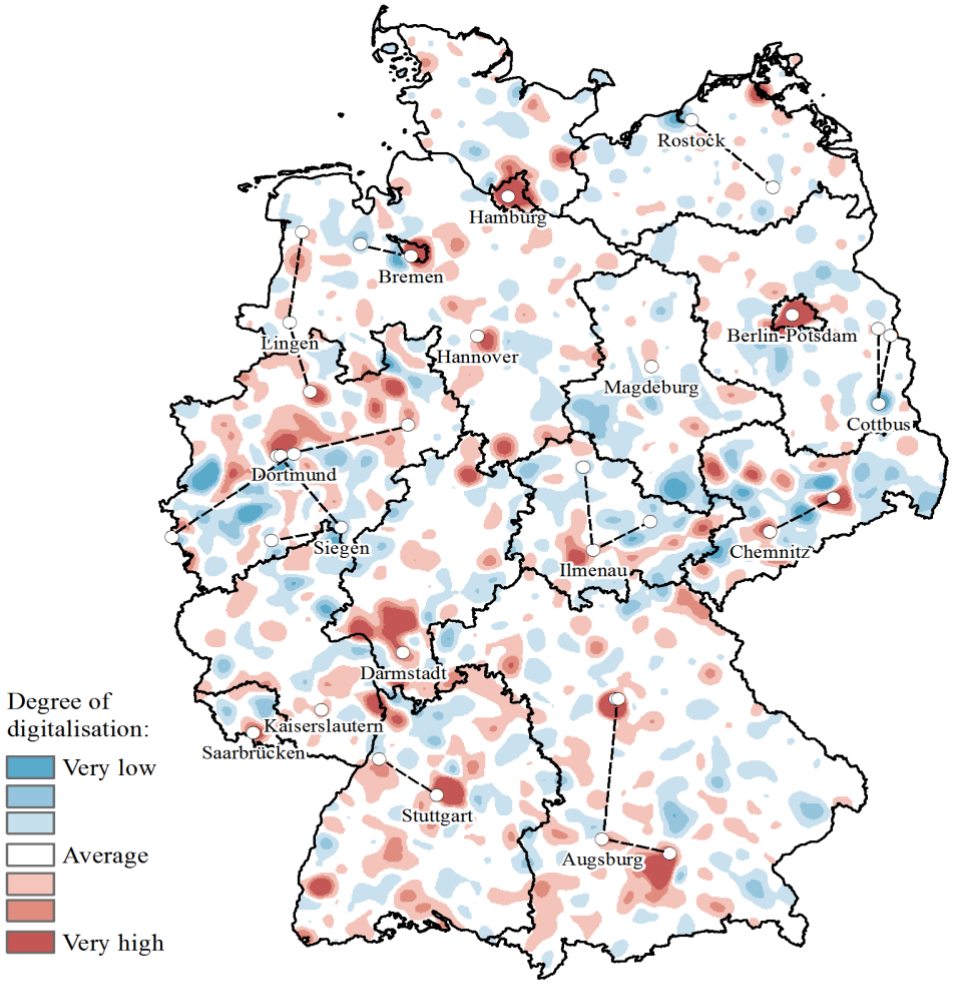
3. Materials and methods

3.1 Research design and case selection

We investigate the intermediaries' role and activities in supporting innovation ecosystems' participants in engaging with the sociotechnical changes underpinning Industry 4.0 production systems in the context of Germany.

Therefore, we rely on a case study research design (Yin, 2017; Gioia et al., 2012; Stake, 2005; Eisenhardt et al., 2016) because it is especially helpful in examining poorly understood phenomena in their natural settings and explicating processes related to "how" research questions (Langley, 1999). In particular, we use a single case study that enables us to account for an in-depth investigation of intermediaries' practices when ecosystem output relates to complex sociotechnical transformations, i.e., the digitalisation of manufacturing.

Figure 1. The location of the regional competence centres (white dots) and the degree of digitalization of SMEs within the state in which they operate.



Source: DigiBreadth Index calculated from the ZEW Mannheim Innovation Panel. Data are from the 2016 Community Innovation Survey; elaboration by the authors, Christian Rammer and Jan Kinne.

In particular, a single case study is particularly apt for our research goals. Our aim, in fact, is not to validate hypotheses or build theories (for which multiple-case studies usually provide a more suitable setting) (Yin 2004) but rather to perform an explorative analysis of this new phenomenon in its context to draw conceptual insights to support the actions of intermediary organisation managers and policy-makers.

To answer our research questions, we explore the case of the German *"Mittelstand 4.0: digital production and work processes*" policy. This initiative targets the creation of the competence centers (CCs) across the country (Figure 1). A CC is a network of innovation intermediaries located within the boundaries of a federal state, tasked with supporting both local innovation ecosystem participants (red areas in Figure 1) and more digitally backward SMEs (blue areas in Figure 1) in terms of their adoption of Industry 4.0 solutions and, more broadly, engaging with manufacturing digitalisation.

We explore this case since the context of its origin and its distinctive features make it the most appropriate candidate with respect to our research question.

The "*Mittelstand 4.0: digital production and work processes"* initiative is part of a broader and more comprehensive policy mix implemented by the German government (Davies, 2016). In the European context, Germany has been a first mover in the field of the industrial use of digital technologies, coupling the use of conventional policy instruments, such as R&D subsidies and tax deductions, with bottom-up initiatives in an attempt to collectively envision the direction of change. In particular, the early initiative "*Platform Industry 4.0*" launched in 2013[1] gathers representatives from government, business, trade unions and research institutes tasked with collectively achieving a shared understanding and common technical standards around the transformations in the technological domain (including IT security, legal frameworks, standardisation processes, and the security of networked systems), the organisational realm and the effects on human beings (BMWi, 2019).

As for the distinctive feature of the policy, the rationale behind the launch of the "*Mittelstand 4.0: digital production and work processes"* initiative is grounded in the fact that most SMEs in Germany were still slow adopters of digital technologies: in 2015, over 30% of German SMEs had introduced only basic elements of digitisation, and a mere 20% showed advanced digital maturity in their operational processes (ZEW, 2016). Moreover, German SME managers seemed to be not fully aware of the economic opportunities stemming from the digital transformation of their business; many of them lacked high-level managerial vision, computing and planning skills or even a strategy, fearing the potentially detrimental effects of Industry 4.0 on competitiveness (Müller et al., 2018).

[1] The policy originates from a cooperation agreement signed by the employers' associations BITKOM, VDMA and ZVEI, accounting for more than 6,000 member companies. The initiative was launched by the federal government with the aim of initiating thematic cooperation on Industry 4.0 extending beyond association boundaries.

In addition, poor interoperability and connections between firms' ICT systems prevented SMEs from benefitting from the industrial application of Industry 4.0 technologies (Stentoft and Brinch, 2020). Germany was one of the first countries to explicitly tackle the heterogeneous pace of the diffusion of digital technologies across its domestic industrial system, addressing the worrisome digital divide emerging between larger companies, start-ups, and SMEs (Stentoft and Brinch, 2020).

Indeed, "*Mittelstand 4.0*" represents one of the more comprehensive strategies devised at the national level to overcome SMEs' reluctance towards Industry 4.0 and the related challenges going forward. Following the launch of the initiative in 2015, in 2018, the government coalition agreement committed to enhancing and further expanding the existing network of CCs (German Coalition's Agreement, 2018). Furthermore, early outcomes and positive feedback from beneficiaries called for an extension of the timespan of initiative activities (BMBF and ACATECH, 2019). Finally, the popularity of the policy ensured the availability and accessibility of a wide range of information regarding its design and implementation. The next section describes the policy in detail.

3.2 Case study description

Eighteen CCs had been established across the country via public competitions occurring in three different funding waves over the 2015-2018 period (with a total budget of 140 million euros) [2]. Currently, each federal state hosts at least one CC (Figure 1).

A CC is a network made up of a limited number of intermediary organisations and nonmarket actors (ranging from 4 to a maximum of 10) experienced in technology development and knowledge transfer activities. Each CC leverages the competences embedded in the two categories of partners that the CC itself is made up of 1) research institutions and research and technologies organisations (such as universities and Fraunhofer institutes), where most Industry 4.0 applications and technologies are developed and tested and 2) nonmarket partners (such as chambers of commerce or industry organisations) familiar with SME needs. This arrangement ensures an appropriate mix of frontier research, technology transfer experience and expertise in tackling the challenges that SMEs face in expanding their business.

CCs are tasked with advising SMEs on the economic benefits of and issues related to the use of Industry 4.0 applications and supporting them in developing tailored solutions for business optimisation. In particular, CCs exclusively target SMEs located in their respective federal states.

[2] Additionally, 8 CCs have been established with a broader national scope and a focus on specific sectors and fields. The latter CCs offer specialized services for very specific industries and handle digitalization challenges not addressed by regional CCs.

Four types of services are offered free of charge: i) information and awareness-raising activities; ii) demonstration activities such as visits to smart factories and digitalized production plants along with access to environments for testing solutions and applications; iii) training courses and workshops offered to both firm managers and employees; and iv) tailored concept development and use-case services fitting SME-specific production cycles to optimize their business.

Each CC was granted a three-year funding package (plus funding for two additional years) of approximately 5–6 million euros. This budget might seem low, but it is appropriate for funded technology and knowledge transfer activities. In fact, CCs are established using existing facilities and leveraging the specific competencies of the partners, and funding cannot be used to conduct novel R&D activities. All CCs display cross-thematic and cross-sector focuses. As represented in Table 1, the CCs offer applications and solutions that address all main dimensions of sociotechnical change (technology, organisation, and human).

Table 1. ***Thematic and sector focuses of competence centres***

Location	Thematic Focus			Sector focus	Funding started in
	Technology	Human	Organization		
Berlin	x	x	x	A, C, E, F, M, L, T	2015
Darmstadt	x	x	x	A, C, E, F, M, L, S, T	2015
Dortmund	x		x	A, C, E, F, M, L, S, T	2015
Hannover	x	x	x	C, E, M, L	2015
Kaiserslautern	x	x	x	C, E, M	2015
Augsburg	x	x	x	C, E, M	2017
Chemnitz	x	x	x	C, E, M, L, S	2017
Hamburg	x	x	x	C, E, M, L	2017
Ilmenau		x	x	C, E, S, M	2017
Stuttgart	x	x	x	C, H, M, L	2017
Bremen	x			A, F, M, L	2018
Cottbus				A, C, E, F, M, L, S, T	2018
Lingen	x		x	A, C, E, F, M, T	2018
Magdeburg	x	x	x	A, C, E, F, M, L, S, T	2018
Rostock	x	x		M, S	2018
Saarbrucken		x	x	C, E, M, L, S	2018
Siegen			x	C, E, M	2018
Kiel			x	M	2018

Legend: A: Agriculture & forestry; C: Construction; E: Energy; F: Fishing; H: Health; M: Manufacturing and crafts; L: Logistics (transport & traffic) and mobility; S: Services; T: Trade

Source: Authors' elaboration based on interviews and factsheets

Finally, an independent national agency acting on behalf of the German Federal government, WIK GmbH, monitors the policy's implementation. Agency data for 2018 report that the knowledge and technology transfer measures implemented by CCs reached more than 60,000 SMEs (involving almost 107,000 employees) and approximately 78,000 employers' associations and chambers (involving almost 167,000 people).

3.3 Data collection

Data came from multiple complementary sources and were collected over a six-month period starting in February 2018. First, desk research was conducted to prepare for the fieldwork. We used both primary and secondary sources to retrieve information on the actors involved in the creation of the CCs, the amount and duration of funding, targets, and the timeline of the policy. Primary sources used include CC newsletters, brochures, videos, press releases, project proposals drafted by the consortium of partners to establish the CCs, and fact sheets reporting the distinctive features of each CC (e.g., location, organisations involved in its setup, services offered by technology, and thematic focuses). Secondary sources used include research reports commissioned by the federal government on state-of-the-art policy implementation, governmental statements, policy documents, and conference proceedings.

Next, fieldwork took place in Germany, specifically in the southwestern metropolitan areas of Stuttgart, Karlsruhe, Mannheim and Kaiserslautern. We conducted eighteen semistructured interviews, in person or over the phone, with nine directors of regional CCs, six officers involved in the daily activities of the CCs, one participant in an event organized by the CC in Stuttgart, and two officers of the independent national agency WIK GmbH (see Table 2).

The sample of interviewees ensured the full coverage of all the different regional contexts and all CC specialisations. The questions focused on 1) the internal CC organisation, actors involved and funding; 2) the nature of the services offered to the SMEs, how technology and knowledge transfer activities were conducted, and any practical problems associated with SME adoption of Industry 4.0 technologies and application; 3) any departure from the original goals set and how unforeseen events and requests from SMEs were approached; and 4) relationships with other CCs and with the national government. Interviews were taped with permission and later transcribed.

In addition, we visited the premises of the CCs headquartered in Stuttgart and Kaiserslautern by taking part in events, showrooms and training sessions organized for managers, employees and trade

union members and thus gaining further insights into how Industry 4.0 was addressed by the regional CCs and perceived by market actors.

Table 2. ***Interviews conducted during fieldwork***

#	CC	Position of the interviewee	Date	Medium	Duration
1	CC Siegen	Director of the CC	8.8.2018	Over the phone, taped	25'48''
2	CC Cottbus	Director of the CC	28.6.2018	Over the phone, taped	19'50''
3	CC Augsburg	Director of the CC	6.7.2018	Over the phone, taped	12'54''
4	CC Lingen	Director of the CC	25.6.2018	Via e-mail	
5	CC Hamburg	Director of the CC	26.6.2018	Via e-mail	
6	CC Dortmund	Director of the CC	22.6.2018	Via e-mail	
7	CC Bremen	Director of the CC	22.6.2018	Via e-mail	
8	CC Kaiserslautern	Director of the CC	14.5.2018	In presence, taped	1 h 20'15''
9	CC Stuttgart	Director of the CC	16.03	In person, taped	23'18''
10	CC Stuttgart	Officer at the CC. Employed at the Fraunhofer Institute for Manufacturing Engineering and Automation.	8.5.2018	In person, taped	1 h 28'25''
11	CC Stuttgart	Officer at the CC. Employed at the Fraunhofer Institute for Systems and Innovation Research.	15.3.2018	In person, taped	21'56''
12	CC Stuttgart	Officer at the CC. Employed at the employer association VDMa, the Mechanical Engineering Industry Association.	29.5.2018	In person, taped	20'06''
13	CC Stuttgart	Member of the work council of a firm in the goldsmith sector.	27.3.2018	Informal talk on the premises of the CC and later interviewed via e-mail	
14	CC Stuttgart	Officer at the CC. Employed at IHK, the Association of German Chambers of Industry and Commerce.	24.5.2018	In person, taped	1 h 27'07''
15	CC Kaiserslautern	Officer at the CC. Employed at the Institute for Technology and Work.	14.5.2018	In person, taped	1 h 20'15''
16	CC Ilmenau	Officer at the CC. In charge of the Marketing and Communication of the CC.	9.7.2018	Via e-mail	
17	WIK	Officer at WIK GmbH.	9.12.2019	Via e-mail	
18	WIK	Officer at WIK GmbH.		Over the phone, taped	

Source: Authors' elaboration

The repeated interactions with CC personnel and the visits to their premises allowed the authors to access further primary sources and engage in informal discussions with participants. Interview bias was limited by controlling for the consistency of answers from each interviewee and among different respondents, as well as through the continuous triangulation of information collected during desk research and fieldwork.

3.4 Data analysis

The analysis of the data involves three main stages. First, we used raw data to organize the case study by chronologically ordering the description of events.

Next, we juxtaposed raw data, notably interview transcripts, field notes and primary sources, against each other to determine their degree of convergence. In the second stage, raw data were classified to capture each informant's experience in conceptual terms while searching for emerging patterns related to the potential challenges that the CCs might have encountered upon diffusing Industry 4.0 solutions to SMEs and to the prospective solutions provided. Coding proceeded mostly using a lexicon of terms obtained from the informants and thus grounded in the data (e.g., "SMEs lack long-term strategies", "spontaneously intensified cooperation", and "practice-oriented approach"). As the coding proceeded, we were careful to progressively trace the emergence of unexpected challenges and difficulties and initiatives taken to overcome them and to sort them by type and in chronological order.

In the third stage, we followed Gioia et al. (2012) in performing axial coding, i.e., the process of seeking similarities and differences between the many first-order categories. The analysis proceeded iteratively to identify emerging patterns and achieve adequate conceptual categories. We then clustered and distilled the nascent second-order conceptual categories into a few key aggregate dimensions. Next, we built our data structure to form an appropriate framework that helps explain the phenomenon we observe and answer our research questions.

4. Findings

The case study findings presentation follows the structure illustrated in Figure 2. The four key aggregate dimensions broadly reflect the context-driven needs that brought CCs to gradually expand their activities from the nonsystemic level 0 to all other system levels 1, 2, 3 (as defined by Kanda et al., 2020 on the basis of the entities in between intermediation occurs). The results are thus presented according to this framework, which we use to draw relevant answers to our research questions.

Figure 2. *Data Structure*

1st-Order Concepts	2nd-Order Themes	Aggregate Dimensions
• SMEs focused on daily activities and lack long-term strategy workforce and business • Research actors involved in the CCs used to engage more often large firms to SME business environment • The portfolio of services offered by the CCs shows a practice- possible number of companies. • Early CC collaboration encouraged by the agency in charge	Eliciting latent demand SMEs Fostering cognitive and SMEs Easing interaction and	Non Systemic strategy System level 1:
related side • CCs struggle to fully meet the heterogeneous SMEs' fill their respective knowledge and competence gaps • Most collaboration efforts occurred in the form of bilateral collaborative practices • Bilateral collaboration improved the coverage of both services provided by CCs located in further regions • Creation of informal thematic "working groups" (WG) • At least one representative per CC involved in each WG	Tackling the Anchoring external specialist knowledge Fully tapping potential CCs Emerging policy Ensuring coherence by the government	System Level 2: Expanding ecosystem knowledge base System level coordination

1

4.1 Nonsystemic level O (intermediation in between individual entities): Developing an SME engagement strategy

The original design of the policy under analysis originally envisioned a network of regional-focused CCs serving the purpose of diffusing Industry 4.0 solutions exclusively among SMEs located

in their states. Each CC was tasked with offering SMEs a portfolio of services, which, as we observed, leveraged the scientific and technical knowledge produced in-house by the involved research partners, mostly represented by technical universities along with Fraunhofer institutes, which are primarily specialized in fields covering natural science and engineering and own know-how on how to carry out applied research in close cooperation with customers from industry and the public sector. It was hence not surprising to discover that all the CC directors were senior researchers employed at these research institutions. The other CCS partners, such as chambers of commerce and industry organisations, were in charge of marketing efforts, acting as channels through which to contact firms and encourage them to visit CC premises and access their services. However, interviewees reported that interactions between research partners and SMEs did not occur as smoothly as government officials had anticipated for three reasons.

First, historically, applied research institutes have usually been contracted either by larger enterprises seeking advanced technological solutions to enhance their production and business or by large system integrators aimed at jointly developing precompetitive technologies and concepts while rarely interacting with SMEs.

Second, the directors of the five CCs set up throughout the first wave of funding agreed that engaging in technology and knowledge transfer activities on digitalisation with SMEs was more difficult than they had expected. The directors stressed that SMEs have little awareness of how to use Industry 4.0 applications to improve their business and become more competitive since they are mostly focused on daily activities and lack long-term strategies. The director of the CC in Stuttgart, one of the strongest in terms of the number and typology of partners involved, stated the following:

> "*Adapting advanced digital and production technologies to SMEs is quite complicated, and even more complicated in the case of handcrafts, as technologies generated by researchers like me and my colleagues employed at Fraunhofer's are usually conceived for fitting the production cycles of big companies. They need to be adapted to the technology supports in SMEs, and the latter show a heterogeneous degree of technological readiness*".

Third, in the inception phase of the initiative, all CC directors realized that, by implementing bilateral transfer activities, they were multiplying the efforts and resources used, given that most of the SMEs were sharing the same kinds of fears and operational challenges related to the industrial usage of Industry 4.0 applications. As the director of the CC located in Kaiserslautern pointed out, such extra efforts were mostly geared towards fostering SME cognitive proximity to potential Industry 4.0 advancements and benefits:

"*Before any technology and knowledge transfer operation, we realized that, as partner of the competence centre, we need to help SMEs figure out their own business models because often they don't even know their model. German SMEs are usually specialized in a niche market, but a market strategy is lacking*".

Altogether, the unprecedented task of interacting with SMEs that CCs had taken over required more extensive engagement than what had been originally planned.

4.2 System level 1 (intermediation in between entities in a network): Nurturing knowledge circulation and absorption

CCs gradually started to devise alternative strategies, along with conventional bilateral interaction for more digitally mature companies, to address the abovementioned challenges and manage to elicit SMEs latent demand for innovation. Hence, drawing from their experience in applied research and technology transfer, all CCs engaged with the creation of more user-oriented content to raise SME awareness, e.g., through open-access webinars, videos, and case studies based on fact sheets showing the successful experiences of Industry 4.0 application implementation in other companies. All these materials were easily and publicly accessible online to reach out to the largest number possible of SMEs. Furthermore, the CCs started to gradually integrate information, demonstrations and training activities and adopt a practice-oriented approach to encourage SME participation; indeed, services were offered in the form of user-friendly languages, blended learning formats coupling collective knowledge sharing and cocreation initiatives with more customized, firm-specific support.

Moreover, so-called "micro-" and "macroprojects" (depending on the number of SMEs involved and their duration) were meant to support SMEs in developing concepts, use cases or niche technologies to tackle specific issues related to business optimisation, e.g., improving the decisional process by networking production and collecting all data on a cloud platform. For instance, the CC in Stuttgart ran, among others, a macro-project titled "*Ecosystem for E-mobility*" that brought together several partners (such as car suppliers, IT companies, energy suppliers and companies building infrastructures for electric vehicle charging) to combine their expertise and codevelop specific concepts or mobile applications for stakeholders composing the value chain in the field of mobility.

Micro- and macro-projects gained growing popularity among firms, and their demand intensified across all CCs. In view of this, federal government officials asked the CCs to further commit to this promising service and to perform "*as many projects as they could and disseminate the concepts produced in order to replicate them in other SMEs*", as reported by the officer of the CC in Stuttgart responsible for implementing macro- and microprojects.

The fieldwork unveiled major differences between the CCs concerning their thematic focus, the content of services delivered and ability to engage with SMEs. This heterogeneity was context-specific and mostly driven by the specific expertise and equipment owned by the partners running the CCs. As Table 1 shows, CCs showed advanced competencies in technical aspects and social elements of Industry 4.0. However, according to our interviews, only a few CCs managed to offer a portfolio of services covering both aspects. Most of the portfolios revolved around technologies and organisation-related solutions, somewhat lacking a focus on the human-related side.

Distinct differences among CCs also emerged during trainings, demonstration services and micro- or macro-projects. In general, showcases were organized, and SMEs were encouraged to visit them and to test specific technologies and solutions. From our sample, it emerged that only the CCs in Kaiserslautern and Dortmund offered guided tours at a real *smart factory*, showcasing only to SMEs located in those areas how a fully networked production process works. CCs located in other states offered access to more limited, although still advanced, services, such as laboratories where test beds and demo factories were made available. The same is true for training services, whose thematic focus reflects the in-house competencies of the CC partners (Table 1). For instance, the few CCs declaring to offer training on "work 4.0" approached different topics, e.g., human resource management and skills upgrading by the CC in Kaiserslautern, qualification and life-long learning for employees by the CC in Dortmund, and ergonomics and human-machine interactions by CCs in Saarbrucken and Siegen. This clearly reveals that human-related aspects of Industry 4.0 are complex, multifaceted and inextricably entwined with the technical aspects.

Overall, our findings highlight that each CC managed, through its distinctive competences and a portfolio of practice-oriented services, to aggregate and express SME latent needs around specific technology initiatives and projects. In particular, the efforts and actions pursued by the CCs expanded from targeting individual SMEs to enable a local network of SMEs for knowledge cocreation within the innovation ecosystem.

4.3 System level 2 (Intermediation in between networks of different entities): Expanding the knowledge base of Industry 4.0 innovation ecosystems

Several drivers soon contributed to the expansion of the knowledge base of the Industry 4.0 innovation ecosystems pivoting around the CCs.

A year after their inception, CCs started to struggle to fully meet the heterogeneous SME demand for services. Clearly, SMEs belong to different sectors and branches; hence, their queries were heterogeneous, reflecting the idiosyncratic economic specialisation and sectoral composition of a given state. Moreover, all CCs gradually started to understand that IoT technologies had aspects

interrelated with the workforce and SME organisational models, which could only be addressed through the incorporation of highly interdependent competencies from different domains. In other words, to address SME queries, the CCs needed to access and anchor external knowledge and capabilities, as no CC was able to provide an all-encompassing portfolio of services covering all Industry 4.0 solutions.

Actually, since the launch of the policy, the federal government has attempted to encourage collaboration between CCs through a common online platform and through conferences that the CCs had to organize twice during the funding period to publicly disseminate their activities. However, because the five CCs were located too far apart to organize joint initiatives, and travel costs were not covered by the budget, interactions between the five CCs during the first wave of funding were limited, primarily occurring during conferences.

Our fieldwork revealed that a decisive moment for the expansion of the innovation ecosystem knowledge base occurred after the onset of the second wave of CCs in 2017. The increased number of CCs, from 5 to 10, reduced physical distances, and many spontaneously started to seek out cooperation with each other, mostly with their neighbouring CCs for cost-opportunity reasons.

Physical proximity and knowledge complementarity on topics of mutual interest represented a recurrent rationale warranting collaboration in most of the interviews. For instance, early spontaneous collaboration activities emerged between the partners of the CC in Kaiserslautern and their neighbouring partners in Darmstadt and Saarbrucken on the topics of human resource management and IT security. Similar collaborations progressively intensified between all CCs in the form of pooling services to virtually integrate their portfolio of competencies. For instance, the director of the CC in Augsburg noted the following:

> "*We started to collaborate with the colleagues of the CCs in Stuttgart, but we have been gradually involved in other activities with the CCs in Chemnitz and Darmstadt. We have found topics of mutual interest, and we have complementary knowledge in our respective fields of expertise. Furthermore, the abovementioned CCs are located only a few hours by car from Augsburg. It would be a lot more difficult to cooperate with colleagues located further apart in Germany*".

All CCs included in our sample declared that they collaborated on a constant basis with other CCs, usually every 4 to 6 weeks, depending on the specific requests put forward by SMEs. In the majority of cases, this collaboration occurred through bilateral initiatives of mutual interest, ranging from the joint production of user-friendly factsheets on Industry 4.0 application (e.g., CC in Hamburg and CC in Hannover on industrial machine retrofitting) to the joint organisation of seminars and conferences

(e.g., CC in Augsburg and CC in Stuttgart on production technologies) or the exchange of personnel for events and training sessions (e.g., CC in Ilmenau and CC in Chemnitz on the topic of IT security).

To raise one example, a common feature found across CCs relates to SME concerns about the potential consequences of production digitisation for the workforce. In this regard, the CC in Kaiserslautern was one of the few to master the multifaceted social aspects of Industry 4.0 and helped other CCs fill their gap in this domain. An officer from the CC in Kaiserslautern stated the following:

> *"We have organized several events at ours and other CC premises and at the firms' premises to inform the employees that the use of digital technologies on the shop floor makes processes more efficient without necessarily involving firing workers. Rather, it might entail upskilling and new organisation of the workforce*".

The collaboration between CCs allowed each of them to virtually expand the number of topics covered by their portfolios and the activities targeting their respective network of local SMEs, e.g., the launch of projects addressing work 4.0 or the attempt to actively engage trade unions from all sectors to codevelop with SME solutions to reshape employees' tasks and skills, thus preventing layoffs and deskilling whenever possible.

Moreover, we observed that bilateral cooperation between CCs also developed as capacity-building efforts. CCs set up during the first wave of funding had an advantage over the others, namely, over the 8 CCs created through the third wave, in terms of experience and ecosystem development. For example, the incipient centre in Hannover sought support from the neighbouring mature centre in Kaiserslautern to set up a specific "readiness check procedure" to assess the digital maturity of SMEs and, more generally, to sort out its portfolio of services. The government encouraged such capacity-building practices in favour of incipient CCs by providing mature CCs with additional funds to serve this specific purpose.

Overall, each CC managed to match SME needs by tapping the experience and knowledge embedded in the CC partners and their respective networks of local SMEs. The anchoring of external knowledge prevented inward-looking behaviours from acting along three directions that simultaneously worked towards the expansion of the ecosystem knowledge base. First, each CC virtually expanded its portfolios, offering services covering both the technical and social dimensions of Industry 4.0 and hence meeting market-driven demand. Second, repeated interaction and collaboration gradually allowed the CCs to fill their respective competence gaps and incorporate novel capabilities via mutual learning. Finally, capacity-building cooperation favoured a faster expansion and consolidation of both incipient and less-equipped CCs.

4.4 System level 3 (Intermediation between actors and their networks and institutions): Multilevel directional coordination

The CCs' operations further evolved to aggregate their views regarding the nature of the sociotechnical changes. They soon operated to better connect with formal institutions (i.e., to ensure reciprocal alignment between their activities and the guidelines on manufacturing digitalisation produced by the government and within Industry Platform 4.0.) and informal (i.e., influencing the industrial environment and culture as well as public opinion on Industry 4.0 challenges and potential benefits).

The conferences organized quarterly by each CC to publicly disseminate their activities represented occasions for CC directors and officers to disclose ongoing collaborative practices. CCs, therefore, could discover the activities carried out by more distant CCs with whom they were not yet collaborating. This pushed CCs to commit ever further towards ecosystem participants by taking a shared normative stance around the nature of sociotechnical changes, whose complexity was only partially tacked by bilateral collaboration initiatives. In particular, informal working groups (WGs) were set up by CCs to exchange knowledge on collaborative practices, learn from one another and team up with different CCs.

Soon, agency WIK GmbH acknowledged the crucial role for the benefit of SMEs of such a sort of coordination mechanism for the success of the collaboration initiatives and for their further diffusion. The agency hence provided further support for the consolidation of the ecosystems as reported by an official from WIK GmbH and as confirmed by other interviewees:

> *"National independent agency WIK GmbH has encouraged these coordination efforts and the institutionalisation of the working groups*".

Therefore, the tentative efforts of self-coordination evolved and were systematized by the intervention of the government, which in March 2019 formally established six permanent WGs in an attempt to push the expanding ecosystems towards a more formalized configuration. Four thematic WGs and two strategic WGs were created.

The former revolved around macro-themes aggregating the major dimensions addressed by CC intervention, i.e., WG "Qualifications, human resource management and Work 4.0" dealing with socially related aspects of Industry 4.0, WG "Information and Technology Demonstrations" addressing technology-related domains and the realm of flexible and interconnected organisations, WG "IT security" tackling data protection systems and the management of decentralized data, and WG "Law" focused on data protection law and compliance with privacy law. WIK GmbH encouraged

the participation of at least one representative per CC in each of these WGs to secure a common governance of both social and technical aspects of Industry 4.0 and to foster collective learning and knowledge circulation among them.

For the two strategic WGs, WG "Marketing" aims at devising strategies to attract further SMEs to use CC services and to engage with the public debate on Industry 4.0, while WG "Leadership" can be conceived as a coordination mechanism to ensure a shared sociotechnical understanding of Industry 4.0 across all CCs and to align their activities accordingly. An official from WIK GmbH noted the following:

> *"There is no contractual obligation for CC directors to participate in strategic WGs. Nevertheless, it is absolutely necessary that they take part in them, especially in WG "Leadership". The latter brings together all the CC directors to shape a common vision of the initiative and coordinate their activities".*

Moreover, all WGs were formally established by WIK GmbH to ensure that the efforts of the CCs would go in the same direction as the Industry 4.0 strategy collectively devised at the national level by "*Platform Industry 4.0*". The latter represents the virtual venue in which the federal government, representatives of science and business, and trade unions have collectively defined a sociotechnical understanding of Industry 4.0 in an attempt to promote the digital transformation of domestic manufacturing in a coordinated and holistic fashion. In particular, through the WGs, WIK GmbH ensures coherence between topics addressed by the CCs and the thematic priorities envisioned by "*Platform Industry 4.0*" and by the government in their strategic policy documents on Industry 4.0 (BMBF, 2018). Overall, the interaction between CCs and the government and institutions gradually shifted from marginal, financial support to endorsement around the establishment of shared governance mechanisms to ensure coherence between the national Industry 4.0 strategy (top-down) and the contextual on-field CC activities (bottom-up).

5. Discussion and conclusions

Prior studies on intermediaries' support for innovation ecosystem participants have not accounted for the possibility of intermediaries overcoming ecosystem limitations and expanding their knowledge base through adaptive behaviours to reach the desired ecosystem outputs. The paper has demonstrated a case in which SMEs' adoption of Industry 4.0 applications and solutions facilitated by intermediaries is not the result of a deterministic or preconceived policy design with a known path forward but of adaptive behaviour. In fact, CCs have experienced a profound change in the activities

and roles carried out that could not have been predicted in advance. In particular, this trajectory is the result of a purposeful process led by CCs involving actors' participation in networks and coordinated actions with institutions to reach ecosystem output, that is, the digital transformation of production processes for the enhancement of domestic industrial competitiveness in global markets.

This research has thus exhibited how intermediaries can support innovation ecosystem participants and digital laggards in engaging with the sociotechnical changes underpinning Industry 4.0 production systems. In particular, to accomplish their mandate, we observe that the CCs had to undertake a piecemeal adaptation of the initial tasks and strategies driven by the contextual SME demand. Specifically, our research demonstrates that the CCs gradually started to operate on multiple system levels (Kanda et al. 2020), improving their activities between multiple networks and toward institutions to fully contribute to the Industry 4.0 sociotechnical transition.

5.1 Supporting innovation ecosystem participants to engage with sociotechnical changes

Our results highlight that CCs departed from the initial idea of performing transaction-based, bilateral intermediary activities approaching Industry 4.0 technology transfer as a linear, unidirectional process from CCs to a single SME. Limiting the activities to bilateral intermediation (nonsystem level 0) simply proved to be unfeasible. On the one hand, the CCs soon realized that SMEs shared common fears and resistances towards manufacturing digitalisation, inducing CCs to multiply efforts and wasting resources. On the other hand, technical aspects of Industry 4.0 were inextricably entwined with complex and multifaceted human-related elements. Consequently, the CCs had to devise new strategies and engage with unprecedented activities that led them to gradually operate across different system levels and between different actors, networks of entities and institutions.

First, CCs started working on "system level 1" by nurturing knowledge circulation and absorption between all ecosystem participants to ensure that Industry 4.0 knowledge sources were homogeneously accessed and available not only from the SMEs participating in the ecosystems but also to the digitally lagging SMEs geographically close to the relevant ecosystem. However, the complexity of this transition and the inherent interdependencies among technological, organisational and human components prevented CCs from adequately meeting the heterogeneous contextual demand coming from SMEs.

Thus, expanding the knowledge base of digital ecosystems by tapping the expertise of the whole network of CCs (system level 2) has proven necessary to enable each CC to fully address both the technical and social aspects of Industry 4.0. Strategic collaboration between the CCs has prevented the rise of inward-looking behaviours within digital ecosystems, an issue that would have hindered

ecosystem participants from adequately addressing manufacturing digitalisation. Altogether, CCs' adaptive behaviour induced by the complexity of the sociotechnical transitions led them to operate at the system levels 1 and 2 and soon to engage with institutions, thus also operating at the system level 3. The direction of change of production norms, culture and practices was thus steered through the setup of the four thematic WGs plus the two strategic WGs tasked with ensuring that a common sociotechnical understanding of Industry 4.0 was shared across all CCs and that their activities were implemented accordingly.

Furthermore, we show that intermediaries can adapt their behaviours not only to operate at different system levels but also to generate synergies between these levels and the entities (actors, networks, institutions) involved. In other words, while our study confirms that complex transitions require the government to nurture a mix of intermediaries on multiple system levels undertaking different roles and activities, our case demonstrates that such a mix of intermediaries can be networked in a single entity (e.g., the CC) that incorporates functions placed across all system levels. In this way, it is possible to avoid conflicts over resources and to generate positive spillovers for the benefit of ecosystem participants and more backward actors, with the ultimate purpose of facilitating and shaping complex sociotechnical transitions.

5.2 Systemic meta-intermediary in the context of sociotechnical transitions

CCs have managed to adapt their functions and activities to reach all system levels thanks to their initial configuration, that is, a network of intermediary organisations including two categories of partners: research and technology organisations on one side and chambers of commerce or industry organisations on the other. This configuration ensured an appropriate mix of competences ranging from frontier research, technology transfer experience and expertise in tackling the challenges SMEs face when expanding their business. To create the CCs, the government leveraged the existing institutional setting on the basis of the idea that networking heterogeneous digitalisation-related competences embedded in a wide array of intermediary organisations would have enabled more comprehensive support for ecosystem participants. Our research demonstrates that such a configuration allowed CCs to dynamically steer innovation ecosystems in a way that enabled SMEs to access and benefit from the multiple competences incorporated in the other CCs.

Thus, we demonstrate that placing heterogeneous intermediaries in different roles might not be a sufficient condition to reach the ecosystem output and, more broadly, the sociotechnical transition desired. In fact, our case shows that networking such heterogeneous intermediaries might represent an appropriate solution when the transition is particularly complex and requires synergies between individual actors (e.g., the SMEs), networks of entities (the intermediaries involved in the CCs but

also networks of SMEs and stakeholders involved in the development of niche technologies) and institutions (e.g., the existing policy mix, public opinion, industrial culture) that are placed across different system levels.

Thus, drawing from the analysis of our case, we suggest the term *systemic meta-intermediary* for describing a network of intermediary organisations that have multiple and heterogeneous competences, which allow it to operate across different system levels (as well as to activate synergies between them), with the goal of facilitating and shaping the transition of a complex sociotechnical system.

The term *systemic meta-intermediary* captures both the collaborative dimension between intermediary organisations operating at different system levels and the coordination of the synergies that intermediaries activate in between different system levels. Furthermore, drawing from our study, we contend that a *systemic meta-intermediary* contributes not only to accelerating sociotechnical transitions but also to scaling up the benefits generated, which encompasses not only ecosystem participants, but also expands to actors that are laggards and entities usually excluded from ecosystem dynamics.

5.3 Policy implications

Summarizing the main policy implications that can be drawn from our study, it can be argued that complex sociotechnical transitions need not only intermediary organisations operating on different system levels but also systemic *meta-intermediary* organisations (such as the CCs) able to generate synergies between these levels and the entities involved therein (actors, networks, and institutions).

As the case of German CCs has shown, the role of meta-intermediaries seems to be crucial for the success of Industry 4.0 policy, in that it allows us to trigger inclusive processes of innovation and development across different actors of the ecosystem, continuously expanding the knowledge base available to participants and minimizing marginalisation dynamics that rapid technological change could create. In this guise, from a policy perspective, the role of meta-intermediaries can be conceived as combining bottom-up and top-down approaches to government intervention, catalysing the active participation of the plurality of entities and actors throughout the territory while coordinating their innovative activities at the institutional level, avoiding effort duplications and inefficiencies in the use of resources.

Moreover, the role of meta-intermediation should be conceived according to a dynamic perspective, whereby meta-intermediaries adapt their functions and behaviours to reach the ecosystem output so that the policy engaging with complex transformations of production systems is versatile in continuously finds solutions and instruments to face unpredictable challenges. From this

perspective, policy-makers and meta-intermediaries' managers should adopt a broad vision of Industry 4.0 sociotechnical transformation, considering the interdependencies among technological, organisational and human elements within the design of Industry 4.0 policies.

5.4 Limitations and suggestions for further research

The primary limitations of this study relate to the fact that an evaluation of the outcomes of the policy analysed in terms of its effects on firms is still missing. Assessing its short- and long-term impacts would require examining a longer timespan to access an appropriate amount of longitudinal data. In this regard, and concerning future promising avenues for research, it would be useful to keep monitoring the implementation of the policy and evaluate its impact through the use of mixed methods.

Comparative studies of Industry 4.0 policies in other economies would further expand this line of research and provide additional insights into whether policy-makers have embraced a sociotechnical understanding of Industry 4.0 and how such policies, namely, intermediary organisations, have been framed and implemented. In this view, it would be interesting to investigate other kinds of complex sociotechnical transitions occurring in the real world and how intermediary organisations relate to them.

Acknowledgements

For this research, we acknowledge ADAPT (The Association for International and Comparative Studies in Labour and Industrial Relations, Italy) and the Centre for European Economic Research (ZEW, Germany) for their valuable support. We also thank the editor and the anonymous reviewers for the comments.

Funding

This research was conducted within the framework of the project «Emilia-Romagna International School of Policy» (cup: E45J19000150004) funded by Emilia-Romagna regional government.

References

M. Arntz, T. Gregory, U. Zierahn, The Risk of Automation for Jobs in OECD Countries. A Comparative Analysis, OECD Social, Employment and Migration Working Papers, N. 189, OECD Publishing, Paper (2016) https://doi.org/10.1787/5jlz9h56dvq7-en.

D. Bailey, C. Corradini, L. De Propris, 'Home sourcing' and closer value chains in mature economies: the case of Spanish manufacturing, Cambridge J. Econ., 42(6) (2018) 1567 1584. DOI: https://doi.org/10.1093/cje/bey020

E. Barbieri, M.R. Di Tommaso, C. Pollio, L. Rubini, Industrial Policy in China: The Planned Growth of Specialised Towns in Guangdong Province, Cambridge J. Reg. Econ. Soc., 1(3): (2019) 401 422. DOI: https://doi.org/10.1093/cjres/rsz012

C. Beaudry, T. Burger-Helmchen, P. Cohendet, Editorial: Innovation policies and practices within innovation ecosystems, Ind. Innov., 28(5) (2021) 535 544. DOI: https://doi.org/10.1080/13662716.2021.1929870

G. Beier, A. Ullrich, S. Niehoff, M. Reiβig, M., Habich, Industry 4.0: How it is defined from a sociotechnical perspective and how much sustainability it includes – A literature review, J. Clean. Prod., 259 (2020) Article 120856. DOI: https://doi.org/10.1016/j.jclepro.2020.120856

G.B. Benitez, N.F. Ayala, A.G. Frank, Industry 4.0 innovation ecosystems: An evolutionary perspective on value cocreation, Int. J. Prod. Econ., 228 (2020) Article 107735. DOI: https://doi.org/10.1016/j.ijpe.2020.107735

P. Bianchi, 4.0. La nuova rivoluzione industriale, Il Mulino, Bologna, 2018.

P. Bianchi, S. Labory, *Industrial Policy for the Manufacturing Revolution Perspectives on Digital Globalisation*, Edward Elgar Publishing, Cheltenham, 2018.

W.P. Boon, E.H. Moors, S. Kuhlmann, R.E. Smits, Demand articulation in emerging technologies: intermediary user organisations as co-producers?, Res. Policy, 40 (2011) 242 252. DOI: https://doi.org/10.1016/j.respol.2010.09.006

BMBF (2018), The High-Tech Strategy 2025. Research and Innovation that benefit the people, Federal Ministry of Education and Research, available from: https://www.bmbf.de/upload_filestore/pub/Research_and_innovation_that_benefit_the_people.pdf [Accessed: 15th June 2019].

BMBF and ACATECH (2019), Vorstudie zur Entwicklung einer bedarfs- und nutzergerechten Unterstützung von KMU bei der Einführung und Anwendung von Industrie 4.0, available from:www.acatech.de/wp-content/uploads/2019/04/Forschungsbeirat_BMBF_KMU-Studie_web_bf-1.pdf [Accessed: 23th September 2020].

BMWi (2019), Plattform Industrie 4.0. Digital Transformation Made in Germany, Federal Ministry of Economic Affairs and Energy, Germany.

T. Brenner, Local Knowledge Resources and Knowledge Flows. Ind. Innov., 14(2) (2007) 121 128. DOI: https://doi.org/10.1080/13662710701252310

F. Butera, Lavoro e a nella quarta rivoluzione industriale: la nuova progettazione socio-tecnica, L'industria, Rivista di economia e politica industriale, 3 (2017) 291 316. DOI: 10.1430/88846

M. Colombo, E. Prodi, F. Seghezzi, Le competenze abilitanti per Industria 4.0. In memoria di Giorgio Usai, ADAPT University Press, Bergamo, 2019.

G. Corò, M. Volpe, D. Pejcic, L. De Propris, Paper on the technological upgrading in manufacturing in the light of the new manufacturing model, MAKERS Report, (2017) available from: http://www.makers-rise.org/wp-content/uploads/2017/10/D1.1-Manufacturing-4.0-protected.pdf, [Accessed: 4th November 2020].

G. Culot, G. Nassimbeni, G. Orzes, M. Sartor, The future of manufacturing: a Delphi-based scenario analysis on Industry 4.0, Technol Forecast. Soc. Change, 157 (2020) Article 120092. DOI: https://doi.org/10.1016/j.techfore.2020.120092

P. Dallasega, E. Rauch, C. Linder, Industry 4.0 as an enabler of proximity for construction supply chains: a systematic literature review, Comput. Ind., 99 (2018) 205 225. DOI: https://doi.org/10.1016/j.compind.2018.03.039.

R. Davies, Industry 4.0. Digitalisation for productivity and growth, European Parliament Research Service, 2016 available from: http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568337/EPRS_BRI(2015)568337_EN.pdf, [Accessed: 13th March 2020].

R. Davies, T. Coole, A. Smith, Review of sociotechnical considerations to ensure successful implementation of Industry 4.0, Procedia Manuf., 11 (2017) 1288 1295. DOI: https://doi.org/10.1016/j.promfg.2017.07.256.

L. De Propris, How the Fourth Industrial Revolution is powering the rise of smart manufacturing, World Economic Forum Agenda, 2016 [Accessed: 28th March 2019].

M. De Silva, J. Howells, M. Meyer, Innovation Intermediaries and Collaboration: Knowledge-Based Practices and Internal Value Creation, Res. Policy, 47 (1) (2018) 70 87. DOI: https://doi.org/10.1016/j.respol.2017.09.011

D.L. Edmondson, F. Kern, K.S. Rogge, The co-evolution of policy mixes and sociotechnical systems: towards a conceptual framework of policy mix feedback in sustainability transitions, Res. Policy, 48(10) (2018) Article 103555. https://doi.org/10.1016/j.respol.2018.03.010.

K.M. Eisenhardt, M.E. Graebner, S. Sonenshein, S. Grand challenges and inductive methods: Rigor without rigor mortis, Acad. Manage. J., 59(4) (2016) 1113 1123. DOI: https://doi.org/10.5465/amj.2016.4004

Forschungsunion, Perspektivenpapier der Forschungsunion: Wohlstand durch Forschung – Vor welchen Aufgaben steht Deutschland?, Berlin, 2013.

C.B. Frey, M.A. Osborne, The future of employment: how susceptible are jobs to computerisation?, Technol Forecast. Soc. Change, 114(C) (2017) 254 280. DOI: https://doi.org/10.1016/j.techfore.2016.08.019

F.W. Geels, From sectoral systems of innovation to sociotechnical systems: insights about dynamics and change from sociology and institutional theory, Res. Policy, 33 (6-7) (2004) 897 920. DOI: https://doi.org/10.1016/j.respol.2004.01.015

F.W. Geels, Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study, Res. Policy, 31 (2002), 1257 1274. DOI: https://doi.org/10.1016/S0048-7333(02)00062-8

M. Good, M. Knockaert, B. Soppe, M. Wright, The Technology Transfer Ecosystem in Academia. An Organizational Design Perspective, Technovation, 82-83 (2019) 35 50. DOI: https://doi.org/10.1016/j.technovation.2018.06.009

German Coalition's Agreement (2018), What Germany's new government stands for, available from: https://www.deutschland.de/en/topic/politics/coalition-agreement-europe-foreign-policy-and-migration, [Accessed: 15th April 2019].

D.A. Gioia, K.G. Corley, A.L. Hamilton, Seeking qualitative rigor in inductive research: Notes on the Gioia methodology, Organ. Res. Methods, 16(1) (2012) 15 31. DOI: https://doi.org/10.1177/1094428112452151

M. Goos, A. Manning, A. Salomons, Explaining Job Polarization: Routine-Biased Technological Change and Offshoring, Am. Econ. Rev., 8 (2014) Article 25092526. DOI: 10.1257/aer.104.8.2509

R. Helmrich, E. Weber, M.I. Wolter, G. Zika, The Consequences of Industry 4.0 for the Labour Market and Education, in: G. Bast, E. Carayannis, D. Campbell (Eds.), The Future of Education and Labor. Arts, Research, Innovation and Society, Springer International Publishing, New York, NY, 2019.

S. Heng, Industry 4.0: Upgrading of Germany's Industrial Capabilities on the Horizon, Deutsche Bank Research Report, Deutsche Bank AG, Frankfurt am Mein, 2014.

J. Howells, Intermediation and the Role of Intermediaries in Innovation, Res. Policy, 35 (5) (2006) 715 728. DOI: https://doi.org/10.1016/j.respol.2006.03.005

W. Kanda, M. Kuisma, P. Kivimaa, O. Hjelm, Conceptualising the systemic activities of intermediaries in sustainability transitions, Environ. Innov. Soc. Transit., 36 (2020) 449 465. DOI: https://doi.org/10.1016/j.eist.2020.01.002

M. Kant, W. Kanda, Innovation Intermediaries: What Does It Take to Survive over Time?, J. Clean. Prod., 229 (2019) 911 930. DOI: https://doi.org/10.1016/j.jclepro.2019.04.213

P. Kivimaa, Government-affiliated intermediary organisations as actors in system-level transitions, Res. Policy, 43 (2014) 1370 1380. DOI: https://doi.org/10.1016/j.respol.2014.02.007

P. Kivimaa, W. Boon, S. Hyysalo, L. Klerkx, Towards a typology of intermediaries in sustainability transitions: a systematic review and a research agenda, Res. Policy, 48 (2019) 1062 1075. DOI: https://doi.org/10.1016/j.respol.2018.10.006

L. Klerkx, C. Leeuwis, Establishment and embedding of innovation brokers at different innovation system levels: insights from the Dutch agricultural sector, Technol. Forecast. Soc. Change, 76 (2009) 849 860. DOI: https://doi.org/10.1016/j.techfore.2008.10.001

H. Kolodny, B. Stymne, R. Shani, J. R. Figuera, P. Lillrank, Design and Policy Choices for Technology Extension Organizations, Res. Policy, 30(2) (2001) 201 225. DOI: https://doi.org/10.1016/S0048-7333(99)00119-5

A. Langley, Strategies for theorizing from process data, Acad. Manage. Rev., 24 (1999) 691-710. DOI: https://doi.org/10.2307/259349

L. Li, China's manufacturing locus in 2025: with a comparison of "Made-in-China 2025" and "Industry 4.0", Technol. Forecast. Soc. Change, 135 (2018) 66-74. DOI: https://doi.org/10.1016/j.techfore.2017.05.028

M. Lombardi, Fabbrica 4.0: I processi innovativi nel 'multiverso' fisico-digitale, Firenze University Press, Firenze, 2017.

E.G. Margherita, A.M. Braccini, Exploring the sociotechnical interplay of Industry 4.0: a single case study of an Italian manufacturing organization, CEUR Workshop Proceedings (CEUR – WS.org). Available from: ceur-ws-org/vol-2789/paper16.pdf, 2020 [Accessed: 12th November 2020].

M. Mars, J.L. Bronstein, R.F. Lusch, The Value of a Metaphor: Organizations and Ecosystems, Organ. Dyn., 41 (4) (2012) 271–280. DOI: https://doi.org/10.1177/1056492617706546

K. Matschoss, E. Heiskanen, Innovation intermediary challenging the energy incumbent: enactment of local sociotechnical transition pathways by destabilisation of regime rules, Technol. Anal. Strateg., 30(12) (2018) 1455 1469. DOI: https://doi.org/10.1080/09537325.2018.1473853

S. Mittal, M.A. Khan, D. Romero, T. Wuest, A critical review of smart manufacturing & Industry 4.0 maturity models: Implications for small and medium-sized enterprises (SMEs), J. Manuf. Syst., 49 (2018) 194 214. DOI: https://doi.org/10.1016/j.jmsy.2018.10.005

J.M. Müller, O. Buliga, K-I. Voigt, Fortune favors the prepared: How SMEs approach business model innovations in Industry 4.0, Technol. Forecast. Soc. Change, 32 (2018) 2-17. DOI: https://doi.org/10.1016/j.techfore.2017.12.019

D. Nazarov, D., A. Klarin, Taxonomy of Industry 4.0 research: Mapping scholarship and industry insight, Syst. Res. Behav. Sci., 37 (2020) 535 556. DOI: https://doi.org/10.1002/sres.2700

S. Pfeiffer, Robots, Industry 4.0 and humans, or why assembly work is more than routine work, Societies, 6 (2016)16 41. DOI: https://doi.org/10.3390/soc6020016

A. Raj, G. Dwivedi, A. Sharma, A.B.L. de Sousa Jabbour, S. Rajak, Barriers to the adoption of industry 4.0 technologies in the manufacturing sector: An inter-country comparative perspective, Int. J. Prod. Econ., 224 (2020) Article 107546. DOI: https://doi.org/10.1016/j.ijpe.2019.107546

G. Reischauer, Industry 4.0 as policy-driven discourse to institutionalize innovation systems in manufacturing, Technol. Forecast. Soc. Change, 132 (2018) 26 33. DOI: https://doi.org/10.1016/j.techfore.2018.02.012

G. Reischauer, W. Güttel, E. Schüßler, Aligning the Design of Intermediary Organisations with the Ecosystem, Ind. Innov., 28 (5) (2021) 594 619. DOI: https://doi.org/10.1080/13662716.2021.1879737

D.K.R. Robinson, M. Mazzucato, The evolution of mission-oriented policies: exploring changing market creating policies in the US and European space sector, Res. Policy, 48 (2019) 936 948. DOI: https://doi.org/10.1016/j.respol.2018.10.005

K. Schwab, The Fourth Industrial Revolution. World Economic Forum, Geneva, 2016.

F. Seghezzi, La nuova grande trasformazione. Adapt University Press, Bergamo, 2017.

A. Sevinc, Ş. Gür, T. Eren, Analysis of the difficulties of SMEs in industry 4.0 applications by analytical hierarchy process and analytical network process, Processes, 6(12) (2018) 264. DOI: https://doi.org/10.3390/pr6120264

M. Sony, S. Naik, Industry 4.0 integration with sociotechnical systems theory: A systematic review and proposed theoretical model, Technol. Soc., 61 (2020) Article 101248. DOI: https://doi.org/10.1016/j.techsoc.2020.101248

R.E. Stake, Qualitative case studies, in: N.K. Denzin e Y.S. Lincoln (Eds.), The Sage handbook of qualitative research, Sage Publications Ltd., Thousand Oaks, 2005.

J. Stentoft, M. Brinch, Digital supply chain transformation: The breakthrough still seems to wait, Dilf Aktuelt, (8) (2020) 6 16.

T.K. Sung, Industry 4.0: A Korea perspective, Technol. Forecast. Soc. Change, 132 (2018) 40 45. DOI: https://doi.org/10.1016/j.techfore.2017.11.005

M. Tiraboschi, Acknowledging and Promoting Research Work in the Private Sector, E-J. Int. Comp. Labour Stud., 5(1) (2016) 141 146.

H. Van Lente, M. Hekkert, R. Smits, B. van Waveren, Roles of systemic intermediaries in transition processes, Int. J. Innov. Manag., 7 (2003) 247 279. DOI: https://doi.org/10.1142/S1363919603000817

R.K. Yin, Case study research: design and methods, SAGE Publications Ltd., Thousand Oaks Fifth edition, 2017.

ZEW, Digitalisierung im Mittelstand: Status Quo, aktuelle Entwicklungen und Herausforderungen, aktuelle Entwicklungen und Herausforderungen, Forschungsprojekt im Auftrag der KfW Bankengruppe, KfW Bankengruppe, Frankfurt, 2016.

Contrubution

Elena Prodi: Conceptualization, Data collection and curation, Methodology, Writing – original draft, Writing – review & editing. **Mattia Tassinari:** Conceptualization, Writing – original draft, Writing – review & editing. **Andrea Ferrannini:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Lauretta Rubini:** Conceptualization, Supervision, Writing – original draft, Writing – review & editing.

PAPER 2 – Structural change and industrialization policy in Ethiopia: Lessons from the agro-industrial parks initiative

Paper published as:

A. Ghione, **E. Prodi,** M. Di Tommaso, Structural Change and Industrialization in Ethiopia: Lessons from the Agro-Industrial Parks Initiative, L'Industria – Rivista di Economia e Politica Industriale, 1/2021

Doi: 10.1430/100323

Abstract

The article analyses the process of the design and implementation of the Integrated Agro-Industrial Parks Initiative, which the Ethiopian Government has identified as one of the main pillars to achieve agricultural modernization, rural industrialization and ultimately the structural transformation of the economy and society in the country. The experience of the Integrated Agro-Industrial Parks is a telling case of the Ethiopian political economy. Hence, the article adopts a political economy perspective to argue that the change in regime that occurred in 2018 opened a window of opportunity for a more constructive policy dialogue that allowed development partners to effectively introduce novel ideas into the policy process, notably, the idea that industrial policy targeting structural change should be designed and implemented adopting a multi-stakeholder and participatory perspective, rather than through the conventional dirigiste, top-down approach that has characterised the Ethiopian developmental state since the late nineties. Policy lessons and remarks are drawn in the conclusions.

Keywords

Ethiopia, agroindustrialparks, politicaleconomy, structuraltransformation, developmentalstate,

JEL Classification O13; O14; O38; O43; O55

1. Introduction

The Ethiopian development trajectory has long been in the global spotlight, attracting considerable attention from international organizations praising the fast-growing economy of the country. Data from the World Bank estimate that Ethiopia's real GDP growth averaged 9.5% per year over the decade 2010-2019, with its domestic economic performance ranking in 12th place worldwide (World Bank 2019). Notwithstanding its populous nature, being home to 109.2 million people, Ethiopia also leads in growth per person. During the same period, Ethiopia's growth in per capita terms averaged 7.7% per year, among the highest in the world. Scholars of economic development have credited the Ethiopian "developmental state" for the high and sustained growth registered. Indeed, since the late nineties, Ethiopian federal governments have subscribed to a state-led development strategy to achieve the economic catch-up of the country in an attempt to replicate the successful industrialization and rapid growth experienced over previous decades by East Asian countries. In particular, the Ethiopian developmental state (Poulton 2014; De Waal 2015; Clapham 2018) has pursued a twofold strategy to spur GDP growth: on the demand side, it has extensively invested public funding to improve civil infrastructures, education and health, while on the supply side, it has encouraged agricultural modernization and labour-intensive industrial growth. In particular, the "Growth and Transformation Plans" (GTP I 2010-2015 and GTP II 2015-2020) devised a mix of industrial policy instruments, notably the creation of special economic zones (SEZs) in the form of industrial parks (for textile, leather and pharmaceuticals and agro-business). These measures have obtained the lion's share of the funding invested in the industrial push, with the aim of achieving the status of a hub for both African countries and middle-income countries by 2025. Notwithstanding these efforts, the agricultural sector (which accounts for 31.1% of GDP and employs 66.2% of the workforce) is still characterized by low productivity rates, underdeveloped value chains and a high level of food insecurity among smallholder farmers (World Bank 2016; World Bank 2019). In 2018, the macroeconomic scenario raised concerns from international organizations: the current account of the balance of payments was in structural deficit due to a high level of imports; the exchange rate was under pressure; external (22.5% of GDP) and public debts (54.6% of GDP) were on the rise; and the rationing of foreign exchange was stifling the investment capacity of the private sector (IMF 2018). In terms of human development, the country managed to reduce poverty (the proportion of people living on less than US$1.25 PPP a day dropped from 56% in 2000 to 31% in 2011) (World Bank 2015) and reach the Millennium Development Goals (MDG) for hunger, education and children's health (National Planning Commission and the United Nations in Ethiopia 2015). In 2019, its overall performance regarding the Sustainable Development Goals ranked Ethiopia 21st out of 52 in the

African Index Rank. The actions taken to combat climate change and end poverty are currently on track with SDG achievement, while the attainment of most SDGs is confronting major and severe challenges. Human development progress in Ethiopia, as measured by the Human Development Index (HDI), has registered a steady increasing trend since 2000 along all of its three components: life expectancy, GNI per capita and education. Only growth in education has slightly flattened since 2010. Between 2000 and 2019, Ethiopia's HDI value increased from 0.292 to 0.485 (an increase of 66.1 %), which yet puts the country in the low human development category, positioning Ethiopia 173 out of 189 countries and territories.

Overall, the structural transformation of the country is still in an early phase (Timmer 2009; Chitonge and Lawrence 2020): industry accounts for 27.3% of GDP (manufacturing for 5.8%) and employs 11.9% of the workforce (World Bank 2019). While most of the manpower has been absorbed by the public sector and is employed in the construction of public infrastructure and services, the role of the private sector in GDP growth has been poor. This is partly explained by the filo-soviet political legacy of the former *Derg* military dictatorship (1974-1991), coupled with the orthodox religious belief widely diffused among Ethiopian political élites ([3]), which have fuelled prejudices of the state apparatus against profit-making entrepreneurial activities and private economic success. In this context, the youth bulge (almost 2 million young Ethiopians are entering the labour market every year) and the increasing flows of rural-urban migration (due to high underemployment rates of young family labourers among smallholders) started pressuring the government to devise job-creating strategies. Further tensions generated from the perceived high level of political corruption limited citizens' rights and freedom (Lefort 2016), culminating in the resignation of the Prime Minister (PM) Hailemariam Desalegn in 2018. The new PM Dr. Abiy Ahmed launched a ten-year plan of economic and social reforms, "Ethiopia 2030: the Pathway to Prosperity", departing from the previous government's approach, which explicitly recognized the role of the private sector as a driver for economic growth but neglected it in practice. The political élite's reconsideration of the role played by the private sector did not occur overnight. As the present study shows, change occurred gradually, and development partners and aid donors contributed to it.

The article adopts a political economic perspective to analyse the case of the Integrated Agro-Industrial Parks initiative. The article contends that the context of social and political unrest in Ethiopia has allowed novel ideas to enter the political discourse: in particular, development partners have managed to persuade political élites that multi-stakeholder and participatory approaches involving business and its representatives are more effective than the conventional dirigiste, top-down

([3]) Approximately 43.5% of the Ethiopian population belongs to the Ethiopian Orthodox church, while 33.9% belongs to Islam. The remaining minority of the population belongs to Pentay Protestantism (18.6%) and other faiths, such as Roman Catholicism (0.7%).

approach to reach policy targets linked to the structural transformation of the economy and society. The experience of Integrated Agro-Industrial Parks (IAIPs) is a case in point since the Ethiopian government identifies IAIPs as one of the main pillars to achieve agricultural modernization, rural industrialization and ultimately the structural transformation of the economy and society in the country. IAIPs are conceived as SEZs designed to attract domestic and foreign investors in agro-processing and spur agricultural development along selected value chains. The design of four pilot IAIPs across the country stretched over the period 2009-2016, and their construction started in 2018. The initiative has involved several institutional stakeholders and development partners, whose role and influence has changed throughout the policy process.

Hence, by adopting a political economy perspective, the article analyses the influence played by policy stakeholders, as well as the role of their respective interests and ideas, over the process of the design and implementation of the IAIPs.

This paper originally contributes to two strands of literature. First, it feeds into the political economy debate on the processes of structural change by adding new evidence from a developing country. By focusing on Ethiopia, the paper attempts to disentangle the interplay between policy stakeholders' respective interests and ideas in shaping the trajectory of the policy under analysis. Second, it adds further empirical evidence to the emerging literature on "new generation" SEZs and IPs by looking at the experience of IAIPs from the perspective of the inclusive and sustainable approach to industrial development developed by UNIDO.

The remainder of the paper is organized as follows: section 2 introduces the developmental state in the Ethiopian context and the industrial policy pursued. Section 3 presents the conceptual framework applied to the case under analysis, while section 4 details the methods and case study selection. Section 5 presents the empirical analysis and discusses the main findings. Section 6 concludes by drawing some policy lessons learned.

2. Two decades of developmental state and industrial policies in Ethiopia

The arduous path of industrialization of Ethiopia started immediately after the fall of the *Derg* regime (1975-1991), under which the expansion of war-related and strategic industries, such as cement and chemical sectors, as well as light-manufacturing industries (e.g., the food and beverages, textiles, leather), was prioritized (Chitonge and Lawrence 2020; Whitfield and Zalk 2020). In 1991, the transitional government of Ethiopia implemented a series of economic policies in cooperation with international development partners and donors to promote post-war macroeconomic stability and restore damaged infrastructures across the country. It was only in the late nineties, when Meles

Zenawi officially took power as PM, that the government started to embrace a hegemonic developmental vision to bring about industrial transformation in the country. Meles (1995–2012) publicly declared the aspiration to follow the development model characterizing some East Asian countries, such as Japan after the Second World War or South Korea and Taiwan in the 1970s and 1980s, and to replicate their successful pattern of growth (Aaron 2017) ([4]). Early interventions prioritized the adoption of the agricultural development-led industrialization (ADLI) strategy, aiming at the promotion of smallholder agricultural growth through the creation of intersectoral linkages between the agricultural and industrial sectors. In parallel, the government reorganized and expanded state-owned enterprises (SOEs) in areas such as utilities and air travel, protecting them by allowing funding to come exclusively from domestic investors. These strategies were generally successful in raising agricultural yields and reducing poverty in rural areas of Ethiopia. However, as pointed out by Berhanu and Poulton (2014) and by Lefort (2012), political interests have often reduced the developmental impact of public investments.

Since 2010, the government has committed to alleviating the binding constraints hindering manufacturing growth and job creation. The 2010-2015 Growth and Transformation Plan (GTP I) and the following 2015-2020 Growth and Transformation Plan II (GTP II) contain a mix of policy instruments explicitly targeting manufacturing growth and industrial employment creation. Both plans rely upon financial and nonfinancial measures and target the improvement in the competitiveness of smallholder agriculture, along with the emergence of domestic manufacturing industries and infrastructure development, in an attempt to keep high real annual GDP growth of at least 11% ([5]). The expansion of the network of industrial parks across the country represented the main nonfinancial pillar of both GTP plans. In particular, under GTP II, the government envisaged the creation of almost 30 industrial parks (IPs), mainly in the agro-processing, leather, textile and pharmaceutical sectors. This strategy aimed at attracting FDIs, creating jobs, increasing export and foreign exchange reserves, and improving the business environment (Oqubay 2018).

Notwithstanding the efforts of the Ethiopian government, several studies have pointed to the limited role played by domestic manufacturing in generating employment, output, productivity

([4]) The unprecedent rapid growth of East Asian countries is a well-known phenomenon that has been thoroughly studied in recent years. The rapid industrialization process characterizing those economies is grounded in what scholars refer to as the "developmental state" model. A central feature of the developmental state model is a well-developed state apparatus that maintains regular and constant connections with the private sector in the process of industrial policymaking, without being captured by rent-seeking coalitions or vested interests (Evans 1995; Weiss 1998).

([5]) Under GTP I, the growth of specific manufacturing industries was targeted. Such strategic sectors were mainly light manufacturing and labour-intensive industries, e.g., textile and apparel, leather, agro-processing, metal and engineering, along with chemical and pharmaceuticals, which were also addressed. Under GTP II, the number of targeted industries extended to include ITC and electronics, petrochemical industry and biotech. In both GTP periods, agro-processing was the industry targeted to reach the highest percentage share of GDP, notably 3.8% and 5.5% in GTP I and II, respectively.

growth and export revenues (Oqubay 2015). Despite its sustained growth rate over time, in 2017, the share of manufacturing over GDP was still below 10%. In other words, Ethiopia struggled to replicate the successful experience of East Asian countries. Several authors have questioned the resemblance of the developmental state model adopted in the African Horn with the one backing the success of the Asian Tigers ([6]). Overall, the limitations of the Ethiopian developmental model have weakened the outcomes of industrial policy interventions over the past decade. Although the employment, export and GDP figures from recent years show positive and fast-growing trends, the country is not even close to achieving the conditions needed to initiate and sustain a process of structural transformation (UNECA 2016).

2.1 Industrial Parks in Ethiopia: the Integrated Agro-Industrial Parks strategy for the structural transformation of the economy

The GTP II plan clearly states the country's ambitions of achieving middle-income status by 2025 and transforming Ethiopia into an African industrial hub. Within this framework, the government has envisaged the creation of almost 30 industrial parks (IPs), mainly in the agro-processing, leather, textile and pharmaceutical sectors, over the past decade. The rationale pushing the Ethiopian government to create these SEZs in a country with limited infrastructure and a poor investment climate ([7]) primarily relates to the exploitation of economies of scale and agglomeration generated by the location of multiple businesses in the same venue. In particular, at IPs, infrastructure and specialistic services are more easily provided and accessed by firms, and the business climate can be improved in an *ad hoc* manner (e.g., by making available customs and revenues services *in situ* or by facilitating access to credit and hard currency to the enterprises located in the parks). In recent years, international organizations and scholars have backed the use of SEZs among African countries with the purpose of economic development. However, empirical scholarly work has warned policymakers of the general heterogeneity of impacts of SEZs (Barbieri *et al.* 2019) and therefore pointed to the importance of aligning the type of SEZ with the location choice. Traditional export processing zones based on just the processing or assembly of imported goods are considered to have limited impact in

([6]) First, Ethiopia lacks a well-prepared bureaucratic apparatus able to nurture productive connections with business and exercise "*discipline over private firms"* (Lin 2017, p.79). The Ethiopian experience shows a scarcity of bureaucratic resources and capacities (skills, technologies, connections), which challenges the implementation of policy initiatives related to the industrialization agenda. Furthermore, although both GTP plans explicitly acknowledge the potential role of the private sector as an engine of economic growth, in practice, the Ethiopian state apparatus has long mistrusted the capacity of the private sector to promote development, limiting any attempt of dialogue and engagement with domestic investors (Clapham, 2018). This aspect has been gradually changing over the past three years following the change of regime in 2018. However, efforts to overcome cultural prejudices towards the private sector and involve business representatives in the design and implementation of the policy are still at an early stage.

([7]) Ethiopia ranks 159th (over 190) in terms of the "ease of doing business" (World Bank 2019).

the African context. Africa faces a highly competitive global environment with consolidated global production networks, and as Farole points out, Africa "*has a fundamental competitiveness challenge with respect to manufacturing owing to issues of geography, scale and transaction costs*" (Farole 2011, p. 7). Hence, the use of SEZs integrated with either natural-resource-based sectors (e.g., processing of agricultural products) or local industry is often encouraged in the African context to maximize technology and knowledge transfer generated from foreign direct investments (FDI). This body of work on African economies feeds into a wider strand of international literature on SEZs and IPs. The early deployment of SEZs and IPs is rooted in an attempt to accelerate national economic growth by maximizing the homegrown industry's advantages (Schmitz 1995). Currently, a large number of countries have been using these policy tools to attract firms and international capital flows and create economic benefits from the concentration of industrial activities therein. In particular, China currently hosts the largest number of SEZs and IPs worldwide (Yu *et al.* 2020).

In recent years, the sustainable development of SEZs and IPs has become a global concern because their deployment has been associated with intensive resource consumption, increasingly generating negative environmental externalities (Liu *et al.* 2018). In particular, since 2013, the UNIDO has promoted an inclusive and sustainable approach to industrial development, offering some guidance to enhance the contribution of SEZs to the Sustainable Development Goals (UNCTAD 2015). Within this framework, "new generation" SEZs and IPs should encourage and help firms operating within their zones to adopt clear standards on labour and environmental practices, e.g., by providing companies with sustainability-related services and infrastructures, along with traditional commercial benefits. Regrettably, the UNIDO reports that most SEZs have not yet promoted environmental and social sustainability, although remarkable efforts towards this direction are being made.

At the international level, the evidence on the performance of SEZs and IPs is mixed. Scholarly work has pointed to the "experimental" nature of the zones considered successful, in which economic activities were carefully controlled by the government, limited in extension (in terms of the people, sectors and localities involved) but very innovative in terms of the aspects gradually experimented with (Di Tommaso *et al.* 2013). Even so, the misallocation of resources and the lack of complementary and integrated interventions (Moberg, 2017) can jeopardize the effectiveness of these policy interventions. Similarly, the evidence of the experience with IPs created in Ethiopia is mixed (UNIDO, 2018). In 2019, at least 12 industrial parks, both private (attracting mainly Chinese investors) and public, were either operational or under construction, providing jobs for over 70,000 people (Cepheus, 2019). Textile products, apparel and garments are the most important goods produced: 81 out of 141 active firms focused on this product line, while 12 tenants were involved in metal products and 6 in leather products as of June 2018 (Cepheus, 2019). According to Hauge

(2019), the combined use of IPs with generous incentives has succeeded in attracting FDI in the manufacturing sector (which increased from 560 million USD in 2007/2008 to 3.712 million USD in 2016/2017) and in raising manufactured exports, led by the textile and leather sectors, from 21 million USD in 2004 to 389 million USD in 2017.

Even so, the policies implemented so far have been inadequate to ensure technological transfer and the creation of linkages (especially backward linkages) between FDI and local industries, two elements that were at the core of the successful SEZ experiences of Taiwan, Korea and China. Hauge points to the lack of a coherent strategy from Ethiopian authorities to create linkages with local suppliers, joint ventures between foreign and local firms and PPPs between public and private (foreign) firms. In the same vein, the technological upgrading of local firms and the capacity building of Ethiopian managers are neglected. In the current scenario, foreign firms dominate manufacturing exports, little technological transfer has taken place after more than 10 years of experience with IPs, and Ethiopians holding managerial positions are still the exception rather than the rule. In other words, Hauge points out that "*South Korea and Taiwan had an intricate carrot-and-stick strategy with respect to attracting manufacturing FDI. Ethiopia has implemented the carrot, but no stick*". In addition, Ethiopian IPs generally suffer from low integration with the local economy (most raw material and intermediate goods are imported), limited technology transfer, issues associated with decent jobs (high rates of workers' turnover, low wages, few Ethiopians in management positions, strikes) and lack of basic services and infrastructure for workers (housing, utilities, transportation, social services) (UNIDO 2018; see also Barrett and Baumann-Pauly 2019 on Awassa IP).

Concerning the specific case under analysis, the Integrated Agro-Industrial Parks envisioned in the Ethiopian Agro-Industry Strategy (Federal Democratic Republic of Ethiopia, 2009) are conceived to integrate agricultural smallholders with the agro-industry sector, thereby achieving agricultural modernization and rural industrialization by means of attracting domestic and foreign investors in agro-industry and exerting a pull factor on the agricultural system. The IAIPs provide farmers with goods (seeds, fertilizers, equipment) and services (market information, credit, extension) through a network of rural transformation centres (RTCs) located in the main commercial towns and equipped with basic infrastructure for grading, storage and primary processing. The Ethiopian agroindustry strategy highlights the need to pursue multiple goals, notably attracting and supervising FDI, reforming the extension system and easing the implementation of contract farming agreements, enhancing the vocational training and university system to match labour demand from business, and building a food safety system to ensure food quality standards and traceability.

3. The role of interests and ideas in the policy process of developing countries: the debate and our research question

Contemporary models of political economy have long considered the concept of "interests" as a powerful analytical tool to explain the behaviours and choices of policymakers. Early classical models, such as the work of Niskanen (1973), conceive interests, notably self-interests, as an element capturing the agency of bureaucratic apparatuses. Notably, Niskanen conceptualizes bureaucrats as an interest group seeking power, wealth and privileges, with the purpose of maximizing their agency's budget and rents. Interests are multifaceted, as Drazen (2008) has pointed out, and their nature can be political (e.g., to achieve or retain power), personal (e.g., accumulate wealth, seek rents, maintain privileges) or institutional (e.g., improve the position of specific agencies). In particular, a considerable body of theories contend that vested interests play a determining role in shaping policy choice. According to this view, the interests of both the selectorate ([8]) and the ruling coalition ([9]) try to make their way into established practices of policymaking in an attempt to influence the directionality of the policies devised (Drazen, 2008). More often than not, interests favour the position of political élites, lobbies and rent-seeking groups at the expense of the general population, distorting policy choices that can ultimately yield inefficient policy outcomes.

The prevailing context in which these arguments have been applied and tested, drawing their strength and legitimacy, relates to developing economies. The experiences of development in African economies represented the laboratories where part of the debate on the political economy of growth-promoting, poverty-relieving intervention emerged in the 1980s (World Bank, 1983) and grew throughout the 1990s and 2000s (Krueger, 1990; Hickey, 2005; Khan and Grey 2006).

Further research conducted in other developing regions of the world contributed to this debate. It is worth recalling the well-established line of inquiry investigating the rise of the developmental state model in East Asian countries. The literature has highlighted the pivotal role played by internal and external political threats to shape the rise of autocratic governments and to spur their initiatives to achieve developmental goals. For instance, the threat of communism, in the forms of either the rise of foreign economic powers or the domestic peasantry, was the driver behind policy choices made by political élites, interested in shielding their stream of rents, retaining much of their power and securing economic and social stability (Campos and Root 1996; Islam and Chowdhury 2000; Poulton 2014; Clapham 2018). In more recent times, the linkages between politics and development have attracted

([8]) The "group who actually selects leaders or who controls the instruments of power that enable a leader to remain in office" (Drazen 2008, 24).

([9]) The "sufficient subset" of the selectorate that actually supports the leaders (Drazen 2008).

increasing scholarly attention (Di John and Putzel 2009; North *et al.* 2009; Khan 2010; Acemoglu and Robinson 2013).

Khan (2010) contends that the enforcement of particular institutions depends upon the relative distribution of powers among different types of organizations, which might contest, obstruct or oppose rules that they perceive to be against their interests. Namely, in the context of developing economies, the country-specific "political settlement" determines the quality of institutions and the allocation of rents, thus shaping the prospects for future development and, in some circumstances, explaining why even "*good governance strategies have fared so poorly"* Khan (2012, p. 30). In recent years, a growing body of work pioneered by Rodrik (2014) has noticed that prevailing models of political economy pay little attention to the role of ideas in shaping interests (and their pursuit) and in determining patterns of political behaviour that ultimately influence policy choices. In other words, by overemphasizing the role of vested interests, conventional "*political economy models often do a poor job of accounting for policy change*" (Rodrik 2014, p. 205). In the same veins, Lavers and Hickey (2016, p. 393) argue that political economy models downplaying the role of ideas in policy determination are not able to explain policy change only on the basis of vested interests because they are "*unable to predict which policies (economic or social) will actually be selected by a particular coalition*". Furthermore, as Hickey has pointed out, the roles of "*ideas and ideology have also emerged as significant in studies of elite commitment*" (2013, p. 16), and one needs to take them into account in the analyses of the political economy of the developmental state. In other words, taking ideas into account along with vested interests "*allows us to provide a more convincing account of both stasis and change in political-economic life*" (Rodrik 2014, p. 190).

However, what does the notion of ideas mean in the context of the political economy model? Early studies suggest that, in the context of political economy models, ideas should be interpreted as a form of ideological preference that enters into the utility function that both policy makers and the selectorate try to maximize. Rodrik integrates this conceptualization, stressing that, in general terms, ideas can influence decisions surrounding the basic building blocks of the political economy: the objective function of political actors ("who are we?"); their perception of the reality and the constraints under which they operate ("how does the world work?"); and their perception about feasible policies or the "strategy space" ("what can be done?"). In particular, from Rodrik's standpoint, in the political economy discourse, the notion of "ideas" should be conceptualized in terms of "policy innovation". Indeed, "*new ideas about what can be done –, i.e., innovative policies – can unlock what otherwise might seem like the iron grip of vested interests*" (Rodrik 2014, p. 194), expanding political actors' strategy space and room for actions. In this sense, since ideas are subject to both manipulation and innovation, they can relax political constraints (i.e., they can improve social welfare without threatening the power of *élites*) and result in policy change. The world is replete with

examples of "innovative policies", especially in processes led by elites in power to promote industrialisation ([10]).

Rodrik suggests that the main sources of ideas as innovative policies are found in learning by doing, emulation of other countries, and times of crisis and political instability. In particular, the last aspect represents key occasions for novel ideas to enter the political discourse and the rethinking of existing policies (Lavers and Hickey 2016). This view contends that is especially "*during periods of institutional instability or 'Knightian uncertainty' – when agents are not only unsure of how to achieve their interests, but also unsure of what their interests are – that actors re-evaluate the core paradigms that guide their decision making and seek new approaches*" (Lavers and Hickey 2016, p. 394). In the words of Blyth (2007, p. 762), "*in moments of uncertainty, crisis-defining ideas not only tell agents 'what has gone wrong' but also 'what is to be done'*."

Drawing from this conceptual framework, the present study will analyse the process of policy design and implementation of the IAIP initiative. In particular, we will focus our analysis over a period with a rapidly changing political context and sociopolitical turmoil (2009-2020) to highlight whether and to what extent policy stakeholders' interests and ideas have shaped policy *stasis* and change. Since 2015, Ethiopia has witnessed increasing discontent emerging from civil society and especially younger people due to the perceived high level of political corruption, the limitation of citizens' rights and the lack of jobs and economic opportunities (Lefort 2016). Riots eventually erupted in several towns in November 2015, followed by the proclamation of the State of Emergency in October 2016. The nomination of Dr. Abiy Ahmed as PM in April 2018 marked the end of the Ethiopian People's Revolutionary Democratic Front (EPRDF) regime and the beginning of a new political era. New economic policies are being designed (e.g., liberalizations in the logistic, transport and banking sectors, privatizations of SOEs, improvement in the business climate) as a way to signal the start of a novel political course. This new political and economic course is currently shaking the very foundations of the country, and it will likely influence the implementation of the policy related to the industrialization agenda, marking a profound discontinuity with the ideological paradigm and the policy practice of the previous government. However, these processes of political democratization and economic reforms have been carried on without the proper political checks and balances, fueling political instability in over the past three years (Lefort, 2018). For instance, the political reforms have granted freedom of political campaign to politicians promoting ethnic and religious divisiveness. The economic reforms, such as liberalization and privatization of SOEs, have undermined vested interests

([10]) Rodrik mentions the cases of England, Germany and Japan, where "*State-directed industrialization, gradual concessions to the rising industrial classes, diversification into commerce and industry, alliance with industrial interests, and similar choices ensured elites could benefit from industrialization while retaining much of their power*") (Rodrik 2014, p. 194).

of several high Tigray People's Liberation Front (TPLF) and EPRDF official. As a result, widespread ethnic clashes have taken place in 2018, 2019 and 2020, and rising tension between the federal government and the Tigray TPLF-led regional government culminated in an armed conflict since fall 2020 ([11]). These events point to the well-known difficulty of promoting liberal democratic reforms in countries characterized by weak institutions (De Waal, 2018), authoritarian political cultures (Vaughan and Tronvoll, 2003), substantial poverty and ethnic heterogeneity (Khan, 2005, Collier, 2007).

In the Ethiopian case, these factors are further compounded by the 1991 ethno-federalist constitutional settlement which has institutionalized ethnicity (Abbink, 2011), very much like in ex-Yugoslavia (Foreign Policy, 2019).

Within this context of political crisis and instability, the study attempts to answer two questions:

1. To what extent have major policy stakeholders' interests and ideas accounted for policy *stasis* and change, with specific reference to the initiative of the IAIPs?
2. How have their respective interests and ideas shaped the phases of design and implementation of the IAIPs?

4. Research methods and case selection

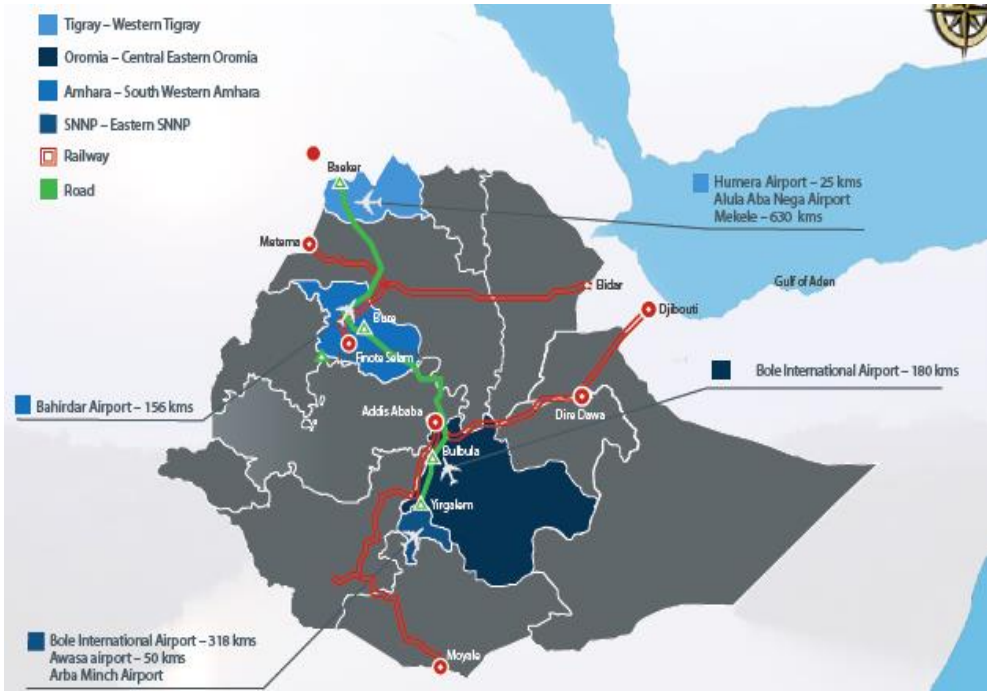
We selected the case of the IAIP initiative for several reasons. First, in the recent history of the Ethiopian industrialization agenda, industrial parks have represented an important domain of industrial policy. Second, as highlighted in section 2, the agro-business sector has been the industry targeted to reach the highest percentage share of GDP, notably 3.8% and 5.5% in GTP I and II, respectively. Hence, the study of the design and implementation of agro-industrial parks in the agro-industry sector is a representative case of major programmes created in the recent decade by the Ethiopian federal government to finance productive development and industrialization in Ethiopia. Third, the IAIP initiative is a telling case about the explicit role played by the vested interests and ideas of major policy stakeholders to shape policy *stasis* and change. Indeed, to our knowledge, this case represents an unprecedented shift in the conventional way the Ethiopian policymakers used to frame policy choices: at some point (notably in the sociopolitical crisis and the following regime change), the policy process has departed from the traditional dirigiste, top-down approach to embrace an inclusive and bottom-up strategy. Furthermore, given the governmental actors and the development partners involved in it, not to mention the context of political instability and crisis in

([11]) On the conflict in Tigray and its root causes see: Plaut, (2020). On the undergoing humanitarian crisis see: OCHA, (2021).

which the policy has been devised and implemented, the IAIP initiative is the ideal case for applying our conceptual framework and exploring the research questions stated above.

The study was conducted using a case study methodology (Yin, 2014). In particular, we conducted an in-depth analysis of the design and implementation processes of the network of four IAIPs scattered across the country and their related RTCs. One of the authors of the article conducted fieldwork in Ethiopia through involvement in the design and implementation of four IAIPs, located in Amhara, Tigray, Oromia and SNNPR (figure 1) ([12]). The analysis of the IAIP experience is based on original empirical research based on participant observation and semistructured interviews collected from February 2019 through July 2020. In particular, we interviewed 22 policy stakeholders, notably senior officials belonging to both the government and aid donors and development partners (see Annex 1). Nineteen interviews were conducted in person, while the remaining three were conducted via online platforms (due to the restrictions following the global health emergency since March 2020).

Figure 1: Location of the 4 IAIPs and their procurement zones



Source: UNIDO

To prepare for the interviews, the authors conducted preliminary in-depth desk research and accessed grey materials concerning IAIP design and implementation, such as feasibility studies on the design of the parks and their potential location produced by Mahindra Consulting Engineering

([12]) He was involved initially as Senior Economist of the Italian Agency for Development Cooperation (since April 2014) and later as Chief Technical Advisor of the IAIP program for UNIDO (since September 2018).

and reports on how to unlock the economic potential of the agri-business sector produced by the Ministry of Trade and Industry. The questions addressed to the interviewees attempted to reconstruct the whole policy process from different angles as well as to understand the drivers behind key policy decisions.

Further questions addressed the role played by different actors in the policy process and the influence of new ideas proposed by development partners in shaping policy change.

This study has a few limitations. First, fieldwork was primarily conducted in the Oromia region. Although the analysis focuses on the initiative as a whole, a large part of the data, informative details and illustrative examples reported in the analysis revolve around the experience of the Oromia region. Second, the program is still ongoing; hence, no policy outcome can be assessed yet. However, the aim of the present study is not to assess policy outcomes but rather to analyse, through the lens of the political economy, the deployment of the policy process and the respective influence of policy stakeholders' ideas and interests on policy *stasis* and change.

5. Empirical analysis and discussion

5.1 Empirical analysis

The design phase (2009-2016): the Ethiopian developmental state at work

The Ethiopian Agro-Industry Strategy launched in 2009 conceived of IAIPs as a strategic tool to achieve goals related to the industrialization agenda, namely, the development of supply value chains through the creation of intersectoral linkages (backward and forward) in the agro-business sector. The actual establishment of a network of IAIPs across the country undertook an arduous trajectory, beginning in the conventional dirigiste fashion that had characterized public interventions over the previous three decades and involving several development partners and aid donors offering generous funding and technical advice to support the growth of added-value activities. The UNIDO, FAO, and AICS (Italian Agency for Development Cooperation) have been the main development partners taking part in the policy process since its early stage ([13]). The first IAIP blueprint envisioned by the Ministry of Industry drew inspiration from the experience of agro-industrial parks in India (Rao 2006), which Ethiopian policymakers visited in 2012. During the visit, high-level government officials appreciated the way in which the concept of agro-industrial parks had been implemented to

([13]) AICS funded 350.000 € for the realization of the feasibility study and business plan for the pilot IAIP. A second grant of 1.4500.000 € funded the technical assistance provided by UNIDO and the FAO. In a later stage, the Emilia-Romagna Region and the University of Ferrara were actively involved in the design of the IAIPs, sharing their expertise on agro-business development with the Ethiopian policymakers.

help smallholder Indian farmers integrate into local supply chains of food processors. In 2014, a steering committee was appointed by the government and tasked with directing the whole policy process, namely, monitoring the policy design phase, approving the feasibility study and managing the implementation of the pilot project once the design phase was completed. The Committee was composed of representatives of the Ministry of Industry, the Ministry of Agriculture, the public Agricultural Transformation Agency (ATA), FAO, UNIDO, UNDP and AICS and chaired by the State Minister of Industry, Dr. Mebrahtu Meles. However, conflictual institutional interests soon entered the early stage of the policy process.

First, although development partners considered the involvement of target beneficiary and main policy stakeholders (e.g., agricultural smallholders and cooperatives, business representatives) essential to achieve the policy goals, representatives of the business sector never took part in the steering committee, nor did the government agree to invite them to join.

Second, the government created two independent specialized agencies, the Industrial Parks Development Cooperation (IPDC) and the Ethiopian Investment Commission (EIC), tasking them to create a network of IPs in the textile and garment sectors and to attract FDIs into the country. The agencies' staff owned remarkable expertise in the implementation of the industrial agenda, for they used to work on it under the jurisdiction of the Ministry of Industry. Even so, both agencies never joined the IAIP Steering Committee for political reasons, nor did they take part in any phase of the policy process, thus depriving it of the technical competences that these two bodies had developed over time in the field of IP design, construction and attraction of FDI.

The design phase of the pilot IAIP occurred in two stages, regarding the realization of the feasibility study and the selection of an area in which to locate the park. For the former, the government contracted *Mahindra Consulting Engineering*, an Indian consultancy company, to carry out the feasibility study and business plan of the pilot IAIP and its related RTCs ([14]). In parallel, the Steering Committee started working to select a suitable location for the pilot IAIP, choosing among 17 agro-industry growth corridors (AIGCs) identified by the ATA. The selection process relied on a set of indicators (e.g., agricultural production potential, interindustry linkages and triggering effect, infrastructure facilities, market potential, access to commercial and support services, and concentration of enterprises and attractiveness for investors) to rank the AIGCs: eventually, the Committee selected the area of Central Eastern Oromia, which ranked first.

([14]) The work of the consultancy lasted from the end of 2014 to mid-2016. During the same period, studies on the agricultural value chains were undertaken by the FAO and Agricultural Transformation Agency (ATA), to enrich the feasibility study.

At this stage of the policy process, the regional government of Oromia was invited to collaborate with the Committee to provide some guidance in identifying the most suitable location in Central Eastern Oromia to establish the pilot park.

The process did not go as smoothly as the federal policymakers expected. Our interviews with high-level Oromia regional public officials unveiled that regional authorities opposed this stance, considering Central Eastern Oromia a well-developed area but a fragile one from an ecological point of view. Horticulture and floriculture were well developed in the region, but the environmental footprint of irrigation in the Rift Valley was already considered a problem. In addition, land expropriation for the purpose of building infrastructures was a sensitive topic in Oromia, in extreme cases even leading to political instability and social turmoil (e.g., the youths' riots erupting in Oromia in November 2015 eventually led to the change in government in 2018). The Oromia regional government thus suggested the choice of an area in West Oromia instead, an option discarded by the Steering Committee in the first place. Conversely, federal policymakers and donors contended that the development of the pilot IAIP and its related RTCs should capitalise on the economic reality of Central Eastern Oromia, for Italy had already been investing in rural development there for the past 20 years: the regions hosts strong cooperatives, representing hundreds of thousands of farmers working in the same value chains and several domestic agro-processors (producing pasta, biscuits and canned vegetables) working in the main cities of the area.

Eventually, minimizing the possibility of triggering political and social unrest due to land expropriation turned out to be the political criterium guiding the location choice, thus generating the sub-optimal and questionable decision to locate the pilot agro-industrial park in the water-stressed zone of Bulbula in Central Eastern Oromia ([15]).

Despite all the efforts channelled into the pilot park and the difficulties encountered, the government decided to broaden the scope of the endeavour. In September 2014, the Steering Committee chairman reported that the government had decided to pilot three more IAIPs located in Southwest Amhara, Eastern SNNP and Western Tigray. The government grounded its decision in the high agroecological diversity of the country and the need to improve the chances of success of the pilot exercise. This seems convincing, but it is noteworthy that the proposed areas did not hold the highest-ranking positions. Rather, these areas, like Oromia, were home to the political parties composing the EPRDF ruling coalition governing the country. Notwithstanding, the Steering Committee agreed on the proposal, and the FAO and UNDP made available additional funding for the realization of the feasibility studies and business plans for the three additional parks.

([15]) Indeed, three years later, the Federal Government would have to allocate funds to the Region for the construction of a 60 km pipeline to bring water to the IAIP of Bulbula.

In June 2015, regarding the presentation of feasibility studies for the additional IAIPs and their related RTCs, the development partners recalled their concerns related to the lack of an inclusive and sustainable approach informing the IAIPs and the industrial development of the hosting areas. First, the AICS and FAO pointed out that prospective tenants, notably domestic and international investors and farmers' cooperatives, were not involved in the feasibility studies. The studies were based on a technocratic analysis of the agricultural potential of the zone, showing poor consideration for the real actors located in those areas and their capacities and needs. Second, it was not clear who would have been in charge of managing the parks and their respective RTCs. According to the studies, 7/8 RTCs scattered across the hosting regions should have connected farmers to the industries in the park. The type of relation bonding farmers' cooperatives, local agro-processors and RTCs was unclear, as was the ownership of the RTCs. The issues raised by the development partners pointed at potential policy distortions produced by the dirigiste, top-down approach pursued by the Ethiopian government.

Even so, these concerns remained unheard; at that stage, there was little room to modify the decisions of the government. Indeed, the increasing social unrest that exploded across the country in late 2015 pushed the government to accelerate the process of creating the IAIPs, publicly announcing their construction as a key action for tackling unemployment in the regions. Youths were the primary participants in the protests triggered by rising unemployment rates, as unveiled by our interviews. In the words of a representative of development partners:

"*Every year, almost 2 million young people entered the labour market, but the focus of the developmental state on the construction of public infrastructures, coupled with the little support provided to the private sector, hindered the creation of new and decent jobs*".

In addition, the PM Hailemariam Desalegn appointed the regional governments to be in charge of IAIP governance through the establishment of Regional Industrial Parks Development Corporations (RIPDCs). Officially, the decision was grounded in the fact that the agro-processing industry is strictly tied to the agriculture sector, whose production is location-specific and which therefore would be better managed by regional authorities. Although the regional government and the newly constituted RIPDCs were poorly equipped to manage the IAIPs in terms of institutional capacity and experience, this sudden institutional change laid the groundwork for the emergence of a novel, unprecedented, bottom-up approach towards policy interventions related to the development agenda.

The implementation phase (2017-2020): an unprecedented departure from the conventional dirigiste approach informing policy interventions related to the developmental agenda

Social turmoil almost paralyzed the country throughout 2016 and 2017, ending with the resignation of the PM Hailemariam Desalegn and the ensuing nomination of a young PM, Dr. Abiy Ahmed, a former Ethiopian Minister and, at that time, a high official of the Oromia regional government. The new PM started the implementation of a broad reform of the economic agenda (the "Home Grown Economic Reform Agenda"), which starkly departed from the approach distinguishing the former regime. This political *momentum* opened up an unprecedented "policy space", which translated into the opportunity for donors to reinvigorate their collaboration with government officials, whose attitude under PM Abiy appeared more likely to embrace developmental partners' standpoints and to question policy choices taken or opposed by the previous government. The developmental partners took advantage of this window of opportunity to speak about their concerns regarding the parks with renewed strength. In particular, the AICS, which until then had provided the highest share of donor funding, started an intense dialogue with the federal and regional governments, encouraging them to consider the needs of local investors and cooperatives in the design and implementation of the parks and RTCs; on the other hand, the AICS undertook three major initiatives that contributed to gradually steering the construction of the IAIPs towards a more inclusive and participatory process:

1. Supporting institutional capacity building for IAIP development;
2. Promoting the IAIPs within the donor community;
3. Supporting federal and local authorities to anchor external knowledge and expertise on bottom-up approaches targeting agro-industrial growth.

The first initiative was articulated in three different projects to support the development of IAIPs and RTCs from several perspectives. The projects aimed at strengthening strategic agro-industrial value chains in the catchment zones of the agro-parks, achieving coordination between the education system and the private sector and enhancing the capacities of the newly established RIPDCs ([16]).

For the promotion of IAIPs among the donor community, the AICS, the Italian Embassy, the Italian Trade Institute and UNIDO started promoting the concept of IAIPs among international donors as an instrument to integrate agriculture and industry among other development partners in an attempt

([16]) The first project aims at developing strategic agricultural value chains with a strong emphasis on business models that link agricultural cooperatives to agro-industries and financial institutions. The project is implemented by the Ministry of Agriculture, ATA and the regional authorities with technical assistance from the FAO.
The second project aims at building the capacities of Technical and Vocational Education and Training (reform of curricula) and strengthening their linkages with private enterprises (via cooperative training models).
The third project aims at creating an effective industrial ecosystem through different activities, such as strengthening the capacities of the RIPDCs, promoting private domestic and foreign investments and technological transfer, setting up a food safety and quality system and facilitating a favourable working environment, especially for women, and decent job conditions.

to build an "international actor network" (Keeley and Scoones 1999) of like-minded partners. This endeavour targeted mainly the European Union, the African Development Bank and the European Investment Bank. Gradually, a shared consensus around the need to adopt context-specific measures, departing from the top-down approach, emerged among international donors, leading to the enlargement of the network of donors involved in the construction of IAIPs ([17]).

Finally, a strategic alliance between the Ethiopian government and the Emilia-Romagna region was promoted by the AICS, the Italian Embassy, the Italian Trade Institute and the University of Ferrara ([18]). Study visits were organized to introduce the Emilia-Romagna model of agri-business industry to the Ethiopian federal and regional authorities, and to development partners ([19]). In particular, study visits in Emilia-Romagna allowed incoming Ethiopian officials to learn about the Emilia-Romagna agro-business model, which relies on dynamic regional networks involving farmer cooperatives, agro-industries, research centres, universities, technopoles and public development authorities. Ethiopian authorities drew multiple lessons, mainly regarding the role played by networks involving local actors to effectively drive agro-industrial development, the importance of having a well-trained group of public managers and the role of public agencies in easing the mobilization of private investments and channelling them towards the growth of the local industry.

Overall, the development partners were guided by the idea that mobilizing an international "epistemic community" (Keeley and Scoones 1999; Stone 2008) with strong expertise in agro-industrial development would be mutually beneficial for the members involved. In particular, such an "epistemic community" was instrumental in exchanging knowledge and best practices and eventually contributed to steering the implementation of the parks towards a multi-stakeholder, participatory approach. The members of the Steering Committee and the regional officials soon expressed their appreciation for the abovementioned initiatives, endorsing the idea of embracing an inclusive, participatory approach for the implementation of the IAIPs and their related RTCs.

([17]) In 2020, the donors' funding for the support of the implementation of the 4 IAIPs reached an amount of approximately 563 million USD, while the Ethiopian government invested an additional 540 million USD. To date, more than 200 private domestic and foreign investors have subscribed to enter the parks. The main donors are Italy, EU, AfDB, EIB, IFAD, The Netherlands, Denmark and Germany.

([18]) This last was already involved in a joint university project with Addis Ababa Business College, i.e., the Ethiopia TRAS-ET project, supported and funded by the Italian Agency for Development Cooperation, targeted the creation of Teaching, Research and Advisory Services in Ethiopia.

([19]) Visits started in started in March 2018 with an explorative mission that brought officials from the Emilia-Romagna development agencies ERVET and ASTER (which merged in May 2018 to create AR-TER, the new innovation and development agency of Emilia-Romagna), as well as members of the Agro-food ClustER (an institutional network that gathers private and public regional stakeholders in the field of agrifood), to the II International Agro Food Forum held in Ababa. Three more study visits followed. Namely, one visit of the former representatives at the Business College of Addis Ababa in December 2018, and two more study visits (in October 2018 and May 2019) of Ethiopian officials (the State Ministers of Finance, Industry and Agriculture, the four CEOs of the RIPDCs, and representatives from the Regional Bureaus of Industry and Agriculture).

Regrettably, this endorsement arrived late. The construction of the four IAIPs and six pilot RTCs (three in SNNP, one in Oromia, one in Tigray and one in Amhara) had already started (and were almost completed, in fact) by the beginning of 2018, following the one-size-fits-all blueprint envisioned in the feasibility studies produced by the consultancy company contracted. Fortunately, not all RTCs had already been built by 2019. Twenty-two RTCs remained to be built, and their implementation is currently following the participatory, bottom-up principles suggested by the development partners and embraced by the Steering Committee ([20]).

In addition, job-related issues, such as the creation of decent jobs, women's empowerment, the protection of women against gender-based violence and the provision of housing and public services to the workforce living in the surroundings of the parks, are entering the policy dialogue ([21]). These topics are increasingly perceived as essential for the overall sustainability of the industrial park strategy in the country. According to several studies (Admasie 2018; Hardy and Hauge 2018; see also Barrett and Baumann-Pauly 2019, for the flagship Awassa industrial park), poor wages and working conditions, coupled with lack of security, housing, transportation, and utilities around the industrial zones, have been triggering increasing protests, strikes and very high levels of workforce turnover over the past years. Some authors contend that these problems are rooted in the hostile attitude of the state-party apparatus towards unionization (Markakis, 2011), which translates into a legal framework providing limited restrictions to private enterprises regarding wage setting, hiring or firing (Blattman and Dercon, 2018).

As a result, trade unions are weak and ineffective ([22]), and real salaries in the manufacturing sector are low ([23]) and have been declining in real terms ([24]). In addition, working conditions pose severe health risks (Blattman and Dercon, 2018). In this context, workers protest by either quitting their jobs,

([20]) As an example, the Oromia RIPDC started consulting for the Cooperatives Unions in Meki (located in the Rift Valley) and in the Bale zone (located in the wheat plateau) before constructing the RTC located in Meki and in Bale-Robe, taking into account their inputs and needs. Moreover, the Meki Batu Cooperative Union, gathering the majority of agricultural smallholders in the area, will likely install an industrial processing plant for tomato in the RTC and is currently working with a private stakeholder interested in investing in the park. The RIPDC is also negotiating participation in the management of the RTC. These concrete examples show how the inclusion of the private sector and farmer organizations in the development trajectory of the country is contributing to the new economic course, departing from the previous dirigiste, top-down approach that had informed the whole design phase of the program.

([21]) In this regard, specific initiatives are being devised by government authorities in cooperation with the AICS and the EU.

([22]) Data from the ILO indicate that unionisation is 9.6%, while the coverage of collective is 9.8% (ILOSTAT). According to Hardy and Hauge (2018), trade unions have little role in bargaining and instead play a mediation role when labour conflicts arise.

([23]) As low as approximately 20 USD per month, according to the Industrial Federation of Textile, Leather and Garment Workers. The IFTLGWU has 55.000 members, 56% of whom are women (Barrie, 2018).

([24]) According to a study commissioned by the JICA and undertaken by the Ethiopian Inclusive Financial Training and Research Institution (2015), real wages between 2010/11 and 2014/15 fell by 23% in the leather and leather products sector and by 18% in the textile and garment sector.

fuelling high turnover rates, or, to a lesser extent, going on strike, all of which methods negatively affect the productivity of the manufacturing sector. Finally, from a macro perspective, the ILO (2017) stresses that the predominance of informal jobs and the inability of the private sector to generate stable and quality employment are challenging the structural transformation of the economy and society in the country.

5.2 Discussion: the role of the main stakeholders and the role of interest versus ideas in shaping the policy process

Socioeconomic instability and the ensuing political changes have provided development partners with the opportunity to encourage the Steering Committee to depart from the conventional top-down approach, informing early policy design and expanding the profile of actors involved in the process. It is important to acknowledge here that this window of opportunity, which opened up in 2018 after the change of regime, was equally exploited by development partners and government officials. In particular, government officials, put under pressure by public opinion, benefitted from this novel policy space because it eventually pushed them to embrace a more inclusive model of agro-industrial development, hence raising the chances to reach prospective developmental goals.

Drawing from our conceptual framework, it is worth noting that *interests* have played a crucial role in the whole policy process.

First, in the inception phase of the policy, IAIPs were promoted as a tool to create jobs and increase rural income in a critical moment for the government. Policies that promote pro-poor growth are perfectly consistent with the developmental state model and serve the political interest of élites to retain their power (Poulton 2014; Clapham 2018).

The need to ensure equity among the regions of the country with the most power and influence led to widening the scope of the programme from one to four IAIPs. The perceptions of élites regarding the increasing social unrest contributed to shaping the policy process, convincing them to critically review the top-down approach.

While there was no obvious political interest at stake in the approach of the Ministry of Industry towards the design and implementation of the IAIPs, we distinguish an institutional interest of the government in retaining control over the process, e.g., by marginalizing other constituencies, such as the federal IPDC and EIC and, at an early stage, the regional governments (until Proclamation n. 886/2015). This is consistent with the Niskanen model of budget-maximizing bureaucracies (Niskanen, 1973). Furthermore, political interests, e.g., the issue of land expropriation in a period in which the political cost of appropriating farmers' land was so high as to spark social unrest, played a pivotal role in the choice of the location of the IAIPs, as in the casa of Bulbula park. In parallel, ideas,

in the form of ideological paradigms, policy models and evidence, played a crucial role in shaping the policy process as well. First, the ideological orientation of the Ethiopian developmental state was determinant in shaping the state-led top-down approach followed during the early design phase. Second, ideas in the form of international policy models (Lavers and Hickey 2016) entered the policy process. In particular, the conceptualization of IPs as a one-size-fits-all solution did not account for the complexity and multifaceted nature of the issue at hand; i.e., developing the agri-business sector primarily involves the integration of agriculture and industry, which requires the joint deployment of measures oriented towards both the development of agricultural value chains and the improvement in the business climate for agro-processors. Such a challenge is context-specific, which implies holistic thinking, the involvement of multiple stakeholders and attention to the sustainability of the measures deployed across multiple dimensions (environmental, social, job-related).

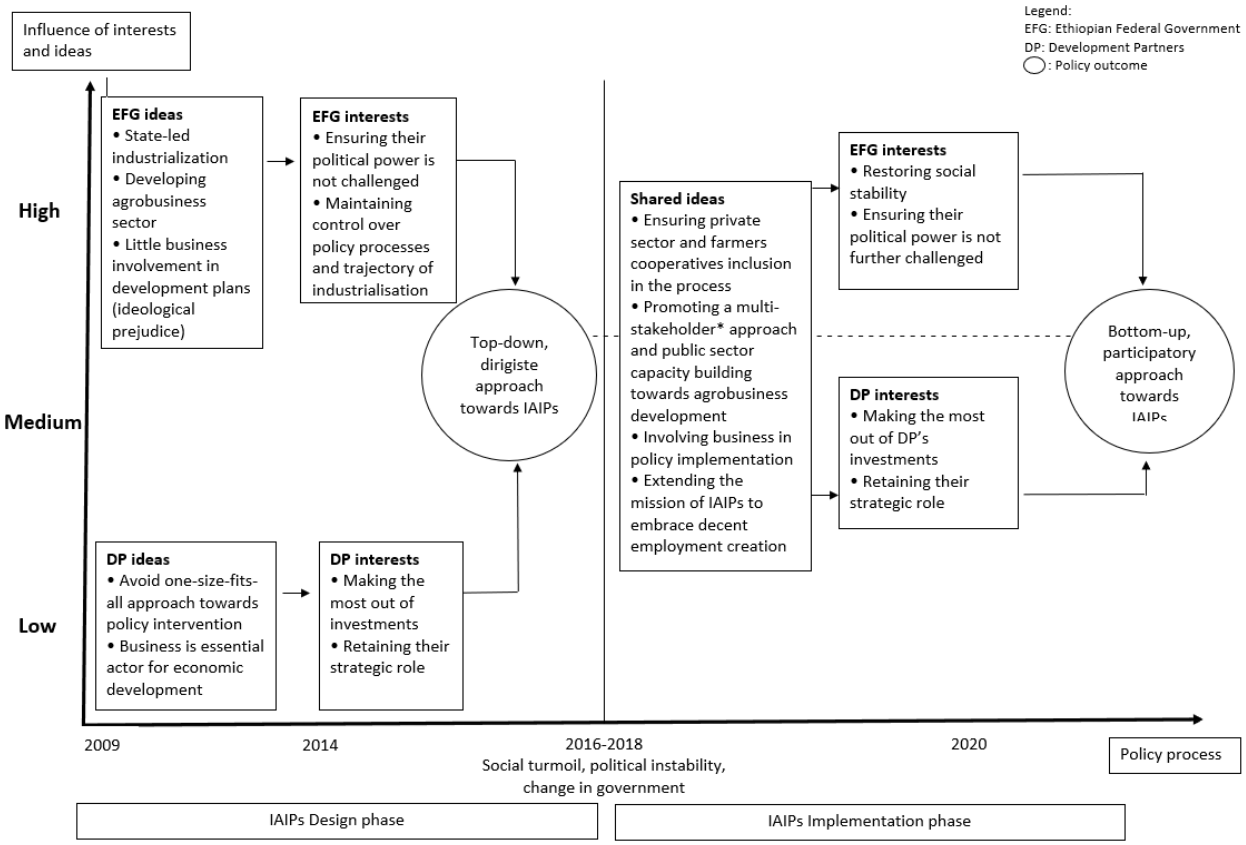
Finally, ideas in the form of "evidence" influenced the process. The identification of the Agro-Industry Growth Corridors was established according to objective criteria, even if the selection of the four AICGs where the IAIPs were located followed political considerations. Again, the identification of the sites for the IAIPs followed objective criteria, but the political cost of expropriating land was the determining factor, at least in Oromia. Here, we see a pattern: evidence received primary consideration only when political interests were not at stake.

The idea of putting cooperatives and private investors at the centre of the project followed a different path. The initial resistance was eventually endorsed to minimize social unrest. Several factors contributed to this policy change. As anticipated, we believe that the most important factors were the opening of the strategy space (Rodrik 2014) brought about by broader political change (Lavers and Hickey 2016) and the role of international actor networks and epistemic communities in modifying the narrative (Sumner *et al*. 2011). In particular, the development partners convinced Ethiopian policymakers that the use of a bottom-up and inclusive approach, with better chances of resulting in successful agro-industrial parks, was in their own interest. Looking at the framework of Rodrik (2014), we could interpret this new approach as an "innovative policy", improving social welfare without threatening the interest of those in power.

Government officials eventually recognized the advantages, in terms of increasing local economic growth and social welfare, of involving cooperatives and private investors in the design, ownership and operational choices related to the IAIPs. After all, these actors do not represent a threat to the power of the political elites because the cooperatives have close links with local government agencies (Berhanu and Poulton 2014), and the government can still exert a certain degree of control over the private sector in IPs (this is in line with Farole and Akinchi, 2011, p.16, regarding China's SEZs experience). In line with the considerations above, figure 2 summarizes the evolution of the whole policy process as well as the extent to which the respective interests and ideas of both the Ethiopian

government and the development partners have shaped the phases of design and implementation of the IAIPs so far.

Figure 2 - the influence of interests and ideas over the policy process



Source: Authors

* The multi-stakeholder approach refers to the involvement of essential institutional actors that were previously not included in the process, such the EIC, the Federal IPDC, the universities, the regional governments and the Ministry of Agriculture, as well as the business sector, its representatives and the cooperative system of agricultural smallholders.

6. Concluding remarks

The present study investigated the influence of policy stakeholders (federal and regional governments, donors, UN agencies, investors, farmer cooperatives) as well as the role played by their respective interests and ideas in shaping the process of the design and implementation of four Integrated Agro-Industrial Parks in Ethiopia. Our study devoted particular attention to the Ethiopian political-economy context, characterized by significant changes in ideological paradigms (from state dirigisme to a gradual *ouverture* to the private sector) and shifts in the power balance between federal and regional governments, the public and private sectors, the government and donors. We limited the research to the design and implementation of the policy, deliberately setting aside the outcomes for the time being, for it is premature to attempt any assessment of the IAIPs economic performance

given that the construction of the parks has to be completed yet. Unfortunately, the rising ethnic violence, occurring especially in Oromia, and an open conflict in the Tigray region are currently threatening the stability of the country and challenging the economic reforms envisioned by PM Abiy. These tensions, coupled with the global health emergency due to the covid-19 pandemic, are further delaying the construction of the IAIPs. However, some policy lessons can still be drawn from the Ethiopian experience. First, promoting economic development means encouraging the growth of added-value, high-productivity sectors. The complexity of this task is mirrored in the multifaceted nature of the added-values sectors and activities, which require the integration of different skills and expertise. Economic development requires holistic thinking and context-specific interventions, relying on a wide array of thoroughly intertwined complementary policy interventions, to nurture all the aspects involved in the growth of added-value sectors. In this view, the set-up of participatory institutional mechanisms to design and monitor the policy initiatives envisaged, coupled with a proper balance between national and regional powers, is a prerequisite that cannot be postponed any longer for the effective implementation of reforms and to keep them aligned to civil population's needs ([25]).

Second, the process of structural change of the economy associated with high-productivity sector growth is interrelated with fundamental shifts in living standards, working conditions and employment creation across communities, cities, regions and nations as a whole (Di Tommaso *et al.* 2020). In other words, the configuration of societies underlying the economy changes as the economy changes. Therefore, successful industrial policy and government interventions in production dynamics upgrades should acknowledge and "*mitigate the potential ecological, economic and social threats to system sustainability that could characterize the process of structural change*" (Ferrannini *et al.* 2021, p. 8). In this perspective, our research unveils that, throughout the process of parks design and implementation in Ethiopia, little attention was paid to social issues, such as decent job conditions, housing and access to utilities and other public services, gender mainstreaming and the provision of security for the workforce living around the parks (especially for women). These issues have eventually entered the policy dialogue since late 2020.

Overall, our findings would benefit from further research on the IAIPs, including an evaluation of the initiative employing sophisticated statistical techniques to single out the contribution of different factors on IAIPs' economic performance, hence feeding into the theory and results developed by the literature on SEZs. In particular, a promising avenue of research would be exploring the links between living and working condition within IAIPs and their performance.

([25]) On the need to set up the right institutional framework, before implementing reforms in the Ethiopian context, see the informative article of A. Zerai (2018).

References

Aaron T. 2017. *State and Economic Development in Africa: The Case of Ethiopia.* Palgrave Macmillan, Switzerland.

Abbink, J. 2011. «Ethnic-based Federalism and Ethnicity in Ethiopia: Reassessing the Experiment after 20 Years». Journal of Eastern African Studies. Vol. 5, No. 4, November 2011, 596-618.

Acemoglu, D. e J. Robinson. 2013. *Why Nations Fail: The Origins of Power, Prosperity and Poverty*. London, Profile Books.

Admasie, A.S. 2018. «Amid Political Recalibrations: Strike Wave Hits Ethiopia». *Labor and Society*. 2018;21:431–435.

Barbieri E., M. R. Di Tommaso, C. Pollio e L. Rubini. 2019. «Industrial policy in China: The planned growth of specialised towns in Guangdong Province». *Cambridge Journal of Regions, Economy and Society*. 12(3): 401–422

Barrett, P.M. e D. Baumann-Pauly. 2019. *Made in Ethiopia: Challenges in the Garment Industry's New Frontier*. New York University Stern Center for Business and Human Rights.

Barrie, L. 2018. *Ethiopia Meeting Stirs Debate on Living Wages*. Just-Style, available online at: https://www.just-style.com/news/ethiopia-meeting-stirs-debate-on-living-wages_id133606.aspx

Berhanu, K. e C. Poulton. 2014. «The Political Economy of Agricultural Extension Policy in Ethiopia: Economic Growth and Political Control». *Development Policy Review*. 32 (S2): 197-213.

Blattman, C., e S. Dercon. 2018. «The Impacts of Industrial and Entrepreneurial Work on Income and Health: Experimental Evidence from Ethiopia». *American Economic Journal: Applied Economics*, 10(3): 1–38.

Blyth, M. 2007. «Powering, Puzzling, or Persuading? The Mechanisms of Building Institutional Orders». *International Studies Quarterly*. 51(4): 761–77.

Campos, J. e H. Root. 1996. *The Key to the Asian Miracle: Making Shared Growth Credible*. The Brookings Institution, Washington DC.

Cepheus. 2019. *Ethiopia's Industrial Parks: A Data Pack on Recent Performance*. Available online at: https://cepheuscapital.com/wp-content/uploads/2019/01/Industrial-Parks-Overview.pdf

Chitonge, H. e P. Lawrence. (2020). «The Political Economy of Industrialization and Industrial Policy in Africa, 1960 - 2018». In «The Oxford Handbook of Industrial Policy» edited by Oqubay, A., C. Cramer, H.J. Chang, e R. Kozul-Wright. Oxford University Press.

Clapham, C. 2018. «The Ethiopian Developmental State». *Third World Quarterly*. 39:6, 1151-1165.

Collier, P. 2007. *The Bottom Billio*n. Oxford University Press. Oxford.

De Waal, A. 2015. *The Real Politics of the Horn of Africa: Money, War and the Business of Power*. Cambridge, UK: Polity Press.

De Waal, A. 2018. *The Future of Ethiopia: Developmental State or Political Marketplace?* World Peace Foundation. Conflict Research Programme. Available online at: https://sites.tufts.edu/reinventingpeace/files/2018/08/The-future-of-ethiopia-20180817.pdf

Di John, J. e J. Putzel, 2009. *Political Settlements: Issues Paper*. Discussion Paper, Governance and Social Development Resource Centre, University of Birmingham, June 2009.

Di Tommaso, M.R., L. Rubini e E. Barbieri. 2013. *Southern China: Industry, Development and Industrial Policy*, London, Routledge.

Di Tommaso, M. R., M. Tassinari, E. Barbieri e M. Marozzi. 2020. «Selective industrial policy and 'sustainable' structural change. Discussing the political economy of sectoral priorities in the US». *Structural Change and Economic Dynamics*, 54, 309–323.

Drazen, A. 2008. «Is There a Different Political Economy for Developing Countries? Issues, Perspectives and Methodology». *Journal of African Economies*, vol. 17, Issue supplement 1, 18–71.

Ethiopian Inclusive Financial Training and Research Institution. 2015. *Basic Empirical Research on Productivity and Wage in Ethiopia*. Addis Ababa.

Evans, P. 1995. *Embedded autonomy: states and industrial transformation*. Princeton University Press, Princeton, New Jersey, USA.

Fantu, C., C. Cramer e A. Oqubay (a cura di). 2019. *The Oxford Handbook of the Ethiopian Economy*. Oxford University Press.

Farole, T. 2011. *Special Economic Zones in Africa: Comparing Performance and Learning from Global Experience*, Directions in Development, The World Bank.

Farole, T. e G. Akinci. 2011. *Special Economic Zones: Progress, Emerging Challenges and Future Directions*, Directions in Development, The World Bank.

Federal Democratic Republic of Ethiopia. November 2009. *Ethiopian Agro-Industry Sector Strategy*. Ministry of Trade and Industry, Addis Ababa.

Ferrannini, A., E. Barbieri, M. Biggeri e M.R. Di Tommaso. 2021. «Industrial Policy for Sustainable Human Development in the post-Covid19 era», *World Development*. Elsevier, vol.137.

Foreign Policy. 2019. *Don't Let Ethiopia Become the Next Yugoslavia*. Bieber, F., Goshu, W.T., 15 January 2019. Available online at: https://foreignpolicy.com/2019/01/15/dont-let-ethiopia-become-the-next-yugoslavia-abiy-ahmed-balkans-milosevic-ethnic-conflict-federalism/

Hardy, V., J. Hauge. 2019. «Labour Challenges in Ethiopia's Textile and Leather Industries: No Voice, No Loyalty, No Exit?» *African Affairs*. 184/473, 712–736.

Hauge, J. 2019. «Should the African Lion Learn from the Asian Tigers? A Comparative-Historical Study of FDI-Oriented Industrial Policy in Ethiopia, South Korea and Taiwan». *Third World Quarterly,* vol. 40, No. 11.

Hickey, S. 2005. «The Politics of Staying Poor: Exploring the Political Space for Poverty Reduction in Uganda». *World Development*. Vol. 33, No. 6, pp. 995–1009

Hickey, S. 2013. *Thinking about the politics of inclusive development: Towards a relational approach*. ESID Working Paper, No. 1. Manchester, ESID.

Keeley, J. e I. Scoones. 1999. *Understanding Environmental Policy Processes: a Review*. IDS Working Paper no. 89, Institute of Development Studies, Brighton.

Khan, M.H. (2005). *Markets, States and Democracy: Patron-Client Networks and the Case for Democracy in Developing Countries*. Democratization, 15 (5), 704–724.

Khan, M. 2010. *Political Settlements and the Governance of Growth-Enhancing Institutions*. SOAS, London. Available on-line at: https://eprints.soas.ac.uk/9968/1/Political_Settlements_internet.pdf

Khan, M. H. 2012. «The political economy of inclusive growth». In De Mello, L. and M. A. Duts (a cura di). *Promoting Inclusive Growth: Challenges and Policies.* OECD Publishing

Khan, M. H. e H. Gray. 2006. *State weakness in developing countries and strategies of institutional reform: operational implications for anti-corruption policy and a case study of Tanzania.* Department for International Development. Available on-line at: http://eprints.lse.ac.uk/50337/

Krueger, A. O. 1990. «Government Failures in Development». *Journal of Economic Perspectives*. 4 (3): 9-23.

IMF. December 2018. *The Federal Democratic Republic of Ethiopia, 2018 Article 4 Consultation*. Washington DC.

ILO. 2017. *Global Employment Trends for Youth 2017: Paths to a Better Working Future*. International Labour Organization.

ILOSTAT. web site: https://ilostat.ilo.org/data/country-profiles/.

Islam, I. e A. Chowdhury. 2000. *The Political Economy of East Asia: Post-Crisis Debates*. Oxford University Press, Melbourne, Australia.

Lavers, T. e S. Hickey. 2016. «Conceptualising the politics of social protection expansion in low-income countries: The intersection of transnational ideas and domestic politics». *International Journal of Social Welfare*. 25 (4), 388–398.

Lefort, R. 2012. Free Market Economy, 'Developmental State' and Party-State Hegemony in Ethiopia: The Case of the 'Model Farmers'. *The Journal of Modern African Studies*. Vol. 50.

Lefort, R. November 2016. *Ethiopia Crisis: Things Fall Apart: Will the Centre Hold?,* Open Democracy.

Lefort, R. (2018). Ethiopia: Climbing Mount Uncertainty. In: Open Democracy, 21 October 2018. Retrieved from: https://www.opendemocracy.net/en/ethiopia-climbing-mount-uncertainty/#_ftnref2 (Last Accessed, 1 February 2021).

Lewis, W. A. 1954. «Economic development with unlimited supplies of labour». *Manchester School of Economics and Social Studies.* Vol. 22, No. 2.

Lin, J.Y. 2017. «Alice Amsden contribution to Development Economics». In «Revisiting Development Theory: a Celebration of Alice Amsden», Clifton J., A. Glasmeier, A. Sheth (a cura di), *Cambridge Journal of Regions, Economy and Society*. Vol. 10, No. 1.

Liu, Z., M. Adams, R.P. Cote, Y. Geng e Y. Li. 2018. «Comparative study on the pathways of industrial parks towards sustainable development between China and Canada». *Resources, Conservation and Recycling*. Vol. 128.

Mahindra Consulting Engineers. March 2018. *Integrated ACPZ & IAIP – Central Eastern Oromia. Feasibility Report Revised.*

Markakis, J. 2011. *Ethiopia: The Last Two Frontiers*. Eastern Africa Series, Oxford: James Currey.

Ministry of Industry. July 2014. *Report on Agro-Industry Growth Corridor (AIGC) Selection for Integrated Agro-Industrial Park (IAIP)*, Ethiopia, Addis Ababa

Moberg, L. 2017. *The Political Economy of Special Economic Zones: Concentrating Economic Development*. Routledge London and New York.

National Planning Commission and the United Nations in Ethiopia. 2015. *Millenium Development Goals Report 2014, Ethiopia*. Addis Ababa.

Niskanen, W. 1973. «An economic model of bureaucracy». In «Bureaucracy: Servant or Master?» a cura di Niskanen, W. Institute of Economic Affairs, London, pp. 7–21.

North, D.C., J.J. Walliss e B.R. Weingest. 2009. *Violence and Social Orders: A Conceptual Framework for Interpreting Recorded Human History*. Cambridge: Cambridge University Press.

OCHA. 2021. *Ethiopia - Tigray Region Humanitarian Update. Situation Report*. Last updated: 6 Jan 2021. Retrieved from: https://reports.unocha.org/en/country/ethiopia/ (Last Accessed: 13 January 2021).

Oqubay, A. 2015. *Made in Africa, Industrial Policy in Ethiopia*. Oxford University Press.

Agricultural Transformation Agency (ATA). May 2014. *Agricultural Transformation Corridors*. Addis Ababa.

Oqubay, A. 2018. «Industrial Policy and Late Industrialization in Ethiopia». In: «The Oxford Handbook of the Ethiopian Economy» a cura di Fantu, C., C. Cramer e A. Oqubay. Oxford: Oxford University Press

Plaut, M. 2020. *The Tigray War*. Review of African Political Economy. 8 December 2020. Available from: https://roape.net/2020/12/08/the-tigray-war/ (Last Accessed, 17 January 2021).

Poulton, C. 2014. «Democratisation and the Political Incentives for Agricultural Policy in Africa». *Development Policy Review*, Vol. 32 (2), 101–122.

Poulton, C. 2018. «What is Agricultural Commercialisation, Why is it Important and How do we Measure it?» *Agricultural Policy Research in Africa*. Working Paper 06, November 2017.

Rao, K.L. 2006. *Agro-Industrial Parks, Experience from India*. Agricultural and Food Engineering Working Document n. 3. FAO, Rome.

Rodrik, D. 2014. «When Ideas Trump Interests: Preferences, Worldviews, and Policy innovations». *The Journal of Economic Perspectives*. Vol. 28(1), 189–208.

Schmitz, H. 1995. «Collective efficiency: growth path for small-scale industry». *Journal of Development Studies.* Vol. 31, 529–566.

Stone, D. 2008. «Global Public Policy, Transnational Policy Communities, and their Networks». *Policy Studies Journal*. Vol. 36 (1), 19–38.

Sumner, A., J. Crichton, S. Theobald, E. Eliya Zulu e J. Parkhurst. 2011. «What Shapes Research Impact on Policy? Understanding Research Uptake in Sexual and Reproductive Health Policy Processes in Resource Poor Contexts». *Health Research Policy and Systems*. Vol. 9, Supplement 1.

Timmer, P. 2009. *A World Without Agriculture*. The EAI Press, Washington DC.

UNCTAD. 2015. *Enhancing the Contribution of Export Processing Zones to the Sustainable Development Goals An analysis of 100 EPZs and a Framework for Sustainable Economic Zones.* Available on-line at: https://unctad.org/system/files/official-document/webdiaepcb2015d5_en.pdf

UNDP. 2018. *Human Development Indices and Indicators: 2018 Statistical Update. Ethiopia.* Available on-line at: http://hdr.undp.org/sites/default/files/Country-Profiles/ETH.pdf

UNECA. 2016. *Transformative industrial policy for Africa*. Addis Abeba.

UNIDO. 2018. *Industrial Park Development in Ethiopia, Case Study Report*. Inclusive and Sustainable Industrial Development Working Paper Series WP 21.

Vaughan, S., Tronvoll, K. 2003. *The Culture of Power in Ethiopian Political Life*. Sida Studies no. 10.
Weiss, L. 1998. *The Myth of the Powerless State: Governing the Economy in a Global Era*. Polity Press, Cambridge, UK.

Whitfield, L. e Zalk, N. 2020. «Phases and Uneven Experiences in African Industrial Policy». In «The Oxford Handbook of Industrial Policy» a cura di Oqubay, A., C. Cramer, H.J. Chang, e R. Kozul-Wright. Oxford University Press

World Bank. 1983. *Accelerated Development in Sub- Saharan Africa: An Agenda for Action,* Washington, D.C.

World Bank. 2015. *Ethiopia Poverty Assessment 2014*. Washington DC.

World Bank. 2016. *Ethiopia's Great Run, The Growth Acceleration and How to Pace It*, Washington DC.

World Bank. 2019. *World Bank Open Data*, Washington DC.

Yin, R.K. 2014. *Case study research: design and methods*. SAGE. Fifth edition.

Yu, X., H. Zheng, L. Sun, Y. Shan. 2020. «An emissions accounting framework for industrial parks in China». *Journal of Cleaner Production*. Vol. 244.

ANNEX 1 – LIST OF INTERVIEWEES

1.
2. The former Minister of Industry
3. The former State Minister of Industry and chairmen of the Steering Committee
4. The Director of Agro Processing at the Ministry of Industry
5. The Senior Director of Agribusiness & Markets of the Ethiopian Agricultural Transformation Agency
6. The CEO of the Federal Industrial Parks Development Corporation and former Vice CEO of the Oromia Industrial Parks Development Corporation
7. The Deputy Commissioner, Head of the Industrial Parks Division of the Ethiopian Investment Commission
8. The Head of the Oromia Public Enterprise Supervising Authority
9. The Head of the Oromia Bureau of Industry
10. The Vice Head of the Oromia Bureau of Industry and former CEO of the Federal Industrial Parks Development Corporation
11. The CEO of the Oromia Industrial Parks Development Corporation
12. The Investments Director of the Oromia Investment Commission
13. The team leader for investment protection of the Oromia Investment Commission
14. The President and Chief Operating Officer of Mahindra Consulting Engineers
15. The FAO IAIP project manager
16. The actual Senior Economist of the Italian Agency for Development Cooperation, who use to be as well the Senior Economist of the Agency until the end of 2013
17. The former UNIDO IAIP National project coordinator
18. The actual UNIDO IAIP National project coordinator
19. The Head of Programs at UNOPS, Ethiopia Office
20. The Team Leader-Rural Transformation and Resilience, of the European Union Delegation
21. The Attaché Agricultural Growth, Rural Transformation and Resilience Team, of the European Union Delegation
22. The Head of European Union, Territorial and International Cooperation, Social Innovation Unit of ARTER – Emilia Romagna Region.
23. A Project Manager employed by the Italian Agency for Development Cooperation involved in the Steering Committee

Contribution

Andrea Ghione: Conceptualization, Data collection, Writing – original draft, Writing – review & editing.
Elena Prodi: Conceptualization, Methodology, Writing – original draft, Writing – review & editing.
Marco R. Di Tommaso: Conceptualization, Supervision, Writing – original draft, Writing – review & editing.

PAPER 3 – Local public spending, electoral consensus, and sustainable structural change

Paper published as:

Di Tommaso, M.R., **Prodi, E.,** Di Matteo, D., Mariotti, I., (2022), Local public spending, electoral consensus, and sustainable structural change, in Structural Change and Economic Dynamics, *in press.*

Doi: https://doi.org/10.1016/j.strueco.2022.06.013

Abstract

This paper explores electoral consensus regarding local public spending as a way for policymakers, particularly in western democracies, to secure long-term electoral support to govern the sustainability of structural change. Public spending is perceived by local electoral constituencies as immediately affecting people's lives and thus strongly influences individual voting behaviour. Focusing on the case of Italy, this paper explores the electoral consensus–public spending nexus on the municipal level. The results show that, on average, an increase in local public spending is associated with a reduction in electoral consensus towards anti-system parties, whereas an increase in local public spending does not yield a significant raise in electoral consensus for pro-system parties. We find nevertheless heterogeneous effects across different geographical areas and spending categories for both anti-system and pro-system party consensus. The results yield insights for scholarly debate and implications for policymaking to garner the electoral consensus needed for sustainable structural change.

Keywords

Sustainable Structural Change; Electoral Consensus; Local Public Spending; Policymaking; Municipality

JEL codes

H7 State and Local Government; Intergovernmental Relations; H4 Publicly provided goods; H11 Structure, Scope, and Performance of Government; D72 Political Processes: Rent-Seeking, Lobbying, Elections, Legislatures, and Voting Behaviour; L88 Government policy; D7 Analysis of Collective Decision-Making

1. Introduction

This paper explores the relationship between local public spending and electoral consensus for sustainable structural change in Italy. By electoral consensus, we mean the ability of political parties to gain and secure electoral support from voters. We proxy this consensus by changes in voting preferences for different types of political parties — namely, 'anti-system' and 'pro-system' parties — over two electoral periods.

From the perspective of political economy, the rationale behind our analysis is that electoral consensus regarding local public spending is a crucial mechanism for governing the continuous process of structural change affecting our ever-changing economies and societies. Specifically, structural change needs to be governed to guarantee its social and economic sustainability. Indeed, structural change is at the heart of economic development processes (Pasinetti, 1981,1993; Ocampo, 2020), which are characterised by shifts in the relative proportions of productive sectors, ultimately leading to a transformation of the socioeconomic system.

Current processes of structural change are triggered by forces mostly connected to increasing globalisation and the cross-country interdependence of economic, social, and political dynamics. Important examples include the reconfiguration of global value chains (GVCs), transformations in the international division of labour (Bianchi and Labory, 2019; Pietrobelli and Rabellotti, 2011), disruptive technological changes (such as consumption behaviours and the automation and digitalisation of production systems), and government policies affecting international industry and trade, such as commercial agreements or protectionist barriers.

Within such structural change dynamics, some sectors aim to expand and capture higher added value, profits, and market shares, while others seek to maintain their market positions or protect themselves from potential downsizing (Scazzieri, 2018; Cardinale and Scazzieri, 2018). However, structural change is neither a neutral process nor a zero-sum game: incompatible sector claims and interests in limited resources represent a significant source of conflict, whether between or within sectors, which might open new lines of disagreement or compromise in the socioeconomic realm or revive old cleavages. In view of this, conflictual relations and idiosyncratic interdependence between actors at various levels of production system aggregation contribute to accelerating, decelerating, encouraging, or hindering the structural transformation of sectors (Andreoni and Scazzieri, 2014; Cardinale, 2018; Cardinale and Scazzieri, 2019; Cardinale and Scazzieri, 2020).

Recent contributions highlight that conflictual interests and interdependence can be accommodated within the economic system only to a certain degree, beyond which the system's viability and sustainability are endangered and, eventually, seriously compromised (Lin, 2012, 2017;

Di Tommaso et al., 2020). An emerging branch of the literature assigns an explicit role to policy interventions with a dual aim: (i) to ensure the sustainability of structural transformations and (ii) to drive structural transformation towards normative development goals — such as inclusive growth and equal opportunities, poverty reduction, environmental protection, reduced inequality in the distribution of income and wealth, and universal access to fundamental goods and services such as health and education (Ferrannini et al., 2021; Sen, 2009, 2013; Myrdal, 1970).

In addition, particularly in democratic countries, government interventions aimed at advancing normative development goals and fostering the sustainability of the required structural transformation need to activate electoral consensus among the public. This means that policy actions need to be politically supported by the electorate in the long term (Di Tommaso, 2020). However, decision-making processes and policy actions might fail to open a debate in which development goals should be promoted or address the need for sustainability in structural change. This is particularly the case when government intervention is led and captured — or simply strongly influenced — by pressures from particular interests and *rent seekers*. In this case, the most influential groups are either unable or deliberately unwilling to reconcile their own interests, privileges, and prerogatives with normative development goals and sustainable trajectories of structural transformation that would benefit society as a whole (Hirschman, 1970; Di Tommaso et al., 2020).

Policy actions aimed at enhancing the sustainability of structural change are thus exposed to the risk of failure because of the contrast in interests between incumbents and newcomers, since the former might seek to defend their positions and the status quo (Cardinale, 2017). Therefore, the institutional framework of democratic countries requires governments to be able to incorporate the perspective of normative goals in public debate and marshal a broad electoral consensus by reconciling conflictual interests along a sustainable trajectory of structural transformation.

We presume that local public spending might be a crucial channel for policymakers to garner the electoral consensus necessary to achieve ambitious normative goals along a sustainable trajectory of structural change (Di Tommaso, 2020). Indeed, local public spending has an important influence on voting behaviour, since it is easily observed by the final beneficiaries and therefore perceived as immediately affecting people's lives (Bellani and Scervini, 2020, p. 9).

This paper thus explores whether local public spending might represent a channel through which governments may reconcile the conflicts of interest inherent to the process of structural change and build the electoral consensus needed to make a trajectory of structural transformation sustainable.

In the following analysis, we proxy electoral consensus using electoral support for anti-system parties. The rise of anti-system parties signals the opening of new cleavages within the socioeconomic system or the sharpening of old lines of conflict between socioeconomic players. In our view, the more electoral consensus anti-system parties can marshal among the electorate, the greater the danger

to structural transformation. Indeed, the emergence and electoral success of new anti-system parties (Mudde, 2014; Levite and Tarrow, 1983; Zulianello, 2018, 2019) signals not only that the degree of conflict within economies and societies is growing, but also that government actions so far have not appropriately addressed the sustainability of structural change dynamics. The existing literature on voting behaviour suggests framing the following research questions:

i. Does an increase in local public expenditure reduce electoral consensus in support of anti-system parties?
ii. Does spending in different categories heterogeneously affect this electoral consensus?

This paper addresses these questions from the point of view of the political conditions needed to ensure a sustainable trajectory towards normative development goals. We examine our research questions in the context of the paradigmatic case of Italy. Italy is an interesting case given the specifics of its structure of internal cleavages and the longstanding presence of anti-system parties in the national party system. The combination of several judicial 'earthquakes', combined with changes in social and living conditions due to the modernisation of the industrial structure (Poguntke and Scarrow, 1996), have undermined the stability of the traditional Italian bipolar party system. These developments have triggered the development of anti-system parties in the past decade, activating additional lines of conflict and increasing political polarisation.

This paper undertakes an econometric analysis of the relationship between local spending and electoral consensus on the municipal level. The outcome variable is electoral consensus, captured as the variation in votes for anti-system and pro-system parties in the 2013 and 2018 elections in Italy.

Overall, the contribution of this paper is twofold. First, from a theoretical perspective and in line with recent contributions, we acknowledge that government interventions should attempt to incorporate a normative perspective while promoting structural change in a way that guarantees social and economic sustainability (Di Tommaso et al., 2020; Ferrannini et al., 2021). We build upon this view to claim that in democratic countries in particular, the government needs to catalyse electoral consensus and thereby secure its own long-term electoral support (Di Tommaso, 2020) to implement sustainable structural change and achieve normative goals. Second, our empirical findings provide evidence for the role that local public spending might play in marshalling sufficient electoral consensus to achieve sustainable structural transformation towards ambitious normative goals. In particular, we find that increasing local public spending is associated with a reduction in electoral consensus towards anti-system parties, whose rise might threaten the sustainability of structural change. In addition, for pro-system party consensus, we find heterogenous effects across different geographical areas and spending categories, suggesting that pro-system parties might not be fully

capable of engaging with policy actions that are properly perceived by local electoral constituencies and able to garner electoral consensus.

The paper is structured into six sections. Section 2 introduces the topic, presenting the three strands of research on which this study is based: contributions on the relationship between public spending and voting behaviour; literature exploring the effects of cleavages and conflicting interests on structural transformation and its sustainability; and contributions addressing the relationship between public spending and sustainable structural change. Section 3 examines the situation in Italy and frames our research questions within the Italian context. Section 4 presents the data and methodology, while Section 5 presents the results of the econometric analysis. The discussion and conclusions follow in the final section.

2. Literature Review

2.1 Public spending and voting behaviour

Whether citizens can understand policy activities and the way in which the electorate responds to policy proposals are long-debated questions (Citrin, 1979; Wlezien, 1995; Mettler, 2010; Toder, 2000) with far-reaching implications for politics (Haselswerdt and Bartels, 2015). The early debate on this subject focused on the assumption that the '*political process runs from mass preference and demands through elected intermediaries to policy output*' (Mettler and Soss, 2004, p. 56). In this vein, the early literature established a linear causal relation between mass preferences over political configurations, expressed through the democratic process, and policy outcomes. The idea that politics plays a pivotal role in channelling public spending across different domains and electoral constituencies (Yeric and Todd, 1996), ultimately affecting how public policy is shaped and delivered, has long influenced theories of government choice over public spending. This is explicitly the case for public choice theory, which, resting on the assumptions of neoclassical economics, views individual political preferences to be a function of economic self-interest. Public choice theory, however, does not establish a clear connection between different patterns of redistribution preferences among the mass public and public expenditure allocation, predicting only that politicians' views on budget size and composition will eventually converge around the preferences of the median voter.

However, recent research has shown that the median voter theorem does not apply to several real-world cases (Alesina and Giuliano, 2010; Bellani and Ursprung, 2019). In addition to predicting inefficient levels of public spending and outcomes, the framework does not capture the voting behaviour of many individuals or the many rationales driving the redistribution activities carried out by governments. Moreover, a growing body of research has challenged the implications of policy

choice theory, showing that redistribution preferences across individuals matter for public spending (Bellani and Scervini, 2020) and the ultimate provision of public goods (Alesina et al., 1999).

In this view, the pioneering work by Citrin (1979) about the influence of public opinion on national and local government spending diverges from the public choice approach. The author found that public opinion supports enhanced budgetary commitments in various domains such as health, education, urban problems, and environmental protection. These conventionally elicit widespread popular support that goes beyond the rational decisions of a self-interested individual. Indeed, although individual preferences for redistribution through public spending depend upon income and wealth levels (Meltzer and Richard, 1981), as neoclassical theories predict, they also contain noneconomic features (e.g. social background, cultural and demographic factors, political attitudes) (Costa-Font and Cowell, 2015; Gründler and Köllner, 2017), which condition individual political behaviour beyond the utility-maximising approach.

However, these studies treat policy as the culminating output of a political process (Easton, 1953) and only rarely as the cause of such forces. The seminal work by Schattschneider (1935), later built upon by Lowi (1964) and Wilson (1973), has argued that policies generate a pattern of political preferences and mobilisation between social groups (see also Adamany, 1972). According to Schattschneider (1935), new policies create new politics, such that neither the government nor political parties need to be as responsive to interest groups as they were traditionally.

Haselswerdst and Bartels (2015) built upon this line of research and discovered that other forces are involved regarding individual preferences over public spending. The authors state that preferences are also context specific and influenced by path dependency. Thus, the policy status quo (i.e. how services have conventionally been delivered, whether through tax breaks or direct public spending) structures how the public and citizens are likely to perceive the policy. Indeed, policy problems are approached differently by different governments; how a government policy has conventionally been delivered shapes '*the political environment by communicating to the public how different problems should be viewed and solved*' (Haselswerdst and Bartels, 2015, 609). In other words, under the assumption that citizens lack a detailed understanding of most public issues and suffer from information asymmetry, voters' behaviour is partly determined by prior experience. Therefore, the policy status quo and preferences for delivery mechanisms might mutually reinforce each other. This framework suggests that it is a challenge to promote fundamental change (Mettler and Soss, 2004). Variations in preferences and voting behaviour do occur, attesting to the ability of the public to provide feedback to policymakers (Pierson, 1993). Variations in how the electorate perceives and responds to public spending (through voting behaviour) can primarily be attributed to awareness-raising campaigns and the disclosure of information on policy proposals from the political elite (Mettler and Guardino, 2011).

The informational content of public policies has drawn the attention of scholars. Studies have shown that when there is general ignorance or little information about the probable consequences of a change in the level of taxation and spending, misperceptions regarding personal costs and benefits are widespread, and people often fail to act in their own interest even if they intend to do so (Citrin, 1979). According to Stretton and Orchard (1994, p. 27), '*most people don't know how to vote for their own interest, and it would cost them too much to find out. Their ignorance has important [political] effects*'. Indeed, suppose the heterogeneity of preferences per se hinders political coordination regarding public spending, conditional on some standard of policy complexity. In this case, general ignorance and misinformation complicate the task of parties and politicians to infer individual and aggregate attitudes towards public spending. However, recent research (Soroka and Wlezien, 2010; Ellis and Faricy, 2011) has shown that the spread and rapid circulation of information in society (through the press, media, family, friends, political groups, and daily experience with government services) are increasingly enabling the electorate to judge the level and distribution of public spending across policy domains and provide feedback to policymakers. Specifically, Ellis and Faricy (2011) argue that the public understands the ideological differences related to various policy delivery mechanisms and reacts accordingly. In other words, the public associates political decisions that alter the balance of direct and indirect spending with a shift in the role of government towards more or less intervention, respectively.

Another issue worth considering is the crucial role of the proximity and visibility of policies to citizens in the outcome of interest. As Soss and Schram (2007) argue, the more proximate a policy is, the more pronounced is its likelihood of influencing interest development. This strand of literature has devoted considerable attention to whether personal proximity to a policy matters for public opinion regarding the policy. Soss and Schram's (2007) analysis reveals that the strategic use of public policy can be a tool for reshaping public opinion. Specifically, visibility regards the degree to which a policy is noteworthy to the mass public (Hacker, 2002), while proximity concerns how a policy exists as a tangible presence affecting people's lives in immediate and concrete ways (Soss and Schram, 2007) ([26]). Proximity can relate to geography (as with some local policies), social relations (as with income-targeted policies), or time (as with policy effects that will arise in the short term). Conversely, some types of foreign policies escaping public notice, relatively opaque domestic policies targeting small constituencies, or policies whose effects will occur only in the distant future (e.g. issues related to electric car battery disposal) are unlikely to influence mass opinion and thus policy change.

[26] According to Dewey (1927), the proximity dimension has long been central to pragmatist and symbolic interactionist theories of democracy.

Looking at this framework through the lens of administrative geography, researchers have observed that the provision of collective goods and services on the local level strongly influences individuals' attitudes and political preferences (Bellani and Scervini, 2020). Local governments have a set of tasks and responsibilities covering various socioeconomic realms (e.g. social rights, social and pro-family policies). These are financed through both taxpayer revenues and grants and transfers from higher levels of government. While central governments might have a larger budget share to invest in policy initiatives, it is within local contexts that policies are most visible and proximate to the public, thus contributing to shaping public opinion. Consequently, it can be inferred that local public spending has a crucial role in forging consensus, and that different spending categories might heterogeneously affect such a consensus, depending upon their visibility and proximity to voters. However, this link has received little empirical investigation only found in recent contributions (Bellani and Scervini, 2020). Thus, we believe that the nexus of local public spending and electoral consensus is deserves further exploration and it is particularly relevant for the sustainability of structural change, as we argue in the next section.

2.2 Structural change, sustainability, and conflicting interests

Structural economic analysis uses the division of labour as a heuristic to highlight constraints and opportunities (Cardinale, 2018; Landesmann, 2018) that shape aggregations of stakeholders in a context of manifold interdependence between productive activities. The positioning of actors in the labor division structure conditions the formation of individual and aggregate interests, which can be conceived as by-products of context-specific production ties and organisational features of economic systems. However, the configuration of the sociopolitical realm (i.e. the map of interests) is not deterministically predicted; rather, several patterns of interest group affiliations are possible within the contingent interplay of economic interdependence among productive sectors (Quesnay, 1759 [1972]; Pasinetti, 1981) ([27]).

In the presence of structural change (that is, the open-ended adjustment of the economic system, characterised by shifts in the relative proportions of productive sectors and transformation of the underlying social features), changes in economic and societal dynamics spread across all system components and open a range of possible reconfigurations of existing structures, the connections therein, and the map of interests.

[27] Specifically, many levels of aggregation and representations of the division of labour can be used, for example, industrial sectors, which are at the heart of most structural economic analyses, but also circular flows, subsystems (Sraffa, 1960), or vertically integrated production ties. In other words, given the various representations of the division of labour, different possible socioeconomic aggregations can arise, so it is necessary to understand which one is relevant in any given situation (Cardinale, 2019) to understand the configuration of the salient interests at play.

Structural change means that some sectors might seek to expand and capture higher shares of added value, while others want to avoid potential downsizing (Scazzieri 2018; Cardinale and Scazzieri, 2018). This might activate novel lines of conflict between socioeconomic groups regarding resources and policy space and revive old ones. However, such conflicting interests between socioeconomic groups can be accommodated and borne by the economic system only to a certain degree, beyond which its viability is compromised, since damaged or declining sectors can negatively affect other sectors through interdependence. Therefore, the possibility of transformations or even disruptions in existing patterns of interdependence are not infinite, but must remain within the range of sector proportions required for the capacity of the system to reproduce itself (Cardinale 2015; Cardinale and Scazzieri, 2019). Inter-sector conflicts are thus systemically sustainable as long as each sector's pursuit of particular interests is conditioned on the shared interest in keeping the system viable (Cardinale and Landesmann, 2017, 2020).

This argument builds upon the Hawkins-Simon viability condition (1949): the system is sustainable to the extent that the investment in and maintenance of certain 'stocks' to reproduce the inputs used in production are ensured and a surplus is generated. In other words, conflicting interests amid economic interdependence are deemed sustainable to the extent to which the system demonstrates an ability to grow. However, this perspective approaches system sustainability mainly from an economic standpoint, although the economic dimension is not the only one that needs to be considered in evaluating the sustainability of structural change (Di Tommaso et al., 2020). The economic perspective is currently being enriched by contributions from scholars and international organisations that point out that a plurality of interconnected dynamics exists in the context of structural change, encompassing the social and ecological realms and equally conditioning the sustainability of the system.

Studies on ecological sustainability have identified conflicting interests between actors and groups over access to natural resources, the burden of pollution, and the societal distribution of environmental benefits and costs (Mi et al., 2017; Liu et al., 2018). From an ecological standpoint, the sustainability of structural change is threatened by intensive energy consumption in industrial processes and production-based carbon emissions, which are increasingly generating negative environmental externalities that might result in system collapse (Worm et al., 2006).

Recent contributions suggest that equal attention should be placed on the notion of social sustainability — broadly defined as a set of conditions that allow for improvements to the living conditions of current and future generations (Böstrom, 2012; Barbieri et al., 2020). It is undeniable that transformations in productive structures, coupled with the worsening economic conditions after the recession and the imposition of austerity policies, have entailed radical changes to the living conditions and rights of individuals and the aggregate demand for goods and services in the

communities to which people belong (Pianta and Gerbaudo, 2015). In this context, the collective mobilisation for social rights and the pursuit of decent work for all have drawn scholarly attention, given the capacity of these phenomena to alleviate social tension (Della Porta and Portos, 2020; Rodrik and Sabel, 2019). Accordingly, these topics have been the focus of international strategies targeting sources of inequality and economic exclusion (European Commission, 2010; UNIDO, 2017). Further exacerbation of dualism in the labour market and social conflicts might deteriorate the social fabric, which underpins the economic prosperity of a country in the long run.

Overall, considering a process of structural change from various perspectives (e.g. ecological, economic, and social) reveals the multifaceted nature of structural conflicts and the juxtaposed interests embedded in production ties, which in turn compound potential causes of system collapse. In this framework, recent studies have pointed to the crucial role that governments might play in reconfiguring the existing structures affected by structural transformation in a sustainable way for the economy and society, thus reducing the risk of system collapse.

Drawing on these strands of literature, we argue that the discussion is no longer about whether governments should promote structural change whose features are sustainable. Indeed, the idiosyncratic conflicts generated in the process of structural change by juxtaposed interests need to be adequately addressed and reconciled through policy actions; otherwise, such conflicts might compound each other and escalate, threatening the integrity of the system. However, we build upon this view to contend that to this end, governments need to build long-run electoral consensus among the mass public with respect to the major realms affected by structural change (e.g. the labour market, environment, inequality, and the provision of public goods) and that policy intervention is therefore needed to guarantee the sustainability of the system (Di Tommaso, 2020).

2.3 Electoral consensus regarding public spending: Why does it matter for sustainable structural change?

Structural economic analyses have only recently begun to account for political dynamics related to public policy. Recent contributions have attempted to bind the conditions for systemic sustainability to the configuration of the political realm. Specifically, these studies have conceptualised the structural cleavages around which the socioeconomic system is organised as a source of political competition (Flora et al., 1999; Cardinale and Coffman, 2014). Indeed, it has been shown that the way in which conflicting interests are structured and positioned in economic systems influences the configuration of the political realm through the democratic process. In exploring the nexus between economic interdependence and political conflicts, these studies have maintained the condition of system viability, implying that political conflict between socioeconomic groups should be kept within

a systemically sustainable level. One significant implication of this nexus directly relates to the economic policy domain. Policy initiatives should be implemented to prevent the exacerbation of current political and underlying socioeconomic cleavages to keep policy-making politically and systemically sustainable.

A second implication, closely entwined with the first, relates to the political consequences of such conflicts for the established party system. Considerable evidence from several western democracies links the inability of established political parties to aggregate conflicts around policy initiatives to the rise of new parties that delegitimise the regime (Dijkstra et al., 2020). Yet with very few exceptions (Cardinale and Coffman, 2014), structural economic analyses have neglected both implications, although they represent a crucial topic for enabling the sustainability of structural change. They have been studied in other fields, however, which offer fascinating insights that might enrich structural economic analysis.

The literature in political science, political economy, and economics (see, among others, Lipset and Rokkan, 1967; Hirschman, 1968; Rae and Taylor, 1970; Svallfors, 2007; Cardinale and Landesmann, 2017, 2020) has long established a connection between the rise of new parties in the political arena and the systemic presence of cleavages over certain crucial socioeconomic features. Conventional cleavages in western democracies mainly relate to the opposition between urban and rural contexts, owners and employees, the state and the church, and the centre and the periphery. Specifically, this literature has shown that it is crucial to understand cleavage patterns (i.e. whether cleavages reflected by new parties overlap, reinforce each other, or add up to new conflictual dimensions). Indeed, the configuration of the cleavage conditions the degree of polarisation of conflict in a system. Specifically, cleavages reinforcing each other and those presenting new lines of conflict tend to aggravate such polarisation. Conversely, the degree of overlap between cleavages entails a partial cementation of interests corresponding to both incumbent and new parties; therefore, cleavages that only partially overlap might contribute to increased social cohesion and thus lead to moderate polarisation (Coser, 1956; Lijphart 1969; Lijphart 1975 [1968]; Pabst and Scazzieri, 2012, 2016; Cardinale et al. 2017). In this sense, established parties can minimise conflicts that open or reduce the political space available for the emergence of new challenges.

This approach has recently been used to investigate how cleavages encourage anti-establishment sentiment among interest groups, conditioning their voting behaviour. Studies have revealed that such cleavages might nurture the rise of populist political movements, benefit parties located in more extreme positions on the ideological spectrum, and weaken support for democracy (Mudde, 2014; Zulianello, 2019; Colantone and Staing, 2018). In particular, Zulianello (2014, 2018, 2019) has employed the cleavages framework to define a modern understanding of anti-system parties. The author departs from the conventional conceptualisation of anti-system parties offered by Sartori

(1976), which are centred around ideological extremism and anti-democratic orientations, instead framing parties' anti-system orientation in terms of systemic and relational properties (e.g. parties' location along the country-specific constellation of cleavages).

On the one hand, there are *pro-system* parties whose orientations are channelled through the structure of cleavages that have historically contributed to establishing the country-specific pattern of political competition and are usually part of government coalitions. On the other hand, new *anti-system* parties give voice to controversial issues that do not fit the existing country-specific cleavage structure. Anti-system parties may activate additional lines of conflict or reactivate old cleavages. In both cases, they increase systemic social and political polarisation (Zulianello, 2014).

Overall, the anti-system orientation of such parties primarily addresses changes in the values system and the resulting inability of established parties to introduce new issues, for instance, ethnographic questions or environmental issues, in the public realm (Ignazi, 1996). In this view, anti-system parties highlight conflicts and interests over new issues and cleavages that '*are not covered by the existing parties, nor related to the existing cleavage structures*' of a country (Hino, 2011, p. 8). If such parties attract a considerable electoral base that shares their transformative aspirations for the socioeconomic system, they could alter the configuration of the established party system.

These studies have seldom crossed the path of structural economic analyses. However, such papers show that the extent to which systemic conflicts across socioeconomic cleavages are mitigated through public spending can be observed and assessed in the political realm. Indeed, the emergence and affirmation of new anti-system parties through the democratic process (Zulianello, 2014) signal the degree of conflict among economic actors with individuals and policymakers and the extent to which the sustainability of structural change dynamics (and the political system as a whole) is ensured or threatened.

Overall, we combine insights from political science with the structural economic literature to argue that juxtaposed sector and societal interests might multiply in the presence of structural change dynamics. If not appropriately prevented or addressed through public spending initiatives on various levels and across multiple domains, this proliferation of conflicting interests could eventually intensify and hinder the sustainability of structural change and the integrity of the established political system. Considering this, we contend that structural change dynamics is sustainable to the extent to which conflicting interests between socioeconomic groups are reconciled. To achieve this aim, we believe that local public spending initiatives across the economic, social, and environmental domains play a crucial role in mitigating conflicts over significant areas affected by structural transformation, thus catalysing the consensus that policymakers need to govern such change.

3. The Case of Italy

Italy is a paradigmatic case of the historical connection between a country-specific cleavage structure and the rise of anti-system parties. Starting in the second half of the nineteenth century, which corresponds to the postwar nation-building phase, the structure of Italian cleavages and the corresponding political party system were primarily organized along two lines of conflict — the labour movement, characterised by a deep split between owners and workers, and state–church opposition — accompanied by other minor dichotomies such as centre–periphery, land–industry, and popular–élite (Sartori, 1978). In this context, the increasing presence of the state in driving national economic growth elevated the emerging party system to a leading role in the society of the time, which lent the established parties, i.e. the Christian Democrat and Communist parties, increasing power (Ignazi, 1996). Such traditional parties have long represented the backbone of Italy's party system status quo, basically serving as the glue supporting context-specific cleavages.

Nonetheless, early anti-system parties started to arise in the 1960s, activating new cleavages over several issues: sexual liberation, anti-militarism, ecology, civil rights, divorce, abortion, legalisation of light drugs, referenda, and direct democracy (Panebianco, 1988). This political configuration continued and gained force during the eighties and nineties, in which the Italian postwar political spectrum solidified.

The Italian 'partitocracy', i.e. the consolidated bipartisan structure of political competition among established (i.e. pro-system) parties, was long perceived as safeguarding the principles of democracy, welfare, and solidarity that represented the pillars of the so-called First Republic (Bardi, 1996). However, in the 1990s, the combination of social changes due to modernisation (Poguntke and Scarrow, 1996) and a series of judicial earthquakes triggered by inquiries into the illegal financing of parties (the 'Tangentopoli') undermined the stability of traditional parties and laid the grounds for a new political order (Waters, 1994), where further emerging anti-system parties gradually entered the scene.

Anti-system parties presented themselves as new political players completely unrelated to the traditional parties, exacerbating classical cornerstones of populist rhetoric such as big vs. small and intellectual vs. common (Ignazi, 1996, p. 293). The anti-system attitude resulted from public disaffection with the political establishment (Betz, 1994) and demands from the mass public for structural change encompassing economic, institutional, and electoral reforms.

The beginning of the so-called Second Republic in 1992 permanently changed the traditional relationship between party choice and socioeconomic conflict in Italy, as reflected in the rise of new anti-system political players. At that time, it was already clear that some would become more system

and party-like, while others would retain their populist, anti-system posture, warding off the siren call of mainstream politics (Bardi, 1996).

Indeed, the parties that represented anti-system politics at the beginning of the Second Republic have followed different paths. For instance, while Forza Italia embraced the moderate right-wing of the liberal democrats, the former Lega Nord (the Northern League, now the Lega) has roughly held its anti-system, populist stance, achieving key electoral wins in the parliamentary elections of 2018 and the European elections of 2019 in the wake of the renewed populist moment in Europe, the UK, and the USA (Mouffle, 2019). The Northern League attracts extensive support from lower-educated, high-income workers, especially in the northern regions of Italy (Bauluz et al., 2021).

The former Alleanza Nazionale, which evolved into Fratelli d'Italia after the end of the right-wing party Popolo della Libertà (which lasted from 2008 to 2013), never relaxed its conservative, identity-building posture and is perhaps the highest expression of anti-system party politics in Italy today. On the other hand, the Partito Democratico (Democratic Party) has continued the legacy of some moderate left-wing parties and Socialists and Christian Democrats from the First Republic, now representing the left pole and being the party most closely aligned with the pluralist and systemic principles of the EU. The Partito Democratico is the dominant party among higher-educated, low-income individuals (Bauluz et al., 2021).

In 2009, a new political actor, the Movimento Cinque Stelle (Five Star Movement), appeared in the political arena. It originally embodied the utmost expression of anti-system sentiment, marshalling strong consensus among disenchanted people suffering from the renewed dichotomies that tended to be amplified in times of crisis (Ferrante and Pontarollo, 2019) (e.g. cosmopolitanism–localism [Gordon, 2018] and sovereignty–pluralism [Ivaldi and Mazzoleni 2020]). It gained support mainly in the south and islands, attracting both middle-educated and high-income voters. Nevertheless, it did not take long to show the chameleon-like, ever-evolving character typical of anti-system parties (Mosca and Tronconi, 2019), often changing positions on multiple issues such as economic policy, immigration, and public investment.

The year 2013 marked another definitive turning point in the Italian party system, whose transformation culminated in the 2018 elections (Bauluz et al., 2021). The enduring economic impact of the great recession, coupled with national austerity measures implemented to address the sovereign debt crisis, contributed to the electoral rise of Movimento Cinque Stelle in the 2013 general elections. Later, in 2018, Movimento Cinque Stelle won with 33% of the popular vote. On the other hand, the far-right regionalist Lega Nord became the party with the most votes within the right-wing coalition. An agreement was reached between Movimento Cinque Stelle and Lega Nord, and for the first time, 'the government was not led by a mainstream party' (Bauluz et al. 2021, p. 7). However, the

agreement did not survive the tensions between the ruling parties for longer than a year, and a new government between Movimento Cinque Stelle and Partito Democratico soon arose.

Thus, the Italian party system has currently departed from its conventional bipolar configuration to embrace a multi-élite profile in which new cleavages and lines of conflict have been added to traditional ones.

3.1 Public spending and the institutional framework in Italy

Italy has four administrative levels of government, i.e. the central government, regions, provinces, and municipalities. The latter represent the lowest level of jurisdiction and thus correspond to the level of administration of public spending closest to the final beneficiaries. For this reason, the municipality is the unit of analysis in the present study. The municipal level of government includes over 8,000 authorities, although enormous heterogeneity exists in terms of population size (the average population is approximately 7,000 inhabitants). Only Milan and Rome have more than a million residents and only 40 cities have more than 100,000 inhabitants, while more than half of municipalities have fewer than 3,000 residents.

Municipalities are tasked with a wide range of public functions, such as providing public transportation and other infrastructure spending; sports, culture, and other leisure activities; public security services; and educational services for children. Municipalities rely mainly on revenue from upper levels of government (transferred both from the central government and from the regions). Furthermore, municipalities collect revenue from municipal taxes paid yearly by real-estate owners and a share of the personal income tax (Agasisti et al., 2020). Another municipal revenue source is '*duties due for waste collection as well as several type of fees, such as parking permits and occupation of public areas*' (Agasisti et al., 2020, p. 6).

On the municipal level, public spending in Italy has undergone different waves that somewhat reflect the economic situation. For instance, periods of economic growth may generate unforeseen revenue which is often used to boost local spending, particularly by municipalities with lower levels of electoral consensus. Such expansions, nevertheless, may easily give way to sharp spending cuts and tax increases when economic crises emerge (Solé-Ollé and Viladecans-Marsal, 2019). Conversely, adverse economic periods may require large cuts to local government spending and general austerity, although these trends may also reflect disempowerment of the local state and an increase in inequality among territories (Gray and Barford, 2018). The latter is, by and large, what has happened in the last twenty years of Italian politics, where the first decade of the 2000s featured relative economic prosperity and a consequent higher spending capacity. Nevertheless, concomitant

with the great recession, several cuts were required to address the crisis, and structural reforms hit various sectors of public spending, particularly the pension system, education, and health care.

Within this framework, the joint discussion of the literature review and the paradigmatic experience of Italy allows us to pose the following empirical research questions:

1) ERQ_1: Does growth in local public expenditure reduce electoral consensus in support of anti-system parties?
2) ERQ_2: Do different spending categories heterogeneously affect this electoral consensus?

The empirical analysis described in the following sections allows us to answer these questions.

4. Research Design: Data Description and Methodology

Two outcome variables were selected to evaluate the effects on electoral consensus of heterogeneity in public expenditure on the municipal (LAU 2) level, namely, support for anti-system parties (ASPs) and pro-system parties (SPs) in Italy.

In contrast to the common approach focusing on disenchanted people and places that use the ballot box to express their discontent (through votes that usually correspond to ASPs), we believe it is also appropriate to measure the magnitude of the effect of public spending on these voters' counterparts (those whose votes express progressivism and adherence to the EU identity and principles in general). This approach offers a triple advantage: (i) it enables us to understand whether public spending can generate consensus in the 'positive' sense of revealed vote preferences (for SPs); (ii) it allows us to overcome the traditional problem of left-wing/right-wing party classification; and (iii) it represents an appropriate measure for answering the two main research questions framed above.

Our dataset takes the shape of a cross-section, where the geographical scale of reference is municipal (LAU 2). All available municipalities, i.e. those where parliamentary elections took place both in 2013 and in 2018, were included into the analysis. This results in just under 8,000 municipalities; however, it should be noted that the effective number, N, of proposed regressions averages around 7,500 municipalities due to some missing values, both in the dependent variables, and in the covariates. Our data sources were varied:

- election data are drawn from the archives of Italian parliamentary elections provided by the open data platform of the Italian Ministry of Interior ('Eligendo', which is available at https://elezioni.interno.gov.it/);
- the Chapel Hill Expert Survey (CHES), which provides information on the degree of openness of parties on a series of structural issues (such as national and international economic policy,

migration and European integration, international relations, and so forth) provided in the form of scores attributed to each party. These scores are provided by a panel of political science experts and are useful for identifying the orientation of a party on the scale of far-right/far-left. Details about the issues addressed and categorised by the CHES are available at https://www.chesdata.eu/ches-europe. We first averaged the values of all variables provided by the CHES into a single weight per each party and then crossed these scores with the raw number of votes for each party on the municipal level to provide a more effective measure of what can be considered anti-system and pro-system parties. In this way, we avoid an arbitrary interpretation of the parties' orientation and we provide a weighted measure of consensus; the mechanism for building the dependent variables weighted by CHES score are described in Section 4.1;

- the main covariates of interest consist in the amount of expenditure per municipality regarding axes — selected from among all expenditure categories — that we consider very close to the citizens' perceptions. In this way, we test the selected categories (later described in Section 4.2) one by one against the weighted consensus, which allows us to identify eventual associations and their significance. Each variable is normalised by municipal gross income (roughly identified with the local gross domestic product) to control for size effects, given the heterogeneity of the municipalities involved into the analysis. The variables are taken from the OpenBilanci platform (https://openbilanci.it/), where open data on municipal public spending are provided;
- the regressions are completed with a series of long-term control variables taken from the ten-year censuses between 2011 and 1991, provided by the Italian Institute of Statistics (ISTAT). These variables are computed as a delta variation between the last period available (2011) and the first period available (1991). Such controls are useful for capturing eventual long-term structural variations that might influence vote preferences regardless of public spending intensity. The list of control variables and the overall descriptive statistics are provided in Section 4.3.

4.1 Dependent variables

The two types of electoral outcome variables are built upon vote preferences ([28]) for the five main Italian parties during the national elections of 2013 and 2018. The parties are the Lega, Fratelli d'Italia (FDI — *Brothers of Italy*), Forza Italia (FI — *Forward Italy*), Movimento Cinque Stelle (M5S —

[28] Only valid votes for the Chamber of Deputies are considered because votes for Senate are limited to individuals who are over 25 years old.

Five Star Movement), and Partito Democratico (PD — *Democratic Party*). In line with Dijkstra et al. (2020), we make use of the Chapel Hill Expert Survey (CHES) ([29]) to classify parties (Bakker et al., 2020), and individual vote preferences on the party level are grouped into two main classes:

- Anti-system parties (ASPs), i.e. those that are vehemently opposed, opposed, or moderately opposed to EU integration (where scores range between 1 and 4; this group includes Lega, FDI, and M5D); and
- Pro-system parties (SPs), i.e. those moderately or strongly in favour of EU integration (where scores range between 4 and 7; the group includes FI and PD).

This partition follows one of the main themes addressed by the CHES (i.e. the European integration): parties' orientations towards the European integration are assessed using a seven-point a scale ranging from 1 to 7 (where 1 = vehemently opposed and 7 = strongly in favour). Parties scoring less than 4 are considered anti-systemic, parties over the value 4 are considered pro-systemic. The full list of variables provided by the CHES and used to compute the weight is listed the endnote n. 5, specifically: "EU integration", "EU policy questions", "ideological questions", "policy dimensions" and "party characteristics". We used, respectively, the CHES versions corresponding to the two years of elections considered (2013 and 2018), in order to have a correspondence with the party orientation in that specific moment: this is because, as shown in literature, some parties can be considered as 'chameleonic' (this is especially true in case of 'populist' parties) and therefore certain party positions may differ over times.

As previously mentioned in the data source description, the dummies for each of the two groups interact with a score σ which includes the average value of all available parameters in the CHES that relate to the dimensions assessed in the survey ([30]):

$$\omega Cons_{o,f;m} = \sigma_{g,y} \times \Sigma vote\ groups_{p,m,y}$$

where $\omega Cons$ is the weighted consensus, *o* indicates the group of votes for the ASP, *f* indicates the group of votes for the SP, *m* indicates the municipal level, $\sigma_{p,y}$is the score computed for each of the two groups, *g* (ASP, SP), in year *y* (2013, 2018), and $\Sigma votegroups_{p,m,y}$ is the sum of the votes for

[29] The scores are selected depending on the election year, i.e. votes for the 2013 election are weighted with scores for 2013, while votes for the 2018 election are weighted with scores for 2018.

[30] The dimensions consist of general questions on 'EU integration', 'EU policy questions', 'ideological questions', 'policy dimensions', and 'party characteristics'. Only items whose scores are available both in 2013 and in 2018 are used to build the overall weighted score.

the two groups on the party level (p), on the municipal base (m), for each of the two election periods of observation (y).

According to similar studies (Albanese et al., 2021; Di Matteo and Mariotti, 2021), this interaction enables a more accurate measurement of the outcome variable than the simple sum of votes for the parties of interest. Once the weighted variables are built, the delta variation between the national elections of 2018 and 2013 is computed as follows:

$$\omega Cons_{o,f;m}{}_{2013}^{2018} = \left(\frac{\omega Cons_{o,f;m2018} - \omega Cons_{o,f;m2013}}{\omega Cons_{o,f;m2013}} \right)$$

Assessing the delta variation between the two election periods may be helpful for avoiding staticity: the results of a single election can offer a snapshot of a specific period but may ignore dynamics in party preferences that may arise even over short periods. Moreover, the research highlights that between different electoral polls, endogenous or exogenous shocks ([31]) may occur, disrupting or increasing a party's voter base; this is particularly frequent in the case of chameleon-like radical left- or right-wing parties (van Kessel, 2015; Mosca and Tronconi, 2019).

4.2 Public spending variables (main covariates)

Data on public expenditure are retrieved from the OpenBilanci platform ([32]), an open data source on the financial accounts of Italian municipalities. Data on local public spending are provided based on the public accounting and financial system reform, which profoundly changed the accounting rules applicable to local authorities. In particular, based on Law 196 of 2009 concerning the public accounting reform, Legislative Decree 118 of 2011 established the criteria for harmonising the public accounting of Italian local and national authorities according to the principles of transparency and openness required on the European level. In this way, the accounting systems have been reformed and expenditures re-categorised into 'missions' and 'programmes' (instead of the previous 'titles' and 'functions'). This categorisation allows us to explain individual items not only in terms of cost items, but also with respect to the specific mission to which each expenditure item is assigned, with the aim of clearly identifying the objective and the purpose of the expenditure.

We use public spending data from 2017 because it represents a one-year lag between the expenditure finalised by the municipality and the election in 2018, which is the final year upon which

[31] For instance, an internal party crisis or pandemic event such as the COVID-19 emergency.
[32] https://openbilanci.it/

the delta variation is computed. This lag is considered appropriate for capturing vote sensitivity to publicly funded interventions that relate to current spending.

The main covariates are built by adding two budget items, i.e. current expenditure (expenses) and capital expenditure (investments), which are contained in the final balance (not the forecast balance) for the respective year.

Based on previous literature, we extract data on the principal kinds of public spending that cover the majority of public interventions, and we select ten main covariates of interest relating to the following:

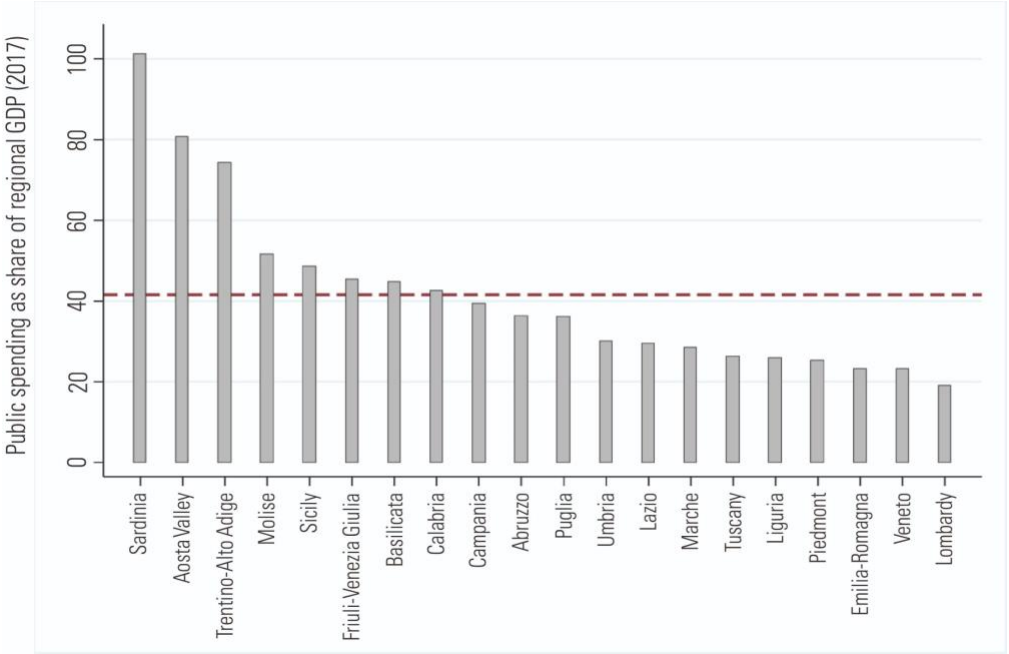
a. Transport and mobility (including sub-assets of rail transport, local public transport, water transport, viaducts, and road infrastructure).
b. Health care (this is mainly handled on the regional NUTS 2 level, and such LAU 2 expenditures only consist of additional spending in excess of the regional health service budget).
c. Education (including the sub-assets of preschool, primary, and secondary school education, university and higher technical education, and ancillary educational services).
d. Employment and vocational training policies (including the sub-assets of services for developing the labour market and employment support).
e. Spatial planning and housing (including the sub-assets of urban and territorial planning, residential building, social housing, public lighting, and ancillary services).
f. Social rights, social and pro-family policies (including the sub-assets of services for children, people with disabilities, elderly people, and individuals at risk of social marginalisation; the social and social health service network; associations and cooperation; and cemetery and post-mortem services).
g. Protection and enhancement of cultural heritage and activities (including the sub-assets of historical artefacts, cultural activities, and other activities in the cultural sector).
h. Youth policies, sport, and leisure (including the sub-assets of municipal swimming pools and stadiums, sports palaces, and other sport facilities).
i. Sustainable development and territorial and environmental safeguards (including the sub-assets of soil conservation; environmental protection, enhancement, and restoration; waste; integrated water services; protected areas, natural parks; protection of nature and forestation; safeguarding and enhancement of water resources; sustainable development of small mountain municipalities; and air quality and pollution reduction).
j. Public order and security (including the sub-assets of local, commercial, and administrative police and integrated urban security systems).

Each sub-asset is combined to create the respective aggregate variable, and overall spending per axis is computed as the share of municipal gross income (GI), given by the sum of all types of income per resident on the municipal level ([33]). This controls for possible size effects, since the municipalities in the dataset are extremely heterogenous, ranging from small municipalities with less than 1,000 inhabitants to large metropolitan cities with two or three million inhabitants (thus reflecting a clear difference in public spending intensity). The normalisation of public spending per axis on the GI (roughly equivalent to the local gross domestic product) is computed as follows:

$$\underline{\chi} = \frac{(x_{a\ldots j})_{2017}}{GI_{2017}} \times 100$$

where $\underline{\chi}$ is the set of $(x_{a,\ldots j})$ main covariates described above, all in percentage shares of municipal GI considered in the same reference year (2017). Figure 1 shows public spending (aggregate) levels on a regional NUTS 2 basis in Italy for the year in question (2017).

Figure 1. Public spending as a share of gross domestic product at NUTS 2 (2017)



Source: Authors' calculations. Note: The dotted line indicates the regional average aggregate spending (NUTS 2) as a share of gross domestic product, which is equal to 41.53%

[33] These data were retrieved from the open platform of the Ministry of Economy and Finance (MEF) https://www1.finanze.gov.it/finanze/pagina_dichiarazioni/public/dichiarazioni.php, provided by the Department of Finance. Data are collected based on taxpayer tax returns (the *Irpef* declaration, namely, the *Imposta sul Reddito delle Persone Fisiche*), where the overall income includes the following types: income from buildings, income from employees and assimilated work, income from pensions, income from self-employment, income from ordinary entrepreneurship, income from simplified entrepreneurship, and income from shareholding. The sum of all income items gives the sum of incomes for each municipality, considered in 2017.

4.3 Control variables

Other variables are included in the model(s) to control for possible long-term structural changes. These refer to changes in: demographics, employment, economic situation, education, and, finally, age dependency. The demographic change consists in the variation of resident population on 1 January for the periods considered (2011 and 1991); employment change is the variation in the number of working-age people employed among the two periods; education change is the variation in the number of graduates; age dependency change is the variation in the ratio of working age people (15-64 years old) and the over-65 population (retired, or in general, economically inactive). All the variables are on the municipal scale and all are computed as the long-term delta variations for the period 2011/1991, that is, before the first election period considered here (2013). The choice to use census data from 2011 and 1991 is to provide a measure which is unable to affect the dependent variable(s) in the election periods considered. An exception is economic change, which corresponds to the medium-term delta variation (2017/2012), because recent economic performance is more likely to be taken into account at the ballot box. Moreover, we include regional fixed effects in all estimations. The summary descriptive statistics of all the variables are provided in the following table.

For the maximum values, the percentage of the expenditure item in some cases exceeds the share of GI because some categories are partially financed by higher-level institutional bodies, such as regional and/or national governments. The Appendix (Table A1) contains a correlation matrix for all the variables used in the analysis. From this, it is clear that in most cases, the values are well below the cut-off value of 0.5; nevertheless, the highest correlations are found — as expected — among the variables indicating the public spending categories (highlighted in light grey). This does not affect our results, however, since in our models we take each spending axis and the control variables against the dependent variable(s) individually. This is clarified at the beginning of Section 5.1.

Table 1. Descriptive statistics

Code	Variable	Source	Mean	Std. Err.	Min	Max	Obs.
Outcome variables, elections							
y_1	weighted consensus, anti-system parties	Italian Ministry of Interior	0.814	0.539	-1	16.45	7,792
y_2	weighted consensus, pro-system parties		-0.413	0.123	-1	0.977	7,792

Main covariates, public spending as share of GI							
x	aggregate spending	OpenBilanci	12.53	19.82	0.018	642.0	7,649
x_0	expenditure$_{2017}$ (sum a-j)		7.130	12.68	0	448.0	7,868
x_1	mobility and transport		1.289	2.458	0	89.35	7,868
x_2	health care		0.353	7.948	0	324.9	7,868
x_3	labour market		0.022	0.265	0	11.01	7,868
x_4	education		0.887	1.160	0	50.33	7,868
x_5	urban		0.632	3.108	0	173.0	7,868
x_6	social rights		1.060	2.177	0	76.47	7,868
x_7	culture		0.286	2.674	0	223.6	7,868
x_8	youth policies		0.235	0.938	0	33.56	7,868
x_9	sustainable development		2.047	2.845	0	65.16	7,868
x_{10}	public order		0.315	0.488	0	21.52	7,868
Control variables							
x_{11}	economic change	MEF	3.588	5.586	-36.70	65.29	7,865
x_{12}	gross incomes$_{2017}$	MEF	1.01e+08	7.34e+08	376,343	4.84e+10	7,868
x_{13}	population$_{2017}$	ISTAT	7590.459	42951.07	30	2,873,494	7,939
x_{14}	demographic change	8000Census	5.813	23.54	-57.95	478.5	8,036
x_{15}	employment change		11.71	14.23	-46.23	131.7	8,036
x_{16}	education change		1.240	0.966	-0.516	22.29	8,031
x_{17}	aged dependency change		35.93	33.68	-69.80	269.6	8,036

Note: The number of observations varies since several territorial regroupings occurred among Italian municipalities over the years. Observations regarding some municipalities were excluded from the analysis since their electoral district did not correspond between 2013 and 2018 elections.

4.4 Model

We use linear regression models to verify the previous assumptions, where the outcome variable is regressed over the public spending predictors. We start by defining the baseline model, which is as follows:

$$y = \beta_0 + \beta_1 \chi_{x1\dots xn} + \Sigma \beta_n X_n + \varepsilon_i,$$

where y is the outcome variable, $\beta_0$is the slope of the intercept, $\beta_1 \chi_{x1\dots xn}$ is the set of the main covariates of interest, $\Sigma \beta_n X_n$ is the pool of long- and medium-term control variables, and $\varepsilon_i$is a stochastic error term. Given the set of variables collected for the analysis, we can rewrite the model with some specifications, namely,

$$\omega Cons_{o,f;m}{}^{2018}_{2013} = \alpha + \beta_{1;m,y} \chi_{x1\dots x10} + \gamma \underline{X}_{m,\delta} controls + v_r + \varepsilon_i,$$

where $\omega Cons$is the dependent variable described above, i.e. the delta variation of votes in the 2018 and 2013 national elections on the municipal level (m) for ASPs (o) and SPs (f), α is the constant term absorbing the bias of the regression model, $\beta_{1;m,y} \chi_{x1\dots x10}$ is the coefficient of the ten selected public spending covariates in a given year (y), $\gamma \underline{X}_{m,\delta}$ is the set of control variables representing structural change over time in multiple socioeconomic dimensions, and v_r represents the regional fixed effects.

Moreover, all estimations are weighted by the resident population in 2017, and the $\underline{\chi}$ covariates are tested individually through multiple models because the public spending items show correlations among each other in the preliminary descriptions.

5. Local spending and voting behaviour: The evidence

5.1 Baseline results

Table 2 shows the results for all Italian municipalities included in the estimations. For ease of presentation, we show only the coefficients of the public spending covariates and the related p values, since they derive from multiple regressions for the above-mentioned reasons. Before proceeding with the results, we clarify that the main covariates of interest related to the public spending axes are not taken together in the regression; instead, they are taken individually since such spending categories show correlation among each other in some cases. The columns of the regressions shown in Table 2

(and later in Table 3) are the vertical transposition of an oblique line of coefficients, which is why diagnostics and other details of the regressions (such as R^2 and the F test) are hidden. The full version of Table 2 is provided in the Appendix with Tables A2 and A3, where we use the anti-system consensus and the pro-system consensus respectively as dependent variable(s). Table 2 is thus a synthetic visualisation of 24 individual regressions, where each spending axis (plus the two types of spending aggregations) are taken individually with respect to the dependent variable(s). The same is true of Table 3, where we also show only the coefficients of the main covariates of interest with respect to the dependent variable(s) following the same scheme. Table 3 synthesises the results of 96 individual regressions in a single table. This is to facilitate reading of the main results by using simplified tables.

We observe that once the major long- and short-term structural changes were controlled for, the change in weighted consensus supporting ASPs was generally negatively associated with most municipal spending categories, considering aggregate spending and sum of the 10 selected covariates as a whole. This means that where public spending was lower, people expressed more scepticism towards European institutions and principles and were more likely to favour parties driven by general populist programmes.

When we look at individual spending categories, we see that eight of the ten coefficients are negatively associated with the weighted consensus in support of ASPs, while two are not significant. In particular, the coefficients for spending on mobility and transport (a), health care (b), employment support and vocational training (d), sustainable development, and territorial and environmental safeguards (i) are statistically significant and negative. Consistently negative but less so are the coefficients related to spending on social rights and pro-family policies (f), protection and enhancement of cultural heritage and activities (g), and public order and security (j). In contrast, the coefficient for education expenditure, albeit negative, is barely significant. Public spending on spatial planning and housing (e) and youth policies, sports, and leisure (h) are not significantly related to the change in the weighted electoral consensus in support of ASPs.

With respect to the results for anti-system voters' counterparts (i.e. SP), we notice that whether we consider aggregate spending level or the 10 covariates as a whole, there are no significant associations with support for SPs. The same holds when the results for the ten spending categories are disaggregated, except for public order, the coefficient which — rather surprisingly — is significantly and positively associated with the dependent variable.

In general, ASPs tend to claim consensus based on political programmes that are — at least in principle — aimed at increasing local and national security. Instead, we see that public spending in this category has positive implications for SPs, which somewhat subverts a cliché. However, although

we do not find significant results in any of the other expense categories on the national level, the scenario differs in some respects when geographical heterogeneities are explored, as is done below.

Table 2. Public spending and electoral consensus

	change in weighted consensus	
parties' groups/ public spending axes	anti-system parties	pro-system parties
aggregate spending	-0.00051*** *0.000*	0.00003 *0.390*
expenditure (sum a-j)	-0.00069*** *0.000*	0.00004 *0.449*
(a) mobility and transport	-0.01117*** *0.000*	0.00076 *0.282*
(b) health care	-0.00081*** *0.000*	0.00005 *0.417*
(c) education	-0.00922* *0.099*	0.00029 *0.913*
(d) labour market	-0.03172*** *0.000*	0.00272 *0.371*
(e) urban	-0.01039 *0.173*	0.00020 *0.889*
(f) social rights	-0.01087** *0.028*	-0.00049 *0.815*
(g) culture	-0.02841** *0.047*	0.00326 *0.362*
(h) youth policies	-0.03838 *0.122*	-0.00202 *0.748*
(i) sustainable development	-0.00635*** *0.001*	0.00004 *0.922*
(j) public order	-0.03804** *0.027*	0.01717*** *0.002*

Note: Coefficients and p values (in italics) are reported. Other regression details (numbers of observations, R-squared values, F statistics) are showed in the Appendix in Tables A2 and A3. Standard errors are robust. Control variables and

regional fixed effects are included. Regressions are weighted by the resident population in 2017. Significance levels: *** p value <0.01; ** p value <0.05; * p value <0.10.

5.2 Geographical heterogeneity

We are interested in exploring heterogeneities in outcomes by geographically decomposing the data. To do so, we apply a NUTS 1 restrictor to the models to visualise differences in the macro area. The previous equation then becomes:

$$\omega Cons_{o,f;m}{}_{2013}^{2018} = \alpha + \left(\beta_{1;m,y}\chi_{x1\dots x10} + \gamma \underline{X}_{m,\delta} controls + v_r\right) \times NUTS1_m + \varepsilon_i$$

where $NUTS1_m$is a categorical variable identifying the Italian macro areas (northwest, northeast, centre, south, and islands) ([34]). We again simplify the visualisation of the results by showing only the coefficients of the public spending variables and the related p values (Table 3).

The results related to geographical heterogeneities are multifaceted. Overall, public spending shows statistically significant associations mainly in the northwest and central regions, while for the northeast and southern regions, only a few spending categories explain the change in weighted consensus in support of the two electoral groups.

Above all, the northwest area confirms the main assumptions of the study because the coefficients of the spending items are mostly negative and significant with respect to the vote change for ASPs, but positive in relation to SPs. In particular, we note the strong negative significance of categories (a), (b), (c), (d), (g), and (j) and the barely negative significance of (e) when ASPs are considered. At the same time, all spending items are positively and significantly associated with support for SPs, where only (f) and (h) fall below statistical significance at 99%. In sum, municipalities in the northwest where public spending was low showed higher changes in their votes for ASPs, while the consensus for mainstream parties (SPs) in municipalities with higher spending was more significant.

The case of the northeast region is a different matter. Items (a), (b), and (f) are somewhat negatively associated with ASP support, while only item (j) explains consensus supporting SPs. We believe these results reflect a general issue of the territorial composition of NUTS 1 macro areas, since the northeast covers two regions, Veneto and Emilia-Romagna, with radically different political legacies. While a far-right electoral consensus remained in Veneto after the dissolution of the Christian Democratic

[34] Each macro area includes multiple NUTS 2 regions. In particular, the northwest includes Piedmont, Aosta Valley, Lombardy, and Liguria; the northeast includes Trentino-Alto Adige/Südtirol, Veneto, Friuli-Venezia Giulia, and Emilia Romagna; the centre includes Tuscany, Umbria, Marche, and Lazio; the south and the islands include Abruzzo, Molise, Campania, Puglia, Calabria, Basilicata, Sicily, and Sardinia.

party in 1994, Emilia-Romagna has been ruled uninterruptedly by left-wing parties since its establishment in 1970.

In the central regions, some significant coefficients confirm the main hypotheses and some unexpected results when ASPs are considered. In particular, the coefficients of spending items (f) and (i) are negative and highly significant with respect to the dependent variable, and those of items (a), (b), (c), (d), and (g) are likewise negative and somewhat significant. In contrast, items (e) and (h) show positive and significant coefficients with respect to the changing votes for anti-system parties. This means that in central regions where such spending and investments were higher, the change in votes for misaligned parties was larger, somewhat in contrast with the general assumptions. We explain this point later in the discussion. Regarding the change in consensus supporting SPs, a significant and positive association with items (a), (c), (d), (f), and (g) emerges, while (b) and (i) are likewise positive but only at the 95% significance level. Items (e), (h), and (j) are not significant.

In the southern Italian regions, a few public spending items explain the change in consensus favouring ASPs, where item (d) is negatively associated with the dependent variable, items (a) and (i) are likewise negative but with lower significance, and items (b) and (c) are only barely significant in relation to the outcome variable. With regard to the counterparts of anti-system voters, none of the public spending items show a statistically significant relationship with the change in votes for SPs.

Table 3. Public spending and electoral consensus by geographical heterogeneity

	change in weighted consensus							
	Anti-system parties				Pro-system parties			
parties' groups/ public spending axes	Northwest	Northeast	Centre	South	Northwest	Northeast	Centre	South
aggregate spending	-0.00126*** *0.000*	-0.00063* *0.096*	-0.00057** *0.015*	-0.00031* *0.086*	0.00072*** *0.000*	-0.00010 *0.474*	0.00037*** *0.007*	0.00003 *0.302*
expenditure (sum a-j)	-0.00137*** *0.000*	-0.00075* *0.066*	-0.00063** *0.016*	-0.00047* *0.050*	0.00077*** *0.000*	-0.00015 *0.287*	0.00040*** *0.007*	0.0003 *0.449*
(a) mobility and transport	-0.01341*** *0.000*	-0.01478* *0.066*	-0.01143** *0.020*	-0.00784** *0.026*	0.00776*** *0.000*	-0.00329 *0.158*	0.00661*** *0.000*	0.00020 *0.681*
(b) health care	-0.00159*** *0.000*	-0.00068** *0.022*	-0.00070** *0.019*	-0.00060* *0.066*	0.00088*** *0.000*	-0.00014 *0.193*	0.00044** *0.016*	0.00004 *0.429*
(c) education	-0.06305*** *0.000*	-0.01242 *0.429*	-0.07402** *0.016*	-0.02462*** *0.003*	0.02277*** *0.000*	0.00316 *0.759*	0.03071*** *0.009*	0.00105 *0.600*

(d) labour market	-0.04587***	-0.00858	-0.01507*	-0.00873*	0.02618***	-0.00109	0.01673***	0.00154
	0.000	0.177	*0.066*	*0.081*	*0.000*	*0.695*	*0.000*	*0.233*
(e) urban	-0.01789*	-0.04593	0.03419**	-0.00556	0.02026***	-0.01571	0.00909	0.00117
	0.098	*0.207*	*0.032*	*0.397*	*0.008*	*0.139*	*0.206*	*0.339*
(f) social rights	-0.00789	-0.01695**	-0.03136***	-0.00272	0.00561**	-0.00353	0.01300***	0.00024
	0.153	*0.035*	*0.004*	*0.375*	*0.049*	*0.312*	*0.008*	*0.764*
(g) culture	-0.08019***	-0.05044	-0.06292**	-0.01702	0.04544***	-0.00037	0.05246***	0.00061
	0.004	*0.179*	*0.020*	*0.124*	*0.000*	*0.980*	*0.000*	*0.704*
(h) youth policies	-0.01882	-0.06508	0.08955**	-0.03633	0.01934**	-0.03032	0.01113	0.00579
	0.129	*0.329*	0.034	0.130	*0.024*	*0.111*	*0.480*	*0.249*
(i) sustainable dev.	-0.00305	-0.01013	-0.02450***	-0.00409**	0.00467***	-0.00262	0.00769**	0.00015
	0.374	*0.215*	*0.004*	*0.013*	*0.003*	*0.550*	*0.024*	*0.716*
(j) public order	-0.07675***	0.02519	-0.01179	-0.02755	0.04376***	0.02171	0.01818	0.00142
	0.002	*0.224*	*0.580*	*0.475*	*0.001*	*0.012*	*0.134*	*0.839*

Note: Coefficients and p values (in italics) are reported. Other regression details (numbers of observations, R-squared values, F statistics) are omitted but available upon request. Standard errors are robust. Control variables and regional fixed effects are included. Regressions are weighted by the resident population in 2017. Significance levels: *** p value <0.01; ** p value <0.05; * p value <0.10.

5.3 Robustness check

To provide a robustness check of the main findings, we substitute the dependent variable from the previous model with a binary variable and rerun the equation in a probit model. Specifically, given the sum of votes for the ASP and SP groups in the 2018 election, the variable takes the value 1 when the ASP vote is prevalent in municipality *m* and 0 otherwise. In this case, we take the value 0 (corresponding to SPs) as the reference category, so the probit model shows the coefficient only for ASPs. We also reverse the dependent variable by assigning a value of 1 to municipalities where the SP vote was prevalent in 2018 and 0 otherwise. Here, we take the value 0 (corresponding to ASPs) as the reference category, which allows us to exhibit the coefficient for SPs in the model results. The main covariate of interest is aggregate spending in 2017 (x), and the rest of the equation is as before, including long-term control variables and regional fixed effects.

Table 4. Robustness check with alternative dependent variable

	ASP_{2018}	SP_{2018}
aggregate spending$_{2017}$	-0.00238** (0.00104)	0.00258** (0.00102)
Controls		
economic change	-0.00878 (0.00659)	0.00875 (0.00705)
demographic change	0.01814*** (0.00203)	-0.01790*** (0.00251)
employment change	-0.00209 (0.00185)	0.00086 (0.00183)
education change	0.01306 (0.03957)	-0.02361 (0.03203)
aged dependency change	-0.00008 (0.00111)	-0.00006 (0.00114)
Reference category	pro-system parties	anti-system parties
Pseudo R^2	0.2381	0.2390
Observations	7,127	7,127
Regional fixed effect	Y	Y
Goodness of fit		
Pearson χ^2 ($p> \chi^2$)	6940.46 (0.9158)	6889.11 (0.9653)

Source: Authors' calculations. Note: Bootstrap standard errors in parentheses (25 repetitions); significance levels: *** p value <0.01; ** p value <0.05; * p value <0.10; estimations are run using probit regression models.

In Table 4, we see that even when we replace the dependent variable, the baseline coefficients for aggregate spending do not vary with respect to the votes for ASPs and SPs. Moreover, the non-significance of the Pearson χ^2 in the post-estimation tests for the general goodness of fit imply a good adaptability of the model to the proposed data.

In particular, when ASPs are considered as prevailing in the municipality with value one (SP is the reference category), the coefficient is negative and statistically significant, thus confirming the results in Table 2. Conversely, when SPs are set as predominant in the municipality (ASP is the reference category), the coefficient is positive. However, in contrast to the results in Table 2, the coefficient of aggregate spending becomes significant at 95%. Among the control variables, we see that demographic change shows a statistical significance in relation to the dependent variable: higher levels of demographic change are positively associated with ASPs, while lower levels of demographic

changes are mainly associated with SPs. This might appear surprising if we were to assume that in most cases, anti-system parties marshal consensus in small, remote places experiencing long-term population decline, but recent literature has shown that ASPs are now also rising in medium-sized cities experiencing decline relative to their prosperous pasts (Rodriguez-Pose, 2018; Dijkstra et al., 2020).

We take these results as robust proof of the baseline results — namely, where local spending on the LAU 2 level is lower, there is a greater association with ASP dominance. In contrast, higher levels of local spending are more associated with SP dominance.

6. Discussion and conclusion

The present paper empirically established a relationship between local public spending and electoral consensus in favour of anti-system parties in Italy. In particular, we find that increasing local public spending, both on the aggregate level and across some specific categories, is associated with a reduction in anti-system party consensus. We contend that this nexus is relevant for helping policymakers sustainably govern structural change for economies and societies.

Moreover, we suggest that the same nexus is also crucial for policies genuinely interested in opening a discussion on a plurality of possible normative objectives. In other words, our exercise is also relevant to the more general debate on the relationship between promoting normative societal goals (Myrdal, 1970; Arndt, 1989; Sen, 1992; Haq 1995) and the need to make structural change sustainable (Cardinale et al., 2017; Cardinale and Scazzieri 2018; Ferrannini et al., 2021; Ngo et al., 2021). Indeed, the rise of new anti-system parties in democratic countries signals the opening of new cleavages within the process of structural change or the revival of old ones. Thus, the more electoral consensus anti-system parties can marshal among the electorate, the more the sustainability of structural change is threatened, posing the risk of stifling debate on ambitious normative goals.

Therefore, we argue that local public spending represents a channel that pro-system parties might consider using to build the long-term electoral consensus that they need from the electorate to promote sustainable structural change (Di Tommaso, 2020) and effectively achieve complex normative societal goals. Indeed, given its proximity and visibility to the final beneficiaries, local public spending is a channel to directly influence voting behaviour and build electoral consensus.

This is why this paper empirically investigated the relationship between local spending and voting behaviour in Italy. In particular, our analysis answers the exploratory research questions and suggests several conceptual insights for scholarly debate and implications for policy-making.

First, in line with previous literature (see Section 2.1), we observe that a growth in local public spending influences individual voting behaviour. In particular, the case analysed here shows that an

increase in public spending on the local level negatively affects electoral consensus in support of anti-system parties, ceteris paribus (ERQ_1). This finding is supported by the ordinary least squares (OLS) estimation and further robustness checks (using a probit model). This suggests that resources channelled on the local level mitigate the probability of a rise in consensus favouring anti-system parties. However, while these results align with our expectations, we find that the relationship between aggregate local spending and pro-system party consensus appears positive but not statistically significant in the baseline estimations. Nevertheless, when we observe the results of the sensitivity analysis in Table 4, the expected significant positive relationship between local public spending and consensus for pro-system parties appears in some cases. In other words, increasing public spending mitigates anti-system party support and may therefore prevent the exacerbation of the socioeconomic cleavages embedded in the process of structural change; however, the weak relationship between local public spending and consensus for pro-system parties seems to suggest that pro-system parties are not fully capable of engaging citizens with initiatives and policy actions that are properly perceived or visible across electoral constituencies. From this perspective, since the opening of a public debate around ambitious socioeconomic normative goals requires electoral support, these results are only partially encouraging. While a reduction in support for anti-system parties might favour the development of such a debate, the weak relationship between local public spending and support for pro-system parties might inhibit it.

Second, we looked at local public spending from the fine-grained perspective of spending categories (ERQ_2). Interestingly, the negative impact on anti-system party consensus is consistent across all spending categories. However, the magnitude of the coefficients is quite heterogeneous: increasing spending in the categories of mobility and transportation, education, culture, and public order are the most effective for reducing anti-system consensus, while social rights, sustainable development, labour market, and healthcare spending also contribute, but to a lesser extent. Finally, urban and youth policies are not statistically significant.

Some of these variations may be due to the inherent appeal of certain interventions (namely, spending on mobility and transportation, education, culture, and public order), which are perceived by the electorate as tangible output concretely affecting their lives, and are thus more proximate than other types of spending in terms of both geography and time to results (Soss and Schram, 2007). From this perspective, the electorate might perceive spending on sustainable development, social rights, and labour market goals as more obscure. Specifically, the boundaries of these spending categories might be perceived as blurred, their constituencies might overlap, and their outcomes are usually distant in time and thus less effective in influencing mass opinion.

However, some caution should be used to interpret the findings related to ERQ_1 and ERQ_2 because regional forces running in opposite directions might be at work. We followed up on this intuition and

conducted an empirical analysis of anti-system/pro-system party votes across geographical macro areas (NUTS 1 level). The empirical evidence for the Italian macro areas shows quite divergent patterns, confirming our intuition. On the one hand, north-western and central Italy display a vertical reduction in anti-system party consensus corresponding to a statistically significant increase in pro-system parties across most spending categories. On the other hand, minor effects are registered for north-eastern and southern Italy in terms of the reduction in anti-system party consensus at both the aggregate and spending category levels. Interestingly, increasing public spending does not affect support for pro-system parties in these macro areas.

It is worth briefly commenting on this result with reference to the north-eastern area, which includes Emilia Romagna, Trentino Alto Adige, Friuli-Venezia Giulia, and Veneto. All these regions traditionally display the highest per capita income among Italian and European regions based on their dynamic and innovative manufacturing industries. Additionally, these areas feature widespread prosperity, good quality of life, and efficient local governments and welfare systems (ISTAT, 2019 ([35]); European Social Progress Index, 2020 ([36]); Nifo and Vecchione, 2014; Bianchi et al., 2021). However, while these regions are quite homogenous in terms of (good) socioeconomic performance, they have followed quite different political trajectories over the past three decades. Only the Emilia Romagna region has been steadily and continuously governed by progressive centre-left parties (i.e. pro-system). This particular aspect deserves further research because it suggests that electoral consensus might in some cases take regional wealth for granted. In other words, it might be that the achieved level of wellbeing has become an embedded characteristic of the socioeconomic system, and citizens might thus perceive it as a sort of *genius loci,* rather than the virtuous outcome of local government policies. From this perspective, we believe that this hypothesis is a promising path for research, beyond the specificity of the situation in Italy.

Overall, ERQ_1 and ERQ_2 are also confirmed through the lens of geography. In particular, we find that the reduction in anti-system party consensus is not homogeneous across macro areas. Specifically, while some socioeconomic conflicts seem to uniformly affect all geographical macro areas (so that public spending on education, public transport, public order, and cultural events helps mitigate support for anti-system parties, as our results suggest), other cleavages seem to be more context specific, embedded in particular institutional frameworks and production interdependencies

[35] Details are available at https://www.istat.it/it/files//2021/01/Regional_accounts_2019.pdf.

[36] Details are available at: https://ec.europa.eu/regional_policy/en/information/maps/social_progress2020/#:~:text=The%20EU%20Social%20Progress%20Index,beyond%20the%20Gross%20Domestic%20Product.&text=The%202020%20results%20show%20that,different%20aspects%20of%20social%20progress.

and thus shaped by the particular structure of interests within a given community. For instance, Italian areas differ in the presence or absence of intermediate institutions — such as trade unions, non-profit organisations, and welfare institutions — that have emerged because of the different regional industrial specialisations and civic traditions characterising the country (Leonardi et al., 2001; Becattini, 1992). The existence of context-specific cleavages is signalled by the ineffectiveness of some spending categories (social rights, labour markets policies, sustainable development, and youth policies) in either mitigating consensus favouring anti-system parties or capturing support for pro-system parties. This topic deserves further attention in research that intersects the established literature on regional differences and disparities with political science studies that, with few exceptions (Knutsen 2010; Martínez-Toledano and Sodano, 2021), have overlooked the regional dimensions of socioeconomic cleavages.

In sum, our analysis of the evidence suggests that pro-system parties should acknowledge the consequences for the sustainability of structural change that might arise from the weak relationship between electoral consensus and local public spending initiatives (on both the aggregate and disaggregated levels). On the other hand, they should intervene to fix this link to secure themselves an electoral foundation that is cohesive and whose interests are expressed and reconciled through decision-making processes.

In terms of policy implications, our analysis suggests that pro-system parties should avoid relying on short-term political support from sector interests to preserve the status quo instead of ensuring a sustainable trajectory of structural transformation. Indeed, such behaviour may open additional cleavages in society, leading to further political polarisation. To this end, effective communication of policy initiatives and their outcomes is a strategic tool for government action. It enables public awareness of government action, which may strengthen policy effectiveness. Moreover, government accountability for public spending through effective communication with the public is an important source of legitimacy and a vehicle for encouraging 'voiceless' stakeholder participation, reinforcing electoral consensus for sustainable structural change to achieve normative goals (Di Tommaso, 2020; Crozier, 2007; Hood, 2008; Esmark, 2019).

Our interpretation falls in line with prior studies (van Heerden and van der Brig, 2017) showing that pro-system parties often react to the rise of anti-system parties by 'demonising' their existence, e.g. pursuing a strategy of exclusion and delegitimisation. In addition to being ineffective over time, such a strategy may produce a boomerang effect. It may induce disengagement from mainstream parties in public life, generating unintended consequences and leading to the further polarisation of society.

Finally, our results suggest avenues for future research. Since our study explored the electoral consensus–public spending nexus by focusing on Italy, future studies may investigate other regional

and national experiences to discuss and compare cross-country differences and similarities. Furthermore, future studies might focus on the emerging of novel socio-economic cleavages (e.g., environmental degradation) that might potentially fuel the rise of anti-system parties. In this view, exploring the relationship between emerging cleavages and pro-and-anti-system consensus at municipal level might be a natural *consecutio* of this analysis. Eventually, given that this paper focused on policy inputs (local public spending in mobility, health care, cultural activities, etc.), it will be important in future work to focus on the living conditions of citizens in select crucial fields (e.g. quality and access to education, health, jobs, culture, and environment) to evaluate how these might affect electoral consensus and thus the sustainability of structural change.

Acknowledgements

This research was conducted within the framework of the project 'Emilia-Romagna International School of Policy' (cup: E45J19000150004) funded by the Emilia-Romagna regional government.

References

Adamany, D., 1972. The Political Science of E. E. Schattschneider: A Review Essay. Am. Polit. Sci. Rev. 66(4), 1321–1335

Albanese, G., Barone, G., de Blasio, G., 2021. Populist voting and losers' discontent: Does redistribution matter?. Eur. Econ. Rev. 141, 104000

Alesina, A., Giuliano, P., 2010. Preferences for redistribution, in: Benhabib, J., Jackson, M.O., Bisin, A. (Eds.), Handbook of Social Economics. North Holland, The Netherlands, pp. 93–131

Alesina, A., Baqir, R., Easterly, W., 1999. Public goods and ethnic divisions. Q. J. Econ. 114, 1243–1284

Agasisti T., Barra C., Zotti, R., 2020. Public finance, government spending and economic growth: the case of local governments in Italy. University of Turin, Department of Economics and Statistics Cognetti de Martiis, Working Papers 202022

Andreoni, A., Scazzieri, R, 2014. Triggers of Change: Structural Trajectories and Production Dynamics. Camb. J. Econ. 38(6), 1391–1408.

Arndt, H.W., 1989, Economic Development: The History of an Idea. The University of Chicago Press, Chicago

Bakker, R., Hooghe, L., Jolly, S., Marks, G., Polk, J., Rovny, J., Steenbergen, M., Vachudova, M.A., 2020. 1999 − 2019 Chapel Hill Expert Survey Trend File. Version 1.2. Available on chesdata.eu

Bardi, L., 1996. Anti-party sentiment and party system change in Italy. Eur. J. Polit. Res. 29, 345–363

Bauluz, L., Gethin, A., Martínez-Toledano, C., Morgan, M., 2021. Historical Political Cleavages and Post-Crisis Transformations in Italy, Spain, Portugal and Ireland, 1953-2020. World Inequality Lab, Working Paper N° 2021/01

Bellani, L., Scervini, F., 2020. Heterogeneity in preferences for redistribution and public spending: A cross-country analysis. Eur. J. Polit. Econ. 63, 101890

Bellani, L., Ursprung, H., 2019. The Political Economy of Redistribution Policy, in: Congleton, R.D., Grofman, B., Voigt, S. (Eds.), The Oxford Handbook of Public Choice, 2. Oxford University Press, Oxford, pp. 520–541. Doi: https://dx.doi.org/10.1093/oxfordhb/9780190469771.013.24

Barbieri, E., Di Tommaso, M.R., Pollio C., Rubini, L., 2020. Getting the specialization right. Industrialization in Southern China in a sustainable development perspective, World Dev. 126, 104701

Betz, H.-G., 1994. Radical Right-Wing Populism in Western Europe. Palgrave Macmillan, Basingstoke

Becattini, G., 1992. The Marshallian industrial district as a socio-economic notion, in: Pyke, F., Becattini, G. Sengenberger, W. (Eds) Industrial Districts and Inter-firm Cooperation in Italy (second edition), International Institute for Labour Studies, Geneva, pp. 37–51

Bianchi, P., Giardino, R., Labory, S., Rinaldi, A., Solinas, G. 2021. Regional Resilience: Lessons from a historical analysis of the Emilia Romagna Region in Italy. Bus. Hist., 10.1080/00076791.2021.1945034

Bianchi, P., Labory, S. 2019. Industrial policy for the manufacturing revolution: Perspectives on digital globalisation. Edward Elgar Publishing, Cheltenham

Böstrom, M. 2012. A missing pillar? Challenges in theorizing and practicing social sustainability: Introduction to the special issue. Sustain.: Sci. Pract. Policy 8(1), 3–14

Cardinale, I., Coffman, D., 2014. Economic Interdependencies and Political Conflict: The Political Economy of Taxation in Eighteenth Century Britain, Economia Politica. 3, 277–300

Cardinale, I., 2015. Towards a structural political economy of resources, in: Baranzini, M., Rotondi, C., Scazzieri, R. (Eds.), Resources, Production and Structural Dynamics. Cambridge University Press, Cambridge, pp. 198–210

Cardinale, I., 2017. Sectoral interests and 'systemic interest': Towards a structural political economy of the Eurozone, in: Cardinale, I., Coffman, D., Scazzieri, R. (Eds), The Political Economy of the Eurozone, Cambridge University Press, Cambridge, pp. 216–237

Cardinale, I, Coffman, D., Scazzieri, R. 2017. Framing the Political Economy of the Eurozone: Structural Heuristics for Analysis and Policy. In: I. Cardinale, D. Coffman e R. Scazzieri (eds.), The Political Economy of the Eurozone, Cambridge, Cambridge University Press, pp. 483-551.

Cardinale, I. Landesmann, M., 2017. Exploring Sectoral Conflicts of Interest in the Eurozone: A Structural Political Economy Approach, in: Cardinale, I. D. Coffman, D., Scazzieri R. (Eds), The Political Economy of the Eurozone. Cambridge University Press, Cambridge, pp. 284–336

Cardinale, I., 2018. A bridge over troubled water: A Structural Political Economy of vertical integration. Struct. Change Econ. Dynam. 46, 172–179

Cardinale, I., Scazzieri, R., 2018. Explaining structural change: actions and transformations. Struct. Change Econ. Dynam. 51, 393–404

Cardinale, I., Scazzieri, R., 2019. Sul Ritorno dell'Economia Politica. Istituto Lombardo, Accademia Di Scienze e Lettere – Rendiconti Di Lettere. https://doi.org/ 10.4081/let.2016.505

Cardinale, I., Scazzieri, R., 2020. Interdipendenze produttive, interessi e condizioni sistemiche: elementi per un'economia politica delle strutture industriali. L'industria. 41, 21–50. https://doi.org/10.1430/97170

Cardinale, I., Landesmann, M., 2020. Generalising the Political Economy of Structural Change: A Structural Political Economy Approach. Struct. Change Econ. Dynam. https://doi.org/10.1016/j.strueco.2020.07.001

Carl., N., Richards, L., Heath, A., 2019. Leave and Remain voters' knowledge of the EU after the referendum of 2016. Elect. Stud. 57, 90–98

Citrin, J., 1979. Do people want something for nothing: public opinion on taxes and government spending. Natl. Tax J. 32(2), 113–129

Colantone, I., Stanig, P., 2018. Global competition and Brexit. Am. Polit. Sci. Rev. 112 (2), 201–218

Coser, L. 1956. The Functions of Social Conflict. Routledge and Kegan Paul Ltd, London

Costa-Font, J., Cowell, F., 2015. Social identity and redistributive preferences: a survey. J. Econ. Surv. 29(2), 357-374

Crescenzi, R., Di Cataldo, M., Giua, M., 2020. It's not about the money. EU funds, local opportunities, and Euroscepticism. Reg. Sci. Urb. Econ. 84, 103556

Crozier, M., 2007. Recursive Governance: Contemporary Political Communication and Public Policy. Polit. Commun. 24(1), 1–18

Della Porta, D., Portos, M., 2020. Social movements in times of inequalities: Struggling against austerity in Europe. Struct. Change Econ. Dynam. 53, 116–126

Dewey, J., 1927. The Public and Its Problems. Holt, New York

Dijkstra, L., Poelman, H., Rodríguez-Pose, A., 2020. The geography of EU discontent. Reg. Stud. 54(6), 737–753

Di Matteo, D., Mariotti, I., 2021. Italian discontent and right-wing populism: determinants, geographies, patterns. Reg. Sci. Policy Pract. 13(2), 371–396

Di Tommaso, M.R., Tassinari, M., Barbieri, E., Marozzi, M., 2020. Selective Industrial Policy and 'Sustainable' Structural Change. Discussing the Political Economy of Sectoral Priorities in the US. Struct. Change Econ. Dynam. 54, 309–323

Di Tommaso, M.R., 2020. Una strategia di resilienza intelligente per il dopo coronavirus. Sulla centralità della domanda e offerta di politica industriale, L'industria. 01/2020, gennaio-marzo, 3–20

Easton, D., 1953. The Political System: An Inquiry into the State of Political Science. Knopf, New York

Esmark, A., 2019. Communicative Governance at Work: How Choice Architects Nudge Citizens towards Health, Wealth and Happiness in the Information Age. Public Manag. Rev. 21(1), 138–158

European Commission, 2010. An integrated industrial policy for the globalisation era putting competitiveness and sustainability at centre stage. COM: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Brussels

Ellis, C., Faricy, C. 2011. Social Policy and Public Opinion: How the Ideological Direction of Spending Influences Public Mood. J. Polit. 73(4), 1095–1110.

Ferrannini, A., Barbieri, E., Biggeri, M., Di Tommaso, M.R., 2021. Industrial Policy for Sustainable Human Development in the post-Covid19 era. World Dev. 137, 105215

Ferrante, C., Pontarollo, N., 2019. Regional voting dynamics in Europe: The rise of antielite and anti-European parties. Environ. Plann. A 52(6), 1019–1022

Flora, P., Kunhle, S., Urwin, D., 1999. State Formation, Nation-Building and Mass Politics in Europe. The Theory of Stein Rokkan. Oxford University Press, Oxford

Gray, M., Barford, A., 2018. The depths of the cuts: the uneven geography of local government austerity. Camb. J. Regions Econ. Soc. 11(3), 541–563

Gründler, K., Köllner S., 2017. Determinants of Governmental Redistribution: Income Distribution, Development Levels, and the Role of Perceptions. J. Comp. Econ. 45(4), 930–962

Gordon, I.R., 2018. In what sense left behind by globalisation? Looking for a less reductionist geography of the populist surge in Europe. Camb. J. Regions Econ. Soc. 11(1), 95–113

Hacker, J.S., 2002. The Divided Welfare State: The Battle of Public and Private Social Benefits in the United States. Cambridge University Press, New York

Haq, M., 1995. Reflections on human development. Oxford University Press, Oxford

Haselswerdst, J., Bartels, B.L., 2015. Public Opinion, Policy Tools, and the Status Quo: Evidence from a Survey Experiment. Polit. Res. Quart. 68(3), 607–621

Hawkins, D., Simon, H.A., 1949. Note: Some conditions of macroeconomic stability. Econometrica 17, 245–248

Hino, A., 2011. New Challenger Parties in Western Europe: A Comparative Analysis. Routledge, Abingdon

Hirschman, A., 1968. The Political Economy of Import-Substituting Industrialization in Latin America. Q. J. Econ. 82(1), 1–32

Hirschman, A., 1970. Exit Voice and Loyalty: Responses to Decline in Firms, Organizations, and States. Harvard University Press, Cambridge (Massachusetts)

Hood, C., 2008. The Tools of Government in the Information Age, in: Goodin E., Moran M., Rein M. (Eds.), The Oxford Handbook of Public Policy. Oxford University Press, Oxford

Ignazi, P., 1996. The intellectual basis of right-wing anti-partyism. Eur. J. Polit. Res. 29, 279–296

Ivaldi, G., Mazzoleni, O., 2020. Economic populism and sovereigntism: the economic supply of European radical right-wing populist parties. Eur. Polit. Soc. 21(2), 202–218

Knutsen, O., 2010. The regional cleavage in Western Europe: Can social composition, value orientations and territorial identities explain the impact of region on party choice? West Eur. Polit. 33(3), 553–585.

Landesmann, M., 2018. Political Economy of Structural Change, in: Cardinale, I., Scazzieri, R. (Eds.), The Palgrave Handbook of Political Economy. Palgrave Macmillan, London, pp. 705–748

Leonardi, R., Nanetti, R.Y., Putnam, R.D., 2001. Making democracy work: Civic traditions in modern Italy. Princeton University Press, Princeton

Levite, A., Tarrow, S., 1983. The Legitimation of Excluded Parties in Dominant Party Systems: A Comparison of Israel and Italy. Comp. Polit. 15(3), 295–327

Lin, J.Y., (Ed.), 2012. New structural economics. A framework for rethinking development and policy. The World Bank, Washington

Lin, J.Y., 2017. Industrial policies for avoiding the middle-income trap: A new structural economics perspective. J. Chin. Econ. Bus. Stud., 15(1), 5–18.

Lijphart, A., 1969. Consociational Democracy. World Polit. 21(2), 207–225

Lijphart, A. (1975). *The Politics of Accommodation: Pluralism and Democracy in the Netherlands. 2d Ed. rev*. University of California Press.

Lipset, S.M., Rokkan, S., 1967. Party Systems and Voter Alignments: Cross-National Perspectives. The Free Press, New York

Liu, Z., Adams, M., Cote, R.P., Geng, Y., Li, Y., 2018. Comparative Study on the Pathways of Industrial Parks towards Sustainable Development between China and Canada. Resour. Conserv. Recy. 128, 417–425

Lowi, T.J., 1964. American Business, Public Policy, Case-Studies, and Political Theory. World Polit. 16(4), 677–715

Martínez-Toledano, C., Sodano, A., 2021. Changing Party Systems, Socio-Economic Cleavages, and Nationalism in Northern Europe, 1956-2017. World Inequality Lab, Working Paper N° 2021/04

Meltzer, A.H., Richard, S.F. 1981. A Rational Theory of the Size of Government. J. Polit. Econ. 89(5), 914–927

Mettler, S., Guardino, M., 2011. From nudge to reveal, in: Mettler, S. (Ed.), The submerged State: How invisible government policy undermine American democracy. Chicago University Press, Chicago

Mettler, S., 2010. Reconstituting the Submerged State: The Challenges of Social Policy Reform in the Obama Era. Perspect. Polit. 8, 803–824

Mettler, S., Soss, J., 2004. The Consequences of Public Policy for Democratic Citizenship: Bridging Policy Studies and Mass Politics. Perspect. Polit. 2, 55–73

Mi, Z., Wei, Y.-M., Wang, B., Meng, J., Liu, Z., Shan, Y., Liu, J., Guan, D., 2017. Socioeconomic impact assessment of China's CO2 emissions peak prior to 2030. J. Clean. Prod. 142, 2227–2236

Mosca, L., Tronconi, F., 2019. Beyond left and right: the eclectic populism of the Five Star Movement. West Eur. Polit. 42(6), 1258–1283

Mouffle, C., 2019. The populist moment. Simbiotica 6(1), 6–11

Mudde, C., 2014. Fighting the System? Populist Radical Right Parties and Party System Change. Party Polit. 20(2), 217–226

Myrdal, G. 1970. The challenge of world poverty. Pantheon, New York

Ngo, C., Di Tommaso, M.R., Tassinari, M., Dockerty, J.M., 2021. The Future of Work: Conceptual Considerations and a New Analytical Approach for the Political Economy. Rev. Political Econ., https://doi.org/10.1080/09538259.2021.1897750

Nifo, A., Vecchione, G., 2014. Do Institutions Play a Role in Skilled Migration? The Case of Italy. Reg. Stud. 48(10), 1628–1649

Pabst, A., Scazzieri, R., 2012. The political economy of civil society. Const. Political Econ. 23(4), 337–356

Pabst, A., Scazzieri, R., 2016. The political economy of Constitution. Œconomia 6(3), 337-362. https://doi.org/10.4000/oeconomia.2433

Panebianco, A., 1988. The Italian radicals: New wine in an old bottle, in: Lawson, K., Merkl, P.H. (Eds.), When Parties Fail. Princeton University Press, Princeton, pp. 110-136

Pasinetti L.L., 1981. Structural Change and Economic Growth: A Theoretical Essay on the Dynamics of the Wealth of Nations. Cambridge University Press, Cambridge
Pasinetti, L.L., 1993. Structural Economic Dynamics: A Theory of the Economic Consequences of Human Learning. Cambridge University Press, Cambridge
Pianta, M., Gerbaudo, P., 2015. In search of European alternatives: anti-austerity protests in Europe, in: Kaldor, M., Selchow, S. (Eds.), Subterranean Politics in Europe. Palgrave Macmillan, Basingstoke, pp. 31–59
Pierson, P., 1993. When Effect Becomes Cause: Policy Feedback and Political Change. World Polit. 45(4), 595–628.
Pietrobelli, C., Rabellotti, R., 2011. Global value chains meet innovation systems: are there learning opportunities for developing countries? World Dev. 39(7), 1261–1269
Poguntke, T., Scarrow, S.E., 1996. The politics of anti-party sentiment: Introduction. Eur. J. Polit. Res. 29, 257–262
Ocampo, J.A. 2020. Industrial Policy, Macroeconomics and Structural Change. CDEP-CGEG WP No. 81, Columbia | SIPA, Center on Global Economic Governance.
Quesnay, F. (1759 [1972]), Quesnay's Tableau Économique. Kuczynski, M., Meek R.L. (Eds.). Macmillan, London-New York. Kelley A.M. for the Royal Economic Society and the American Economic Association
Rae, D.W., Taylor, M., 1970. The Analysis of Political Cleavages. Yale University Press, New Haven
Rodrik, D., Sabel, C., 2019. Building a Good Jobs Economy. Harvard Kennedy School Faculty Research, Working Paper N° RWP20-001
Rodriguez-Pose, A., 2018. The revenge of the places that don't matter (and what to do about it). Cam. J. Regions Econ. Soc., 11(1), 189–209
Rodriguez-Pose, A., 2020. Institutions and the fortunes of territories. Reg. Sci. Policy and Pract. 12(3), 371–386
Sartori, G., 1976. Parties and Party Systems. A Framework for Analysis. Cambridge University Press, Cambridge
Sartori, G., 1978. Anti-Elitism Revisited. Gov. Oppos. 13(1), 58–80
Scazzieri, R., 2018. Structural dynamics and evolutionary change. Struct. Change Econ. Dynam. 46, 52–58
Schattschneider, E.E. 1935. Politics, Pressures and the Tariff: A Study of Free Private Enterprise in Pressure Politics, as Shown in the 1929–1930 Revision of the Tariff. Archon Books, Hamden
Sen, A. K., 1992. Inequality reexamined. Oxford University Press, Oxford-New York
Sen, A. K., 2013. The political dynamics of economic growth. World Dev. 47, 71–86
Sen, A. K., 2009. The idea of Justice. The Belknap Press of Harvard University Press, Cambridge (Massachusetts)
Solé-Ollé, A., Viladecans-Marsal, E., 2019. Housing booms and local spending. J. Urban Econ. 113, 103185
Soroka, S., Wlezien, C., 2010. Degrees of Democracy. Cambridge University Press, Cambridge
Soss, J., Schram S.F., 2007. A Public Transformed? Welfare Reform as Policy Feedback. Am. Polit. Sci. Rev. 101(1), 111–127
Stretton, L., Orchard, L., 1994. Public Goods, Public Enterprise, Public Choice. Theoretical Foundations of the Contemporary Attack on Government, Palgrave Macmillan, Basingstoke
Svallfors, S. 2007. The Political Sociology of the Welfare State: Institutions, Social Cleavages and Orientations, Studies in Social Inequality. Stanford University Press, Stanford (California)
Toder, E.J., 2000. Tax Cuts or Spending–Does It Make a Difference?. Nat. Tax J. 53(3, Part 1), 1–8
van Kessel, S., 2015. Populist parties in Europe. Agents of discontent?. Palgrave Macmillan, Basingstoke
UNIDO (United Nations Industrial Development Organization), 2017. Structural change for inclusive and sustainable industrial development. United Nations Industrial Development Organization, Wien
Van Heerden, S. C., van der Brug, W. 2017. Demonisation and electoral support for populist radical right parties: A temporary effect. Electoral Stud. 47, 36–45
Yeric, J.L., Todd, J.R., 1996. Public Opinion: The Visible Politics, 3rd edition. Peacock Publishers, Itasca (Illinois)
Waters, S., 1994. 'Tangentopoli' and the emergence of a new political order in Italy. West Eur. Polit. 17(1), 169–182
Wilson, J.Q., 1973. Political Organizations. Basic Books, New York
Wlezien, C., 1995. The public as thermostat: dynamics of preferences for spending. Am. J. Polit. Sci. 39, 981–1000
Worm, B., et al., 2006. Impacts of biodiversity loss on ocean ecosystem services. Science 314, 787–790
Zulianello, M., 2014. New anti-system parties and political competition: the case of Italy, in Zeynep Güler, E. (Ed.), New opportunities and impasses: theorizing and experiencing politics, POLITSCI '13 Political Science Conference. Kilit Yayı ncı lı k / DAKAM Publishing, Istanbul
Zulianello, M., 2018. Anti-System Parties Revisited: Concept Formation and Guidelines for Empirical Research. Gov. Oppos. 53(4), 653–681
Zulianello, M., 2019. Anti-System Parties. From Parliamentary Breakthrough to Government. Routledge, London-New York

Contributions

Marco R. Di Tommaso: Conceptualization, Methodology, Writing –original draft, Writing –review & editing. **Elena Prodi:** Conceptualization, Methodology, Writing –original draft, Writing –review & editing. **Dante Di Matteo:** Data curation, Methodology, Writing –original draft, Writing –review & editing. **Ilaria Mariotti:** Methodology, Supervision, Writing –original draft, Writing –review & editing.

Appendix A

Table A1. Correlation matrix of the variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Code	Variable																			
Outcome variables, elections																				
1	weighted consensus, anti-system parties	1																		
2	weighted consensus, pro-system parties	-0.088	1																	
Main covariates, public spending as share of GI																				
3	aggregate spending	0.098	-0.016	1																
4	expenditure$_{2017}$ (sum a-j)	0.091	-0.014	0.841	1															
5	mobility and transport	-0.010	-0.006	0.645	0.818	1														
6	health care	0.039	-0.018	0.502	0.519	0.299	1													
7	labour market	0.023	-0.006	0.542	0.664	0.727	0.253	1												
8	education	0.067	-0.015	0.329	0.357	0.223	0.143	0.268	1											
9	urban	0.092	0.003	0.273	0.338	0.034	0.076	0.067	0.038	1										
10	social rights	0.092	-0.057	0.350	0.390	0.141	0.131	0.171	0.232	0.100	1									
11	culture	0.023	-0.010	0.233	0.267	0.026	0.040	0.046	0.034	0.020	0.053	1								
12	youth policies	0.068	-0.026	0.178	0.180	0.015	0.148	0.020	0.075	0.078	0.096	0.018	1							
13	sustainable development	0.147	0.033	0.448	0.499	0.225	0.249	0.226	0.125	0.095	0.165	0.042	0.111	1						

14	public order	0.118	0.020	0.174	0.158	0.025	0.062	0.034	0.083	0.061	0.104	0.018	0.048	0.200	1					
Control variables																				
15	demographic change	-0.196	0.013	-0.247	-0.191	-0.023	-0.222	-0.050	-0.074	-0.144	-0.136	-0.054	-0.064	-0.214	-0.114	1				
16	employment change	0.166	-0.046	0.158	0.090	-0.006	0.044	0.024	0.027	0.129	0.060	0.042	0.028	0.119	0.100	-0.057	1			
17	education change	-0.043	-0.042	0.100	0.008	-0.020	0.113	-0.005	0.006	0.031	-0.048	0.0004	0.049	-0.010	-0.063	0.080	0.098	1		
18	economic change	-0.005	-0.010	-0.071	-0.062	-0.041	0.025	-0.037	-0.026	-0.026	-0.093	0.034	0.024	-0.094	-0.098	0.007	-0.150	0.105	1	
19	aged dependency change	-0.001	0.069	-0.037	0.020	0.038	-0.008	0.034	-0.003	-0.043	0.059	-0.016	0.021	-0.007	0.029	-0.074	-0.347	-0.046	0.023	1

Table A2. Extended version of Table 2 with anti-system parties as the dependent variable

	change in weighted consensus for anti-system parties (left column of Table 2)											
public spending axes	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)	OLS (7)	OLS (8)	OLS (9)	OLS (10)	OLS (11)	OLS (12)
aggregate spending	-0.00051*** (0.00014)											
expenditure (sum a-j)		-0.00069*** (0.00017)										
(a) mobility and transport			-0.01117*** (0.00260)									
(b) health care				-0.00081*** (0.00021)								
(c) education					-0.00922* (0.00558)							
(d) labour market						-0.03172*** (0.00729)						
(e) urban							-0.01039 (0.00762)					
(f) social rights								-0.01087** (0.00493)				
(g) culture									-0.02841** (0.01430)			
(h) youth policies										-0.03838 (0.02479)		
(i) sustainable development											-0.00635*** (0.00183)	
(j) public order												-0.03804** (0.01719)

Control variables	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Regional fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R^2	0.514	0.514	0.5177	0.5134	0.5112	0.5129	0.5082	0.5109	0.5099	0.5082	0.5104	0.5081
F (P>F)	81.75 (0.000)	87.48 (0.000)	97.47 (0.000)	88.39 (0.000)	83.29 (0.000)	92.33 (0.000)	79.55 (0.000)	74.97 (0.000)	75.23 (0.000)	79.52 (0.000)	83.02 (0.000)	84.18 (0.000)
Observations	7,571	7,767	7,767	7,767	7,767	7,767	7,767	7,767	7,767	7,767	7,767	7,767

Note: Robust standard error in parentheses. Regressions are weighted by the resident population in 2017 to control for size effects in municipalities with resident populations over the vote share. Significance levels: *** p value <0.01; ** p value <0.05; * p value <0.10.

Table A3. Extended version of Table 2 with pro-system parties as the dependent variable

	Change in weighted consensus for anti-system parties (right column of Table 2)											
public spending axes	OLS (13)	OLS (14)	OLS (15)	OLS (16)	OLS (17)	OLS (18)	OLS (19)	OLS (20)	OLS (21)	OLS (22)	OLS (23)	OLS (24)
aggregate spending	0.00003 (0.00004)											
expenditure (sum a-j)		0.00004 (0.00005)										
(a) mobility and transport			0.00076 (0.00071)									
(b) health care				0.00005 (0.00006)								
(c) education					0.00029 (0.00266)							
(d) labour market						0.00272 (0.00304)						
(e) urban							0.00020 (0.00148)					
(f) social rights								-0.00049 (0.00209)				
(g) culture									0.00326 (0.00358)			
(h) youth policies										-0.00202 (0.00631)		

(i) sustainable development											0.00004 (.00042)	
(j) public order												0.01717*** (0.00547)
Control variables	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Regional fixed effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
R^2	0.286	0.282	0.283	0.282	0.282	0.283	0.282	0.282	0.282	0.282	0.282	0.284
F (P>F)	27.51 (0.000)	28.29 (0.000)	28.83 (0.000)	28.51 (0.000)	28.83 (0.000)	27.64 (0.000)	27.98 (0.000)	28.06 (0.000)	28.22 (0.000)	27.98 (0.000)	28.03 (0.000)	29.51 (0.000)
Observations	7,571	7,767	7,767	7,767	7,767	7,767	7,767	7,767	7,767	7,767	7,767	7,767

Note: Robust standard error in parentheses. Regressions are weighted by the resident population in 2017 to control for size e ffects in municipalities with resident populations over the vote share. Significance levels: *** p value <0.01; ** p value <0.05; * p value <0.10.

PAPER 4 – Do informal institutions matter for the economic resilience of European regions? A study of the post-2008 shock

Paper published in: Economia Politica

Prodi, E., S. Ghinoi, L. Rubini, F. Silvestri, Do informal institutions matter for the economic resilience of European regions? A study on the post-2008 shock.
Doi: https://doi.org/10.1007/s40888-022-00293-5

Abstract

This paper investigates the relationship between informal institutions and resilience across EU regions in the years following the 2008 Great Recession. By using voluntary work as a proxy for informal institutions, we analyse its association with regional resilience over two different periods: the resistance phase (2008–2010) and the recovery phase (2010–2013). Overall, we find robust evidence that voluntary work is positively associated with greater regional resilience. Our results also show that there is a relation between voluntary work and formal institutions, represented by welfare state models. Overall, the effect of voluntary work is always positive for strong welfare states, but its effect is mitigated by the presence of public provisions. Additionally, in regions with a relatively weaker institutional context, informal institutions retain their positive effect. However, in this context, informal institutions appear to take more time to deploy their effects, but their positive impact on regional labour market recovery is even stronger than in other welfare regimes, probably due to the poor public support that characterises this welfare system.

Keywords: regional resilience, informal institutions, voluntary work, European regions

JEL Classification: R1, R11, O38, L3

1. Introduction

The 2008 Great Recession marked a turning point in the field of economic studies. As the most severe recession since the 1929 Great Depression (Eigner and Umlauft, 2015), it attracted considerable attention from researchers attempting to investigate the causes that fuelled its outbreak, its immediate effects across countries and regions, and its legacy on production systems. In this context, a spectrum of studies in the field of regional economics and economic geography have approached the analysis of the 2008 shock through the conceptual lens of resilience (Martin 2012; Breathnach et al. 2015; Crescenzi et al. 2016; Pontarollo and Serpieri 2020). The concept has been borrowed from socioecological studies and used to explain the pervasiveness and the geographically heterogeneous impact of the 2008 crisis. Within this framework, resilience defines "*the capacity of a regional or local economy to withstand or recover from market, competitive and environmental shocks to its developmental growth path, if necessary by undergoing adaptive changes to its economic structures and its social and institutional arrangements, to maintain or restore its previous developmental path, or transit to a new sustainable path characterised by a fuller and more productive use of its physical, human and environmental resources"* (Martin and Sunley 2015, p. 13).

The growing attention to the concept of regional resilience has pushed researchers to collect evidence on precrisis elements shaping regional responses to unexpected shocks. To date, the literature has highlighted that, along with national macroeconomic conditions, context-specific regional factors (such as socioeconomic conditions, the specialisation of the economy, innovation capacity, human capital, and the quality of the institutional environment) are key to sheltering regional economies in the aftermath of the crisis, contributing to overall regional resilience (Crescenzi et al. 2016). However, while the influence of formal institutions has received attention (Oorschot, Arts and Halman, 2005; Ezcurra and Rios 2019), studies on regional resilience have neglected the potential role of informal institutions. This gap in the literature is surprising, since a well-established strand of research on the economic performance of regions has found evidence that informal institutions contribute to a large extent to shaping productive and market relations and to the development of economic activities (Dei Ottati 1994; Rodriguez-Pose and Storper 2006; Rodriguez-Pose 2013). In particular, strong ethical norms, trust-based tight-knitted social networks, cultures of engagement and participation facilitate information and knowledge circulation across the economy of a territory (Yao et al. 2020; Zhao and Hao 2021). According to this view, such resources accruing from civil society might also play a relevant role in times of economic hardship (Popenoe 1988).

Therefore, studies have pointed out that the nexus between institutions and economic resilience should not only focus on formal institutions.

The present paper aims to fill this gap by investigating whether and to what extent informal institutions, expressed in terms of citizens' involvement in unpaid voluntary work and activities, contributed to mitigating the impact of the post-2008 crisis across the European region. Furthermore, we are also interested in exploring the interaction between informal institutions and formal institutions, identified by the welfare state model in place in the relevant region, to assess the possible influence of such an interaction on regional resilience.

To this aim, we follow the empirical approach by Filippetti et al. (2020) that, in line with previous literature, observes regional resilience across two different subperiods: i) the resistance phase, when the labour market is hit the hardest by the shock and employment losses occur; and ii) the response phase, when the labour market recovers. This approach allows us to detect eventual changes in the influence of informal institutions over the two time frames studied and to draw relevant policy implications.

Overall, our study contributes to prior research in three ways. First, we introduce the role of informal institutions in the literature on regional resilience, which has thus far been overlooked. Second, we account for the interaction between informal institutions and the welfare state model in place in the relevant region and analyse their joint impact on regional resilience. Third, we observe the influence of informal institutions, as well as their interaction with different welfare models, over two different time frames, i.e., the resistance and the rebound phases, to capture potential changes in the impact of one stage on the other and draw relevant policy implications.

The remainder of the paper is structured as follows: Section 2 reviews the literature on regional resilience and connects it with studies on informal institutions. Section 3 presents the methodology, while Section 4 shows the empirical results. Section 5 discusses the results and draws the main conclusions of the paper.

2. Literature Review

2.1 Postshock resilience: types and determinants

The term *resilience* is multifaceted because it has been used in several disciplines. In the domains of mathematics, physics and engineering, it is used synonymously with elasticity because it measures the "*speed at which the system returns to the stable point or trajectory following a perturbation*" (Gallopin 2006, p. 299). However, the equilibrium-restoring implications yielded by such a mechanical conception of systems are disputed by socioecological studies (Hollings 1973), where resilience accounts for system renewal and reorganisational processes (Berkes 2007), defining the ability of systems to absorb change and adapt to the effects of external disturbances. Such an

evolutionary-based understanding of resilience has exerted great influence over other branches of the social sciences that have applied the concept using different units of analysis and at different spatial scales (Brown and Westaway, 2011; Cardinale 2019).

All the disciplines that contributed to building the scholarship around the concept of resilience share a common element of understanding, that is, the idea that resilience does not exist in isolation but represents an idiosyncratic property of a system intimately related to how its structure and features respond to the waves of disturbances experienced (Adger 2000).

In the aftermath of the 2008 downturn, this idea has attracted considerable attention from economic research as well. Indeed, although the outbreak of the 2008 global recession caused a sharp decline in economic activity worldwide, a spectrum of studies in regional economics and economic geography observed uneven and heterogeneous patterns of economic recovery among countries and regions (Crescenzi et al., 2016). The concept of resilience has, thus, entered this field too, where it has been applied to explain why territories behave heterogeneously in the face of disruptive recessionary shocks (Martin 2012; Capello et al. 2015; Breathnach et al. 2015; Faggian et al. 2018; Di Tommaso 2020). In this context, *resilience* has been framed as a complex and multifaced process of systemic adaptation and transformations through disruption involving several stages. Martins (2012) identified four progressive and interrelated phases: (i) *resistance*, i.e., the sensitivity of regional output and employment to exogenous shocks; (ii) *recovery*, measuring how fast the region bounces back from a negative shock; (iii) *reorientation,* which concerns the extent to which a region changes after a shock by modifying, for example, its economic sectoral composition; and (iv) *renewal*, that is, the ability of a regional economy to renew its growth path.

The collected evidence on the spatially heterogeneous impact of the crisis mainly draws from analyses focusing on a single country, such as the UK (Rocchetta and Mina, 2017), Italy (Mazzola et al., 2018), Ireland (Breathnach et al., 2015) and the U.S. (Han and Goetz, 2015). Other studies adopt, instead, a cross-regional comparative perspective at the EU level (see Crescenzi et al., 2016; Rizzi et al., 2018; Ezcurra and Rios, 2019).

All these works assess economic resilience mainly by looking at the changes in the labour market before and after the crisis, thus primarily focusing on the regional *resistance* and the *recovery* phases. Indeed, labour market dynamics, in general, are more effective in capturing the depth of the structural change occurring within a local economy (Cardinale and Scazzieri 2018; Faggian 2018).

Hence, regional resilience has been assessed foremost in terms of postcrisis variation in regional/county employment levels (Martin 2012; Fingleton et al. Martin 2012; Davies 2011; Brown and Greenbaum 2017; Ezcurra and Rios 2019; Crescenzi et al. 2016) or by the ratio of the employment drop to the rebound (Han and Goetz 2015). Recently, other studies have used the change in the

number of hours worked before and after a shock (Filippetti et al., 2020) as another way to look at employment dynamics and compare cross-regional reactions to the crisis in Europe.

Studies converge around the fact that, along with national macroeconomic conditions, context-specific features play a crucial role in helping territories respond to unforeseen shocks. In particular, major sources of regional economic resilience encompass those inherent structural endowments (both physical and intangible), namely, (i) the sectoral composition of economic activities and their diversity (Groot et al. 2011), (ii) the intensity of innovation activities and technological specialisation (Filippetti et al. 2020), (iii) the presence of a well-educated workforce (Crescenzi et al. 2016), and (iv) labour market characteristics (Luci, 2009; Bardhan, 1983).

Additionally, Ezcurra and Rios (2019) have recently found that the way in which governments administer public services also contributes to the adaptability and responsiveness of regional economies in times of crisis. These authors have drawn from a well-established stream of literature in the field of new institutional economics, contending that government institutions matter to the growth and development of economic activities (Rodrigues Pose, 2013; Agostino et al., 2020) since "*they promote stability and regulation by providing norm and authoritative behavioural guidelines"* (Holmes et al., 2013, p.533). In particular, the literature acknowledges that the welfare state takes on the role of a protective buffer in times of economic hardships for individuals and regions to alleviate the negative consequences of shocks (Stuckler et al. 2009; Visser et al. 2014).

Institutional economics studies have highlighted that research on institutional environments refers not only to formal institutions but also to immaterial and informal types of institutions. According to the literature, the latter "*include a series of features of group life such as norms, traditions and social conventions, interpersonal contacts, relationships, and informal networks"* (Rodriguez-Pose 2013 p.1038) that arise spontaneously through repeated community interactions.

However, even if in the literature there is a strong belief, supported by empirical evidence, that informal institutions contribute to the economic growth and adaptiveness of regions (Hudson 1994; Rodriguez-Pose 2013), their potential cushioning role for the economies of regions in times of economic hardships has been mostly overlooked (Reeskens and Vandecasteele 2017).

We believe that such a relationship is an interesting and pivotal one to be investigated for two major reasons.

First, the evolutionary concept of regional resilience used in economic geography draws from ecological studies, stressing evolutionary adaptation over equilibrium. Through this lens, informal institutions represent an intrinsic part of the way in which a socioeconomic system copes with and adapts to changing external circumstances. In particular, when informal institutions — namely, those identified in terms of interpersonal social trust (Knack and Keefer, 1997; Zak and Knack, 2001; Beugelsdijk et al., 2004) and cultural norms of engagement in civic life (Lim and Laurence 2015;

Uhyel 2018) — nourish trust-based community bonds, they contribute to shaping and enhancing the idiosyncratic capacity of regions to adopt and recombine new knowledge, as well as to engage in innovative and creative activities (North, 1990) to seek joint solutions to problems (Morgan, 2007). Second, it is widely acknowledged that the nexus between government institutions and economic phenomena should not be, whenever possible, studied separately from informal institutions (North 1990; Serageldin and Grootaert, 1999). Indeed, *"at the local level, formal government and other institutions interact with a dense set of informal networks, associative frameworks and voluntary associations"* (Serageldin and Grootaert, 1999, p. 51). Therefore, informal networks, norms and cultures of civic engagement should be considered as well because their interaction with formal institutions has important consequences for economic activities (Putnam 1993; Serageldin and Grootaert, 1999; Helmke and Levitsky, 2006; North, 1990; Pejovich, 1999; Alfano 2022).

Thus, investigating the informal institutions-regional resilience nexus allows us to fill the current gaps in the literature as well as to build upon previous studies in the field of resilience that limited their analysis to formal institutions. This study aims to take a closer look at the role of informal institutions, expressed in terms of citizens' involvement in unpaid voluntary work and activities, on regional economic resilience, without losing sight of the fact that such informal institutions may partially interact with efforts made by formal institutions, as the literature suggests.

2.2 Informal institutions: a catalyst for regional resilience?

Informal institutions relate to unwritten norms, cultural and moral values, traditions and religious beliefs regulating the relations and interactions among actors (Lewin et al., 2011; North, 1990). They can be defined as "*the informal ways by which human beings have structured human interaction*" (North, 1990, p. 36). They encompass societal norms, unwritten behavioural rules or ideologies that everyone has an interest in preserving because they represent the set of "*shared mental models*" that have been inherited from the past and "*have passed the test of time*" (Pejovich 1999, p. 166), even if they "*have never been consciously designed*" (Sugden, 1986, p. 54; Tonoyan et al., 2010). Because of this, informal institutions are considered "*more primary and deep-seated than formal institutions in orienting individual and organisations' behaviours*" (Crossland and Hambrick, 2011, p. 800), since they represent historically rooted conventions and social traits that arise spontaneously through repeatedly community interaction (Fukuyama 2000) and are gradually internalised by economic actors and passed from generation to generation (Lewin et al., 2011; Pejovich 1999; Rodriguez-Pose and Storper 2006; Pahl-Wostl 2009).

Among informal institutions, the literature has devoted considerable attention to interpersonal social trust (Knack and Keefer, 1997; Zak and Knack, 2001; Beugelsdijk et al., 2004) and cultural

norms of engagement in civic life (Lim and Laurence 2015; Uhyel 2018) that are mutually reinforcing and embody the spirit of a community (Putnam, 1993, 2000; Beugelsdijk and Van Schaik, 2005). Such informal institutions contribute to shaping the attitude of society towards civic engagement and the involvement and participation of individuals in voluntary activities, which often develop in organisations such as voluntary associations and clubs. (Turner, 1999)

The attitude of individuals towards volunteering, both in formal organisations and in informal helping activities, captures the altruistic values, moral beliefs about voluntary work as a duty, and cultural propensity towards participation in civic life (Lim and Laurence 2015; Bekkers 2011; Musick and Wilson 2008; Putnam 2000; Bale 1996), *"because values are an important attribute of culture, it seems reasonable to assume that collective values are important for volunteering as well. Volunteering will be more common in societies with a spirit of solidarity*" (Dekker and Halman, 2003, p.7). In the same vein, Lim and Laurence (2015, p.338) assert that "*volunteering tends to be more common and stable in communities where a strong cultural norm of trust and civic engagement makes it a natural part of community life*". For these reasons, the involvement of citizens in unpaid voluntary organisations and activities is rooted in the altruistic and prosocial values of a community and therefore captures the informal institutional endowment of the community itself. Therefore, unpaid voluntary work might be used as a proxy for the informal institution endowment characterising a given territory.

While it is widely acknowledged that institutions affect the economic performance of regions (North 1990; Dei Ottati 1994; Vasquez-Barquero 2002, Acemoglu and Johnson 2005), most studies have concentrated on formal institutions while overshadowing the role of informal institutions, which is still poorly understood (Gertler 2010). However, several studies have observed that informal institutions contribute to a large extent to shaping productive and market relations and, thus, play a relevant role in the potential of regions to develop economic activities (Beugelsdijk and Van Schaik 2003; Williamson 2009; Rodriguez-Pose 2013).

A well-known example of the nexus between informal institutions and economic prosperity relates to the formation of successful industrial districts in central and northern Italy. In particular, in regions such as Emilia-Romagna, Tuscany or Veneto, dense communitarian bonds underpinned by trust and shared political, social and cultural identity have strongly contributed to the development of economic activities in the form of agglomerations of small and medium-sized businesses characterised by a mix of cooperative and competitive behaviours (Brusco and Sabel, 1981; Dei Ottati, 1994; Becattini et al., 2009; Becattini, 2015). Informal institutions have also played a crucial role in the transitions of Eastern European countries, such as the Czech Republic, Hungary, Poland and Slovenia (Raiser 2001). Another case in point beyond the European boundaries is the well-established social network typical of China called *guanxi*, which can be defined as personal relationships based on trust and

reciprocity through which individuals exchange favours (Wang, 2000) and make economic activities thrive.

On a more general level, informal institutions contribute to achieving economic prosperity by promoting social cooperation (Putnam, 1993), enhancing the financial system (Guiso et al., 2004; Duarte et al., 2012), and promoting stable networks of interfirm relations (Dei Ottati 1994) and international trade (Guiso et al., 2004). Furthermore, the evidence collected supports that strong ethical norms, trust-based tight-knitted social networks, cultures of engagement and participation facilitate information and knowledge circulation across the economy of a territory (Yao et al. 2020; Zhao and Hao 2021). Conversely, in areas characterised by a weak informal institutional environment, the potential for knowledge circulation and coordination of expectations through frequent interpersonal and production relations is hampered, as is the generation of creative responses, especially in times of economic hardships (Dobler 2011).

Finally, in regional studies, it is also important to consider both formal and informal institutions. Indeed, the latter can partly alleviate and compensate for the shortcomings of the former, given the potential underlying commonalities in their functions, although they cannot fully replace each other (Kafouros et al. 2021; Ugyel 2018). Specifically, while resources accruing from civil society can play a relevant role in buffering regional economies from the negative impact of a shock (Popenoe 1988), they should be considered in relation to their relevant institutional context (Grabner 2021 in Rudiger Wink ed.; Pascario e Pintilescu 2021), particularly with welfare state models. Indeed, to fully understand the role of informal institutions in withstanding a job crisis and supporting economic recovery, it should be acknowledged that they might interact with the support provided by the welfare state (Reeskens and Vandecasteele 2017). This view has been partially confirmed by studies highlighting that voluntary work might fill the gap in institutional intervention in some specific socioeconomic fields and support the formulation of policy responses to new, emerging threats to human well-being for which there are no established (or poor) governance institutions (Anderson and Chang 2020).

In summary, the literature has highlighted various reasons supporting the idea that informal institutions might have an inherent capacity to influence regional resilience, although research in this field has neglected this dimension.

In particular, we contend that informal institutions are a crucial asset that sustain regional employment levels in ordinary times as well as in periods of economic hardship (such as the crisis Europe experienced in 2008–2013), thus contributing to regional resilience.

In the sections that follow, we explore the hypothesis that a positive correlation exists between informal institutions and the resilience of a region, while also considering the interaction between informal institutions and the efforts made by welfare state models.

3. Methodology

3.1 Data description

This study primarily investigates the nexus between informal institutions and the economic resilience of European regions during and in the aftermath of the 2008 Great Recession. Particular attention is also devoted to the potential interaction between informal institutions and welfare state models.

The dataset used is a cross-section of 192 NUTS2 regions and covers all EU27 members, with the exception of Croatia, Ireland, Poland, Cyprus, Malta, Denmark, Slovenia, and Sweden, for which data on the variables of interest over the period considered are missing.

Dependent variables

In line with previous studies (Breathnach et al. 2015; Rizzi et al. 2018; Filippetti et al. 2020), we break down regional resilience into two periods: resistance and recovery. In particular, the resistance period refers to the years 2008–2010, during which regions tried to withstand the economic shock, whereas the recovery period refers to the years 2010–2013, during which regions started to bounce back from the shock (Filippetti et al. 2020; Martin 2012).

We follow the literature and proxy resilience in terms of employment performance. Thus, the better a region performs in terms of employment reduction containment in the 2008–2010 period, the greater its resistance to the exogenous shock; in parallel, a fast increase in employment levels over 2010–2013 indicates a robust economic recovery. Specifically, to measure cross-regional employment performance over both the resistance and the recovery phases, we follow Filippetti et al. (2020) and use the number of hours worked; hence, a region is considered resistant if its relative drop of worked hours with respect to the average European drop in 2008–2010 was substantially low, while it is considered rapidly recovering if it was able to return to its relative precrisis amount (or more) of worked hours over the 2010–2013 recovery period.

Drawing from Faggian et al. (2018) and Filippetti et al. (2020), we create two indices to estimate the resistance and recovery capacity of regions: the sensitivity index (SI) and the response index (RI), respectively.

These indices are computed as follows:

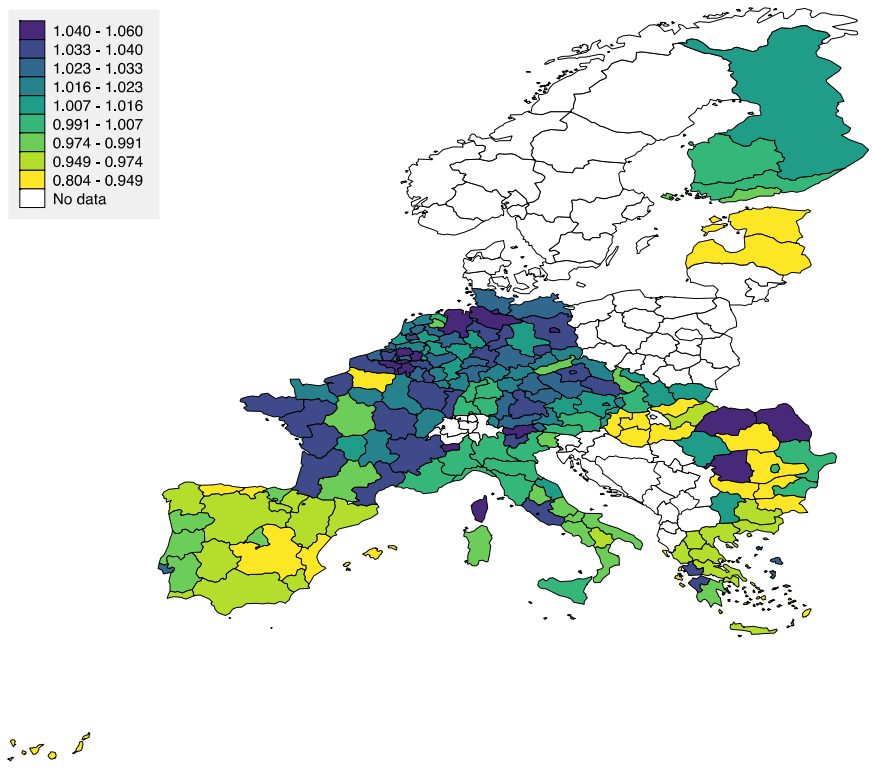
$$SI = \frac{\frac{Er,2010}{Er,2008}}{\frac{En,2010}{En,2008}} \quad (1)$$

$$RI = \frac{\frac{Er,2013}{Er,2010}}{\frac{En,2013}{En,2010}} \quad (2)$$

In the above equations, *Er* indicates the number of hours worked in region *r* in the year of reference (2008, 2010, or 2013). *En* refers to the average number of hours worked in European Union (EU) countries, which allows us to understand the relative performance of each European region within the EU context. Higher values of SI indicate a higher resistance during the crisis period; at the same time, higher RI values show a higher capacity of recovery for region *r*.

Figures 1 and 2 illustrate the SI and RI indices for the European regions observed, respectively.

Figure 1 – Sensitivity index (SI) across observed European regions

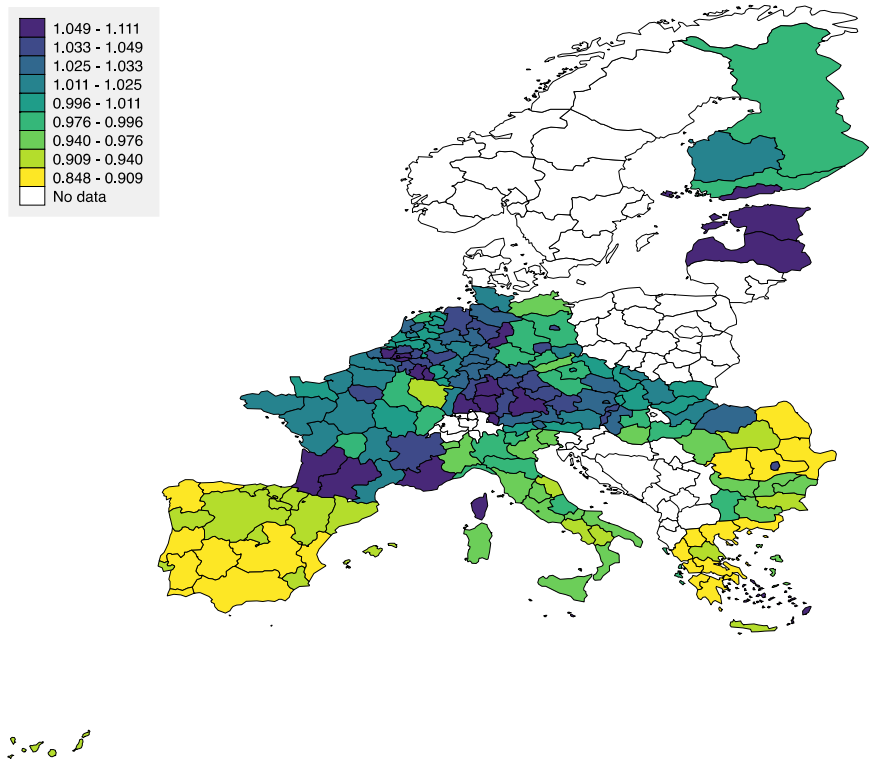


Source: Authors' elaborations

The regions that best withstood the crisis were concentrated in continental Europe, the Nordic countries and a few Romanian regions (Figure 1). The regions that performed better in terms of

recovery belong to continental Europe and to the Baltic area (Figure 2). Conversely, regions located in southern Europe performed relatively worse in both periods (Figures 1 and 2).

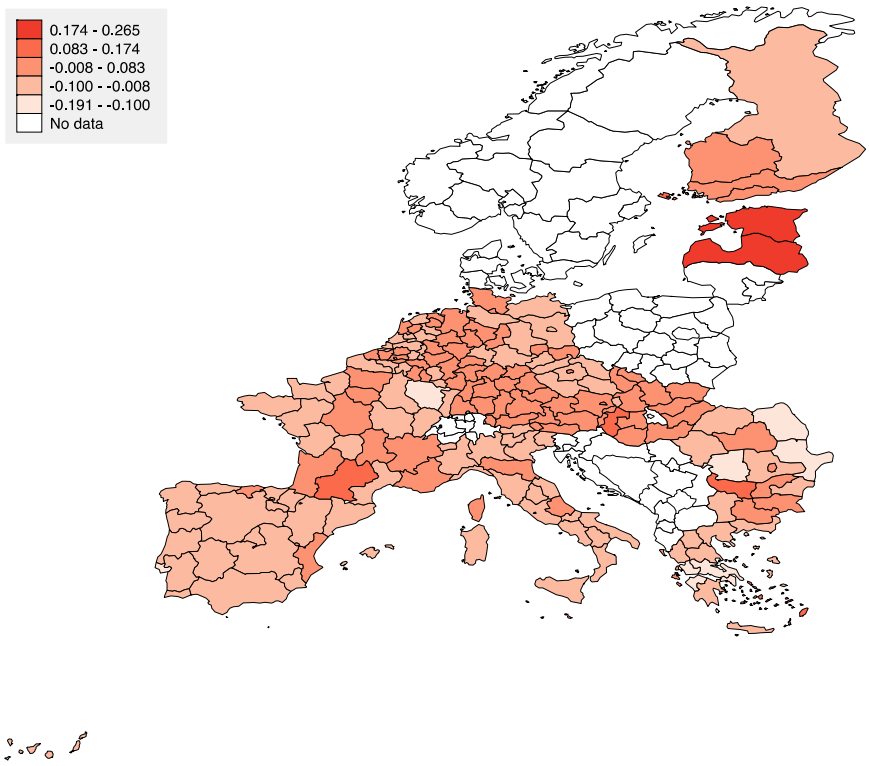
Figure 2 – Response index (RI) across observed European regions



Source: Authors' elaborations

Figure 3 shows the extent to which each region managed to improve labour market performance in the recovery phase compared to the resistance phase. Overall, regions located in continental Europe and in the Nordic area, along with several areas of Eastern Europe, managed to raise employment levels in the recovery phase more than in the resistance phase. Conversely, in the recovery phase, regions located in southern Europe display a labour market performance that is weaker compared to the early stage of the crisis, with very few exceptions, i.e., Emilia-Romagna in Italy and the Comunidad Valenciana in Spain, which stand out as important manufacturing centres.

Figure 3 – Difference between RI and SI index



Source: Authors' elaborations

Main explanatory variables

In line with previous studies, we have used data from the European Values Study (EVS, 2008) to measure informal institutions (Kaase et al. 2014; Fazio e Lavecchia 2013; Oorschot, Arts and Halman, 2005). The EVS is a large-scale, cross-national survey of attitudes, opinions and values using adult population samples that are representative both at the national and regional levels ([37]). Specifically, we created an indicator that accounts for citizens' involvement in unpaid voluntary work and activities and for the existence of a culture of civic engagement (Lim and Laurence 2015) within a given region. This indicator (*Volunteering*) measures the share of the population voluntarily engaged in unpaid work activities ([38]). In particular, the indicator is calculated as the proportion of the population of a

[37] Only Denmark is not representative at the regional level, but the country is not included in this study.

[38] In line with the definition of volunteer work by Tilly and Tilly (1994): "*unpaid work provided to parties to whom the worker owes no contractual, familial, or friendship obligations*" (p. 291).

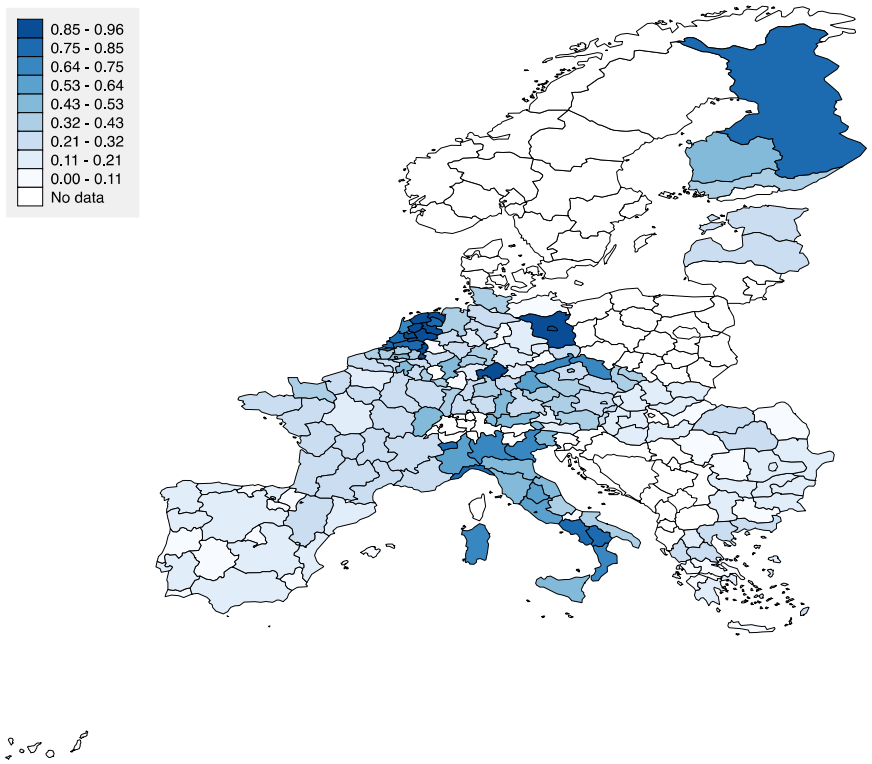
region engaged in at least one voluntary activity ([39]). The indicator ranges between zero (no people doing unpaid voluntary work) and one (the entire population in the representative sample is engaged in at least one unpaid voluntary activity): the closer this indicator is to one, the greater the involvement of the regional population in voluntary activities. For example, a value of 0.6 indicates that 60% of the regional population participates in at least one of the listed unpaid voluntary activities.

We acknowledge that unpaid voluntary work might have a certain degree of formality, often being carried out as an organised service with rules given to participants by voluntary associations. However, the degree of internal organisation that a voluntary service/association adopts does not directly imply that it should be considered a formal institution, as the literature suggests. Indeed, "*the abilities and effectiveness of the institutions at the macro- and microlevels (and in the formal and informal spheres) influence outcomes. Institutions need values, but they also need organisational and management capacity and communication and technical skills in order to act effectively upon these values*" (Serageldin and Grootaert 1999, p.51). This means that both formal and informal institutions require a certain degree of organisation to effectively deploy their effects. Hence, even when voluntary work is organised, the involvement of individuals in unpaid voluntary work remains spontaneous and, thus, reflects the extent to which a culture of participation in civic life is present in a community. In other words, although we cannot exclude the fact that our indicator captures a small degree of formality, it is an appropriate approximation of informal institutions. Indeed, the data on which the indicator is based do not refer to voluntary associations but to the individual propensity to participate in voluntary organisations and activities. In particular, they refer to a question in the ESV survey (see footnote 3) addressing the actual involvement of the surveyed population in voluntary work, not their memberships in voluntary organisations, which does not necessarily entail actual participation in voluntary activities.

Figure 4 shows the distribution of citizens involved in voluntary activities across the European regions observed. Unpaid voluntary work seems to be clustered within countries and localised in some specific regions, primarily belonging to Belgium, the Netherlands, Finland, Italy, Germany, Austria and the Czech Republic.

[39] The survey asked the respondents "*which, if any, of the following list of voluntary organizations and activities are you currently doing unpaid voluntary work for?*". Such a question primarily addresses in general terms the involvement of individuals in unpaid voluntary works across different activities and organizations. The list of voluntary activities and organizations included: a) Social welfare services for elderly, handicapped or deprived people; b) Religious or church organizations; c) Education, arts, music or cultural activities; d) Trade unions; e) Political parties or groups; f) Local community action on issues like poverty, employment, housing, racial equality; g) Third world development or human rights; h) Conservation, the environment, ecology, animal rights; i) Professional associations; j) Youth work (e.g., scouts, guides, youth clubs etc.); k) Sports or recreation; l) Women's groups; m) Peace movements; n) Voluntary organizations concerned with health; o) Other groups; and p) None.

Figure 4 – Unpaid voluntary work across the European regions observed (year=2008)



Source: Authors' elaborations

Regarding formal institutions, we identify them using welfare state models.

Over the past decades, social studies and welfare scholars (Esping-Andersen, 1990 and 1999; Leibfried, 1993; Ferrera, 1996; Aidukaite, 2006) have converged around the idea that there are different models of the welfare state in Europe. These models have been identified mainly according to, on the one hand, the degree to which basic resources and services needed to sustain people's lives are detached from the market mechanism (decommodification) and, on the other hand, to the degree to which social security is assigned to the family system rather than to the public sector (familiarisation). Moreover, welfare states across Europe have also been grouped according to common historical-institutional and geographical features. The result is a five-category taxonomy, which has been used as a reference framework in this work.

The first is the Continental model, which is rooted in the corporatist and conservative arrangements deriving from the so-called "Bismarckian legacy", i.e., a welfare mix shaped by the influence of the Catholic Church and by a corporatist approach to State regulation (Leichsenring, 2001). Such a model is based on medium levels of decommodification and low levels of familiarisation. Germany best represents this group, which also encompasses France, Belgium Luxembourg, Austria and Hungary.

The latter is included due to the historical ties still existing with the Bismarckian insurance scheme adopted under the Austro-Hungarian Empire and to some other common traits shared with the Continental model (Orosz, 2018; Hajighasemi, 2019; Cavallo and Silvestri, 2022).

The second is the Mediterranean model, typical of southern European countries, encompassing Spain, Portugal, Italy and Greece (Leibfried, 1993; Rhodes 1996). The Mediterranean model is historically rooted in the dictatorships that started over the XX century and shaped welfare provisions across these countries. This model is characterised by a highly fragmented and corporatist income maintenance system, the formation—in some cases—of elaborated forms of clientelism for the selective distribution of cash subsidies (Ferrera 1996), and the strong reliance on the Church, local charity organisations, voluntary activities and family ties as social safety nets (Hajighasemi, 2019; Bambra and Eikemo, 2009).

The third is the Social-democratic model. It is characterised by full decommodification and defamiliarisation, which results in a comparatively generous social expenditure by the government and a commitment towards full employment and income protection. This model encompasses Sweden, Finland, Norway, Iceland, Denmark and, to some extent, the Netherlands (Bekker and Mailand, 2019). The latter case is usually represented as a hybrid welfare system between the Continental and the Social-democratic groups. However, "*scholars are of the opinion that, institutionally, the Dutch welfare system comes closer to the social-democratic type because its social security system contains not only Bismarckian-type social insurance for workers but also universal people's insurances that cover all citizens, and because its insurance and assistance benefits are comprehensive and relatively generous*" (Oorschot 2006, p. 58; see also Goodin and Smitsman 2000; Visser and Hamerijck 1997).

The fourth is the Anglo-Saxon model (not relevant for the present study). This model is characterised by a liberal approach to the welfare state that minimises the decommodification and defamiliarisation levels. Typical of this approach are the United Kingdom, Ireland and Malta (Esping-Andersen 1990; Bambra and Eikemo, 2009).

The fifth is the Transition countries model, encompassing most post-socialist EU countries. This group came about after the break-up of the Soviet Union. The transition period was characterised by substantial privatisation and liberalisation of the economic system, which challenged the design of the socialist welfare and insurance system. Currently, welfare states in these countries, i.e., the three Baltic Republics, Poland, the Czech Republic and Slovakia, Slovenia and Croatia, Romania and Bulgaria, are experiencing a demise of the universalism of the communist welfare state and a shift towards policies associated more with the Anglo-Saxon regime, notably the marketisation of public provisions and decentralisation (Bambra and Eikemo; 2009). However, until the transition process is

not concluded and the landing is defined, it is advisable to group these countries together within the cluster of Transition welfare states (Adukaite, J. 2009; Hajgasemi, 2019).

The following table summarises the five proposed models with respect to EU countries inside and outside the coverage of our study.

Table 1 – Classification of EU Countries by Welfare model

Welfare Model	EU countries considered in the study	EU countries not considered in the study
Continental	Austria, Belgium, Germany, France, Luxembourg, Hungary	-
Transition countries	Bulgaria, Czech Republic, Estonia, Lithuania, Latvia, Romania, Slovakia	Croatia, Poland, Slovenia
Mediterranean	Greece, Italy, Portugal, Spain	-
Social-democratic	Finland, Netherlands	Denmark, Sweden
Anglo-Saxon	-	Ireland, Malta

Source: Authors' elaboration

Clearly, all of the NUTS 2 regions belonging to a given country are assumed to display the same welfare model. We thus include in the econometric specification a categorical variable ranging from 1 to 4, where the value 1 is associated with regions belonging to countries displaying a Continental welfare model; 2 to the welfare state in transition countries (and therefore in the relevant regions); 3 to the Mediterranean welfare model and thus is associated with Italian, Spanish, Portuguese and Greek regions; and 4 to the regions belonging to the countries adopting a Social-democratic model.
Table 2 summarises this information by welfare state models, showing that, on average, regions with the Continental and Social-democratic welfare models are those whose labour markets performed better in the recovery phase than in the resistance phase. The opposite holds for regions in transition and southern countries. However, it is worth noting that the labour market performance of regions in transition countries is slightly below zero. This means that their performance is more similar to that of Social-democratic and Continental welfare states than to the southern welfare model, which appears to lag behind the other three groups.

Table 2 – Difference between RI index and SI index – Average values by welfare models

Welfare model	RI - SI	N° obs
Continental	0.0076	89
Transition countries	-0.0022	30
Mediterranean	-0.0453	56
Social-democratic	0.0014	17

Source: Authors' elaborations

Control variables

Other variables are included as controls (*X)* at the regional level, accounting for the main socioeconomic features of regions, as well as for their tangible and intangible endowments (Table 3). In particular, population density controls for the demographic composition of the regions, whereas regional gross domestic product is a proxy for the size of the regional economy. The share of the population working in the industry sector controls for the regional weight of the secondary sector, while the share of the population with tertiary education accounts for the quality of human capital endowment. Furthermore, the number of patent applications per million inhabitants accounts for regional attitudes towards research and its innovation capacity, which, along with human capital, represent crucial assets for its economic prosperity.

Table 3 – Explanatory and control variables

Main explanatory variables	***Description***	***Year***	***Source***
Volunteering	Share of population involved in at least one unpaid voluntary activity	2008	European Value Survey
Welfare model	Categorical variables ranging from 1 to 4, where 1 represents the Continental model, 2 the welfare model in transition countries, 3 the Mediterranean model and 4 the Social-democratic welfare model.	/	Literature (various sources)
Other control variables	***Description***	***Year***	***Source***
Population density	Logarithm of regional population density	2008 and 2010	Eurostat

Size of the economy	Logarithm of the regional gross domestic product (Million purchasing power standards)	2008 and 2010	Eurostat
Human capital	Share of population 25–64 years with tertiary education (level5 5-8)	2008 and 2010	Eurostat
Innovation capacity	Patent applications to the EPO (per capita)	2008 and 2010	Eurostat
Share of workers in manufacturing	Share of people employed in manufacturing sector	2008 and 2010	Eurostat

Source: Authors' elaboration

* Data available at: https://www.gu.se/en/quality-government/qog-data/data-downloads/european-quality-of-government-index

3.2 Model estimation and econometric strategy

When considering which econometric specification allows us to appropriately investigate the relationship between resilience and informal institutions, it is important to note that the ability of a region to both resist the negative consequences of a crisis and to recover from it might not be randomly distributed. Indeed, Figures 1, 2 and 3 suggest the presence of spatial clusters of regions with similar levels of resilience during the crisis, whereas only in a few cases do regions stand out among neighbouring areas, showing a markedly different performance. Furthermore, the literature has shown the existence of a strong link between a given region's resilience and the average resilience of neighbouring regions (Ezcurra and Rios 2018; Filippetti et al. 2020; Pontarollo and Serpieri 2020).

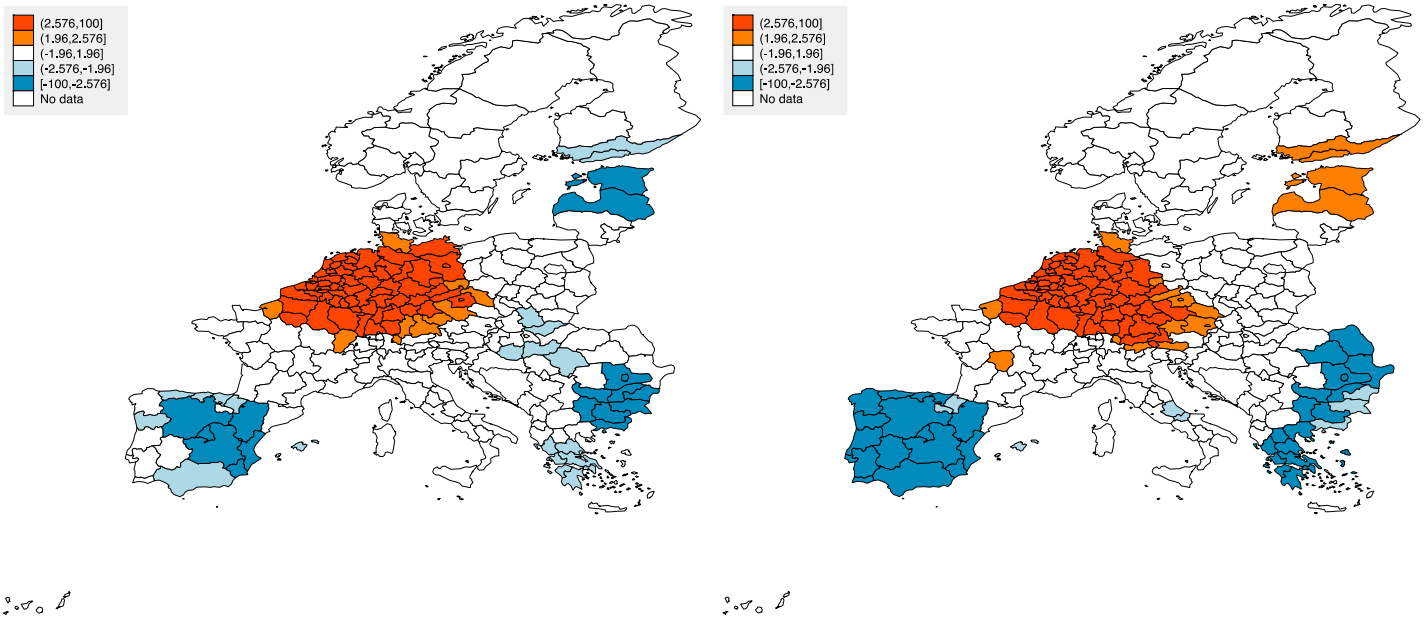
To confirm such a spatial pattern, both in the aftermath of the shock and in the recovery phase, we perform a Moran's *I* test of spatial dependence. Moran's *I* statistics test for the existence of global spatial autocorrelation in the distribution of regional resilience (Moran, 1950). The results for both SI and RI (*I* statistic is 0.30 with p-value =0.00 and 0.47 with p-value=0.00, respectively, see Tables 7 and 8 in Appendix A) lead to the rejection of the null hypothesis of spatial randomisation in the distribution of regional resilience, pointing to the presence of a general tendency to cluster within the study area.

We also perform a Hot Spot Analysis for detecting local spatial autocorrelation. Specifically, the Hot Spot Analysis tool calculates the Getis-Ord Gi* statistic for each feature in a dataset (Getis and Ord, 1992; Ord and Getis, 1995).

The Gi* statistic return for each feature in the dataset is a z scorez-score and the relevant p-value. For statistically significant positive z-scores, the larger the z-score is, the more intense the local clustering of high values (hot spot). For statistically significant negative z-scores, the smaller the z-score is, the more intense the local clustering of low values (cold spot). In other words, the resulting

z-scores and p-values identify statistically significant spatial clusters of high values (hot spots) and low values (cold spots) (see Tables 9 and 10 in Appendix A). When calculating the Gi* statistic, we have followed the literature according to which knowledge spillovers, due to their tacit nature, operate in a range of approximately 300 km (Bottazzi and Peri 2003; Filippetti et al. 2020).

Figure 5 – The Hot Spot Map based on the Getis-Ord GI* statistics by SI (left map) and RI (right map)



Source: Authors' elaborations.

Regions are grouped into local clusters. Cold spots (blue and light blue regions) identify statistically significant spatial clusters of low values for SI and RI, whereas hot spots (orange and red regions) identify statistically significant spatial clusters of high values for SI and RI. For white regions, z-scores are not statistically significant.

Figure 5 shows that in the aftermath of the crisis (SI), some statistically significant "cold" spatial clusters were concentrated in Spain, Greece, the Baltic regions, Bulgaria, Romania and Hungary, whereas a wider hot cluster was located in continental Europe. For the RI, we observe hot local clusters in continental Europe, Finland and the Baltic regions, whereas statistically significant cold clusters are located in Spain, Eastern Europe and, to a lesser extent, Italy. This suggests that the resilience performance of a region is affected by that of neighbouring regions.

Given the global and local spatial correlation of both SI and RI, we resort to a spatial autoregressive model (SAR). The SAR model is a fairly general spatial specification accounting for the spatial lag

of the dependent variable. Indeed, the results of the global and local spatial autocorrelation tests have shown that the possible presence of spatial spillovers between neighbouring regions related to their resilience capacity is a spatial process. Thus, this suggests considering an SAR model where the outcomes of a region are affected by the outcomes of the nearby regions.

Equations 3 and 4 show the model specification.

$$SI_i = \alpha + \rho Wy + \beta * volunteering_i + \gamma * WelfareModel_i + \delta * Volunteering_i * WelfareModel_i + \Delta * X_i + u_i \quad (3)$$

and

$$RI_i = \alpha + \rho Wy + \beta * volunteering_i + \gamma * WelfareModel_i + \delta * Volunteering_i * WelfareModel_i + \Delta * X_i + u_i \quad (4)$$

where

ρWy = *the spatial lags of the dependent variable*

Resilience is our dependent variable. As stated above, we decompose resilience in SI and RI; thus, both indices are considered dependent variables in two different cross-section SAR spatial models. *Volunteering*, which already proxies the presence and intensity of informal institutions across regions, is our main explanatory variable, along with the categorical variable *WelfareModel* and the interaction term $Volunteering_i * WelfareModel_i$. The latter allows the effects of unpaid voluntary work on regional resilience to differ by the relevant welfare model. X is the vector of exogenous variables included as controls. ρ is the coefficient of the spatially lagged dependent variable, while W is an $n \times n$ contiguity spatial weights matrix specified as a row normalised binary contiguity matrix, with elements wij=1 if two spatial neighbourhoods share a common border and 0 otherwise.

Following Filippetti et al. (2020), in the SI specification, the explanatory variables refer to 2008 (the initial year of the resistance period on which the SI index is calculated), whereas in the RI specification, the explanatory variables refer to 2010 (the initial year of the recovery period on which the RI index is calculated). Therefore, regressors in Equation (3) use 2008 data, while those in Equation (4) use 2010 data. The only exception concerns *Volunteering,* which is measured in 2008 for both estimations since the data collected by the EVS survey are available only for a limited number of years. However, given that the time distance between SI and RI only covers two years, it seems reasonable to assume that in such a short period of time, the informal institutional endowments of regions, including our main explanatory variable, are stable, and potential changes would only be marginal even when facing an unforeseen shock, as the literature suggests (Cortinovis et al. 2017;

Sarracino and Mikucka, 2015; Lim and Laurence 2015). Finally, descriptive statistics are reported in Table 4, while the correlation between regressors is shown in Table A5 in Appendix A.

Table 4 – Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Population density 2008	190	4.98	1.08	1.85	8.80
Population density 2010	190	4.98	1.08	1.85	8.85
Size of the economy 2008	192	10.34	1.02	6.99	13.30
Size of the economy 2010	192	10.31	1.03	7.05	13.32
Human capital 2008	188	3.04	0.37	1.91	3.85
Human capital 2010	188	3.10	0.36	2.19	3.90
Innovation capacity 2008	186	110.04	132.58	0	626.10
Innovation capacity 2010	185	110.29	136.63	0	721.29
Share of workers in manufacturing 2008	192	25.60	7.58	8.26	46.4
Share of workers in manufacturing 2010	192	23.91	7.25	7.83	43.38
Volunteering	182	0.31	0.24	0	0.96

Source: Authors' elaboration

4. Empirical results

Table 5 presents the main results of our empirical analysis, estimated through a generalised spatial two-stage least square (GS2SLS) estimator. For each of the two indices SI and RI, we run three specifications: Columns (1) and (4) focus on the association between the dependent variables and *Volunteering*, while Columns (2) and (5) include both *Volunteering* and the categorical variable controlling for welfare models. Columns (3) and (6) include the interaction term between the two.

Table 5 – Main empirical findings

	SI	SI	SI	RI	RI	RI
	(1)	(2)	(3)	(4)	(5)	(6)
Volunteering	0.020**	0.0360***	0.0131	0.0362***	0.0698***	0.1219***
	(0.0085)	(0.0125)	(0.0186)	(0.0105)	(0.0167)	(0.0199)
Population density	0.0064**	0.0048	0.0063	0.0088**	0.0037	0.0026
	(0.0027)	(0.0036)	(0.0039)	(0.0036)	(0.0029)	(0.0030)
Size of the economy	0.0017	0.0038	0.0039	-0.0063	0.0004**	-0.0021
	(0.0035)	(0.0037)	(0.0038)	(0.0040)	(0.0029)	(0.0029)
Human capital	-0.0208**	-0.0209*	-0.0284**	0.0412***	0.0350***	0.0482***
	(0.0098)	(0.0117)	(0.0130)	(0.0142)	(0.0132)	(0.0138)
Innovation capacity	0.0001***	0.0001*	0.0001	0.0002***	0.0001***	0.0001***
	(0.00002)	(0.00002)	(0.00001)	(0.00001)	(0.00003)	(0.00003)
Share of workers in Manufacturing	-0.0016***	-0.0016***	-0.0018***	0.0014**	0.0010**	0.0010**
	(0.000)	(0.0005)	(0.0005)	(0.0006)	(0.0004)	(0.0004)
Continental welfare		0.0327***	0.0147		0.0861***	0.1185***
		(0.0060)	(0.0108)		(0.0064)	(0.0113)
Transition countries welfare		0.0195	0.0091		0.0596***	0.0723***
		(0.0156)	(0.0177)		(0.0126)	(0.0161)
Social-democratic welfare		0.0071	0.0598 ***		0.0293**	0.0630***
		(0.0120)	(0.0181)		(0.0121)	(0.0160)
Mediterranean welfare		omitted	omitted		omitted	omitted
Continental welfare x volunteering			0.0645**			-0.1225***
			(0.0304)			(0.0331)
Transition countries welfare x volunteering			0.0380			-0.0403
			(0.0415)			(0.0399)
Social-democratic welfare x volunteering			-0.0498**			-0.0820***
			(0.0228)			(0.0192)
Mediterranean welfare x volunteering			omitted			omitted
Spatial lag-dependent variables	0.0382**	0.0231*	0.0292**	0.0027	-0.0469**	-0.0507**
	(0.0124)	(0.0130)	(0.0135)	(0.0204)	(0.0196)	(0.0196)
Constant	1.0030***	0.9857 ***	1.0065 ***	0.8179***	0.7978 ***	0.7784 ***
	(0.0472)	(0.0479)	(0.0483)	(0.0671)	(0.0521)	(0.0516)
N	178	178	178	177	177	177
R-squared	0.291	0.380	0.401	0.378	0.682	0.709

*p < 0.10, **p < 0.05, ***p < 0.01; standard errors in parentheses.
Source: Authors' elaboration

The estimated coefficients of the spatial lag of the dependent variables SI and RI are statistically significant, indicating the existence of a spatial dependence in regional resilience. In other words, the capacity for a given region to withstand the crisis and recover from it is affected by the capacity of its neighbouring regions. This result confirms the need to account for spatial models when studying regional resilience across EU regions.

Turning to the main focus of the paper, Columns (1) and (4) show that the coefficient of *Volunteering* is positive and statistically significant for both SI and RI.

This means that the existence of informal institutions in a region is associated, on average and *ceteris paribus,* with greater regional resilience, both in the resistance (SI) and in the recovery phase (RI). This is consistent with most of the arguments in the literature review in Section 2, specifically the fact that immaterial resources accruing from civil society might play a relevant role in times of economic hardships to cushion regional economies from the negative impact of a shock (Popenoe 1988).

Moreover, the coefficients of *Volunteering* suggest that the endowment of informal institutions represents a pivotal asset supporting regions withstanding the crisis, but it is even more crucial for the labour market recovery in the aftermath of economic downturns.

In Columns (2) and (5), we control for the typology of the welfare state model. Additionally, in these cases, *Volunteering* is positive and statistically significant. Additionally, we observe that when we control for the welfare state institutions in place in a given region, the estimate of *Volunteering* is positive and its effect increases both for SI and RI, confirming the important role played by informal institutions, on average and *ceteris paribus*, for the resilience of regions. In particular, as a baseline category, we have used the Mediterranean welfare state, where a crucial role for social security is attributed to family and informal social ties, which act as a last-resort protection network. Our results show that, especially in the recovery phase (RI), the regions located in a country displaying either a Continental, a Transition or a Social-democratic type of welfare experience a labour market recovery that is higher than that experienced by regions characterised by Mediterranean welfare regimes. Moreover, we find that the Continental welfare state is the one that supports the most regional resilience, both in the SI and RI phases.

These results are in line with recent studies that have shown that the effects of the 2008 crisis have been cushioned differently across European states, depending on the welfare regime in place (Ólafsson and Kolbeinn 2019; Ronchi 2018; Dumitrache and Tache 2013; Hemerijck 2012). In particular, the consequences of the crisis have been especially hard for Mediterranean countries, whereas overall Continental countries managed quite well to counteract the negative welfare consequences during the Great Recession (Ólafsson and Kolbeinn 2019; Ronchi 2018; Moreno-Fuentes and Marí-Klose 2016).

Finally, in Columns (3) and (6), we add the interaction term between *Volunteering* and welfare state regimes. We are interested in observing how the impact of unpaid voluntary work on regional resilience might differ depending on the conditioning of the welfare state models in place in the regions. Overall, our results show that the effect of an increase in unpaid voluntary work differs across regions depending upon the welfare model in place in that region.

In particular, for SI, we observe that *Volunteering* is no longer statistically significant ([40]). This could be due to the fact that informal institutions in regions with a Mediterranean welfare state are not strong enough to mitigate the negative consequences of the crisis on the labour market in the immediate aftermath of the crisis (SI).

Looking at the other interaction estimates in SI, we see that the values in regions characterised by Continental and Social-democratic welfare states are statistically significant and overall positive. In particular, the estimate value for *Volunteering* in the Continental welfare state is 0.0645, whereas the actual estimate for *Volunteering* in the Social-democratic welfare state is 0,01([41]). Indeed, the negative sign of the variable *SocialDemocratic Welfare x Volunteering* should not be interpreted as a negative effect of social democratic welfare on resilience compared to the baseline category, i.e., the Mediterranean model. Rather, it points to a "crowding-out effect" (Reeskens and Vandecasteele 2017) that social democratic welfare exerts on the impact of voluntary work. In other words, "*generous welfare provisions erode the supportive role of immaterial resources"* (Reeskens and Vandecasteele 2017, p. 46. See also Fukuyama 2001; Reeskens and Oorschot 2014). This might explain why in SI, the overall effect of unpaid voluntary work in a social democratic region is small (given that it is eroded by a strong welfare state) but still positive and nonnegligible compared to the effect of unpaid voluntary work in the Mediterranean welfare state, which is not significant.

No effect is registered for voluntary work in regions belonging to the Transition welfare model. This result might be the consequence of what has been stated in the literature review, that transition countries do not yet have a common and clear welfare state model but are instead in a transformative phase, which seems to be converging towards the Anglo-Saxon model, in which the role of public provisions and support is minimal.

In the recovery phase, we observe that *Volunteering* is positive and statistically significant at the 1% level and that the effect is the highest across all six specifications. This suggests that while informal institutions in Mediterranean welfare regimes do not support regions withstanding a crisis,

[40] It is important to note that the coefficient of *Volunteering* in Columns 3 and 6 is not, as in the other columns, the average effect of voluntary work on resilience, but it instead refers to the effect of unpaid voluntary work conditioning on the Mediterranean welfare model.

[41] The coefficient value for the variable *SocialDemocraticWelfare xVolunteering* is calculated by adding up 0.0598 (the coefficient of the variable *Social Democratic Welfare*) and -0.0498 (the coefficient of the variable *SocialDemocraticWelfare x Volunteering*). Hence, 0.0598 + (-0.0498) = 0,01.

they seem to play a meaningful role in the recovery stage, suggesting a strong impact of informal institutions on regional resilience and no crowding-out effect exerted by a relatively weaker welfare regime.

Looking at the other interaction terms in RI, we see that the estimates in regions characterised by Continental and Social-democratic welfare states are statistically significant at the 1% level and overall positive. In particular, the overall estimated value for voluntary work in Continental welfare states is 0,1179 ([42]), whereas for Social-democratic welfare state, it is 0,1029 ([43]). It is interesting to note that in RI, the interaction terms related to Continental and Social-democratic welfare have a negative sign. Again, this suggests that informal institutions might partially compete with the support provided by generous welfare state regimes, as in the case of Continental and Social-democratic regimes. In other words, also in the recovery stage, the effect of *Volunteering* on resilience is partially mitigated by the provisions of strong welfare states. Again, no specific effect is registered for *Volunteering* in regions of transition countries.

Our results are robust to the use of an alternative estimation strategy and spatial model (see Appendix B).

With respect to the control variables included in our model, a few comments are worth noting. Table 5 shows that the employment share in manufacturing is negatively associated with the resistance of a region, while it is significant for its recovery. This points to the fact that a region characterised by a larger manufacturing sector suffers more from labour market contractions in terms of lost hours worked in the early phase of an economic downturn but not in its aftermath, where manufacturing becomes a crucial asset for labour market recovery and job creation. This finding is in line with prior studies, which suggest that firms in the manufacturing sector made up of traditional and lower-value added activities have less capacity to resist the crisis and make relatively lower contributions to the resilience of the region (Filippetti et al. 2020; Sarra et al. 2019). In fact, a large number of these firms do not survive the crisis in the medium-long run (and thus exit the market) or suffer from a high contraction of hours worked in the early phase.

Conversely, the innovation capacity of regions seems to be an important endowment that explains labour market resilience. This result confirms previous findings on the determinants of regional resilience (Filippetti et al. 2020; Crescenzi et al. 2016), according to which an innovative regional environment is conducive to a higher level of economic resilience.

[42] The coefficient value for the variable *Continental xVolunteering* is calculated by adding up 0.1219 (the coefficient of the variable *Volunt*eering), 0.1185 (the coefficient of the variable *ContinentalWelfare*) and -0.1225 (the coefficient of the variable *ContinentalWelfare x Volunteering*).

[43] The coefficient value for the variable *SocialDemocraticWelfare x Volunteering* is calculated by adding up 0.1219 (the coefficient of the variable *Volunt*eering), 0.0630 (the coefficient of the variable *SocialDemocraticWelfare*) and -0.0820 (the coefficient of the variable *SocialDemocraticWelfare x Volunteering*).

Finally, concerning the effect of the educational attainment of human capital on resilience, we observe that across the SI regressions, all coefficients are negative and statistically significant at a minimum at the 5% level, while in the RI regressions, they are all positive and significant at the 1% level. This might be because a better qualification of workers usually corresponds to higher wages and, therefore, to higher labour costs. Given that the first reaction of firms after the crisis was to reduce labour costs by adjusting quantities (Fabiani et al. 2015), it is reasonable to assume that such a reaction is more intense in regions characterised by a more educated and therefore, more expensive, workforce. However, the abundance of a qualified workforce in the region facilitates organisational innovation and the identification of creative solutions to the external shock, thus increasing regional recovery capacity (Crescenzi et al. 2016).

5. Discussion and Conclusions

The paper explores the relationship between informal institutions and resilience across EU regions following the 2008 Great Recession. Specifically, by building upon early research by Filippetti et al. (2020), we observe the impact that the quality of institutions and voluntary work exert on regional resilience over two different periods of the crisis: the resistance phase and the recovery phase.

Overall, our results show that informal institutions are a crucial asset for regional resilience, supporting regions in preserving employment both during and in the aftermath of economic downturns. Moreover, the effect of informal institutional action gains strength as recovery proceeds because it is higher for RI than for SI.

Nevertheless, we observe some differences in the effects of informal institutions on the resilience capacity of regions when we control for the welfare state model in place. While an increase in voluntary activities in regions characterised by the Continental and Social-democratic welfare models yields an increase both in the SI and RI index, an increase in voluntary activities in regions characterised by Mediterranean welfare displays its effect only in the recovery phase. The latter case is characterised by highly fragmented welfare provisions and limited coverage; therefore, to combat poverty and labour market exclusions, such a model relies the most on informal networks and solidarity rather than on universal safety nets provided by the institutions (Rhodes 1996). In this framework, in the early stages of the crisis, informal institutions act in emergency circumstances and have limited ability to self-organise and coordinate their actions to immediately withstand the crisis. However, as time passes, informal institutions might be better able to align their actions to emerging difficulties and to increase the strength of their effects, becoming significant and more effectively supporting the recovery.

Overall, the effect of voluntary work is always positive for strong welfare states, but its effect is mitigated by the presence of public provisions. Additionally, in regions with a relatively weaker institutional context (such as the Mediterranean model), informal institutions retain their positive effect. However, in this context, informal institutions appear to take more time to deploy their effects, but their positive impact on regional labour market recovery (RI) is even stronger than in other welfare regimes, probably due to the poor public support that characterises this welfare system model.

In terms of policy implications, our study shows that informal institutions and resources accrued from civil society are relevant for the resilience of regions, regardless of the typology of the welfare system in place. However, our analysis shows that formal and informal institutions should not be treated as separate worlds, given the positive interaction between them during economic hardship. This should be considered, and possibly exploited, to magnify the overall resilience effect on the social and economic welfare of regions. For instance, by improving the capacity of public authorities to steer the voluntary actions of communities towards the socioeconomic areas more affected by the crisis and the more vulnerable groups, it might be possible to activate a more rapid and coordinated response to the crisis and, possibly, even a more efficient use of public resources.

Moreover, we believe that if it is true that the variety of institutional endowments of EU regions is a signal of the existence of regional disparities, such a mix might be targeted to favour convergence. In particular, it might be strategic to continue favouring collaboration practices and secondments programmes involving governments located in both advanced and more laggard regions to enhance the spread of institutional best practices and to speed up the process of institutional upgrading across backwards regions. These initiatives would be in line with previous actions implemented by the EU (such as the "Twinning program" benefitting candidate countries) and might boost already existing European Territorial Cooperation programs, such as the Interreg Europe, specifically designed to support interregional collaboration. The same can also be done at the national level, especially in countries such as Italy or Spain that suffer from longstanding regional divides. Initiatives of a similar kind are already in place in Germany (Prodi et al. 2021).

Our study also suffers from some limitations. Concerning informal institutions, studies converge around the lack of univocal measures; hence, we have used voluntary work since, according to the literature, it seems to appropriately capture trust-based community bonds and the culture of civic engagement. A more informative picture might be drawn using multifaceted measures of informal institutions, conditioned upon the availability of structured and reliable data.

Further research could focus on investigating the nature of the interaction between voluntary work and formal institutions. Qualitative approaches seem particularly suitable to shed more light on such a mechanism and its determinants. Moreover, the same analysis could be performed with regard to the recent pandemic. Despite being of a different nature and having a distinct origin than the Great

Recession, its economic, social and health consequences have, nevertheless, required a massive intervention from governments, as well as the activation of social and family networks to withstand the dramatic impact of the pandemic shock. Therefore, it would be interesting to explore the role played by both formal and informal institutions in such a specific context in a few years.

Acknowledgments

This research was conducted within the framework of the project "Emilia-Romagna International School of Policy" (CUP: E45J19000150004) funded by the Emilia-Romagna regional government.

We wish to thank the editor and the two anonymous reviewers for their insightful comments. We also wish to thank Edinson Tolentino Raymondi for his suggestions on methodology development.

References

Acemoglu, D., & Johnson, S. (2005). Unbundling institutions. Journal of political Economy, 113(5), 949-995.

Adger, W.N. (2000), Social and ecological resilience: are they related?, Progress in Human Geography**.** 24(3): 347– 364.

Alfano, V. Does social capital enforce social distancing? The role of bridging and bonding social capital in the evolution of the pandemic. *Econ Polit* 39, 839–859 (2022). https://doi.org/10.1007/s40888-021-00255-3

Andersson, L. P., Chang, K., Molina-Garzón, A. (2020), Voluntary leadership and the emergence of institutions for self-governance, Proceedings of the National Academy of Sciences Nov 2020, 117 (44) 27292 27299; DOI: 10.1073/pnas.2007230117

Agostino, M., Di Tommaso, M. R., Nifo, A., Rubini, L., & Trivieri, F. (2020). *Institutional quality and firms' productivity in European regions*. Regional Studies, 54(9), 1275-1288.

Aidukaite, J. (2006). The formation of social insurance institutions of the Baltic States in the post-socialist era. Journal of European Social Policy, 16(3), 259-270.

Bales, K. (1996). Measuring the propensity to volunteer. Social Policy & Administration, 30(3), 206-226.

Bambra, C., & Eikemo, T. A. (2009). Welfare state regimes, unemployment and health: a comparative study of the relationship between unemployment and self-reported health in 23 European countries. *Journal of Epidemiology & Community Health*, *63*(2), 92-98.

Becattini, G. (2015). *La coscienza dei luoghi: il territorio come soggetto corale*. Donzelli editore.

Becattini G., Bellandi, M., De Propris L (eds.), (2009), A Handbook of Industrial Districts, Cheltenham (UK), Edward Elgar.

Bekker S., Mailand M. (2019). The European flexicurity concept and the Dutch and Danish flexicurity models: How have they managed the Great Recession? Social & Policy Administration, 53, 142–155.

Bekkers, R. (2012). Trust and volunteering: Selection or causation? Evidence from a 4 year panel study. Political Behavior, 34(2), 225-247.

Berkes, F. 2007. 'Understanding uncertainty and reducing vulnerability: lessons from resilience thinking.' Natural Hazards 41:283–295.

Beugelsdijk, S., De Groot, H.L.F. and van Schaik, A. (2004), Trust and economic growth, Oxford Economic Papers 56, 118–134.

Beugelsdijk, S. & van Schaik, T. (2005). Social capital and growth in European regions: An empirical test. European Journal of Political Economy, 21, 301-324.

Bottazzi, L., & Peri, G. (2003). Innovation and spillovers in regions: Evidence from European patent data. European economic review, 47(4), 687-710.

Breathnach P., van Egeraat C., Curran D. (2015), *Regional economic resilience in Ireland: the roles of industrial structure and foreign inward investment*, Regional Studies, Regional Science, 2(1), 497–517

Brown, K. and E. Westaway. 2011. Agency, Capacity and Resilience to Environmental Change: Lessons from Human Development. Annual Review of Environment and Resources 36:321-342.

Brown, L., & Greenbaum, R. (2017). The role of industrial diversity in economic resilience: An empirical examination across 35 years. Urban Studies: An International Journal of Research in Urban Studies, 54(6), 1347-1366.

Brusco, S. and Säbel, C. 1981, Artisanal Production and Economic Growth, in F. Wilkinson (a cura di), The Dynamics of Labour Market Segmentation, Academic Press, London

Capello, R.; Caragliu, A.; Fratesi, U. Spatial heterogeneity in the costs of the economic crisis in Europe: Are cities sources of regional resilience? J. Econ. Geogr. 2015, 15, 951–972.

Cardinale, I., Scazzieri, R., 2018. Explaining structural change: actions and transformations. Struct. Change Econ. Dynam. 51, 393–404

Cardinale, I. (2019) Vulnerability, Resilience and 'Systemic Interest': a Connectivity Approach. *Netw Spat Econ*. https://doi.org/10.1007/s11067-019-09462-9

Cavallo M., Silvestri F. (Editors) (2022). Sustainable model for social enterprises and altruistic entrepreneurs. Bologna University Press. Bologna

Chibber, V. (1999). Building a developmental state: The Korean case reconsidered. Politics & Society, 27(3), 309-346.

Cortinovis N., Xiao J., Boschma R., van Oort F. G. (2017), *Quality of government and social capital as drivers of regional diversification in Europe*, Journal of Economic Geography, 17(6), 1179–1208

Crescenzi, R., Luca, D., & Milio, S. (2016). The geography of the economic crisis in Europe: National macroeconomic conditions, regional structural factors and short-term economic performance. Cambridge Journal of Regions, Economy and Society, 9(1), 13–32.

Crossland, C., & Hambrick, D. C. 2011. Differences in managerial discretion across countries: How nation-level institutions affect the degree to which CEOs matter. *Strategic Management Journal,* 32(8): 797–819.

Davies, S., 2011, Regional resilience in the 2008-2010 downturn: comparative evidence from European countries, Cambridge Journal of Regions, Economy and Society, Cambridge Political Economy Society, vol. 4(3), pages 369-382.

Dawson, C., Baker, P.L. & Dowell, D. Getting into the 'Giving Habit': The Dynamics of Volunteering in the UK. *Voluntas* 30, 1006–1021 (2019). https://doi.org/10.1007/s11266-019-00133-4

Dekker, P., & Halman, L. (Eds.). (2003). The values of volunteering: Cross-cultural perspectives. Springer Science & Business Media.

Dobler, C. (2011), The Impact of Formal and Informal Institutions on Economic Growth: A Case Study on the MENA Region, Hohenheimer volkswirtschaftliche Schriften, No. 65, ISBN 978-3-653-00883-8, Peter Lang International Academic Publishers, Frankfurt a. M., http://dx.doi.org/10.3726/978-3-653-00883-8

Duarte, J, S Siegel and L Young (2012). Trust and credit: The role of appearance in peer-to-peer lending,The Review of Financial Studies, 25(8), 2455–2484.

Dumitrache, V., and Tache, I. (2013). Impact of global economic crisis on the European welfare states. European Research Studies Journal, 16(3), 3-18

Dei Ottati, G. (1994) Cooperation and competition in the industrial districts as an organization model, European Planning Studies 2, 463–483.

Di Tommaso, M. R., (2020), Una strategia di resilienza intelligente per il dopo coronavirus. Sulla centralità della domanda e offerta di politica industriale, L'industria, Rivista di economia e politica industriale, 41, pp. 3 - 20

Eigner, P., & Umlauft, T. S. (2015). The Great Depression (s) of 1929-1933 and 2007-2009? Parallels, Differences and Policy Lessons. *Parallels, Differences and Policy Lessons (July 1, 2015). Hungarian Academy of Science MTA-ELTE Crisis History Working Paper*, (2).

Esping-Andersen G. (1990). The Three Political Economies of the Welfare State. International Journal of Sociology, 20, 3

Esping-Andersen G. (1999). Social Foundations of Postindustrial Economies. OUP Oxford

EVS (2008), *Integrated Dataset*, GESIS Data Archive, Cologne, ZA4800, v.4.0.0 (2016-04-15), doi:10.4232/1.12458

Ezcurra, R. and Rios, V. (2019), Quality of government and regional resilience in the European Union. Evidence from the Great Recession, Papers in Regional Studies, 98:1267–1290. DOI: 10.1111/pirs.12417

Fabiani, S., Lamo, A., Messina, J., & Rõõm, T. (2015). European firm adjustment during times of economic crisis. IZA Journal of Labor Policy, 4(1), 1-28.

Faggian A., Gemmiti R., Jaquet T., Santini I. (2018), *Regional economic resilience: The experience of the Italian local labor systems*, The Annals of Regional Science, 60, 393–410

Fazio, G., & Lavecchia, L. (2013). Social capital formation across space: proximity and trust in European regions. International Regional Science Review, 36(3), 296-321;

Filippetti A., Gkotsis P., Vezzani A., Zinilli A. (2020), *Are innovative regions more resilient? Evidence from Europe in 2008–2016*, Economia Politica, 37(3), 807–832

Ferrera M. (1996). Il modello Sud-europeo di welfare state. Italian Political Science Review. 26, 1. 167-101

Fingleton, B., Garretsen, H., Martin, R. (2012) Recessionary shocks and regional employment. J. Reg. Sci., 52, 109–133.

Fukuyama F. (2000) Social Capital and the Civil Society. IMF Working Paper Number 74. International Monetary Fund (IMF), Washington, DC.

Gallopin, C. G. (2006), Linkages between Vulnerability, Resilience and Adaptive Capacity, Global Environmental Change, 16: 293-303

Gertler, M. S. (2010). Rules of the game: The place of institutions in regional economic change. Regional studies, 44(1), 1-15.

Getis, A. and J.K. Ord. 1992. "The Analysis of Spatial Association by Use of Distance Statistics" in Geographical Analysis 24(3).

Grabner, S.M. (2021). Regional Economic Resilience: Review and Outlook. In: Wink, R. (eds) Economic Resilience in Regions and Organisations. Studien zur Resilienzforschung. Springer, Wiesbaden. https://doi.org/10.1007/978-3-658-33079-8_2

Groot, S. P. T., Mohlmann, J. L., Garretsen, J. H., & de Groot, H. L. F. (2011). The crisis sensitivity of European countries and regions: Stylized facts and spatial heterogeneity. Cambridge Journal of Regions, Economy and Society, 4(3), 437–456.

Guiso, L, P Sapienza and L Zingales (2004). The role of social capital in financial development,American Economic Review, 94(3), 526–556

Hajgasemi A. (2019). European Welfare States and Globalization: Strategies in Era of Economic Restructuring. Edward Elgar Publishing, Cheltenham (UK)

Han, Y., and S. J. Goetz. 2015. "The Economic Resilience of US Counties during the Great Recession." The Review of Regional Studies 45 (2): 131–149.

Helmke, G. & Levitsky, S. (2006). Informal institutions and democracy. Lessons from Latin America. Baltimore, MD. John Hopkins University Press.

Hajighasemi, A. (2019). *European Welfare States and Globalization: Strategies in Era of Economic Restructuring*. Edward Elgar Publishing.

Hemerijck, A. (2012). *Changing welfare states*. OUP Oxford.
Holling, C.S. (1973) Resilience and Stability of Ecological Systems, Annual Review of Ecology and Systematics, 4:1, 1-23
Holmes, R. M, Miller T., Hitt, M. A. & Salmador, M. P. (2013). The interrelationships among informal institutions, formal institutions, and inward foreign direct investment. Journal of Management, 39(2), 531-566.
Hudson, R. (1994) Institutional change, cultural transformation, and economic regeneration: myths and realities from Europe's old industrial areas, in AMIN A. and THIRFT N. (Eds) Globalization, Institutions, and Regional Development in Europe, pp. 196–216. Oxford University Press, Oxford.
Kaasa, A., Vadi, M. & Varblane, U. Regional Cultural Differences Within European Countries: Evidence from Multi-Country Surveys. Manag Int Rev 54, 825–852 (2014)
Kafouros, M., Subramanya Prasad Chandrashekar, Murod Aliyev, Alan Kai Ming Au, (2021) How do formal and informal institutions influence firm profitability in emerging countries?, Journal of International Management, https://doi.org/10.1016/j.intman.2021.100890.
Knack, S., & Keefer, P. (1997). Does social capital have an economic payoff? A cross-country investigation. The Quarterly journal of economics, 112(4), 1251-1288.
Leibfried S. (1993). Towards a European welfare State? In: Jones C. (Editor), New Perspectives on the Welfare State in Europe. Routledge, London.
Leichsenring K. (2001). Austria. Social enterprises and new childcare services, In: Borzaga C., Defourny J. (Eds.). The Emergence of Social Enterprise. Studies in the Management of Voluntary and Non-Profit Organizations. London
Lewin, A. Y., Massini, S., & Peeters, C. 2011. Microfoundations of internal and external absorptive capacity routines. *Organization Science,* 22(1): 81–98.
Lim, C., & Laurence, J. (2015). Doing good when times are bad: Volunteering behaviour in economic hard times. The British journal of sociology, 66(2), 319-344.
Luci, A. (2009). Female labour market participation and economic growth. *International Journal of Innovation and Sustainable Development*, *4*(2-3), 97-108.
Bardhan, K. (1983). Economic growth, poverty and rural labour markets in India: a survey of research. *ILO Working Papers*, (992228833402676).
Martin R. (2012), *Regional economic resilience, hysteresis and recessionary shocks*, Journal of Economic Geography, 12, 1–32.
Martin, R., and Sunley, P. (2015). On the notion of regional economic resilience: Conceptualization and explanation. Journal of Economic Geography, 15(1), 1–42.
Mazzola, F., Lo Cascio, I., Epifanio, R., & Di Giacomo, G. (2018). Territorial Capital and Growth over the Great Recession: a Local Analysis for Italy". The Annals of Regional Science, 60(2), 411-441
Moran, P. A. (1950). Notes on continuous stochastic phenomena. *Biometrika*, *37*(1/2), 17-23.
Moreno-Fuentes, F. J., & Marí-Klose, P. (Eds.). (2016). *The Mediterranean Welfare Regime and the Economic Crisis*. Routledge.
Morgan, K. (2007). The learning region: Institutions, innovation and regional renewal. Regional Studies, 41, S147–S159.
Morris, M. (1998). Voluntary work in the welfare state (Vol. 197). Psychology Press.
Musick, M. and Wilson, J. 2008 Volunteers: A Social Profile, Indianapolis: Indiana University Press.
Mutchler, J. E., Burr, J. A., & Caro, F. G. (2003). From paid worker to volunteer: Leaving the paid workforce and volunteering in later life. Social forces, 81(4), 1267-1293.
North D.C. (*1990*), Institutions, Institutional Change, and Economic Development, Cambridge: Cambridge University Press.
Ólafsson, S., and Kolbeinn S., (2019), 'Welfare Consequences of the Crisis in Europe', in Stefán Ólafsson and others (eds), Welfare and the Great Recession: A Comparative Study (Oxford) online edn, Oxford Academic, 21 Feb. 2019), https://doi.org/10.1093/oso/9780198830962.003.0002.

Oorschot, W. V., Arts, W., & Halman, L. (2005). Welfare state effects on social capital and informal solidarity in the European Union: evidence from the 1999/2000 European Values Study. *Policy & Politics*, *33*(1), 33-54.

Ord, J.K. and A. Getis. 1995. "Local Spatial Autocorrelation Statistics: Distributional Issues and an Application" in Geographical Analysis 27(4).

Orosz, Á. (2018). Transformations of the welfare state in Hungary. Rozprawy Ubezpieczeniowe. Konsument na rynku usług finansowych, 3(29), 50-65.

Pahl-Wostl, C. (2009). A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. Global environmental change, 19(3), 354-365.

Pascariu, G. C., Iacobuță-Mihăiță, A., Pintilescu, C., & Țigănașu, R. (2021). Institutional Dynamics and Economic Resilience in Central and Eastern EU Countries. Relevance for Policies. Transylvanian Review of Administrative Sciences, 17(SI), 77-103.

Pejovich, Svetozar. 1999. The effects of the interaction of formal and informal institutions on social stability and economic development. Journal of Markets and Morality 2 (2): 164-81. Price, Robert M.1.

Pontarollo, N. and Serpieri, C. (2020), A composite policy tool to measure territorial resilience capacity, *Socio-Economic Planning Sciences*, **70**, issue C, 10.1016/j.seps.2018.11.006

Popenoe, D. (1988). Disturbing the nest. Family change and decline in modern society. New York: Aldine de Gruyter.

Putnam, R.D. (1993), What makes democracy work?. Nat Civic Rev, 82: 101-107. https://doi.org/10.1002/ncr.4100820204

Putnam, R., Leonardi, R. & Nanetti, R. Y. (1993). Making Democracy Work. Princeton (NJ). Princeton University Press.

Putnam, R.D. 2000 Bowling Alone: The Collapse and Revival of American Community, New York: Simon and Schuster.

Raiser, M. (2001), Informal Institutions, Social Capital and Economic Transition: Reflections on a Neglected Dimension in Cornia, A. G., and Popov, V. (eds), Transition and Institutions. The Experience of Gradual and Late Reformers, Oxford University Press.

Reeskens, T., & Vandecasteele, L. (2017). Hard times and European youth. The effect of economic insecurity on human values, social attitudes and well-being. International journal of psychology, 52(1), 19-27.

Rhodes M. (1996) Southern European Welfare States: Identity, Problems and Prospects for Reform, South European Society and Politics, 1:3, 1-22, DOI: 10.1080/13608749608539480

Rizzi, P., Graziano, P., & Dallara, A. (2018). A capacity approach to territorial resilience: the case of European regions. The Annals of Regional Science 60(2), 285-328.

Rocchetta, S. and Mina, A. (2019) Technological coherence and the adaptive resilience of regional economies, Regional Studies, Vol. 53, Issue 10.

Rodríguez-Pose A.and Storper M. (2006) Better rules or stronger communities? On the social foundations of institutional change and its economic effects, Economic Geography 82, 1–25.

Rodríguez-Pose A. (2013), Do Institutions Matter for Regional Development? Regional Studies, Vol.47, Issue 7.

Ronchi, S. (2018). Which roads (if any) to social investment? The recalibration of EU welfare states at the crisis crossroads (2000–2014). *Journal of Social Policy*, *47*(3), 459-478.

Sarra, A., Di Berardino, C., & Quaglione, D. (2019). Deindustrialization and the technological intensity of manufacturing subsystems in the European Union. Economia Politica, 36(1), 205-243.

Sarracino F., Mikucka M. (2015), *Social Capital in Europe from 1990 to 2012: Trends and Convergence*, Social Indicators Research, 131(1), 407–432

Scott, W. R. (2008). Institutions and Organizations: Ideas and Interests. 3rd ed. Thousand Oaks (CA). Sage Publications.

Serageldin, I. and Grootaert, C. (2000) Defining Social Capital: An Integrating View. In: Dasgupta, P. and Serageldin, I., Eds., Social Capital: A Multifaceted Perspective, World Bank, Washington DC, 40-59.

Stuckler, D., Sanjay, B., Suhrcke, M., Coutts, A., & McKee, M. (2009). The public health effect of economic crises and alternative policy responses in Europe. The Lancet, 374(9686), 315–323.
Soloviov, V., 2022, Linking regional autonomy–embeddedness value orientation and innovation. J Innov Entrep 11, 18
Sugden, R. (1986). The Economics of Welfare, Rights and Co-operation.
Thoits, P. A., & Hewitt, L. N. (2001). Volunteer work and well-being. Journal of health and social behavior, 115-131.
Tilly, C., & Tilly, C. (1994). Capitalist work and labor markets. In N. J. Smelser, & R. Swedberg (Eds.), Handbook of economic sociology (pp. 283–313). Princeton, NJ: Princeton University Press.
Tonoyan, V., Strohmeyer, R., Habib, M., & Perlitz, M. (2010). Corruption and entrepreneurship: How formal and informal institutions shape small firm behavior in transition and mature market economies. Entrepreneurship theory and practice, 34(5), 803-832.
Ugyel, L. (2018). Integrating formal and informal institutions: towards a healthy community in the Pacific. Development Policy Centre Discussion Paper, (69).
Van Oorschot, W. (2006). Making the difference in social Europe: deservingness perceptions among citizens of European welfare states. Journal of European social policy, 16(1), 23-42.
Vázquez-Barquero, A. (2002). Endogenous development: Networking, innovation, institutions and cities. Routledge.
Visser, M., Gesthuizen, M., & Scheepers, P. (2014). The impact of macro-economic circumstances and social protection expenditure on economic deprivation in 25 European countries, 2007–2011. Social Indicators Research, 115(3), 1179–1203.
Yao, F.K., Jiang, K., Combs, D.R. *et al.* Informal institutions and absorptive capacity: A cross-country meta-analytic study. *J Int Bus Stud* (2020). https://doi.org/10.1057/s41267-020-00361-7
Wang, H. (2000). Informal institutions and foreign investment in China. The Pacific Review, 13(4), 525-556.
Williamson, C. R. (2009). Informal institutions rule: institutional arrangements and economic performance. Public Choice, 139(3), 371-387.
Wilson, J., & Musick, M. (1997). Who cares? Toward an integrated theory of volunteer work. American sociological review, 694-713.
Zak, P. J., & Knack, S. (2001). Trust and growth. The economic journal, 111(470), 295-321.
Zhao, L. and Hao, H. (2021) Informal institution and corporate innovation: From the perspective of social trust, International Journal of Financial Engineering, Vol. 8, No. 3

Contributions

EP: Conceptualization; Methodology; Formal Analysis and Investigation; Writing—Original Draft; Writing—Review & Editing; Supervision. SG: Conceptualization; Formal Analysis and Investigation; Writing—Original Draft. LR: Conceptualization; Writing—Original Draft; Writing—Review & Editing; FS: Conceptualization; Writing—Original Draft.

APPENDIX A –

Table A1 - Moran's I statistic for the SI index

Number of Obs = 188

Variable	Moran's I	E(I)	SE(I)	Z(I)	p-value
SI	0.30472	-0.00535	0.02919	10.62278	0.00000

Source: Authors' elaboration

Table A2 - Moran's I statistic for the RI index

Number of Obs = 188

Variable	Moran's I	E(I)	SE(I)	Z(I)	p-value
RI	0.47362	-0.00535	0.02945	16.26104	0.00000

Source: Authors' elaboration

Table A3 - The Gi* statistic for the SI index

Distance by a simplified version of Vincenty formula (unit: km)

	Obs.	Mean	S.D.	Min	Max
Distance	17578	1126.399	682.556	2.255	5082.482

*Getis-Ord G*i(d) Statistics*

Number of Obs = 188

Variable	z<=-2.58	-2.58<z<=-1.96	-1.96<z<1.96	1.96<=z<2.58	2.58<=z
SI	34	6	28	2	118

Source: Authors' elaboration

Table A4 - The Gi* statistic for the RI index

Distance by a simplified version of Vincenty formula (unit: km)

	Obs.	Mean	S.D.	Min	Max
Distance	17578	1126.399	682.556	2.255	5082.482

*Getis-Ord G*i(d) Statistics*

Number of Obs = 188

Variable	z<=-2.58	-2.58<z<=-1.96	-1.96<z<1.96	1.96<=z<2.58	2.58<=z

RI	42	2	19	6	119

	Population density 2008	Population density 2010	Size of economy 2008	Size of economy 2010	Human capital 2008	Human capital 2010	Innovation capacity 2008	Innovation capacity 2010	Share of workers in manufacturing 2008	Share of workers in manufacturing 2010	Volunteering
Population density 2008	1.00										
Population density 2010	0.99	1.00									
Size of economy 2008	0.54	0.54	1.00								
Size of economy 2010	0.55	0.55	0.99	1.00							
Human capital 2008	0.32	0.32	0.34	0.36	1.00						
Human capital 2010	0.34	0.34	0.35	0.36	0.98	1.00					
Innovation capacity 2008	0.33	0.33	0.44	0.45	0.36	0.35	1.00				
Innovation capacity 2010	0.29	0.29	0.41	0.42	0.34	0.33	0.98	1.00			
Share of workers in manufacturing 2008	-0.29	-0.30	-0.19	-0.20	-0.41	-0.40	-0.05	-0.02	1.00		
Share of workers in manufacturing 2010	-0.25	-0.25	-0.16	-0.16	-0.42	-0.41	0.01	0.03	0.98	1.00	
Volunteering	0.16	0.17	0.17	0.18	-0.002	0.006	0.20	0.18	-0.13	-0.07	1.00

Table A5 – Correlations among explanatory variables

Source: Authors' elaboration

APPENDIX B – Robustness check

To test the robustness of our results obtained through the SAR model, we use an alternative estimation strategy and spatial model. For this purpose, we estimate our main equations using a spatial Durbin error model (SDEM) in lieu of an SAR.

The spatial Durbin error model (SDEM) is a model allowing for fully flexible spillovers, since it includes endogenous interaction effects among the explanatory variables (WXθ) and interaction effects among error terms (λWu).

Equations 5 and 6 become as follows:

$$SI_i = \alpha + \beta * volunteering_i + \gamma * WelfareModel_i + \delta * Volunteering_i * WelfareModel_i + \Delta * X_i + WX_i\theta + u_i \quad (5)$$

and

$$RI_i = \alpha + \beta * volunteering_i + \gamma * WelfareModel_i + \delta * Volunteering_i * WelfareModel_i + \Delta * X_i + WX_i\theta + u_i \quad (6)$$

where

$$u_i = \lambda Wu + \varepsilon_i$$

Table B1 shows that the relationships under analysis remain mostly unaltered, regardless of the spatial model considered.

Table B1 – Robustness check: results estimated through an SDEM model

	SDEM	
	SI	**RI**
Volunteering	0.0033	0.0853***
	(0.0172)	(0.0226)
Population density	0.0018	0.0039
	(0.0026)	(0.0029)
Size of the economy	0.0029	-0.0062*
	(0.0031)	(0.0032)
Human capital	-0.0167*	0.0513 ***
	(0.0097)	(0.0157)
Innovation capacity	-0.0001	0.0001***
	(0.00001)	(0.00003)
Share of workers in manufacturing	-0.0018***	0.0012**
	(0.0005)	(0.0006)
Continental welfare	-0.0077	0.1385***
	(0.0164)	(0.0220)
Transition countries welfare	0.0598***	0.1167***
	(0.0186)	(0.0240)

Social-democratic welfare	0.0091***	0.1006***
	(0.0315)	(0.0337)
Mediterranean welfare	omitted	omitted
Continental welfare x volunteering	0.0661**	-0.0910***
	(0.0265)	(0.0328)
Transition countries welfare x volunteering	-0.0413	-0.0327
	(0.0408)	(0.0373)
Social-democratic welfare x volunteering	-0.0310**	-0.0744**
	(0.0318)	(0.0348)
Mediterranean welfare x volunteering	omitted	omitted
Spatial lag error term	0.3892***	0.3785***
	(0.1490)	(0.1345)
W x Volunteering	-0.0252	0.0692**
	(0.0269)	(0.0304)
W x Population density	0.0106	-0.0009
	(0.0066)	(0.0059)
W x Size of the economy	0.0071	0.00001
	(0.0051)	(0.0053)
W x Human capital	-0.0369*	-0.0119
	(0.0191)	(0.0175)
W x Innovation capacity	-0.0001	0.0001
	(0.0001)	(0.0001)
W x Share of workers in manufacturing	0.0004	-0.0010
	(0.0009)	(0.0009)
W x Continental welfare	-0.0024	-0.0092
	(0.0213)	(0.0252)
W x Transition countries' welfare	-0.0872***	-0.0525
	(0.0308)	(0.0332)
W x Social-democratic welfare	0.1382***	-0.0363
	(0.0456)	(0.0379)
W x Continental welfare x volunteering	0.1280**	-0.1012*
	(0.0497)	(0.0573)
W x Transition countries' welfare x volunteering	0.1853***	0.0102
	(0.0596)	(0.0559)
W x Social-democratic welfare x volunteering	-0.0835	-0.0419
	(0.0525)	(0.0442)
Constant	1.0158 ***	0.8116 ***
	(0.0415)	(0.0566)
N	178	177
R-squared	0.5828	0.7322

*p < 0.10, **p < 0.05, ***p < 0.01; standard errors in parentheses.
Source: authors' elaboration

PAPER 5 – Conceptualizing and measuring "industry resilience": Composite indicators for postshock industrial policy decision-making

Paper published as:

M. R. Di Tommaso, **E. Prodi**, C. Pollio, E. Barbieri, Conceptualizing and measuring "industry resilience": composite indicators for postshock industrial policy decision-making, in Socio-Economic Planning Sciences, *in press*

Doi: https://doi.org/10.1016/j.seps.2022.101448

Abstract

Can resilience be a relevant concept for industrial policy? Resilience is usually described as the ability of a socioeconomic system to recover from unexpected shocks. While this concept has caught the attention of regional economics researchers seeking to understand the different patterns behind regional recovery after a disruption, it is increasingly recognized that resilience can have policy-relevant conceptual applications in many other regards. In this paper, we apply it to industries and define the "industry resilience" concept and measurements. Our contribution is twofold. Theoretically, we frame industry resilience as a useful conceptual framework for policy-making to support the selection of industrial policy targets that are more capable of recovering after unexpected shocks. In addition, industry resilience can mitigate government failures by supporting decision-makers in promoting both economically and socially sustainable structural change. Methodologically, building on post-2008 U.S. data, we develop two composite indicators (CIs) to separately analyze quantitative and qualitative postshock variations in sectoral employment. Such CIs support policy-makers in visualizing sectoral performances dynamically and multidimensionally and can be used to compare each sector both to other sectors and to its counterfactual. Our results highlight that sectors react heterogeneously to shocks. This points to the relevance of tailoring vertical industrial policies according to sector features and the aims of industrial policy initiatives.

Keywords

Industry resilience, composite indicators, CIs, industrial policies, employment

JEL Classification

L52, O14, C43, L16

1. Introduction

The concept of resilience has acquired increasing prominence in many natural and social science disciplines (Earvolino-Ramirez, 2007; Longstaff, 2009; Raid and Botterill, 2013) among researchers seeking to understand the different patterns shaping subject recovery after a shock. While the concept has also been widely used since 2008 in the field of management and economic studies (Martin, 2012; Reggiani, 2013; Crescenzi *et al.*, 2016; Cardinale, 2019), the role of resilience in relation to the postshock industrial structure has been less explored (Canova *et al.*, 2012; OECD, 2021).

The topic is indeed relevant for policy-makers designing and implementing industrial policies, particularly considering that an increasing body of literature is challenging the mainstream definition of industrial policies as the way in which government promotes the competitiveness and productivity of industrial sectors through vertical policy initiatives (Pack, 2000; Foreman-Peck and Federico, 1999) in favor of a broader view. Indeed, industrial policy is increasingly conceived of as a way to deal with a multiplicity of socioeconomic objectives through the implementation of a variety of tools aimed at modifying industrial sectors (Chang and Andreoni, 2020; Barbieri *et al.*, 2019; Bailey *et al.*, 2019; Bailey *et al.*, 2019; Mazzucato, 2013; Stiglitz and Lin, 2013; Bianchi and Labory, 2011; Cowling and Tomlinson, 2011; Cimoli *et al.*, 2009). In particular, recent contributions have stressed how industrial policy can be interpreted as a set of tools to govern structural change (Di Tommaso *et al.*, 2020a; Andreoni *et al.*, 2019), defined as the relative proportions between sectors of the economy. In line with other spheres of public decision-making (Genovese, 2019; Goulart Coelho *et al.*, 2017; Bruno and Genovese, 2016; Zavadskas and Turskis, 2011), industrial policies also need to be supported through novel methodologies to accomplish such complex and multifaceted tasks, particularly in times of uncertainty. The capacity of industrial policy to manage structural change should be considered particularly relevant given that growth and development imply a process of continuous structural transformation and face endogenous or exogenous unexpected shocks. Moreover, structural changes can produce economically and socially unsustainable outcomes, which could arise from a plurality of interconnected processes, such as ecological, economic and social dynamics. Such outcomes can emerge either from the process of continuous structural transformation that economic development implies (e.g., the adoption of ICT and automation in manufacturing) or from unexpected shocks. Especially when these shocks are particularly severe and unpredicted (e.g., the 2008 global crisis and the COVID-19 pandemic), they can shake social and economic arrangements and endanger the sustainability of structural change (Herrfahrdt-Pähle *et al.*, 2020; Cardinale, 2019; Adger, 2006). Shocks of these kinds in fact might rapidly lead to the collapse of companies, sectors, and territories. The velocity of these unexpected disruptions undermines the

socioeconomic system as a whole and its capacity to govern and promote the future path of desirable structural change.

In this paper, we are focused specifically on this last aspect – i.e., threats to structural change sustainability coming from unexpected shocks. In this context, industrial policy becomes an essential tool to promote socially sustainable structural change (Di Tommaso *et al.*, 2020a) as a process that occurs without causing the collapse of the entire socioeconomic system and possibly promoting an improvement in the life of communities in the long term (Ferrannini *et al.*, 2021; Barbieri *et al.*, 2020). While we also recognize that sustainability entails a plurality of intertwined dimensions, our contribution specifically concerns social sustainability, which is a rather overlooked aspect relative to other pillars of the sustainability debate (Eizenberg and Jabareen, 2017).

Once industrial policy is conceptualized as a tool to promote the sustainability of structural change, the choice of *which industries* policy-makers target through industrial policy is particularly relevant, since different sectors can display substantially different capacities to promote sustainable structural change (Ngo *et al.*, 2021; Di Tommaso *et al.*, 2017). In particular, industrial sectors can react very differently to shocks, absorbing them and adapting to the new environment, therefore displaying different resilience capacities (Canova *et al.*, 2012; OECD, 2021). From the perspective of this paper, the ability not to collapse in the immediate aftermath of a shock is a desirable goal in the attempt to ensure future paths of sustainable structural change. Nevertheless, it is also necessary to clarify that resilience capacity might have different sources working for, or even against, structural change. For instance, it is true that companies, or entire sectors, might be resilient because they are capable of undertaking virtuous processes of internal structural transformation based on investments, R&D and innovation. In contrast, it is also true that they might appear resilient only because they are effective in capturing protection through the action of regressive coalitions. Therefore, being able to carefully study the nature of *postshock industry resilience* should be considered crucial to support policy-making in selecting sectors able to foster sustainable structural change.

This paper specifically addresses this last point and is a first step in this direction. In particular, we offer a novel methodology to examine postshock industry resilience and the different degrees to which industries react to shocks to support the design of selective industrial policies. From this perspective, in this contribution, we purposefully focus on industries as units of analysis. This choice is grounded in real-world evidence and recent literature.

First, while production organizations can have various configurations (such as vertically integrated chains, interdependent networks and territorial agglomerations; see Pasinetti, 1973; Cardinale and Landesmann, 2017; Amin and Thrift, 1992; Scazzieri, 2021; and Scazzieri, 1993, among others), industries and sectors still represent one of the objects that most frequently draws attention in industrial policy measures, as testified by many industrial policy experiences worldwide and observed

in several contributions (see, for example, Di Tommaso *et al.*, 2020a; Aiginger and Rodrik, 2020; Andreoni and Tregenna, 2020; Chang and Andreoni, 2020; Ferrannini *et al.*, 2021). Given that our proposition is to build and test a novel methodology to assess industrial resilience, our first empirical exercise relates to such widespread industrial policy targets.

Second, industry is a particularly relevant level of analysis from a political economy perspective. Indeed, industrial sectors have always been considered to represent sociopolitical aggregations of interests (Quesnay, 1759; Smith, 1776; Ferguson, 1995; Cardinale and Landesmann, 2017), with clear implications for policy formulation and implementation and for economic dynamics (Coen 2007; Coen and Richardson, 2009).

We make a first empirical application of our methodology by using data on U.S. industries from the post-2008 downturn, with an additional focus on manufacturing, given the increasing prominence that the sector has assumed in policy initiatives since the 2008 crisis.

Our contribution is threefold. First, we look at various dimensions of the change in employment within industrial sectors during and after a crisis. In particular, by developing a tailored index, we observe a) a measure of the quantity and b) a measure of the quality of the jobs preserved. Second, we move a step forward relative to previous studies by modeling industry resilience, looking at the behavior of these variables *across the whole crisis-and-recovery period* and against a hypothetical counterfactual trend, rather than simply accounting for pre- to postcrisis differences. Finally, we use this modeling to develop two composite indices (one for employment quantity and one for employment quality), allowing us to rank industrial sectors according to their performance. To assess the overall postshock industry resilience of sectors, such composite indices are also analyzed jointly, potentially enabling policy-makers to tailor relevant policy choices accordingly.

The remainder of the paper is as follows: the next section analyses relevant literature contributions on resilience and sets our research in the debate about structural change and social sustainability. Section 3 develops the methodology and describes the data. Section 4 shows the empirical application in the U.S. case, together with some methodological robustness checks. Concluding remarks, policy implications and future research lines are included in section 5.

2. A review of the literature

Over the past decades, the concept of resilience has attracted considerable attention from different disciplinary fields (Earvolino-Ramirez, 2007; Longstaff, 2009; Raid and Courtenay Botterill, 2013) and has been applied to different units of analysis, stages of the life course and spatial scales (Brown and Westaway, 2011; Cardinale, 2019).

The concept of resilience originates from early studies in physics[44], math and engineering (Bodin and Wiman, 2004; Norris *et al.*, 2008), where it measures the "*speed at which the system returns to the stable point or trajectory following a perturbation*" (Gallopin, 2006, p. 299).

More recent applications in ecology (Holling, 1973; Deangelis, 1980; Adger, 2000; Gunderson, 2000; Gunderson and Holling, 2002), psychology (Richardson, 2002; Coutu, 2002; Windle, 2011), management and decision-making (Fiksel, 2006; Sheffi, 2007; Neville *et al.*, 2016; Sajko *et al.*, 2020) and economic studies (Modica and Reggiani, 2015; Boschma, 2015; Crescenzi *et al.*, 2016, Cardinale, 2019; Pontarollo and Serpieri, 2020a; OECD, 2021; Soufi *et al.*, 2022; to cite only some) have departed from such a *return-to-equilibrium* interpretation and broadly define resilience as the ability to absorb changes and adapt to emerging circumstances (Adger, 2006; Folke *et al.*, 2010). In these studies, therefore, resilience accounts for systems' endurance and renewal (Berkes, 2007; Simmie and Martin, 2010; Pinheiro *et al.*, 2022), stressing, particularly for social systems, the ability of humans to learn and adapt (Klein *et al.*, 2003; Klein *et al.*, 2003; Raid and Botterill, 2013).

The 2008 economic downturn has contributed to intensifying research on and applications of the concept in economic studies. First, regional economics and economic geography have used it as a lens to explain why territories behave heterogeneously in the face of disruptive recessionary shocks, stressing that regions' adaptability to economic crises depends upon place-specific features (Martin, 2012; Bristow and Healy, 2015; Capello *et al.*, 2015; Breathnach *et al.*, 2015; Faggian *et al.*, 2018; Ezcurra and Rios, 2019; Filippetti *et al.*, 2020).

More recently, however, other stands of literature have acknowledged the need to also look at sector-specific patterns of response and adaptation to shocks (Fromhold-Eisebith, 2015; OECD, 2021). Indeed, industries react heterogeneously to a crisis, given that economic activities experience different degrees of fluctuation over the business cycle. In other words, *crises impact firms and workers differently depending on their industry* (OECD, 2021). In this view, postshock industry resilience might become a relevant framework for informing and orienting policy initiatives targeting sectors. However, the few studies that have attempted to assess the resilience of industries are, on the one hand, based mostly on anecdotal evidence and case studies (Holm and Østergaard, 2015; Rajesh, 2018); on the other hand, they have primarily focused only on specific aspects characterizing resilience, such as the degree of supply chain susceptibility to disruptive events (Rajesh, 2018), the overall risks associated with supply–customer relationships (Chowdhury and Quaddus, 2017), and industries' inner features affecting their capacities to withstand a crisis (OECD, 2021).

To the best of our knowledge, only Canova *et al.* (2012) have proposed a measure for industry resilience that allows ranking of sectors based on their resilience, thus offering policy-makers

[44] See, for instance, Merriam-Webster Dictionary Online at http://www.merriamwebster.com.

informative insights into how to enhance less resilient industries. Specifically, their study examined industry resilience in terms of sectoral output changes occurring across EU countries over the 2008–09 downturn, revealing considerable cross-sectoral differences. As the authors suggest, extending this work by exploring other sector-specific features would contribute to supporting decision-makers targeting sectoral interventions. In view of this, we believe that such a research avenue could be pursued and complemented by looking at industry resilience through the lens of structural change.

2.1 Industry resilience from the perspective of sustainable structural change

Structural change refers to the open-ended process of adjustment of the economic system, characterized by shifts in the relative proportions of productive sectors and by a transformation of underlying social features (Andreoni and Chang, 2019; Cardinale and Scazzieri, 2019; 2020). It entails a process of continuous conflict and negotiation among actors within and across sectors, with the consequence that some sectors seek expansion and capture higher shares of employment and value-added while others aim at preserving themselves from potential downsizing (Pasinetti, 1981; Scazzieri, 2018; Cardinale and Scazzieri, 2019). This approach crucially sheds light on employment dynamics across sectors, including potential intra- and intersectoral employment shifts, and opens up a range of possible reconfigurations of the economic system.

While structural change entails phases of adjustment of economic structures (Landesmann and Scazzieri, 1990, 1996; Scazzieri, 2018; Bianchi and Labory, 2018, 2019), it also modifies the shape of the underlying society (Nomaler *et al.*, 2021; UNIDO, 2017; Michaels *et al.*, 2012; Marx, 1867). Specifically, such transformations change the living conditions of individuals and communities. They induce radical changes in individual and social behaviors and in people's needs and demand for goods, services and rights (Ferrannini *et al.*, 2021). This might lead to the exacerbation of inequalities and social conflicts and to decreasing social cohesion (Ngo *et al.*, 2021; Andreoni *et al.*, 2019; Kawachi *et al.*, 1997), thus exposing the process of structural change to dynamics that in many respects may not be sustainable. However, even when the sustainability of structural change appears to be granted, severe and unexpected shocks can drastically challenge the socioeconomic system and its desirable dynamic transformations (Herrfahrdt-Pähle *et al.*, 2020; Cardinale, 2019; Adger, 2006).

Social sustainability, in particular, has been interpreted, on the one hand, as a condition in which societies are able to maintain and reproduce their social conditions (Littig and Grießler, 2005; Vallance *et al.*, 2011). In this sense, socially sustainable structural change processes are those that happen without endangering the vitality of social systems (Di Tommaso *et al.*, 2020a). On the other hand, some studies assert that social sustainability also emphasizes an improvement in the conditions of people and communities, thus entailing, for example, social justice and equity, poverty alleviation

or the expansion of opportunities and capabilities (Sen, 1999; Boström, 2012; Cuthill, 2010; Eizenberg and Jabareen, 2017; Barbieri *et al.*, 2020; Ferrannini *et al.*, 2021).

In this framework, for the purpose of this paper, written to investigate the relationship between shocks and structural change sustainability, it seems to us particularly relevant to focus on employment dynamics. In doing so, we begin to explore the social dimension of this sustainability. We decided to study the aftershock variation in jobs from both quantitative and qualitative perspectives. This is consistent with the growing attention in international debates to the relevance of decent employment opportunities (ILO, 2019), particularly the creation of good jobs. Such jobs are interpreted as those entailing stable contracts, adequate wages and social protections and allowing individuals to cultivate life, dignity, and, in general, a sense of fulfilment (Ngo *et al.*, 2021; Mutari and Figart, 2015; Rodrik and Sabel, 2019). While the contribution of good jobs to the improvement in people's life conditions is apparent, from a societal standpoint, such jobs also entail improvements in social cohesion and the mitigation of social conflicts (Rodrik and Sabel, 2019; Kawachi *et al.*, 1997). The exacerbation of labor market dualism brought about by the current transformations of productive structures (e.g., through the use of nonstandard forms of employment that deteriorate wages and working conditions in general; Kalleberg, 2001, 2011; ILO, 2015) might indeed fragment countries' social fabric and trigger social conflicts, undermining economic prosperity in the long run and affecting the sustainability of the process of structural change (Kleinknecht *et al.*, 2006). In this view, understanding how each sector withstands a downturn and the subsequent recovery in terms of both employment quantity and quality becomes a crucial feature for industrial policies seeking to govern structural change dynamics by orienting them toward a sustainable path.

3. Data and Methodology

Previous studies on resilience in the field of economic geography and regional economics have measured resilience mainly in terms of postshock changes in the regional/county employment rate (Martin, 2012; Fingleton *et al.*, 2012; Davies, 2011; Brown and Greenbaum, 2017; Ezcurra and Rios, 2019; Crescenzi *et al.*, 2016; Filippetti *et al.*, 2020) or the ratio of the employment drop to the rebound (Han and Goetz, 2015). To a lesser extent, such changes in employment after a crisis have been coupled with changes in other key economic variables, such as GDP (Crescenzi *et al.*, 2016; Pontarollo and Serpieri 2020a), productivity (Pontarollo and Serpieri, 2020a), and volumes of trade flows (Mazzola *et al.*, 2018).

Few attempts have been made to observe the behavior of the economic variables across the whole drop-and-recovery period. In this regard, to the best of our knowledge, only Han and Goetz (2015 and especially 2019) have proposed the design of an index that can offer empirical insights into how a shock is experienced over time in different regions, taking into consideration how quickly and to

what extent employment drops and recovers, counterfactual trends, and the duration of both phenomena.

We start from these previous methodological steps to develop our methodology, which is based on observation of the behavior of our variables of interest across the whole crisis-and-recovery period. In our view, this allows us to have a better grasp of the amplitude, duration and velocity of employment changes, particularly for policy purposes.

Methodologically, we follow four steps. First, we select the variables that allow us to measure employment levels and employment quality by sector (section 3.1). We use data on U.S. employment retrieved from various sources and build an original database. In particular, for employment quality, we consider different variables and build an index to take into account job stability and salaries (*Job quality index*, section 3.1.2). Second, we depart from the existing methods – mainly used in regional studies – that analyze resilience as pre- vs. postcrisis employment variation to model the phenomenon looking at the behaviors of the curves of the variables under scrutiny (section 3.2). We sum up such variations into a composite indicator, and we apply this methodology to the employment level and the employment quality index and obtain two composite indicators (section 3.3)

3.1 Data selection and description

3.1.1. Employment quantity

The first data source that we used is U.S. Department of Labor Bureau of Labor Statistics (BLS) data, which include monthly data on employment for 15 two-digit NAICS sectors.[45] We selected the number of employees per sector as a proxy for employment quantity, and to correctly identify the time span to measure the crisis and the recovery, we first observed the trend of the business cycle related to the 2008 crisis. A business cycle is usually identified by two local points (Han and Goetz, 2015; Hall *et al.*, 2003):

- a peak, which indicates the local maximum of the economic cycle, with the economic downturn starting the month after the economy – or sector – records its peak; and

- a trough, which indicates the local minimum of the economic cycle, after which the economic recovery begins.

[45] In our paper, by "industry," we mean the sphere of economic activities that have the same "common market" and areas of productions (Marshall, 1890; Moss, 1984). We therefore look at all economic activities rather than only at manufacturing.

According to the National Bureau of Economic Research calculation of the U.S. Business Cycle Expansions and Contractions[46], the U.S. economy entered a recession in January 2008, following the peak in December 2007, and the cycle reached its trough after 18 months. To observe the sectoral business cycles, in a similar fashion to other studies (see, e.g., Han and Goetz, 2015, for the case of U.S. counties), we allowed a ±12 month deviation from the overall economic trend to identify each sector's peak. Therefore, we first observed each sector's employment trend starting from January 2007 to January 2009.

Table 1 reports the peaks and troughs for the 15 initial sectors. The data show substantial heterogeneity with respect to the peak month and the fall duration. According to the BLS data, the first sector to enter the crisis was construction (March 2007), followed by manufacturing and wholesale trade, whose peak corresponded with that of the general economic cycle. The last sector to fall into crisis was professional and business services in November 2008. The distance between the peak and trough months of each sector also vary greatly, ranging from a minimum of 13 months for mining to a maximum of 46 months for construction. In addition, we found three sectors – utilities, educational services and health care and social assistance – for which we could not identify clear peak and trough months. Therefore, we excluded them from the analysis, leaving us with 12 sectors.

Table 1 – Peaks and troughs by sector

Sector	Peak Month	Trough Month	Peak to Trough (Months)
Mining	September 2008	October 2009	13
Construction	March 2007	January 2011	46
Manufacturing	December 2007	February 2010	26
Wholesale trade	December 2007	May 2010	29
Transportation and warehousing	April 2008	December 2009	20
Finance and insurance	July 2008	August 2010	37
Real estate and rental and leasing	June 2008	January 2011	31
Information	March 2008	August 2011	41
Accommodation and food services	July 2008	February 2010	19
Retail trade	March 2008	December 2009	21
Arts, entertainment and recreation	February 2008	March 2010	25
Professional and business services	November 2008	May 2010	18
Utilities		No peaks observed	
Educational services		No peaks observed	
Health care and social assistance		No peaks observed	

Sources: Authors' elaboration based on BLS data

[46] https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions. Last retrieved on 8 October 2021.

In addition to analyzing all sectors, we focused on manufacturing subsectors and selected the 17 NAICS subsectors for which BLS data are available and for which we could explicitly identify a peak between January 2007 and December 2008[47]. A table reporting peaks, troughs and peak-to-trough duration for the manufacturing subsectors is available in the appendix (Table A1); in this case as well, we find substantial cross-subsector variation.

Such cross-sector heterogeneity leads us, consistent with previous studies (see, e.g., Han and Goetz, 2015), to consider different starting and end periods of the economic downturn for each industry as follows: for each industry *j*, the starting period ($t_{0,j}$) is the month after the employment peak ($X_{peak,j}$).

3.1.2 Employment quality: Building a Good Jobs Index

Together with the observation of how postshock industry resilience performs on the quantity side, we aim to describe to what extent industries are also able to recover from the employment quality side, that is, through the creation or recovery of good jobs, after a shock. To address this dimension, building on the literature that we have explored previously (see section 2.1), we took into account the salary aspect and the contractual aspect and summarized them in an index that we call the *Good Jobs Index*, whose increase (decrease) should indicate an increase (decrease) in the quality of the jobs created by each sector.

For earnings, we collected BLS data for the monthly average hourly earnings of all employees for each sector *j* (AVG_W_j). Regarding the contractual component, we wished to measure the intensity to which standard forms of employment (full-time permanent employment) were used in the sector. ILO (2016) identifies four types of nonstandard employment: temporary employment, part-time work, temporary agency work and other forms of employment involving multiple parties, disguised employment and dependent self-employment. To the best of our knowledge, however, there are no available data on the distinct use of standard versus nonstandard forms of employment by sector for the time span that we consider. Therefore, we decided to proxy this aspect as the percent deviation between the actual number of workers employed in an industry and the full-time equivalent (for a similar approach, see Alpert *et al.*, 2019).

[47] Specifically, we study the following manufacturing subsectors: wood products, nonmetallic mineral products, primary metals, fabricated metal products, machinery, computer and electronic products, electrical equipment and appliances and components, transportation equipment, furniture and related products, other miscellaneous durable manufacturing, textile mills and textile products mills, paper and paper products, printing and related support activities, petroleum and coal products, chemicals, plastic and rubber products, food and beverage and tobacco products. We exclude apparel and leather and allied products since we found no peaks during the period under analysis.

We retrieved data from the U.S. Bureau of Economic Analysis (BEA) and used full-time and part-time employees by industry (*FTE&PTE*) to measure the actual employees in each sector and full-time equivalent employees by industry (*FTEE*).[48] The closer the actual number of workers to the full-time equivalent, the greater is the use of standard forms of employment; conversely, the larger the distance between the actual number of workers and the full-time equivalent, the higher is the number of workers hired with part-time or temporary (of less than 1 year) contracts. The contractual part of the index, for each sector *j*, is therefore represented by the reciprocal of the percent deviation of the *FTE&PTE* from *FTEE* ($FTEE_j/(FTE\&PTE_i\text{-}FTEE_j)*100$), a measure that grows when the distance between actual and full-time equivalent workers tends to zero.[49]

The final *Good Jobs Index GJI* is the product of the salary component (monthly average hourly earnings of all employees for each sector *j*) and the contractual component, normalized via *minmax* normalization to allow variation between 0 and 1.

$$GJI = NORM\left(AVG\_W_J * \frac{FTEE_j}{(FTE\&PTE_j - FTEE_j) * 100}\right). \quad (1)$$

3.2 Modeling industry resilience

Many contributions, given the complexity of measuring all the dimensions of resilience, resolve the measurement issue by taking the simple difference between pre- and postshock employment levels (see, e.g., Crescenzi *et al.*, 2016; Martin *et al.*, 2016; Ezcurra and Rios, 2019). However, others have underlined that resilience should also take into account different elements: in addition to differences in levels, the velocity of the drop to the minimum and of the rebound and the counterfactual behavior that the region would have shown in absence of the shock should be examined (Fratesi and Perucca, 2018; Han and Goetz, 2015; Pontarollo and Serpieri, 2020b). We follow this second approach, which allows us to account for and analyze various dimensions of the change. We draw from the work by Han and Goetz (2019) to develop a model taking into account drops, rebounds, velocity, and counterfactual measures related to the variables that we use to look at industry resilience.

We synthetize the industry resilience modeling in Figure 1. The figure represents the trend of employment in industry *j* before and after a shock. At t_0, sector *j* experiences the employment *peak*,

[48] These data are available only on an annual rather than monthly basis. In the final quality index, therefore, the monthly variation across each year is ensured by the wage component, while the contractual component is constant for each year.
[49] For the cases in which *FTE&PTE* and *FTEE* are equal, the measure is not defined. This happens in only one subsector of manufacturing (petroleum and coal) and for two years (2011 and 2014). In these two cases, we substituted the missing value with the average value of the two years before and after.

whereupon the recession starts. At t_{min}, sector *j* experiences the employment *trough*, after which the sector recovers.

The employment peak and trough represent the local minimum and maximum and allow us to define the behavior of the curve and to identify the two major dimensions of industry resilience, i.e., the employment *drop* and the employment *rebound*. The employment *drop* is the vertical distance between the employment *peak* and the employment *trough*. After the employment *trough*, we can observe the employment *rebound*, and the change in employment for each sector after a certain period t_{end} from the *trough*. We set the ending period ($t_{end,j}$) to 24 months after the employment trough ($X_{min,j}$) to allow an observable trajectory for each sector to be clearly defined.[50] In developing their measure of resilience, Han and Goetz (2019) also take into account the velocity of the recession and of the rebound as the time spent by the variable to reach the *trough* level and the time spent to reach the *rebound* level. We build upon this approach to compose our first three indicators to be included in the final industry resilience composite index:

1. **Industry Rebound** $IR_j = X_{j,end} - X_{j,min}$, which represents the change in the employment level from the trough over the 2 years after the employment trough. It measures the extent of the recovery of an industry over a given period in absolute terms.

2. **Industry Drop Velocity** $IDV_j = \frac{X_{j,min} - X_{j,0}}{t_{j,min} - t_{j,0}}$, which is the slope of the employment drop from t_0 to t_{min} and measures the velocity of the employment decline.

3. **Industry Recovery Velocity** $IRV_j = \frac{X_{j,end} - X_{j,min}}{t_{j,end} - t_{j,min}}$, which is the slope of the employment recovery from t_{min} to t_{end} and measures the velocity of the employment rise.

Finally, Han and Goetz (2015; 2019) measure the drop at the trough as the distance between the expected value of employment $\hat{X}$, using a compound growth rate over the 36 months before the peak and the value at the trough. In our context, the inclusion of the counterfactual dimension is relevant in a cross-sector comparative perspective, given that a similar variation in employment in different sectors might imply very different dynamics according to their pre-crisis trends. Consequently, based on available data, we compute the expected value of employment if the shock had not happened, both

[50] The choices on the time span for measuring the recovery differ greatly across the contributions looking at resilience. For instance, Han and Goetz (2015, 2019) set t_{end} to 6 months after the trough. Other studies, such as Pontarollo and Serpieri (2020a), look at long-term resilience, analyzing the capability of a sector to recover over a 7-year period. We chose an intermediate range to allow the sector to clearly reveal an observable trajectory and smooth short-term volatility effects. At the same time, we wish to avoid excessively long time spans, which might be influenced by other factors independent of the shock and that are more relevant when we are looking at the resilience of industries rather than of territories (such as long-term technological change).

for the trough and for the rebound. Based on a steady-state growth path, we use a compound growth rate over the 36 months before the peak for employment quantity and 12 months before the peak for employment quality[51]. In this way, we are able to develop indicators 4 and 5:

4. **Rebound-Counterfactual Difference Ratio** $RCD_j = \frac{X_{j,end} - X_{j,0}}{\hat{X}_{j,end} - X_{j,0}}$, which is the ratio between the actual rebound–peak difference and the one that we would have observed in the absence of the shock (counterfactual).

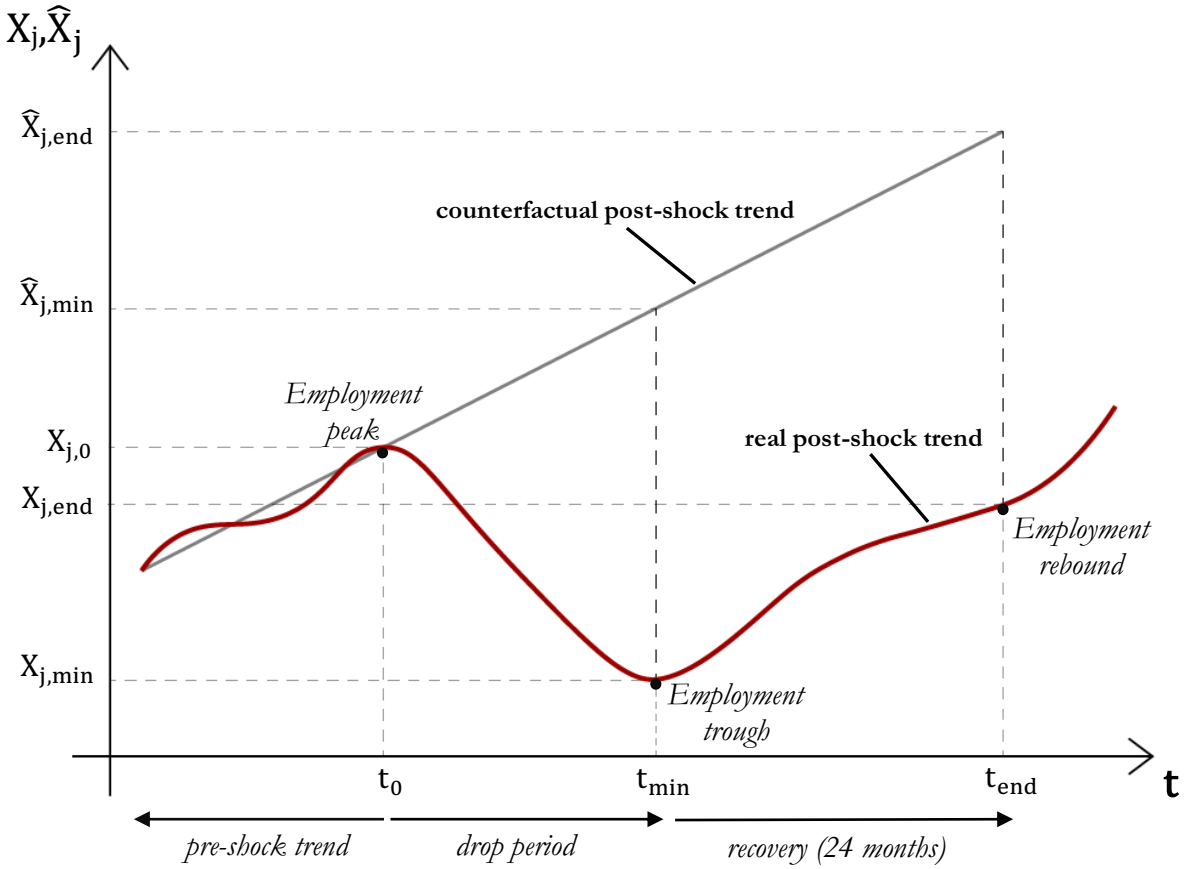
5. **Trough–Counterfactual Difference Ratio** $TCD_j = \frac{X_{j,min} - X_{j,0}}{\hat{X}_{j,min} - X_{j,0}}$, which is the ratio between the actual trough–peak difference and the one that we would have observed in the absence of the shock (counterfactual).

6. Finally, we include **Industrial Average Employment** $\bar{X}_j = \frac{\sum_{t=0}^{T} X_{j,t}}{n}$, calculated as the average of the variable over the peak–rebound period.

To allow for comparability among the sectors, which can vary greatly in terms of size, the minimum and the rebound values are calculated as the percentage deviation from the peak value (=100) for each sector. The six measures described above are computed accordingly.

[51] The shorter time span of the period to calculate the compound growth rate of employment quality is due to salary data availability.

Figure 1. Modeling Industry Resilience



Source: Authors' elaboration

3.3 Composite indicators of industry resilience and an evaluation matrix

To assess industry resilience in a synthetic measure encompassing its multifaceted dimensions, we use composite indicators (CIs).

CIs are frequently used to capture and assess phenomena that are difficult to observe and measure. They have been frequently used to compare cross-sectional performances and statuses in a variety of realms that, in the socioeconomic sphere, include competitiveness, degree of openness, and socioeconomic and political characteristics (see, e.g., Rubini *et al.*, 2021; Di Tommaso *et al.*, 2017; Pontarollo and Serpieri, 2020a; Bulut, 2020). Composite indicators are used to build performance-based rankings among observations and are widely diffused among policy-makers, international organizations and other bodies to inform decision-makers, governments, citizens and investors about trends and changes in country rankings over time (a few examples of these are UNDP, 2021, and previous years; Pichon *et al.*, 2020; and Alkire and Santos, 2014).

In the same spirit, we built two CIs ranking the *J* sectors on the basis of *K*=6 indicators capturing the behavior of the curve. We proceeded as follows: for each sector, we calculated the *K* indicators described previously (section 3.2) for both employment quantity (i.e., the number of people employed in the sector) and employment quality (i.e., the *Good Jobs Index*).[52] These *K* indicators were then integrated into two CIs, one for quantity (*CI_QUANT*) and one for quality (*CI_QUAL*).

Composite indicator building involves three major steps: a) normalization to make the variables comparable, b) indicator weighting, and c) aggregation (JRC-EC 2008).

For the first step of normalization, considering the nature of our data, we resorted to rank transformation, which is a robust method that neatly addresses outliers and skewed variables (Becker, 2021):

$$I_{kj} = Rank(x_{kj}) \tag{2}$$

where I_{kj} represents the normalized value of individual indicator *k* for sector *j*.

Ranks are defined so that the lowest indicator value has a rank of 1, the second lowest a rank of 2, and so on (Becker, 2021).

For the weights, we attached the same weight to all variables. This choice was made following general practice in composite indicator building, where uniform distributions are often assigned to the input factors (Saisana *et al.*, 2005; Marozzi, 2015; JRC-EC, 2008).

As an aggregation method, we used an equally weighted geometric mean, which uses the product of the indicators as follows. For each sector j:

$$gM_j = (\prod_{i=1}^{k} I_j^{w_k})^{1/\sum_{i=1}^{k} w_k}, \tag{3}$$

where I_j is the rank-normalized indicator and w_k is the corresponding weight. Compared to other standard aggregation procedures, the geometric mean is more robust to outliers and allows for nonsubstitutability of the single indicators (Becker, 2021; JRC-EC, 2008). We found that the latter property is particularly desirable for our case. In fact, our methodology is innovative in that it uses indicators aimed at capturing different dimensions of the behavior of the sectors. Indeed, we aimed

[52] For the peak, the trough and the rebound months for each sector, we always use those related to employment quantity as the reference. This is justified by the fact that crisis and recovery periods are generally defined by looking at quantity measures, while there is no guarantee that quality measures follow a cyclical trend, which is necessary for identifying peaks and troughs. Therefore, the CI for the *Good Job Index* measures the resilience properties of the quality dimension over the time span of the quantity dimension.

to combine aspects such as velocities, trends and sizes that, according to our theoretical framework, all contribute to providing pieces of information on industry resilience that are not mutually substitutable.

In the robustness checks, we test the equal weighting scheme adopted in our CIs against weights randomly perturbated by a specified noise factor to control for alternative weighting schemes (Becker, 2021).

The final CIs were obtained from ordering in descending order the geometric mean values and assigning higher rankings to higher values, which correspond to an overall better performance. The results consist of two rank-based CIs, one for quantity (*CI_QUANT*) and the other for quality (*CI_QUAL*).

When these CIs are analyzed individually, they provide information about the relative performance of each sector during and after the crisis in terms either of employment level or of job quality. They can also be analyzed jointly to assess whether sectors react to a crisis consistently in both dimensions.

4. Results

This section consists of an illustrative application of the CIs in the case of the U.S. post-2008 crisis. It has the main objective of highlighting the nature of the information and results that the methodology that we developed can give to policy- and decision-makers. Nevertheless, this first elaboration also gives some insightful suggestions on how the relation between quantitative and qualitative resilience can work in some cases, which can also be relevant in terms of policy implications.

First, to summarize the information given in the data section, in Table 2, we summarize the variables and the sources used to build the two dimensions (quantity and quality) on which we measure resilience. In the appendix (Table A2), we report some summary statistics.

Table 2 – Summary of variables for measuring quantity and quality

Variable	Component	Measured as	Source
QUANTITY DIMENSION			
Employment	(*only one variable)*	Number of workers, thousands	BLS
QUALITY DIMENSION			
Good Jobs Index	Salary (AVG_W_j)	Average hourly earnings of all employees (in U.S. $)	BLS
	Contracts $(FTEE_j/(FTE\&PTE_i-FTEE_j))$	Percent deviation of the sum of full-time and part-time workers (number of workers) from the full-time equivalent (in FTE).	BEA

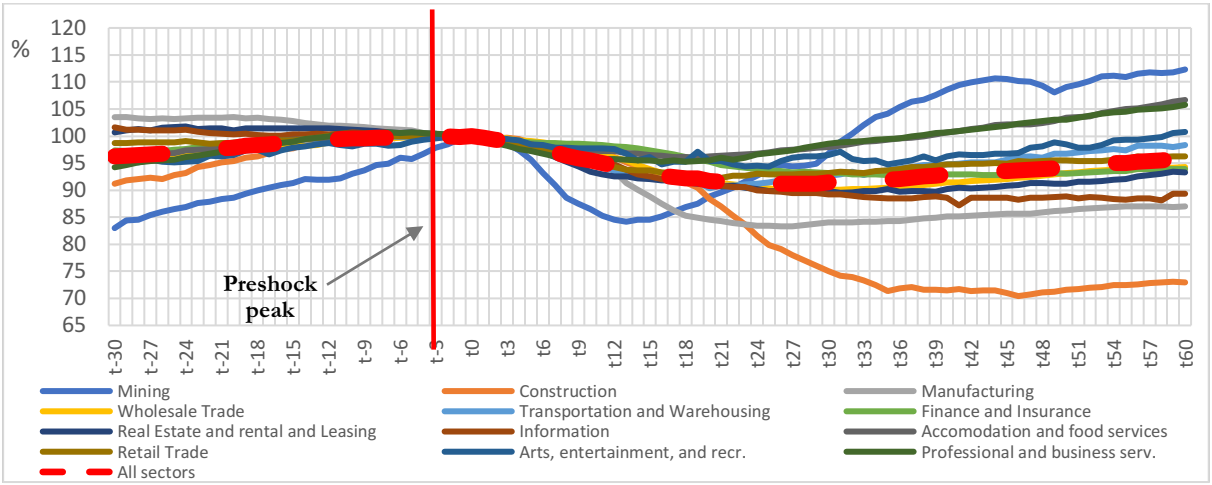
Source: Authors' elaboration

Before proceeding with the index calculations and graphical representation, after having made the theoretical case in Figure 1, we report in Figure 2 the actual trends of employment quantity by sector across the crisis period.[53] For the calculation of the CIs, for all sectors, t_0 is the month in which the employment trend experiences the last peak before the recession. Given the differences among previous trends, the peak can be more or less visible: for example, the mining sector (Figure 2.a) and primary metal subsectors (Figure 2.b) show a clear growing preshock trend and a noticeable decrease after the peak; other sectors or subsectors, such as nonmetallic mineral products (Figure 2.b) or chemicals (2.c), display a smoother curve. After the shock, the local minimum happens for different sectors at different points in time, sometimes very distant from one another (compare, for instance, the cases of mining, manufacturing, and construction in Figure 2.a or the cases of primary metals, wood products and furniture in Figure 2.b). More generally, from this descriptive evidence, it appears that sectors reacted very differently to the shocks, with some of them recovering and improving with respect to precrisis periods and others experiencing long-run stagnation with virtually no recovery. This also gave rise in some cases to among-sector divergent trends that appear to be persistent over time.

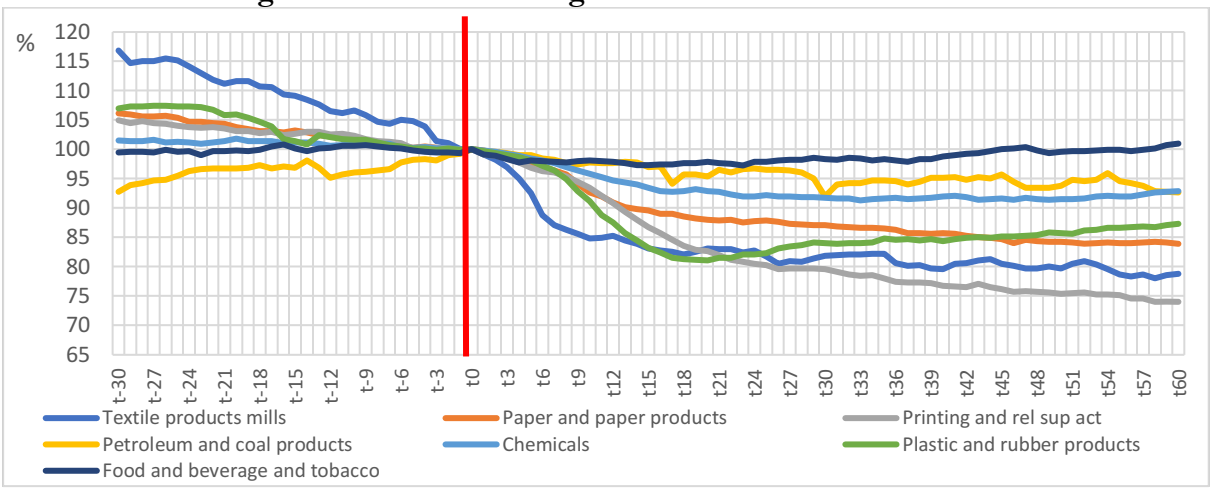
[53] For the sake of readability, due to the high number of subsectors in manufacturing, we report durable and nondurable sectors separately in Figures 2.b and 2.c, respectively.

Figure 2 – Employment trends for U.S. sectors during the 2008 recession (preshock peak value=100).

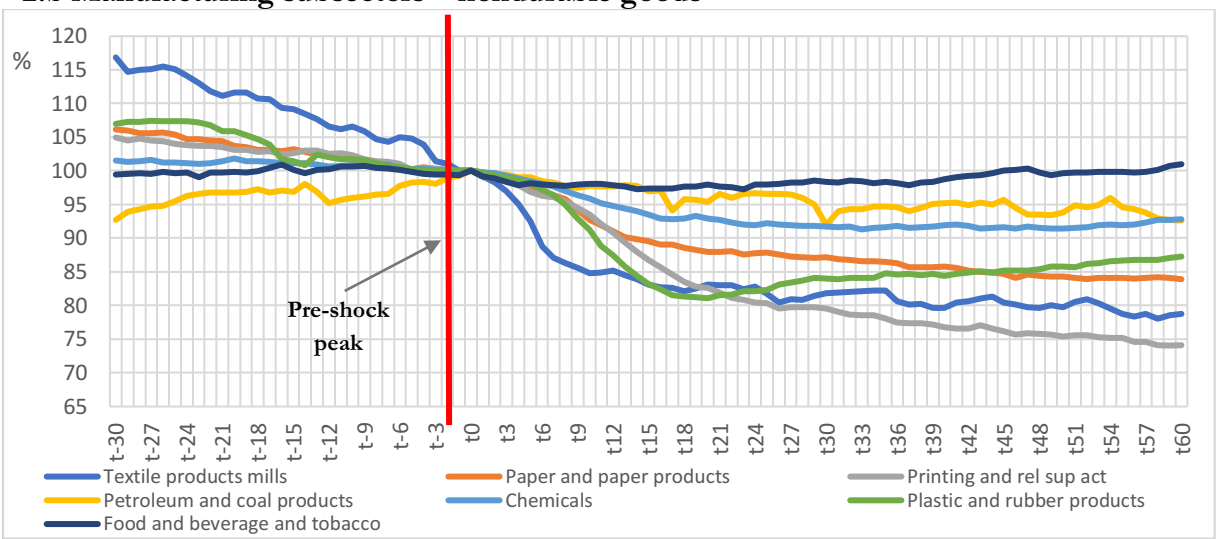
2.a – All sectors



2.b Manufacturing subsectors – durable goods



2.b Manufacturing subsectors – nondurable goods



Source: Authors' elaborations on BLS data

Note: All variations are measured as the percentage change with respect to the preshock peak value of each sector

Table 3 reports the first transformation for quantitative resilience, measured as the variation in employment quantity. In the first section (A), the table reports, for each sector, the value and the ranking *I* of the six individual indicators capturing the behavior of the curve, where the higher the value is, the higher the position in the relative ranking. A first result is that each sector displays different behaviors in relation to each of the six measures capturing industry resilience, thereby validating the choice of measuring different aspects of the curve and including all of them in the final index. In the second section of table (B), we report for each sector the geographic mean *gM* of the six individual indicators and the associated final ranking (*CI_QUANT*).

The construction of the composite indicator related to quality resilience *CI_QUAL* is the same as that used for *CI_QUANT*, and the results are reported in Table 4. Each sector is assigned a partial rank for each variable. Such ranks are summarized in the geometric mean *gM* and ranked accordingly.

Table 5 summarizes the results for both *CI_QUANT* and *CI_QUAL*, while Figure 3 reports the matrix representing quantitative and qualitative resilience jointly. The main result emerging from the analysis, which is useful in terms of policy implications, is that sectors can behave heterogeneously in terms of both employment quantity and quality. In other words, different sectors show different industry resilience capacities. For the specific case of the U.S. 2008 crisis under analysis, this heterogeneity takes the form of a trade-off between the quantitative and the qualitative aspects of employment: the majority of the sectors are located either in the second quadrant (four sectors) or in the fourth quadrant (five sectors) of the matrix. The negative relation between *CI_QUANT* and *CI_QUAL* is also confirmed by Spearman's ρ, which is negative and significant at 10% ($\rho_s = -0.57$*). Since manufacturing includes a large variety of subsectors and given the increasing role that manufacturing and related policy initiatives have acquired, particularly in the aftermath of the 2008 crisis (Stiglitz and Lin, 2013; Salazar-Xirinachs *et al.*, 2014; Altenburg and Lütkenhorst, 2015; European Commission, 2014; Mazzucato *et al.*, 2015), we offer a specific focus on it to explore how its subsectors perform in terms of industry resilience.

Table 3. Quantitative resilience: Building *CI_QUANT* – all sectors

Sector	A												B	
	IR		***IDV***		***IRV***		***RCD***		***TCD***		$\bar{X}$		***gM***	***CI_QUANT***
	Value	***I***	**Value**	***I***	**Value**	***I***	**Value**	***I***	**Value**	***I***	**Value**	***I***		
Mining	22.15	12	-1.44	1	0.944	12	0.223	9	-1.74	7	93.4	6	**6.16**	**4**
Construction	4.14	7	-0.8	2	0.137	7	-1.19	3	-2.18	6	80.49	1	**3.48**	**11**
Manufacturing	2.961	5	-0.8	2	0.119	6	2.182	11	5.023	11	88.37	2	**5.28**	**7**
Wholesale trade	3.655	6	-0.42	5	0.159	8	-0.75	6	-2.21	5	93.34	5	**5.75**	**5**
Transportation and warehousing	4.836	9	-0.51	4	0.211	9	-0.8	5	-3.6	2	94.18	7	**5.32**	**6**
Finance and insurance	1.31	1	-0.22	11	0.056	2	-1.15	4	-2.33	4	94.93	9	**3.83**	**10**
Real estate and rental and leasing	2.594	3	-0.34	7	0.106	4	-7.41	1	-17.5	1	92.08	4	**2.64**	**12**
Information	1.854	2	-0.31	8	0.054	1	4.774	12	9.067	12	91.1	3	**4.36**	**8**
Accommodation and food services	5.584	10	-0.21	12	0.231	10	0.234	10	-1.13	8	98.14	12	**10.24**	**1**
Retail trade	2.653	4	-0.39	6	0.114	5	-1.26	2	-3.07	3	94.63	8	**4.23**	**9**
Arts, entertainment, and recreation	4.445	8	-0.23	10	0.094	3	-0.11	7	-1.09	10	96.67	10	**7.43**	**3**
Professional and business services	5.925	11	-0.24	9	0.258	11	0.114	8	-1.11	9	97.59	11	**9.76**	**2**

Source: Authors' elaboration based on BLS data

Notes: IR= Industry Rebound; IDV= Industry Drop Velocity; IRV= Industry Recovery Velocity; RCD= Rebound-Counterfactual Difference Ratio; TCD= Trough-Counterfactual Difference Ratio; $\bar{X}$= Industrial Average Employment gM = geometric mean

Table 4. Qualitative resilience: Building CI_QUAL – all sectors

Sector	A												B	
	IR		***IDV***		***IRV***		***RCD***		***TCD***		$\bar{X}$		***gM***	***CI_QUAL***
	Value	***I***	**Value**	***I***	**Value**	***I***	**Value**	***I***	**Value**	***I***	**Value**	***I***		
Mining	-15.74	1	-1.81	2	-1.73	1	-0.10	6	-0.29	4	88.15	4	2.40	12
Construction	14.14	9	-0.90	5	0.27	8	-0.03	7	-0.23	5	85.38	3	5.79	7
Manufacturing	3.07	6	-1.06	4	0.39	9	1.20	12	5.23	12	84.14	2	6.29	6
Wholesale trade	3.87	8	0.14	11	0.06	6	-0.17	4	-0.07	7	100.90	11	7.39	3
Transportation and warehousing	3.81	7	-1.07	3	0.03	3	-0.28	3	-1.06	3	91.07	6	3.88	10
Finance and insurance	15.64	10	0.13	10	0.75	10	0.49	11	0.42	10	108.01	12	10.47	1
Real estate and rental and leasing	18.53	11	-0.32	8	0.75	11	0.11	9	-0.10	6	91.09	7	8.46	2
Information	-1.34	4	0.09	9	0.04	4	-0.66	2	-2.29	2	100.56	10	4.23	8
Accommodation and food services	98.98	12	-5.49	1	3.74	12	-0.12	5	-37.09	1	30.14	1	2.99	11
Retail trade	-2.46	3	-0.80	6	0.20	7	0.48	10	1.43	11	90.32	5	6.41	5
Arts. entertainment. and recreation	-1.08	5	-0.33	7	0.05	5	0.06	8	0.22	9	97.23	8	6.82	4
Professional and business services	-8.44	2	0.15	12	-0.37	2	-12.07	1	0.11	8	98.00	9	3.89	9

Source: Authors' elaboration based on BLS data.

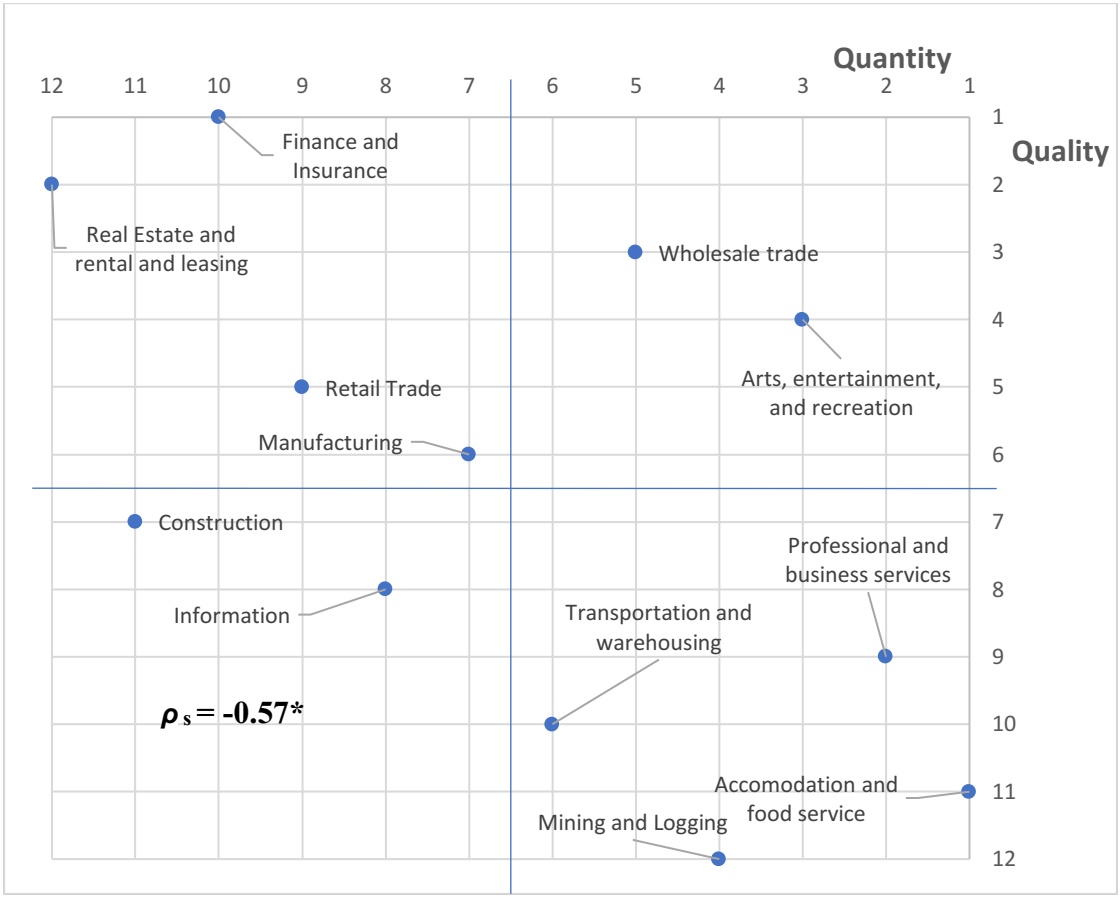
Notes: IR= Industry Rebound; IDV= Industry Drop Velocity; IRV= Industry Recovery Velocity; RCD= Rebound-Counterfactual Difference Ratio; TCD= Trough-Counterfactual Difference Ratio; $\bar{X}$= Industrial Average Employment; gM = geometric mean

Table 5. *CI_QUANT* and *CI_QUAL* – all sectors

Sector	*CI_QUANT*	*CI_QUAL*
Mining	**4**	**12**
Construction	**11**	**7**
Manufacturing	**7**	**6**
Wholesale trade	**5**	**3**
Transportation and warehousing	**6**	**10**
Finance and insurance	**10**	**1**
Real estate and rental and leasing	**12**	**2**
Information	**8**	**8**
Accommodation and food services	**1**	**11**
Retail trade	**9**	**5**
Arts, entertainment, and recreation	**3**	**4**
Professional and business services	**2**	**9**

Source: Authors' elaboration based on BLS and BEA data

Figure 3. Matrix – all sectors



Source: Authors' elaboration based on BLS and BEA data

Table 6 and Figure 4 apply our methodology to the 17 manufacturing subsectors. In this case, the heterogeneity among subsectors is even more pronounced than before, as the point cloud is scattered among the four quadrants with no clear observable trend. Indeed, contrary to the previous case, the quality and quantity indicators for manufacturing subsectors do not seem to show a specific relation, as also indicated by the low and nonsignificant Spearman's ρ (ρ_s = - 0.05).

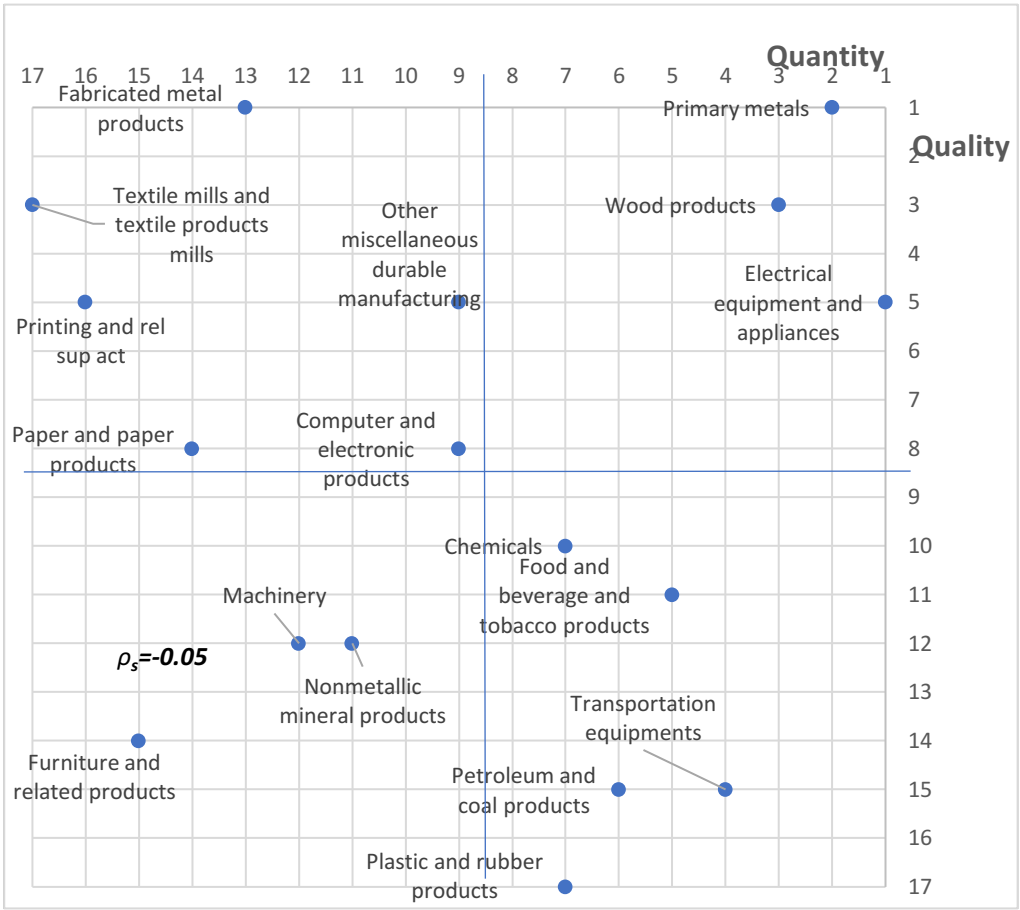
Interpreting the motivations behind the heterogeneous reactions to the shock of the different sectors is beyond the scope of this paper. What we want to stress here is that the results obtained using the CIs measuring industry resilience represent a *preparatory dashboard* that can inform decision-makers about the ability of industries to react to shocks. Such a dashboard, displaying industries' different degrees of resilience, provides policy-makers with informative insights enabling them to decide which sectors to focus on for policy purposes. Starting from this basis, decision-makers might decide to follow up and take further actions to identify which factors characterize high-resilience sectors in comparison to others and whether such features can be adopted in other industrial contexts to strengthen their resilience. For instance, stronger industry resilience might be related to, among others, sectoral technological endowments and productive capacity (Stiroh, 2001; Graetz and Michaels, 2018; Acemoglu and Restrepo, 2017; 2019; Ngo *et al.*, 2021), the type of backward and forward linkages connecting sectors (Marshall, 1890; OECD, 2021; Holm and Østergaard, 2015; Rajesh, 2018), market volatility (Comin and Philippon, 2005; Ngo *et al.*, 2021), the scale of market competition (Acemoglu and Restrepo, 2017; Autor *et al.*, 2015), and the structure and diffusion of industrial relations (Marsden, 1995; Kochan *et al.*, 1994; Wial, 2018). The assessment of industry resilience, as depicted by the dashboard developed and presented in this study, represents a preparatory phase for the investigation of such aspects.

Table 6. *CI_QUANT* and *CI_QUAL* – manufacturing subsectors

Sector	*CI_QUANT*	*CI_QUAL*
Wood products	**10**	**2**
Nonmetallic mineral products	**11**	**10**
Primary metals	**9**	**1**
Fabricated metal products	**15**	**4**
Machinery	**14**	**15**
Computer and electronic products	**5**	**12**
Electrical equipment and appliances	**1**	**3**
Transportation equipment	**6**	**13**
Furniture and related products	**13**	**14**
Other miscellaneous durable manufacturing	**2**	**6**
Textile products mills	**16**	**9**
Paper and paper products	**12**	**8**
Printing and related support activities	**17**	**5**
Petroleum and coal products	**8**	**17**
Chemicals	**4**	**7**
Plastic and rubber products	**3**	**16**
Food and beverage and tobacco products	**7**	**11**

Source: Authors' elaboration based on BLS and BEA data

Figure 3. Matrix – manufacturing subsectors
Source: Authors' elaboration based on BLS and BEA data



4.1 Robustness checks

4.1.1 Uncertainty analysis

Composite indicators, like any model, have associated uncertainties. In particular, the results that they generate might be dependent on the choices related to their design. To address this issue, we resort to *uncertainty analysis*, which "focuses on how uncertainty in the input factors propagates through the structure of the composite indicator and affects the composite indicator value" (JRC-EC, 2008; p.34). Specifically, uncertainty analysis is a Monte Carlo simulation–based procedure applied to the formula defining the composite indicator, which each time randomly varies the uncertain parameters identified to estimate the output distributions.

In general, uncertainty analysis helps gauge the robustness of composite indicators and improves the transparency of how they are built (Saisana *et al.*, 2005; Marozzi, 2015; Luzzati and Gucciardi, 2015; Becker, 2021). In our framework, we use uncertainty analysis to test the robustness of the sector rankings based on the two composite indicators that we built (*CI_QUANT* and *CI_QUAL*).

In our case, we assume that key uncertainties could primarily arise from the weights used, which are commonly considered a major source of uncertainty (Becker *et al.*, 2015; Marozzi, 2015).

Concerning the weights, our main results rely on equal weighting, following the construction choice of most composite indicators (Annoni and Dijkistra, 2019). However, a few studies on composite indicator building contend that an inherent degree of uncertainty often surrounds weight values (Pontarollo and Serpieri, 2020a; JRC-EC, 2008; Munda and Nardo, 2005).[54] To take this aspect into account, in our robustness check, we randomly perturb weights by a specified noise factor.

Following Becker (2021), for each replication of the composite indicator, a random value is attributed to each weight ω_i', following the form:

$$\omega_i' = \omega_i + \epsilon_i, \epsilon_i \sim U[-\phi\omega_i, \phi\omega_i] \quad (4)$$

[54] The existing contributions offer some alternative weighting methods. For instance, statistical models such as principal components analysis (PCA) allow the endogenous determination of weights (JRC-EC, 2008; Decancq and Lugo, 2013; Aluja *et al.* 2018, Dutta *et al.*, 2021 and many more); other methods to establish weights include participatory procedures involving various stakeholders – experts, citizens and politicians (Munda, 2007). Unfortunately, neither technique fits our framework. Specifically, few correlations exist among the indicators that we use, which is a relevant precondition for the application of PCA; in addition, the limited sample size does not suggest the need to further compress information using PCA. On the other hand, the novelty of our methodology does not allow us to elicit the weights based on stakeholder information.

where ω_i is the nominal weight, ϵ_i is the added noise, and ϕ is a "noise factor". In our case, we use ϕ =0.25, meaning that we let ω'_i vary between +/-25% of its nominal value, following a uniform distribution.

To perform the uncertainty analysis, we use the R software package COINr (Becker, 2021). We apply 10,000 Monte Carlo simulations on our composite indicators to combine alternative input values. COINr assumes equal probability for all alternatives, i.e., uniform distributions (Becker, 2021).

The results of the uncertainty analysis are reported in Figures 4 and 5.

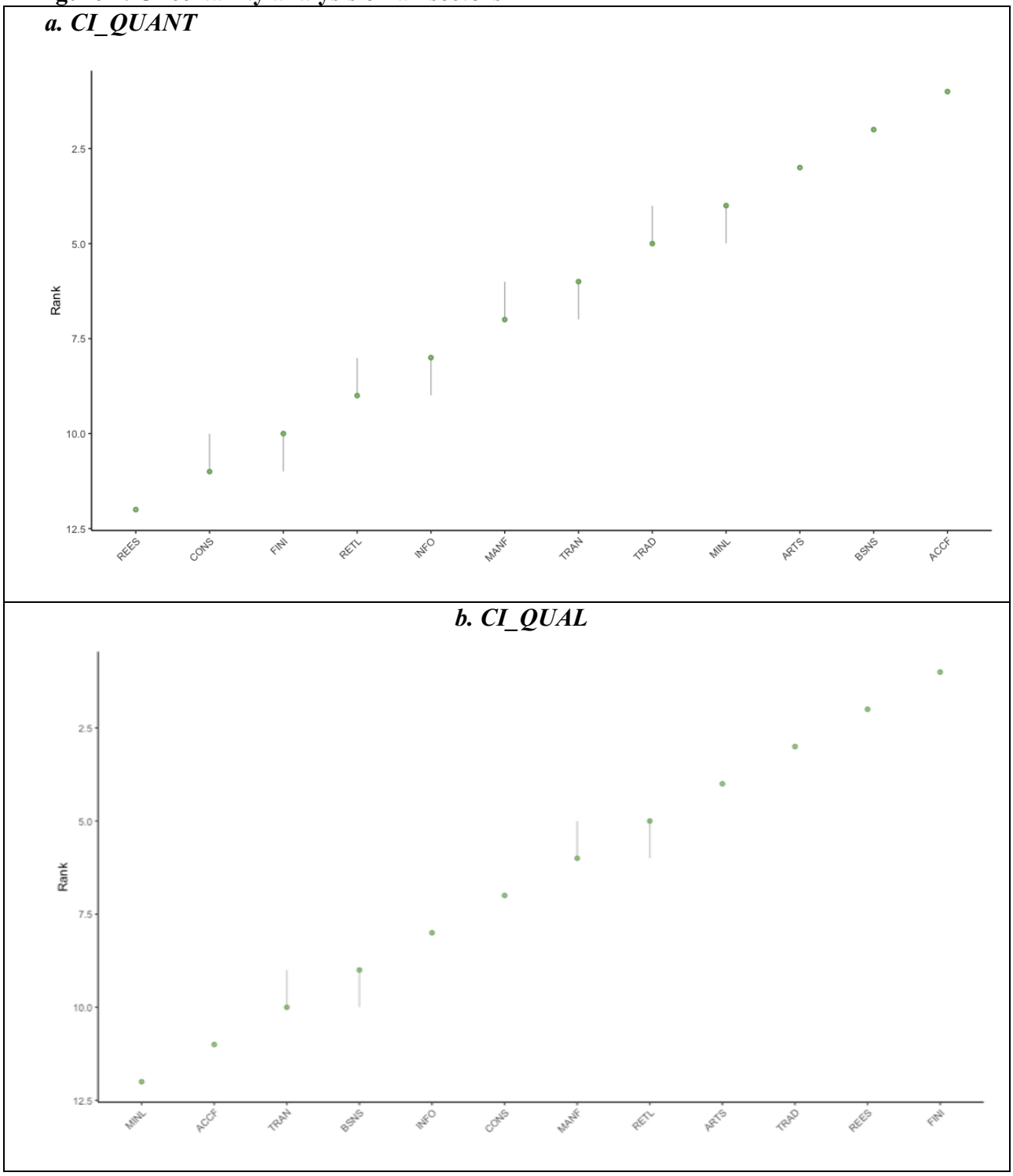
Each graph shows the sector rankings with their related uncertainty bounds, which limit the rank uncertainty distribution between its 5th and 95th percentiles. A narrow uncertainty interval means that the ranking is more robust because it depends only to a limited extent on the selection of a particular set of weights. Conversely, a wider interval indicates a higher volatility of the sector's ranking, which markedly depends on the specific design of the composite indicator (Marozzi, 2015).

For the analysis of all sectors (Figure 4), both *CI_QUANT* and *CI_QUAL* are robust to the weight perturbances. For both cases, the head and the tail of the rankings are highly stable. For the intermediate positions, the confidence intervals tend to be generally narrow, with a max imum possible variation of only one position.

The results related to manufacturing subsectors (Figure 5), limited to the quantity dimension *CI_QUANT* (5.a), are sufficiently robust. The related confidence intervals are wider, although the possible ranking variation is above 4 positions only for 5 out of 17 subsectors. Regarding *CI_QUAL* (5.b), the main results are confirmed: only computers and electronic products, fabricated metal products and other miscellaneous durable manufacturing display wider confidence intervals.

Overall, the inclusion of a simulations-based uncertainty analysis represents a further useful element for policy-makers to gain insights into the heterogeneous behaviors of sectors facing unexpected shocks.

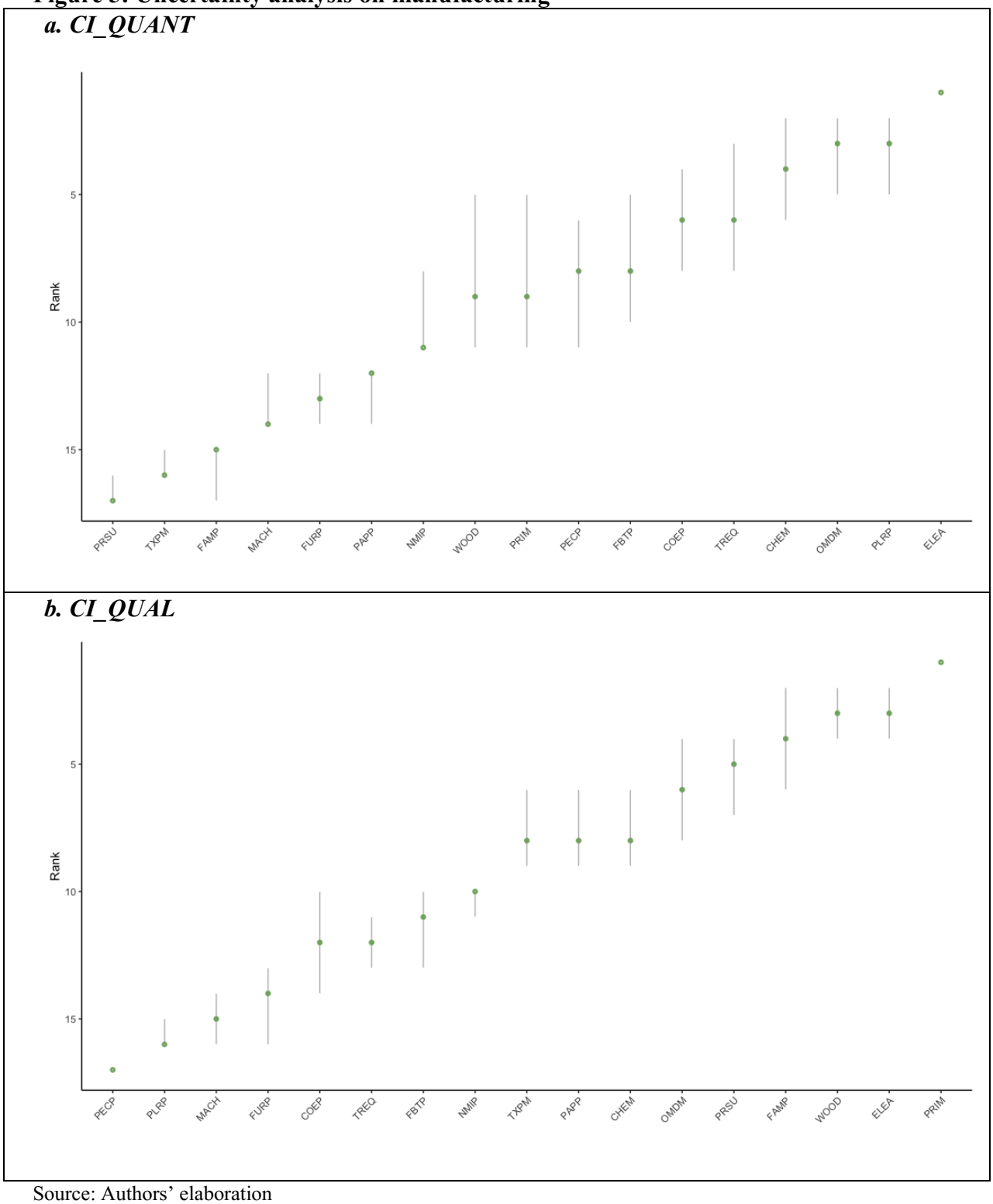
Figure 4: Uncertainty analysis on all sectors



Source: Authors' elaboration

Note: The results show the median (green dot) and the corresponding 5th and 95th percentiles (bounds) of the distribution of sectors. Uncertain input factor: weights. Sector coding: ACCF – accommodation and food services; ARTS – arts, entertainment, and recreation; BSNS – professional and business services; CONS – construction; FINI – finance and insurance; INFO – information; MANF – manufacturing; MINL – mining; REES – real estate and rental and releasing; RETL – retail trade; TRAD – wholesale trade; TRAN – transportation and warehousing.

Figure 5: Uncertainty analysis on manufacturing



Source: Authors' elaboration

Note: The results show the median (green dot) and the corresponding 5th and 95th percentiles (bounds) of the distribution of sectors. Uncertain input factor: weights. Sector coding: CHEM – chemicals; COEP – computer and electronic products; ELEA – electrical equipment and appliances; FAMP – fabricated metal products; FBTP – food and beverage and tobacco products; FURP – furniture and related products; MACH – machinery; NMIP – nonmetallic mineral products; OMDM – other miscellaneous durable manufacturing; PAPP – paper and paper products; PECP – petroleum and coal products; PLRP – plastic and rubber products; PRIM – primary metals; PRSU – printing and rel sup act; TREQ – transportation equipment; TXPM – textile products mills; WOOD – wood products

4.1.2 Units of measurement

A second robustness check is related to the unit of measurement that we use. In our main results, we computed the dimensions that make up our CIs (Section 3.2) by using *absolute values* of employment, in line with previous studies (Han and Goetz, 2015; 2019).

Indeed, by using employment levels, we have been able to identify relevant peaks, troughs and rebounds related to sectoral business cycles and leverage these elements to build the few dimensions on which our CIs are based (see also Lucchese and Pianta, 2012; Quadrini and Trigari, 2007; Fiorito and Kollintzas, 1994, on the use of employment as a business cycle indicator). This methodology has allowed us to study the behavior of each sector over time and to rank sectors based on their performance over the shock period. A possible way to enrich the analysis is to integrate some information about the *relative weight* that each sector accounts for in the economy and how its relative weight changes during and after the crisis. To take a first step in this direction, we modify the *CI_QUANT* index by substituting the indicator corresponding to sector *j's* average employment level over the whole period ($\overline{X_j}$) with the sector's average *employment share* over the total employment over the period:

$$\overline{X(s)}_j = \frac{\sum_{i=0}^{n} \frac{X_{j,i}}{\sum_j X_{j,i}} * 100}{n} \tag{5}$$

The resulting index and matrix are reported below for all sectors. Compared with the original ranking of *CI_QUANT*, the new index gives a few different results, as shown in Table 7. In particular, the performance seems particularly different for manufacturing and mining, given that the index formulated in this way is more sensitive to the relative size of the sector, independent of how well it performs following a shock. The other sectors, instead, do not move up (or down) more than two positions. This is reflected in the matrix where the information about *CI_QUANT* and *CI_QUAL* are analyzed jointly: apart from manufacturing, which moves to the first quadrant, and mining, which moves to the third quadrant, the other modifications in the ranking do not affect in which of the four quadrants each sector is placed (Fig. 6).

The results obtained through this robustness check can complement the main results in providing additional informative insights related to the relative size of sectors to policy-makers seeking to understand postshock sectoral performance.

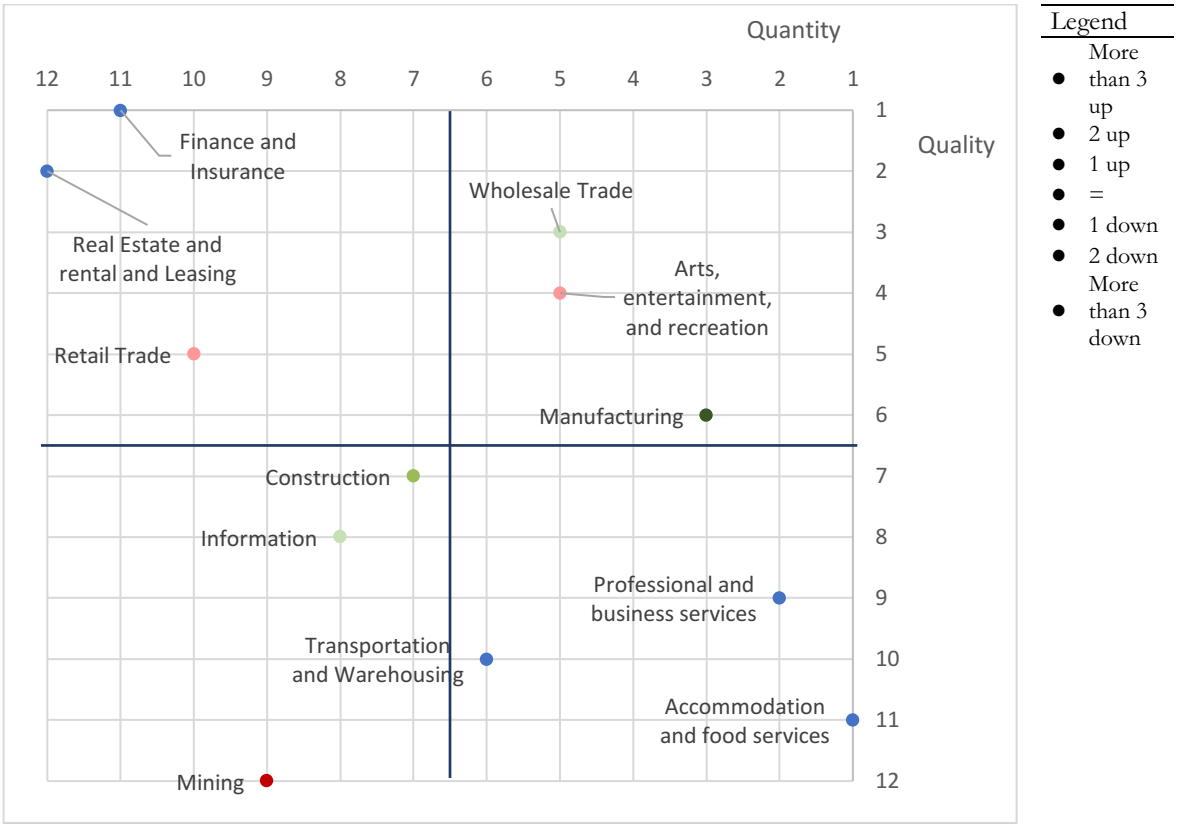
Table 7 – Using average share to build CI_QUANT: Rankings compared

Sector	*CI_QUANT (using $\overline{X}_j$)*	*CI_QUANT (using $\overline{X(s)}_j$)*
Accommodation and food services	1	1
Professional and business services	2	2
Arts, entertainment, and recreation	3	5
Mining	4	9
Wholesale trade	5	4
Transportation and warehousing	6	6
Manufacturing	7	3
Information	8	8
Retail trade	9	10
Finance and insurance	10	11
Construction	11	7
Real estate and rental and leasing	12	12

Legend	
Color	Positions
	More than 3 up
	2 up
	1 up
	=
	1 down
	2 down
	More than 3 down

Source: Authors' elaboration

Figure 6 – Using average share to build CI_QUANT: Matrix between CI_QUANT and CI_QUAL



Source: Authors' elaboration

5. Concluding remarks and policy implications

In this study, we have elaborated on the concept of *postshock industry resilience* in the context of socially sustainable structural change and offered a methodology to measure it. In this view, the application of the CIs to the U.S. case has to be considered as an illustrative exercise. We choose not to interpret the internal sectoral dynamics at this stage or the specific causal linkages with the 2008 shock. Rather, we intend this exercise as a demonstration of a *modus operandi* (Di Tommaso *et al.*, 2020a) that can be used for and by governments designing and implementing industrial policies.

From the perspective of structural change sustainability, postshock industry resilience can work as a valuable indicator to inform decision-makers on which sectors are able to couple employment retention with good-quality jobs and to warn of the possible interrelation between the two aspects of job quantity and job quality. The general evidence that we find is that the different industries react heterogeneously to shocks; i.e., they display different degrees of postshock industry resilience. This reinforces the idea that policy-makers should be aware of such differences, especially given that industrial policy de facto, whether explicitly or not, targets specific sectors. Sector resilience matters because it might reinforce the overall socioeconomic system's resilience during a severe shock. From the perspective that we discussed in this paper, this might mean preventing the collapse of the system and, in this way, contributing to the future sustainability of structural change.

However, it is also important to specify that recognizing different industry resilience capacities is a first necessary step demanding further understanding of the real determinants of these differences. As we anticipated, industry resilience can be the result of the virtuous reactions of firms, territories and industries that are genuinely better at reorganizing themselves after the shock. In these cases, industrial policy should be able to recognize such capacities and act accordingly. However, resilience capacities can also be the result of less virtuous actions: lobbying and capturing with the aim of opposing structural change and desirable future transformation. In these cases, again but from the opposite perspective, industrial policy should intervene properly. With this paper, we hope to stimulate further research on the relationship between industry resilience and structural change sustainability.

This line of reasoning seems particularly timely given the increasing importance and use of industrial policy interventions as a tool to react to the global long-term downturns since the 2008 global crisis (Block, 2008; Mazzucato, 2013; Bailey *et al.*, 2019; Di Tommaso *et al.*, 2017, 2019, Di Tommaso *et al.*, 2020b; Tassinari, 2019), which indeed calls for solutions to strengthen the capability of governments to design and implement policy interventions effectively and efficiently. This is even more true for selective industrial policies, which can be exposed to a variety of potential issues regarding government failures (Krueger, 1990; Le Grand, 1991; Chang, 1994, 2011; Buigues and

Sekkat, 2009; Bailey *et al.*, 2019; Schuck, 2014; Pollio and Rubini, 2019). In this view, therefore, industry resilience represents a conceptual and methodological instrument that, on the one hand, supports policy-makers in selecting and prioritizing policy targets and, on the other hand, increases transparency about such a selection process and its accountability to citizens and social stakeholders.

Industry resilience, of course, represents *one among many* possible criteria that could be chosen by policy-makers. In addition, this methodology does not prescribe *which sectors* are to be promoted by industrial policies. This is a choice that ultimately lies in the hands of policy-makers, who might choose among different strategies. For instance, policy-makers might want to "pick the winner" among sectors according to their resilience capability or support weaker sectors to achieve higher degrees of resilience or even target a mix of the two.

A few words of caution on this study are then needed. First, for the current application, our methodology has produced results that can provide specific indications of postshock industry resilience in the context of the 2008 financial crisis. In this sense, it can inform on how the same or similar sectors could react to shocks displaying analogous features. Further research could expand on this evidence by exploring the industry resilience of sectors facing shocks of a different nature and with different transmission mechanisms. This could lead to the creation of a taxonomy linking sectors and postshock industry resilience by types of shocks. Second, we also wish to clarify that the results that we obtain, in terms of heterogeneity, are also related to the time span that we have considered to assess resilience: further studies might encompass a longer time span to complement our evidence with additional information (Neffke *et al.*, 2018; Neffke *et al.*, 2011; Diodato and Weterings, 2015).

Our study also opens additional research avenues. First, our methodology can be tested in settings with other countries, groups of countries or lower-level geographical units.

A second possible research path arises from the fact that we find a potential trade-off between quality and quantity dimensions in the all-sector case while this evidence does not seem to hold in the case of manufacturing subsectors. This might suggest that working on more fine-grained industrial aggregation levels could yield different results with respect to the more general ones. Such a hypothesis could be tested in future studies.

Third, in this paper, we chose industries as units of observation for the reasons explained in the introduction. Nonetheless, we acknowledge that several production configurations other than sectors exist, e.g., clusters, districts, networks, groups, and value chains (Becattini *et al.*, 2009; Pasinetti, 1973; Ortega-Colomer *et al.*, 2016; Amin and Thrift, 1992; Scazzieri, 1993, and many more), which might also be relevant from the policy-making point of view. In light of this, further investigations might explore the adaptability of our methodology to other policy-relevant typologies of production organization.

Moreover, while we have offered a contribution on how to measure industrial resilience, future studies are needed to identify the industry-level determinants of resilience, which could depend upon a number of factors, including the organization of production, the structure of the production network, and technological endowments (OECD, 2021; Scazzieri, 2021; Li *et al.*, 2022).

Finally, we believe that the industry resilience perspective could strengthen the evidence on regional resilience produced by regional economics and economic geography studies (Bailey *et al.*, 2020). In particular, relevant insights could be generated by studying how regional resilience relates to the local industrial mix and its industry resilience profile.

Acknowledgments

This research was conducted within the framework of the project "Emilia-Romagna International School of Policy" (CUP: E45J19000150004) funded by the Emilia-Romagna regional government.

We wish to thank the editor and the two anonymous reviewers for their insightful comments. We are indebted to William Becker for his valuable indications on the methodological application. We also wish to thank Daniel Vasconcellos Archer Duque for his advice on the methodology development and Vieri Calogero for his suggestions on the connections with the existing literature. We also thank Filippo Prodi for his assistance with Figure 1.

References

Acemoğlu, D., and Restrepo, P. (2017). Robots and jobs: Evidence from the US. NBER Working Paper No, 23285. https://www.nber.org/papers/w23285.

Acemoglu, D., and Restrepo, P. (2019). "Artificial Intelligence, Automation, and Work." In Agrwal, A. Gans, J. and Goldfarb, A. (eds.) The Economics of Artificial Intelligence: An Agenda, Chicago: The University of Chicago Press.

Adger, W. N. (2000). Social and ecological resilience: are they related?. *Progress in human geography, 24(3)*, 347-364.

Adger, W. N. (2006). Vulnerability. *Global environmental change, 16(3),* 268-281.

Aiginger, K., and Rodrik, D. (2020), Rebirth of industrial policy and an agenda for the Twenty-First century, Journal of Industry, *Competition and Trade*, 20, 189–207.

Alkire, S., and Santos, M. E. (2014). Measuring acute poverty in the developing world: Robustness and scope of the multidimensional poverty index. *World Development*, *59*, 251-274.

Alpert, D., Ferry, J., Hockett, R. C., and Khaleghiyan, A. (2019). The US Private Sector Job Quality Index. *Cornell Legal Studies Research Paper*, (20-33).

Altenburg, T., and W. Lütkenhorst. 2015. *Industrial Policy in Developing Countries: Failing Markets, Weak States*. Cheltenham: Edward Elgar.

Aluja, T., Morineau, A., Sanchez, G. (2018). Principal Component Analysis for Data Science: https://pca4ds.github.io

Amin, A., and Thrift, N. (1992). Neo-Marshallian nodes in Global Networks, International journal of Urban and Regional Research 16 (4). *571*, *87*.

Andreoni, A. and Chang, H.-J. (2019). The Political Economy of Industrial Policy: Structural Interdependencies, Policy Alignment and Conflict Management. *Structural Change and Economic Dynamics, 48(C),* 136–150.

Andreoni, A., and Tregenna, F. (2020). Escaping the middle-income technology trap: A comparative analysis of industrial policies in China, Brazil and South Africa. *Structural Change and Economic Dynamics*, *54*, 324-340.

Andreoni, A., Chang, H. J., and Scazzieri, R. (2019). Industrial policy in context: Buildin g blocks for an integrated and comparative political economy agenda. *Structural change and economic dynamics*, *48*, 1-6.

Annoni, P. and Dijkstra, L., (2019). EU regional competitiveness index 2019. *European Commission*.

Autor, D. H., Dorn, D., and Hanson, G. H. (2015). Untangling trade and technology: Evidence from local labour markets. *The Economic Journal*, *125*(584), 621-646.

Bailey, D., Glasmeier, A., Tomlinson, P. R., and Tyler, P. (2019). Industrial policy: new technologies and transformative innovation policies?. *Cambridge Journal of Regions, Economy and Society, 12*(2), 169-177.

Bailey, D., Pitelis, C., and Tomlinson, P. R. (2020). Strategic management and regional industrial strategy: Cross-fertilization to mutual advantage. *Regional Studies*, *54*(5), 647-659.

Barbieri, E., Di Tommaso, M. R., Pollio, C., and Rubini, L. (2019). Industrial policy in China: The planned growth of specialised towns in Guangdong Province. *Cambridge Journal of Regions, Economy and Society*, *12*(3), 401-422.

Barbieri, E., Di Tommaso, M. R., Pollio, C., and Rubini, L. (2020). Getting the specialization right. Industrialization in Southern China in a sustainable development perspective. *World Development*, *126*, 104701.

Becattini, G., Bellandi, M., and De Propris, L. (Eds.). (2014). *A handbook of industrial districts*. Edward Elgar Publishing.

Becker W, Paruolo P, Saisana M, Saltelli A. (2015). Weights and importance in composite indicators: mind the gap. In: Ghanem R, Higdon D, Owhadi H, editors. Handbook of uncertainty quantification. Cham: Springer.

Becker, W., (2021). Composite Indicator Development and Analysis in R with COINr, https://bluefoxr.github.io/COINrDoc/

Berkes, F. (2007). Understanding uncertainty and reducing vulnerability: lessons from resilience thinking. *Natural hazards*, *41*(2), 283-295.

Bianchi, P., and Labory, S. (2018). *Industrial policy for the manufacturing revolution: Perspectives on digital globalisation*. Edward Elgar Publishing.

Bianchi, P., and Labory, S. (2019). Manufacturing regimes and transitional paths: Lessons for industrial policy. *Structural Change and Economic Dynamics*, *48*, 24-31.

Bianchi, P., and S. Labory. 2011. *Industrial Policies after the Crisis. Seizing the Future*. Cheltenham: Edward Elgar.

Block, F. (2008). Swimming against the current: The rise of a hidden developmental state in the United States. *Politics and society*, *36*(2), 169-206.

Bodin, P., and Wiman, B. (2004). Resilience and other stability concepts in ecology: Notes on their origin, validity, and usefulness. *ESS bulletin*, *2*(2), 33-43.

Boschma, R. (2015). Towards an evolutionary perspective on regional resilience. *Regional Studies, 49*(5), 733–751.

Boström, M. (2012). A missing pillar? Challenges in theorizing and practicing social sustainability: Introduction to the special issue. Sustainability: *Science, Practice, and Policy, 8*(1), 3–14.

Breathnach, P., Van Egeraat, C., and Curran, D. (2015). Regional economic resilience in Ireland: The roles of industrial structure and foreign inward investment. *Regional Studies, Regional Science*, *2*(1), 497-517.

Bristow, G., and Healy, A. (2015). Crisis response, choice and resilience: insights from complexity thinking. *Cambridge Journal of Regions, Economy and Society*, *8*(2), 241-256.

Brown, K., and Westaway, E. (2011). Agency, capacity, and resilience to environmental change: lessons from human development, well-being, and disasters. *Annual review of environment and resources*, *36*, 321-342.

Brown, L., and Greenbaum, R. T. (2017). The role of industrial diversity in economic resilience: An empirical examination across 35 years. *Urban Studies*, *54*(6), 1347-1366.

Bruno, G., and Genovese, A. (2016). Location analysis for public sector decision-making in uncertain times: an introduction to the special issue. *Socio-Economic Planning Sciences*, *53*, 2-3.

Buigues, P.A., Sekkat, K. (2009). *Industrial Policy in Europe. Japan and the USA. Amounts, Mechanisms and Effectiveness*. Palgrave Macmillan.

Bulut, H. (2020). The construction of a composite index for general satisfaction in Turkey and the investigation of its determinants. *Socio-Economic Planning Sciences*, *71*, 100811.

Canova, F., Coutinho, L., and Kontolemis, Z. G. (2012). *Measuring the macroeconomic resilience of industrial sectors in the EU and assessing the role of product market regulations* (Vol. 112). Publications Office of the European Union.

Capello, R., Caragliu, A., and Fratesi, U. (2015). Spatial heterogeneity in the costs of the economic crisis in Europe: are cities sources of regional resilience?. *Journal of Economic Geography*, *15*(5), 951-972.

Cardinale, I. (2019). Vulnerability, resilience and 'systemic interest': a connectivity approach. *Networks and Spatial Economics*, 1-17. Doi: https://doi.org/10.1007/s11067-019-09462-9

Cardinale, I., and Scazzieri, R. (2019). Explaining structural change: actions and transformations. *Structural change and economic dynamics*, *51*, 393-404.

Cardinale, I., and Scazzieri, R. (2020). Interdipendenze produttive, interessi e condizioni sistemiche: elementi per un'economia politica delle strutture industriali. *L'industria*, *41*(1), 21-50.

Cardinale, I., Landesmann, M.A. (2017). Exploring sectoral conflicts of interest in the Eurozone: a structural political economy approach. In: Cardinale, I., Coffman, D., Scazzieri, R. (eds) *The political economy of the Eurozone*. Cambridge University Press, Cambridge: 284–336.

Chang, H. J. (2011). Institutions and economic development: theory, policy and history. *Journal of institutional economics*, *7*(4), 473-498.

Chang, H. J., and Andreoni, A. (2020). Industrial policy in the 21st century. *Development and Change*, *51*(2), 324-351.

Chang, H.-J., (1994). *The Political Economy of Industrial Policy.* New York: St. Martin's Press.

Chowdhury, M. M. H., and Quaddus, M. (2017). Supply chain resilience: Conceptualization and scale development using dynamic capability theory. *International Journal of Production Economics*, *188*, 185-204.

Cimoli, M., Dosi, G., and Stiglitz, J. E. (2009). *Industrial policy and development: The political economy of capabilities accumulation*. New York: Oxford University Press.

Coen, D. (2007). Empirical and theoretical studies in EU lobbying. *Journal of European Public Policy*, *14*(3), 333-345.

Coen, D., and Richardson, J. (Eds.). (2009). *Lobbying the European Union: institutions, actors, and issues*. OUP Oxford.

Comin, D., and Philippon, T. (2005). The rise in firm-level volatility: Causes and consequences. *NBER macroeconomics annual*, *20*, 167-201.

Coutu, D. L. (2002). How resilience works. *Harvard business review*, *80*(5), 46-56.

Cowling, K., and Tomlinson, P. R. (2011). Post the 'Washington Consensus': economic governance and industrial strategies for the twenty-first century. *Cambridge Journal of Economics*, *35*(5), 831-852.

Crescenzi, R., Luca, D., and Milio, S. (2016). The geography of the economic crisis in Europe: national macroeconomic conditions, regional structural factors and short-term economic performance. *Cambridge Journal of Regions, Economy and Society*, *9*(1), 13-32.

Cuthill, M. (2010). Strengthening the 'social'in sustainable development: Developing a conceptual framework for social sustainability in a rapid urban growth region in Australia. *Sustainable development*, *18*(6), 362-373.

Davies, S. (2011). Regional resilience in the 2008–2010 downturn: comparative evidence from European countries. *Cambridge Journal of Regions, Economy and Society*, *4*(3), 369-382.

DeAngelis, D. L. (1980). Energy flow, nutrient cycling, and ecosystem resilience. *Ecology*, *61*(4), 764-771.

Decancq, K., and Lugo, M. A. (2013). Weights in multidimensional indices of wellbeing: An overview. *Econometric Reviews*, 32(1), 7-34.

Di Tommaso, M. R., Tassinari, M., Barbieri, E., and Marozzi, M. (2020a). Selective industrial policy and 'sustainable' structural change. Discussing the political economy of sectoral priorities in the US. *Structural Change and Economic Dynamics*, *54*, 309-323.

Di Tommaso, M. R., Tassinari, M., Bonnini, S., and Marozzi, M. (2017). Industrial policy and manufacturing targeting in the US: New methodological tools for strategic policy-making. *International Review of Applied Economics*, *31*(5), 681-703.

Di Tommaso, M.R., Tassinari, M., Ferrannini, A., (2019). "Industry and government in the long-run: on the true story of the American model". In: Bianchi, P., Ruiz Duran, C., Labory, S. (Eds.), *Transforming industrial policy for digital age: production, territories, and structural change*. Cheltenham, Edward Elgar Publishing.

Di Tommaso, M.R., Tassinari, M., Ferrannini, A., (2020b). "Industrial policy and societal goals". In: Pressman, S. (Ed.), *A new look at the American case (from Hamilton to Obama and Trump). How Social Forces Impact the Economy*, London and New York, Routledge.

Di Tommaso, M. R., and S. O. Schweitzer. 2013. *Industrial Policy in America. Breaking the Taboo*. Cheltenham: Edward Elgar.

Diodato, D., and Weterings, A. B. (2015). The resilience of regional labour markets to economic shocks: Exploring the role of interactions among firms and workers. *Journal of Economic Geography*, *15*(4), 723-742.

Dutta, I., Nogales, R., and Yalonetzky, G. (2021). Endogenous weights and multidimensional poverty: A cautionary tale. *Journal of Development Economics*, *151*, 102649.

Earvolino-Ramirez, M. (2007), Resilience: A Concept Analysis, *Nursing Forum 42*(2), 73–82.

Eizenberg, E., and Jabareen, Y. (2017). Social sustainability: A new conceptual framework. *Sustainability*, *9*(1), 68.

European Commission (2014), *For a European Industrial Renaissance*, Brussels: COM 14/2.

Ezcurra, R., and Rios, V. (2019). Quality of government and regional resilience in the European Union. Evidence from the Great Recession. *Papers in Regional Science*, *98*(3), 1267-1290.

Faggian, A., Gemmiti, R., Jaquet, T., and Santini, I. (2018). Regional economic resilience: The experience of the Italian local labor systems. *The Annals of Regional Science*, *60*(2), 393-410.

Ferguson, T. (1995). *Golden rule: The investment theory of party competition and the logic of money-driven political systems*. University of Chicago Press.

Ferrannini, A., Barbieri, E., Biggeri, M., and Di Tommaso, M. R. (2021). Industrial policy for sustainable human development in the post-Covid19 era. *World development, 137*, 105215.

Fiksel, J. (2006). Sustainability and resilience: Toward a systems approach. *Sustainability: Science, Practise, Policy, 2*(2), 14–21.

Filippetti, A., Gkotsis, P., Vezzani, A., and Zinilli, A. (2020). Are innovative regions more resilient? Evidence from Europe in 2008–2016. *Economia Politica*, *37*(3), 807-832.

Fingleton, B., Garretsen, H., and Martin, R. (2012). Recessionary shocks and regional employment: evidence on the resilience of UK regions. *Journal of regional science*, *52*(1), 109-133.

Fiorito, R., and Kollintzas, T. (1994). Stylized facts of business cycles in the G7 from a real business cycles perspective. *European Economic Review*, *38*(2), 235-269.

Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., and Rockström, J. (2010). Resilience thinking: integrating resilience, adaptability and transformability. *Ecology and society*, *15*(4).

Foreman-Peck J. and Federico G. (1999), 'Industrial Policies in Europe: Introduction', in: G. Federico and J. Foreman-Peck (Eds.), *European Industrial Policy: The Twentieth Century Experience*, Oxford: Oxford University Press.

Fratesi, U., and Perucca, G. (2018). Territorial capital and the resilience of European regions. *The Annals of Regional Science, 60*(2), 241-264.

Fromhold-Eisebith, M. (2015). Sectoral resilience: Conceptualizing industry-specific spatial patterns of interactive crisis adjustment. *European Planning Studies, 23*(9), 1675-1694

Gallopín, G. C. (2006). Linkages between vulnerability, resilience, and adaptive capacity. *Global environmental change*, *16*(3), 293-303.

Genovese, A. (2019). Multi-Criteria Decision Making for public sector management: Bridging the gap between theory and practice. *Socio-Economic Planning Sciences*, *68*, 100651.

Goulart Coelho, L. M., Lange, L. C., and Coelho, H. M. (2017). Multi-criteria decision making to support waste management: A critical review of current practices and methods. *Waste Management and Research, 35*(1), 3-28.

Graetz, G., and Michaels, G. (2018). Robots at work. *Review of Economics and Statistics*, *100*(5), 753-768.

Gunderson, L. H. (2000). Ecological resilience—in theory and application. *Annual review of ecology and systematics*, *31*(1), 425-439.

Gunderson, L.H. and Holling, C.S. (2002). *Panarchy: Understanding Transformation in Human and Natural Systems*. Washington: Island Press.

Hall, R., Feldstein, M., Frankel, J., Gordon, R., Romer, C., Romer, D., and Zarnowitz, V. (2003). *The NBER's Business-Cycle Dating Procedure*. Business Cycle Dating Committee, National Bureau of Economic Research.

Han, Y., and Goetz, S. J. (2019). Predicting US county economic resilience from industry input-output accounts. *Applied Economics, 51*(19), 2019-2028.

Han, Y., and S. J. Goetz. (2015). The Economic Resilience of US Counties during the Great Recession. *The Review of Regional Studies 45*(2): 131–149.

Handmer, J. W., and Dovers, S. R. (1996). A typology of resilience: rethinking institutions for sustainable development. *Industrial and Environmental Crisis Quarterly*, *9*(4), 482-511.

Herrfahrdt-Pähle, E., Schlüter, M., Olsson, P., Folke, C., Gelcich, S., and Pahl-Wostl, C. (2020). Sustainability transformations: socio-political shocks as opportunities for governance transitions. *Global Environmental Change*, *63*, 102097.

Holling, C. S. (1973). Resilience and stability of ecological systems. *Annual review of ecology and systematics*, *4*(1), 1-23.

Holm, J. R., and Østergaard, C. R. (2015). Regional employment growth, shocks and regional industrial resilience: a quantitative analysis of the Danish ICT sector. *Regional Studies, 49*(1), 95-112.

ILO (International Labour Office) (2015). *Non-standard forms of employment*. International Labour Office, Geneva.

ILO (International Labour Office). (2016). *Non-standard employment around the world: understanding challenges, shaping prospects*, International Labour Office, Geneva.

ILO (International Labour Office). (2019). *Time to act for SDG 8: Integrating decent work, sustained growth and environmental integrity.* International Labour Office, 2019

Joint Research Centre-European Commission (JRC-EC). (2008). *Handbook on constructing composite indicators: methodology and user guide*. OECD publishing.

Kalleberg, A. L. (2001). Organizing flexibility: the flexible firm in a new century. *British journal of industrial relations*, *39*(4), 479-504.

Kalleberg, A. L. (2011). *Good jobs, bad jobs: The rise of polarized and precarious employment systems in the United States, 1970s-2000s*. Russell Sage Foundation.

Kawachi, I., Kennedy, B. P., Lochner, K., and Prothrow-Stith, D. (1997). Social capital, income inequality, and mortality. *American journal of public health*, *87*(9), 1491-1498.

Klein, R. J., Nicholls, R. J., and Thomalla, F. (2003). Resilience to natural hazards: How useful is this concept?. *Global environmental change part B: environmental hazards*, *5*(1), 35-45.

Kleinknecht, A., Oostendorp, R. M., Pradhan, M. P., and Naastepad, C. W. M. (2006). Flexible labour, firm performance and the Dutch job creation miracle. *International Review of Applied Economics*, *20*(2), 171-187.

Kochan, T. A., Katz, H. C., and McKersie, R. B. (1994). *The transformation of American industrial relations*. Cornell University Press.

Krueger, A. O. (1990). Government failures in development. *Journal of Economic perspectives*, *4*(3), 9-23.

Landesmann, M., Scazzieri, R. (1990), "Specification of structure and economic dynamics." In: Baranzini, M., Scazzieri, R. (Eds.), *The Economic Theory of Structure and Change*. Cambridge University Press, Cambridge, pp. 95–121.

Landesmann, M., Scazzieri, R. (1996), "The production process: description and analysis." In: Landesmann, M., Scazzieri, R. (Eds.), *Production and Economic Dynamics.* Cambridge University Press, Cambridge, pp. 191–228 .

Le Grand, J. (1991). The theory of government failure. *British journal of political science*, *21*(4), 423-442.

Li, Y., Ma, H., Xiong, J., Zhang, J., and Divakaran, P. K. P. (2022). Manufacturing structure, transformation path, and performance evolution: An industrial network perspective. *Socio-Economic Planning Sciences*, 101230.

Littig, B., and Grießler, E. (2005). Social sustainability: A catchword between political pragmatism and social theory. *International Journal of Sustainable Development*, *8*(1/2), 65–79.

Longstaff, P. H. (2009). Managing Surprises in Complex Systems: Multidisciplinary Perspectives on Resilience. *Ecology and Society, 49*(1), 49.

Lucchese, M., and Pianta, M. (2012). Innovation and employment in economic cycles. *Comparative Economic Studies*, *54*(2), 341-359.

Luzzati, T. , Gucciardi, G., (2015). A non-simplistic approach to composite indicators and rankings: an illustration by comparing the sustainability of the EU Countries. Ecological Economics, 113 (5), 25–38.

Marozzi, M. (2015). Measuring trust in European public institutions. *Social Indicators Research*, *123*(3), 879-895.

Marsden, D. (1995). *The impact of industrial relations practices on employment and unemployment.* Centre for Economic Performance, London School of Economics. Discussion Paper No. 240

Marshall, A. (1890). *Principle of economics*. London: Macmillan

Martin, R. L. (2012). Regional economic resilience, hysteresis and recessionary shocks. *Journal of Economic Geography, 12*(1), 1-32

Martin, R., Sunley, P., Gardiner, B., and Tyler, P. (2016). How regions react to recessions: Resilience and the role of economic structure. *Regional Studies*, *50*(4), 561-585.

Marx, M. (1867). *Capital*. Hamburg, Otto Meissner

Mazzola, F., Lo Cascio, I., Epifanio, R., and Di Giacomo, G. (2018). Territorial Capital and Growth over the Great Recession: a Local Analysis for Italy. *The Annals of Regional Science*, *60*(2), 411-441

Mazzucato, M. (2013). *The Entrepreneurial State. Debunking Public vs. Private Sector Myths*. London and New York: Anthem Press

Mazzucato, M., Cimoli, M., Dosi, G., Stiglitz, J. E., Landesmann, M. A., Pianta, M., Walz, R., and Page, T. (2015). Which Industrial Policy Does Europe Need?. *Intereconomics*, *50*(3), 120–155

Michaels, G., Rauch, F., and Redding, S. J. (2012). Urbanization and structural transformation. *The Quarterly Journal of Economics*, *127*(2), 535-586.

Modica, M. and Reggiani, A. (2015) Spatial Economic Resilience: Overview and Perspectives. *Networks and Spatial Economics*, *15*(2), 211-233.

Moss, S. (1984). The History of the Theory of the Firm from Marshall to Robinson and Chamberlin: The Source of Positivism in Economics. *Economica*, New Series, *51*(203), 307-31

Munda G. (2007), Social multi-criteria evaluation, Springer-Verlag, Heidelberg, New York, Economics Series.

Munda G. and Nardo M. (2005), Constructing Consistent Composite Indicators: the Issue of Weights, EUR 21834 EN, Joint Research Centre, Ispra.

Mutari, E., and D. Figart. (2015). *Just one More Hand: Life in the Casino Economy*. Lanham: Rowman and Littlefield.

Neffke, F., Hartog, M., Boschma, R., and Henning, M. (2018). Agents of structural change: The role of firms and entrepreneurs in regional diversification. *Economic Geography*, *94*(1), 23-48.

Neffke, F., Henning, M., and Boschma, R. (2011). How do regions diversify over time? Industry relatedness and the development of new growth paths in regions. *Economic geography*, *87*(3), 237-265.

Neville, K., O'Riordan, S., Pope, A., Rauner, M., Rochford, M., Madden, M., and O 'Brien, C. (2016). Towards the development of a decision support system for multi-agency decision-making during cross-border emergencies. *Journal of Decision systems*, *25*(sup1), 381-396.

Ngo, C.N., Di Tommaso, M. R., Tassinari, M., and Dockerty, J. M. (2021). The future of work: Conceptual considerations and a new analytical approach for the political economy. *Review of Political Economy*, 10.1080/09538259.2021.1897750

Nomaler, O., Verspagen, B., van Zon, A. (2021). "Structural Change, Economic Development, and the Labour Market". In: Alcorta, L., Foster-McGregor, N., Verspagen, B., and Szirmai, A. (Eds.), *New Perspectives on Structural Change: Causes and Consequences of Structural Change in the Global Economy.* Oxford: Oxford University Press, pp. 577-595.

Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F. and Pfefferbaum, R. L. (2008). Community Resilience as a Metaphor, Theory, Set of Capacities, and Strategy for Disaster Readiness. *American Journal of Community Psychology*, *41*(1), 127-150.

OECD. (2021). *Strengthening Economic Resilience Following the COVID-19 Crisis: A Firm and Industry Perspective*, OECD, Publishing, Paris, https://doi.org/10.1787/2a7081d8-en.

Ortega-Colomer, F. J., Molina-Morales, F. X., and Fernández de Lucio, I. (2016). Discussing the concepts of cluster and industrial district. *Journal of technology management and innovation*, *11*(2), 139-147.

Pack H. (2000). Industrial Policy: Growth Elixir or Poison?. *World Bank Research Observer*, *15*(1): 47–67.

Pasinetti, L. L. (1973). The Notion of Vertical Integration in Economic Theory, *Metroeconomica*, 25 (1): 1–29.

Pasinetti, L.L. (1981). *Structural Change and Economic Growth: A Theoretical Essay on the Dynamics of the Wealth of Nations*. Cambridge: Cambridge University Press.

Pichon, E., Widuto, A., Dobreva, A and Jensen, L. (2020). Ten composite indices for policy-making, European Parliamentary Research Service, available at: https://www.europarl.europa.eu/RegData/etudes/IDAN/2021/696203/EPRS_IDA(2021)696203_EN.pdf

Pinheiro, R., Frigotto, M. L., and Young, M. (2022). *Towards Resilient Organizations and Societies: A Cross-Sectoral and Multi-Disciplinary Perspective*. Bern: Springer Nature.

Pollio, C., and Rubini, L. (2019). Who drives the automotive sector? Thailand selective policies. *International Journal of Emerging Markets, 16*(2), 370-390.

Pontarollo, N. and Serpieri, C. (2020a). A composite policy tool to measure territorial resilience capacity, *Socio-Economic Planning Sciences*, *70,* C, 100669.

Pontarollo, N., and Serpieri, C. (2020b). Towards regional renewal: a multilevel perspective for the EU. *Regional Studies*, *54*(6), 754-764.

Quadrini, V., and Trigari, A. (2007). Public employment and the business cycle. *The Scandinavian Journal of Economics*, *109*(4), 723-742.

Quesnay, F. (1972 [1759]). *Quesnay's Tableau Économique*. Eds. Marguerite Kuczynski and Ronald L Meek. London; New York: Macmillan; A.M. Kelley for the Royal Economic Society and the American Economic Association.

Raid, R., and Botterill, L. C. (2013). The Multiple Meanings of 'Resilience': An Overview of the Literature. *Australian Journal of Public Administration*, *72*(1), 31–40

Rajesh, R. (2018). On sustainability, resilience, and the sustainable–resilient supply networks. *Sustainable Production and Consumption, 15,* 74-88.

Reggiani, A. (2013) Network resilience for transport security: some methodological considerations. *Transport Policy*, *28*, 63–68

Richardson, G. E. (2002). The Metatheory of Resilience and Resiliency. *Journal of Clinical Psychology, 58*(3), 307–321.

Rodrik, D., and Sabel, C. (2019). Building a good jobs economy. HKS Working Paper No. RWP20-001 . Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3533430

Rubini, L., Pollio, C., Spigarelli, F., and Lv, P. (2021). Regional social context and FDI. An empirical investigation on Chinese acquisitions in Europe. *Structural Change and Economic Dynamics*, *58,* 402-415.

Saisana, M. , Saltelli, A. , Tarantola, S., (2005). Uncertainty and sensitivity analysis tech- niques as tools for the quality assessment of composite indicators. Journal of the Royal Statistical Society: Series A (Statistics in Society), *168*, 307–323.

Sajko, M., Boone, C., and Buyl, T. (2020). CEO greed, corporate social responsibility, and organizational resilience to systemic shocks. *Journal of Management*, *47*(4), 957-992.

Salazar-Xirinachs, J. M., Nübler, I., and Kozul-Wright, R. (2014). *Transforming Economies: Making Industrial Policy Work for Growth, Jobs and Development.* Geneva: International Labour Office Publications, ILO.

Scazzieri, R. (1993), *A Theory of Production: Tasks, Processes, and Technical Practices*, Oxford, Clarendon Press.

Scazzieri, R. (1993). *A Theory of Production: Tasks, Processes, and Technical Practices*, Oxford, Clarendon Press.

Scazzieri, R. (2018). Structural dynamics and evolutionary change. *Structural Change and Economic Dynamics*, *46*, 52–58.

Scazzieri, R. (2021), Complex structures and relative invariance in economic dynamics, in A. Reggiani, L.S. Schintlter, D. Czamanski and R. Patuelli (eds.), Handbook on Entropy, Complexity and Spatial Dynamics: A Rebirth of Theory?', Cheltenham, UK and Northampton, Massachusetts, USA, Edward Elgar, 274-289.

Scazzieri, R. (2021). Decomposability and Relative Invariance: the Structural Approach to Network Complexity and Resilience. *Networks and Spatial Economics*, https://doi.org/10.1007/s11067-021-09519-8

Schuck, P. (2014). *Why government fails so often and how it can do better.* Princeton University Press, Princeton.

Sen A. (1999). *Development as Freedom*. Alfred Knopf, New York.

Sheffi, Y., and Rice, J. B. Jr. (2005). A supply chain view of the resilient enterprise. *MIT Sloan management review, 47*(1), 41.

Simmie, J., and Martin, R. (2010). The economic resilience of regions: towards an evolutionary approach. *Cambridge Journal of Regions, Economy and Society, 3*(1), 27-43.

Smith, A. (1776). An inquiry into the nature and causes of the wealth of nations. London: printed for W. Strahan; and T. Cadell, 1776.

Soufi, H. R., Esfahanipour, A. and Shirazi, M. A. (2022). A quantitative approach for analysis of macroeconomic resilience due to socio-economic shocks. *Socio-Economic Planning Sciences,* Volume 79, https://doi.org/10.1016/j.seps.2021.101101.

Stiglitz, J. E., and Lin, J. Y. (Eds). (2013). *The Industrial Policy Revolution I: The Role of Government beyond Ideology.* New York: Palgrave Macmillan.

Stiroh, K. (2001). Investing in Information Technology: Productivity Payoffs for US Industries. *Current Issues in Economics and Finance, 7*(6): 1–7.

Tassinari, M. (2019). *Capitalizing Economic Power in the US. Industrial Strategy in the Neoliberal Era*. International Political Economy Series. Cham, Switzerland: Palgrave Macmillan

UNDP. (2021). *Human Development Report 2020*. Available at: http://hdr.undp.org/sites/default/files/hdr2020.pdf

UNIDO. (2017). *Structural Change for Inclusive and Sustainable Industrial Development.* Vienna

Vallance, S., Perkins, H. C., and Dixon, J. E. (2011). What is social sustainability? A clarification of concepts. *Geoforum*, *42*(3), 342–348.

Wial, H. (2018). "New Bargaining Structures for New Forms of Business Organization". In: Friedman, S., Hurd, R. W., Oswald, R. A., and Seeber, R. L. (Eds.), *Restoring the promise of American labor law.* Ithaca, NY: Cornell University Press, pp. 303-313

Windle, G. (2011). What is resilience? A review and concept analysis. *Reviews in Clinical Gerontology, 21*(2): 152–169.

Zavadskas, E. K., and Turskis, Z. (2011). Multiple criteria decision making (MCDM) methods in economics: an overview. *Technological and economic development of economy, 17*(2), 397-427.

Contributions:

Marco R. Di Tommaso: Conceptualization; Writing - Original Draft; Writing – Review & Editing; Supervision **Elena Prodi:** Methodology, Investigation; Formal Analysis; Writing - Original Draft; Writing – Review & Editing; **Chiara Pollio:** Methodology, Writing - Original Draft; Writing – Review & Editing; Visualization; **Elisa Barbieri:** Conceptualization; Writing – Review & Editing.

APPENDIX A

Table A1 – Peaks and troughs by sector, manufacturing

Sector	Peak Month	Trough Month	Peak to Trough (Months)
Wood products	July 2007	July 2011	48
Nonmetallic mineral products	January 2008	January 2011	36
Primary metals	September 2008	October 2009	14
Fabricated metal products	May 2008	February 2010	21
Machinery	July 2008	January 2010	18
Computer and electronic products	March 2008	April 2010	25
Electrical equipment and appliances	May 2008	January 2010	20
Transportation equipment	February 2008	June 2009	16
Furniture and related products	April 2007	March 2011	47
Other miscellaneous durable manufacturing	December 2007	June 2010	38
Textile products mills	September 2008	January 2012	40
Paper and paper products	April 2008	February 2012	46
Printing and rel sup act	January 2008	November 2011	46
Petroleum and coal products	July 2008	January 2011	30
Chemicals	April 2008	January 2011	33
Plastic and rubber products	February 2008	October 2009	20
Food and beverage and tobacco products	November 2008	October 2010	23

Table A2 – Summary statistics

	Obs	Mean	St dev	Min	Max
ALL SECTORS					
Employment (thousands)	626	6123.72	4093.54	1883	15535
Average hourly wage	626	23.40	5.34	11.96	32.96
Full-time and part-time workers (thousands)	66	7054.89	5160.56	639	18080
Full-time-equivalent workers (thousands)	66	6493.08	4715.25	630	16773
MANUFACTURING					
Employment (thousands)	480	0.04	0.02	0.01	0.15
Average hourly wage	480	19.46	14.65	1.74	88.07
Full-time and part-time workers (thousands)	480	840.13	8730.62	0.04	131469
Full-time-equivalent workers (thousands)	224	2863.65	1969.22	657.89	10947.90

Source: Authors' elaboration

Note: While data for employment and average hourly wage are measured monthly, data on part-time, full-time, and full-time equivalent workers are measured yearly. See also section 3.1 for more details

PAPER 6 – Does Industry Resilience Matter for Postshock Industrial Policy? A Focus on Tourism-Related Industries

Paper published in: Tourism Economics

Prodi, E., Fasone, V., Di Tommaso, M.R., (2022), Does Industry Resilience matter for postshock Industrial Policy? A focus on tourism related industries

Doi: https://doi.org/10.1177/13548166231154314

This paper below is an early version of the paper submitted to: Tourism Economics

Abstract

In the past and in our present, selective industrial policies are increasingly used by national and local governments to achieve national societal goals. However, industrial policies have showed to be complex and vulnerable interventions demanding robust and transparent tools able to justify government choices and to mitigate the potential rise of government failures. Such tools are even more required in our present and in the years to come, since several challenges are upcoming in the near future and will probably threating our economies and societies, as the Covid-19 pandemic has recently done. In this paper, we contend that postshock *industry resilience* represents a desirable societal goal, and thus an equally desirable policy goals, for it values the ability of an industry to withstand a shock and recover in its aftermath, thus preserving or even improving the economic and social conditions of the system. In this view, we have built upon previous studies (Di Tommaso et al. 2022) testing innovative methodologies able to guide and support policymakers with the process of industry selection. Specifically, we have developed and applied a methodology to measure *industry resilience,* showing how different sectors react to shocks. We have focused on the case of Italy and measured industry resilience in the aftermath of the 2008 shock, devoting particular attention to tourism-related industries. Our results show that industries, even tourism-related ones, reacted heterogeneously to the 2008 shock. This reinforces the idea that policy-makers should be aware of such different postshock sectoral behaviors when framing industrial policy in order to carefully select policy targets coherently with policy goals, while increasing transparency in terms of accountability to citizens and social stakeholders.

Keywords: industry resilience, tourism, industrial policies, employment

Jel Classification: L52, O14, C43, L16

1. Introduction

1.1 Selective industrial policy and societal goals

This paper focuses on "selective industrial policies". Specifically, we are interested in those governments interventions that, by choosing and targeting specific industries, intend to promote goals that might be considered relevant for the society. A typical and traditional example are those policies investing in the national construction industry to contrast recession and unemployment (as it happened in the New-deal Times or more recently after the 2008 crisis). Another example, thinking about our contemporary emergencies, is represented by those policies designed to support the growth of the national renewable-energy industry to fight climate change or to the ensure energy independence from abroad in strategic sectors (Hirschman 1958; Polenske et al. 1990; Nivola 2008; Bag 2010; Mazzucato 2013; Di Tommaso and Schweitzer; Cardinale 2019; Jewell et al. 2016).

Everywhere, in the past and in our present, selective industrial policies have been used by national and local governments to achieve what have been defined - in that country and in that historical moment - national societal goals (Lall and Teubal 1998; Barbieri et al. 2019; Tassinari 2019; Di Tommaso et al 2020a; Di Tommaso et al. 2020b; Ferrannini et al. 2021; Silvestri et al. 2022; Prodi 2022; Landini and Ferrannini 2022; Bellandi et al. 2022). However, selective industrial policy has always attracted criticisms because their potential failures (Krueger, 1990; Le Grand, 1991; Chang, 1994, 2011; Buigues and Sekkat, 2009; Di Tommaso and Schweitzer, 2013; Schuck, 2014).

Again: everywhere, in the past and in our present, selective industrial policy have showed to be complex and vulnerable interventions demanding robust and transparent tools able to justify government choices. Public investment and preferences towards one specific sector over another need to be carefully analysed, discussed and evaluated (ex-ante and ex-post) in terms of their supposed capacity of achieving specific societal goals (Di Tommaso et al. 2017, 2020, 2022; Ngo et al. 2021).

In this framework, as a wide and established literature has highlighted (see, e.g., Krueger, 1990; Le Grand, 1991; Chang, 1994; Di Tommaso and Schweitzer, 2013; Di Tommaso et al 2017), important "failures" might arise during the process of industry/sector selection. Indeed, before and during the implementation of the policy, a multitude of actors and stakeholders are in the position of influencing the process of target selection (Hirschman, 1970; Cardinale, 2017; Scazzieri et al., 2015).

First, we might expect traditional "internal failures" given that governments are not "black boxes": they are complex organization where lack of competence, scarce and asymmetric information, self-serving bureaucrats, internal competition and overlapping of competences might easily push policies away from the expected desired outcomes. This complexity might have an impact on how sectors are

actually selected by governments, defining priorities and preferential policies that have limited justification if confronted with those goals declared as the real rationales of the intervention.

Second, along with "internal government failures", great challenges are related to the fragility of the government-industry-society relationships. Governments might be captured by some partial interests who know how to organize themselves, demand and obtain special policy attention with the further risk of encouraging rent-seeking, clientelism, corruption, insane exchange of political consensus with policy intervention. Once again, these dynamics might have an impact on how sectors are chosen, making (since the very beginning), the policy process inefficient and ineffective.

In this complex and realistic setting, government selective interventions have to be justified according to their capacity of achieving specific normatively-defined societal goals. In principle, an ideal process would be the discussion and the comparative evaluation of how different sectors might contribute to the promotion of well-defined societal goals. For example, to what extent government support to manufacturing vs services might represent a solution to wide objectives, such as: fostering economic growth, innovation or competitiveness; lowering national dependency from abroad in strategic sectors; fighting unemployment, economic, social and territorial disparities; contrasting environmental crisis and climate change. Or, to enter in a more desirable specificity: would investing in construction industry to create new public works (roads, trains, bridges, dams, etcetera) effectively counteract the economic and social risks connected to job losses? Or again, would the support to electric engine production or renewables (solar or wind power) promote a more green economy and society?

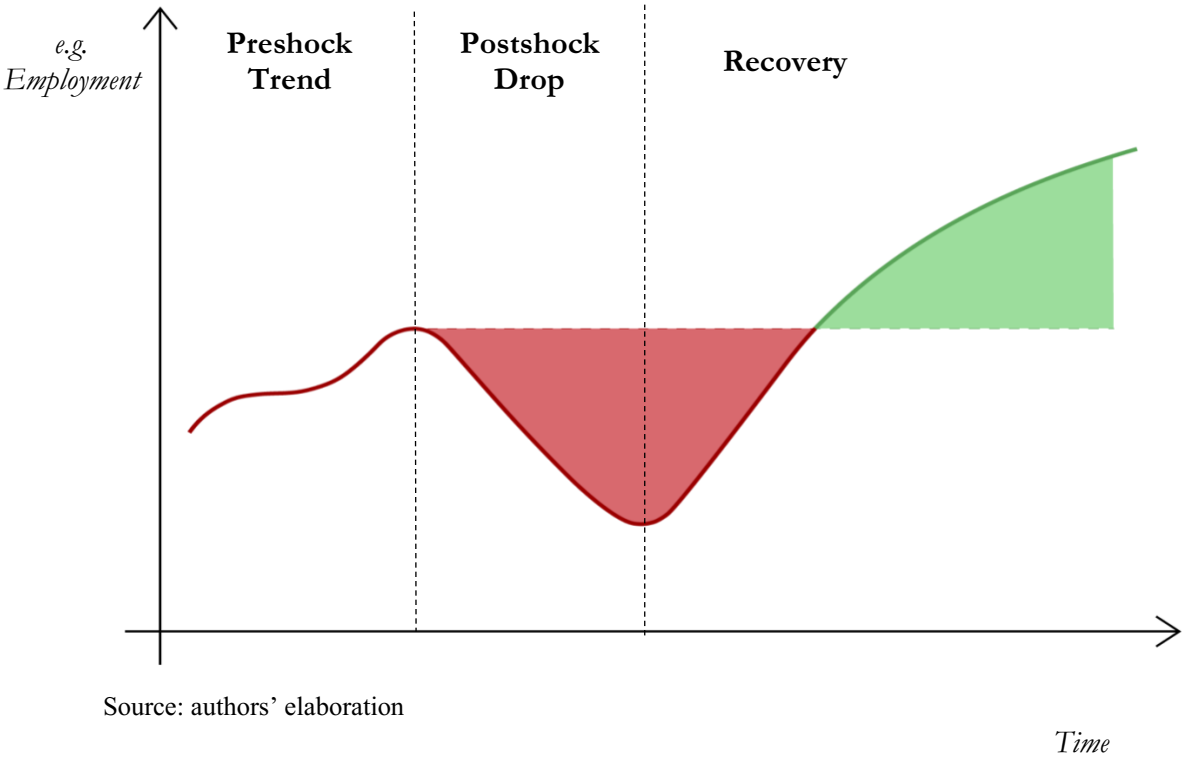
In this framework, we are interested in developing and testing innovative methodologies able to guide and support policymakers with the process of industry selection. Robust and transparent methodologies should be considered crucial tools for mitigating the potential rise of the abovementioned "internal and external government failures" in a perspective of policy accountability and social watch. Such methodologies would represent clear point of reference during the process of industry selection that might regulate the interaction in this delicate field encompassing bureaucrats, policy makers, stakeholders and citizens.

1.2 Industry resilience

In the background so far discussed, this paper investigates the nexus between selective industrial policy and *postshock industry resilience*. The intuitive idea - elaborated during the Covid-19 pandemic - is that making our economies and societies more resilient to unexpected shock could/should be considered a desirable national societal goal and thus an equally desirable policy goal (Di Tommaso et al. 2022). Covid-19 is the most recent evidence of the vulnerability of our economies

and societies. However, a long list of other possible upcoming "expected and unexpected-shocks" (such as those related to climate change, energy prices or global food insecurity, future financial crises) seems to urge the need of policy interventions able to work along two directions: first, making postshock economic and social drop less sudden and severe, hence irreparable; second, fostering recovery capacity and velocity. In other words, with reference to figure 1, policy efforts could/should aim at minimizing the red area (related to the "*drop"* of the economy and social welfare) and maximizing the green one (related to the "*recovery"* of the economy and social welfare).

Figure 1 – Resilience: Drop and Recovery



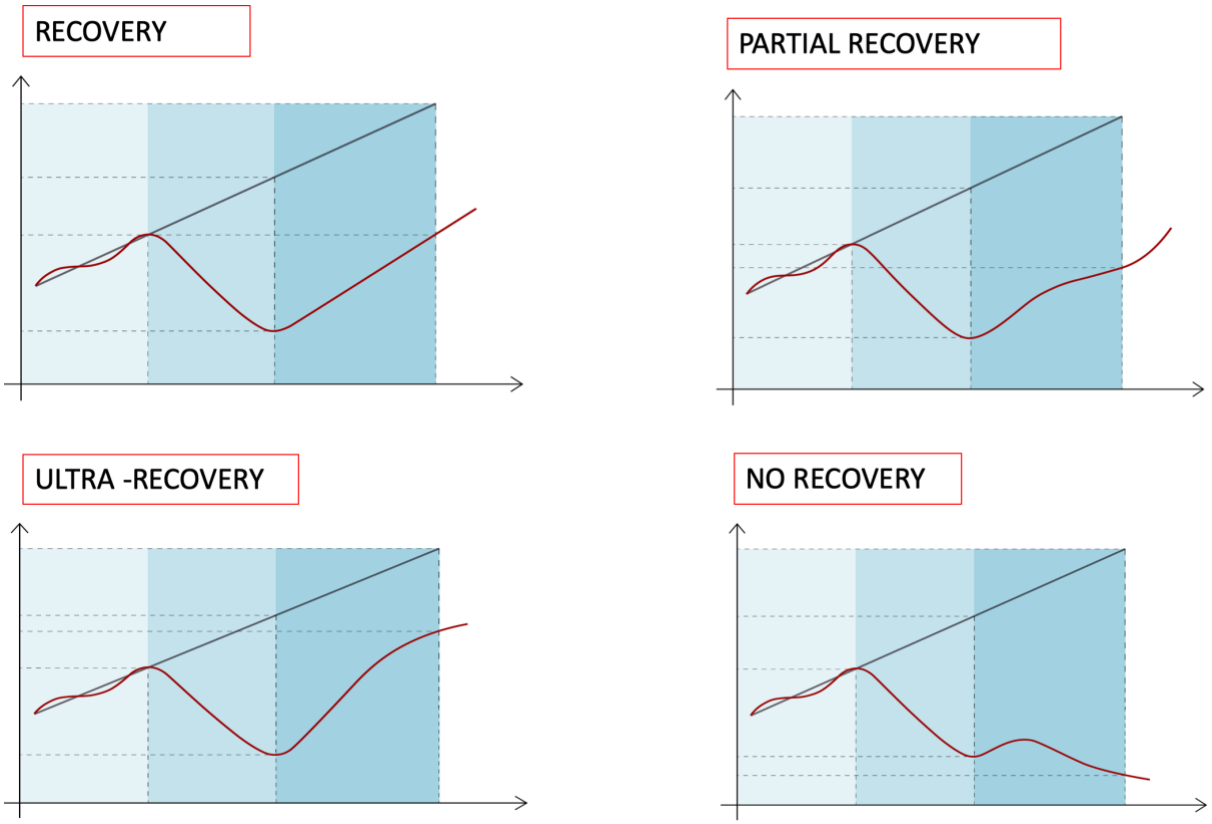
Source: authors' elaboration

Clearly, the reactions of the economy and society to shocks may vary, following trajectories of partial or full recovery, or even what we might define an "ultra-recovery". In addition, it exists in principle the possibility that shocks may also result in a definitive collapse with no recovery at all (figure 2).

It is also clear that the postshock resilience capacity of our economies and societies is the result of a variety of interrelated economic, social and institutional dimensions. And this is what we observe and understand for example when we realize how heterogenous has been the impacts of Covid-19 across different actors and territories (Cortes and Forsythe 2020; Bailey et al. 2020; Emmerling et al. 2021). However, in this paper we are particularly interested in the value of what we define "industry resilience", where industry here is meant as synonymous of sector (Marshall 1961; Moss 1984; Di

Tommaso et al., 2022). Building-up a growing debate in social, economic and management studies (Earvolino-Ramirez, 2007; Longstaff, 2009; Raid and Botterill, 2013; Martin, 2012; Reggiani, 2013; Crescenzi et al., 2016 Cardinale, 2019) - "industry resilience" is here defined as follow: *the way, the extent and the speed at which industries return to the previous state, trend or trajectory after a shock, thus achieving a partial or a full recovery (or even what we might define an "ultra-recovery")* (Di Tommaso 2020; Di Tommaso et.al 2022; OECD, 2021; Canova et al., 2012).

Figure 2 – Postshock industry resilience: different recovery trajectories



Source: authors' elaboration

The intuition and the assumption here is that *industry resilience to shock* may be particularly important for economies and societies. As many observers and scholars animating an international and interdisciplinary debate suggest (Beck 1986; OECD 2011; Tiraboschi 2020, Hynes et al. 2020; World Economic Forum 2022), we all should be and get prepared to further upcoming unexpected shocks of different nature: the more resilient are our productive systems, the better would be for the economy and the society as a whole. Indeed, the Covid-19 pandemic cannot be considered an isolated event: other similar challenges in the near future will probably threat our economies and societies, due to the global interconnectedness of countries political and commercial relations (OECD 2011; Hynes et al. 2020). The growing frequency of such extreme events associated to climate change is

another important example. In general, we should start considering economic shocks as frequent and unpredictable events, not being an exception anymore in our highly interconnected and globalized world (OECD 2011; Hynes et al. 2020).

So, studying sectors' reactions to shocks should be considered a relevant field for policy making and in particular for industrial policy design and implementation. By recognizing the economic and social value of industry resilience, novel rationales for industrial policy interventions in favour of specific sectors/industries would arise: for example, supporting the most resilient sectors because of their potential capacity of fostering wider dimensions of economic and social resilience; or, on the contrary, investing in sectors that have proved to be scarcely resilient to shocks to make the economy and the society more resilient as a whole.

Thus, in this paper we contend that industries' resilience should be evaluated and appreciated by policy-making as a relevant societal goal; specifically, we suggest that measuring sectorial resilience capacities could offer important elements to guide selective industrial policies motivated by the goal of making our societies more resilient to shocks. In view of this, in the following paragraphs, we present and apply a methodology to measure *industry resilience,* showing how different sectors react to shocks (Di Tommaso et al. 2022). The idea behind this methodology is that rigorous and transparent information on the heterogeneity of sectorial reactions to a shock - the way, the extent and the speed at which industries return (or not) to the pre-shock state/trend/trajectory achieving a full, a partial or a ultra recovery - matters for policy interventions. Indeed, such information are important since they offer - during the complex process of policy design and implementation where a plurality of actors and stakeholder are involved - solid evidences on the rationales of the intervention, lowering the risk of "internal and external government failures" highlighted in the previous paragraph.

Specifically, we'll test this methodology against the Italian case, in order to understand how and to what extent sectors have reacted in the aftermath of the 2008 shock. Particularly attention will be devoted to tourism-related industries. Indeed, while sectors such as manufacturing and construction have received great attention from scholars in the aftermath of the crisis due their vital role in the Italian economy (Girardi 2012; Lagravinese 2015; Terkaj, W., & Tolio, T. (2019), the service sectors has been mostly treated as a homogeneous aggregate. However, the service sector encompasses few sub-sectors, so called tourism-related industries, that deserve particular attention in a country like Italy given the relevance of tourism on the national economy (Bank of Italy, 2019). Such tourism-related industries are mainly embodied, according to the literature (Leiper 1979) by the following setors: 1) "Transportation and storage" ([55]), 2) "Accommodation and food service activities", 3) "Arts, entertainment and recreation and other service activities", and 4) "Wholesale and retail trade:

[55] See considerations in the previous section number 3.

repair of motor vehicles and motorcycles". It is therefore interesting to see how such segments of the tourism industry have reacted to the recessionary crisis, considered the pivotal role that tourism plays in the Italian economy: indeed, tourism represents a share above 10% of the Italian GDP, and a share above 11% of employment (Istat, 2014), which are larger values than the European average data (Cellini 2015). Moreover, Italy Ranks 5th worldwide by the number of international tourist arrivals and place number 4th worldwide by the amount of international tourism receipts (Organization, 2010).

The rest of the paper is organized as follows: the next section develops the methodology we'll test and presents the data used and elaborated. In section 3 we show the empirical application of the methodology of the Italian case, presenting main results. Finally, we offer conclusive remarks where we discuss the main result of our analysis, the most relevant policy implications and some future research lines.

2. Data and Methodology

2.1. Measuring industry resilience through the composite indicators

In order to assess postshock sectoral behavior in Italy in the aftermath of 2008, we use composite indicators (CIs). Specifically, we build upon previous studies that have pioneered the concept of industry resilience as a relevant societal goal and developed a methodology based on CIs to assess it (Di Tommaso et al. 2022).

CIs have been often used in a variety of realms for policy-makers informing purposes: indeed, they can be used to aggregate multiple information on complex phenomena and synthetize them into simple and easily understandable pieces of information. Hence, they are increasingly diffused among policy-makers, international organizations and other bodies to support informed decision-makers on policy initiatives (a few examples of these are UNDP, 2021, and previous years; Pichon *et al.*, 2020; and Alkire and Santos, 2014). Considering the framework of this paper, they represent a useful tool that can mitigate the rise of government failures, particularly by supporting policy-makers in selecting and prioritizing targets and increasing transparency about such a selection process and its accountability to citizens and social stakeholders (Krueger, 1990; Le Grand, 1991; Chang, 1994, 2011; Buigues and Sekkat, 2009; Bailey *et al.*, 2019; Schuck, 2014; Pollio and Rubini, 2019; Ferrannini et al. 2021).

Recent studies have developed composite indicators (CIs) that assess industry resilience based on cross-sectors employment variations, both in terms of quantity and quality, over the whole crisis-and-recovery period. By building performance-based rankings (Di Tommaso et al., 2022; Han and Goetz

2019; Han and Goetz 2015), such CIs provide decision-makers with policy-relevant information on sectoral behaviors during and in the aftermath of an unexpected shock.

We use and test such a methodology against the Italian case. It is original in the fact that it departs from previous studies on resilience in the field of economic geography and regional economics which have measured resilience mainly in terms of overall changes in the regional/county employment rate as the aftereffect of the crisis (Martin, 2012; Fingleton *et al.*, 2012; Davies, 2011; Brown and Greenbaum, 2017; Ezcurra and Rios, 2019; Crescenzi *et al.*, 2016; Filippetti *et al.*, 2020).

By grasping the amplitude, duration and velocity of the changes affecting sectoral employment, the CIs developed by Di Tommaso et al. (2022) can support policy-makers in visualizing sectoral performances dynamically and multidimensionally; they also allow the comparison of each sector with other sectors and with their own counterfactual trend.

Accordingly, we proceed by following three main steps: first, we illustrate the six indicators developed by Di Tommaso et al. (2022) to model industry resilience. Second, we select the variables that allow us to measure employment changes by sector: in particular, we use data on employment levels to assess changes in employment quantity, while we use the ratio between temporary employment and total employment to assess employment quality. Third, we detail how we build our CIs after observing the variables' behavior across all of the six indicators.

First, industry resilience has been modelled by six indicators - eventually synthetized into two composite indicators - capturing different aspects of postshock sectors' behaviors. This approach departs from those contributions which have simplified the complexity of the concept and measured resilience by taking the simple difference between pre- and postshock employment levels (see, e.g., Crescenzi *et al.*, 2016; Martin *et al.*, 2016; Ezcurra and Rios, 2019).

Specifically, the indicators capturing different aspects of postshock sectors' behaviors have been identified starting from the local points that shape sectors' business cycles (Han and Goetz, 2015; Hall et al. 2003), namely:

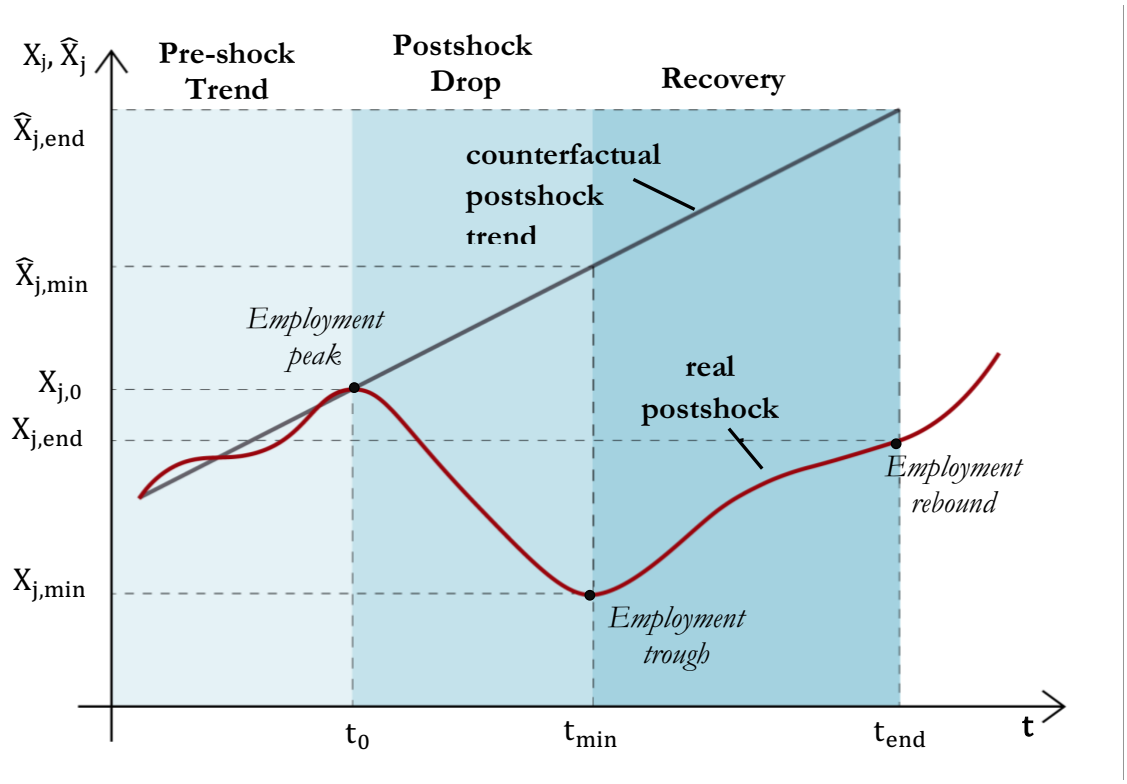
- the *peak,* $t_{0,}$ which indicates the local maximum of the economic cycle, with the economic downturn starting the month after the economy – or sector – records its peak;
- the *trough*, t_{min}, which indicates the local minimum of the economic cycle, after which the economic recovery begins.

Further, a third crucial point used to create the indicators is the *rebound* point, $t_{end.}$ This is not a local point of the curve, but it signals where the timespan considered for measuring the recovery ends. It is set after 24 months after the *trough* (Di Tommaso et al. 2022), thus allowing the sector to clearly reveal an observable trajectory while at the same time smoothing short-term volatility effects as well

as avoiding excessively long timespans, which might be influenced by other factors independent of the shock.

Figure 3 shows how industry resilience is modelled. The figure represents the trend of employment in industry *j* before and after a shock. At t_0, sector *j* experiences the employment *peak*, whereupon the recession starts. At t_{min}, sector *j* experiences the employment *trough*, after which the sector recovers.

Figure 3 – Industry resilience



Source: Authors' elaboration on Di Tommaso et al. (2022)

These three points allows to retrieve the following information on sectors:

1) The actual behavior of the postshock curve, proxied by the following indicators:

Industry Rebound $IR_j = X_{j,end} - X_{j,min}$, which represents the change in the employment level from the trough over the 2 years after the employment trough. It measures the extent of the recovery of an industry over a given period in absolute terms.

Industry Drop Velocity $IDV_j = \frac{X_{j,min} - X_{j,0}}{t_{j,min} - t_{j,0}}$, which is the slope of the employment drop from t_0 to t_{min} and measures the velocity of the employment decline.

Industry Recovery Velocity $IRV_j = \frac{X_{j,end} - X_{j,min}}{t_{j,end} - t_{j,min}}$, which is the slope of the employment recovery from t_{min} to t_{end} and measures the velocity of the employment rise.

2) The counterfactual behavior of the curve, captured by the following indicators:

Rebound-Counterfactual Difference Ratio $RCD_j = \frac{X_{j,end} - X_{j,0}}{\hat{X}_{j,end} - X_{j,0}}$, which is the ratio between the actual rebound–peak difference and the one that we would have observed in the absence of the shock (counterfactual).

Trough–Counterfactual Difference Ratio $TCD_j = \frac{X_{j,min} - X_{j,0}}{\hat{X}_{j,min} - X_{j,0}}$, which is the ratio between the actual trough–peak difference and the one that we would have observed in the absence of the shock (counterfactual).

3) Sectors' size, which is captured by the indicator:

Industrial Average Employment $\bar{X}_j = \frac{\sum_{t=0}^{T} X_{j,t}}{n}$, calculated as the average of the variable over the peak–rebound period.

Hence, industry resilience accounts for multiple dimensions characterizing postshock sectors' behavior, namely drops, rebounds, velocity, and counterfactual elements related to both employment quantity and employment quality.

2.2. Data, variables and indicators

After illustrating the six indicators modelling industry resilience, we now present the data used for this exercise on the Italian case. Data are from the European Union Labour Force Survey (EU-LFS), which includes employment quantity quarterly data for 10 one-digit NACE sectors. In line with Di Tommaso et al. (2022), we have first observed the trend of the business cycle related to the 2008 crisis to identify the local points (the peak and the trough) and the rebound point. Table 1 reports the peaks, the troughs and the rebound points for the 10 sectors ([56]).

[56] Appendix A contains further details on sectors selection.

Table 1 – Peaks and troughs by sector

Sector	Peak Quarter	Trough Quarter	Rebound Quarter	Peak to Trough (Months)
Agriculture, forestry and fishing	2010 – Q4	2014 – Q1	2016 – Q1	39
Manufacturing	2007 – Q3	2013 – Q2	2015 – Q2	69
Construction	2008 – Q4	2013 – Q1	2015 – Q1	51
Wholesale and retail trade; repair of motor vehicles and motorcycles	2008–Q3	2011 – Q2	2013 – Q2	33
Transporation and storage	2008–Q4	2009 – Q2	2011 – Q2	6
Accomodation and food service activities	2009 – Q3	2014 – Q4	2016 – Q4	63
Financial and insurance activities	2011 – Q4	2014 – Q1	2016 – Q1	27
Real estate activities; Professional scientific and technical activities; Administrative and support service activities	2007 – Q4	2012 – Q1	2014 – Q1	51
Human health and social work activities	2009 – Q2	2010 – Q4	2012 – Q4	18
Arts, entertainment, recreation and other service activities	2007 – Q3	2011 – Q4	2013 – Q4	51
Mining and quarrying	Data for this sector covering the period 1998 - 2008 use the NACE Rev. 1.1 classification. The latter, for the aim of this research, is not fully compatible with data covering the period 2008 - 2022 which use the NACE Rev. 2 classification instead. Such a break in the time series and transitions from NACE Rev. 1.1 to NACE Rev. 2 prevent us from calculating the counterfactual indicators. See Appendix A for further details.			
Education	*Ut supra*			
Public administration and defence; compulsory social security	*Ut supra*			
Electricity, gas, steam and air conditioning supply	*Ut supra*			
Water supply; sewerage, waste management and remediation activities	*Ut supra*			
Information and communication	*Ut supra*			
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	*Ut supra*			

Sources: Authors' elaboration based on BLS data
Note: Q1 encompasses January, February and March, Q2 encompasses April, May and June, Q3 encompasses July, August, and September, while Q4 encompasses October, November, December.

Overall, we find substantial cross-sector variations in the aftermath of the 2008 shock: the EU – LFS data show that the first two sectors facing the crisis are Manufacturing and Arts, entertainment, recreation and other service activities (2007 – Q3), whereas Agriculture, forestry and fishing is the last sector to experience the crisis (2010 – Q4). The distance between the peak and trough months of

each sector also varies greatly, ranging from a minimum of 6 months (Transportation and storage) to a maximum of 69 months (Manufacturing).

We have excluded from the analysis sectors for which no peak was clearly identified, as well as sectors for which data on counterfactual trends were not possible to be emphasized. We are thus left with 10 sectors, for which we are able to calculate the value of each one of the six abovementioned indicators.

In the original framework by Di Tommaso et al. (2022), employment quality is the second dimension characterizing industry resilience, for it signal to what extent industries are also able to create or recover good jobs after a shock. While the authors build a *Good Jobs Index,* using information on stability of employment contracts and earnings, we partly depart from this approach due to the lack of information on salary. Still, we retain information on stability of contracts, provided by the EU – LFS data. Hence, we proxy employment quality by contractual stability, which we capture through the percentage of temporary employment ([57]) over total employment. The highest the percentage, the lowest the stability of contracts within the sector, and hence the lowest the quality of employment, we assume. Such an assumption is in line with bot theoretical and empirical studies contending that firms using temporary contracts pursue low-road employment strategies, characterized by the creation of cheap and low-quality jobs. In other words, and generalizing to the sectoral level, the number of temporary contracts used within a given sector signals the presence of low quality of jobs in it (Kalleberg 2011; ILO 2015; Alpert *et al.*, 2019).

Once identified the six indicators modelling industry resilience, and the two variables that embody it, we start building the two CIs ranking the J sectors on the basis of the K=6 indicators.

We proceed through the following steps:

I) For each sector, we calculate the value of each one of the six indicator, both for employment quantity (i.e., the number of people employed in the sector) and employment quality (the share of temporary employment on total employment); to allow for comparability among the sectors, which can vary greatly in terms of size, the minimum and the rebound values are calculated as the percentage deviation from the peak value (=100) for each sector.

[57] According to the Eurostat glossary, data on temporary employment include types of work under a fixed-term contract, as against permanent work where there is no end-date. Typical cases are: people in seasonal employment; people engaged first by an agency or employment exchange and then hired to a third party to do a specific task (unless there is a written work contract of unlimited life); people with specific training contracts.

II) We then rank normalized each indicator value to make the variables comparable across indicators and sectors (Becker, 2021; Di Tommaso et al. 2022), as follows:

$$I_{kj} = Rank(x_{kj}) \quad (1)$$

where I_{kj} represents the normalized value of individual indicator k for sector j.

Ranks are defined so that the best performing indicator's value ranks 10, the second-best ranks 9 and so on (Becker, 2021) until 1 (the worst performing indicator's value).

For employment quantity, lowest values generally correspond to worst quantitative performance (i.e., a contraction of overall jobs). For employment quality, the opposite holds: lowest values (i.e., lower percentage of temporary employment) generally correspond to better quality performance of the sectors and to a contraction of the percentage of temporary jobs. Exception is made for the two counterfactual indicators for employment quality. Indeed, we realized that calculating the ratio between the actual trough–peak (rebound-peak) difference and the one that we would have observed in the absence of the shock (counterfactual) makes little sense when we use the % of temporary employment on total employment.

In other words, the RCD and TCD indicators as originally framed by Di Tommaso et al. (2022), once used with our measure of employment quality, generate values that, when ordered, do not reflect sector counterfactual performance. We are therefore impeded from creating the partial rankings for the counterfactual indicators. In order to overcome this issue, we have partially departed from the original counterfactual indicators: specifically, we have directly ranked sectoral counterfactual performances on the basis of the identification of four groups of sectors' behaviors:

1) *Good trends being maintained:* Sectors where the share of low-quality employment was decreasing before the shock and continued to decline in the aftermath of it. Sectors belonging to this group have the highest rank.

2) *Bad trends being reversed:* Sectors where the share of low-quality employment was increasing before the shock but declined in the aftermath of it. Sectors belonging to this group have the medium-high rank.

3) *Bad trends being maintained:* Sectors where the share of low-quality employment was increasing before the shock and continued to increase in the aftermath of it. Sectors belonging

to this group have the medium-low rank.

4) *Good trends being reversed:* Sectors where the share of low-quality employment was declining before the shock but increased in the aftermath of it. Sectors belonging to this group have the lowest rank.

Hence, in terms of relationship between their counterfactual and actual trend, sectors belonging to the first group are the best performers, while the fourth group include the worst performer sectors. Sectoral performances within groups are ordered based on the amount of low-quality employment reduced, thus in descendent order (see Appendix B).

III) We weight indicators by attaching the same weight to each one of the six indicators, as the literature suggests in similar cases (Saisana *et al.*, 2005; Marozzi, 2015; JRC-EC, 2008);

IV) We follow Di Tommaso et al. (2022) and use as aggregation method the equally weighted geometric mean, which uses the product of the indicators as follows. For each sector j:

$$gM_j = (\prod_{i=1}^{k} I_j^{w_k})^{1/\sum_{i=1}^{k} w_k}, \quad (2)$$

where I_j is the rank-normalized indicator and w_k is the corresponding weight.

The geometric mean is more robust to outliers and allows for no substitutability of the information provided by each indicator (Becker, 2021; JRC-EC, 2008).
The final CIs were obtained from ordering in descending order the geometric mean values and assigning higher rankings to higher values, which correspond to an overall better performance. The results consist of two rank-based CIs, one for quantity (*CI_QUANT*) and the other for quality **(***CI_QUAL).*

3. Empirical Analysis and Results

In this section, we apply the two composite indicators (CIs) - measuring industry resilience in terms of changes in jobs quantity and quality across sectors in the aftermath of the 2008 shock - to the Italian case. The emerging results related to the postshock quantitative and qualitative profiles of sectoral employment are then analysed in order to draw useful insights for industrial policy design and implementation. In particular, we offer a specific focus on the tourism-related industries, which,

as anticipated in the introductory paragraph, deserve particular attention in a country like Italy given their relevance on the national economy (see also: Bank of Italy, 2019). Indeed, we want to understand how the different tourism' sectors perform in terms of post shock resilience within the Italian economy.

We recall that, according to Leiper (1979), four aspects compose the tourism product: 1) transport, 2) hospitality, 3) recreation, and 4) shopping. In our study, these components are encompassed by the following sectors: 1) "Transportation and storage" ([58]), 2) "Accommodation and food service activities", 3) "Arts, entertainment and recreation and other service activities" ([59]).

Before proceeding with the calculations of the indices, we begin our empirical analysis by emphasizing industry trends in terms of dynamics of total employment. Accordingly, we report in Figure 4 the trends of employment quantity by sector in Italy over the years 1998-2021. We observe these series to depict the behavior of each industry over time.

As first evidence, we observe a heterogeneous cross-sectors performance and a different response to the diverse *stimuli* coming from the environment, including financial or economic shocks. Primarily, it can be noticed that sectors' behaviors can be classified in three major groups.

A first group maintains almost the same trend, if we compare the starting point of the observation (i.e., the year 1998) and its end, although some fluctuations over the time appears. Within this group, even though the final numbers of workers in the sector remain similar to the initial stage, we can emphasize some sector with a more evident instability and others with a certain stability.

A second and a third cluster of sectors show a constant increasing and a decreasing trend, respectively, and consequently a different level of employment at the end of the period considered. Specifically, the sectors "Financial and insurance activities", "Transportation and storage", and "Wholesale and retail trade: repair of motor vehicles and motorcycles", belong to the first group. In particular, "Transportation and storage" is the sector with the higher instability, instead "Wholesale and retail trade: repair of motor vehicles and motorcycles" reports the lower.

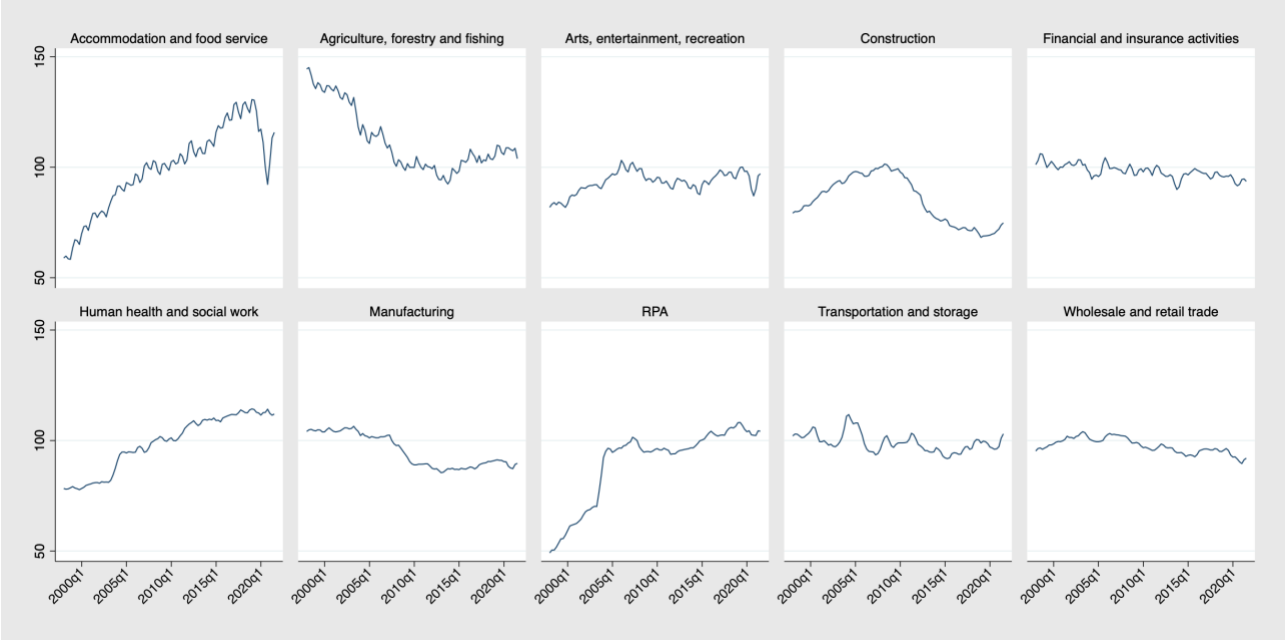
For "Accommodation and food service activities", "Arts, entertainment and recreation and other service activities", "Human health and social work activities", and "Real estate activities,

[58] See considerations in the previous section number 3.

[59] As already stated in the literature by Leiper and more in general in practice in the national accounts, the tourism industry includes also the retail sector (i.e., shopping activities). Unfortunately, in this study we are not able to account for the "Retail sector" because of availability of data. In fact, this last information, in the Eurostat database of which we make use, is included in the macro sector "Wholesale and retail trade: repair of motor vehicles and motorcycles" making data processing hard. Nevertheless, the analysis maintains a good level of reliability in the light of the relative weight of retail trade within such an industry. The Bank of Italy (2019), in the last report before the diffusion of the pandemic, by determining the value added by branch of tourism industries attributes to the retail sector a percentage of 6.1 in the general account of tourism industry. Obviously, the core branch of the sector is "Accommodation and food service activities" that obtains 55.6%.

professional, scientific and technical activities, administrative and support service activities", the graph shows a constant increase in employment.

Figure 4 – Employment trends for Italy's sectors from 1998 to 2021



Source: authors' elaboration on EU-LSF quarterly data. Data smoothed using the moving average technique.
Note: RPA: Real estate activities, professional, scientific and technical activities, administrative and support service activities

As expected, particular evidence emerges in the pandemic period in which from one side "Accommodation and food service activities" and "Arts, entertainment and recreation and other service activities" collapse, while on the other side "Human health and social work activities" maintain the same increasing trend.

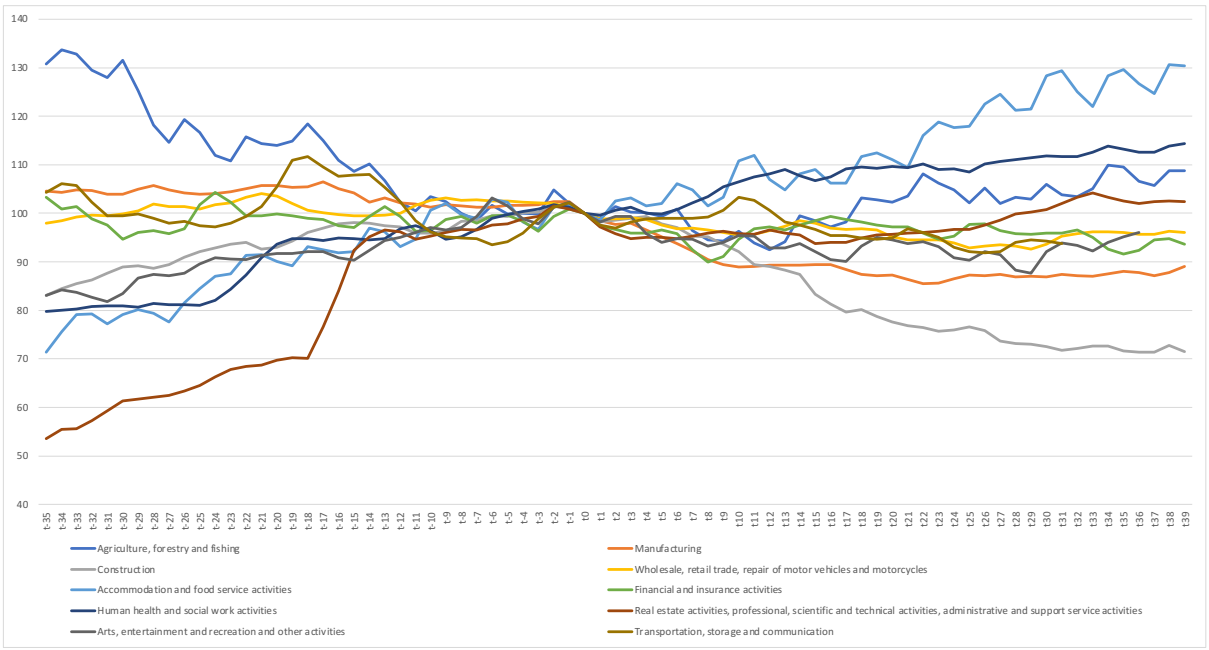
"Agriculture, forestry and fishing", "Construction" and "Manufacturing" are the sectors that experience the worst performance. All these sectors reduce the number of workers over time. In contrast to the others two sectors in this group, "Construction" represents the only industry that increase its figure for a limited time (from 1998 to 2010) just before the crisis collapse. "Agriculture, forestry and fishing", and "Manufacturing" maintain a relative stability after 2012.

In Figure 5, we complement the descriptive information provided above. We report the trends of employment quantity by sector, each one of them indexed to its own pre-shock peak value, for the sakes of cross-sector comparability.

Generally, Figure 5 confirms that sectors have reacted very differently to the shock. Some of them, for instance, "Accommodation and food service activities" and "Human health and social work activities" recover and improve with respect to precrisis periods; others like "Transportation and storage" and "Wholesale and retail trade: repair of motor vehicles and motorcycles" are experiencing

a long-run stagnation, with virtually no recovery like in the case of "Manufacturing" and "Construction". This latter represents a peculiar case, since it records an increasing trend until 2008 and after it obtains the worst results of the ten compared industries (see the grey line). A "fan-shaped" trend captures the reaction to the crisis of the different sectors. This has also given rise in some cases to among-sector divergent trends that appear to be persistent over time.

Figure 5 – Employment trends for Italy's sectors during the 2008 recession (preshock peak value=100)



Source: Authors' elaborations on EU-LSF quarterly data. Data smoothed using the moving average technique.
Note: All variations are measured as the percentage change with respect to the preshock peak value of each sector

Focussing on tourism-related industries, the heterogeneity among sectors is neat. "Accommodation and food service activities", and "Arts, entertainment, recreation and other service activities" report an increasing trend on the number of employees, although their respective curves are very dissimilar, while "Transportation and storage" recovers its previous levels: indeed, the increasing trend of "Accommodation and food service" is constant until the COVID-19 diffusion. Conversely "Arts, entertainment, recreation and other service activities" experiences a slight increasing trend until 2008 and after that experiences a general stability. "Accommodation and food service" industry represents a sector that improve its performance with respect to precrisis periods, whereas "Transportation and storage" seems to face a long-run stagnation, although this general trend is characterized by a particular volatility.

Moving to the empirical application of the two CIs, Table 2 reports the cross-sector variation in employment quantity measured against the six indicators, while Table 3 reports the results for the

qualitative dimension of employment. The partial rankings' values related to the indicators TCD and RCD for quality employment are reported in Appendix B. Table 4 summarizes the final ranking for both *CI_QUANT* and *CI_QUAL*.

In both tables 2 and 3, we have reported for each sector the value of the indicators and the respective position in the partial ranking *I*. The higher the value is, the higher the position in the relative ranking. We also report for each sector the geographic mean (*gM*) encompassing the six individual indicators and the associated final ranking for both the quantitative (*CI_QUANT*) and the qualitative (*CI_QUAL)* dimensions.

Concerning the synthetic quantitative index *CI_QUANT*, table 2 shows that the best performer is "Accommodation and food service activities", while the worst is "Construction". Looking at the synthetic qualitative index *CI_QUAL,* "Financial and insurance activities" reaches the best score while "Agriculture, forestry and fishing" the worst position in the ranking.

It is worth to note that "Accommodation and food service activities" ranks high in *CI_QUAL*, while "Construction" ranks as the worst sector also in *CI_QUANT*. This makes "Accommodation and food service activities" the overall best performing sector, while "Construction" the worst for both CIs.

"Human health and social work activities" and "Wholesale and retail trade: repair of motor vehicles and motorcycles" record a medium-high ranking position (respectively, the 2nd place in quantity and 6th in quality and *vice versa* for the case of wholesale and retail trade). Other two sectors achieve a medium-low classification: "Arts, entertainment, recreation and other service activities" (7th place in quantity and 5th in quality), "Transportation and storage" (5th rank in quantity and 7th in quality). "Real estate activities, professional, scientific and technical activities, administrative and support service activities", are the only industries that obtain the same place in both ranking, the fourth.

"Manufacturing", as it is the case of "Construction", experiences a negative performance both in terms of quantity and quality employment, scoring overall as the second last worst sector, after "Construction".

It is worth to zoom in on the partial ranking positions scored by each sector. On the quantitative side, "Accommodation and food service activities" obtain good results for what concerns industry drop velocity and industry recovery velocity; "Human health and social work activities" have the highest industry rebound rate and more in general high results of the indices; "Transportation and storage" shows the highest index regarding the velocity of the employment decline, while "Financial and insurance activities" have the highest value related to the counterfactual measure of the trough. "Construction" has the worst values nearly for every one of the six partial indicators.

Turning to the six quality indicators, the only sector - by the way the best performer - that records a good result across all of the indicators is "Financial and insurance activities". All the other industries show heterogeneous values. For instance, "Agriculture, forestry and fishing" have the worst result on the counterfactual measure of the rebound and on the industrial average employment and in contrast a relatively high trough-counterfactual difference ratio; "Construction" registers the lower drop velocity, and difference of the trough-counterfactual and a high industry rebound rate; "Transportation and storage" report a rebound velocity very low and the highest drop velocity, while "Manufacturing" has the lower industry rebound rate.

The analysis of the partial ranking for the four tourism-related industries highlights that:

1) "Transportation and storage" shows, on the quantitative side, the highest result for the IDV indicator, while a very low performance for the two counterfactual indices. Concerning the quality indicators, the rebound and the recovery velocity are very low;

2) "Accommodation and food service activities" performs very well on each single quantitative indicators by reaching the higher place in the ranking. On the qualitative side, the sector obtains medium results with a high industrial average employment performance;

3) For "Arts, entertainment and recreation and other service activities", it is important to remark how under the quantitative profile the sector obtains a low result in the industry rebound and in the recovery velocity indicators instead a very high performance for the rebound and a trough-counterfactual index on the qualitative side.

Table 2. Quantitative resilience: Building *CI_QUANT*

Sector	A												B	
	IR		***IDV***		***IRV***		***RCD***		***TCD***		$\bar{X}$		***gM***	***CI_QUANT***
	Value	***I***	**Value**	***I***	**Value**	***I***	**Value**	***I***	**Value**	***I***	**Value**	***I***		
Accommodation and food service activities	11.5	9	0.446	10	1.91	10	0.342	7	-0.169	8	100.4	10	8,92	**1**
Human health and social work activities	12.7	10	-0.282	8	1.36	9	0.810	9	-1.13	7	100.3	9	8,61	**2**
Agriculture, forestry and fishing	9.84	7	-0.757	4	1.25	8	2.35	10	7.42	9	91.4	4	6,57	**3**
Real estate activities, professional, scientific and technical activities, administrative and support service activities	4.45	5	-0.234	9	0.426	5	-0.684	6	-1.73	5	92.8	6	5,86	**4**
Transportation and storage	5.9	6	-4.04	1	0.49	6	0,80	8	14.77	10	96.2	8	5,33	**5**
Wholesale, retail trade, repair of motor vehicles and motorcycles	2.89	4	-0.486	7	0.217	4	-0.892	4	-2.69	4	95.7	7	4,29	**6**
Arts, entertainment, recreation and other service activities	2.2	2	-0.54	6	0.39	2	-0.78	5	-1.34	6	88.8	3	4,04	**7**
Financial and insurance activities	10.6	8	-1.16	2	1.17	7	-1.90	3	-9.53	1	91.6	5	3,45	**8**
Manufacturing	2.47	3	-0.622	5	0.218	3	-4.93	2	-7.73	2	87.3	2	2,38	**9**
Construction	-4.10	1	-1.08	3	-0.667	1	-2.51	1	-3.20	3	86.5	1	1,62	**10**

Source: Authors' elaboration based on Eurostat data. Notes: IR= Industry Rebound; IDV= Industry Drop Velocity; IRV= Industry Recovery Velocity; RCD= Rebound-Counterfactual Difference Ratio; TCD= Trough-Counterfactual Difference Ratio; $\bar{X}$= Industrial Average Employment gM = geometric mean

Table 3. Qualitative resilience: Building CI_QUAL

Sector	A										B	
	IR		***IDV***		***IRV***		***RCD***	***TCD***	$\bar{X}$			
	Value	***I***	**Value**	***I***	**Value**	***I***	***I***	***I***	**Value**	***I***	***gM***	***CI_QUAL***
Financial and insurance activities	-31,1	10	-3,93	9	-1,73	10	10	10	69,9	10	**10.00**	**1**
Wholesale, retail trade, repair of motor vehicles and motorcycles	7,7	5	-0,10	7	0,80	6	9	7	93,5	8	**6.85**	**2**
Accommodation and food service activities	2,6	6	0,72	3	1,44	5	7	4	88,5	9	**5.92**	**3**
Real estate activities, professional, scientific and technical activities, administrative and support service activities	-4,5	7	0,07	6	-1,12	9	6	3	106,7	2	**5.14**	**4**
Human health and social work activities	12,9	3	-1,93	8	1,99	3	2	9	95,0	6	**4.54**	**5**
Arts, entertainment, recreation and other service activities	-19,6	8	0,65	4	0,10	7	5	2	95,9	6	**3.73**	**6**
Manufacturing	22,7	1	0,25	5	3,02	2	4	6	99,4	5	**3.66**	**7**
Construction	-22,8	9	1,37	1	-0,47	8	3	1	106,4	3	**3.30**	**8**
Transportation and storage	15	2	-10,95	10	3,19	1	8	5	91,2	8	**3.15**	**9**
Agriculture, forestry and fishing	8,9	4	1,07	2	1,87	4	1	8	106,82	1	**2.70**	**10**

Source: Authors' elaboration based on Eurostat data.

Notes: IR= Industry Rebound; IDV= Industry Drop Velocity; IRV= Industry Recovery Velocity; RCD= Rebound-Counterfactual Difference Ratio; TCD= Trough-Counterfactual Difference Ratio; $\bar{X}$= Industrial Average Employment; gM = geometric mean

Table 4. *CI_QUANT* and *CI_QUAL* – all sectors

Sector	*CI_QUANT*	*CI_QUAL*
Accommodation and food service activities	**1**	**3**
Human health and social work activities	**2**	**6**
Agriculture, forestry and fishing	**3**	**10**
Real estate activities, professional, scientific and technical activities, administrative and support service activities	**4**	**4**
Transportation and storage	**5**	**7**
Wholesale, retail trade, repair of motor vehicles and motorcycles	**6**	**2**
Arts, entertainment, recreation and other service activities	**7**	**5**
Financial and insurance activities	**8**	**1**
Manufacturing	**9**	**8**
Construction	**10**	**9**

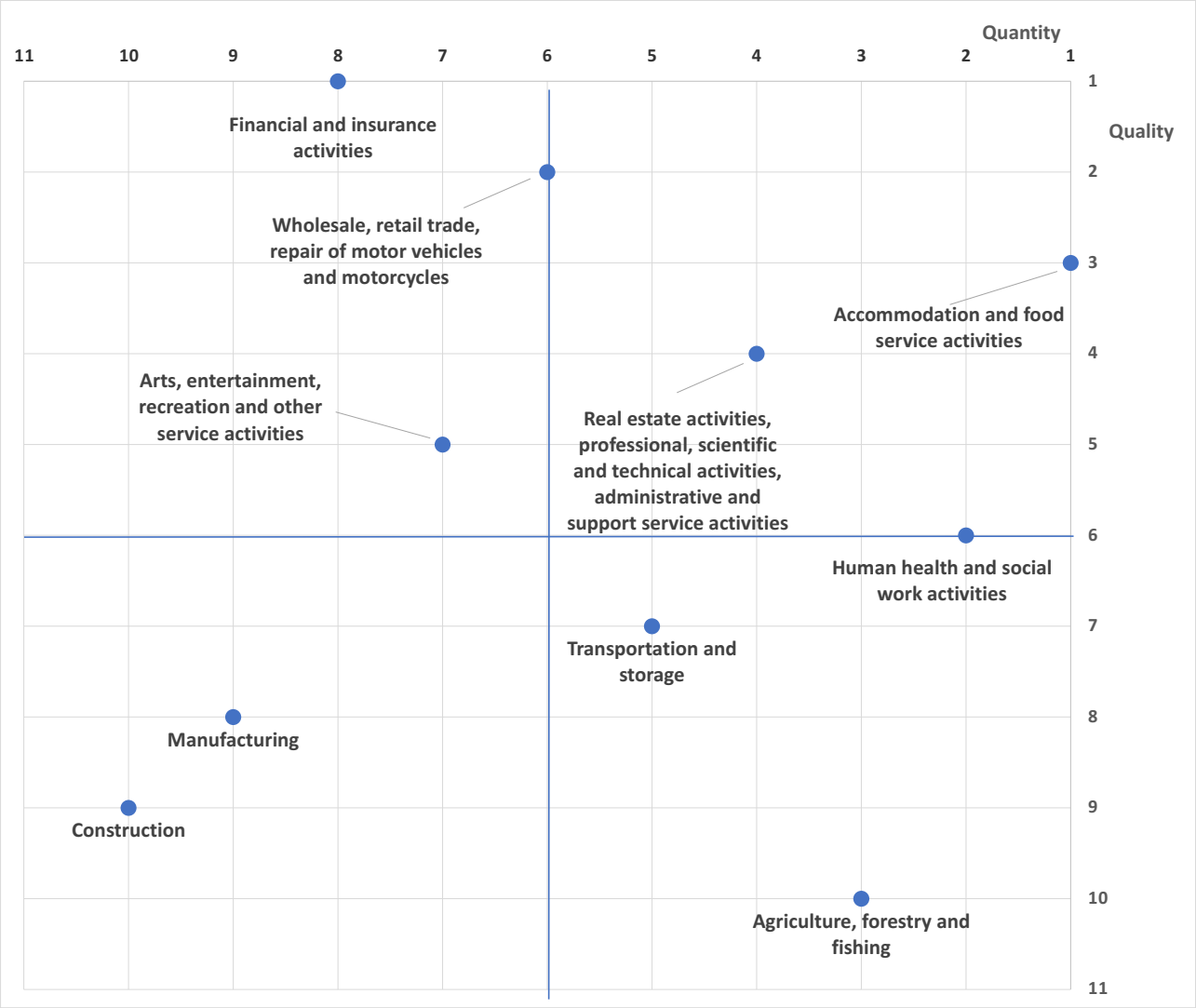
Source: Authors' elaboration based on Eurostat data

Figure 6 reports the matrix representing quantitative and qualitative resilience jointly. The main result emerging from the matrix is that sectors behave quite heterogeneously among them in terms of both employment quantity and quality. Indeed, all of the sectors under analysis are equally distributed across the matrix where in each quadrant lie at least two sectors. In two additional cases, we have sectors located on the border line: 1) "Wholesale and retail trade: repair of motor vehicles and motorcycles" between the first and second quadrant; and 2) "Human health and social work activities between first and fourth quadrant". Overall, sectors in the Italian economy show different postshock industry resilience capacities. Such a heterogeneity seems to take in some cases the form of a trade-off between the quantitative and the qualitative aspects of employment. In particular, it is worth to note that all of the sectors in the service industry are scattered on the first, second or fourth quadrant: this means that they have scored sufficiently good either on the quantitative or the qualitative side. Conversely, "Manufacturing" and "Construction" are the only industries located in the third quadrant, which means that they performed negatively for both quantity and quality employment.

Tourism-related industries show the same abovementioned dynamics. The three sectors are located on three different quadrants. "Accommodation and food service activities" show the overall best

performance (high in quantity and quality) lying on the first quadrant. "Arts, entertainment, recreation and other service activities" and "Transportation and storage" are located respectively in the second and in the fourth quadrant, scoring medium results on both dimensions. Specifically, these two sectors have indeed experienced opposite performance in terms of quality and quantity employment: while "Transportation and storage" has experienced a good performance in terms of quantity, "Arts, entertainment, recreation and other service activities" has done better on the qualitative side.

Figure 6. Matrix



Source: Authors' elaboration based on Eurostat data

4. Robustness Check

In order to test the robustness of the two CIs, we resort to uncertainty analysis (UA), which is a Monte Carlo simulation–based procedure applied to the formula defining the composite indicator. UA "focuses on how uncertainty in the input factors propagates through the structure of the composite

indicator and affects the composite indicator value" (JRC-EC, 2008; p.34), and it is frequently used to assess the synthetic index robustness. We follow Di Tommaso et al. (2022) and perform an uncertainty analysis where we assume that the major source of the uncertainty that might affect the CIs could arise from weights distributions. Indeed, we have assumed equal weights for each of the six indicators, although an inherent degree of uncertainty often surrounds weight values (Pontarollo and Serpieri, 2020; JRC-EC, 2008; Munda and Nardo, 2005). We thus perform a randomly weights perturbation to assess whether and to what extent our CIs could depend on the underling weights.

To perform the uncertainty analysis, we use the R software package COINr (Becker, 2021). We run 10,000 Monte Carlo simulations and obtain 10,000 alternative combinations of the input values that make up our CIs. COINr assumes equal probability for all alternatives, i.e., uniform distributions of the outcomes (Becker, 2021).

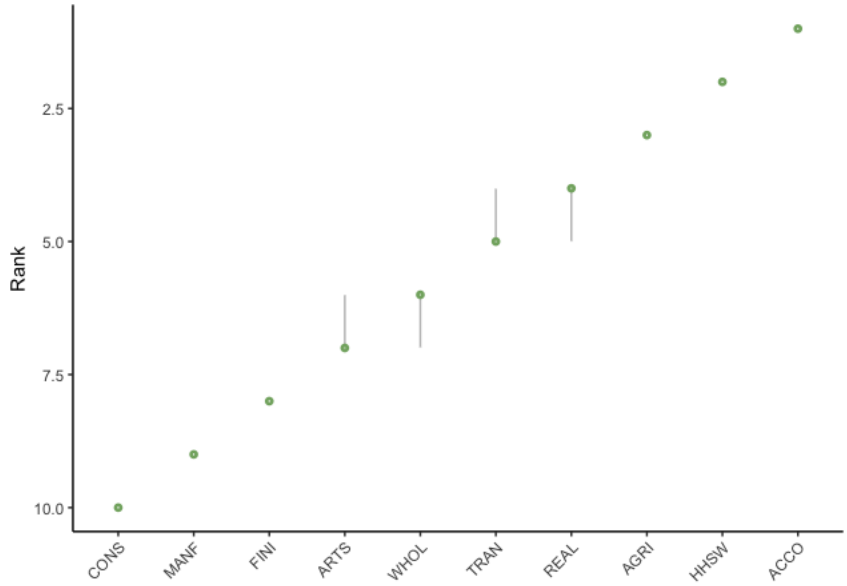
For each replication of the composite indicator, a random value is attributed to the weight ω_i', following the form (Becker, 2021):

$$\omega_i' = \omega_i + \epsilon_i, \epsilon_i \sim U[-\phi\omega_i, \phi\omega_i] \quad (3)$$

where ω_i is the nominal weight, ϵ_i is the added noise, and ϕ is a "noise factor". In our case, ϕ =0.3, which means that we let ω'_i vary between +/-30% of its nominal value, following a uniform distribution.

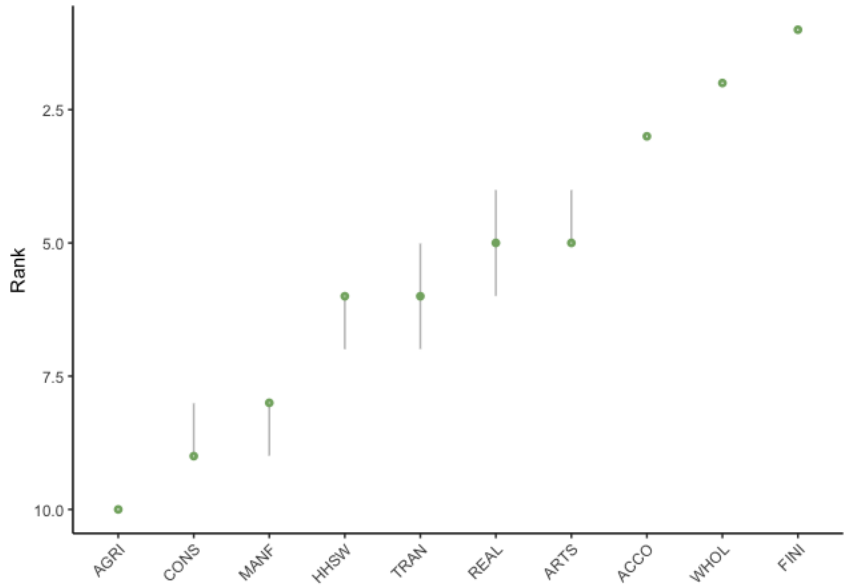
The results of the uncertainty analysis are reported in Figures 7 and 8. The graphs reports sectors' ranking positions and their associated uncertainty interval: the narrower the uncertainty interval, the more robust the ranking position. In other words, this means that the ranking position depends to the associated weight only to a limited extent, and thus it is reasonably independent form the CI design. Both figure 5 and 6 show that the CIs are sufficiently robust to weights perturbances. For both cases, the heads of the rankings are highly stable. For the intermediate positions, the confidence intervals tend to be generally narrow, with a maximum possible variation of only two positions. The tail of the ranking is highly stable for *CI_QUANT,* while it experiences limited variation (maximum one position) for *CI_QUAL*.

Figure 7: Uncertainty analysis on *CI_QUAN*



Source: Authors' elaboration
Note: The results show the median (green dot) and the corresponding 5th and 95th percentiles (bounds) of the distribution of sectors. Uncertain input factor: weights. Sector coding: AGRI - Agriculture, forestry and fishing; MANF – Manufacturing; CONS – Construction; WHOL – Wholesale and retail trade; repair of motor vehicles and motorcycles; ACCO - Accommodation and food service activities; TRAN - Transportation and storage; FINI - Financial and insurance activities; REAL - Real estate activities; Professional, scientific and technical activities; Administrative and support service activities; HHSW - Human health and social work activities; ARTS - Arts, entertainment and recreation; Other service activities.

Figure 8: Uncertainty analysis on *CI_QUAL*



Source: Authors' elaboration
Note: The results show the median (green dot) and the corresponding 5th and 95th percentiles (bounds) of the distribution of sectors. Uncertain input factor: weights. Sector coding: AGRI -

Agriculture, forestry and fishing; MANF – Manufacturing; CONS – Construction; WHOL – Wholesale and retail trade; repair of motor vehicles and motorcycles; ACCO - Accommodation and food service activities; TRAN - Transportation and storage; FINI - Financial and insurance activities; REAL - Real estate activities; Professional, scientific and technical activities; Administrative and support service activities; HHSW - Human health and social work activities; ARTS - Arts, entertainment and recreation; Other service activities.

5. Concluding remarks: main results, policy implications and research agenda

This paper is grounded in the debate on selective industrial policy, societal goals and government failures. As we have highlighted, both in the past and in our present, selective industrial policies are increasingly used by national and local governments to achieve - in that country and in that historical moment - national societal goals. However, industrial policies have showed to be complex and vulnerable interventions demanding robust and transparent tools able to justify government choices and to mitigate the potential rise of government failures. Such tools are even more required in our present and in the years to come, since an increasingly body of scholars contend that several challenges are upcoming in the near future and will probably threating our economies and societies, as the Covid-19 pandemic has recently done. In this context, government selective interventions have therefore to be justified according to their capacity of achieving specific normatively-defined societal goal. In this paper, have defined *industrial resilience,* as "*the way, the extent and the speed at which industries return to the previous state, trend or trajectory after a shock, thus achieving a full or a partial recovery"* and we contend that it should be considered a desirable national societal goal and thus an equally desirable policy goal. Indeed, from the perspective discussed in this paper, industry resilience represents a desirable societal goal for it values the ability of an industry to withstand a shock and recover in its aftermath, thus preserving or even improving the economic and social conditions of the system.

In this view, in this study we have built upon previous studies (Di Tommaso et al. 2022) to test innovative methodologies able to guide and support policymakers with the process of industry selection. Specifically, we have developed and applied a methodology to measure *industry resilience,* showing how different sectors react to shocks. The information retrieved by such a methodology offer - during the complex process of policy design and implementation where a plurality of actors and stakeholder are involved - solid evidences on the rationales of the intervention, lowering the risk of "internal and external government failures" highlighted in the introduction paragraph.

We have focused on the case of Italy and measured industry resilience in the aftermath of the 2008 shock, devoting particular attention to tourism-related industries.

The general evidence, as showed in Figure 6, is that industries reacted heterogeneously in response to the 2008 shock. This means that sectors display different capacities of dealing with employment

retention and good quality jobs. This reinforces the idea that policy-makers should be aware of such different postshock sectoral behaviors when framing industrial policy intervention aiming at supporting the resilience of our economies and societies. Indeed, such information would support policymakers to carefully select policy targets coherently with the policy goal, while increasing transparency in terms of accountability to citizens and social stakeholders.

Overall, the ranking and their visualization through the industry resilience matrix we have elaborated (figure 6) enables a novel *modus operandi* (Di Tommaso et al 2020; Di Tommaso et al. 2022) for the design and implementation of industrial policy, since it represents a valuable tool informing decision-makers on sectors' reactions to shocks. On the basis of the information provided the matrix, policymakers can ground policy intervention in favour of specific sectors/industries on novel rationales: for instance, they can decide to support the most resilient sectors because of their potential capacity of fostering wider dimensions of economic and social resilience; or, on the contrary, they could resolve to invest in those sectors that have proved to be scarcely resilient to shocks, with the attempt to make the economy and the society more resilient as a whole.

However, on a more general level, it is important to clarify that the value of the methodology and of the illustrative exercise presented do not lie in the specific rankings we presented, but it is rather grounded into the idea that robust and transparent methodologies for sectors selection matter for policymaking. Indeed, sectors' rankings may vary according to different societal goals, but what is important is that such rankings represent an informative basis to support decision-making to communicate – both to internal and external actors and stakeholders – why some sectors could be preferable over other. In this perspective, such methodologies contribute to mitigate the rise of potential government failures, while increasing policy transparency and social accountability.

Concerning tourism-related industries, the quantity and quality performances displayed by the CIs point to a high heterogeneity in terms of their respective ranking positions. The overall matrix (figure 6) reveals different degrees of resilience characterizing tourism-related industries: this would suggest policymakers that policy initiatives targeting tourism should be crafted taking into the account the specificities - included their individual *industry resilience* capacity – of the sectors that make up the tourism industry.

However, customizing industrial policy intervention (also) according to their postshock *industry resilience* capacity might entail the involvement of a multitude of actors and stakeholders in the policy design and implementation; the latter, through lobbying activities and rent-seeking behavior, could eventually oppose a genuine recovery and adaptation of the sector after the shock, drifting the sectoral trajectory away from a desirable transformation. Policymakers should take into account this risk and act accordingly to avoid the rise of this kind of government failure.

Overall, *industry resilience* represents one among many *modus operandi* (Di Tommaso et al. 2020a) that can be used for and by governments designing and implementing industrial policies; however, it is a one that in current times of increasing global challenges and potential economic shock seems particularly relevant for supporting the resilience of our economies and societies.

The paper has some limitations. First, the variable takes into consideration relate to employment, according to Di Tommaso et al. (2022). We do not look, instead, at other possible aspects of the phenomenon related to value added or production. This is a research trajectory that future studies might pursue to enrich the concept of *industry resilience.* Other limitations refer to the possibility of analyzing Italian sub-sectors that make up the wider industry level accounted for in this paper. This has not been possible due to the lack of data and breaks in time series for both employment quantity and quality. Third, our results are context specific, refer to a marker economy and can not be generalized, for instance, to other economic systems, for instance that of a developing country. Future research could test this methodology against other economic system, such as China, or focus on more limited geographical levels, such as region/province.

Moreover, while we have offered a contribution on how to measure industrial resilience, future studies are needed to identify the industry-level determinants of resilience, which could depend upon a number of factors, including the organization of production, the structure of the production network, and technological endowments (OECD, 2021; Scazzieri, 2021; Li et al., 2022). In this stream, an interesting analysis could be carried on different tourism destinations at a national or regional level and consequently by encompassing also their different stage of the life-cycle (e.g., introduction, growth, maturity, and decline). Further, another interesting and under investigated domain refers to the performances of tourism-dependent regions or the estimation of the weight of tourism in the overall resilience results of these territories. A pioneering study of Watson and Deller (2022), for instance, find that a greater dependency enhance economic resilience.

Finally, further research could expand on this evidence by exploring the industry resilience of sectors facing shocks of a different nature and transmission mechanisms like for example in the case of COVID-19 pandemic. Of course, this latter point call for actions from governments. The tourism industry, as argued by Assaf and Scuderi (2020), needs for credible measures from governments to generate market confidence and reduce the risks by incentivizing sustainable recovery and innovation. Clearly, there is also space for questioning the ways through which policy-makers should include tourism into their development strategies on innovation.

References

Alkire, S., and Santos, M. E. (2014). Measuring acute poverty in the developing world: Robustness and scope of the multidimensional poverty index. *World Development*, *59*, 251-274.

Alpert, D., Ferry, J., Hockett, R. C., and Khaleghiyan, A. (2019). The US Private Sector Job Quality Index. *Cornell Legal Studies Research Paper*, (20-33).

Assaf, A., & Scuderi, R. (2020). COVID-19 and the recovery of the tourism industry. *Tourism Economics*, *26*(5), 731-733.

Bailey, D., Clark, J., Colombelli, A., Corradini, C., De Propris, L., Derudder, B., ... & Usai, S. (2020). Regions in a time of pandemic. *Regional Studies*, *54*(9), 1163-1174.

Banca d'Italia, (2019). Turismo in Italia: numeri e potenziale di sviluppo (transl. *Tourism in Italy: figures and potential of development*). *Quaderni di Economia e finanza (Occasional papers)*, 505, 7-111. Retrieved from: https://www.bancaditalia.it/pubblicazioni/qef/2019-0505/QEF_505_19.pdf

Bang, G. (2010). Energy security and climate change concerns: Triggers for energy policy change in the United States?. *Energy policy*, *38*(4), 1645-1653.

Barbieri, E., Di Tommaso, M.R., Pollio, C., Rubini, L., 2019. Industrial policy in China: The planned growth of specialised towns in Guangdong province. Camb. J. Reg., Econ. Soc. doi: 10.1093/cjres/rsz012

Becker W, Paruolo P, Saisana M, Saltelli A. (2015). Weights and importance in composite indicators: mind the gap. In: Ghanem R, Higdon D, Owhadi H, editors. Handbook of uncertainty quantification. Cham: Springer.

Becker, W., (2021). Composite Indicator Development and Analysis in R with COINr, https://bluefoxr.github.io/COINrDoc/

Bellandi, M., Giannini, V., & Iacobucci, D. (2022). La Missione 1 del pnrr: quali opportunità da cogliere e barriere da superare?. *L'industria*, *43*(2), 227-244.

Bellini, N., Grillo, F., Lazzeri, G., & Pasquinelli, C. (2017). Tourism and regional economic resilience from a policy perspective: Lessons from smart specialization strategies in Europe. *European Planning Studies*, *25*(1), 140-153.

Brown, L., and Greenbaum, R. T. (2017). The role of industrial diversity in economic resilience: An empirical examination across 35 years. *Urban Studies*, *54*(6), 1347-1366.

Buigues, P.A. , Sekkat, K. , 2009. Industrial Policy in Europe. Japan and the USA. Amounts, Mechanisms and Effectiveness. Palgrave Macmillan.

Canova, F., Coutinho, L., and Kontolemis, Z. G. (2012). *Measuring the macroeconomic resilience of industrial sectors in the EU and assessing the role of product market regulations* (Vol. 112). Publications Office of the European Union.

Cardinale, R. , 2019. Theory and practice of State intervention: Italy, South Korea and stages of economic development. Struct. Change Econ. Dyn. Volume 4p, pp, 206–216 .

Cardinale, I. (2019). Vulnerability, resilience and 'systemic interest': a connectivity approach. *Networks and Spatial Economics*, 1-17.

Cardinale, I. , 2017. Sectoral interests and 'systemic' interest: towards a structural po- litical economy of the Eurozone. In: Cardinale, I., Coffman, D., Scazzieri, R. (Eds.), The Political Economy of the Eurozone. Cambridge University Press, Cambridge, pp. 216–237 .

Cellini, R., & Cuccia, T. (2015). The economic resilience of tourism industry in Italy: What the 'great recession' data show. *Tourism Management Perspectives*, *16*, 346-356.

Chang, H.-J. , 1994. The Political Economy of Industrial Policy. St. Martin's Press, New York .

Chang, H.-J. , 2011. "Industrial policy: can we go beyond an unproductive confrontation? In: Lin, J.Y., Pleskovic, B. (Eds.), Global: Lessons from East Asia and the Global Financial Crisis. World Bank, Washington DC .

Cheng, L., & Zhang, J. (2020). Is tourism development a catalyst of economic recovery following natural disaster? An analysis of economic resilience and spatial variability. *Current Issues in Tourism*, *23*(20), 2602-2623.

Cortes, G. M., & Forsythe, E. (2020). Heterogeneous Labor Market Impacts of the COVID-19 Pandemic. *ILR Review*, 00197939221076856.

Crescenzi, R., Luca, D., and Milio, S. (2016). The geography of the economic crisis in Europe: national macroeconomic conditions, regional structural factors and short-term economic performance. *Cambridge Journal of Regions, Economy and Society*, *9*(1), 13-32.

Davies, S. (2011). Regional resilience in the 2008–2010 downturn: comparative evidence from European countries. *Cambridge Journal of Regions, Economy and Society*, *4*(3), 369-382.

Di Tommaso, M.R. , Schweitzer, S.O. , 2013. Industrial policy in America. Industrial policy in America. Breaking the Taboo, Cheltenham, UK and Northampton. Ed- ward Elgar, MA, USA

Di Tommaso, M. R., Tassinari, M., Bonnini, S., and Marozzi, M. (2017). Industrial policy and manufacturing targeting in the US: New methodological tools for strategic policy-making. *International Review of Applied Economics*, *31*(5), 681-703.

Di Tommaso, M.R. , Tassinari, M. , Bonnini, S. , Marozzi, M. , 2017. Industrial policy and manufacturing targeting in the US: new methodological tools for strategic policy-making. Int. Rev. Appl. Econ. 31 (no. 5) .

Di Tommaso, M. R. (2020). Una strategia di resilienza intelligente per il dopo coronavirus. Sulla centralità della domanda e offerta di politica industriale. *L'industria*, *41*(1), 3-20.

Di Tommaso, M. R., Tassinari, M., Barbieri, E., & Marozzi, M. (2020a). Selective industrial policy and 'sustainable'structural change. Discussing the political economy of sectoral priorities in the US. *Structural change and economic dynamics*, *54*, 309-323.

Di Tommaso, M.R. , Tassinari, M. , Ferrannini, A. , 2020b. Industrial policy and societal goals. In: Pressman, S. (Ed.), A new look at the American case (from Hamilton to Obama and Trump). How Social Forces Impact the Economy, Routledge ISBN 9780367439002

Di Tommaso, M. R., Prodi, E., Pollio, C., & Barbieri, E. (2022). Conceptualizing and measuring "industry resilience": Composite indicators for postshock industrial policy decision-making. *Socio-Economic Planning Sciences*, 101448.

Earvolino-Ramirez, M. (2007), Resilience: A Concept Analysis, *Nursing Forum 42*(2), 73–82.

Emmerling J., Furceri D., Libano Monteiro F., Loungani P., Ostry J.D., Pizzuto P., Tavoni M., (2021), Will the Economic Impact of COVID-19 Persist? Prognosis from 21st Century Pandemics, IMF Working Papers, No. 2021/119

Ezcurra, R., and Rios, V. (2019). Quality of government and regional resilience in the European Union. Evidence from the Great Recession. *Papers in Regional Science*, *98*(3), 1267-1290

Filippetti, A., Gkotsis, P., Vezzani, A., and Zinilli, A. (2020). Are innovative regions more resilient? Evidence from Europe in 2008–2016. *Economia Politica*, *37*(3), 807-832.

Fingleton, B., Garretsen, H., and Martin, R. (2012). Recessionary shocks and regional employment: evidence on the resilience of UK regions. *Journal of regional science*, *52*(1), 109-133.

Girardi, D. (2012). The construction sector in Italy, crisis and change. *MPRA Paper*, (49901).

Hall, R., Feldstein, M., Frankel, J., Gordon, R., Romer, C., Romer, D., and Zarnowitz, V. (2003). *The NBER's Business-Cycle Dating Procedure*. Business Cycle Dating Committee, National Bureau of Economic Research.

Han, Y., and S. J. Goetz. (2015). The Economic Resilience of US Counties during the Great Recession. *The Review of Regional Studies 45*(2): 131–149.

Han, Y., and Goetz, S. J. (2019). Predicting US county economic resilience from industry input-output accounts. *Applied Economics, 51*(19), 2019-2028.

Hirschman AO (1958) The strategy of economic development. Yale University Press, New Haven

Hynes, W., Trump, B., Love, P., & Linkov, I. (2020). Bouncing forward: a resilience approach to dealing with COVID-19 and future systemic shocks. *Environment Systems and Decisions*, *40*(2), 174-184.

ILO (International Labour Office) (2015). *Non-standard forms of employment*. International Labour Office, Geneva.

Jewell, J., Vinichenko, V., McCollum, D., Bauer, N., Riahi, K., Aboumahboub, T., ... & Cherp, A. (2016). Comparison and interactions between the long-term pursuit of energy independence and climate policies. *Nature Energy*, *1*(6), 1-9

Joint Research Centre-European Commission (JRC-EC). (2008). *Handbook on constructing composite indicators: methodology and user guide*. OECD publishing.

Kalleberg, A. L. (2011). *Good jobs, bad jobs: The rise of polarized and precarious employment systems in the United States, 1970s-2000s*. Russell Sage Foundation.

Krueger, A.O. , 1990. "Government failures in development. J. Econ. Perspect. 4 (3), 9–23 .

Lagravinese, R. (2015). Economic crisis and rising gaps North–South: evidence from the Italian regions. *Cambridge Journal of Regions, Economy and Society*, *8*(2), 331-342.

Landini, F., and Ferrannini, A. (2022). Politiche e investimenti per l'inclusione e la coesione nel Piano Nazionale di Ripresa e Resilienza: analisi critica dell'approccio, degli obiettivi e delle strategie d'intervento. *L'industria*, *43*(3), 381-402.

Le Grand J. (1991), The theory of government failure, Br. J. Political Sci., 21, 4, pp. 423-442.

Lee, Y. J. A., Kim, J., Jang, S., Ash, K., & Yang, E. (2021). Tourism and economic resilience. *Annals of Tourism Research*, *87*(C).

Leiper, N. (1979). The framework of tourism: Towards a definition of tourism, tourist, and the tourist industry. *Annals of tourism research*, 6(4), 390-407.

Longstaff, P. H. (2009). Managing Surprises in Complex Systems: Multidisciplinary Perspectives on Resilience. *Ecology and Society, 49*(1), 49.

Marozzi, M. (2015). Measuring trust in European public institutions. *Social Indicators Research*, *123*(3), 879-895.

Marshall, A. (1890). *Principle of economics*. London: Macmillan

Martin, R. L. (2012). Regional economic resilience, hysteresis and recessionary shocks. *Journal of Economic Geography, 12*(1), 1-32.

Mazzola, F., Pizzuto, P., & Ruggieri, G. (2019). The role of tourism in island economic growth and resilience: A panel analysis for the European Mediterranean countries (2000–2015). *Journal of Economic Studies*.

Mazzucato, M. , 2013. The Entrepreneurial State. Debunking Public vs. Private Sector Myths. Anthem Press, London, New York

Moss, S. (1984). The History of the Theory of the Firm from Marshall to Robinson and Chamberlin: The Source of Positivism in Economics. *Economica*, New Series, *51*(203), 307-31.

Munda G. and Nardo M. (2005), Constructing Consistent Composite Indicators: the Issue of Weights, EUR 21834 EN, Joint Research Centre, Ispra.

Ngo, C.N., Di Tommaso, M. R., Tassinari, M., and Dockerty, J. M. (2021). The future of work: Conceptual considerations and a new analytical approach for the political economy. *Review of Political Economy*, 10.1080/09538259.2021.1897750

Nivola, P. S. (2008). Rethinking" energy Independence, Brookings, available at: https://www.brookings.edu/wp-content/uploads/2016/06/1230_energy_nivola.pdf.

OECD. (2021). *Strengthening Economic Resilience Following the COVID-19 Crisis: A Firm and Industry Perspective*, OECD, Publishing, Paris, https://doi.org/10.1787/2a7081d8-en.

Pascariu, G. C., Ibănescu, B. C., Nijkamp, P., & Kourtit, K. (2021). Tourism and Economic Resilience: Implications for Regional Policies. In *Tourism and Regional Science* (pp. 129-147). Springer, Singapore.

Perani, G., & Cirillo, V. (2015). *Matching industry classifications. A method for converting Nace Rev. 2 to Nace Rev. 1* (No. 1502).

Pichon, E., Widuto, A., Dobreva, A and Jensen, L. (2020). Ten composite indices for policy-making, European Parliamentary Research Service, available at: https://www.europarl.europa.eu/RegData/etudes/IDAN/2021/696203/EPRS_IDA(2021)696203_EN.pdf

Polenske, K. R., & Sivitanides, P. (1990). Linkages in the construction sector. *The Annals of Regional Science*, *24*(2), 147-161.

Pollio, C., and Rubini, L. (2019). Who drives the automotive sector? Thailand selective policies. *International Journal of Emerging Markets, 16*(2), 370-390.

Prodi, E. (2022), La collaborazione tra ricerca e imprese in Italia e in Germania: analisi e implicazioni di politica industriale per il PNRR. *L'industria*, *43*(4), *forthcoming*.

Pontarollo, N. and Serpieri, C. (2020). A composite policy tool to measure territorial resilience capacity, *Socio-Economic Planning Sciences*, *70,* C, 100669.

Raid, R., and Botterill, L. C. (2013). The Multiple Meanings of 'Resilience': An Overview of the Literature. *Australian Journal of Public Administration*, *72*(1), 31–40.

Reggiani, A. (2013) Network resilience for transport security: some methodological considerations. *Transport Policy*, *28*, 63–68

Romao, J., Guerreiro, J., & Rodrigues, P. M. (2016). Tourism growth and regional resilience: The 'beach disease'and the consequences of the global crisis of 2007. *Tourism Economics*, *22*(4), 699-714.

Saisana, M. , Saltelli, A. , Tarantola, S., (2005). Uncertainty and sensitivity analysis tech- niques as tools for the quality assessment of composite indicators. Journal of the Royal Statistical Society: Series A (Statistics in Society), *168*, 307–323.

Scazzieri, R. , Baranzini, M. , Rotondi, C. , 2015. 'Resources, scarcities and rents: tech- nological interdependence and the dynamics of socio-economic structures'. In: Baranzini, M., Rotondi, C., Scazzieri, R. (Eds.), Resources, Production and Structural Dynamics. Cambridge University Press, Cambridge, pp. 427–484 .

Silvestri, F., Lepore, D., Spigarelli, F., & Rubini, L. (2022). Transizione ecologica nel pnrr: alcune riflessioni sui processi di cambiamento e innovazione. *L'industria*, *43*(3), 403-423.

Schuck, P. , 2014. Why government fails so often and how it can do better. Princeton University Press, Princeton

Tassinari, M., 2019. Capitalizing Economic Power in the US. Industrial Strategy in the Neoliberal Era, International Political Economy Series. Palgrave Macmillan, Cham https://doi.org/10.1007/978- 3- 319- 76648- 5 _ 1

Terkaj, W., & Tolio, T. (2019). The Italian flagship project: factories of the future. In *Factories of the Future* (pp. 3-35). Springer, Cham.

UNDP. (2021). *Human Development Report 2020*. Available at: http://hdr.undp.org/sites/default/files/hdr2020.pdf

Watson, P., & Deller, S. (2022). Tourism and economic resilience. *Tourism Economics*, *28*(5), 1193-1215.

Contributions:

Elena Prodi: Data curation, Methodology, Investigation; Formal Analysis; Writing - Original Draft; Writing – Review & Editing; **Vincenzo Fasone:** Conceptualization; Writing - Original Draft; Writing – Review & Editing; Supervision; **Marco R. Di Tommaso:** Methodology, Writing - Original Draft; Writing – Review & Editing;

APPENDIX A

In order to identify the different sectors, in this study we refer to the Statistical Classification of Economic Activities (NACE). In the timespan of our analysis Eurostat provide two different classifications NACE Rev.1 and NACE Rev.2. The first refers to the period 1998-2008 and the second the range 2008-to date. Accordingly, data collection from the EU-LFS has experienced an effort to align the two series. Indeed, Eurostat provides correspondence tables to facilitate conversion between the two-coding system at 1 digit level (Table 1A). Some sectors find a direct correspondence, as it is the case for the sectors in bold.

Table 1A - Correspondence table between sections of NACE Rev 1.1 and NACE Rev. 2

NACE Rev. 1.1		NACE Rev. 2	
Section	*Description*	*Section*	*Description*
A	**Agriculture, hunting and forestry**	**A**	**Agriculture, forestry and fishing**
B	**Fishing**		
C	Mining and quarring	B	Mining and quarrying
D	**Manufacturing**	**C**	**Manufacturing**
E	Electricity, gas and water supply	D E	Electricity, gas, steam and air conditioning supply Water supply, sewerage, waste management and remediation activities
F	**Construction**	**F**	**Construction**
G	**Wholesale and retail trade: repair of motor vehicles, motorcycles and personal and household goods**	**G**	**Wholesale and retail trade; repair of motor vehicles and motorcycles**
H	**Hotels and restaurants**	**I**	**Accommodation and food service activities**
I	Transport, storage and communications	H J	Transportation and storage Information and communication
J	**Financial intermediation**	**K**	**Financial and insurance activities**
K	Real estate, renting and business activities	L M N	Real estate activities Professional, scientific and technical activities Administrative and support service activities
L	Public administration and defence; compulsory social security	O	Public administration and defence; compulsory social security
M	Education	P	Education
N	**Health and social work**	**Q**	**Human health and social work activities**
O	Other community, social and personal services activities	R S	Arts, entertainment and recreation Other service activities
P	Activities of private households as employers and undifferentiated production activities of private households	T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
Q	Extraterritorial organisations and bodies	U	Activities of extraterritorial organisations and bodies

Source: Eurostat – available at: https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF
Note: sectors highlighted in bold in column NACE rev. 2 are those used in this paper.

In terms of employment levels, sectoral correspondences can be observed in Table 2A. Indeed, only for the year 2008, employment levels are reported in the EU-LFS for both Nace Rev. 1.1 and Nace Rev. 2. For the abovementioned sectors, we are thus able to observe that changes in the employment levels categorized through the Nace Rev. 2 classification with respect to the Nace Rev. 2: as we can see from Table 2A, delta variations are very limited, thus allowing correspondences.

Table 2A - % variation between Nace Rev.2 and Nace Rev. 1.1.

	2008Q1	2008Q2	2008Q3	2008Q4	AVERAGE 2008
	Δ%	**Δ%**	**Δ%**	**Δ%**	
Agriculture, forestry and fishing	-4,2 %	-3,4 %	-2,7 %	-3,0 %	-3,3 %
Manufacturing	-2,8 %	-2,7 %	-2,8 %	-3,0 %	-2,8 %
Construction	1 %	0,9 %	0,7 %	0,7 %	0,8 %
Wholesale and retail trade; repair of motor vehicles and motorcycles	-1,1%	-0,8 %	-1,00%	-1,00%	-1 %
Accommodation and food service activities	0 %	0 %	0,00%	0,00%	0 %
Financial and insurance activities	0 %	0,1%	0,32%	0,35%	0,1 %
Real estate activities; Professional, scientific and technical activities; Administrative and support service activities	-7 %	-6,4 %	-6,38%	-7,70%	-6,8 %
Human health and social work activities	-1,0 %	-0,8 %	-1,1 %	-1,0 %	-1,0 %
Arts, entertainment and recreation and other services activities	-9,7 %	-7,5 %	-7,2 %	-9,2 %	-8,4 %
Transportation and storage	0,4 %	0,2 %	0,4 %	0,5 %	0,4 %

Source: authors' elaboration on EU-LFS data
Note: Nace Rev. 1.1 considered as basis.

Conversely, in some cases how Perani and Cirillo (2015) argue it is harder to convert data from Nace Rev.2 to Nave Rev.1.1 or *viceversa* (for instance for: Nace Rev. 1.1 "K - Real estate, renting and business activities", Nace Rev. 1.1 "I - Transport, storage and communications" and Nace Rev. 1.1 "O - Other community, social and personal services activities").

There is little or no information on the share of an "old" industry that is transferred to different "new" ones. Thus, for the Nace Rev. 1.1 "K - Real estate, renting and business activities", we have found a sufficiently good correspondence (Table 2A) by adding up Nace Rev.2 "L - Real estate activities", "M - Professional, scientific and technical activities" and "N - Administrative and support service activities".

For what concerns the Nace Rev. 1.1 "I - Transport, storage and communications" and the Nace Rev. 1.1 "O - Other community, social and personal services activities", we have proceeded differently.

For Nace Rev. 1.1 "I - Transport, storage and communications", we found good correspondence with Nace Rev. 2 "H -Transportation and storage", when we drop the communication-related subsectors and those related to transportation support in the former. In order to do so, we have looked at the composition of the subsectors at the two-digit level that made up both Nace Rev. 1.1 "I - Transport,

storage and communications" and Rev. 2 "H- Transportation and storage". Table 3A and 4A illustrate the respective activities.

Table 3A – Two-digit sub-sectors kept (green color) and dropped (red color) in Rev. 1.1 "I - Transport, Storage and Communication"

NACE_R1/TIME	2008Q1	2008Q2	2008Q3	2008Q4
I-60 Land transport and transport via pipelines	543,8	556,1	562,9	566,9
I-61 Water transport	28,3	34,4	31,1	31,0
I-62 Air transport	28,2	32,3	39,4	46,2
I-63 Supporting and auxiliary transport activities; activities of travel agencies	285,9	299,3	305,2	269,6
I-64 Post and telecommunications	350,5	361,7	353,8	336,2

Source: Authors' elaboration on EU-LFS data

Table 4A – Two-digit sub-sectors kept (green color) and dropped (red color) in Rev. 2 "H – Transport and Storage"

NACE_R2/TIME	2008Q1	2008Q2	2008Q3	2008Q4
H-49 Land transport and transport via pipelines	546,5	557,7	566,1	570,6
H-50 Water transport	28,3	34,4	30,9	30,8
H-51 Air transport	28,2	32,3	39,4	46,2
H-52 Warehousing and support activities for transportation	227,8	243,9	236,8	220,4
H-53 Postal and courier activities	191,9	210,8	198,3	189,6

Source: Authors' elaboration on EU-LFS data

For the sake of our analysis, we therefore retain only the subsectors "Land transport; transport via pipelines", "Water transport" and "Air transport" for both sector classifications, given the perfect correspondence. In other words, the Rev. 2 "H - Transportation and storage" sector (whose data goes from 2008 and 2021) and the sectors Rev. 1.1 "I - Transport, storage and communications" (whose data span from 1998 to 2007) are considered correspondent in this study under the condition that both classifications include only the following three subsectors: "Land transport; transport via pipelines", "Water transport" and "Air transport".

We have proceeded in a similar way also for the Nace Rev. 1.1 "O - Other community, social and personal services activities" and Nace Rev. 2 "R - Arts, entertainment and recreation" and "S - Other service activities".

Nace Rev. 1.1 "O - Other community, social and personal services activities" corresponds sufficiently good to the sum of Nace Rev. 2 "R - Arts, entertainment and recreation" and Nace Rev. 2 "S - Other service activities", under the condition that we drop the activity "O-90 Sewage and refuse disposal, sanitation and similar activities" from the former and "S-95 Repair of computers and personal and household goods" from the latter.

Hence, we add up the sectors Rev. 2 "R - Arts, entertainment and recreation" and "S - Other service activities" (whose data goes from 2008 and 2021): their sum corresponds sufficiently good to Rev 1.1 "O - Other community, social and personal services activities (whose data span from 1998 to 2007) only under the condition that we keep matching subsectors while dropping the following subsectors: "O-90 Sewage and refuse disposal, sanitation and similar activities" from the latter and "S-95 Repair of computers and personal and household goods" from the former. Table 5A and 6A illustrate the respective activities.

Table 5A – Two-digit sub-sectors kept (green color) and dropped (red color) in Rev 1.1 "O - Other community, social and personal services activities"

NACE_R1/TIME	2008Q1	2008Q2	2008Q3	2008Q4
O-90 Sewage and refuse disposal, sanitation and similar activities	144,9	155,5	160,4	156,7
O-91 Activities of membership organization n.e.c.	171,0	176,7	166,9	165,7
O-92 Recreational, cultural and sporting activities	292,3	320,9	324,4	297,0
O-93 Other service activities	439,0	475,4	499,3	437,9
Total (without O-90)	902,3	973,0	990,6	900,6

Source: Authors' elaboration on EU-LFS data

Table 6A - Two-digit sub-sectors kept (green color) and dropped (red color) in in Rev. 2 "R - Arts, entertainment and recreation" and "S - Other service activities"

NACE_R2/TIME	2008Q1	2008Q2	2008Q3	2008Q4
R-90 Creative, arts and entertainment activities	60,1	75,3	90,6	78,1
R-91 Libraries, archives, museums and other cultural activities	35,7	47,2	42,8	39,2
R-92 Gambling and betting activities	25,9	31,4	23,0	17,9
R-93 Sports activities and amusement and recreation activities	93,2	105,7	109,6	93,6
S-94 Activities of membership organisations	158,5	164,5	153,8	151,0
S-95 Repair of computers and personal and household goods	95,3	93,2	92,9	95,8
S-96 Other personal service activities	441,0	475,4	499,3	437,9
Total (without S-95)	814,4	899,5	919,1	817,7

Source: Authors' elaboration on EU-LFS data

Then, overall, we consider the following sectors (according to the NACE rev 2 classification), which can be considered to have a correspondent sector in the NACE rev. 1.1 classification:

1) A – Agriculture, forestry and fishing

2) C – Manufacturing

3) F – Construction

4) G – Wholesale and retail trade; repair of motor vehicles and motorcycles

5) I – Accommodation and food service activities

6) H – Transportation and storage (H-49 Land transport and transport via pipelines, H-50 Water transport, H-51 Air transport).

7) K – Financial and insurance activities

8) L-N – Real estate activities; Professional, scientific and technical activities; Administrative and support service activities

9) Q – Human health and social work activities

10) R-S – Arts, entertainment and recreation; Other service activities (R-90 "Creative, arts and entertainment activities", "R-91 Libraries, archives, museums and other cultural activities", "R-92 Gambling and betting activities", "R-93 Sports activities and amusement and recreation activities", "S-94 Activities of membership organizations" and "S-96 Other personal service activities").

APPENDIX B

As explained in section 2.2, RCD and TCD indicators as originally framed by Di Tommaso et al. (2022), once used with our measure of employment quality, generate values that, when ordered, do not reflect sector counterfactual performance. We are therefore impeded from creating the partial rankings for the counterfactual indicators. Under these circumstances, the fuzziness inherent in the information that can only be represented by means of qualitative data[(1)]. Hence, we have ranked RCD and TCD indicators based on qualitative considerations, as explained in sections 2.2. The tables below illustrate the ranking values for RCD and TCD indicators related to employment quality.

Table 1B – TDC indicator partial rankings for employment quality

Sectors	$X_{j,0}$	$\widehat{X}_{j,min}$	*counterfactual trend*	$X_{j,min}$	*actual trend*	$\widehat{X}_{j,min} - X_{j,min}$	Ranking
Good trends being maintained Performances are ordered based on the amount of low-quality employment reduced.							
Financial and insurance activities	100	92,2	**decreasing**	66,1	**decreasing**	26,10	**10**
Human health and social work activities	100	99,9	**decreasing**	89,0	**decreasing**	10,8	**9**
Agriculture, forestry and fishing	100	98,9	**decreasing**	93,6	**decreasing**	5,3	**8**
Bad trends being reversed Performances are ordered based on the amount of low-quality employment reduced.							
Wholesale and retail trade; repair of motor vehicles and motorcycles	100	135,6	**increasing**	87,8	**decreasing**	47,8	**7**
Manufacturing	100	139,7	**increasing**	96,2	**decreasing**	43,4	**6**
Transportation and storage	100	105,2	**increasing**	76,1	**decreasing**	29,0	**5**
Accommodation and food service activities	100	112,8	**increasing**	83,9	**decreasing**	28,8	**4**
RPA	100	118,4	**increasing**	102,4	**decreasing**	16,0	**3**
Bad trends being maintained							
Arts, entertainment and recreation and other activities	100	108,4	**increasing**	106,5	**increasing**	1,9	**2**

(1) See: Shen, Y., Ruan, D., Hermans, E., Brijs, T., Wets, G., & Vanhoof, K. (2011). Modeling qualitative data in data envelopment analysis for composite indicators. *International Journal of System Assurance Engineering and Management*, *2*(1), 21-30.

Good trends being reversed							
Construction	100	86,3	**decreasing**	112,8	**increasing**	-26,4	**1**

Source: authors elaboration
Note: values are calculated as the percentage deviation from the peak value (=100) for each sector.
$X_{j,min}$ is the actual value of the trough
$\hat{X}_{j,min}$ is the counterfactual value of the trough
RPA: Real estate activities, professional, scientific and technical activities, administrative and support service activities

Table 2B- RDC indicator partial rankings for employment quality

Sectors	$X_{j,0}$	$\hat{X}_{j,end}$	***counterfactual trend***	$X_{j,end}$	***actual trend***	$\hat{X}_{j,end} - X_{j,end}$	**Ranking**
Good trends being maintained Performances are ordered based on the amount of low-quality employment reduced.							
Financial and insurance activities	100	85,8	**decreasing**	35	**decreasing**	50,7	**10**
Bad trends being reversed Performances are ordered based on the amount of low-quality employment reduced.							
Wholesale and retail trade; repair of motor vehicles and motorcycles	100	169,3	**increasing**	95,4	**decreasing**	73,8	**9**
Transportation and storage	100	126,8	**increasing**	90,7	**decreasing**	36,07	**8**
Accommodation and food service activities	100	118,1	**increasing**	86,5	**decreasing**	31,5	**7**
RPA	100	128,3	**increasing**	97,6	**decreasing**	30,3	**6**
Arts, entertainment and recreation and other activities	100	112,6	**increasing**	86,8	**decreasing**	25,7	**5**
Manufacturing	100	156,9	**increasing**	118,9	**decreasing**	38 [(2)]	**4**
Good trends being reversed Performances are ordered based on the amount of low-quality employment reduced.							
Construction	100	80,6	**decreasing**	90	**increasing**	-9,4	**3**
Human health and social work activities	100	99,7	**decreasing**	101,9	**increasing**	-2,1	**2**
Agriculture, forestry and fishing	100	98,3	**decreasing**	102,5	**increasing**	-4,2	**1**

Source: authors elaboration

[(2)] Here, although a reduction in temporary employment by 38% from the counterfactual to the actual trend, the reversed trend has not been able to reduce temporary employment more that the peak value (=100), conversely to the other sectors belonging to the same group. This justifies the latter position within the group.

Note: values are calculated as the percentage deviation from the peak value (=100) for each sector.
$X_{j,end}$ is the actual value of the rebound point
$\hat{X}_{j,end}$ is the counterfactual value of the rebound point
RPA: Real estate activities, professional, scientific and technical activities, administrative and support service activities

FINAL REMARKS

The collection of paper presented in this thesis has focused on industrial policy, here conceptualized as public interventions governing the process of structural change affecting contemporary production systems towards desired societal goals, while ensuring, in parallel, that such structural transformations are economically, socially and environmentally sustainable (Di Tommaso et al. 2020).

In particular, the papers have explored, both from a theoretical and an empirical angle, how contemporary real-world industrial policy practices can overcome the rise of potential government failures in order to eventually reach desired policy goals while ensuring structural change sustainability.

On the basis of the evidence collected, this research stresses that new analytical tools and conceptual frameworks oriented towards a sustainable structural change should be developed within the industrial policy debate. Such analytical tools and conceptual frameworks should provide policymakers with reliable information on how different targets express different capacities to achieve certain desired policy objectives, thus enabling a novel *modus operandi* for the design and implementation of industrial policy. From a political economy perspective, such *modus operandi* could support policymakers to overcoming potential information asymmetries affecting policymaking processes as well as to communicate – both to internal and external actors and stakeholders – why some sectors could be preferable over other, thus mitigating the rise of potential government failures, while increasing policy transparency and social accountability. This idea departs from previous studies on industrial policy which either overlooked political economy issues related to the rise of potential government failures or considered government failures as a "destiny" or a "fate" to which industrial policy cannot escape.

Overall, we argue that elaborating novel analytical tools and conceptual frameworks oriented towards structural change sustainability would mitigate the potential rise of government failures, ultimately allowing policy intervention to be better linked to the desired goals envisioned by decision-makers.

Below I present and discuss the results offered by each one of the paper with respect to the general research questions.

Paper 1 ("Industry 4.0 policy from a sociotechnical perspective: the case of German competence centers") and 2 ("Structural Change and Industrialization in Ethiopia: Lessons from the Agro-Industrial Parks Initiative") have attempted to answer to RQ1: How do industrial policy practices in

the contemporary context govern structural change processes towards desired goals? How they ensure structural change sustainability?

Paper 1 has showed that complex structural transformations such as Industry 4.0 are the results of multifaceted interactions between technical and social aspects. The sociotechnical nature of structural transformations, such as the digital transformation of SMEs or the ecological transition, should therefore be acknowledged by policymaking and accounted for in policy design and implementation: focusing for instance only on the technological part, while overlooking the interrelated social aspects, could hinder the accomplishment of the envisioned transformations and generate social tensions that could threat the sustainability of such process.

Moreover, the paper has demonstrated that structural transformations are complex by definition and encompasses plenty of stakeholders, namely economic, social, institutional and political actors which also contribute to shape such transformation through their interactions. In this context, policy intervention should not be conceived as a deterministic and top-down intervention by design with a known path forward: conversely, policymakers should be aware that several issues and discoveries might be encountered along the policy implementation. An adaptive approach towards policy implementation is hence suggested to ensure structural change sustainability. Indeed, as we have showed, CCs have experienced a profound change in the activities and roles carried out to achieve the policy goals that could not have been predicted in advance. To accomplish their mandate, we have observed that the CCs had to undertake a piecemeal adaptation of the initial tasks and strategies driven by the contextual SMEs demand. Specifically, our research demonstrates that the CCs gradually started to operate on multiple system levels, improving their activities between multiple networks and toward institutions to fully contribute to the Industry 4.0 sociotechnical transition and thus to ensure that this transition would have occurred in a sustainable way.

Two further considerations follows from this research: first, when we suggest that industrial policy should adopt an adaptive behavior in order to reconfigure itself according to potential instances emerging from the target beneficiaries and stakeholders, we also mean that traditional policy tool, such as innovation intermediaries, should be prone to adapt their traditional tasks to new ones: in this regard, the paper has showed that innovation intermediaries have progressively shifted from traditional bilateral intermediation to unprecedent multi-level intermediation activities – a shift in their role that we have defined *systemic meta-intermediary.*

Second, the paper remarks the crucial role of place-based interventions. However, our results suggest that place-based interventions might not be sufficient to tackle structural transformations of great magnitude, such as the one presented in the paper. The socio-technical nature of the process under analysis and the multiple stakeholders involved suggest the need to balance the decentralization of tasks and responsibilities with a central mechanism coordinating the operations of the actors

involved at multiple levels, in order to ensure the reach of the desired outcomes. Hence, policy initiatives tackling structural change processes should address multiple levels: on the one hand, the policy should operationalized and implemented on a more decentralized level, leveraging the resources and capabilities existing across territories. On the other hand, on a more centralized level, governments should monitor that the policy implementation proceeds smoothly across territories: in our view, this means that governments should ensure that a coherent vision and directionality of the transformation is shared by all of the policy constituencies and transferred to the territories accordingly. In this perspective, governments should make an effort to reconcile and align different stakeholders interests around the direction of the transformation: this would make the coordination of the policy constituencies and of the policy actions more effective, efficient and oriented towards a sustainable structural change.

Paper 2 approaches a different process of structural changes, the one related to economic development. In particular, the paper purposefully adopts a political economy perspective in an attempt to disentangle the interplay between policy stakeholders' respective interests and ideas in shaping the trajectory of the policy under analysis, i.e., the network of Integrated Industrial Parks. The paper has identified two different phases of the policy trajectory: in the policy design phase, only a few powerful stakeholders have shaped the policy initiative, in a way that has benefitted their longstanding privileged positions. However, the policy initiative has soon clashed against social unrest and political turmoil which reached a climax in 2018. It became soon clear that the traditional dirigiste, top-down approach used to frame the Integrated Industrial Park Initiative was somewhat threatening the sustainability of the process of structural change affecting the Ethiopian economy and society: indeed, the creation of the Industrial Parks, targeting the creation of hundreds of jobs in agricultural value chains, was proceeding very slowly, triggering social unrest and dissatisfaction among the population. Besides, our research has unveiled that, throughout the process of parks design and implementation in Ethiopia, little attention was paid to social issues, such as decent job conditions, housing and access to utilities and other public services, gender mainstreaming and the provision of security for the workforce living around the parks (especially for women). These issues exacerbated the protests and the social dissatisfaction with the initiative. Hence, in 2018, Ethiopia experienced a change in the political regime and a more progressist political leader took power. This event opened a window of opportunity for more policy stakeholders to enter the phase of policy implementation, namely institutional actors that were previously not included in the process, such as the universities, the regional governments and the Ministry of Agriculture, as well as the business sector, its representatives and the cooperative system of agricultural smallholders.

The new multi-stakeholder approach has started to influence the implementation of the Industrial Parks, in an attempt to partially corrected the policy trajectory, by incorporating and balancing within the initiative new and crucial instances related to technical, institutional, political, social aspect

Also in this case, policy adaptation during its implementation seems to be key for tackling complex structural change processes whose direction cannot be define *a priory* by policymakers. Also in this case, it seems crucial having a good balancing between place-based initiatives that value and leverage the resources existing on the territories and a central government that reconcile and align different stakeholders interests in a unified policy vision as a way to effectively coordinate policy actions.

Overall, both the German and the Ethiopian cases have shown that industrial policy tackling processes of structural change should be also looked at from the angle of political economy: indeed, an effective, efficient and sustainability-oriented coordination of the multiple and interrelated policy actions dealing with the multifaceted aspects of socio-technical transitions seem to require, as a precondition, that governments reconcile and align different stakeholders interests and harmonized them within a shared vision of the transformation and of its direction.

In the light of the preliminary results offered by paper 1 and 2, paper 3, 4, 5 and 6 have attempted to provide answers to RQ2: Which are the potential advancements on the nexus industrial policy-structural change sustainability-government failures?

In particular, paper 3 ("Local public spending, electoral consensus, and sustainable structural change") and 4 ("Do informal institutions matter for the economic resilience of European regions? A study of the post-2008 shock") have dealt with RQ2a: What novel conceptual frameworks might guide policymakers in identifying how different targets express different capacities to achieve certain desired policy goals?

Paper 3 has established a conceptual and an empirical relationship between electoral consensus, local public spending and structural change sustainability. On the one hand, given its proximity and visibility to the final beneficiaries, local public spending is able to influence voting behaviour and build electoral consensus. On the other hand, public spending across relevant socio-economic areas can represent a way to reconcile and mitigate conflictual and juxtaposing socio-economic interests occurring during the process of structural change. The extent to which such interests are reconciled is measured via electoral consensus towards pro-system parties. Hence, local public spending represents a channel that government might consider using to garner the long-term electoral consensus they need from the electorate to govern structural change processes in a sustainable way and thus achieve complex normative societal goals.

Overall, in a perspective of structural change sustainability, the paper has framed the local public spending – electoral consensus nexus as a one that could guide policymaking to prevent the exacerbation of socioeconomic cleavages and conflicts embedded in the process of structural change.

Paper 4 approaches the notion of resilience which has been used in economic studies to describe the extent to which territories reacted heterogeneously to unforeseen shock. We wanted to understand whether there was room for it to be transferred it the industrial policy field and used as conceptual framework guiding policymakers in identifying how different targets express different capacities to achieve certain desired policy goal. While conducting this investigation by means of an accurate literature review, we have found that few recent studies have acknowledged the need to also look at sector-specific patterns of response and adaptation to shocks (Fromhold-Eisebith, 2015; OECD, 2021), thus suggesting that resilience could be applied to industry policy studies as well. Indeed, industries react heterogeneously to a crisis, given that economic activities experience different degrees of fluctuation over the business cycle. In other words, *crises impact firms and workers differently depending on their industry* (OECD, 2021). In this view, we started thinking that industry resilience might become a relevant framework for informing and orienting policy initiatives targeting sectors in the aftermath of a shock. This research path sounded especially promising since the few studies that have attempted to assess the resilience of industries are, on the one hand, based mostly on anecdotal evidence and case studies (Holm and Østergaard, 2015; Rajesh, 2018); or, on the other hand, they have primarily focused only on specific aspects characterizing resilience, such as the degree of supply chain susceptibility to disruptive events (Rajesh, 2018), the overall risks associated with supply–customer relationships.

Furthermore, while conducting this literature review on resilience across different subjects, we have identified that the relationship between informal institutions and resilience represents a potential research gap in the economic field. Thus, we have decided to attempt at filling this gap and we have investigated such a relationship across EU regions in the years following the 2008 Great Recession. Specifically, we have found robust evidence that informal institutions (proxied by voluntary work) are positively associated with greater regional resilience. Moreover, we have also found an empirical relation between informal and formal institutions, which we have proxied by welfare state models.

Overall, the effect of informal institutions in the context of strong welfare states is always positive, but its effect is mitigated by the presence of public provisions. Additionally, in regions with a relatively weaker institutional context, informal institutions retain their positive effect. However, while in this context informal institutions appear to take more time to deploy their effects, their positive impact on regional labour market recovery is stronger than in other welfare regimes.

Paper 5 ("Conceptualizing and measuring "industry resilience": composite indicators for postshock industrial policy decision-making") and 6 ("Does Industry Resilience matter for postshock Industrial Policy? A focus on tourism related industries"), along with RQ2a, deals also with RQ2b: What analytical tools might embody a novel *modus operandi* for industrial policy design and implementation to make government intervention better linked to the desired policy and oriented towards a sustainable structural change?

Paper 5 focusses on threats to structural change sustainability coming from unexpected shocks, such as the 2008 global crisis and the COVID-19 pandemic, which have shaken social and economic arrangements. Shocks of these kinds might rapidly lead to the collapse of companies, sectors, and territories. The velocity of these unexpected disruptions undermines the socioeconomic system as a whole and its capacity to govern and promote the future path of desirable structural change. In this view, the choice of *which industries* policy-makers should target in the aftermath of an unexpected shock to support socio-economic recovery is particularly relevant, since different sectors can display substantially different capacities to orient the structural change towards a sustainable path.

In this paper, we argued that industrial sectors can react very differently to shocks, absorbing them and adapting to the new environment, therefore displaying different resilience capacities. In particular, the ability not to collapse in the immediate aftermath of a shock is a desirable goal in the attempt to ensure future paths of sustainable structural change. Therefore, *postshock industry resilience* should be considered a crucial conceptual framework guiding policy-making in selecting sectors able to foster sustainable structural change. In this early framework so-called *postshock industry resilience,* it seemed to us particularly relevant to focus on employment dynamics, thus mainly focusing on the social dimension of sustainability. Specifically, when conceptualizing *postshock industry resilience,* we have drawn from previous studies on resilience (paper 4) which have mainly proxied it in terms of employment level change in the aftermath of the shock. However, we have partly departed from these studies and made a step forward by incorporating also a qualitative perspective on employment changes. This is consistent with the growing attention in international debates to the relevance of decent employment opportunities, particularly the creation of good jobs. Hence, *postshock industry resilience* refers to the aftershock variation in jobs from both quantitative and qualitative perspectives.

The paper then develops a novel methodology (based on two composite indicators) to operationalize *postshock industry resilience*, i.e., to assess the different degrees to which industries react to shocks, with the aim of enabling policy-makers to tailor relevant policy choices accordingly.

The application of the CIs to the U.S. case has to be considered as an illustrative exercise showing that different industries react heterogeneously to shocks; i.e., they display different degrees of *postshock industry resilience.*

From the perspective of structural change sustainability, *postshock industry resilience* can work both as a valuable conceptual framework and analytical tool to inform decision-makers on which sectors are able to couple employment retention with good-quality jobs in the aftermath of a shock and which are not and might thus deserve some support.

Overall, we have intended this exercise as a demonstration of a novel *modus operandi* that can be used by governments for designing and implementing industrial policies oriented towards structural change sustainability, especially in the aftermath of an unforeseen shock.

Paper 6 build upon paper 5's results. In particular, it fine tunes the conceptualization of postshock industry resilience which we have defined as: *the way, the extent and the speed at which industries return to the previous state, trend or trajectory after a shock, thus achieving a partial or a full recovery (or even what we might define an "ultra-recovery")* (Di Tommaso 2020; Di Tommaso et.al 2022; OECD, 2021; Canova et al., 2012). Then, we have applied the composite indicators capturing industry resilience to the Italian case, in order to understand how and to what extent sectors have reacted in the aftermath of the 2008 shock. Particular attention has been devoted to tourism-related industries given the relevance that tourism has for the Italian economy.

The general evidence is that industries reacted heterogeneously in response to the 2008 shock. This means that sectors display different capacities of dealing with employment retention and good quality jobs. Also tourism-related industries reveals different degrees of resilience: this would suggest policymakers that policy initiatives targeting tourism should be crafted taking into the account the specificities – included their individual *industry resilience* capacity – of the sectors that make up the tourism industry.

Overall, the information retrieved by such a methodology offer – during the complex process of policy design and implementation where a plurality of actors and stakeholder are involved – some evidence on which grounding the rationales of the intervention, thus lowering the risk of "internal and external government failures". However, on a more general level, it is important to clarify that the value of the methodology and of the illustrative exercise presented in paper 5 and 6 do not lie in the specific sectoral rankings presented, but it is rather grounded into the idea that robust and transparent methodologies for sectors selection matter for policymaking. Indeed, sectors' rankings may vary according to different societal goals, but what is important is that such rankings represent an informative basis to support decision-making to communicate – both to internal and external actors and stakeholders – why some sectors could be preferable over other. In this perspective, such methodologies, besides being oriented towards structural change sustainability, contribute also to mitigate the rise of potential government failures, while increasing policy transparency and social accountability.

To conclude, this collection of papers contributes to the international debate on contemporary industrial policy in the context of structural changes. In particular, the papers have framed the relationship between industrial policy, structural change sustainability and government failures as a partially unexplored line of research to be pursued over the next years. Specifically, the research points out that, within the current debate on industrial policy, new conceptual framework and analytical tools oriented towards a structural change sustainability should emerge and be discussed to support policymakers in governing socio-economic transformation towards desired societal goals, while mitigating the rise of government failures.

To pursue this research trajectory, a mutual engagement between theory and practice of industrial policy seems essential, as we have tried to argue and demonstrate through this collection of paper. Clearly, this collection provides neither exhaustive answers to the research questions stated above, nor they aspire to fulfill this task. In fact, these papers represent only a piece of a larger and more complex puzzle that needs the contribution and reflections of more scholars in the futures. Future studies could purse and nurture this research path by analyzing other virtuous industrial policy practices dealing with structural change sustainability in order to draw further lessons and principles along with those emerged from the case studies of Germany and Ethiopia. Concerning novel conceptual frameworks and analytical tools, we have elaborated the *local public spending–electoral consensus* nexus and the *postshock industry resilience* as tools that can be used by governments to design and implement industrial policies. Particularly, *postshock industry resilience* is framework that in current times of increasing global challenges and potential economic shock seems relevant for supporting the resilience of our economies and societies. However, it represents *one among many* possible criteria that could be chosen by policy-makers. In this view, further research in this area could elaborate other sustainability-oriented tools supporting policymakers with target selection.

With respect to *industry resilience,* future advancements could refer to the study of other countries, groups of countries or lower-level geographical units or to the analysis of industry-level determinants of resilience, which could depend upon a number of factors, including the organization of production, the structure of the production network, and technological endowments. Further research could expand on this evidence by exploring the industry resilience of sectors facing shocks of a different nature and transmission mechanisms like for example in the case of COVID-19 pandemic. Another possible research avenue could be enriching *industry resilience* with other variables capturing other aspects of structural change sustainability, for instance those related to the environment, such as environmental degradation and energy efficiency. Finally, we believe that the industry resilience perspective could strengthen the evidence on regional resilience produced by regional economics and economic geography studies. In particular, relevant insights could be generated by studying how regional resilience relates to the local industrial mix and its industry resilience profile.

Acknowledgments

I am most grateful to my PhD supervisor – Marco R. Di Tommaso – for his valuable, competent and passionate academic guidance. He has always found the right words to encourage me in goods and in hard times alike. Besides, his ability to build "bridges" across people, disciplines and ideas is what has inspired me the most, and what I believe is most needed in our increasingly complex word.

I am also extremely grateful to Lauretta Rubini, Elisa Barbieri, Chiara Pollio, Andrea Ferrannini, Francesco Silvestri, and Mattia Tassinari for contributing to my research as competent co-authors but especially for being passionate scholars and people of great human value.

I am very grateful to Marianna Scaglioso for her precious support, continuous encouragement and for her genuine friendship.

I want to also thank Professor R. Scazzieri for the inspiring conversations we had over the past months and for stimulating and nurturing my academic curiosity.

A heartfelt "thank you" goes to my family and to my true friends for their unconditional love and support throughout this journey. They are my major source of strength and confidence.