

Economic resilience to shocks

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WMREDI project - Economic resilience to shocks: implications for labour markets

Economic Resilience Discussion Document



Prepared by Dr Tasos Kitsos¹, a.kitsos@bham.ac.uk. For relevant published work, please see

Kitsos, A. (2020) 'Economic resilience in Great Britain: an empirical analysis at the local authority district level.' In: Bristow, G. & Healy, A. (eds.) [Handbook on Regional Economic Resilience](#). Cheltenham: Edward Elgar.

Kitsos, A., Carrascal-Incera, A. & Ortega-Argilés, R. (2019) 'The Role of Embeddedness on Regional Economic Resilience: Evidence from the UK'. [Sustainability](#), 11 (14).

Kitsos, A. & Bishop, P. (2018) 'Economic resilience in Great Britain: the crisis impact and its determining factors for local authority districts'. [The Annals of Regional Science](#), 60 (2). pp 329-347.

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Summary

The purpose of this document is to be an evolving resource on local economic resilience and its drivers. The 2008 crisis and its profound socio-economic impacts have sparked researchers and policymakers' interest in the causes and effects of crises. Different countries, and more importantly for this review, different local areas have felt the impact of the Great Financial Crisis (GFC) to varying degrees. At the peak of the GFC, local authorities such as Tamworth have lost one-in-five of their pre-crisis jobs while Hackney was increasing its employment numbers at the same rate.

Understanding the process of resistance to shocks can assist policymakers to develop strategies that assist places to grow more sustainably and be better prepared to face natural or human-made shocks. In economics, the work of Cerra et al. (2012), Cerra and Saxena (2008), Groot et al. (2011) and Duval et al. (2007) has shown that economic disturbances can potentially have time-persistent effects on economies, whilst economic and other policies, as well as the institutional framework, can have a differential impact on both resilience and recovery. At the subnational level, a growing body of literature points to the varying impact of exogenous shocks on regional economies and the differential ability of places to cope with hardship (Bristow et al., 2014; Kitsos & Bishop, 2018; Martin, 2012).

The term *Regional Economic Resilience* has emerged to describe this varying ability of places to avoid or overcome a crisis. The term has its origins in environmental sciences and the study of ecosystems before its evolutionary trajectory in social sciences. Its abstract meaning has enabled a range of stakeholders to come together and discuss different aspects of its multi-faceted nature. At the same time, resilience's

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vagueness meant that its conceptual and operational specificity has been subject to debate. To avoid confusion, it is beneficial for every relevant study to start with defining resilience conceptually and operationally to answer questions such as *resilience of what?* and *resilience to what?*

Since its introduction, several studies have examined regional economic resilience and identified the differential impact of crises in various sub-national geographies (from local authorities to travel-to-work areas and the NUTS hierarchical classification). More importantly, a range of studies has identified factors that can enhance or hinder resilience performance.

We categorise these factors into five interconnected realms which we suggest produce the resilience outcomes observed when an area is faced with a crisis:

- *Industrial ecosystems* covering characteristics such as the specialisation and dynamism of local economies
- *Place* characteristics representing path dependency and physical geography
- *Individual* characteristics such as qualifications and demographics
- *Institutional infrastructure* attributes such as the fitness of national and local institutional set-ups
- *Decision-making* which covers matters of agency and leadership.

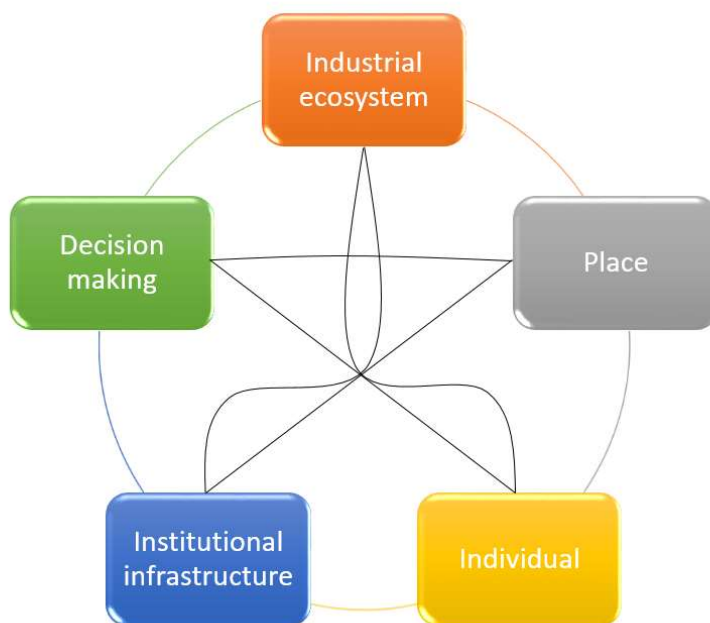


Figure 1. The five interconnected realms of resilience factors.

The document starts with a discussion on the historical evolution of the concept of economic resilience before examining its operationalisation, the uneven spatial footprint of the 2008 and COVID crisis. It continues by outlining existing research on the resilience determinants and highlights unanswered questions on the role of technology, embeddedness, entrepreneurship and institutions that research under project 4A will aim to contribute to.

It aims to serve as a primer for WMREDI's project 4A on economic resilience, and it will be updated throughout the project. As such, it is intended to be a starting point for discussion on which comments, suggestions and additions are greatly welcomed.

1) The concept of economic resilience

Holling (1996; 1973) was amongst the first to introduce the concept of resilience within ecological studies. By resilience, he referred to the capacity of a system to withstand change before it transforms or becomes extinct. In economics, the foundations of resilience can be traced to Levin et al. (1998), Perrings (1994; 1998), Arrow et al. (1995) and Farber (1995). These authors helped transfer the concept from environmental studies to economics via the treatment of societies as systems comprising the economy and its environment. Reggiani et al. (2002) have taken the concept a step further by analysing it as a dynamic process of socio-economic spatial analysis, which uses economic indices and mathematical processes to identify resilience levels.

Resilience has multiple meanings in different scientific fields (see Maru (2010) and Brand and Jax (2007) for a range of them in different scientific fields). In economics and economic geography the definitions of resilience can be grouped into two (non-mutually exclusive) broad categories, representing three distinct notions of the concept (Hill et al., 2010; Martin & Sunley, 2014) (Table 1). The first group consists of equilibrist approaches involving multiple-equilibria (Fingleton, Garretsen & Martin, 2012; Hill *et al.*, 2010; Martin & Sunley, 2014). Most of these definitions view resilience as a rebound to a previous condition or a move towards a new one. Hence, they operationalise the concept on that basis. One of the most explicit definitions within this approach is that of Hill et al. (2010):

"We conceptualize regional economic resilience as the ability of a region [...] to recover successfully from shocks to its economy that throw it substantially off its prior growth path and cause an economic downturn." (Hill et al., 2010, p.2).

The initial definitions of resilience in the study of ecosystems were related to locally stable equilibria and exogenous shocks. Resilience was linked to a move back to the equilibrium point measured in terms of the speed of return or the amount of force that can be counterbalanced (Kitsos, 2020; Martin & Sunley, 2014; Modica & Reggiani, 2014) (Table 1). In environmental studies, *engineering resilience* was connected to a system's ability to maintain or return to its original condition after being subjected to a shock. In economics, *engineering resilience* is represented by Friedman's *plucking model* (Fingleton, Garretsen & Martin, 2012; Friedman, 1993) where economic growth follows an upward path along which there are ups and downs. However, there is always a mechanism that pushes an economy back to the predetermined growth path. The size of a recession predicts the rebound's size, but the size of the rebound does not predict the size of the next recession (Martin, 2012). This model suggests that any recession will be a temporary phenomenon without permanent effects on the region and that there is a growth ceiling which remains unaffected by these shocks (Fingleton, Garretsen & Martin, 2012).

The rigidity of single equilibrium approaches led to conceptualisations that treat resilience as a process of multiple equilibria (table 1). This form of resilience termed *ecological resilience* is the second of the three notions (Kitsos, 2020; Martin & Sunley, 2014; Modica & Reggiani, 2014). Here, the structural change is considered permanent with the definition allowing for a more adaptive view of resilience with multiple equilibria and links to evolutionary approaches (Simmie & Martin, 2010). Attached to this perspective is the notion of *hysteresis* (Cross, Grinfeld & Lamba, 2009; Martin, 2012), which describes the move to a new equilibrium state after being subjected to a shock. The new equilibrium state is permanent and incurs changes to the *plucking* model's growth ceiling. Hysteresis can be both positive and negative and is complementary to economic resilience.

Table 1 Perspectives of Resilience.

Source: Kitsos (2018)

Perspective	Meaning	Measurement
Resilience of ecosystems (Engineering resilience)	Movement back to equilibrium (Single equilibrium approach)	Speed or amount of force counterbalanced
Ecology (Ecological resilience)	Movement to new equilibrium point or stability domain (multiple equilibria with adaptation perspectives)	Amount of force sustained until change of structural characteristics
Resilience as a dynamic process	Adaptation to continuously changing environments	Capacity to adapt and create new development paths

The second group of definitions comprises evolutionary approaches where various factors interact to influence the capacity of a region to adapt to changing conditions. In these approaches, resilience is treated as a dynamic process of continuous adaptation and regions are regarded as systems of economy-environment or Complex Adaptive Systems (CAS) (Boschma, 2015; Bristow & Healy, 2015; Martin & Sunley, 2014) (Table 1). This dynamic approach emerged after criticism of the static or distinct outcome view of equilibrium based approaches.

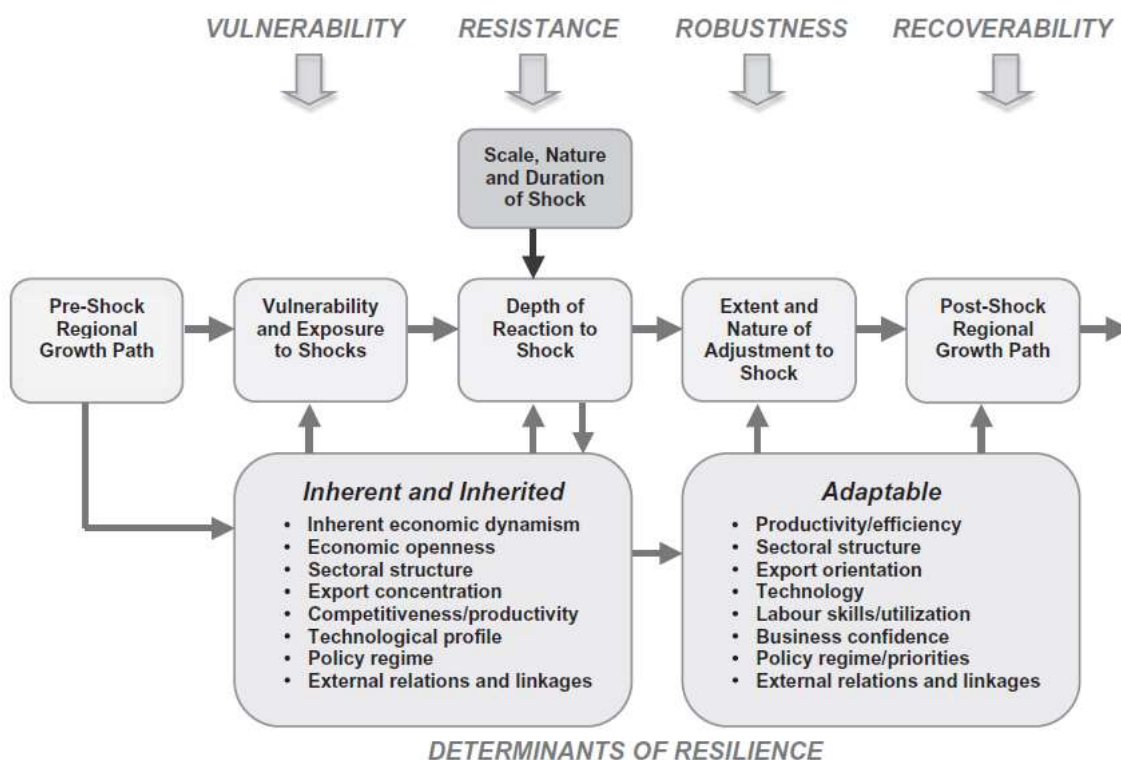
The response to these criticisms is introducing a conceptual framework that views growth as a dynamic and evolutionary process where regions continually adapt to challenges. These approaches' attention is centred on evolution, change and transformation. They differ from approaches that focus on the speed of return to a predetermined equilibrium or the magnitude of force required to switch from one equilibrium to another. These approaches treat regions as individual socio-economic systems where resilience is a dynamic process rather than a country's miniature. Martin & Sunley (2014) provide an example of such a definition where resilience is treated as:

“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 & Sunley, 2014, p.13).

This third perception of resilience is linked to the potential for positive hysteretic reactions which refers to an economy's ability to adapt to different economic conditions and seize potential opportunities (Glaeser, 2005; Martin, 2012; Martin & Sunley, 2007). Resilience is considered a dynamic process of change where the actions of individual stakeholders can make a system adaptive through their decision making. As a result, resilience is treated as an ever-continuing process of adaptation through changes in the structure of the economy, the skill base etc., that responds to continuous external changes in the economic environment rather than the movement from one equilibrium to another (Simmie & Martin, 2010). Martin and Sunley (2014) have sketched out this evolutionary process of resilience revolving around four interrelated elements:

- a) *Vulnerability*: the exposure and sensitivity of a local economy to shocks
- b) *Resistance*: the capability of a region to mitigate the initial impact of a shock
- c) *Robustness*: the ability of a local socio-economic system to adapt in the face of an adversity
- d) *Recoverability*: the capacity of a local socio-economic system to effectively recover from a crisis by developing a new developmental path.



Source: (Martin & Sunley, 2014, p.42)

2) Measuring resilience

Given the different theoretical approaches to resilience, it is not surprising that there is a wide range of different methodologies and measures used to operationalise and examine the concept in empirical studies (Martin & Gardiner, 2019; Modica & Reggiani, 2014; Pontarollo & Serpieri, 2018; Sensier, Bristow & Healy, 2016). Due to the multifaceted nature of resilience, some researchers use composite indicators to represent the concept in disaster (Cardona et al., 2008; Cutter et al., 2008) and socio-economic resilience studies (Briguglio et al., 2009; Östh, Reggiani & Galiazzo, 2015; Pontarollo & Serpieri, 2018; Psycharis, Kallioras & Pantazis, 2014). Briguglio et al. (2009) construct a resilience index based on data on macroeconomic stability, microeconomic market efficiency, good governance and social development at the national level. At lower spatial levels, Östh, Reggiani & Galiazzo (2015) use 12 variables on economic, socio-demographic and 'sense of community' characteristics to develop a resilience indicator for Swedish municipalities, whilst Pontarollo & Serpieri (2018) use five variables across two components distinguishing between *slow-burning processes* and *Shock wave or dynamic processes*. Finally, Psycharis et al. (2014) construct a composite index of resilience for NUTS II and III in Greece for the period 2006-2010.

Composite indicators offer a variety of advantages including the ability to reflect the different dimensions of a concept in one outcome to assist interpretation and comparability over time, increased informational value compared to single measures and enabling discussion on a common basis amongst stakeholders with different agendas (Giovannini et al., 2008). They also suffer from several drawbacks related to the robustness of their construction. Even when clearly laid out, the choices of aggregation and weighting methods entail a degree of arbitrariness, whilst data availability often restricts the choice of variables included. However, the increase of statistics and development of robustness checks provide promising potential for composite indicators to represent complex concepts such as resilience.

Several studies focused on analysing the impact of downturns on single proxies of performance (Kitsos, 2020; Martin & Gardiner, 2019; Martin & Sunley, 2014; Modica & Reggiani, 2014). Kitsos and Bishop (2018) and Kitsos (2020) use a range of labour market measures (employment, full-time equivalent employment, unemployment and claimant count rates) to identify resilience factors in Local Authority Districts in the UK whilst Lee (2014) examines the crisis impact on British cities using changes in unemployment rates and claimant counts and Fingleton, Garretsen and Martin (2012) investigate the employment performance of GB regions. Davies (2011) focuses on changes in rates of unemployment in a number of EU countries, Di Caro (2015; 2017) examines the differential resilience of Italian regions in terms of labour markets, whilst Groot et al. (2011) and Hill et al. (2010) focus on both employment/unemployment and output measures in the EU and US respectively. In discussing the choice between income and employment measures, Cellini et al. (2017) focus on Italian regions and find significantly different results when ranking local areas according to their resilience measured by income and employment. The authors suggest that the two variables are influenced by different factors and fail to identify a relationship between employment and income movement in different crises. They conclude that regional resilience is shock and

measure specific and suggest that the two measures provide complementary information (Cellini, Di Caro & Torrisci, 2017).

Most research focuses on measuring aspects of the labour market (Kitsos, 2020; Martin & Gardiner, 2019; Martin & Sunley, 2014; Modica & Reggiani, 2014). The rationale for this focus is related to both practical and theoretical considerations. Labour market data tend to be more readily available and reliable at lower geographical levels than output measures. Di Caro (2015) opts for the use of employment data based on more significant variation at the regional level than GDP and the fact the data do not require deflating. Fingleton et al. (2012) argue that labour market adjustments are one of the main options available for firms to reduce costs during a recession and hence the impact of a crisis may manifest itself particularly strongly in the labour market.

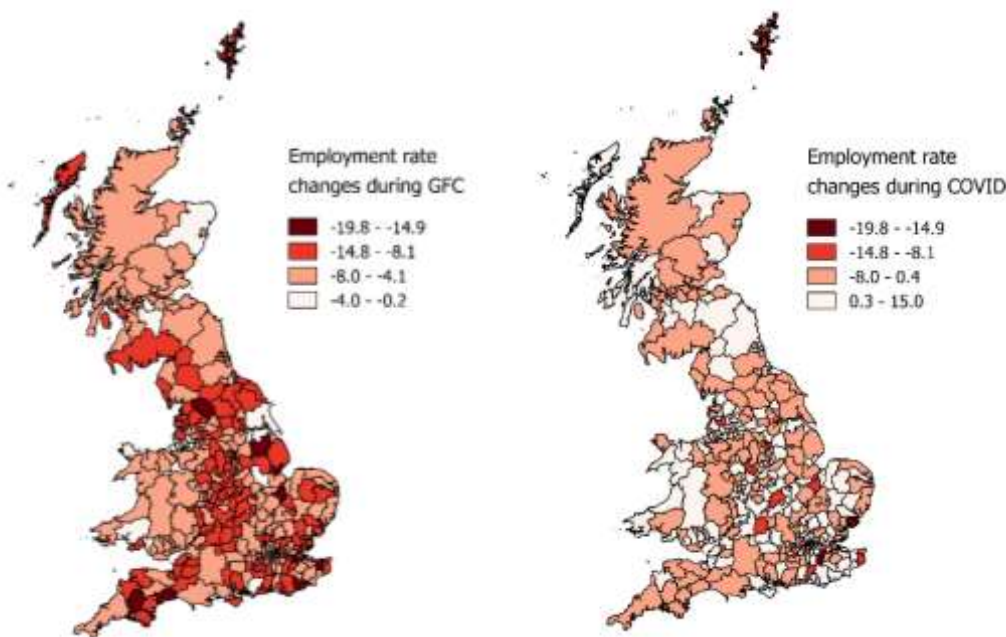
Labour market conditions also reflect wider social problems in local areas. Joblessness has been positively associated with loss of skills and human capital (Bell & Blanchflower, 2010); reduced happiness both for the unemployed (Bell & Blanchflower, 2010; Clark & Oswald, 1994; Winkelmann & Winkelmann, 1998) and for those fearing unemployment (Bell & Blanchflower, 2010; Di Tella, MacCulloch & Oswald, 2001; Di Tella, MacCulloch & Oswald, 2003); long-lasting psychological and health effects (Arulampalam, 2001; Beale & Nethercott, 1987; Bell & Blanchflower, 2010); the creation of a vicious cycle of criminality and further unemployment (Bell & Blanchflower, 2010; Carmichael & Ward, 2000; Carmichael & Ward, 2001; Falk, Kuhn & Zweimüller, 2011) as well as family breakdowns (Brinkley et al., 2008; Clayton, 2011).

Using these proxies, several studies established a consistently differential spatial footprint of crises on different economic sectors and localities with a particular focus on the Great Financial Crisis of 2008. From differences among countries (Briguglio *et al.*, 2009; Duval, Elmeskov & Vogel, 2007; Groot *et al.*, 2011) to regions (Di Caro, 2015; Di Caro, 2017; Faggian et al., 2018; Martin, 2012), cities (Lee, 2014; Martin & Gardiner, 2019), towns (Fingleton & Palombi, 2013) and local authorities (Kitsos, 2020; Kitsos & Bishop, 2018). Crises are not all the same. They differ in their nature and propagation channels. Some are sectoral (i.e. the downturn of the early 1980s in the UK) whilst others are more systemic (i.e. the 2008 GFC in the way it has evolved). Some stem from supply-side constraints whilst others are the outcome of demand shifts. Finally, some originate purely from the economic sphere whilst others are the result of disasters (environmental or human-made) or health related such as the current Covid-19 crisis. However, the evidence is consistent and clear. Recessions unevenly affect different localities. The next section compares the 2008 GFC with the available information we have for the emerging Covid-19 crisis.

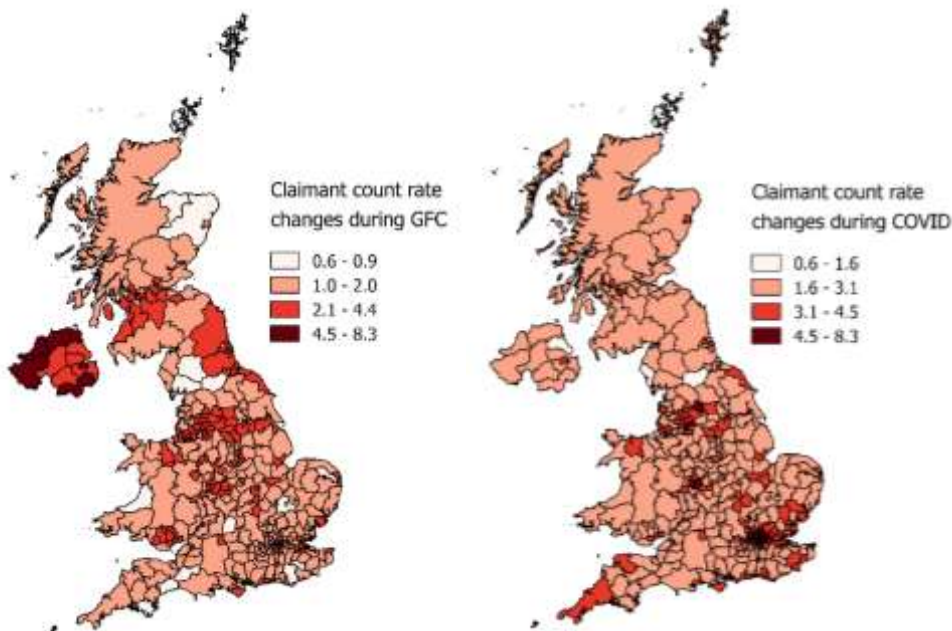
3) 2008 GFC and the COVID-19 crisis

With the COVID crisis still unfolding at the time of writing and with certain lags in the production of reliable and comparable statistics, any comparison of outcomes between the GFC and the COVID crises is premature. However, their uneven spatial footprint is a common element that highlights the need for more place-based responses to strengthen local resilience.

The maps below use data from ONS' Annual Population Survey to compare the maximum pre-crisis employment rate to its minimum post-crisis rate. To provide some level of comparability, the data refers to the July-June period and ranges from 2004 to 2020. Up to June 2020, the COVID crisis has had a smaller impact on employment rate drops (average of +0.3 change in employment rates between 2019-2020) compared to the GFC (average of -8 change in employment rates between pre and post-crisis). This could be the effect of policy measures taken during the recent crisis (e.g. furlough scheme) or more likely a lag on the measurable impact of the COVID crisis.



Using more up to date administrative data on claimant counts for November of each year shows a more consistent picture between the two crises with the COVID one appearing to be more severe even at this early stage (average of 3.1 points difference compared to 2.1 for the GFC). Again, comparing the two crises is not advisable since the qualification criteria for employment seeking benefits have changed during our study period.



What we can safely say from these maps is that crises affect places in different ways and severity. Some places are more resilient than others. Despite the long-term dynamics that generate and maintain the capacity of a place to avoid or overcome a crisis, resilience is not a static characteristic but a dynamic feature that can be built, strengthened or deteriorate in time. It is the outcome of the interactions and interrelations of several factors which the literature is still trying to uncover. The next section systematically discusses these factors and highlight what we know and what we do not know in understanding and building local resilience.

4) Resilience factors

Research on regional economic resilience to date has identified a series of factors that may affect a local area's performance in the face of adversity. From individual traits to the characteristics of local industrial structures, resilience is the outcome of interactions between socio-economic forces and constantly interacting and evolving mechanisms. In this section, we group resilience factors in five interconnected realms (Figure 1) to gain insights into enhancing local resilience outcomes.

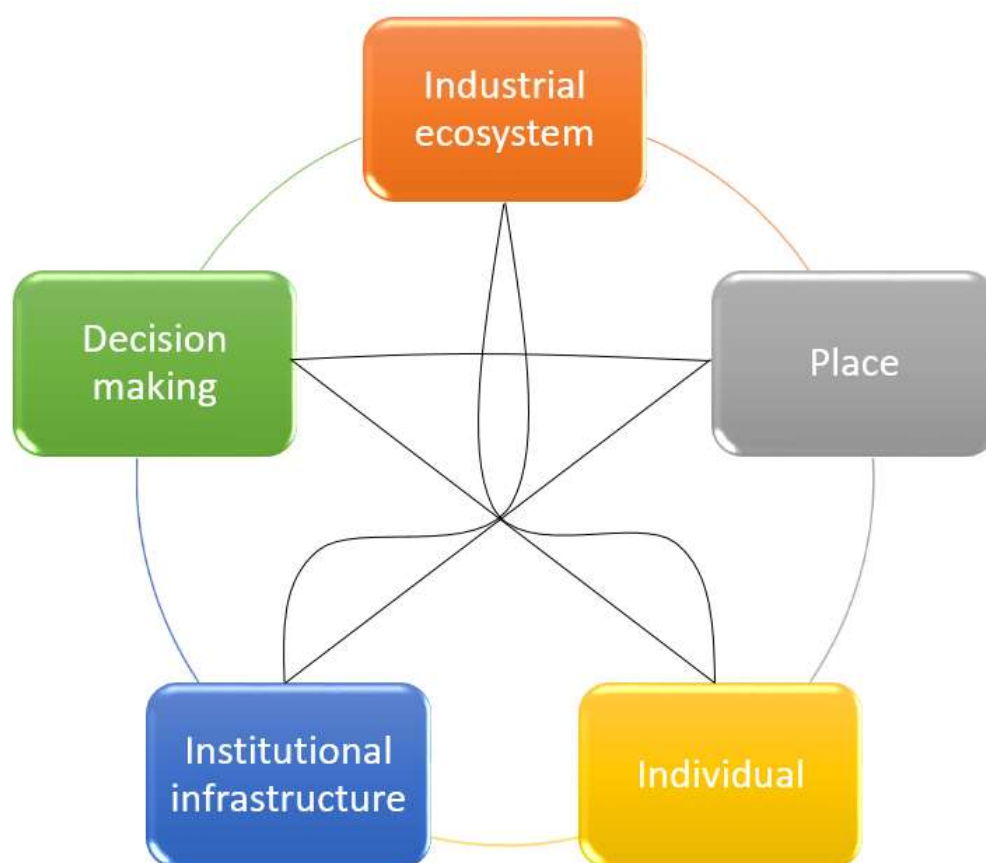


Figure 1. The five interconnected realms of resilience factors.

4.1 Industrial Ecosystem

The realm of the *industrial ecosystem* includes all these resilience drivers that relate to characteristics of regional economies. From the sectoral composition of employment and output to more nuanced attributes such as the level of diversification or the vibrancy of business dynamics, several characteristics of local industrial structures are expected to affect resilience outcomes.

4.1.1 Sectoral characteristics, origin and transmission

Economic downturns may have differential impacts on various sectors and industries (Canova et al., 2012; Kilian & Park, 2009; Kitsos, 2020; Navarro-Espigares, Martín-Segura & Hernández-Torres, 2012). Different sectors exhibit varying demand, supply, competition and location characteristics, uneven capital intensity or

productivity differentials that could translate into variable local impacts of the recession (Gregg & Wadsworth, 2010). The effect of these characteristics on resilience is also relative to each crisis's nature and origin, its transmission and propagation mechanisms, institutional factors, and sector characteristics, including the size and age of businesses.

The origin of the shock might indicate the most vulnerable sectors during a crisis. For example, the oil price shocks of the 1970s were expected to have a greater impact on manufacturing and, in particular, the supply and demand for consumer durables that use energy (Kilian, 2008; Lee & Ni, 2002). Following the same principles, the late 2000s downturn which emerged in the financial sector and the housing market might be expected to hit the financial services industry and construction (Clayton, 2011; Lee, 2014). However, the origin of the crisis provides only an indication of potentially vulnerable sectors and, depending on policy actions and the transmission mechanisms, the final impact may affect sectors unrelated to the origin of the crisis.

Most theoretical work on the transmission and propagation mechanisms of shocks relates to the early 1970s oil price shocks (Lee & Ni, 2002). Theories often stress the supply-side effects of the rise in oil prices on reduced productivity through the decrease in this input. However, these theories have attracted little detailed empirical study and, more importantly, failed to explain the observed differential impact of oil price rises on different industries (ibid.). On the other hand, demand-side theories focus on income, uncertainty and operational cost effects, and changing patterns of consumption, spending, saving and investment (Kilian, 2008). The income effect focuses on reducing household disposable income due to the rise of energy prices which leads to a reduction in consumer demand. The uncertainty and operational cost effects (Hamilton, 1988; 2003) suggest that demand for consumer durables that use energy may be affected by a sudden oil price rise, impacting specific sectors such as car manufacturing. At the same time, individuals may raise their savings rate as a response to uncertainty and concerns over employment (Kilian, 2008).

Similar demand and supply-side effects were at play in the case of the 2008 crisis. The analysis of supply-side effects tended to focus on the impact of limited credit availability and the associated reduction of investment (Bonaccorsi di Patti & Sette, 2012), whilst the demand-side effects remain in essence the same as in studies of the 1970s shock. Several researchers also examine how the recent crisis has been transmitted across countries via the linkages between banks in financial markets (Hesse, Frank & González-Hermosillo, 2008; Kalemli-Ozcan, Papaioannou & Perri, 2013), whilst others suggest that trade transmitted the crisis across borders (Claessens, Tong & Wei, 2012). Coupled with the varying income elasticity of demand, profitability and productivity rates for different goods and sectors (Canova *et al.*, 2012; Fingleton, Garretsen & Martin, 2012; Martin, 2012; Martin & Sunley, 2014), the above effects can result in disparate impacts on different sectors of the economy.

Institutional factors may also affect the impact of economic downturns on different sectors, revealing the interplay between the realms of *decision-making*, *institutional infrastructure* and the *industrial ecosystem*. Market rigidities limit the flexibility of prices and wages leading to high entry costs, reduced competition and adverse employment effects making adaptation to changing circumstances harder and lengthier (Blanchard & Giavazzi, 2003; Canova *et al.*, 2012; Pissarides, 2003). Different product market regulations across

sectors may affect the entry and exit conditions in these sectors, impacting competition and efficiency levels (Ahn, 2002). Increased competition levels lead to lower product prices, whilst low entry barriers lead to the entry of more productive firms and the exit of those less productive. The incumbent businesses in more competitive environments will also have a greater motive to adopt more productive methods, improving overall production efficiency (Canova *et al.*, 2012; Griffith, Harrison & Simpson, 2010; Melitz, 2003). As a result, flexibility and low entry barriers can help a local economy renew its business stock with more dynamic and productive firms that would be better able to adapt to the economic crisis's challenges. Furthermore, different market regulations including protectionist policies such as those seen for the banking sector (Gordon, 2011; Haldane, 2010; 2011), for example, will lead to a differential impact of the 2008 crisis in various sectors.

At the firm-level, size and age may be significant factors affecting the capacity to respond to crises. These characteristics may, for example, affect access to capital markets, with young and small firms depending on intermediary credit and being constrained by their balance-sheet position, whilst large firms can use direct sources of credit (Fort *et al.*, 2013; Gertler & Gilchrist, 1994; Gertler & Hubbard, 1988). Using firm-level surveys, Popov & Udell (2012) find that the effects of banking constraints are greater for firms with limited tangible assets whilst Artola & Genre (2011) suggest that young and small firms had to face actual credit constraints (as opposed to the general perception of lending constraints for all firms) during the 2008 financial crisis. Ferrando & Grieshaber (2011) find similar results in relation to the age of a business but mixed results in terms of size. In turn, Campello *et al.* (2010), survey a number of Chief Financial Officers in firms across the US, Europe and Asia and find that borrowing constraints have led firms to postpone attractive investment opportunities.

Consequently, firm-level characteristics appear to be significant during the downturn, leading to different rates of labour hoarding, inventory accumulation and dissipation, resulting in differential impacts of the economic crisis (Fort *et al.*, 2013; Gertler & Gilchrist, 1994; Gertler & Hubbard, 1988; Sharpe, 1994). To the extent that sectors and crises are differentiated in the characteristics above, it is expected that crises would have disparate effects across regions on the basis of the importance of different sectors in these areas.

Groot *et al.* (2011) study EU NUTS II regions and find a significant effect of the sectoral composition on sensitivity to business cycles (using the change in GDP and unemployment as indicators of the cycles), whilst Brakman *et al.* (2014) find a positive relationship of a local focus in export-oriented industries and regional resilience (measured by the change in unemployment and real GDP/capita. Martin (2012) shows the UK-wide differential impact between production and services on employment and output in three different UK recessions. Whilst the 1980s downturn had a disproportionate impact on production industries in the Midlands and the North (*ibid.*), the 1990s recession was more related to the housing markets and services which were more prevalent in the South (Lee, 2014). Davies (2011) on the other hand, finds that the initial response (in terms of unemployment) to the recent recession was better in places with low manufacturing employment rates whilst the rebound had mixed results in relation to a local economic structure when examining the performance of several European regions during the recent economic crisis.

Due to the nature and origin of the 2008 financial crisis, it might be thought that the sectoral impact would be more significant on services such as finance and banking, real estate and construction and lower on the public sector, which acted as a buffer during the initial recession period (2008-2010) (Clayton, 2011). However, the literature is ambiguous as to whether the 2008 crisis hit manufacturing or services more severely. On the one hand, finance and business services showed the largest decrease in jobs during 2008-2009 with Q4 of 2008 seeing the largest decrease in jobs in the sector since Q2 of 1978 (ONS, 2009). On the other hand, Gregg and Wadsworth (2010) find that the largest immediate fall of output was in manufacturing and that manufacturing and construction bore most of the losses in 2008-2009 with a drop of 8-10% in employment. However, manufacturing jobs have been declining since 1978, so it is difficult to attribute the employment decrease in manufacturing solely to the 2008 recession. Simultaneously, the loss of output in manufacturing for Q3 and Q4 of 2008 and Q1 2009 was the largest in the last 30 years (ONS, 2009). The ESPON project on regional economic resilience in Europe identifies a mixed picture of the manufacturing sector's contribution to employment resilience and a positive relationship between employment in services and financial services at the industry level and regional economic resilience (Bristow *et al.*, 2014).

One explanation for these mixed views is the finding of Martin *et al.* (2016) who show that it was region-specific effects other than differences in industrial structures that influenced regions' performance during different recessions. The authors find that the industrial mix's importance on resilience performance differs across crises and has decreased since the 1970s. If economic downturns increasingly affect a greater number of industrial sectors, through the increased interconnectedness of the latter - as measured by the growth of outsourcing (Bartel, Lach & Sicherman, 2005; McCarthy & Anagnostou, 2004) or the length of value chains (Elms & Low, 2013), this effect likely takes place at different points in time during a crisis period. As a result, a study that examines the 2008 crisis across various sectors using data for 2008-2010 may find different results from a study considering the period 2008-2014 due to the time lag in the transition of the crisis across sectors. The contrasting studies on the sectoral impact of the crisis discussed above examine different measures and data for different time periods of the recent crisis and these factors could be important drivers of their opposing findings.

The literature on the initial effects of the 2008 downturn agrees on the limited immediate impact of the crisis on the public sector. Although not entirely public sector in nature, the education, health and public administration sectors continued to grow during the first quarters of the 2008 crisis (Gregg & Wadsworth, 2010; Lee, 2014; ONS, 2009). However, this is not the case with developments after 2009 in the UK. Similarly, in the EU, the ESPON project suggests an initial positive relationship between employment in the public sector and resilience; however, at approximately 2011, this shows evidence of changing sign due to the austerity measures in a range of different countries across Europe (Bristow *et al.*, 2014).

An explanation for the initial resistance of the public sector to the crisis could be that demand for some public services was either unaffected – such as the demand for education and health – or growing – such as the demand for job centres' services – during the recession (ONS, 2009). Traditionally, whether actively following counter-cyclical policies or exhibiting slow adjustment to implementing cutbacks, the public sector has been considered a buffer, protecting employment at times of economic crisis. The extensive reduction

of public sector jobs that accompanied the post-crisis austerity measures mean that the initial positive effects of public sector employment on resilience to the crisis were less pronounced during the post-2011 period. To the extent that employment in the public sector varies significantly across LADs, reductions in its workforce will have a differential spatial impact. Data from the Annual Population Survey for 2007 show significant heterogeneity on the prevalence of public sector jobs with the public sector accounting for 36.9% of employment in Rochford, Essex to 9.8% in Corby, Northamptonshire.

The discussion above suggests that if we are to understand better the role of local industrial ecosystems on resilience performance, we need nuance and detail in firms' interactions within sectors and regions. Concepts such as industrial diversification, relatedness, entrepreneurship and embeddedness offer greater insights into the mechanisms affecting local resilience outcomes.

4.1.2 Specialisation and diversification

The sectoral composition of employment is related to the locational decisions of firms and hence the degree of specialisation and diversification in an area. Firms co-locate in order to take advantage of dynamic externalities such as knowledge spillovers. The potential benefits of such externalities affect the industrial structure in different LADs and may lead to a differential impact of the crisis across LADs.

Through knowledge spillovers, improvements and innovations that occur in one firm may be transferred and improve other firms' productivity (Dasgupta & Stiglitz, 1980; Glaeser et al., 1992; Griliches, 1979; Lounsbury, 1979). If these spillovers are not paid for by the recipient firms, then firms receive external benefits from their counterparts in which the knowledge was originally produced. Moreover, if it is costly to transmit knowledge across space, spatial proximity may enhance such spatial spillovers. There is wide agreement on the presence of these kinds of externalities; there are different views as to whether these primarily occur within the same industry (Marshall-Arrow-Romer) or across industries (Jacobs). This issue is critical as the nature of such spillovers might impact the locational decisions of firms, thereby affecting the sectoral composition of employment, creating varying levels of diverse and/or specialised industrial structures, and, consequently, leading to a differential impact of the crisis on localities. Several studies examine localised externalities at the empirical level, but the results concerning the relative merits of specialisation and diversity are mixed and complex (De Groot, Poot & Smit, 2016).

To add insight beyond the collocation of industries, Frenken et al. (2007) introduce the concept of relatedness where positive Jacobs' externalities are expected to be present when industries are diverse but somehow related. A similar understanding comes from Rocchetta and Mina (2019), and what they refer to as technological coherence using patent data to identify the closeness of local innovation production as well as the identification of clusters based on input-output relationships such as the attempts by Behrens, Boualam and Martin (2019), .

Portfolio theory, where variety in assets is expected to lower the risk associated with shocks, may be of relevance means that a diversified economic base may be able to mitigate the negative impact of an asymmetric shock better than a specialised one since, in the latter, the size and interconnectedness of the specialised sectors may amplify the impact of a sector-specific shock (Frenken, Van Oort & Verburg, 2007). This is particularly useful when considering diversification in markets and demand characteristics. Firms

and economies may be diversified in products and/or sectors with similar demand characteristics or have a broad set of products and/or sectors based on different demand characteristics. Hence, specialisation may leave local economies prone to asymmetric shocks as different sectors face correlated demand whilst diversification may allow local economies to contain sector-specific shocks without their effects being widely spread (Di Caro, 2017; Frenken, Van Oort & Verburg, 2007; Lee, 2014; Turok, 2009).

Martin (2012) finds a link between reliance on production and the sensitivity of regions to disturbances. Fingleton and Palombi (2013) also suggest that increased specialisation and reduced diversification has left British towns prone to shocks by examining wage data at the end of the 19th and beginning of the 20th century. Di Caro (2017) finds a positive relationship between relative diversity (as expressed by Duranton and Puga's (2000) Relative Diversity Index) and resilience in Italian regions whilst Lee (2014), on the other hand, does not identify a link between specialisation and the 2008 crisis' unemployment impact in British cities. In addition, diverse US metros have been found to exhibit lower unemployment and higher stability over time (Malizia & Ke, 1993) whilst specialised EU regions exhibit higher (Longhi, Nijkamp & Traistaru, 2005) and more volatile (Ezcurra, 2011) unemployment rates.

Recently, the availability of relational data allowed researchers to add qualitative insights into sectoral relatedness aspects. Rocchetta and Mina (2019) use the notion of technological coherence to underpin the intellectual closeness of patents in a region and find that it has a positive effect on resilience as an adaptation to changing conditions. Delgado, Porter and Stern (2015) and Behrens, Boualam and Martin (2019) develop algorithms looking at co-location, intersectoral trade and occupational data to identify clusters in the US which are found to influence resilience during downturns (Delgado, Porter & Stern, 2016). Finally, Kitsos, Carrascal-Incera and Ortega-Argilés (2019) exploit the regional input-output tables to measure the embeddedness of local economic systems and find a curvilinear relationship between the level of local economic embeddedness and resilience performance in UK regions.

4.1.3 Entrepreneurship

Several studies highlight the contribution of entrepreneurship to economic growth through innovation and job creation (Audretsch & Keilbach, 2005; Audretsch, Belitski & Desai, 2015; Gherhes, Vorley & Williams, 2018; Soininen et al., 2012; Williams & Vorley, 2014). Audretsch and Keilbach (2005, proposed the notion of entrepreneurial capital to signal the capacity of an area to generate entrepreneurs. Measuring this by the number of firm births adjusted for the population but also accounting for the financial risk involved depending on the industry of start-ups, the authors provide evidence for its positive link to increased labour productivity. However, when it comes to economic growth, they only find a positive relationship when they use risk-oriented entrepreneurship capital (ibid.).

In terms of the mechanics behind the relationship between entrepreneurship and growth, Acs et al. (2009) and Audretsch and Keilbach (2007) propose a knowledge spillover theory of entrepreneurship based on Romer's (1990b) endogenous growth model in which new, endogenously created knowledge increases the technological opportunities to be exploited by entrepreneurs. Several new firms are created by employees leaving their jobs. In these firms, the entrepreneurs use the knowledge acquired but not exploited in their previous posts. Entrepreneurship then becomes a mechanism via which knowledge spillovers are

transmitted. The number of entrepreneurial opportunities created is dependent on the knowledge intensity of the environment in which entrepreneurial individuals operate (Audretsch & Keilbach, 2007).

At times of economic distress, entrepreneurship may become even more important, as entrepreneurs could play a role in mitigating the effects of a downturn by generating employment and renewal of the existing stock of businesses with new and more dynamic firms (Bishop & Shilcof, 2016). In addition to this, there are many specific characteristics associated with entrepreneurs that may be particularly relevant at times of economic downturns, such as flexibility and adaptability (ibid). Supporting the existence of specific characteristics affecting performance during economic crises, Soininen et al.'s (2012) study of Finnish firms found that high levels of entrepreneurial aspects such as innovation and pro-activeness positively impacted the performance of firms during the downturn whilst increased risk-taking negatively affected profitability.

Glaeser, Ponzetto and Tobio (2014) provide a model of urban growth in which entrepreneurship is the vehicle through which skills can help local areas mitigate the negative impacts of industrial decline. The authors argue that, if the number of employers is not fixed, the model predicts that highly skilled individuals become entrepreneurs at times of economic distress. When there is an adverse shock that reduces employers' stock, the high skills of individuals will lead to increased entrepreneurship, which will increase the number of employers and wages (ibid.). It follows then that, to the extent that different areas exhibit different concentrations of highly skilled individuals, they will exhibit different entrepreneurial and resilience levels.

Firm formation shows significant geographical differences (Acs *et al.*, 2009; Acs & Mueller, 2008; Audretsch & Keilbach, 2007; Bishop, 2012; Reynolds et al., 2005) and these differences are time persistent in several countries such as the Netherlands (van Stel & Suddle, 2008), USA (Acs & Mueller, 2008), Germany (Fritsch & Wyrwich, 2012) and Sweden (Andersson & Koster, 2011). In the UK, Fotopoulos (2014, provides evidence on time persistent spatial stickiness (slow propensity to change) of entrepreneurship for the period 1994-2007. In particular, he finds that previous entrepreneurship rates determine future ones in UK regions. This path dependency and persistent geographical pattern of entrepreneurship may be the result of some factors such as the institutional capacity (Martin & Sunley, 2006), sectoral specialisation and industry characteristics (Anyadike-Danes & Hart, 2006; Stam, 2010), positive feedback (Andersson & Koster, 2011), available skills' pools (Bishop, 2012; Bishop & Brand, 2014) and localised returns (Krugman, 1991; Martin & Sunley, 2006) in an area.

Institutions, culture and norms affect the provision of several services: access to finance, advice and informal business networks and highlight the linkages to the realm of *institutional infrastructure*. These factors are important in the exploitation of resources and opportunities and the generation and dissemination of knowledge that affects entrepreneurship and, hence, to an individual's decision to become an entrepreneur (Sautet, 2005). Saxenian (1990) examines how local institutions, service firms, educational organisations and networks can influence the local entrepreneurial culture and promote technology and knowledge spillovers in Silicon Valley. The institutions - and especially the informal institutions - which affect entrepreneurial culture and activity, tend to be self-replicating and evolve slowly in time (Freytag & Thurik, 2007; Fritsch & Wyrwich, 2012; Martin & Sunley, 2006). These attributes can lead to path-

dependency and spatial stickiness of entrepreneurship and, to the extent that entrepreneurship can assist the mitigation of the crisis impact, it can lead to geographically different levels of resilience.

UK firm birth rates are also associated with sector growth and industry specialisation and characteristics. Sectors with low entry barriers and opportunities for new services such as Business Services exhibit a high tendency to generate new firms (Anyadike-Danes & Hart, 2006; Stam, 2010). As a result, places which specialise in these types of industries and sectors will have greater firm formation rates and, more importantly, the geographical differences in entrepreneurship (and hence, resilience) will be time persistent since the specialisation of an area is slow to change.

The greater concentration of entrepreneurs in an area further enhances local entrepreneurial activity through serial entrepreneurship (Stam, Audretsch & Meijaard, 2008), positive feedback (Andersson & Koster, 2011) and dynamic increasing returns (Martin & Sunley, 2006). Failing entrepreneurs have a high propensity to re-establish a firm usually close to the place themselves and their families live (Nielsen & Sarasvathy, 2011; Stam, Audretsch & Meijaard, 2008; Stokes & Blackburn, 2002). Through the entrepreneurial activity, a feedback effect can develop through which entrepreneurs act as role models, hence increasing firm formation in an area (Fritsch & Wyrwich, 2012) through the expectation of success and significant returns. If these returns increase with the increase of scale of activities and are localised, then entrepreneurship's spatial stickiness leads to circular and cumulative causation (Krugman, 1991; Martin & Sunley, 2006). All these contribute to creating a virtuous cycle of path dependence where places with high firm birth rates are better positioned to retain these rates in the future.

A high concentration of businesses can also create localised skill pools, further enhancing entrepreneurship (Brown, Lambert & Florax, 2013; Stam, 2010). This localised and diverse knowledge capital is important for entrepreneurship through spillovers from existing firms across different sectors and creating and better exploiting opportunities for nascent entrepreneurs (Bishop, 2012; Bishop & Brand, 2014). These spillovers may exhibit a degree of spatial stickiness since human capital accumulates slowly and is connected to an area's industrial structure. The proximity reduces transmission cost for this knowledge, technology and geography-specific (Essletzbichler & Rigby, 2005).

Thus, entrepreneurship is key to growth and may potentially mitigate the crisis impact and assist adaptation for recovery (Bishop, 2018; Korber & McNaughton Rod, 2018; Williams, Vorley & Ketikidis, 2013). The flexibility and innovation aspects of entrepreneurial activity are key to identifying and exploiting opportunities during a crisis (Soininen *et al.*, 2012), whilst firm formation can replace firms' existing stock with more dynamic ones. Higher rates of firm births imply more opportunities for employment growth and less impact from the economic downturn. Bishop (2018) finds that high rates of unrelated knowledge diversity also positively affect the impact of entrepreneurship on a local authority's ability to adapt during the 2008 crisis. The path dependency and spatial stickiness of entrepreneurship and the differing sectoral specialisation in regions indicate that entrepreneurial activity's positive effects will disproportionately affect local areas. For example, during the 2008 economic crisis, three Services sectors with traditionally high proportions of birth rates have continued to generate the highest birth rates (Bishop & Shilcof, 2016). Simultaneously, severe economic shocks may disrupt existing institutions, culture and networks that

contribute to spatial stickiness and circular causation and create new entrepreneurship patterns and potential growth.

In summary, there is increasing evidence that entrepreneurship can assist the adaptation and recovery of local areas with two caveats. Firstly, its spatial stickiness creates an uneven spatial landscape for resilience performance. Secondly, the characteristics of newly born firms mean that they may be more exposed to economic crises, leading to more severe recession stages. This evidence points to further research on the relationship between entrepreneurship and crises.

4.2 Place

The realm of place includes all these factors associated with a local area's history and geographical characteristics that may affect its resilience. Examples of these factors include its previous socio-economic performance, the levels of urbanisation, and physical geography and accessibility characteristics. These factors can significantly constrain or boost resilience performance to different degrees.

Path dependency suggests that the conditions before a shock could influence the post-shock performance of countries and regions. The spatial imbalance of growth in the UK (Gardiner et al., 2013) and the geographically varying impact of past recessions in the 80s and 90s (Champion & Townsend, 2013; Martin, 2012) have created a landscape that exhibits significant divisions. This, coupled with spatially sticky and location-specific factors, implies that the 2008 crisis is likely to have had a geographically diverse impact. At the onset of the financial crisis, regions in the UK were characterised by differing pre-crisis economic conditions, past investments and resource endowments. The outcomes of these differences were observed in varying growth levels and labour market characteristics. The uneven distribution of these factors may potentially constrain or enhance the ability of a region to adapt to a crisis (Lee, 2014; Martin & Sunley, 2006; Wolfe, 2010) and, hence, it is essential to examine the impact of these initial conditions.

The empirical literature has been inconclusive regarding the effect of pre-existing conditions on the 2008 crisis impact on local labour markets. Berthoud (2009) finds no clear relationship between pre and post-recession unemployment. However, Lee (2014) and Clayton (2011) suggest that the highest unemployment increases were in places with already high unemployment rates when JSA claimant count data is considered. Using European data at the individual level, Doran and Fingleton (2016) construct post-2008 counterfactuals for the no-crisis scenario and compare them to the European Social Survey's actual outcomes. Connecting the realm of *place* to that of the *individual*, they find that individuals living in high unemployment regions have a lower employment probability during the recession. However, Lee (2014) finds the opposite relationship when examining unemployment rates (instead of JSA) at the UK cities' local level. Geelhoed, Royuela and Castells-Quintana (2020) find that income inequality can negatively affect resilience performance in Spanish municipalities whilst Duran and Fratesi (2020) suggest that Italy's lagging regions experience higher business cycle volatility. These results highlight the need for further research to clarify the impact of initial conditions on resilience performance.

Cities may have a crucial role to play in both mitigating the recession impact and fuelling recovery. In 2014, almost 54% of the UK population lived in cities (according to the Centre for Cities classification), and these conurbations generated almost 60% of the national GVA. Urban agglomerations possess several

geographical and demand and supply-side characteristics that give them an advantage over rural areas. Several of these characteristics are captured by factors such as diversity, externalities, skills and demographics. However, it is also important to consider the effect of urbanisation on the crisis impact in more detail to account for any significant characteristics that other variables are not captured.

Increased proximity to cities may enable knowledge to travel faster whilst their size means they have the critical mass to host institutions and functions that generate knowledge and assist growth linking the realm of *place* to *institutional infrastructure*. Such institutions could be universities or business organisations that provide functions of knowledge and information transfer as well as business support (Bishop, 2009; Bishop, 2012; Bishop & Gripaos, 2010; Dewhurst & McCann, 2006). The term urbanisation externalities has been coined to refer to these types of benefits arising from the existence of firms in urban areas (Bishop & Gripaos, 2010; Essletzbichler & Rigby, 2005).

Moreover, larger cities may be more attractive places to live for highly skilled employees (Becker, Glaeser & Murphy, 1999; Glaeser & Resseger, 2010). Florida (2002; 2010) and Florida et al. (2008; 2010) highlight the importance of talented people and the creative class in cities in shaping high growth firms' geography and, consequently, regional growth. High levels of density and diversity in cities provide demand for a wide range of consumer services, amenities and an environment that may motivate talented individuals to move and seek employment in these areas (Florida, 2002; Florida, Mellander & Stolarick, 2008; Glaeser, Kolko & Saiz, 2001).

Consequently, firms, and especially those focusing on high added value, human capital and innovation-intensive processes, are expected to locate in cities to take advantage of the large pool of highly skilled employees. This, in turn, may lead to higher levels of entrepreneurship in cities (Capello, Caragliu & Fratesi, 2015; Champion & Townsend, 2013; Lee, 2014; Lee, Morris & Jones, 2009). At the same time, firms located in urban areas benefit from urbanisation externalities (Bishop & Gripaos, 2010; Essletzbichler & Rigby, 2005; Frenken, Van Oort & Verburg, 2007) whilst the cities' broad consumer base allows for agglomeration of similar businesses and the generation of specialisation and/or diversification related externalities. Concerning this, Duranton & Puga (2000; 2001) suggest that firms will locate their production in specialised or diversified cities according to a product's life cycle stage. In particular, they argue that at the initial stages of a product's life cycle, firms will tend to locate in diversified cities where they can take advantage of knowledge created in other sectors, whilst at the stage of maturity they will relocate to specialised cities to take advantage of economies of scale in mass production.

However, high density may involve negative externalities which could outweigh the positive ones. The proximity of large numbers of individuals may increase congestion costs, whether in terms of transport costs or increased competition for the same resources or customer base. Supporting this at the practical level, some studies find adverse effects of density (used as a proxy for urbanisation economies) in manufacturing and a statistically insignificant effect on services (Bishop & Gripaos, 2010; Combes, 2000; Deidda, Paci & Usai, 2006).

When the recession hits, urban areas may be better equipped to mitigate the adverse effects due to high concentrations of dynamic firms (Glaeser, 2005; Glaeser & Resseger, 2010; Glaeser & Saiz, 2003; Schultz,

1975; Shapiro, 2006) benefiting from high levels of human capital, and positive externalities. At the individual level, a more skilled and younger population offers greater potential for skilled labour hoarding and increased flexibility. Simultaneously, the diversity of the consumer base and suppliers reduces the risk of sectoral business cycle events impacting the whole local economy since firms do not overly depend on the same labour and product markets.

With regards to the 2008 recession in the UK, it was widely expected that the origin of the crisis in the financial sector would lead to a disproportionate impact on urban rather than rural areas. However, for several reasons, including the decision to support banking at the national and supranational level, evidence suggests that cities avoided the brunt of the crisis impact, at least in the first years of the recession (Gordon, 2011; Lee, Morris & Jones, 2009). Empirical studies support the argument that urban areas performed better during the 2008 economic crisis (Capello, Caragliu & Fratesi, 2015). The ESPON project finds a positive relationship between an urban area and economic resilience (Bristow *et al.*, 2014) whilst Brakman, Garretsen and van Marrewijk (2014) find a positive relationship between the degree of urbanisation and economic resilience in regions. However, Capello, Caragliu and Fratesi (2015) suggest that agglomeration economies stemming from urban size alone are not enough to guarantee resilience. It is the quality of functions, infrastructure and production factors and networks that make a difference.

The final consideration of place characteristics and their effects on resilience revolves around its spatial characteristics. Fixed geographical attributes such as mountains, coastlines, etc may influence an area's resilience by impacting its connectivity to other regional, national and international economies. In this sense, remoteness has been found to harm local resilience in several countries (Bristow *et al.*, 2014; Giannakis & Bruggeman, 2020; Östh, Reggiani & Nijkamp, 2018). These findings highlight that these negative effects' persistence is a matter of infrastructure (physical and digital) development rather than insurmountable constraints.

Overall, the realm of *place* represents the contextual factors that come into play when a region is faced with a crisis. These range from the results of past crises to the evolution of local industrial structures as well as urbanisation processes and infrastructure development highlighting the interconnections between *place* and the rest of the realms.

4.3 Individual

Individual characteristics can significantly affect the resilience performance at the micro and macro level. Attributes such as qualifications, age group and other traits influence mobility inertia and individual labour market performance which at the aggregate level can shape a region's response to a crisis.

Skills have long been considered a significant contributor to economic growth. The work of Arrow (1962, , Becker (1962, , Schultz (1959; 1960; 1961), Nelson and Phelps (1966) ,Lucas (1988; 1990) and Romer (1986; 1989; 1990b) introduced human capital in the form of knowledge and expertise into macroeconomic growth models. At the empirical level, several studies have identified a positive relationship between human capital and economic growth (Barro, 2001; Bassanini & Scarpetta, 2002) whilst Moretti (2004) finds positive externalities of graduates the wages of all groups in the labour market. At the same time, studies including those of Walsh (1935) and Mincer (1958; 1962; 1974) provided evidence of a positive relationship between

education and income at the individual level whilst Acs & Armington (2004) find a positive relationship between human capital and employment growth.

The move towards more skill-intensive production methods in recent years, coupled with labour market polarisation (Brinkley, 2009; Salvatori, 2015; UKCES, 2014) creates conditions of high demand for skilled individuals in the labour market. In examining job polarisation, Salvatori (2015) argues that, in the UK, the jobs requiring the lowest educational level were the ones which lost the greater shares of employment in the last three decades. The high demand for skills means that LADs with greater shares of skilled individuals will have greater growth potential.

At the same time, Schultz (1975) argues that educated individuals adapt more easily as economic circumstances change, using assets more efficiently, obtaining better credit arrangements, and exploiting new income opportunities. More recent arguments on this revolve around financial inclusion (Finlayson, 2009; Rowlingson & McKay, 2016) and suggest that improving financial literacy would increase resilience in times of economic distress. Supporting Schultz's hypothesis, Glewwe & Hall (1998) using data from Peru, find that households with more educated individuals adapt better to shocks. These arguments suggest that more educated individuals may be better able to identify coping strategies in the event of a downturn.

Moreover, skilled employees are a highly valued asset due to embedded knowledge and experience. In the face of reduced demand, it is possible that firms may opt to hoard this type of labour rather than lose this kind of capital (Brinkley, 2009; Clayton, 2011; UKCES, 2014). It is also possible that skilled employees are able to perform (or learn to perform) the tasks of lower-skilled positions but not the opposite; this provides them with an advantage over individuals with low human capital when employers are considering restructuring (Gordon, 1999; Gordon, 1985; Gregg & Wadsworth, 2010). Overall, places with greater shares of highly skilled workers may adapt more rapidly to changing circumstances, which may mitigate the local crisis impact.

Doran and Fingleton (2015; 2016) find that education, as well as age, affect resilience outcomes at the individual level in the US and Europe whilst Kitsos and Bishop (2018) and Lee (2014) are some of the studies in the UK highlighting the role of qualifications in local resilience performance. Hill et al. (2010) find that regions with high population rates with low levels of education are more prone to downturns and less likely to exhibit high resilience. In addition, Glaeser (2005) argues that human capital was a major driver behind Boston's adaptability when facing adversity. However, it has been suggested that just increasing the stock of qualifications is not necessarily an adequate condition for increased resilience; rather, it is the working experience and the job skills positively related to overcoming adversity (Bristow *et al.*, 2014).

This is the second channel via which human capital may affect the crisis impact in an area, namely through human and firm-specific capital created through on-the-job training (Becker, 1962; Hashimoto, 1981). Several researchers found that increased rates of training are associated with reduced likelihoods of layoffs and staff turnover (Becker, 1962; Hashimoto, 1981; Molina & Ortega, 2003). However, evidence from North America suggests that firms with higher rates of training tend to be less technologically advanced, more unionised and with low rates of R&D (Molina & Ortega, 2003). These opposing characteristics suggest that the net impact of such training can only be identified by further empirical analysis.

Linked to human capital and the ability to adapt, demographics may significantly affect the growth and capacity of a place to withstand the impact of an economic crisis. Even though the effect of demographic structure on empirical growth models is underexplored (Durlauf & Quah, 1999; Persson, 2004), there are several ways in which the age structure and trends can, at the theoretical level, affect an area. Canton et al. (2002) suggest that the increased difficulty of older-aged individuals in adopting innovations could potentially create pressures against technological progress when older people are disproportionately represented in the population. If this is the case, an ageing society could see shifts in demand towards labour-intensive services where productivity growth is likely to be lower (Van Groezen, Meijdam & Verbon, 2005).

In growth models, population ageing, typically interpreted in terms of lower population growth, has a somewhat obscure growth effect. In endogenous growth theories, on the one hand, it could increase technological innovation since the relative cost of labour is higher (Poot, 2008; Romer, 1990a), whilst on the other, it could decrease human capital accumulation and investment due to the lower level of savings in the economy (Poot, 2008; Steinmann, Prskawetz & Feichtinger, 1998). Persson (2004) incorporates demographic heterogeneity within the Mankiw, Romer, and Weil (MRW) (1992) model and finds that it improves the measurement of labour and human capital by incorporating a differential effect of various age cohorts on aggregate labour supply. This consideration of the age structure addresses the author's identified biases in the MRW model due to the correlation of age structure to explanatory variables such as income, educational attainment and population growth rates. As a result, by accounting for demographics it is possible to better explain growth differences among states in the U.S. (Persson, 2004).

Most of the impact of demographics on growth appears to stem from its relationship to human capital and productivity. If human capital stocks are subject to accumulation through education, training and work experience, and obsolescence and depreciation during an individual's lifetime (Brunow & Hirte, 2009b; Skirbekk, 2004), these stocks will be expected to rise to a certain age and then decline. Due to the connection between human capital and productivity, a similarly shaped relationship with demographics may be expected for the latter. The rationale for this is that work experience can increase productivity up to a certain point, after which it is challenging to make productivity gains from increased tenure in a position (Skirbekk, 2004). As a result, if individual productivity depends on human capital and its stock changes with age, then differences in productivity and growth in models based on aggregate production functions could be indirectly explained/affected by age structures (Brunow & Hirte, 2009a).

Several empirical studies identify an inverted U-shaped relationship between age structure and various human capital, productivity and growth measures (Brunow & Hirte, 2009b; Poot, 2008; Skirbekk, 2004). Brunow and Hirte (2006; 2009b) find an inverted U-shape relationship between age and growth in European regions, with the 45-54 age cohort making the most significant contribution to output growth. Persson (2004) finds that the initial age structure of the population affects future output in U.S. states in a similar way, whilst Lindh and Malmberg (1999) and Feyrer (2007) provide evidence of an inverted U-shaped relationship between productivity, its growth and output and workforce demographics with the 40-49 cohort having the most substantial positive effect (ibid). The latter also suggests that a significant proportion of the productivity gap between rich and poor countries is explained by demographics (ibid).

Finally, Tang and MacLeod (2006) find that older employees are less productive than younger ones and that the working population's growing age will negatively impact productivity growth in Canada.

At the individual level, the reasons behind the decline of productivity after a certain age are mainly related to the decrease in cognitive abilities over time, which is commonly observed even across species (Bunk, 2000; Minois & Le Bourg, 1997; Prskawetz & der Wissenschaften, 2006; Skirbekk, 2004). Verhaegen and Salthouse's (1997) literature overview suggests that certain mental capacities such as reasoning and speed decline in time. Work experience may counteract some of these factors (Colonia-Willner, 1998) but as Rybash et al. (1988) argue, job-specific knowledge becomes locked-in and increasingly non-transferable. Smith (1996) also finds that older workers find it more challenging to switch between tasks and solve new problems compared to younger aged workers (Robertson & Tracy, 1998).

Of course, the relationship between age, cognitive ability and productivity is mediated by the task at hand, and these findings refer to aggregates and averages. Accumulated work experience and tacit knowledge can benefit older employees in performing tasks they already know well. This could be the reason behind Colonia-Willner's (1998) findings that there are no performance differences between older and younger managers. However, as the complexity of tasks increases, the more important mental agility becomes, and this has a negative impact on the relationship between age and productivity (Myerson et al., 1990).

With this in mind, the increased use of technology and frequent technological change enhance the importance of mental agility and adaptability over work experience in productivity and push the productivity peak to younger ages (Baltes & Lindenberger, 1997; Hoyer & Lincourt, 1998; Prskawetz & der Wissenschaften, 2006). This, coupled with lower job mobility as individuals grow older (Dixon, 2003), may create a dysfunctional system which is slow to change and adjust. Oswald (1996; 1997) added the homeownership aspect in this argument, suggesting a positive relationship between homeownership and unemployment within and across countries due to reduced mobility. Examining US data, Green and Hendershott (2001) confirm the result for middle age cohorts but not for younger groups. This suggests that younger individuals have not accumulated significant amounts of assets to constrain their mobility as a response to unemployment.

The capacity to adjust and change directly impacts on an area's competitiveness and its response to the pressures arising from economic distress such as the 2008 downturn (Poot, 2008). Hence, an area's age structure may emerge as a significant determinant of the resilience performance in a locality. In this process, younger aged workers are likely to have an advantage due to their mobility and agility characteristics, which may enable them to adapt faster during the crisis.

4.4 Institutional infrastructure

The interest in institutions stems from the understanding that underachieving institutions directly affect the socio-economic performance of nations (Acemoglu & Robinson, 2012). With regards to resilience, effective institutions can develop adaptability and respond quickly to changing circumstances. Research on the impact of institutions on resilience is limited and broadly focus on market performance and interventions at the macro level. Other expressions of institutions affecting the crisis impact in localities include civic capital and the institutional ability to innovate in order to overcome disturbances in a region's/system's

development (Foster, 2007; Swanstrom, 2008; Wolfe, 2010). We consider institutions as infrastructure to highlight that good institutions require short, medium and long-term investment. Besides, institutional infrastructure tends to depreciate in time and hence requires maintenance to remain effective in the medium to long-run.

Institutions are important factors that may affect development paths and the resilience performance of their locality (Glaeser, 2005; Simmie & Martin, 2010; Treado & Giarratani, 2008; Wolfe, 2010) with policy interventions a significant influence on local outcomes at times of adversity (Glaeser, 2005; Glaeser, Ponzetto & Tobio, 2014; Wolfe, 2010). Wolfe (2010) uses a case study of Ottawa and Waterloo in Canada. It highlights the interactions between path dependence and the city's economic and industrial structure with institutions in the civic domain in forming policies to counterbalance the opposing forces of external shocks. Stakeholders and institutions can work together and exploit regional assets and construct competitive advantages to reverse negative trends related to either external shocks or path dependency (ibid).

Simmie and Martin (2010) use the divergent examples of Cambridge - a highly successful region in terms of adaptation - and Swansea - a relatively failing region - during recession periods. They argue that the evolving institutional framework and operations within it were instrumental in Cambridge's success whilst Swansea's reliance on rootless FDI, based on externally generated and transferable knowledge proved to be prone to transferring operations to more efficient locations than embedding resilient elements in the area at times of economic distress (ibid).

A limited number of empirical studies such as Cerra et al. (2012), Briguglio et al. (2009) and Duval et al. (2007) stress the importance of policies and the institutional framework in the resilience and recovery of countries. Briguglio et al. (2009) suggest that, despite the inherent vulnerabilities that an economy may be facing, it is possible to pursue policies that will absorb or quickly mitigate the adverse effects of external shocks. This emphasis on policies is shared with Cerra et al. (2012) who examine the recovery stage of national economies. The authors use the growth rate of broad money (M2) to measure monetary expansion or contraction and the fiscal deficit over trend GDP to measure fiscal policies. They also investigate the effects of real currency depreciation and the exchange rate regime and find that different policies have different effects on the speed of recovery or the crisis's persistence. Finally, they argue that the effectiveness of these policies depends on the nature of the crisis by distinguishing between ordinary and banking crises (Cerra, Panizza & Saxena, 2012).

Similarly, Duval et al. (2007) suggest that the varying response of countries to crises is due to different resilience capacities built upon differences in the policies, regulations and institutions in labour, product and financial markets. For example, countries with labour and product market rigidities are found to be subject to prolonged but reduced initial impacts of a crisis' output gap whilst flexibility in financial markets reduces the persistence of these output gaps but increases their impact. However, it is not clear which of the effects (prolonged and low impact or short and high impact) is preferable for a region in recession. At the same time, the authors argue that each downturn's size is another influential factor on the effects of policies and regulatory regimes during the crisis with large, systemic incidents of recession reducing the effectiveness of

such policies and regulations (Duval, Elmeskov & Vogel, 2007). Thus, it is impossible to provide broad policy proposals which fit all cases.

A largely under-examined factor in this realm is the role of devolution as an institutional framework for resilience performance. The empowerment of local governance has multiple benefits linked to the better knowledge of local circumstances and greater accountability. These attributes can help local agility and fine-tune responses to crises and resilience to shocks. The homogeneity of devolution by country makes within country studies particularly different, but the combination of devolution with a consideration of the decision making agents (next realm) may provide significant insights into these forces' interaction.

4.5 Decision making

Finally, resilience studies stress the importance of agency in fostering resilience. This realm is closely aligned to the *institutional infrastructure* but focuses more on the individual decision-makers who are the catalysts that can enhance or impede resilience performance in an area through their actions.

Some of the most important contributions in this field concern local leadership (Beer & Clower, 2014; Beer & Lester, 2015; Bristow & Healy, 2013; Sotarauta & Beer, 2016) and the relationship between local economic development and the leadership capacities of specific actors.

Glaeser (2005) examines the evolution of Boston over time and argues that an influential factor in shaping its development trajectory is local government, whilst Pike et al. (2010) and Bristow and Healy (2013) also stress the role of actors in resilience performance. Their nature and capabilities are considered instrumental in foreseeing and acting in time to increase the resilience of places.

Treado and Giarratani (2008), studying the case of intermediate steel industry suppliers in Pittsburgh U.S., argue that the local cluster strength was based on the connections, contacts and inter-dependencies among intermediate steel suppliers. This was key to mitigating the adverse effects of the local steel industry decline (ibid).

In a conceptual study, Martin and Sunley (2014) identify four subsystems which interact to shape the economic resilience of a place and which they call

“the structural and business subsystem; the labour market subsystem; the financial subsystem; and the governance subsystem” (Martin & Sunley, 2014, p.26).

They argue that these subsystems are influenced by the agency and the notions, norms, perceptions and general ideas of local decision-makers (Martin & Sunley, 2014).

The growing qualitative literature on the effects of leadership on growth, for example, confirms the importance of the former on the latter and provides useful insights into concepts that are hard to measure (Beer & Clower, 2014; Hambleton, 2014; Sotarauta & Beer, 2016). However, the further scope for quantitative analysis would greatly add to these arguments by quantifying the effects of agency on resilience.

5) Unanswered questions

The above overview of the literature on resilience factors highlights the multitude of forces at play and the need for further research into individual determinants and their interactions that lead to different resilience outcomes. Organising these unanswered questions of economic resilience helps us set up a research agenda for the future. As with the rest of the document, these questions are not an exhaustive list but aim to contribute to existing and future discussions and are subject to further development.

5.1 Role of technology

Technology and innovation are likely drivers of local economic resilience, affecting most of the realms of resilience factors. More technologically advanced businesses and regions are more productive and expected to innovate their way out of crises. These dynamics are path-dependent and with long-lasting effects that are slow to change in time. For example, previous research has found that early engagement with the digital economy can explain regional productivity differences in the UK with a lag of more than 15 years (Tranos, Kitsos & Ortega-Argilés, 2020). Evidence from the 2008 crisis suggests that innovation and particularly finance-dependent activities have been reduced with few signs of a rebound until the COVID crisis (Roper & Turner, 2020) although they were crucial for resilience performance (Bristow & Healy, 2018; Clark, Huang & Walsh, 2010). These are significant trends in the COVID crisis with technology-enabled (and dependent) economic functions affecting economic and health outcomes.

Interesting questions in the interrelationships between technology, innovation and resilience remain. For example, is the internet-enabled, increasing economic interconnectedness a positive contributor to economic resilience or does it generate crisis propagation channels? If such, how can policies assist regions that are more interconnected to overcome disturbances? Is there a bi-directional relationship between innovation and crises, and how can policies intervene to maximise the benefits?

5.2 Embeddedness

The share of local economic activity anchored in a region is also likely to affect resilience outcomes. More embedded industrial ecosystems are expected to decrease transaction costs and provide agglomeration externalities. However, too embedded systems run the risk of 'cognitive myopia' (Buciuni & Pisano, 2018) and lock-in negative effects (Boschma & Iammarino, 2009). Evidence has already been found that embeddedness has a non-linear relationship to resilience in the UK (Kitsos, Carrascal-Incera & Ortega-Argilés, 2019). It is important to validate these findings in different countries and crises as well as to unpack the mechanisms and nuances of the relationship between embeddedness and resilience.

5.3 Entrepreneurship

In theory, entrepreneurial regions would be expected to have better resilience outcomes. High entrepreneurship rates point to dynamic local economies with the replacement of the business stock that can no longer compete. However, large numbers of newly-established firms also mean a large portion of the business population is on an unstable footing with reduced capacity to access financing (Kitsos & Bishop, 2018). Evidence from the US and the 2008 crisis already suggests that places with higher

entrepreneurial dynamism have had worse recessions but better recoveries (Kacher et al., 2018). These discussions are particularly relevant to the COVID crisis, and the levels of support (or lack of) received from newly-found businesses and the self-employed. Consequently, there is a need to further unpack the relationship between entrepreneurship and resilience in order to formulate policies that maximise the benefits and minimise the risks of entrepreneurial dynamism.

5.4 Institutions & Agency

Despite their potential, the role of local institutions (e.g. local authorities, universities etc.) and leadership are among the least researched drivers of local economic resilience. Few studies have highlighted the importance of these factors for economic development and resilience, primarily at the case-study level (Beer & Clower, 2014; Beer & Lester, 2015; Glaeser, 2005; Simmie & Martin, 2010; Sotarauta & Beer, 2016). The importance of local institutions has been highlighted further by responding to the current pandemic's challenges (Burlina & Rodríguez-Pose, 2020). Consequently, there is a great need for further examining the attributes of institutions (and institutional set-ups, e.g. level of devolution) and agents that benefit local resilience the most

6) Concluding remarks

This document aims to serve as a starting point in discussing local economic resilience and its drivers. Economic crises appear as a historical recurrence, and whilst much research has gone into the origins of most crises, there has been little consideration as to how to prepare for one until 2008. The GFC has seen the growth of a range of research into why places within the same country experience crises so differently. As such, progress has been made into conceptualising and operationalising local economic resilience with the most understanding of resilience, focusing on a dynamic perspective measured by either single labour market outcomes or composite indicators.

Research continues in trying to unpack the drivers and mechanisms of economic resilience. Several factors have been found to affect the performance of places during a crisis. We group these factors into five interconnected realms representing local industrial ecosystems, place & individual characteristics, and the institutional infrastructure and local decision-making capabilities. Research findings so far cover much ground but also point to unanswered questions. To paraphrase Socrates, we now know more of what we do not know. This helps us set the directions for promising future research that can inform academic and policy discussions around strengthening the economic resilience of places.



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