



OECD Local Economic and Employment Development (LEED)
Papers 2022/09

Policies for resilient local economies

Wessel Vermeulen

<https://dx.doi.org/10.1787/872d431b-en>

Policies for Resilient Local Economies

By Wessel Vermeulen

The COVID-19 pandemic has critically tested OECD economies, with major differences in economic repercussions at the subnational level. The pandemic can be characterised as a combination of shocks to local economies: (i) a recession, (ii) a supply-side shock mirroring a natural disaster, and (iii) the economic and workplace adjustments accelerated by pre-existing megatrends (e.g. automation, green transition). This paper reviews the empirical evidence for effective policies from across the OECD to strengthen local economic resilience through support for people, firms and places. There is a strong need for effective policies in times of recessions, natural disasters and long-term structural change. Policies that strengthen economic resilience strongly overlap with policies for local productivity growth and vice-versa. Moreover, some policies aiming to increase resilience through adding redundancy in production or infrastructure can serve productivity in the long-term.

JEL codes: R1, R11, R5, R58

Keywords: Regional economic resilience, subnational economic policy, economic shocks, recessions, industrial change, megatrends, COVID-19, regional economic systems

ABOUT THE OECD

The OECD is a multi-disciplinary inter-governmental organisation of 38 member countries which engages in its work an increasing number of non-members from all regions of the world. The Organisation's core mission today is to help governments work together towards a stronger, cleaner, fairer global economy. Through its network of 250 specialised committees and working groups, the OECD provides a setting where governments compare policy experiences, seek answers to common problems, identify good practice, and co-ordinate domestic and international policies. More information available: www.oecd.org.

ABOUT OECD LOCAL ECONOMIC AND EMPLOYMENT DEVELOPMENT (LEED) PAPERS

The OECD Local Economic and Employment Development (LEED) Programme Papers present innovative ideas and practical examples on how to boost local development and job creation. A wide range of topics are addressed, such as employment and skills; entrepreneurship; the social economy and social innovation; culture; and local capacity building, among others. The series highlights in particular policies to support disadvantaged places and people, such as the low skilled, the unemployed, migrants, youth and seniors.

OECD Working Papers should not be reported as representing the official views of the OECD or of its member countries. The opinions expressed and arguments employed are those of the author(s).

Working Papers describe preliminary results or research in progress by the author(s) and are published to stimulate discussion on a broad range of issues on which the OECD works. Comments on Working Papers are welcome, and may be sent to the Centre for Entrepreneurship, SMEs, Regions and Cities, OECD, 2 rue André-Pascal, 75775 Paris Cedex 16, France.

This paper is authorised for publication by Lamia Kamal-Chaoui, Director, Centre for Entrepreneurship, SMEs, Regions and Cities, OECD.

This document, as well as any statistical data and map included herein, are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

© OECD 2022

You can copy, download or print OECD content for your own use, and you can include excerpts from OECD publications, databases and multimedia products in your own documents, presentations, blogs, websites and teaching materials, provided that suitable acknowledgement of OECD as source and copyright owner is given. All requests for public or commercial use and translation rights should be submitted to rights@oecd.org.

Acknowledgements

This paper was prepared within the framework of the Spatial Productivity Lab (SPL) at the OECD Trento Centre for Local Development. The Centre is a part of the Local Economic and Employment Development (LEED) Programme at the OECD Centre for Entrepreneurship, SMEs, Regions and Cities (CFE), led by Lamia Kamal-Chaoui, Director.

The discussion paper draws on work prepared for the EU DG REGIO funded project on Productivity Policy for Places (Productivity and Resilience). Some of the presented arguments draw on discussions and interventions in the 9th, 12th and 13th SPL meetings.

Comments on early drafts of the paper from Nadim Ahmad, Karin Maguire, Rudiger Ahrend, Alexandra Tsvetkova, Alexander Lembcke, Anna Rubin, Mattia Corbetta, and Jenny Vyas (all from the OECD Centre for Entrepreneurship, SMEs, Regions and Cities) are gratefully acknowledged.

Table of contents

Acknowledgements	3
Introduction	5
What is local economic resilience and how does it relate to policy intervention?	7
Absorbing a shock	9
Recovery	9
Bounce forward into new growth paths	10
Policies for local economic resilience	11
Policies for resilience to recessions and sector-specific shocks	11
Policies for resilience to natural disasters	14
Policies for resilience to megatrends	19
Policies for resilience in the aftermath of COVID-19	24
Taking stock and conclusion	31
Policies for (long-term) productivity and economic resilience mutually reinforce each other	31
Are there contradictions of policies for productivity and economic resilience?	32
Conclusion	33
References	34
Tables	
Table 1. Aspects of resilience and relation to policy	8
Table 2. Policies for regional economic resilience during recessions and sector-specific shocks	11
Table 3. Policies for regional economic resilience to natural disasters	15
Table 4. Policies for regional economic resilience to megatrends	19
Table 5. COVID-19 policies, regional resilience and productivity	25
Boxes	
Box 1. Defining economic resilience at the national and regional level	8
Box 2. Great East Japan Earthquake	18
Box 3. The end of coal and the consequences for mining regions	20
Box 4. Michigan-Ontario automotive industry	22
Box 5. Early experiences of increased automation, robotics and artificial intelligence	23
Box 6. Teleworking	28
Box 7. Global supply chains and local production	29

Introduction

The theme of economic resilience has taken centre stage in the wake of COVID-19. The pandemic brought back the State as an essential economic actor to coordinate a healthcare response, support vaccine research and development, guarantee employee income, and underwrite business loans. Each of these measures aimed to lighten and shorten the economic hardship and shield private income from a sudden downfall. In short, these policies demonstrated how the government, labour markets and private businesses interact to provide resilience in the face of this new crisis. The subnational implications of the COVID-19 pandemic and national policies are still to emerge fully. However, clearly there was great variation in how places were affected by the pandemic (OECD, 2021^[1]).

This paper reviews economic policies that are adopted or activated during periods of economic upheaval and assesses the empirical evidence on their immediate effectiveness on regional labour markets and businesses as well as the consequences for longer-term regional productivity. Beyond the pandemic, national and regional policy makers, face continuous and various shocks from recessions, to natural disasters, industrial transformation and megatrends. As with the pandemic, global or national shocks will have varying effects for different regions. While national governments tend to lead policy-making on global trends, international emergencies (such as a pandemic), and “plain” recessions (OECD, 2021^[2]), local governments often have a strong role to play in implementation. In addition, other economic headwinds may have a strong regional impact. These can be sudden and relatively short-lived, such as natural disasters, or slow moving with long-term implications, such as structural change and industrial transformation.

Many of the national policies that aim to support economic resilience will have important local implications.¹ For instance, during the pandemic, governments in most OECD countries adopted various forms of employment or income guarantees for affected workers and credit extensions and transfers to firms that saw their production capacity fall. Such national policies still have differentiated regional impacts based on the local economic structure and the concentration of jobs most affected by the need for self-isolation and social distancing. For instance, business support schemes were provided typically to the firms that apply for them given some eligibility requirements. Therefore, different areas may see varying rates of applications and disbursements. Similarly, employment support tends to be concentrated in the most affected labour market or sectors.

Policy makers may need to consider if economic support during periods of upheaval negatively affect economic dynamism that is required for productivity growth in the medium and long-term. Targeting jobs, short-term work schemes aim to retain employer-employee relations and diminish the incidence of unemployment. An often voiced reservation to such a policy is that it could decrease the allocative efficiency in the labour market by preventing workers to move to better performing firms. Targeting firms, governments can underwrite credit extensions to firms that are exposed to exogenous shocks, e.g. from global commodity price fluctuations or other global events. However, if such extensions are predominantly allocated to the weakest firms that use such schemes, the policy could harm the process of creative destruction in the economy. Finally, to boosting local economic resilience to natural disasters

¹ The terms local, regional and subnational are used interchangeably in this paper. Notably, ‘regional’ always refers to subnational rather than global regions.

such as earthquakes and extreme weather events may require sizeable infrastructure investments. In brief, policies that may help to make economies resilient to exogenous shocks could come at a cost to productivity.

This paper finds that there is a substantial overlap in policies that make economies resilient and those that make regions economically prosperous. These include policies that support a dynamic business environment, diversified industrial base and local skills development. Policies can help strengthen local economic dynamism in the private sector and make workers agile in adapting to new circumstances. A successful interaction between local businesses and policy makers allows a region to identify economic opportunities and harness spillovers from innovation while avoiding technology lock-in and entrenching sectoral interests. In short, policies for local productivity growth and economic development can be fully consistent with creating an economically resilient region able to withstand or adapt to shocks and changing environments.

Moreover, the current empirical evidence suggests that the overall gain from insuring employer-employee relationships or schemes that support business through an exogenous crisis outweigh the cost of loss of economic efficiency. The economic support measures for workers and firms that many governments implemented over the COVID-19 pandemic function like a public insurance scheme. The support implies a pooling of risk within countries between regions and sectors more or less affected by social distancing restrictions. The maintenance of employer-employee linkages through various short-term work schemes implies a pooling of risk between different types of workers. While these policies are justified on social grounds, they are also anticipated to facilitate the recovery when restrictions ease and economic demand restores. The maintenance of employer-employee linkages avoids loss of skills and relevant experience of workers and saves costs on re-hiring. Short-term business support schemes allow otherwise viable firms to pull through exogenous shocks as well, avoiding financial capital destruction. Moreover, current empirical evidence suggests that these support schemes appear to be sufficiently well-targeted and do not substantially reduce allocative efficiency or business renewal. At the same time, not all workers were equally covered, especially those on temporary or other non-standard contracts, or the self-employed, while younger and smaller firms were less likely to benefit from emergency measures in the COVID-19 pandemic.

Nevertheless, there are also areas where regional economic resilience appears to contradict productivity growth. For instance, efficiency in supply chains and just-in-time delivery leaves little space for unforeseen disruptions. However, arguments that consider the need for spare capacity and additional redundancy in production capacity for essential goods as contrary to productivity growth and efficiency actually overlook a crucial aspect. Disruption of activity presents a real costs to businesses and workers. Productivity growth during recoveries and in the longer term is stronger when interruptions during times of crisis can be avoided.

What is local economic resilience and how does it relate to policy intervention?

The concept of regional resilience is an extension from national level resilience. Policies to strengthen economic resilience were endorsed by OECD Ministerial Council Meetings (OECD, 2014^[3]; OECD, 2015^[4]), and also part of the current deliberations following the COVID-19 pandemic (OECD, 2021^[5]; OECD, 2021^[2]).² Resilience is acknowledged to be multi-dimensional through its relation to economic, social and environmental implications. Resilience may also relate to technological factors, such as physical infrastructure and cyber security. In this paper, the focus will be on economic resilience at the local level, such as the economic repercussions of local natural disasters and the local implications of global or national business cycle and sectoral shocks.

Martin and Sunley (2015, p. 12^[6]) suggest a definition by answering the following four questions: ‘resilience of what, to what, by what means and with what outcome?’:

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, so as to maintain or restore its previous developmental path, or transit to a new sustainable path characterized by a fuller and more productive use of its physical, human and environmental resources. (Martin and Sunley, 2015, p. 13^[6])

The ‘of what’ is the “regional or local economic developmental growth path”. In this way, the local economy is not analysed with respect to a recent level, but rather its longer-term productivity trend. While various regions may be specialised in a certain sector, it appears inappropriate to equate a regional economy with a specific sector (Sweeney, Mordue and Carey, 2020^[7]). Therefore, the discussion on regional resilience is best analysed beyond a region-sectoral view.

The ‘to what’ is “the market competitive and environmental shocks.” This hints that business cycle downturns as well as environmental and natural disasters, potentially ranging from a global pandemic to earthquakes and extreme weather events. The ‘by what means’ is “adaptive changes to its economic structures and its social and institutional arrangements.” This abstraction also includes possibilities of industrial change, as well as changes to the political landscape and local governance.

One could argue that not all shocks require institutional changes. Especially when it comes to the economy, various policies that are institutionally permanent and automatically applied in times of exogenous shocks, such as unemployment insurance during recessions and emergency aid after natural disasters. Generally known in macroeconomics as ‘automatic stabilisers’, these instruments provide resilience, or at least some economic protection, without needing policy changes (Caldera Sánchez, Rasmussen and Röhn, 2015^[8]; Di Maggio and Kermani, 2016^[9]).

² See also the overview in Figueiredo, Honiden and Schumann (2018, p. 17^[17]).

Box 1. Defining economic resilience at the national and regional level

Similar to studies at the national level, regional resilience is usually operationalised by tracking regional GDP or employment before, during and after a shock or economic crisis. Studies on national resilience can also include aspects of the financial sector such as through data on credit expansion and the housing market (Caldera Sánchez et al., 2017^[10]).

The academic literature provides a lively debate on the concept of regional economic resilience (Simmie and Martin, 2010^[11]; Bristow, 2010^[12]; Hassink, 2010^[13]; Martin, 2012^[14]; Boschma, 2015^[15]; Hynes et al., 2020^[16]). The concept relates to various types of disruptions and change that regional economies experience. Disruptions may be temporary or long term, sector-specific or economy wide. Moreover, there is fierce debate about what it entails to be resilient and what not, and how resilience may be observed and (quantitatively) evaluated.

Resilience can refer to the extent that regional output or employment falls following a shock, how long it experiences declining levels and the speed of its recovery to pre-existing trends. Arguably, all these aspects relate to resilience. This paper follows the definition proposed by Martin and Sunley (2015^[6]).

Sources: Author's elaboration.

Finally, the 'to what end', is "to maintain, restore or transit to a new sustainable growth path". This acknowledges the possibility that a perturbed growth path was not the first best for the region. Hence, if the pre-shock trend was underperforming relative to peers, the shock may be used to reorient towards a better growth path in the future. In this case, a shock provides an opportunity for renewal. This requires local governmental capacity to recognise the possibility that the past and future can be on different growth trajectories.

Table 1. Aspects of resilience and relation to policy

Aspect of resilience	Associated concepts	Contributing policy examples
Absorbing a shock (ecology)	Robustness, redundancy, mitigation	(Fiscal/disaster) scenario planning, stress-testing Stimulating sectoral diversity and networks
Recovery, bounce back (engineering)	Resourcefulness, recoverability	Counter-cyclical fiscal policy, including at local level Active labour market policies, including to employers. SMEs may benefit from alternative sources of funding beyond bank lending.
Fundamental adaptability, Bounce forward (evolution)	Renewal, reorientation	New regional growth strategies, including for economic diversification, innovation and entrepreneurship.

Source: Aspect of resilience after resilience types by Martin and Sunley (2015^[6]), other columns are author's elaborations. See also Figueiredo, Honiden and Schimann (2018^[17]).

In addition to this definition, the literature has used various operationalisations that concentrate on specific aspects of resilience, each borrowed from concepts existing in other disciplines: a shock absorbing or a resistance type of resilience, associated with ecology; a bounce-back type of resilience, associated with engineering; and adaptation to changing circumstance, associated with concepts of evolution (Martin and Sunley, 2015^[6]).

Resilience can be related to both shocks that may be temporary and sector specific and to long-term transitions affecting the entire economy (OECD, 2021^[2]; Faggian and Ascani, 2021^[18]). The former relates to recessions, sector-specific shocks or local natural disasters with an assumption that the economic

structure of a region remains otherwise largely unchanged. Resilience in this context is then demonstrated when some regions appear to either resist or recover to pre-existing growth paths better and faster than others. Over a longer horizon, regional economies may need to demonstrate a certain process of continuous adaptability as new technologies, skills, and demands replace those from the past. Table 1 lists the conceptual aspects of resilience with associated concepts and some examples of policies that may enhance or target each.

Absorbing a shock

One policy objective is ensuring that (negative) external shocks have a minimal real impact on the local economy. Ideally, a shock is absorbed or resisted and has no further implications or spillovers.³ Both absorption and resistance can be associated with pre-existing conditions in an economy, such as the economic structure of a local economy, exhibited through its composition of industries and the average skill-level of people, and the financial health of firms, citizens and local governments. It may also include firms keeping higher stocks and supplies to cover for times of disruptions or during emergencies. A diverse industrial base would help mitigate the negative impacts of demand shocks that are sector-specific or business cycle shocks that affect sectors to varying extents. If there is a need for workers to change jobs due to a shock, it can be beneficial if sectors are related in their use of technologies and skills, such that workers are able to find matching opportunities within the same region (Boschma, 2015^[15]). More generally, the skill level of people is often associated with a form of flexibility in job characteristics or changes. Therefore, regional productivity policies that are in line with such objectives can have a positive contribution to building resilience as well.

A more direct policy related to this type of resilience is planning for shocks and unforeseen events. This includes the planning for natural disasters or other large industrial accidents, but also mandated scenario analysis and stress tests for economic shocks on financial accounts in public and private sectors. Planning for disasters requires strong local co-ordination, while the quality of scenario development, stress tests and implementation of resulting recommendations may vary with the quality of local governance. Such local policies may be complementing national policies and regulation on financial buffers for the financial sector as well as within government departments and for local authorities.

Recovery

When shock absorption is insufficient or infeasible, the focus of resilience concentrates on the recovery from a negative shock. Discussions of this type tend to focus on the speed of the recovery after a downturn, with narratives on a 'bounce-back' to pre-existing growth paths. In the economics literature, this could be associated with policies that aim to stabilise an economy through business cycle downturns, including fiscal spending and automatic stabilizers, such as unemployment insurance.

However, new policies during downturns that aim to support the economy can also facilitate a bounce-back to economic growth. Such policies will have three objectives: limit the decrease of economic output, shorten the spell of negative growth or employment loss, and accelerate the recovery towards pre-existing trends. Each of these aspects will overlap or interact with aspects associated with absorptive resilience discussed above. The smaller the impact of an exogenous shock, the less need for fiscal tools to counter the negative shock and stimulate a recovery. The more dynamic and diversified an economy, the more

³ This report uses the term 'resistance against shocks' as a feature of (ecological) resilience. Others have proposed the concept of 'resistance to change', such that the outcome after a shock and intervention is one of decline (Sweeney, Mordue and Carey, 2020^[7]).

likely the region finds a path to recovery where some workers are able to find alternative employment fitting with their skills and experiences.

Bounce forward into new growth paths

Finally, resilience can be associated with fundamental changes in an economy after an economic shock or long-term disruptions. The issue is that the ‘bounce-back’ type of resilience may be sub-optimal if the pre-existing state was undesirable to start with. For instance, if the growth path of a region was lagging relative to suitable benchmarks and a shock deteriorates the situation, the ambition should be to consider a more thorough overhaul of the economy. In this case, policy makers and other regional stakeholders may aim to ‘exploit’ the shock to initiate fundamental changes of the regional economy; an application of the credo ‘never let a crisis go to waste’. Such changes may require economic diversification, firm upgrading and new strategies for policy makers to attract or stimulate firms and industries with new growth potential.

Regional economic resilience goes beyond the resilience of individual regionally-based sectors (Sweeney, Mordue and Carey, 2020^[7]). While we can observe cases of renewal after temporary shocks, from natural disasters to recessions, slow-moving trends can also call for resilience. Over longer time horizons, sectors may risk becoming obsolete or fundamentally change their characteristics. In such cases, regional resilience tends to be recognised as successful not by maintaining a specific sector, but through the ability to demonstrate a continuous process of adaptability, renewal of economic activities and dynamically changing economic specialisations.

As set out here, the three aspects of resilience are likely mutually beneficial. For instance, suppose that regional policy makers have processes in place that plan for and evaluate economic programmes that are beneficial for local businesses and well placed in the context of larger global economic trends. Such processes would also contribute to monitoring the regional economy over more cyclical and transitory shocks, contributing to a level of shock absorptive capacity as well. The reverse argument applies too. An economy characterised by absorptive capacity to a shock tends to be dynamic and diverse with firms and industry agile enough to select into new growth opportunities on a continuous basis.

Policies for local economic resilience

Policies for resilience to recessions and sector-specific shocks

Regions within countries tend to be differently affected by economic cycles.⁴ Quantitative studies that aim to find some determinants for these differences tend to relate them to the pre-existing conditions, including industrial and labour composition, geographic and economic linkages within the country and demographic factors (Eraydin, 2016^[19]; Rizzi, Graziano and Dallara, 2018^[20]). While useful, these offer limited options for policy during recessionary periods.

One implicit assumption in considering recessions is that not every economic shock requires a fundamental revision of the regional economy. Some shocks are truly transitory, and policies to navigate these temporary cycles make good policy. However, this should not preclude policy makers from considering recessions as a trigger for a more fundamental review of a regional economy. Such a review, however, belongs to a long-term process, which is discussed further below in the context of megatrends.

Table 2. Policies for regional economic resilience during recessions and sector-specific shocks

Policy area	Geographic level	local resilience outcome	Local productivity outcome
(Unemployment) Transfers	Nationally organised, intra-national transfers	Robustness through Interregional risk-sharing	+ Stimulating local demand, - May decrease allocative efficiency through reduced interregional mobility of workers
Short-time work schemes	Nationally organised, firms can self-select into scheme	Robustness through interregional risk-transfer	+ Prevent loss of skills and experience. - Potential delay in growth of new opportunities
Active labour market policies (ALMPs)	National regulation with local implementation and tailoring	Recoverability through increased adaptability to local economic shocks and trends	+ Shorten unemployment spells and increase allocative efficiency of labour.
Local government administration	Local government	Resistance and mitigation through Planning and preparation for various scenarios	+ Local government efficiency in service delivery, spillovers to local economy.

Source: Author's elaborations.

Reviews on specific policies for resilience to recessions are often done at the national level (Caldera Sanchez and Nicoletti, 2016^[21]; Röhn et al., 2015^[22]; Caldera Sánchez, Rasmussen and Röhn, 2015^[8]). However, it is well acknowledged that recessions have differentiating impacts within countries, between demographic groups and places (Ahrend, Arnold and Moeser, 2011^[23]). In addition to economy-wide

⁴ References include Fingleton, Garretsen and Marti (2012^[177]), Holm and Østergaard (2015^[175]), Diodato and Weterings (2015^[176]), Fratesi and Rodríguez-Pose (2016^[181]), Sensier, Bristow and Healy (2016^[183]), Faggian et al. (2018^[178]), Fratesi and Perucca (2018^[179]), and Di Caro and Fratesi (2018^[180]).

business cycle dynamics, sector-specific shocks may also affect some regional economies adversely. For instance, exporting sectors may be strongly affected by currency fluctuations, energy-intensive industries by world oil prices and manufacturing by commodity prices more broadly. Such fluctuations may be temporary but may still have implications for local employment based on the presence of adversely affected sectors.

This section focuses on concrete policies that are implemented at the local level, which prepare for or are used during business-cycle downturns or sector-specific shocks, and potentially can be scaled in times of need. Table 2 provides a summarising overview of the most important policies and their relation to regional economic resilience.

Labour market policies and instruments

All OECD member states have worker support programmes in place that are present over the entire business cycle and could scale according to need. These include national policies such as unemployment insurance and job retention schemes (sometimes referred to as passive policies) and job-seeker support (active policies).

Regional impact of transfers and short-time work schemes

Passive labour market policies tend to be nationally arranged and funded. Yet, two specific channels make these policies relevant for regional analysis and policy. Unemployment benefits transfer to the regions that need them the most. This happens almost automatically as the impact of recessions is never evenly spread around a country (Caldera Sánchez, Rasmussen and Röhn, 2015^[8]). In Canada, eligibility for employment insurance transfers are also dependent on the state of local labour markets (OECD, 2014^[24]). Regional transfers are important channels of resilience through subnational risk sharing. A study from the US suggests that unemployment insurance provides the equivalent of government multiplier up to 1.9 (each USD 1.00 of government spending, benefits the economy by USD 1.90) while more generous unemployment insurance decreases the effect of economic shocks to local economies (Di Maggio and Kermani, 2016^[9]). However, generally the benefits are a proportion of past wages. Therefore, if regions most strongly affected by recessions are also below average productivity and wage levels, this welfare provision does not necessarily counter dynamics of interregional divergence.

Job retention schemes provide employment support with the aim to keep workers in employment. While still considered ‘passive’ labour market instruments, these programmes are more adaptable to changing circumstances and can be scaled and targeted, including to specific places or firms. Such schemes are known under different names (furlough, short-time work, *kurzarbeit*, *activité partiel*, job retention schemes, and wage subsidies) and countries may operationalise these differently. However, their aim is largely the same: to retain the relation between employer and employee during the period of low activity, with governments covering partly for lost income to employees for hours not worked, or cost of employment to employers for retaining workers. While socially beneficial, government-supported schemes may also make economic sense and benefit productivity over the economic cycle. In the absence of job retention schemes, job losses would be larger. Disrupted labour relationships would also cause a loss in job-specific knowledge for the redundant employees and additional costs for employers who must seek, hire and train new employees when a recession ends.

During the COVID-19 pandemic, many countries have increased access to job retention existing schemes or introduced new schemes (OECD, 2020^[25]; OECD, 2020, p. 61^[26]). This mirrors, to some extent, the flexible approach of using such schemes during the 2008 Global Financial Crisis (GFC), although their use during the pandemic has increased across countries (OECD, 2010, p. 50^[27]; OECD, 2021, p. 98^[28]) (OECD, 2010, p. 50^[27]). Causal firm-level evidence from France, Italy and Switzerland demonstrates that firms which used the job retention schemes around the GFC experienced stronger employment growth

during the recovery period compared to those that did not use the schemes (Cahuc, Kramarz and Nevoux, 2018^[29]; Giupponi and Landais, 2020^[30]; Kopp and Siegenthaler, 2021^[31]).⁵

Some occupations and sectors may not be covered well in job retention schemes. Especially people on non-standard forms of employment (freelance, intermittent, hybrid – e.g. combining salaried part-time work with freelance work) were less likely to be eligible for support than other workers (OECD, 2020^[32]; OECD, 2021^[28]). In some sectors, such as in the creative and cultural sectors the use of such contracts is more common. Non-standard contracts tend present a more precarious job situation for workers, which is then compounded by lower accessibility to public job support programmes.

Nonetheless, this pattern of expanded eligibility can also bring about undesirable results. Various studies warn about the need to find the optimal duration (Brenke, Rinne and Zimmermann, 2013^[33]; Hijzen and Martin, 2012^[34]; Boeri and Bruecker, 2011^[35]; Hijzen and Venn, 2011^[36]). The reason is that such schemes may risk keeping workers in jobs that are not viable in the long term. Some “productivity enhancing labour reallocation across sectors and firms” would be appropriate in recoveries (OECD, 2010, p. 11^[27]). The challenge is that such jobs cannot always be identified *a priori*. Fortunately, cross-country evidence from OECD countries show that the programmes are effective in preserving jobs with only minor losses in allocative efficiency (Hijzen and Martin, 2012^[34]).⁶

In many countries, job retention schemes are regulated at the national level, with little discretion of local policy makers (Hijzen and Venn, 2011^[36]). Despite this, substantial regional differences emerge in the use of the schemes. Italian evidence suggests that the take up of the short-term work schemes is dependent on the broader institutional framework of the labour market and income protection (Boeri and Bruecker, 2011^[35]). Hence, the take-up of the short-term work schemes is really due to the varying need of sectors and firms. Indeed, in Germany the take-up of *kurzarbeit* can be related to regional circumstances, including during the period of German unification, the geographical concentration of sectors and firm size (Brenke, Rinne and Zimmermann, 2013^[33]). Similarly, the take-up of these schemes in Italy tends to be regionally concentrated, and this concentration increases during recessions (Boeri and Bruecker, 2011^[35]). Nevertheless, very little research looks structurally at this regional impact of short-term work schemes in conjunction with other place-based policies for local productivity growth.

Locally implemented active labour market policies

Active labour market policies (ALMPs) refer to a collection of policy instruments, such as incentivising and aiding job seekers to find new employment, subsidised and alternative employment, and education opportunities. Across OECD countries ALMPs are regionally governed or nationally coordinated while implemented through regional labour offices potentially in coordination with municipalities (OECD, forthcoming^[37]). Therefore, ALMPs tend to have stronger regional policy dimension than passive policies. The autonomy at the regional level to implement and organise the instruments provides the opportunity to adapt ALMPs to the local needs, for instance by targeting the development of the most relevant skills given local industries (OECD, 2014^[38]). Regional variation in the organisation and use intensity also allows to make comparative assessments in policy effectiveness (Giguère and Eberts, 2009^[39]; Frölich and Lechner, 2010^[40]; Altavilla and Caroleo, 2013^[41]).

There is scope to expand the use of ALMPs during recessions in those regions where unemployment is rising faster, as ALMPs tend to be more effective during downturns than in normal times (Card, Kluve and

⁵ These studies control for potential selection effects of firms into the application and approval process, and other confounders such that the use of a job retention scheme can be said to causally affect firm level outcomes, which include higher survival rate, a reduction in employment redundancies during the downturn and an increase in hiring during a recovery period.

⁶ There is some evidence from Italy and Australia that allocative efficiency decreases with the length or persistence of the downturn (Giupponi and Landais, 2020^[30]; Andrews, Hambur and Bahar, 2021^[192]).

Weber, 2018^[42]; Lechner and Wunsch, 2009^[43]). Furthermore, evidence from Germany and Switzerland suggests that regional differences in intensity of ALMPs are positively associated with placement of jobseekers into jobs without discernible negative displacement effects on other job seekers (Wapler, Werner and Wolf, 2018^[44]; Frölich and Lechner, 2010^[40]).

The regional organisation of labour market offices also affects their operations. First, there may be regional spill-overs, for instance when the working area of a specific labour office does not match the reach of the local labour market (Dauth, Hujer and Wolf, 2016^[45]). This suggests scope for coordination across labour offices active in the same local labour market. Second, ALMPs combine a host of activities, not all of them have shown to be consistently effective. Evidence from Italy indicates that, even when regionally implemented, regions with a different economic structure tend to use a similar mix of ALMPs (Altavilla and Caroleo, 2013^[41]). However, their effectiveness depends on the regional supply of jobs. ALMPs are more effective when the number of open vacancies is large, but cannot address issues that underlie a region's lack of jobs. Coordination between labour offices and other areas of economic policy could, therefore make both areas of policy potentially more effective.

Local government functioning during recessions

The role of local governments during recessions came to the fore after the 2008 Global Financial Crisis. The maintenance of local public services affects the local economy, for instance by preventing local public sector lay-offs, maintaining capital expenditures on infrastructure and community spaces, and through continued delivery of public services such as education and care. Various studies have documented how local governments, across countries, navigate the challenge of reduced income, from local sources and a central government adopting an austerity policy, while aiming to maintain services as much as possible (Charbit, 2011^[46]). The general tendency is that local governments are limited to run a pro-cyclical fiscal policy, where a counter-cyclical policy would be desirable (Rodden and Wibbels, 2010^[47]).

There can be a substantial variation in active policy measures that are undertaken across and within countries. Part of the variation in successfully implementing policies for economic recovery is related to the organisational quality of local administrations within countries (Barbera, Guarini and Steccolini, 2020^[48]; Barbera et al., 2017^[49]; Davies, 2011^[50]). Therefore, there is scope for fora that aim to share best practices among local governments to enhance their resilience during economic downturns. For instance, since 2010 the UK went through a transformation of decreased revenue with more responsibility for local governments' service delivery (Kitson, Martin and Tyler, 2011^[51]; Gray and Barford, 2018^[52]). This transformation impacted councils differently. The search for solutions and innovation in service delivery is also dependent on local leadership and initiatives, and related to institutional resilience (Shaw, 2012^[53]; John, 2014^[54]).

Policies for resilience to natural disasters

The conceptual discussion of resilience to shocks is closely aligned with the literature on economic effects of natural disasters. Various studies have investigated what determines the extent of the impact, speed of the recovery and development of new growth paths after disasters at national and local levels (Noy, 2009^[55]; Cavallo and Noy, 2011^[56]; Strobl, 2011^[57]; Fomby, Ikeda and Loayza, 2013^[58]). Specifically, the hypothesis that a disaster may have some 'cleansing' or 'creative destruction' effect, which allows growth after the event to outpace the pre-disaster trend, has been observed in some contexts (Tanaka, 2015^[59]; Cole et al., 2019^[60]).⁷

⁷ Policies that directly address the engineering resilience or security of infrastructure, such as electricity grids, pipelines, cyber networks and building safety requirements are not considered in this paper.

Table 3. Policies for regional economic resilience to natural disasters

Policy area	Geographic level	Regional resilience outcome	Productivity outcome	Resilience concept
Infrastructure (ports, transport network)	Regional and local	Limit direct damage and increase overall network resilience	+ Limit costs and downfall in times of disruption, - redundancy in normal times	Resistance
Private sector supply chain	National, some local potential	Information on susceptibility to disruptions in GVC could be gathered. Little scope for local policy that directly affects private sector GVC.		Recoverability
	National regulation on production location	Uninterrupted supply during international disputes	- Loss of international specialisation	Redundancy
Finance and Insurance	National public recovery funds	Interregional transfers	+ Policy on division between allocation for (ex-ante) mitigation and (ex-post) repair	Robustness
	Multi-level network of private sector finance	Broad network of physical branches and online services provides mutual resilience	- Branch network may be costly to maintain	Robustness
Local planning	Local government	Efficient public-private interaction during emergency	- Time required to establish and monitor plans	Recoverability
	In case of destruction, rethink potential for rebuilding for a new economy	Increased resilience to future shocks	+ Avoid future disruption and build on existing local economic strengths	Renewal

Source: Author's elaborations.

Above all, the costs in human life from natural disasters can be immense, either at the time of impact or because of subsequent events, for instance due to disruptions of energy, water and medical supplies.⁸ Internationally, the number of casualties from natural disasters tends to be strongly related to income levels, which already suggests that economic development is crucial to limit the cost of and resilience to natural disasters. However, this association sidesteps the identification of precise channels. The quality of infrastructure networks, quality of physical structures and building codes, planning for emergency relief and reconstruction, and internationally coordinated early warning systems are just some of the essential features that fall under the responsibility of national governments (OECD, 2004^[61]; OECD, n.d.^[62]; OECD, 2019^[63]; OECD, 2012^[64]).

The literature on natural disasters covers both high-, middle- and low-income countries. The remainder focuses on cases and policy options that are most relevant for OECD and EU member states. Among this set of countries, those most intensively studied in economics literature are Japan (earthquakes and tsunami) and the United States (hurricanes), with some further cases on New Zealand and Chile (earthquakes). Less investigated in the economics literature are the regional economic consequences of forest fires such as those observed increasingly frequently and intensely in parts of Australia, the United States and southern Europe.

Natural disasters tend to strike locally, and their repercussions can often be tracked at a granular spatial level. What matters for policy is to understand what determines the resilience of regional economies both at the time of impact and in the aftermath during the recovery phase. Another crucial element is to recognise whether a recovery should focus on repairing the damage, or on rebuilding for a new economy. For these policies, three topics can be distinguished: infrastructure and trade, supply chains and networks,

⁸ The 2011 Great East Japan Earthquake and tsunami is estimated to have cost almost 20 000 lives. Hurricane Katrina claimed around 1 800 lives in 2005. In low-income countries, the death tolls from similarly strong earthquakes or extreme weather events tends to be much higher.

and financing and insurance.⁹ Table 3 provides a summarising overview of the most important policies and their relation to regional economic resilience

Infrastructure and trade

Large earthquakes and powerful hurricanes have caused major damage to infrastructure, such as roads and seaports. Naturally, physical infrastructure is crucial for the operation of firms in their deliveries to markets, whether domestically or internationally. Globally, natural disasters and extreme weather events have substantial effects on international trade, but this effect likely correlates with the quality of national governments (Gassebner, Keck and Teh, 2010^[65]). Even volcanic disruptions are shown to have affected trade flows, with potentially longer-term effects on the trade network (Besedeš and Panini, 2018^[66]). Locally, interruption of ports affects areas further inland too (Sytsma, 2020^[67]).

The size of the immediate and medium-term economic effects of the damage to infrastructure is in part due to the availability of alternative roads and modes of transport unaffected by the disaster events. Damaged roads due to an earthquake in Chile affected firms' routes to sea ports, increasing their total cost of exports, as evidenced through the reduction of the total number of shipments from affected plants (Volpe Martincus and Blyde, 2013^[68]). When ports are damaged by a natural disaster, such as those in Japan in 2011, the effect is noticeable locally and globally (Boehm, Flaaen and Pandalai-Nayar, 2019^[69]; Ando and Kimura, 2012^[70]). Locally, the reduction in port capacity appears to concentrate in bulk goods and those that are difficult to transport domestically. In contrast, perishable and technology goods, which are likely to be more time-sensitive and part of global value chains (GVCs), are less affected (Hamano and Vermeulen, 2020^[71]; Friedt, 2018^[72]).

These discussions relate to two aspects of resilience. First, multiple ports connected through rail and road infrastructure offer overall (system) resilience since others can compensate for the disruptions of one or several ports. The reason that different types of goods can be affected differently by a disruption in transport facilities can be explained through a trade-off in the cost of delayed delivery against the cost of using alternative (less optimal) roads and ports (Hamano and Vermeulen, 2020^[71]; Friedt, 2018^[72]). Second, the majority of natural disasters do not completely destroy a port. Often, disruptions from natural disasters are measured in days, not months. Therefore, some redundancy in the capacity of individual ports, in the form of slack capacity in warehousing and berths, can aid during the recovery phase. There is evidence that port utilisation rates temporarily increase after a disruption as they process the delayed cargo (Verschuur, Koks and Hall, 2020^[73]).

Therefore, resilient infrastructure networks that include redundancy and spare capacity at distribution centres, such as ports, provides resilience to the domestic and international transport of goods. Such redundancy may imply a certain opportunity cost of unused production capacity. However, such a cost must be set against the welfare costs of the potential disruption during disasters appropriately discounted against the probability of an event occurring. Sytsma (2020^[67]) estimates that the welfare costs of a disruption from a major hurricane in the US is equivalent to a trade tariff of around 4% to globally affected trade partners, and implies that collectively importers of US products would have a willingness to pay up to USD4 billion in order to avoid such disruption.

⁹ Labour markets are a fourth important policy area around natural disasters. However, labour market effects of natural disasters are not considered in this section. There tends to be a strong overlap in the policies discussed in the section on recessions and megatrends. Specific evidence on labour markets and related policies following natural disasters is provided in McIntosh (2008^[182]), Venn (2012^[195]), Deryugina (2017^[184]) and Deryugina, Kiwano and Levitt (2018^[185]) related to hurricane Katrina (2005) in the US, and Ranghieri and Ishiwatari (2014^[77]) regarding the Great East Japan Earthquake (2011).

Local long-term effects may emerge if rebuilt ports are unable to recapture the lost trade volumes where import and export activity has been replaced by other ports. In this regard, Trepte and Rice (2014^[74]) recount how the initial shock to the port of Kobe, Japan, in 1995, did not affect aggregate trade for Japan as nearby ports were able to absorb the activity. In the longer-term, however, the rebuilt Kobe port did not easily grow to its former level for a lack of a natural advantage, while nearby ports retained their advantage won during the disaster. The authors contrast this with the experience of the US after hurricane Katrina in 2005. The ports near New Orleans were severely incapacitated after the hurricane and alternative ports were not in the position to absorb their trade. This lack of resilience of the system resulted in a loss of trade and raised goods prices. However, after the reconstruction, the affected ports completely recovered their trade volumes due to their natural locational advantage.

Supply chains and networks

Related to the discussion of transport networks is the topic of supply chains and business networks. A number of studies have analysed how the input-output linkages and financial networks of a firm affect its ability to recover from a natural disaster. On the one hand, a network allows a shock to reverberate to other firms. On the other hand, the network may also be beneficial in the time of recovery when firms can draw on network capacity and resources. The evidence suggests that both mechanisms are at play, and the aggregate effect on firms may depend on their placement in the supply chain and the extent to which other firms are directly or indirectly affected. Indeed, firms in the same supply network and jointly affected appeared to recover more slowly compared to firms linked to other firms outside of the affected areas (Todo, Nakajima and Matous, 2015^[75]; Carvalho et al., 2020^[76]).

The role of business networks in the resilience to natural disasters is an interesting addition to the role of business clusters and knowledge networks, which are credited with contribution to regional economic growth and resilience. Therefore, policies that support and facilitate such networks for regional growth can have additional beneficial effects during the times of disasters.

The 2011 Great East Japan Earthquake highlighted the international dimension of supply links as well. Japanese suppliers were involved in international supply chains for highly specialised parts for electronics and cars, some of which happened to be located in the area where the earthquake and tsunami struck. However, overall the manufacturing sector has proven resilient and large firms were able to switch production domestically to other plants and even internationally (Ranghieri and Ishiwatari, 2014^[77]). Nonetheless, other evidence on the international business links traced through company affiliates indicated an almost one-to-one disruption, suggesting that existing suppliers cannot be easily replaced in the short run (Boehm, Flaaen and Pandalai-Nayar, 2019^[69]).

Further regional policy intervention is less evident in this area. On the one hand, competitive firms should learn from such disruptions and critically review their supply chains to assess the risks of similar events re-occurring. Even relatively small events can have global implications, for instance when the Ever Green container ship blocked the Suez Canal for two weeks in 2021. The CEO of Maersk, one of the largest global shipping firms, noted that the pandemic already started a shift in the industry towards greater resilience of supply chain disruptions (FT, 2021^[78]). On the other hand, these linkages are privately organised, with little role for governments to advise how they may be organised better. However, national or regional governments may require firms to keep disaster preparation plans for their plants. Such preparation plans would stipulate how disruptions from a potential natural disaster are mitigated (OECD, 2021^[2]).

Additionally, disaster preparation planning can take into account how individual plants are linked to GVCs. Occasionally, national governments have indicated that specific products or technologies must be available domestically or at least available from producers based in ‘friendly’ nations, for instance as an issue of national security for products with military applications (Wehrle and Pohl, 2016^[79]). More recently, this issue has also become salient for medical supplies (OECD, 2021^[2]). Beyond this, however, restrictions on global

supply chains must be considered very carefully. These supply chains are consequential in increasing economic efficiency and knowledge diffusion and, therefore, contribute to long-term productivity growth.

Finance and insurance

The role of finance and insurance can be divided in two parts, one public and one private. Reconstruction after a disaster requires fiscal transfers to the specific areas. The cost of reconstruction is generally shared between central and local governments according to pre-existing rules (OECD, n.d.^[80]). Mexico has a specific disaster fund that guarantees funding is available when necessary, independent of the fiscal position of the central government. The fund appears successful in transferring financial resources to affected areas, but its structure was also noted to focus on reconstruction rather than on funding projects for prevention and mitigation (World Bank, 2012^[81]; Martinez, 2005^[82]; Saldaña-Zorrilla, 2007^[83]). Japan's experience of allocating funding structurally for mitigating and prevention of damage from natural disasters since the 1960s may offer further inspiration on how to organise public policy in this area (Ranghieri and Ishiwatari, 2014^[77]).

Box 2. Great East Japan Earthquake

The Great East Japan Earthquake was, in fact, a series of tremors of extraordinary magnitude, with epicentres off the north-east Honshu coast near the region of Tohoku in March 2011. The earthquake caused some damage to buildings, but the main damage and fatalities were due to the tsunami that followed. Almost 20 000 people lost their lives. The tsunami also flooded the Fukushima-Dashi nuclear power plant, which interrupted its cooling systems, causing a meltdown in some of the reactors and spillage of nuclear material in the air and water.

A comprehensive report on the experience of Japan following the earthquake and tsunami of March 2011 indicates how essential it is to be prepared for severe disasters (Ranghieri and Ishiwatari, 2014^[77]). Alternative physical infrastructure (roads and railways) as well as a slack capacity of ports offered resilience to the transportation system in the immediate aftermath of a disaster and during the medium term of recovery (Hamano and Vermeulen, 2020^[71]; Akakura and Ono, 2017^[84]).

Recent research has evaluated how the private sector coped with the event and what were some of the critically differentiating factors of success. Disaster planning at the level of individual plants was related to the speed of re-opening after closure (Cole et al., 2017^[85]). Business network improved firms' recoverability. Even if business networks allow for the transmission of shocks, the aggregate picture suggests that networks offer support to individual firms and increase the resilience of the overall system and across regions (Ando and Kimura, 2012^[70]; Boehm, Flaaen and Pandalai-Nayar, 2019^[69]; Carvalho et al., 2020^[76]; Evgenidis, Hamano and Vermeulen, 2021^[86]).

International spillovers emerge when disruption of firms in one country affects the performance of firms in others through the GVCs. Local monitoring for such international vulnerabilities would be informative. For instance, some foreign affiliates of Japanese firms in the US saw a fall in output following the disaster (Boehm, Flaaen and Pandalai-Nayar, 2019^[69]). After the 2011 Great East Japan Earthquake, OECD member states agreed on the principle that global value chains can contribute to the resilience of economies, as well as pose some risk, that require acknowledgement and partnership between firms and governments (OECD, 2013^[87]).

On the side of the private sector, the relation between financial institutions and firms is relevant too. Financial means and insurance are crucial for business continuity in the immediate aftermath of natural

disasters. Hosono et al. (2016^[88]) indicate that firms banking with institutions located in Kobe had lower investment in the aftermath of the 1995 Kobe earthquake. In the future, financial services provision may move further online, such that the physical locations of bank branches become less important in credit provision during emergencies.¹⁰ Yet, the financial sector must be able to bear the liabilities of paying out large insurance sums to households and firms. The experience in Japan showcases that it has largely managed to do exactly that. Box 2 reviews the case of the Great East Japan Earthquake and the evidence of various dimensions of economic resilience to regions and firms associated with it.

Policies for resilience to megatrends

Megatrends are global changes that progress slowly but steadily to fundamentally change the way we live and work. Following recent OECD reports, these trends can be grouped along three dimensions, technological, demographic and environmental change (OECD, 2019^[89]). Technology includes both production processes and the demand for new goods and (digital) services. Demographic change includes issues of ageing societies but also international migration, and the interaction of these. Environmental change considers both the consequences of global warming, the 'climate crisis', the loss of bio-diversity and the push towards an environmentally neutral and circular economy.

Megatrends do not affect places equally. For instance, the challenge of making the global economy less reliant on fossil fuels concentrates in energy intensive sectors, and sectors producing energy-intensive products. The ever-evolving technological frontier affects sectors such as agriculture, manufacturing and services, but in different ways and with different consequences for jobs, productivity and regional resilience. Some of these trends interact, for instance, when regions that depend on fossil fuel extraction activities face the consequences of the need for renewable resources and compete against the declining marginal costs of renewable energy due to technological progress.

Table 4. Policies for regional economic resilience to megatrends

Policy area	Geographic level	Regional resilience outcome	Productivity outcome	Resilience concept
Local planning	For sudden transitions, plan for new opportunities leveraging existing regional attributes. Interaction of local and higher-level governments jointly with private sector	Detect emerging trends early, increase adaptability	- Forego short-term gains from further specialisation, + with potential medium and long-term growth benefit	Reorientation
Labour skills and mobility	National and local	Role for regional mobility, may negatively affect individual regions	+ Increase allocative efficiency	Absorptive capacity
		Skills increases adaptability	+ skills directly relate to labour productivity and innovation.	Absorptive capacity

Source: Author's elaborations.

¹⁰ Evidence from Italy during the 2020 pandemic suggests, however, that both physical bank branches and the quality of online services affect the allocation of emergency credit (Core and De Marco, 2020^[147]).

Box 3. The end of coal and the consequences for mining regions

Thermal coal has been a stable and abundant energy resource since the industrial revolution.^a Yet, nowadays it is widely acknowledged that among unrenewable fossil energy resources it has the highest environmental cost. The CO₂ emissions released when burning coal are the highest among the closest alternatives, such as oil and natural gas. Moving to a zero-emission economy, or at least a CO₂-neutral economy, will involve the end of coal. Or, as stated by Antony Venables and Paul Collier, “since coal is the key polluting fuel, any successful strategy for combating global warming will have the closure of coal as a major consequence” (2014, p. 493^[90]).

Coal consumption among all OECD member states is declining. Among OECD member states, the largest producers of coal are the US, Australia, Poland and Germany (BP, 2019^[91]). While the US saw a short revival of coal over the past years, this is unlikely to last. Indeed, recent statements from the Biden administration indicate a strong commitment to phase out coal (United States Department of State, 2021^[92]). The 2021 COP26 meeting led to a global commitment to reduce coal based power supply.

Coal production tends to be concentrated in specific areas. For instance, in the US coal production is concentrated in Wyoming, West Virginia and Pennsylvania. In Poland, production is concentrated in Upper Silesia. Managing the shift out of coal will require strong public policy for those people still involved in the sector, but also the regions that will lose a major industry (Shotter and Majos, 2020^[93]; Shotter and Huber, 2019^[94]). Germany has recently grappled with this issue as it intends to close all coalmines imminently and phase out all coal-based power plants over the next 15 years. Compensation packages for energy firms, regions and workers were designed, including the option to (re-)locate specific government and military operations in regions that are losing jobs due to this transformation (Buck, Chazan and McCormick, 2019^[95]; Buck, 2020^[96]).

These areas are not the first to transition away from coal. The experience of other countries, not necessarily positive, may aid in designing policies that offer the best opportunities for people and places. During the period 1960-1990, several European countries closed economically unviable coalmines. The context of these closures varied between the UK, Netherlands, Germany and Belgium, and so have public policies to manage the transition. The rapidity of the closure of UK coalmines was perhaps unprecedented for a sector in any OECD member state (Glyn and Machin, 1997^[97]). Recent research on the closing of UK coalmines in the 1970s and 1980s demonstrates that regions with closed mines still have higher levels of (hidden) unemployment today relative to comparable regions that did not have mines (Aragón, Rud and Toews, 2018^[98]; Barr, Magrini and Meghnagi, 2019^[99]). The slow recovery in employment is partly explained by the lack of alternative jobs, and insufficient policy initiatives to address this situation. It also indicates that labour mobility does not fully offset these types of structural shocks. Slightly more positive experiences can be found in the south of the Netherlands and western Germany, where active policy coordination to establish new industries in former coal mining regions facilitated the transitions (Kasper et al., 2013^[100]; OECD, 2019^[101]). However, even in the Netherlands, this transition is said to have taken 35 years, and not all policy interventions during this period were equally efficient or successful. This highlights the need for regular policy evaluation and adaptability to changing circumstances during long-term transitions.

Mining regions, not only those based on coal, would do well to strategically plan for the future, and, depending on the specific resource that is excavated, anticipate the potential for reduced production. Policies to diversify the regional economy early are, therefore, a strong recommendation to increase the resilience to the implications of environmental policies of coal mining regions (OECD, 2017^[102]; OECD, 2018^[103]; OECD, 2019^[101]). Recent successful cases offer lessons for others (Cain, 2019^[104]; OECD, 2019^[105]). Various countries and organisations have already contributed to discussions and

formulation of strategies to make the transition in a sustainable and equitable fashion (e.g. the EU “Just Transition Platform” and the Canadian Task force “Just Transition for Canadian Coal Power Workers and Communities”).

^a While this box concentrates on thermal coal (used in energy production), metallurgic coal, used in the steelmaking is not free from concern as coal free steel production is likely to become an important transition too (McKinsey, 2020^[106]; Silverstein, 2021^[107]; Hes, 2020^[108]). Yet, transition out of thermal coal is currently more prominent and eminent.

Regional economies may face a fundamental long-term shift in the structure of their economy due to such megatrends. Instead of temporary policies, long-term policies that support continuous change and facilitate the development of new opportunities are required (Table 4). A resilient region is characterised by demonstrating a continuous responsiveness to changing circumstances and regular evaluation of these trends and existing policies, while avoiding protecting specific economic activities solely based on past successes and current employment levels. Hence, this is where policies for long-term productivity and policies for resilience strongly overlap.

The OECD recently reviewed policies for urban and rural areas in light of megatrends (OECD, 2019^[89]), highlighting policy options for regions. First, strategic reviews can uncover whether regions are specifically reliant on industries, activities or resources impacted by one of the trends. Fossil fuel resource extraction is one such sector. Current policies that aim to protect jobs in coal mining are in direct contrast to the need for preparing for the future with projected strongly declining global demand for such resources (IEA, 2020^[109]). Resources such as coal are point resources, concentrated in specific geographic areas. Therefore, the closure of extraction activities can have strong regional implications with persistent effects, further reviewed in Box 3. Beyond resource extraction are manufacturing sectors that are energy intensive and therefore also susceptible to transitions in the near future. As manufacturing sectors tend to be regional concentrated, employment effects tend to vary across regions, making some regional labour market relatively more vulnerable to the transition, require policy responses (OECD, forthcoming^[110]; OECD, forthcoming^[111]).

Technological progress may imply reorientation of industries, with the local implication of plant closures. Recent evidence from Germany demonstrates that mass layoffs at specifically high-wage-paying plants have substantial local economic spillovers, causing further job losses in other plants operating in the same industry (Gathmann, Helm and Schönberg, 2020^[112]).¹¹ This suggests a role of agglomeration economies in regional economies, with externalities that go beyond the directly affected firms. However, the authors warn against using this argument for policy intervention as their evidence also shows that regional labour mobility largely mitigates permanent income loss of affected workers. Lay-off periods are often anticipated and rumoured about before the event. Evidence from Austria shows that those leaving the plant up to a year before a lay-off event suffer economically less than those that are laid off later. This is partly explained by a selection in the workers that leave early, notably those that were higher paid already (Schwerdt, 2011^[113]). Consequently, those laid-off workers unable or unwilling to move, for instance those in older cohorts or workers that lack skills that can be applied in different industries, will bear a larger brunt of the event. For these workers, policy initiatives and the availability of effective active labour market programmes are essential.

Both pieces suggest that what makes people resilient to such events are their skills and their ability to be occupationally and regionally mobile. Skills that are in demand in other local industries or other places

¹¹ Other work on European countries suggests that large lay-off events may not be directly related to the adoption of advanced technologies or digitalisation of work places beyond wider industry trends (Silva, Menon and MacDonald, 2019^[189]). In the US, mass lay-off events are correlated with the broader economic business cycle and are associated with regional economic factors such as local unemployment, industrial base and share of people with little post-secondary education (Yildiran, 2021^[190]).

provide the precondition for job transition. While geographic mobility may be costly at a personal level, it can be argued that it is good for the economy more broadly, if people can find new opportunities that increase their productivity (Partridge and Tsvetkova, 2020^[114]). Nevertheless, differences in the capacity of workers and their dependents to go through such transitions provides a strong justification for social agreements between employers and employee representatives, in conjunction with national and local social policies, around mass layoff events. Moreover, regional resilience cannot rely on workers moving in one direction only. A region must have the ability to create economic and employment opportunities to attract people from elsewhere and incorporate workers that are less regionally mobile.

While the above evidence points to the regional economic implications that events at a single plant can have, a trend may affect an entire sector. If a sector is regionally concentrated, such as natural resource extraction or manufacturing clusters, the repercussions for a region may be more dire indeed. A region can risk a permanent loss of employment, unless new opportunities emerge. For instance, the Michigan-Ontario area has had to deal with a major transformation of the automotive industry, which is arguably still ongoing. The role of local policy to deal with such major decade-spanning economic dynamic in a geographically concentrated sector is relevant yet challenging, as discussed in Box 4.

Artificial intelligence and automation are two other global trends that have received attention from policy makers interested in understanding the repercussions on productivity growth and labour markets (Ernst, Merola and Samaan, 2018^[115]). The adoption of these technologies is expected to affect certain occupations more strongly than others. Early evidence of whether the adoption of more machines and robots replaces or complements workers is mixed and probably dependent on local circumstances and institutions (Acemoglu and Restrepo, 2020^[116]; Stiebale, Südekum and Woessner, 2020^[117]).

Box 4. Michigan-Ontario automotive industry

During the recession of 2007-09, one major restructuring occurred in the US automotive industry. General Motors and Chrysler went through bankruptcy procedures with financial aid from the federal government (Goolsbee and Krueger, 2015^[118]). The US automotive industry, ranging from plants of domestic and foreign brands to their parts suppliers, can be an important employer to local economies. The Detroit area remains a central hub of the industry, especially for domestic brands (Klier and Rubenstein, 2010^[119]).

The decline of manufacturing in Michigan also affected the city of Detroit, which experienced a substantial decline in population (McDonald, 2014^[120]). Whereas local policy makers first aimed to replace the automotive activity with other industrial manufacturing, these efforts were unable to reverse the declining trend. More recently, the strategic plans focus on improving the quality of life of current residents, rather than the absolute growth of the city's population and economy (Schindler, 2016^[121]).

There is also an important cross-border component of the automotive industry in southern Ontario (Canada), which remains strongly related to the US activities. The Canadian federal government and Ontario's provincial government have supported the automotive industries over decades with grants and incentives but these have not created a growing trend for the sector in this region either (Sweeney, Mordue and Carey, 2020^[7]; Rutherford and Holmes, 2014^[122]).

However, policies that aim to help in forging a new regional growth path do not necessarily have to be bound to the growth path of the formerly dominant sector. As the case of coal mining regions demonstrates (Box 3), a megatrend may make a specific sector unviable (globally or regionally), such that there is no alternative than focusing on new economic activities. There is some evidence that the Michigan-Ontario area is transforming into a knowledge and innovation cluster that serves the automotive industry, even if actual manufacturing has declined (Hannigan, Cano-Kollmann and Mudambi, 2015^[123]; Sweeney, Mordue and Carey, 2020^[7]).

Box 5 further reviews the latest evidence on the effect of automation on workers. Recent country reports from New Zealand and Canada provide useful assessments for the potential disruption that may lie ahead for their economies and offer a platform to structure policies around (Green, 2020^[124]; OECD, 2020^[125]).

Box 5. Early experiences of increased automation, robotics and artificial intelligence

The adoption of robots varies between countries and manufacturing sectors. Acemoglu and Restrepo (2018^[126]) suggest that this variation can be explained through a combination of differences of aging across societies, another megatrend, and the variation in the location of sectors where robots can substitute for manual workers. A reduction in the relative number of middle-aged workers induces firms to invest in robotic capital. Evidence from local US labour markets suggests that the adoption of robots affects employment and wages of workers negatively, especially those workers at the bottom to middle part of the wage distribution and with skills and occupations that are most subject to substitution by robots (Acemoglu and Restrepo, 2020^[116]). In the US, the average effect was estimated to be a reduction in wages of 0.4% for each additional robot per thousand workers, a transition that the US experienced over a 20-year period. The most disadvantaged groups, e.g. with the lowest levels of education, may have been affected up to three times as hard, and some sector, e.g. manufacturing, may see much larger robot adoptions than what the average suggests. The evidence further suggests that there is little wage gain among other occupations, and limited substitution of employment towards other activities. This would imply that some workers affected by the local adoption of robots are permanently displaced from the labour market.

Yet, evidence from Germany and other European countries does not bear this out as an inevitability. Specifically, effective and inclusive local labour support initiatives for skills-transition, including at the firm or sector level, appear to play an important role for differing trends across countries (Graetz and Michaels, 2018^[127]; Dauth et al., 2018^[128]; Parolin, 2019^[129]; Bessen et al., 2019^[130]). Education institutions offer another possibility to prepare new workers for jobs that are not under threat of imminent displacement.

Local productivity growth increases with the adoption of robots. The earlier mentioned evidence of stagnating wages indicates that the profits of the productivity gain largely benefit capital owners and other high-ranking managers that control these factors of production. Moreover, the adoption of robots tends to be concentrated among the larger and most productive firms (Stiebale, Südekum and Woessner, 2020^[117]). Therefore, over the long term, these characteristics risk a further polarisation of labour markets and market concentration among manufacturing firms (OECD, 2019^[131]).

Looking beyond robotisation, the introduction of artificial intelligence (AI) at the workplace is expected to affect also various 'white-collar' jobs in the future (Webb, 2020^[132]). Machine learning, a subset of AI, focusses on prediction tasks. The role of such tasks in various occupations may offer some insights in how various jobs are affected or changed (Agrawal, Gans and Goldfarb, 2019^[133]). Acemoglu et al. (2022^[134]) find that adoption of AI in US firm establishments changes the skills demand and may have some negative effect on the demand for (non-AI and overall) jobs (Acemoglu et al., 2022^[134]).

Long-term industrial transition requires innovation-oriented policies at the local level (OECD, 2019^[101]). Many cases of successful transitions centred on developing and facilitating innovation networks, entrepreneurship, skill development, and social inclusivity (Bristow, 2010^[12]). These policies must be developed locally and be place-specific ensuring that they build on the existing strengths of a place, aid the development of new activities and contribute to a new growth path for an economy (Ashby et al., 2009^[135]). The OECD supports the view that local governments must be open to "embrace disruption" of megatrends, rather than resist the change (OECD, 2020^[136]; Sweeney, Mordue and Carey, 2020^[7]). Hence,

the role of local governmental institutions and their openness towards new economic possibilities for regions become a crucial element as well. Past successful networks of industry and government may be close-knit and relatively inaccessible to newcomers. Such networks may resist disruption, as they provide a tendency to support the status quo and disregard new growth opportunities (Boschma, 2015^[15]).

Monetary transfers within countries, or in a supranational context such as EU cohesion funding, may also play a role during long-term transitions. For instance, in Germany effective annual regional transfers amount to more than EUR 50 billion (Henkel, Seidel and Südekum, 2021^[137]). EU cohesion funding also targets areas related to megatrends. While the effectiveness of EU cohesion funds as related to regional development is actively studied, a review of this evidence, suggesting a complex picture, is beyond the scope of this paper (Becker, Egger and von Ehrlich, 2010^[138]; Pieńkowski and Berkowitz, 2015^[139]; OECD, 2018^[140]).

Policies for resilience in the aftermath of COVID-19

The COVID-19 pandemic offers both optimistic and pessimistic narratives of resilience. The pessimistic one starts with the global number of fatalities and the largely unprecedented economic (opportunity) costs. Among other things, the lack of preparedness to a pandemic among many governments, for instance by having a pandemic-scenario script ready, tested, implemented and internationally coordinated, was palpable.¹² The positive narrative is that within one year of the identification of the virus genome, the global medical science community published over 13 000 papers on the virus and the disease, and developed several effective vaccines, which were tested and approved for mass use by national and international regulatory bodies. Additionally, many national governments went to unprecedented lengths to cover or cushion people and businesses for lost incomes.

In this global emergency, impacts may vary greatly across and within countries, and across firms and people. The identification of virus hotspots was an important trigger for local restrictions, even if such local measures were quickly scaled up nationally in many OECD countries. However, the economic fall-out of the virus in combination with non-pharmaceutical interventions or NPIs (government policies to limit spread of the disease and lower the number of social contacts) affected places differently depending on the sectoral and occupational composition. Places dense in business services were able to see their workers continue working remotely from home. Essential services and shops remained open almost everywhere, but the recreation and hospitality establishments were often closed the first and longest over the waves of infections across countries and regions. While manufacturing halted almost completely in the beginning of the pandemic, mitigation measures ensured that during the second and subsequent waves, workers could remain at the workplace while observing safe social distance.

One consequence of restrictions on social gatherings was the closure of schools. This is likely to affect young people and those focused on manual skills more than students in more academic orientations. Among children, social divisions are likely to play a strong role in the extent to which they were able to continue their learning at home. Firstly, the loss of learning may have pronounced consequences for the future productivity growth. Secondly, the variation in the effects of these restrictions among age cohorts, social groups and professional orientations may lay the foundation of negative consequences concentrating within groups that tend to be least resilient to economic shocks. Therefore, strong public policy focused on preparing all people for a lifelong learning process must be maintained.

¹² Some evidence suggests that European and North American countries had a higher level of preparedness prior to the COVID-19 pandemic (Oppenheim et al., 2019^[186]). However, the experience of Asian countries with the SARS (2003) outbreak appeared to have aided their response in 2020 (Babu et al., 2021^[187]; Shokoohi, Osooli and Stranges, 2020^[188]).

The COVID-19 pandemic brings together various aspects of the previously discussed shocks and associated local policies. The economic fallout translated in a recession for most economies. Various policies targeting the labour market in recessions were again central to the policy mix (OECD, 2020^[141]; ILO, 2020^[142]). These policies intend to maintain the employer-worker relations such that production can be resumed quickly once it is safe to do so. This should help firms and local economies to return to growth once a sufficient share of the population is vaccinated.

The pandemic resembles a natural disaster, with supply-side effects and reverberations in global supply chains. Workers bound to isolate at home or other government restrictions on business activity resulted in a supply-side shock. However, these do not constitute destruction of physical capital like the experience of destructive earthquakes or weather events. Therefore, production and productivity can be expected to restore relatively quickly.

Table 5. COVID-19 policies, regional resilience and productivity

Policy area	Resilience outcome	Potential long-term productivity effects
Economic Support		
Short-term work schemes	Minimised income fluctuation for workers	+ Maintain employer-employee relations and skills, facilitate recovery
	Facilitate recovery of employment activity	- Limit labour allocation between firms
Financial transfers and credit to firms	Prevent bankruptcies of otherwise financially sound firms	+ Allow existing firms time to adapt to new world
		- Disrupt cycle of creative destruction
Long-term change		
Teleworking	Increased flexibility in mode of work, for some occupations	+ Increased employee wellbeing due to greater flexibility of work-live balance
		- Reduced office-based social contact may harm collaborative and creative processes
Automation of production processes	Reduction in employment dependence may reduce some risks of disruption	+ As a form of technological advancement, drives productivity growth among adopters. Other regions may find negative productivity effect if automation also leads to relocation of manufacturing activities
	Adoption of advanced technologies tends to be skewed towards best performing regions and may reinforce disparities between places, people and firms	
Global supply chains (GVC) adjustment	Limiting dependence on sole suppliers and routes increases resistance to local disruptions	Potentially reduced global specialisation increases costs

Source: Author's elaborations.

Finally, the pandemic may be a catalyst for long-term change akin to transformations due to megatrends that have the potential to revolutionise entire sectors and regions. Some of the trends that were already ongoing, such as digitalisation of education, online presence of retailers and teleworking, have accelerated. The pandemic also interacts with existing megatrends. For instance, there are calls that the crisis may provide the opportunity to fasten the transition to a greener economy. Various cities have used the lockdowns to rearrange streets to prioritise public transport, bikes and pedestrians over cars.

The next subsections discuss policies related to each of these three angles (economic support, recovery and megatrends) and review the evidence of the implications for resilience and productivity. Additionally, a review of some of the emerging global trends that were catalysed by pandemic are reviewed. A summary of the findings is presented in Table 5.

Economic support

As stated, governments went to unprecedented lengths to cushion the economic blow. Broadly speaking, the measures targeting workers and firms in the private sector focused on four dimensions: employment and wage support, access to credit, monetary transfers and tax support.¹³ The availability of support measures is strongly correlated with income level of a country. High income countries generally introduced more instruments, with a wider eligibility and more generous funding. Many of these governments cover both debt of SMEs and the wages of workers (Xavier Cirera et al., 2021^[143]). The emergency programmes were mostly targeted measures and involved different levels of government. Central governments took the lead in business support measures and instruments, local governments were at the frontline of assessing the local impact and implementing direct aid measures (OECD, 2020^[144]).

Coordination between central and local government on budgeting will be an important topic when consolidating the costs of the crisis. A survey among local governments in EU member states found that most expect a fall in revenue (either from the national government or from local sources) and an increase in expenditures. Local governments expect to spend more on social and public services, but also on support to local SMEs and self-employed entrepreneurs (OECD and European Committee of the Regions, 2020^[145]). Local governments embedded in more decentralised national frameworks and those with larger populations expect a larger effect on their revenue and expenditures.¹⁴ Larger and more autonomous local governments also tend to be more active in planning and implementing economic support measures, such as public investment stimulus and direct support to businesses (OECD and European Committee of the Regions, 2020^[145]).

At a national level, the central government support serves as a financial risk-sharing insurance mechanism across regions. Besides the variation in regional intensity, the pandemic has widely different implications for different sectors and occupations. Only some sectors and occupations are classified as essential, or can be performed remotely, insulating them from the shutdown restrictions. These sectors and occupations are not evenly spread among regions. Evidence from the UK suggests that such differences are observed even within cities (Davenport et al., 2020^[146]). Therefore, the emergency government support programs transfer the financial exposure of the pandemic away from the most vulnerable places.

The emerging empirical evidence from micro-data in various countries provides encouraging news on the effectiveness of the economic support policies. Credit guarantees appear to have aided disproportionately the smaller, financially weaker firms or less productive firms, according to evidence from Italy, Portugal and the US (Core and De Marco, 2020^[147]; Kozeniauskas, Moreira and Santos, 2020^[148]; Cororaton and Rosen, 2020^[149]; Granja et al., 2020^[150]). As an evaluation of policy effectiveness in terms of targeting the firms that need it most, this appears to be successful. The support allowed many firms to stay in business including those that are quite viable in normal times. The continuation of such firms will strengthen the recovery and avoid unnecessary shocks to economically weaker regions.

¹³ Various policy trackers, including one of the OECD, track policy initiatives but these predominantly do so at the national, rather than subnational, level. Some trackers that focus on or include economic policy measures are OECD COVID action map: <https://oecd.github.io/OECD-COVID-action-map/>, IMF Policy responses to COVID: <https://www.imf.org/en/Topics/imf-and-COVID19/Policy-Responses-to-COVID-19>, World Bank Map of SME-support measures in response to COVID-19: <https://www.worldbank.org/en/data/interactive/2020/04/14/map-of-sme-support-measures-in-response-to-COVID-19> University of Oxford Blavatnik School of Government COVID-19 Government Response Tracker (OxCGRT): <https://www.bsg.ox.ac.uk/COVIDtracker>, Harvard Business School Global Policy Tracker: <https://www.hbs.edu/COVID-19-business-impact/Insights/Economic-and-Financial-Impacts/Global-Policy-Tracker>, US based Committee for a Responsible budget, <https://www.COVIDmoneytracker.org/>, US based Accountable.us <https://COVIDbailouttracker.com/>.

¹⁴ The cited report defined the level of decentralisation through the shares of central and local government spending as a percentage of GDP.

However, the support schemes may not have been equally accessible for all firms. Across OECD countries “33% of small and medium sized enterprises (SMEs) that were one to two years old in 2020 received government support, compared to 39% of those three to four years old and 45% of SMEs with at least five years of activity” (OECD, 2021, p. 39^[151]).¹⁵ Similarly, smaller firms were less likely to receive government support relative to larger firms.

Italian evidence on the credit distribution of a pandemic loan guarantee scheme also indicates that conditions of the banking sector prior to the pandemic mattered for the efficiency of its implementation. The physical branch networks, reflecting regional heritage of banking, as well as the efficiency of its IT systems, predict the number of loans and the speed of lending decisions (Core and De Marco, 2020^[147]). Evidence from the US also points towards a role of productivity differences within the banking sector in the spatial allocation of credit (Granja et al., 2020^[150]).

Some firms that have received aid may still fall in bankruptcy later once credit guarantee schemes are withdrawn. Analogous to the importance of “flattening the curve” of virus cases among the population in order to not hit the constraints of the health system, the credit guarantee can smoothen a wave of bankruptcies while avoiding a negative spiral through credit markets (OECD, 2021^[152]).

Nevertheless, policy makers should still allow and plan for the weakest firms to close (Rajan, 2020^[153]; Hodbod et al., 2020^[154]; FT, 2021^[155]). Some capital destruction (bankruptcy) will happen, and it must happen in the cycle of renewal for the best businesses to survive and resources from the closing firms to feed innovation and creativity of better performing firms. Therefore, local governments must anticipate this future stream of bankruptcies. The policies discussed above in the context of recessions will likely feature prominently to support affected workers and aid them in the transition to new employment through active labour market policies.

A new world

The pandemic forced many people to use new work methods and processes and called on people’s ingenuity and creativity to deliver goods and services in new ways. Some of these new work methods and processes will last and become part of the post-pandemic world.

Teleworking is likely to become a more prominent feature for many people. This will come at the cost of centralised office locations (e.g. central business districts), but probably less so for places of manufacturing. The productivity effects of teleworking are complex to analyse since many people were working at home in a forced manner. Post-pandemic teleworking may contribute to better arrangements between work and personal circumstances. International evidence on the link between teleworking and productivity is mixed so far, but generally the experience appears positive for those workers that can find a good balance (Angelici and Profeta, 2020^[156]; CPB, 2021^[157]). The effect of teleworking for places and policies are further discussed in Box 6.

¹⁵ The percentages are based on a survey of firms that have a presence on Facebook, and therefore may not be fully representative of the business population of OECD member states.

Box 6. Teleworking

The national lockdowns initiated during the pandemic massively expanded teleworking as a mode of work for many people. Substantial differences in habitual teleworking practices existed prior to the pandemic across EU countries (Milasi, González-Vázquez and Fernández-Macías, 2021^[160]). Teleworking tended to be more widely adopted among the business services sectors or among administrative, management and IT occupations. Sectors and occupations that rely on personal contact, unsurprisingly, saw lower uptake. However, differences in the industrial structure cannot fully explain the observed differences of teleworking practices across countries. Even within the same sector, large variations remain. It appears that national differences in management practices, culture, public services (e.g. availability of affordable childcare) and legal context matter as much. Many of these considerations became temporarily irrelevant during the pandemic but still play a role in the adoption of teleworking and its prevalence in the future.

Occupational and sectoral characteristics also play an important role in the distribution of teleworking at the subnational level. Most jobs amenable to teleworking are located in urban areas, with capital cities often topping the national rankings with an average share of teleworkable jobs that is 9 percentage points higher relative to the national mean. The difference between the top and the bottom region in the share of teleworkable jobs can be large, on average 15% of all jobs (OECD, 2020^[161]).

Adoption of teleworking has important implications for the resilience of places. First, places with a large share of jobs amenable to teleworking are expected to weather the pandemic better, or at least mitigate some of its impacts (the spread of the virus affects urban areas more strongly too). Second, teleworking may become a more permanent feature in economies. Local economic development policies must take this into account (OECD, 2020^[162]). For instance, a recent report sets out how teleworking in the public and private sector can be used as a tool for regional development across a range of policy objectives (OECD, 2021^[163]).

Teleworking partially disconnects the place of work from the place of residence. An outstanding question is how many people will want to make teleworking a more regular mode of work, how many employers are willing to accommodate this, and how far away will workers move if a daily commute is no longer necessary. Firms and policy makers are active in querying their employees about future preferences and exploring management consequences (Taylor et al., 2021^[164]; Hamersma, Krabbenborg and Faber, 2021^[165]). This information is useful for policy makers too, since preferences to relocate away from cities have implications for commuting patterns and local housing markets (Ramani and Bloom, 2021^[166]). Digital infrastructure of fibre and mobile data networks may become important determinants for regions to adjust successfully to a large share of teleworking jobs and to retain or attract residents. Communities dependent on the office-based workers may see a strong decline in economic activity (De Fraja, Matheson and Rockey, 2021^[167]).

The evidence from both before and during the pandemic indicates that SMEs have more difficulties in the transition to teleworking. Investment in IT infrastructure, systems and software can be substantial fixed costs that large firms find easier to bear than SMEs. One can expect innovations in delivering such services to smaller firms with the increased demand, for instance through cloud-based services. A smooth access to such infrastructure and technology may be considered a (local) public good, similarly to essential utility and transport infrastructure. Local policy makers would do well to facilitate such investments and provide support to businesses in this area (OECD, 2020^[162]).

Some scholars have pointed to the overlap between the occupations that were most vulnerable to job losses during the pandemic and those occupations expected to be most affected by automation, reviewed

in Box 5 (Chernoff and Warman, 2020^[158]; Acemoglu, 2020^[159]). The worry here is that the pandemic has accelerated the transformation and business may have invested in technology that makes those occupations redundant in the recovery. Occupations most at risk for both replacement by automation and restricted for social distancing reasons are thought to be in retail sales, secretarial assistance and other occupations in administrative capacities (Chernoff and Warman, 2020^[158]). In places where there was extensive use of short-time work schemes, the cost of retaining people who are temporarily unable to perform their duties is likely to be lower. Therefore, the speed of the transition may differ between countries depending on the scale of this labour market support during the pandemic. This interaction between seemingly independent policies for local resilience to recession (short-time work schemes) and resilience to long-term trends (adapting skills to automation) offers an interesting case study for future analysis.

Analogously to natural disasters, the pandemic brought to surface the vulnerability in the supply of some goods and services. Perhaps most prominent is the vulnerability of the healthcare and hospital provision across and within countries. The number of hospital beds and intensive care units per inhabitant became a key indicator of crisis preparedness. This points to the level of redundancy that countries were willing to keep within their public health organisations for unforeseen events. However, even if beds were available, medical staff were under immense pressure to provide the necessary care. Moreover, there are differences among countries in the level of decentralisation of public healthcare provision, which has also been linked to the health outcomes (Kirchhof, 2020^[168]). Places that lacked the required number of beds have adopted various strategies to cope with the surge in demand, with unequal success. Some governments built temporary hospitals at breakneck speed; others moved patients around the country, or even across national borders to cope with surging demand for intensive care units. These solutions also demonstrate resilience, as creativity and cooperation across levels of government and places are used to provide better outcomes.

Box 7. Global supply chains and local production

The domestic lockdown and international travel restrictions demonstrated anew the interconnectedness of global supply chains. The pandemic also highlighted that national restrictions on exports can suddenly limit access to goods that are in the greatest demand and considered to be an ultimate necessity in times of a global health crisis, such as medication, medical garments and medical devices (OECD, 2020^[169]). The (temporary) shortfalls warrant policy consideration, with the objective to strengthen the resilience of medical supply chains. There are some indications that governments might consider designating certain products as essential or critical and impose requirements on where production facilities must be based. Moreover, additional production capacity may be held in reserve for future shocks. Rather than having such spare production capacity organised strictly at the national level, multilateral coordination could offer cost-effective solutions for groups of countries.

More generally, it remains to be seen whether the pandemic will have lasting implications for the organisation of GVCs in products that are not constrained by new government regulations (Javorcik, 2020^[170]). One element that requires further study is how regions were affected based on where they are positioned in the supply network. There is some evidence at the national level that a country's forward and backward linkages in the international GVC affected its aggregate trade flows (Kejžar and Velić, 2020^[171]; ILO, 2020^[172]). Internationally operating firms as well as their local suppliers should assess these risks and vulnerabilities. As reviewed Box 2, OECD principles from previous disaster events highlight that firms can play an important role in strengthening the resilience of their international linkages and production capacity (OECD, 2013^[87]; OECD, 2021, p. 50^[2]). Importantly, where production facilities are large contributors to local labour markets, these assessments may have implications for policy makers at the regional level.

Some medical and non-medical goods were in short supply, many of them dependent on international supply chains. Forced factory closures and limits to international travel affected global supply chains, especially early in 2020. However, these disruptions have proven to be temporary for most goods, showing the resilience of the global supply chains over the course of the pandemic. Box 7 discusses how interruptions in GVCs affected places of production and reviews potential likely policy implications for the post-pandemic world.

Finally, once the dust of the pandemic has settled, policy makers should consider how the response of this period may affect future economic crisis. For instance, the recession following the 2008 Global Financial Crisis led to a substantial reduction in public services provisions or a reduction in their scope in many countries. The pandemic reiterated the role of the State as an economic stabiliser and as a provider or organiser of essential services. However, the global financial crisis also led to increased regulatory oversight and capital requirements for financial institutions, which have weathered the pandemic well up to the time of writing.

Taking stock and conclusion

After having reviewed policies for regional economic resilience over three types of shocks and the COVID-19 pandemic, some common themes emerge.

Local government is essential in supporting firms and people across transitions. Local policies do not need to be distortionary. For instance, facilitation of knowledge networks, and strategic reviews of economic trends will build capacity among relevant public sector departments and the wider business community to respond to temporary and structural economic shocks. Such networks should be open to innovative contributions, new technologies and even disruptive ideas. Not every shock to an economy will require a fundamental review of a regional economy. Instead, long-term resilient regions tend to rely on a process that continuously reviews the current state of affairs against future trends. The failure to spot changing trends early may have severe long-term costs and may make eventual transitions harder.

In times of uncertainty and recovery, local governments can extend direct economic support to firms, especially to SMEs. As reviewed in this paper, these policies have successful track records in many places, which suggests that the benefit of temporarily supporting firms during macroeconomic shocks outweigh the costs of supporting long-term unviable firms.

In many OECD and EU member states, local administrations, such as local labour offices, are the first line of help for job seekers. Well-organised local administrations have the opportunity to help individuals understand how their current skills fall in line with other trends, and what type of skills may be required in the future. Such aid works well when vacancies are abundant and local job-losses are limited to individual firms, because this allows workers to find new suitable jobs within the same local labour market. In times of recessions, when demand decreases for the whole economy, some support to maintain employee-employer links could be crucial to facilitate future growth.

Policies for (long-term) productivity and economic resilience mutually reinforce each other

What matters for policy is to understand what gives rise to the resilience of people in the economy, (local) labour markets, firms and places (Martin and Sunley, 2015, p. 34^[6]). Local governments may have strategies for the development of workers' skills and for attracting to and retaining skilled labour in the area. Similarly, there may be policies to promote entrepreneurship, strategies for 'smart specialisation' and long-term projects to improve local transport and trade infrastructure. These aspects of policy may be initiated for reasons of long-term economic growth, but this review highlighted that such initiatives are also beneficial in times of exogenous economic headwinds (OECD, 2012, p. 55^[173]).

Various quantitative studies have associated regional economic characteristics with resilience. One can observe an overlap of these factors with factors associated with spatial productivity (Tsvetkova et al., 2020^[174]). Such factors include a diverse industrial base, but one that allows for technological transfers and complementary skills between the various firms and industries. It also includes institutional factors, such as responsive local governments with the capacity to initiate policies that support private enterprise and skill development.

Are there contradictions of policies for productivity and economic resilience?

The main aspect where policies for resilience can counter productivity growth is where policies for resilience either slow necessary economic transformations or enforce redundancy in the use or capacity of productive resources. Both of these can be justified on a welfare basis, and it is important to consider whether this implies a level or a growth effect on productivity in the long term.

Policies that aim to slow down the default rates and job losses relate to the first aspect of slowing change. As argued, there are reasons why such policies can be economically beneficial, as well as socially desirable. Nonetheless, necessary changes that competitively select firms and allocate workers to better jobs must be allowed to happen too and ideally sooner rather than later. Productivity indicators tend to vary more strongly over the business cycle if 'labour hoarding', i.e. the retention of workers during downturns, is part of the labour market response (OECD, 2012, p. 61^[173]). This indicates that labour institutions or policies that aim to limit job losses during recessions do so at the apparent cost of productivity in the short-term. This requires a balancing act in the trade-off between cushioning change, promoting welfare and resilience outcomes, and observed productivity. Moreover, this requires a consideration on the trade-off between current and future productivity growth. Future productivity growth may well be aided through maintaining and supporting employee-employer links over transitory shocks, even if in the short-run observed productivity may become more volatile. As reviewed, the latest evidence on firms using temporary support schemes demonstrate stronger growth during a recovery.

The second aspect relates to maintaining stocks of products and of back-up production capacity for certain essential goods. On a very general level, buffer or slack in a system supports resilience, but potentially at the cost of productivity through reduced efficiency. Firstly, this implies a level effect, rather than a growth effect on productivity. Additionally, one must take again a broad view. Much of the safety equipment and safety measures adopted across the world are never used, from fire extinguishers in buildings to the emergency lanes on highways. However, in the event that such equipment and spare capacity becomes invaluable, their upfront costs are offset quickly.

The need for spare capacity in medical supplies and care facilities came to the fore during the pandemic. Moreover, natural disasters have demonstrated the role of spare capacity at ports, in business networks and global supply chains. There is an implicit price for continued operation in the face of a disruption. This implicit price must be accounted for when considering the cost of reduced productivity of below optimal utilisation rates. The trade-off is not unlike an insurance scheme, where recurring premiums is the price to pay for the ability to receive compensation in the event of accident or disaster.

A final aspect where resilience and productivity may be on opposing sides relates to the role of specialisation and diversification. Specialisation allows for allocation of resources to the most productive activities. At the same time, a shock to such activities could imply large costs for a transition to new areas of specialisation. Diversification, instead, has the potential to protect against some shocks, with the implied cost of productivity growth. In reality, this dichotomy appears false.

Specialisation strategies, such as the regional priorities defined in EU supported 'smart specialisation strategies', aim to provide a relatively broad specialisation that combines multiple industrial and service sectors within a broader knowledge and innovation network and regionally specific natural assets. There is little evidence that such strategies are defined too narrowly and, therefore, increase the vulnerability of regional economies to shocks.

Implicit in a specialisation strategy is the assumption that new trends and specialisations are identified early enough for a region to remain at the forefront of global competitiveness. A diversified base of a knowledge networks and skills development allows for a more organic selection process into new opportunities at an early stage, without requiring foresight on the new trends of the future.

Conclusion

This paper has reviewed the evidence on various policies that are implemented at the local level in response to three types of shocks: recessions, natural disasters and the repercussions originating from megatrends. The evidence does not point to unsurmountable differences between policies that aid the resilience of regional economies and policies focused on regional economic development and productivity growth in the longer run.

The evidence does indicate that there is further scope to enhance some policy programmes in order to increase their effectiveness. For instance, further studies on the organisation and use of active labour market policies during and following major recessions, including the pandemic, will be essential to learn more about their functioning. The pandemic has accelerated or changed some global trends, from automation at the workplace to the organisation of global value chains. Policies to support affected workers, firms and places through this transition will be essential for local economic growth.

Globalisation offers great benefits to society, even if specialisation implies displacement of some economic activities to the benefit of others. The evidence does not support the argument that the pandemic has demonstrated that globalisation decreases the resilience of local economies. However, following previous natural disasters, global value chains have adapted to decrease the reliance on single production locations or suppliers and increase the strength of the overall supply network. Therefore, some changes in global value chains can be expected to emerge in the near future, with implications for local production facilities.

Finally, some megatrends can have major negative implications for regional economies, from the transition to a greener economy to the displacement of jobs from automation. Adaptation to megatrends may require substantial transformations for regional economies. Therefore, it is essential to analyse and plan early and continuously at the local level and prepare people and firms for the future through support to learning new skills and adoption of new technologies. Such support would boost local productivity and make places more resilient to future changes.

References

- Acemoglu, D. (2020), *Written Testimony for the House Committee on the Budget Hearing on Machines, Artificial Intelligence, & the Workforce: Recovering & Readyng Our Economy for the Future*,
<https://budget.house.gov/sites/democrats.budget.house.gov/files/documents/Acemoglu%20-%20Testimony%20-%20AI%20Hearing.pdf> (accessed on 8 February 2021). [159]
- Acemoglu, D. et al. (2022), “Artificial Intelligence and Jobs: Evidence from Online Vacancies”, *Journal of Labor Economics*, Vol. 40/S1, pp. S293-S340, <https://doi.org/10.1086/718327>. [134]
- Acemoglu, D. and P. Restrepo (2020), “Robots and jobs: Evidence from US labor markets”, *Journal of Political Economy*, Vol. 128/6, pp. 2188-2244, <https://doi.org/10.1086/705716>. [116]
- Acemoglu, D. and P. Restrepo (2018), “Demographics and Automation”, *NBER Working Papers*, No. 24421, National Bureau of Economic Research, Cambridge, MA, <https://doi.org/10.3386/W24421>. [126]
- Agrawal, A., J. Gans and A. Goldfarb (2019), “Artificial intelligence: The ambiguous labor market impact of automating prediction”, *Journal of Economic Perspectives*, Vol. 33/2, pp. 31-50, <https://doi.org/10.1257/JEP.33.2.31>. [133]
- Ahrend, R., J. Arnold and C. Moeser (2011), “The Sharing of Macroeconomic Risk: Who Loses (and Gains) from Macroeconomic Shocks”, *OECD Economics Department Working Papers*, No. 877, OECD Publishing, Paris, <https://doi.org/10.1787/5kg8hw5467wd-en>. [23]
- Akakura, Y. and K. Ono (2017), “Estimation method for port cargo demands after large-scale earthquakes and tsunamis”, *Journal of JSCE*, Vol. 5/1, pp. 113-122, https://doi.org/10.2208/journalofjsce.5.1_113. [84]
- Altavilla, C. and F. Caroleo (2013), “Asymmetric Effects of National-based Active Labour Market Policies”, *Regional Studies*, Vol. 47/9, pp. 1482-1506, <https://doi.org/10.1080/00343404.2011.635139>. [41]
- Ando, M. and F. Kimura (2012), “How did the Japanese Exports Respond to Two Crises in the International Production Networks? The Global Financial Crisis and the Great East Japan Earthquake”, *Asian Economic Journal*, Vol. 26/3, pp. 261-287, <https://doi.org/10.1111/j.1467-8381.2012.02085.x>. [70]
- Andrews, D., C. Criscuolo and P. Gal (2016), *The Global Productivity Slowdown, Divergence across Firms and the Role of Public Policy*. [191]
- Andrews, D., J. Hambur and E. Bahar (2021), “The COVID-19 shock and productivity-enhancing reallocation in Australia: Real-time evidence from Single Touch Payroll”, *OECD Economics Department Working Papers*, No. 1677, OECD. [192]

- Angelici, M. and P. Profeta (2020), *Smart-Working: Work Flexibility without Constraints*, <http://www.RePEc.org> (accessed on 28 January 2021). [156]
- Aragón, F., J. Rud and G. Toews (2018), “Resource shocks, employment, and gender: Evidence from the collapse of the UK coal industry”, *Labour Economics*, Vol. 52, pp. 54-67, <https://doi.org/10.1016/j.labeco.2018.03.007>. [98]
- Ashby, J. et al. (2009), *Delivering economic success: An international perspective on local government as stewards of local economic resilience*, Norfolk Trust Fellowship. [135]
- Babu, G. et al. (2021), *Pandemic preparedness and response to COVID-19 in South Asian countries*, Elsevier B.V., <https://doi.org/10.1016/j.ijid.2020.12.048>. [187]
- Barbera, C., E. Guarini and I. Steccolini (2020), “How do governments cope with austerity? The roles of accounting in shaping governmental financial resilience”, *Accounting, Auditing and Accountability Journal*, Vol. 33/3, pp. 529-558, <https://doi.org/10.1108/AAAJ-11-2018-3739>. [48]
- Barbera, C. et al. (2017), “Governmental financial resilience under austerity in Austria, England and Italy: How do local governments cope with financial shocks?”, *Public Administration*, Vol. 95/3, pp. 670-697, <https://doi.org/10.1111/padm.12350>. [49]
- Barr, J., E. Magrini and M. Meghnagi (2019), “Trends in economic inactivity across the OECD: The importance of the local dimension and a spotlight on the United Kingdom”, *OECD Local Economic and Employment Development (LEED) Papers*, No. 2019/09, OECD Publishing, Paris, <https://doi.org/10.1787/cd51acab-en>. [99]
- Becker, S., P. Egger and M. von Ehrlich (2010), “Going NUTS: The effect of EU Structural Funds on regional performance”, *Journal of Public Economics*, Vol. 94/9-10, pp. 578-590, <https://doi.org/10.1016/j.jpubeco.2010.06.006>. [138]
- Besedeš, T. and A. Panini (2018), *Experimenting with Ash: The Trade-Effects of Airspace Closures in the Aftermath of Eyjafjallajökull*. [66]
- Bessen, J. et al. (2019), *What happens to workers at firms that automate*, CPB, <https://www.cpb.nl/automatic-reaction-wat-gebeurt-er-met-werknemers-als-hun-bedrijf-automatiseert#docid-159794> (accessed on 1 April 2021). [130]
- Boehm, C., A. Flaaen and N. Pandalai-Nayar (2019), “Input Linkages and the Transmission of Shocks: Firm-Level Evidence from the 2011 Tohoku Earthquake”, *Review of Economics and Statistics*, Vol. 101/1, pp. 60-75, https://doi.org/10.1162/rest_a_00750. [69]
- Boeri, T. and H. Bruecker (2011), “Short-time work benefits revisited: some lessons from the Great Recession”, *Economic Policy*, Vol. 26/68, pp. 697-765, <https://doi.org/10.1111/j.1468-0327.2011.271.x>. [35]
- Boschma, R. (2015), “Towards an Evolutionary Perspective on Regional Resilience”, *Regional Studies*, Vol. 49/5, pp. 733-751, <https://doi.org/10.1080/00343404.2014.959481>. [15]
- BP (2019), *BP Statistical Review of World Energy 2020*, <http://www.bp.com/statisticalreview>. (accessed on 19 January 2021). [91]
- Brenke, K., U. Rinne and K. Zimmermann (2013), “Short-time work: The German answer to the Great Recession”, *International Labour Review*, Vol. 152/2, pp. 287-305, <https://doi.org/10.1111/j.1564-913X.2013.00181.x>. [33]

- Bristow, G. (2010), “Resilient regions: re-’place’ing regional competitiveness”, *Cambridge Journal of Regions, Economy and Society*,
, pp. 153-167, <https://doi.org/10.1093/cjres/rsp030>. [12]
- Buck, T. (2020), *Germany strikes €44bn deal to phase out coal use in energy supply*, Financial Times, <https://www.ft.com/content/0e26b798-3848-11ea-a6d3-9a26f8c3cba4> (accessed on 20 January 2021). [96]
- Buck, T., G. Chazan and M. McCormick (2019), *Germany struggles with dirty energy in climate change battle*, Financial Times, <https://www.ft.com/content/897922e2-129b-11e9-a581-4ff78404524e> (accessed on 20 January 2021). [95]
- Cahuc, P., F. Kramarz and S. Nevoux (2018), “When Short-Time Work Works”, IZA Institute of Labour Economics, <http://www.iza.org> (accessed on 12 February 2021). [29]
- Cain, K. (2019), *A just transition for the Latrobe Valley*, Latrobe Valley Authority, Australia. [104]
- Caldera Sánchez, A. et al. (2017), “Strengthening economic resilience: Insights from the post-1970 record of severe recessions and financial crises”, *OECD Economic Policy Papers*, No. 20, OECD Publishing, Paris, <https://doi.org/10.1787/6b748a4b-en>. [10]
- Caldera Sanchez, A. and G. Nicoletti (2016), *Resilience of economies to exogenous shocks by*. [21]
- Caldera Sánchez, A., M. Rasmussen and O. Röhn (2015), “Economic resilience: what role for policies?”, *OECD Economics Department Working Papers*, No. 1251, OECD Publishing, Paris, <https://doi.org/10.1787/5jrxhgf61q5j-en>. [8]
- Card, D., J. Kluve and A. Weber (2018), “What Works? A Meta Analysis of Recent Active Labor Market Program Evaluations”, *Journal of the European Economic Association*, Vol. 16/3, pp. 894-931, <https://doi.org/10.1093/jeea/jvx028>. [42]
- Carvalho, V. et al. (2020), “Supply Chain Disruptions: Evidence from the Great East Japan Earthquake*”, *The Quarterly Journal of Economics*, <https://doi.org/10.1093/qje/qjaa044>. [76]
- Cavallo, E. and I. Noy (2011), “Natural disasters and the economy - A survey”, *International Review of Environmental and Resource Economics*, Vol. 5/1, pp. 63-102, <https://doi.org/10.1561/101.00000039>. [56]
- Charbit, C. (2011), “Governance of Public Policies in Decentralised Contexts: The Multi-level Approach”, *OECD Regional Development Working Papers*, No. 2011/4, OECD Publishing, Paris, <https://doi.org/10.1787/5kg883pkxkxhc-en>. [46]
- Chernoff, A. and C. Warman (2020), *COVID-19 and Implications for Automation*, NBER working paper series. [158]
- Cole, M. et al. (2019), “Natural disasters and spatial heterogeneity in damages: the birth, life and death of manufacturing plants”, *Journal of Economic Geography*, Vol. 19/2, pp. 373-408, <https://doi.org/10.1093/jeg/lbx037>. [60]
- Cole, M. et al. (2017), “Pre-disaster planning and post-disaster aid: Examining the impact of the great East Japan Earthquake”, *International Journal of Disaster Risk Reduction*, Vol. 21, pp. 291-302, <https://doi.org/10.1016/j.ijdr.2016.12.015>. [85]

- Collier, P. and A. Venables (2014), "Closing coal: economic and moral incentives", *Oxford Review of Economic Policy*, Vol. 30/3, pp. 492-512, <https://doi.org/10.1093/oxrep/gru024>. [90]
- Core, F. and F. De Marco (2020), "Public Guarantees for Small Businesses in Italy during COVID-19", *SSRN*, <https://doi.org/10.2139/ssrn.3604114>. [147]
- Cororaton, A. and S. Rosen (2020), "Public Firm Borrowers of the US Paycheck Protection Program", *SSRN Electronic Journal*, <https://doi.org/10.2139/ssrn.3590913>. [149]
- CPB (2021), *Thuiswerken vóór, tijdens en ná de coronacrisis*, Centraal Planbureau. [157]
- Dauth, W. et al. (2018), "Adjusting to Robots: Worker-Level Evidence", *Institute Working Paper*, No. 13, Federal Reserve Bank of Minneapolis, <https://doi.org/10.21034/iwp.13>. [128]
- Dauth, W., R. Hujer and K. Wolf (2016), "Do Regions Benefit from Active Labour Market Policies? A Macroeconometric Evaluation Using Spatial Panel Methods", *Regional Studies*, Vol. 50/4, pp. 692-708, <https://doi.org/10.1080/00343404.2014.931571>. [45]
- Davenport, A. et al. (2020), *The geography of the COVID-19 crisis in England*, The Institute for Fiscal Studies, <http://www.nuffieldfoundation.org> (accessed on 27 January 2021). [146]
- Davies, S. (2011), "Regional resilience in the 2008-2010 downturn: comparative evidence from European countries", *Cambridge Journal of Regions, Economy and Society*, pp. 369-382, <https://doi.org/10.1093/cjres/rsr019>. [50]
- De Fraja, G., J. Matheson and J. Rockey (2021), "Zoomshock: The geography and local labour market consequences of working from home", *Covid Economics*, Vol. 64, pp. 1-41. [167]
- Deryugina, T. (2017), "The Fiscal Cost of Hurricanes: Disaster Aid versus Social Insurance", *American Economic Journal: Economic Policy*, Vol. 9/3, pp. 168-198, <https://doi.org/10.1257/pol.20140296>. [184]
- Deryugina, T., L. Kawano and S. Levitt (2018), "The Economic Impact of Hurricane Katrina on Its Victims: Evidence from Individual Tax Returns", *American Economic Journal: Applied Economics*, Vol. 10/2, pp. 202-233, <https://doi.org/10.1257/app.20160307>. [185]
- Di Caro, P. and U. Fratesi (2018), "Regional determinants of economic resilience", *Annals of Regional Science*, Vol. 60/2, pp. 235-240, <https://doi.org/10.1007/s00168-017-0858-x>. [180]
- Di Maggio, M. and A. Kermani (2016), "The Importance of Unemployment Insurance as an Automatic Stabilizer", *Harvard Business School Working Paper*, No. 17-009, <https://www.hbs.edu/faculty/Pages/download.aspx?name=17-009.pdf> (accessed on 23 September 2021). [9]
- Diodato, D. and A. Weterings (2015), "The resilience of regional labour markets to economic shocks: Exploring the role of interactions among firms and workers", *Journal of Economic Geography*, Vol. 15/4, pp. 723-742, <https://doi.org/10.1093/jeg/lbu030>. [176]
- Eraydin, A. (2016), "Attributes and Characteristics of Regional Resilience: Defining and Measuring the Resilience of Turkish Regions", *Regional Studies*, Vol. 50/4, pp. 600-614, <https://doi.org/10.1080/00343404.2015.1034672>. [19]

- Eriksson, T. (2012), "Flexicurity and the Economic Crisis 2008-2009: Evidence from Denmark", [196]
OECD Social, Employment and Migration Working Papers, No. 139, OECD Publishing, Paris,
<https://doi.org/10.1787/5k8x7gw8btq6-en>.
- Ernst, E., R. Merola and D. Samaan (2018), *International Labour Organization*, [115]
<http://www.ilo.org/publns>. (accessed on 8 February 2021).
- Evgenidis, A., M. Hamano and W. Vermeulen (2021), "Economic consequences of follow-up [86]
disasters: lessons from the 2011 Great East Japan Earthquake", *Energy Economics*,
<https://doi.org/10.1016/j.eneco.2021.105559>.
- Faggian, A. and A. Ascani (2021), "Productivity and resilience. A post-COVID-19 perspective", [18]
OECD-EC high-level expert workshop series Productivity Policy for Places, OECD,
<https://www.oecd.org/regional/W5-S1-Alessandra-Faggian-Andrea-Ascani.pdf> (accessed on
31 January 2022).
- Faggian, A. et al. (2018), *Regional economic resilience: the experience of the Italian local labor [178]
systems*, Springer Verlag, <https://doi.org/10.1007/s00168-017-0822-9>.
- Figueiredo, L., T. Honiden and A. Schumann (2018), "Indicators for Resilient Cities", *OECD [17]
Regional Development Working Papers*, No. 2018/02, OECD Publishing, Paris,
<https://doi.org/10.1787/6f1f6065-en>.
- Fingleton, B., H. Garretsen and R. Martin (2012), "Recessionary shocks and regional [177]
employment: Evidence on the resilience of u.k. regions", *Journal of Regional Science*,
Vol. 52/1, pp. 109-133, <https://doi.org/10.1111/j.1467-9787.2011.00755.x>.
- Fomby, T., Y. Ikeda and N. Loayza (2013), "The growth aftermath of natural disasters", *Journal [58]
of Applied Econometrics*, Vol. 28/3, pp. 412-434, <https://doi.org/10.1002/jae.1273>.
- Fratesi, U. and G. Perucca (2018), *Territorial capital and the resilience of European regions*, [179]
Springer Verlag, <https://doi.org/10.1007/s00168-017-0828-3>.
- Fratesi, U. and A. Rodríguez-Pose (2016), "The crisis and regional employment in Europe: what [181]
role for sheltered economies?", *Cambridge Journal of Regions, Economy and Society*,
Vol. 9/1, pp. 33-57, <https://doi.org/10.1093/cjres/rsv032>.
- Friedt, F. (2018), "Natural Disasters, Aggregate Trade Resilience and Persistent Local [72]
Disruptions: Evidence From Hurricane Katrina", *SSRN Electronic Journal*,
<https://doi.org/10.2139/ssrn.3214242>.
- Frölich, M. and M. Lechner (2010), "Exploiting regional treatment intensity for the evaluation of [40]
labor market policies", *Journal of the American Statistical Association*, Vol. 105/491,
pp. 1014-1029, <https://doi.org/10.1198/jasa.2010.ap08148>.
- FT (2021), *Keeping zombie companies alive is the right call*, Financial Times, Kate Allen, [155]
<https://www.ft.com/content/ac2828ad-7930-43ef-a227-1cbd8ff8c018> (accessed on
4 February 2021).
- FT (2021), "Suez blockage will accelerate global supply chain shift, says Maersk chief", *Financial [78]
Times*, <https://www.ft.com/content/e9452046-e88e-459a-9c54-341c85f3cb0d> (accessed on
5 May 2021).

- Gassebner, M., A. Keck and R. Teh (2010), "Shaken, Not Stirred: The Impact of Disasters on International Trade", *Review of International Economics*, Vol. 18/2, pp. 351-368, <https://doi.org/10.1111/j.1467-9396.2010.00868.x>. [65]
- Gathmann, C., I. Helm and U. Schönberg (2020), "Spillover Effects of Mass Layoffs", *Journal of the European Economic Association*, Vol. 18/1, pp. 427-468, <https://doi.org/10.1093/jeea/jvy045>. [112]
- Giguère, S. and R. Eberts (2009), "Effects of Decentralisation and Flexibility of Active Labour Market Policy on Country-Level Employment Rates", in *Flexible Policy for More and Better Jobs*, OECD Publishing, Paris, <https://doi.org/10.1787/9789264059528-5-en>. [39]
- Giupponi, G. and C. Landais (2020), "Subsidizing Labor Hoarding in Recessions: The Employment & Welfare Effects of Short Time Work", No. 13310, Centre for Economic Policy Research, http://cepr.org/active/publications/discussion_papers/dp.php?dpno=13310 (accessed on 12 February 2021). [30]
- Glyn, A. and S. Machin (1997), "Colliery Closures and the Decline of the UK Coal Industry", *British Journal of Industrial Relations*, Vol. 35/2, pp. 197-214, <https://doi.org/10.1111/1467-8543.00048>. [97]
- Goolsbee, A. and A. Krueger (2015), *A retrospective look at rescuing and restructuring general motors and chrysler*, American Economic Association, <https://doi.org/10.1257/jep.29.2.3>. [118]
- Graetz, G. and G. Michaels (2018), "Robots at work", *The Review of Economics and Statistics*, Vol. 100/5, pp. 753-768, https://doi.org/10.1162/rest_a_00754. [127]
- Granja, J. et al. (2020), *Did the Paycheck Protection Program Hit the Target?*, National Bureau of Economic Research, Cambridge, MA, <https://doi.org/10.3386/w27095>. [150]
- Gray, M. and A. Barford (2018), "The depths of the cuts: the uneven geography of local government austerity", *Cambridge Journal of Regions, Economy and Society*, Vol. 11/3, pp. 541-563, <https://doi.org/10.1093/cjres/rsy019>. [52]
- Green, N. (2020), *Technological change and the future of work*. [124]
- Hamano, M. and W. Vermeulen (2020), "Natural disasters and trade: the mitigating impact of port substitution", *Journal of Economic Geography*, Vol. 20/3, pp. 809-856, <https://doi.org/10.1093/jeg/lbz020>. [71]
- Hamersma, M., L. Krabbenborg and R. Faber (2021), *Gaat het reizen voor werk en studie door COVID structureel veranderen?*, KiM Netherlands Institute for Transport Policy Analysis, Ministry of Infrastructure and Water Management, Netherlands, <https://www.kimnet.nl/publicaties/publicaties/2021/10/28/gaat-het-reizen-voor-werk-en-studie-door-covid-structureel-veranderen> (accessed on 3 December 2021). [165]
- Hannigan, T., M. Cano-Kollmann and R. Mudambi (2015), "Thriving innovation amidst manufacturing decline: the Detroit auto cluster and the resilience of local knowledge production", *Industrial and Corporate Change*, Vol. 24/3, pp. 613-634, <https://doi.org/10.1093/icc/dtv014>. [123]
- Hassink, R. (2010), "Regional resilience: a promising concept to explain differences in regional economic adaptability?", *Cambridge Journal of Regions, Economy and Society*, Vol. 3/1, pp. 45-58, <https://doi.org/10.1093/cjres/rsp033>. [13]

- Henkel, M., T. Seidel and J. Südekum (2021), “Fiscal transfers in the spatial economy”, *American Economic Journal: Economic Policy*, <https://ideas.repec.org/p/zbw/dicedp/322.html> (accessed on 28 January 2021). [137]
- Hes, D. (2020), *Albanese says we can't replace steelmaking coal. But we already have green alternatives*, *The Conversation*, <https://theconversation.com/albanese-says-we-cant-replace-steelmaking-coal-but-we-already-have-green-alternatives-126599> (accessed on 27 January 2021). [108]
- Hijzen, A. and S. Martin (2012), *The role of short-time working schemes during the global financial crisis and early recovery: a cross-country analysis.*, <http://www.oecd.org/els/workingpapers>. (accessed on 18 December 2020). [34]
- Hijzen, A. and D. Venn (2011), “The Role of Short-Time Work Schemes during the 2008-09 Recession”, *OECD Social, Employment and Migration Working Papers*, No. 115, OECD Publishing, Paris, <https://doi.org/10.1787/5kgkd0bbwvxp-en>. [36]
- Hodobod, A. et al. (2020), *Avoiding zombification after the COVID-19 consumption game-changer*, *VoxEU*, <https://voxeu.org/article/avoiding-zombification-after-covid-19-consumption-game-changer> (accessed on 22 December 2020). [154]
- Holm, J. and C. Østergaard (2015), “Regional Employment Growth, Shocks and Regional Industrial Resilience: A Quantitative Analysis of the Danish ICT Sector”, *Regional Studies*, Vol. 49/1, pp. 95-112, <https://doi.org/10.1080/00343404.2013.787159>. [175]
- Hosono, K. et al. (2016), “Natural disasters, damage to banks, and firm investment”, *International Economic Review*, Vol. 57/4, pp. 1335-1370, <https://doi.org/10.1111/iere.12200>. [88]
- Hynes, W. et al. (2020), “Bouncing forward: a resilience approach to dealing with COVID-19 and future systemic shocks”, *Environment Systems and Decisions*, pp. 174-184, <https://doi.org/10.1007/s10669-020-09776-x>. [16]
- IEA (2020), *World Energy Outlook 2020*, OECD Publishing, Paris, <https://doi.org/10.1787/557a761b-en>. [109]
- ILO (2020), *COVID-19 and global supply chains: How the jobs crisis propagates across borders*, International Labour Organization, https://www.wto.org/english/news_e/pr855_e.htm. (accessed on 8 February 2021). [172]
- ILO (2020), *Delivering income and employment support in times of COVID-19: Integrating cash transfers with active labour market policies*, International Labour Organisation. [142]
- Javorcik, B. (2020), “Global supply chains will not be the same in the post-COVID-19 world”, in Baldwin, R. and S. Evenett (eds.), *COVID-19 and Trade Policy: Why Turning Inward Won't Work*, CEPR. [170]
- John, P. (2014), “The Great Survivor: The Persistence and Resilience of English Local Government”, *Local Government Studies*, Vol. 40/5, pp. 687-704, <https://doi.org/10.1080/03003930.2014.891984>. [54]
- Kasper, J. et al. (2013), *Na de mijnsluiting in Zuid-Limburg. 35 jaar herstructurering en reconversie 1965-2000 en een doorkijk naar 2010*, Stichting Behoud Mijnhistorie, Maastricht. [100]

- Kejžar, K. and A. Velić (2020), "Covid-19, trade collapse and GVC linkages: European experience", *Covid economics*, Vol. 61, <https://cepr.org/content/covid-economics-vetted-and-real-time-papers-0> (accessed on 27 January 2021). [171]
- Kirchhof, P. (2020), "A tale of two countries: how decentralized organization and long-term investment build resilient healthcare systems", *European Heart Journal - Quality of Care and Clinical Outcomes*, Vol. 6/3, pp. 201-203, <https://doi.org/10.1093/ehjqcco/qcaa036>. [168]
- Kitson, M., R. Martin and P. Tyler (2011), "The geographies of austerity", *Cambridge Journal of Regions, Economy and Society*, Vol. 4/3, pp. 289-302, <https://doi.org/10.1093/cjres/rsr030>. [51]
- Klier, T. and J. Rubenstein (2010), "The changing geography of North American motor vehicle production", *Cambridge Journal of Regions, Economy and Society*, Vol. 3/3, pp. 335-347, <https://doi.org/10.1093/cjres/rsq024>. [119]
- Kopp, D. and M. Siegenthaler (2021), "Short-Time Work and Unemployment in and after the Great Recession", *Journal of the European Economic Association*, <https://doi.org/10.1093/jeea/jvab003>. [31]
- Kozeniauskas, N., P. Moreira and C. Santos (2020), *Covid-19 and Firms: Productivity and Government Policies*, Centre for Economic Policy Research, London, <http://www.cepr.org>. [148]
- Lechner, M. and C. Wunsch (2009), "Are Training Programs More Effective When Unemployment Is High?", *Journal of Labor Economics*, Vol. 27/4, pp. 653-692, <https://doi.org/10.1086/644976>. [43]
- Maravalle, A. and Ł. Rawdanowicz (2020), "Automatic fiscal stabilisers: Recent evolution and policy options to boost their effectiveness", *OECD Economics Department Working Papers*, No. 1636, OECD Publishing, Paris, <https://doi.org/10.1787/816b1b06-en>. [194]
- Martinez, C. (2005), *Natural Disasters Fund (FONDEN)*. [82]
- Martin, R. (2012), "Regional economic resilience, hysteresis and recessionary shocks", *Journal of Economic Geography*, Vol. 12/1, pp. 1-32, <https://doi.org/10.1093/jeg/lbr019>. [14]
- Martin, R. and P. Sunley (2015), "On the notion of regional economic resilience: conceptualization and explanation", *Journal of Economic Geography*, Vol. 15/1, pp. 1-42, <https://doi.org/10.1093/jeg/lbu015>. [6]
- McDonald, J. (2014), "What happened to and in Detroit?", *Urban Studies*, Vol. 51/16, pp. 3309-3329, <https://doi.org/10.1177/0042098013519505>. [120]
- McIntosh, M. (2008), *Measuring the labor market impacts of Hurricane Katrina migration: Evidence from Houston, Texas*, <https://doi.org/10.1257/aer.98.2.54>. [182]
- McKinsey (2020), *Decarbonization challenge for steel Hydrogen as a solution in Europe*, McKinsey & Company, <https://www.mckinsey.com/industries/metals-and-mining/our-insights/decarbonization-challenge-for-steel> (accessed on 27 January 2021). [106]
- Milasi, S., I. González-Vázquez and E. Fernández-Macías (2021), "Telework before the COVID-19 pandemic: Trends and drivers of differences across the EU", *OECD Productivity Working Papers*, No. 21, OECD Publishing, Paris, <https://doi.org/10.1787/d5e42dd1-en>. [160]

- Noy, I. (2009), "The macroeconomic consequences of disasters", *Journal of Development Economics*, Vol. 88/2, pp. 221-231, <https://doi.org/10.1016/j.jdeveco.2008.02.005>. [55]
- OECD (2021), *Fostering economic resilience in a world of open and integrated markets. Risks, vulnerabilities and areas for policy action*, OECD, Paris, <https://www.oecd.org/newsroom/OECD-G7-Report-Fostering-Economic-Resilience-in-a-World-of-Open-and-Integrated-Markets.pdf> (accessed on 22 September 2021). [2]
- OECD (2021), *Meeting of the OECD Council at Ministerial Level. Key Issues Paper*. [5]
- OECD (2021), *OECD Employment Outlook 2021: Navigating the COVID-19 Crisis and Recovery*, OECD Publishing, Paris, <https://doi.org/10.1787/5a700c4b-en>. [28]
- OECD (2021), *OECD Regional Outlook 2021: Addressing COVID-19 and Moving to Net Zero Greenhouse Gas Emissions*, OECD Publishing, Paris, <https://doi.org/10.1787/17017efe-en>. [1]
- OECD (2021), *OECD SME and Entrepreneurship Outlook 2021*, OECD Publishing, Paris, <https://doi.org/10.1787/97a5bbfe-en>. [151]
- OECD (2021), *Supporting jobs and companies: A bridge to the recovery phase*, OECD. [152]
- OECD (2021), *Supporting jobs and companies: A bridge to the recovery phase*, OECD, <https://doi.org/10.1787/08962553-en>. [197]
- OECD (2021), "The future of remote work: Opportunities and policy options for Trentino", *OECD Local Economic and Employment Development (LEED) Papers*, No. 2021/07, OECD Publishing, Paris, <https://doi.org/10.1787/35f78ced-en>. [163]
- OECD (2020), *Broad-based Innovation Policy for All Regions and Cities*, OECD Publishing, Paris, <https://doi.org/10.1787/299731d2-en>. [136]
- OECD (2020), *Capacity for remote working can affect lockdown costs differently across places*, OECD, https://read.oecd-ilibrary.org/view/?ref=134_134296-u9iq2m67ag&title=Capacity-for-remote-working-can-affect-lockdown-costs-differently-across-places. (accessed on 26 January 2021). [161]
- OECD (2020), "Culture shock: COVID-19 and the cultural and creative sectors", *OECD Policy Responses to Coronavirus (COVID-19)*, OECD Publishing, Paris, <https://doi.org/10.1787/08da9e0e-en>. [32]
- OECD (2020), "Exploring policy options on teleworking: Steering local economic and employment development in the time of remote work", *OECD Local Economic and Employment Development (LEED) Papers*, No. 2020/10, OECD Publishing, Paris, <https://doi.org/10.1787/5738b561-en>. [162]
- OECD (2020), *Job Creation and Local Economic Development 2020: Rebuilding Better*, OECD Publishing, Paris, <https://doi.org/10.1787/b02b2f39-en>. [141]
- OECD (2020), *Job retention schemes during the COVID-19 lockdown and beyond*, <https://www.oecd.org/coronavirus/policy-responses/job-retention-schemes-during-the-covid-19-lockdown-and-beyond-0853ba1d/> (accessed on 30 June 2021). [25]

- OECD (2020), "Participation in job retention schemes has been massive in some countries: Approved applications and actual participants in job retention schemes as a share of dependent employees", in *OECD Employment Outlook 2020: Worker Security and the COVID-19 Crisis*, OECD Publishing, Paris, <https://doi.org/10.1787/1686c758-en>. [26]
- OECD (2020), *Preparing for the Future of Work in Canada*, OECD Reviews on Local Job Creation, OECD Publishing, Paris, <https://doi.org/10.1787/05c1b185-en>. [125]
- OECD (2020), *The Face Mask Global Value Chain in the COVID-19 Outbreak Evidence and Policy Lessons*, Tackling Coronavirus (Covid-19), https://read.oecd-ilibrary.org/view/?ref=132_132616-l4i0j8ci1q&title=The-Face-Mask-Global-Value-Chain-in-the-COVID-19-Outbreak-Evidence-and-Policy-Lessons (accessed on 25 January 2021). [169]
- OECD (2020), *The Territorial Impact of COVID-19: Managing the Crisis across Levels of Government - OECD*, Tackling coronavirus (COVID-19), https://read.oecd-ilibrary.org/view/?ref=128_128287-5agkkojaaa&title=The-territorial-impact-of-covid-19-managing-the-crisis-across-levels-of-government (accessed on 22 January 2021). [144]
- OECD (2019), "Determinants and impact of automation: An analysis of robots' adoption in OECD countries", *OECD Digital Economy Papers*, No. 277, OECD Publishing, Paris, <https://doi.org/10.1787/ef425cb0-en>. [131]
- OECD (2019), *Good Governance for Critical Infrastructure Resilience*, OECD Reviews of Risk Management Policies, OECD Publishing, Paris, <https://doi.org/10.1787/02f0e5a0-en>. [63]
- OECD (2019), *Health at a Glance 2019: OECD Indicators*, OECD Publishing, Paris, <https://doi.org/10.1787/4dd50c09-en>. [193]
- OECD (2019), *OECD Mining Regions and Cities Case Study: Outokumpu and North Karelia, Finland*, OECD Rural Policy Reviews, OECD Publishing, Paris, <https://doi.org/10.1787/cd72611b-en>. [105]
- OECD (2019), *OECD Regional Outlook 2019: Leveraging Megatrends for Cities and Rural Areas*, OECD Publishing, Paris, <https://doi.org/10.1787/9789264312838-en>. [89]
- OECD (2019), *Regions in Industrial Transition: Policies for People and Places*, OECD Publishing, Paris, <https://doi.org/10.1787/c76ec2a1-en>. [101]
- OECD (2018), *OECD Economic Surveys: European Union 2018*, OECD Publishing, Paris, https://doi.org/10.1787/eco_surveys-eur-2018-en. [140]
- OECD (2018), *Proceedings of the 2nd OECD Meeting on Mining Regions*. [103]
- OECD (2017), *Mining regions and their cities Scoping paper to inform the first OECD meeting on Mining Regions*. [102]
- OECD (2015), *Ministerial Council Meeting*, <https://www.oecd.org/mcm/documents/ministerial-council-statement-2015.htm> (accessed on 25 June 2021). [4]
- OECD (2014), "Aligning local employment, skills and economic development policies", in *Job Creation and Local Economic Development*, OECD Publishing, Paris, <https://doi.org/10.1787/9789264215009-6-en>. [38]

- OECD (2014), *Employment and Skills Strategies in Canada*, OECD Reviews on Local Job Creation, OECD Publishing, Paris, <https://doi.org/10.1787/9789264209374-en>. [24]
- OECD (2014), *Ministerial Council Statement*, <https://www.oecd.org/mcm/2014-ministerial-council-statement.htm> (accessed on 25 June 2021). [3]
- OECD (2013), *Interconnected economies: Benefiting from Global Value Chains.*, [https://www.oecd.org/mcm/C-MIN\(2013\)15-ENG.pdf](https://www.oecd.org/mcm/C-MIN(2013)15-ENG.pdf) (accessed on 28 January 2021). [87]
- OECD (2012), *Technology to manage natural disasters and catastrophes.*, OECD Publishing, <http://www.wmo.int>. (accessed on 14 January 2021). [64]
- OECD (2012), “What Makes Labour Markets Resilient During Recessions?”, OECD Publishing. [173]
- OECD (2010), *OECD Employment Outlook 2010: Moving Beyond the Jobs Crisis*, https://doi.org/10.1787/empl_outlook-2010-en (accessed on 11 January 2021). [27]
- OECD (2004), *Large-scale Disasters: Lessons Learned*, OECD Publishing, Paris, <https://doi.org/10.1787/9789264020207-en>. [61]
- OECD (n.d.), *Fiscal Resilience to Natural Disasters. Lessons from country experiences.*, OECD Publishing, Paris, <https://doi.org/10.1787/27a4198a-en>. [80]
- OECD (forthcoming), “Multi-level governance of active labour market policies”, *OECD Local Economic and Employment Development (LEED) Papers*, OECD. [37]
- OECD (forthcoming), “Regional industrial transitions to Climate Neutrality: Identifying vulnerable regions”, OECD Publishing. [111]
- OECD (forthcoming), “Regional industrial transitions to net climate neutrality: Identifying most affected sectors”, OECD publishing. [110]
- OECD (n.d.), *Reviews of Risk Management Policies*, https://www.oecd-ilibrary.org/governance/oecd-reviews-of-risk-management-policies_19934106 (accessed on 15 January 2021). [62]
- OECD and European Committee of the Regions (2020), *The impact of the COVID-19 crisis on regional and local governments: Main findings from the joint CoR-OECD survey*, <http://www.oecd.org>. (accessed on 22 December 2020). [145]
- Oppenheim, B. et al. (2019), “Assessing global preparedness for the next pandemic: Development and application of an Epidemic Preparedness Index”, *BMJ Global Health*, Vol. 4/1, p. 1157, <https://doi.org/10.1136/bmigh-2018-001157>. [186]
- Parolin, Z. (2019), “Automation and occupational wage trends”, *OECD Social, Employment and Migration Working Papers*, No. 228, OECD Publishing, Paris, <https://doi.org/10.1787/596b32ce-en>. [129]
- Partridge, M. and A. Tsvetkova (2020), “Local ability to rewire and socioeconomic performance: Evidence from US counties before and after the Great Recession”, *OECD Local Economic and Employment Development (LEED) Papers*, No. 2020/04, OECD Publishing, Paris, <https://doi.org/10.1787/31b980f6-en>. [114]

- Pieńkowski, J. and P. Berkowitz (2015), “Econometric assessments of Cohesion Policy growth effects: How to make them more relevant for policy makers? - Regional Policy - European Commission”, *Working Papers*, No. 02/2015, European Commission, Directorate-General for Regional and Urban Policy, https://ec.europa.eu/regional_policy/en/information/publications/working-papers/2015/econometric-assessments-of-cohesion-policy-growth-effects-how-to-make-them-more-relevant-for-policy-makers (accessed on 6 May 2021). [139]
- Rajan, R. (2020), “State support for Covid-hit companies has to change”, *Financial Times*, <https://www.ft.com/content/baeb54fa-8902-4ac9-a4a1-fdf48cf13a8e> (accessed on 21 December 2020). [153]
- Ramani, A. and N. Bloom (2021), *The doughnut effect of COVID-19 on cities*, VOX, CEPR Policy Portal, <https://voxeu.org/article/doughnut-effect-covid-19-cities> (accessed on 4 February 2021). [166]
- Ranghieri, F. and M. Ishiwatari (2014), *Learning from Megadisasters: Lessons from the Great East Japan Earthquake*, The World Bank, <https://doi.org/10.1596/978-1-4648-0153-2>. [77]
- Rizzi, P., P. Graziano and A. Dallara (2018), *A capacity approach to territorial resilience: the case of European regions*, Springer Verlag, <https://doi.org/10.1007/s00168-017-0854-1>. [20]
- Rodden, J. and E. Wibbels (2010), “Fiscal decentralization and the business cycle: an empirical study of seven federations”, *Economics & Politics*, Vol. 22/1, pp. 37-67, <https://doi.org/10.1111/j.1468-0343.2009.00350.x>. [47]
- Röhn, O. et al. (2015), “Economic resilience: A new set of vulnerability indicators for OECD countries”, *OECD Economics Department Working Papers*, No. 1249, OECD Publishing, Paris, <https://doi.org/10.1787/5jrxhqjw54r8-en>. [22]
- Rutherford, T. and J. Holmes (2014), “Manufacturing resiliency: economic restructuring and automotive manufacturing in the Great Lakes region”, *Cambridge Journal of Regions, Economy and Society*, Vol. 7/3, pp. 359-378, <https://doi.org/10.1093/cjres/rsu014>. [122]
- Saldaña-Zorrilla, S. (2007), *Socio-economic vulnerability to natural disasters in Mexico: rural poor, trade and public response*. [83]
- Schindler, S. (2016), “Detroit after bankruptcy: A case of degrowth machine politics”, *Urban Studies*, Vol. 53/4, pp. 818-836, <https://doi.org/10.1177/0042098014563485>. [121]
- Schwerdt, G. (2011), “Labor turnover before plant closure: “Leaving the sinking ship” vs. “Captain throwing ballast overboard””, *Labour Economics*, Vol. 18/1, pp. 93-101, <https://doi.org/10.1016/j.labeco.2010.08.003>. [113]
- Sensier, M., G. Bristow and A. Healy (2016), “Measuring Regional Economic Resilience across Europe: Operationalizing a complex concept”, *Spatial Economic Analysis*, Vol. 11/2, pp. 128-151, <https://doi.org/10.1080/17421772.2016.1129435>. [183]
- Shaw, K. (2012), “The Rise of the Resilient Local Authority?”, *Local Government Studies*, Vol. 38/3, pp. 281-300, <https://doi.org/10.1080/03003930.2011.642869>. [53]
- Shokoohi, M., M. Osooli and S. Stranges (2020), “COVID-19 pandemic: What can the west learn from the east?”, *International Journal of Health Policy and Management*, Vol. 9/10, pp. 436-438, <https://doi.org/10.34172/ijhpm.2020.85>. [188]

- Shotter, J. and E. Huber (2019), *Can Poland wean itself off coal?*, Financial Times, [94]
<https://www.ft.com/content/674ce754-6b9b-11e9-80c7-60ee53e6681d> (accessed on 20 January 2021).
- Shotter, J. and A. Majos (2020), *Climate change: will coronavirus hasten the demise of Poland's coal?*, Financial Times, [93]
<https://www.ft.com/content/7df61210-3ecb-490e-8959-4822e1b1b56a> (accessed on 20 January 2021).
- Silva, F., C. Menon and D. MacDonald (2019), *Structural Adjustment, Mass Lay-offs, and Employment Reallocation*, OECD, [189]
<https://doi.org/10.1787/23074957>.
- Silverstein, K. (2021), *We Could Be Making Steel From Green Hydrogen, Using Less Coal*, [107]
 Forbes.com, <https://www.forbes.com/sites/kensilverstein/2021/01/25/we-could-be-making-steel-from-green-hydrogen-using-less-coal/> (accessed on 27 January 2021).
- Simmie, J. and R. Martin (2010), "The economic resilience of regions: Towards an evolutionary approach", *Cambridge Journal of Regions, Economy and Society*, Vol. 3/1, pp. 27-43, [11]
<https://doi.org/10.1093/cjres/rsp029>.
- Stiebale, J., J. Südekum and N. Woessner (2020), "Robots and the rise of European superstar firms", No. DP15080, CEPR, [117]
http://cepr.org/active/publications/discussion_papers/dp.php?dpno=15080 (accessed on 8 February 2021).
- Strobl, E. (2011), "The economic growth impact of hurricanes: Evidence from U.S. coastal counties", *Review of Economics and Statistics*, Vol. 93/2, pp. 575-589, [57]
https://doi.org/10.1162/REST_a_00082.
- Sweeney, B., G. Mordue and J. Carey (2020), "Resilient or resistant? Critical reflections on resilience in an old industrial region", *Geoforum*, Vol. 110, pp. 125-135, [7]
<https://doi.org/10.1016/j.geoforum.2020.02.005>.
- Sytsma, T. (2020), "The Impact of Hurricanes on Trade and Welfare: Evidence from US Port-level Exports", *Economics of Disasters and Climate Change*, Vol. 4/3, pp. 625-655, [67]
<https://doi.org/10.1007/s41885-020-00067-y>.
- Tanaka, A. (2015), "The impacts of natural disasters on plants' growth: Evidence from the Great Hanshin-Awaji (Kobe) earthquake", *Regional Science and Urban Economics*, Vol. 50, pp. 31-41, [59]
<https://doi.org/10.1016/j.regsciurbeco.2014.11.002>.
- Taylor, H. et al. (2021), *Hybrid and remote working in the North of England: Impact and future prospects*, Work Foundation, Newcastle University Business School. [164]
- Todo, Y., K. Nakajima and P. Matous (2015), "How do supply chain networks affect the resilience of firms to natural disasters? Evidence from the Great East Japan Earthquake", *Journal of Regional Science*, Vol. 55/2, pp. 209-229, [75]
<https://doi.org/10.1111/jors.12119>.
- Trepte, K. and J. Rice (2014), *An initial exploration of port capacity bottlenecks in the USA port system and the implications on resilience*. [74]
- Tsvetkova, A. et al. (2020), "The spatial dimension of productivity: Connecting the dots across industries, firms and places", *OECD Regional Development Working Papers*, No. 2020/01, [174]
 OECD Publishing, Paris, <https://doi.org/10.1787/ba5edb47-en>.

- United States Department of State (2021), *Remarks at the Keynote Session of B20 2021 Inception Meeting*, John Kerry, Special Presidential Envoy for Climate, <https://www.state.gov/remarks-at-the-keynote-session-of-b20-2021-inception-meeting/> (accessed on 22 January 2021). [92]
- Venn, D. (2012), “Helping Displaced Workers Back Into Jobs After a Natural Disaster: Recent Experiences in OECD Countries”, *OECD Social, Employment and Migration Working Papers*, No. 142, OECD Publishing, Paris, <https://doi.org/10.1787/5k8zk8pn2542-en>. [195]
- Verschuur, J., E. Koks and J. Hall (2020), “Port disruptions due to natural disasters: Insights into port and logistics resilience”, *Transportation Research Part D: Transport and Environment*, Vol. 85, p. 102393, <https://doi.org/10.1016/j.trd.2020.102393>. [73]
- Volpe Martincus, C. and J. Blyde (2013), “Shaky roads and trembling exports: Assessing the trade effects of domestic infrastructure using a natural experiment”, *Journal of International Economics*, Vol. 90/1, pp. 148-161, <https://doi.org/10.1016/j.jinteco.2012.11.001>. [68]
- Wapler, R., D. Werner and K. Wolf (2018), “Active labour market policies in Germany: do regional labour markets benefit?”, *Applied Economics*, Vol. 50/51, pp. 5561-5578, <https://doi.org/10.1080/00036846.2018.1487526>. [44]
- Webb, M. (2020), “The Impact of Artificial Intelligence on the Labor Market”, Stanford University, <https://web.stanford.edu/> (accessed on 15 February 2021). [132]
- Wehrlé, F. and J. Pohl (2016), “Investment Policies Related to National Security: A Survey of Country Practices”, *OECD Working Papers on International Investment*, No. 2016/2, OECD Publishing, Paris, <https://doi.org/10.1787/5jlwrrf038nx-en>. [79]
- World Bank (2012), *Mexico’s Natural Disaster Fund-A Review*, <http://www.worldbank.org> (accessed on 15 January 2021). [81]
- Xavier Cirera, M. et al. (2021), “Policies to support businesses through the COVID-19 Shock: A Firm Level Perspective”, *Covid Economics*, Vol. 64, pp. 42-72. [143]
- Yildiran, C. (2021), “Mass lay-offs in the United States of America, An analysis over 1995 – 2013”, *SSRN Electronic Journal*, <https://doi.org/10.2139/ssrn.3762922>. [190]