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# Drivers of Transformation and Recovery from Shrinking

An analysis of sectoral proximity and linkages in Ireland after the  
Great Recession

by

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*Abstract:* To understand the mechanisms of economic resilience, we have studied how sectoral proximity relates to the regional capability to transform and recover from a shrinking crisis. Through a comparative study of Irish regions, a proximity analysis provided evidence that the majority of new sectors in the recovering region developed in proximity to the region's leading sector. This leads to the conclusion that existing sectors in an economy may through proximity promote the entry of new sectors and that such a sectoral micro-transformation is in turn promoted by a large sectoral variety in the economy. Thus, this study provides an empirical illustration of a specific mechanism driving transformation.

*Keywords:* Proximity analysis, Sectoral variety, Shrinking recovery, Sectoral transformation, Regional disparity, The Great Recession

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# Abbreviation

ABSEI	Annual Business Survey of Economic Impact
DETE	Department of Enterprise, Trade and Employment
EBOPS	Extended Balance of Payments Services Classification
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross domestic product
GNI	Gross National Income
GPT	General purpose technology
HS	Harmonised System
IDA	Irish Development Authority
NACE	Statistical classification of economic activities in the European community
OECD	Organisation for Economic Co-operation and Development
PIIGS	Portugal, Italy, Ireland, Greece and Spain
PPP	Purchase power parity
RCA	Revealed comparative advantage
rev.	Revision
SITC	Standard International Trade Classification
U.S.	United States

# 1. Introduction

Economic crisis has caused headlines during the early 2020s. This raises questions about why economies are affected differently by a crisis and whether divergence due to differing capabilities may be a long-term outcome. Thus, it is relevant to understand the mechanisms of resilience, both in terms of resisting shrinking, bouncing back and transforming the economic system (Martin & Sunley, 2015). With the aim to understand the underlying mechanism of crisis resilience, this thesis will focus on the financial crisis of 2008, also called the Great Recession, when economies demonstrated widely different resilience capabilities (Giannakis & Bruggeman, 2017).

Recent development research has argued that resilience to shrinking is a key factor for development as developed economies and economies on the way to reach development alike have this factor in common (Andersson, 2018; Broadberry & Wallis, 2017; Easterly, Kremer, Pritchett & Summers, 1993). This field largely focuses on either structural transformation (Andersson, Julia & Palacio, 2021) or institutional conditions (Broadberry & Wallis, 2017). However, the conclusions from this field of research are mainly based on observations on a national level. If instead observing regional shrinking, it is found that among developed economies almost 20% of subnational regions were shrinking on average every second year between 2000-2019 whereupon they demonstrated a higher shrinking frequency than the most frequently shrinking, non-developed economies (author's calculation based on OECD, 2022). To better understand the impact of shrinking it is therefore relevant to understand the mechanisms behind such regional disparity. This is further relevant as regional inequality has been argued to drive populism more than other types of inequality which in turn has political and economic consequences (Rodeigues-Pose, 2018).

With a specifically regional focus, economic geographers approach the topic of shrinking resilience differently, as well as suggesting different determinants. Rather than structural transformation and institutional factors they emphasise business cycles (Lundquist, Olander & Martynovich, 2017) and sectoral mix (Boschma, 2015; Frenken, van Oort & Verburg, 2007). So far, the debates in economic geography and development have been parallel and without interaction, though links exist between them. For example, structural transformation is based



on the sectoral mix, whereupon it may be reasoned that the difference between the two fields partly is a difference between micro and macro-level analyses.

Based on a comparative review of these two fields in the following theoretical discussion, it will be argued that transformation is a key mechanism of resilience (Andersson, Julia & Palicio, 2021; Broadberry & Wallis, 2017; Martin & Sunley, 2015) and that this is connected to relatedness and linkages between sectors (Boschma, 2015, Hassink, 2010). By using proximity as a proxy for relatedness, which measures how likely it is for an economy hosting sectors A to also host sector B (Hidalgo, Klingler, Barbási and Hausman, 2007), this thesis therefore intends to contribute to the understanding of this mechanism by asking the following research question: *How does sectoral proximity impact the regional transformation process during a shrinking crisis?*

For this study, Ireland will serve as a case study given it is one of few countries that since the 1970s succeeded to develop out of the middle-income trap (Hartman, Zagato, Gala & Pinheiro, 2021), whereupon more backward economies have shown interest in its development model as a mean to catch up (Barry, 2007; Brazys & Regan, 2017). However, during the Great Recession, Ireland experienced the historically most severe economic downturn by any developed nation during peacetime (Donovan & Murphy, 2013) whereupon this case contradicts development economists' idea that developed economies are characterized by resistance to shrinking. Nevertheless, in the aftermath of this crisis, Ireland outperformed other European states regarding growth, recovery and ability to reinvent itself. However, the whole country was not part of this recovery as some Irish regions have since 2008 ranked among the worst performing regions in Europe. For example, the Midland region is today 37,1% poorer than in 2007 and it is one of the European subnational regions which have shrunk the most since 2000 (author's calculation based on OECD, 2022).

Given the definition of resilience used throughout this thesis where the concept applies not only to shrinking resistance but also to the ability to recover (Martin & Sunley, 2015), the Irish case provides an opportunity to study specifically the mechanisms of recovery as none of its regions were able to resist shrinking while the recovering capabilities have been uneven (OECD, 2022). To do so, this thesis will compare two Irish regions, South-East and Midland, where the former has demonstrated a successful recovery from the Great Recession while the latter has not yet initiated its recovery (OECD, 2022). To detect any transformation in the

form of a sectoral shift, the period 2000-2019 will be studied. This includes the prosperous years prior to the financial crisis while excluding any impact of the Covid-19 pandemic and the crisis following the Ukraine war as this is an ongoing crisis by the time of this study in contrast to the Great Recession which may be studied in hindsight.

## 2. Theory

Resilience to economic shrinking has primarily been approached by two fields; economic development which studies the different abilities of countries to resist shrinking and thus develop modern economic growth (Andersson, Julia & Palacio, 2021; Broadberry & Wallis, 2017; Pritchett, Sen & Werker, 2018), and economic geography which aims to understand spatial aspects of why crises affect regions differently (Boschma, 2015; Frenken, van Oort & Verburg, 2007). By reviewing these two fields it is found that while economic development recently has made some interesting contributions to the understanding of why shrinking is as relevant as growth to understand development, the field is isolated from economic geography whereupon there are two sets of frameworks to understand the mechanism of shrinking. After first establishing how some key concepts are to be understood throughout this thesis, this chapter will discuss resilience to shrinking from the lens of economic development and geography respectively and as an outcome of this discussion, the chapter will be concluded by motivating for a theoretical framework.

### 2.1. Central concepts

#### 2.1.1. Crisis and shrinking

“A crisis is a situation faced by an individual, group or organization which they are unable to cope with by the use of normal routine procedures and in which stress is created by sudden change” (Booth, 2003 as cited in Al-Dahash, Thayaparan & Kulatunga, 2016:1193). Thus, while a crisis is a broad concept which may be used in a range of fields, this specific definition emphasizes that it is about how an event affects individuals, groups or organisations (which includes states and regions) rather than the event itself.

Note that the terms economic shrinking and crisis will be used interchangeably in parts of this thesis due to differences in common terminology in economic development and economic geography. Although shrinking here refers to any single year of negative growth rate

(Broadberry & Wallis, 2017), within the context of the Great Recession and given the below definition of resilience, the terms economic shrinking and crisis are here substitutable.

### 2.1.2. Resilience

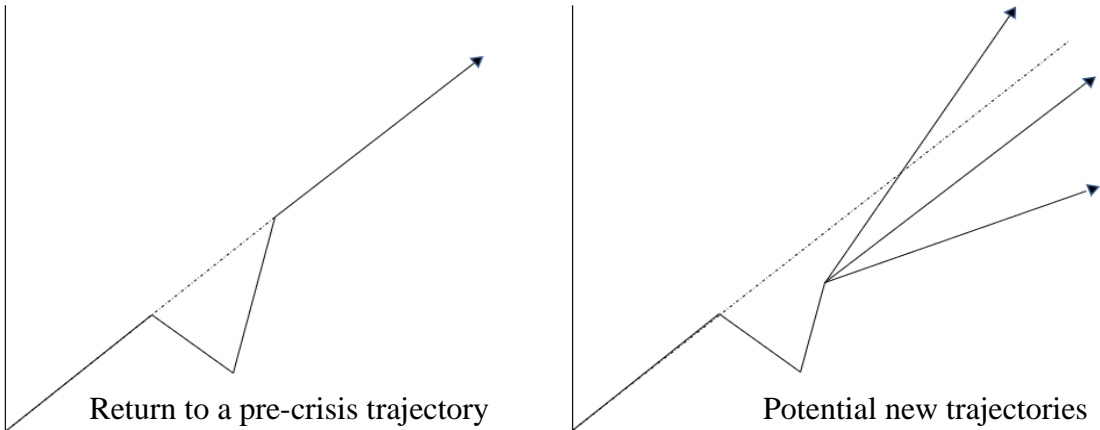
Scholars from different sciences and economists alike define and use the term resilience in multiple ways which has made the concept to occur as vague (Brand & Jax, 2007). Two distinct papers, authored by Martin and Sunley (2015) and Pendall, Foster and Cowell (2010) set out to solve this issue by summarising three main definitions relevant to the economic sciences. These two papers correspond regarding the first two definitions, which lead up to Martin and Sunley (2015) proposing a final definition which will serve as the foundation of the concept throughout this thesis.

The first definition of resilience concerns the original definition and highlights the ability of an economy to bounce back to its pre-crisis trajectory. Martin and Sunley (2015) further add that this definition also includes how rapid the recovery is. This is a reasonable amendment, given that societies may sooner or later return to pre-crisis levels, but if that takes a millennium it makes little sense to define such a recovery as resilience. Nevertheless, while this definition based on an equilibrist trajectory is the most prevalent in research, it has been criticised by evolutionary scholars. They reason that contexts are rarely (if ever) static, but economies are instead constantly adapting and due to such incremental changes there cannot be any static trajectory to bounce back to (Boschma & Frenken, 2006; Mahoney & Thelen, 2010:2; Simmie & Martin, 2010). Furthermore, this definition could also be criticised based on the empirical evidence presented by development economists in section 2.3, which shows that the goal to reach long-term success (on a national level) includes moving away from a state of rapid growth episodes toward a steady growth which tends to be slower (Broadberry & Wallis, 2017; Pritchett, Sen & Werker, 2018). Thus, with the logic of a bounce-back definition of resilience, an economy transforming from a high growth rate into a slower, steady and more sustainable growth would be considered non-resilient. Despite the argument proposed by above development economists that withstanding shrinking is key, this definition of resilience does not take this into account and as a result defines economies, including the most long-term prosperous ones, which have managed to shift from high growth rates during

their development phase into an optimal slow but steady growth rate. This makes a definition of resilience based solely on the ability to rapidly return to a pre-crisis growth trajectory unsatisfactory despite being intuitive.

The second definition of resilience is also equilibrant but without requiring a return to the pre-crisis trajectory. Instead, it reasons that a crisis may initiate a shift to a new trajectory at either a higher or lower equilibrium, where the lower option would not be considered a demonstration of resilience according to the first definition (Pendall, Foster & Cowall, 2010). These different scenarios related to an equilibrant trajectory are illustrated in figure 2.1. Pendall, Foster and Cowall point out that this definition includes that the economy is not significantly affected by the crisis before shifting trajectory but has the capacity to withstand shrinking. This is relevant for this definition to be valid, otherwise, every society would be defined as resilient given that they must at some point stop shrinking and thus reach a new trajectory to not go extinct. Therefore, what makes an economy resilient according to the second definition is rather that it is strong and stable enough to absorb shocks and thus more or less resist shrinking (Pendall, Foster & Cowall, 2010). However, in contrast to the final definition, this does not by default include structural adaptability as new trajectories might potentially be explained by factor prices whereupon it may be questioned if the outcome is due to capabilities or just luck.

In short, the difference between the first and second definition of resilience concerns the capability to bounce back versus the capability to avoid the crisis altogether.



**Figure 2.1.** Stylized illustrations of equilibrant trajectories. Source: Simmie & Martin (2020)

For the final definition of resilience, different suggestions are provided. Pendall, Foster and Cowall (2010) present a model which states that societies cannot be inherently defined as resilient as this is a cyclical and thus temporary capability. However, this is not a definition of the concept but a model which will not be further explored here. On the contrary, Martin and Sunely (2015) suggest that an economy demonstrates resilience by having the ability to benefit from a crisis and it does so by adapting its structure in response to challenges and thus improving its capabilities.

Based on this discussion, Martin and Sunley (2015) conclude that resilience is a process which incorporates four elements which may be studied independently. These are *vulnerability* to being affected by a crisis, *resistance* to shrinking during a crisis which is measured by the depth of shrinking, *robustness* to adjust the structures of the economy and finally *recoverability* which refers to whichever new path the economy recovers to. Next, it shall be discussed how economic geography and economic development respectively approach the determinants of why regions and states demonstrate different capabilities regarding these four elements.

## 2.2. Economic development: Exploring national shrinking resilience

While growth and how to achieve it by tradition have been central to economic sciences (Jones, 1990; Kaldor, 1957; Mankiw, Romer, & Weil, 1992; Romer, 1990; Solow, 1956; Swan, 1956), it has recently been acknowledged that to achieve modern economic growth the capability to resist shrinking is likewise crucial. Easterly, Kremer, Pritchett and Summers (1993) pioneered this approach when they observed that developing countries demonstrated high growth volatility over time despite stable country characteristics. This caused them to direct focus towards the ability to avoid shocks, thus shrinking, as a central difference between developed and developing economies.

If growth models cannot fully explain episodic growth, shrinking is an important aspect when aiming to understand the global disparity between countries. Central concepts in the

most common patterns among developing countries are acceleration (Hausman, Pritchett & Rodrik, 2005) followed by decelerations (Jones & Olken, 2008) with the result being a highly volatile growth experience. On the contrary, developed countries have demonstrated a unique ability to maintain their growth at stable but lower levels. For example, between 1890-2010 growth in Denmark oscillated between just 1,91% and 1,94% annually and this pattern has been typical among today's developed economies (Pritchett, Sen & Werker, 2018).

If these economies stopped shrinking at a lower development level, like the above Danish example, the capability to maintain stable growth is not by default exclusive to high-income countries. For example, Andersson (2018) found that between 1951-2016 East Asian economies demonstrated a declining shrinking frequency which supposedly explains why Taiwan, South Korea and Thailand in 2016 were 18 times richer than the Sub-Saharan countries with the highest shrinking frequency despite being 28% poorer at the beginning of this period (author's calculation based on Feenstra, Inklaar & Timmer, 2015). This idea about frequency and rate of shrinking as defining concepts for resilience (Broadberry & Wallis, 2017) corresponds to one of the defining elements of the concept, the capability of *resistance*.

Thus, if the overall objective according to this branch of development theory is to achieve *resistance* to shrinking, the succeeding question has been to understand what determines which economies are able to transform their growth trajectories, that is through *robustness* to adjust economic structures. By analysing the now developed economies which underwent this transformation more than a century ago, Broadberry and Wallis (2017) suggest four proximate determinants for shrinking to decline, namely structural transformation, technological change, demographic change, and a decline in warfare. However, the first and utmost threshold to achieve shrinking resilience is, as they argue, institutional change and more precisely the development of impersonal rule enforcement and thus equality before the law. However, this is a challenging threshold to achieve since it requires the elite/state to give up its privileges to enforce rules in its own favour (North, Wallis & Weingast, 2006).

The hypothesis is that if the pendulum swings in favour of impersonal rule enforcement, it promotes firm entry, competition and complexity which in turn promotes structural transformation (Broadberry & Wallis, 2017; Pritchett, Sen & Werker, 2018). This is relevant as it has been suggested that a transformation away from agriculture should increase overall

resilience to shrinking by diminishing sensitivity towards unpredictable factors like weather and volatile prices (Easterly et al. 1993).

Apart from sectoral employment shifts, Prichett, Sen and Werker (2018) refer to structural transformation as an overall increase in product complexity, which in turn enhances the opportunity to diversify production (Hausmann, Hidalgo, Bustos, Coscia, Simoes & Yildirim, 2014). In the following section, it is reviewed how economic geographers further explore this link between diversity and resilience.

To summarize, while the development research reviewed in this section value resistance to shrinking to facilitate long-term growth maintenance, it does not emphasize any potential ability of economies to bounce back and recover from shrinking episodes. It therefore does not address that also developed economies occasionally do shrink, as was the case during the stock market crash of 1929, the oil crisis of 1973 and the Great Recession of 2008 as well as why some economies, for example Ireland after 2008, demonstrated better recoverability than others, for example Greece (Giannakis & Bruggeman, 2017). Thus, it is not a universal model for understanding shrinking at any stage of development. As shall be seen in the following section, economic geography may in this regard complement economic development's current understanding of shrinking.

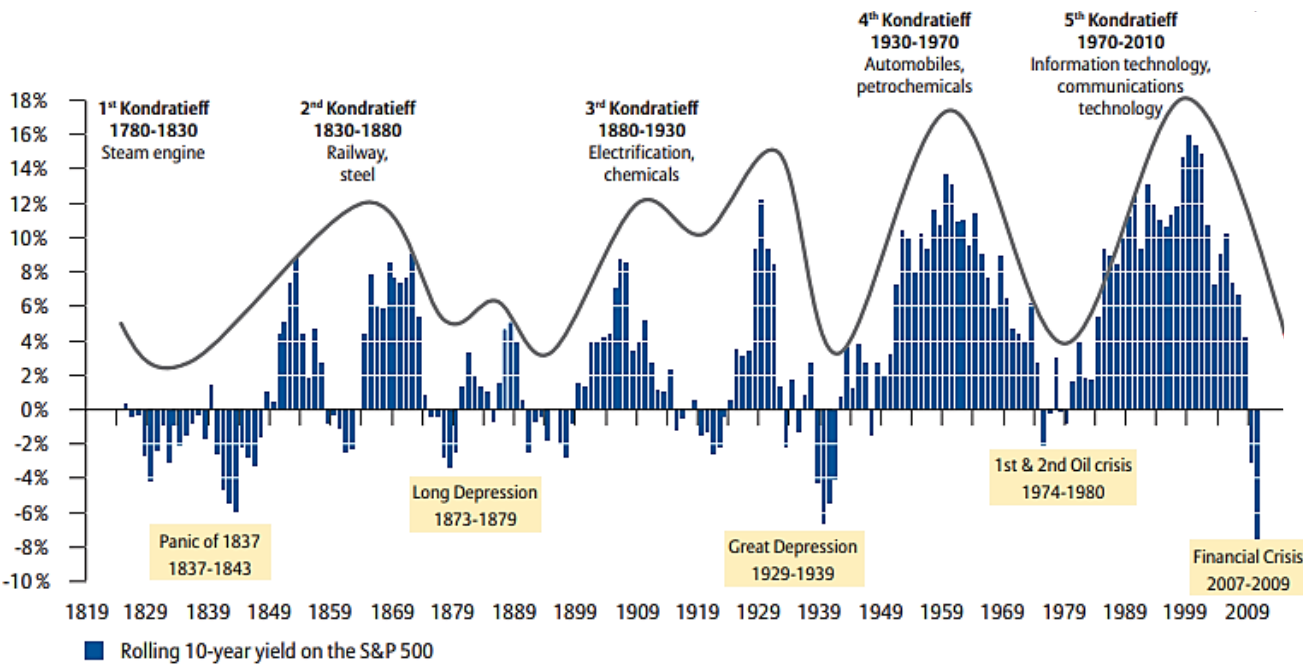
### 2.3. Economic geography: Exploring regional crisis resilience

While development economists have largely focused on understanding the ability of underdeveloped economies to catch up and reach modern economic growth, economic geographers rather aim to understand disparity and capabilities within economies. In contrast to development economics, this field is generally biased towards developed economies, whereupon it highlights that shrinking is not exclusive to backward economies failing to catch up. Among economic geographers who address resilience to crisis/shrinking, some reason that crises are a cyclical phenomenon (Bort, 1960; Neffke, Henning, Boschma, Lundquist & Olander, 2011; Lundquist, Olander & Martynovich. 2017; Pendall, Foster & Cowell, 2010),



while others address the impact of industrial diversity and relatedness within an economy (Boschma, 2015; Frenken, van Oort & Verburg, 2007; Pendall, Foster & Cowell, 2010). Both of these themes will in the given order be addressed in this section.

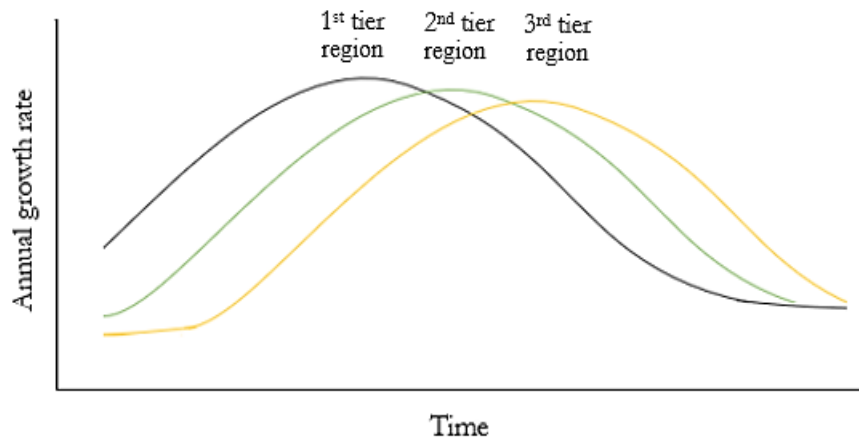
In 1973 the booming post-war era came to an end and economic crises made a return to developed economies. By marking a shift from one economic paradigm to another, this recession fitted into the cyclical pattern observed by Kondratieff (1979) and Schön (2012) where investment in general purpose technology (GPT) is followed by diffusion, rationalisation, increased competition and ultimately crisis as the opportunities of the given GPT runs out. However, according to this model, such a crisis creates a fertile environment for investment in new technology whereupon a new cycle begins. In terms of resilience, this would be a phase of *recovery* from the preceding crisis. Figure 2.1 illustrates the peaks and crises in relation to the so-called Kondratieff cycle.



**Figure 2.1.** Kondratieff-cycles, 1780-2010. Source: Allianz Global Investors (2010:6)

Some economic geographers incorporate and develop this idea to understand regional disparity regarding crisis resilience, such as Neffke, et al. (2011) who theorise that regions attract different kinds of industries which in turn grow during different stages of a structural cycle. Based on this Lundquist, Olander and Martynovich (2017) propose that metropolitan regions tend to pull ahead during the beginning of a growth cycle as agglomerations promote spillover which benefits such regions during an innovation phase. However, they theorize that

as the opportunities of a GPT reach its limits, this growth will reach a momentum whereafter medium-sized, smaller and finally peripheral regions converge toward the metropolitan region. These regions will be fuelled by their advantage of backwardness when the GPT diffuses throughout the economy and during the rationalisation phase when firms seek to lower production costs outside metropolitan regions (Neffke et al. 2011). A stylized illustration of these regional waves is presented in figure 2.2. In conclusion, this cyclical theory suggests that (wide) spatial disparities are transitional since convergence can be expected in the long run. However, in terms of *recoverability*, metropolitan regions would therefore hypothetically be more resilient to cyclical crises given their growth period follows just after the crisis.



**Figure 2.2.** Regional lead-lag growth pattern. Source: Lundquist, Olander & Martynovic (2017)

Henning, Lundquist and Olander (2016) further theorize why different regions strive during different phases of the structural cycle. Given that different regions attract different types of industries (Neffke et al., 2011) and thus produce for different target markets, they argue that shifting consumer and producer demands in the economy throughout the structural cycle contribute to the lead-lag pattern illustrated in figure 2.2. Thus, when first-tier regions drive growth during the innovation phase, the market is supply-driven and oriented toward business-to-business trade, while growth in later structural phases is demand-driven and industries in less agglomerated regions catch up by targeting consumers (Henning, Lundquist & Olander, 2016). However, it should be noted that both Lundquist, Olander and Martynovich's (2017) regional lead-lag model and Henning, Lundquist and Olander's (2016) target market framework are based on Swedish observations, but similar cyclical convergence have previously been observed also among U.S. regions (Bort, 1960).

While cyclical divergence and convergence could be understood as deterministic, the above theories do not explain why resilience sometimes differs between similarly agglomerated regions. Rather than emphasizing similarity in the regional mix, Martin, Sunley, Gardner and Tyler (2016) therefore direct attention to region-specific features, specifically institutional context, labour market and access to capital. Thus, their intention is to understand regional resilience as a capability rather than an automatic mechanism. However, their approach highlighting region-specific competitiveness cannot by default rule out that regional convergence and divergence nonetheless are cyclical as the features mentioned may potentially be just as affected by structural phases as target markets and agglomeration level. For example, if a structural crisis is followed by an inventive phase, it is probable that regions with features like a high-skilled workforce or easier credit access will be more resilient in terms of recovery since these features may be more competitive during specifically this phase. Thus, the difference between Martin et al.'s (2016) approach and the regional lead-lag approach is that the former does not assume a catch-up by regions not demonstrating immediate post-crisis resilience.

The second theme of economic geography to be addressed is the long-standing debate about whether diversification or specialisation produces the most optimal outcome. Promoters of specialisation argue that this encourages knowledge spillovers among firms within a sector, the so-called MAR externalities, as well as promote the benefit of economies of scale (Marshall, 1890; Arrow, 1962; Romer, 1986). However, the risk with specialisation is that it increases an economy's *vulnerability* by 'putting all the eggs in one basket' (Frenken, van Oort & Verburg, 2007). The opposing argument in the specialisation versus diversity debate is that rather a diversity of sectors promotes knowledge spillovers between sectors and innovation since it encourages the combination of knowledge from different sectors to create something new, the so-called Jacobs' externalities (Jacobs, 1969).

From these two general views, the arguments have developed with the introduction of the concepts of unrelated and related variety. With the former, an economy includes a diverse but unconnected mix of sectors and this is suggested to promote resilience since it hinders failure in one sector to spread throughout the economy (Frenken, van Oort & Verburg, 2007). The second option, related variety, is defined as a diverse mix of sectors being interlinked and it is argued to improve resilience since it enhances the opportunity of sectors, firms and individuals to combine knowledge and create new paths (Boschma, 2015). It may therefore be

concluded that these two arguments address two different elements of resilience, namely *vulnerability* for unrelated variety and *recoverability* for related variety.

To elaborate on this discussion and contextualise which type of sectoral mix is preferable for resilience, Frenken, van Oort and Verburg (2007) address that the benefits of related and unrelated variety are different in metropolitan and rural regions. In line with the above discussion on cyclical models, they reason that related variety has the potential to promote resilience by making agglomerated areas into innovation centres while smaller regions rather attract production facilities which do not similarly benefit from knowledge spillovers. Thus, the argument is that related variety does not benefit peripheral regions enough to compensate for the increased vulnerability of relatedness. Finally, while it has been found that unrelated variety better than related variety impeded employment losses (Frenken, van Oort & Verburg, 2007), it is easier for the unemployed to find a new job under related variety (Neffke & Henning, 2013). Thus, by once again connecting to the defining elements of resilience, it appears as if unrelated variety is less *vulnerable* to shrinking while related variety promotes the capability of *recoverability*. These arguments may be concluded with that related variety promotes growth while unrelated variety combats shrinking.

This debate about nuances of diversification and specialisation is tied to resilience through two other concepts in line with Martin and Sunley's (2015) definition of resilience, namely adaptation which is when an economy transforms its existing path and adaptability when it develops new paths (Hassink, 2010). However, Boschma (2015) reasons there is a trade-off between these two capabilities. While a variety of sectors stimulate the combination of knowledge to create something new, specialized regions are less likely to achieve adaptability as they tend to be more bound by lock-ins. On the other hand, regions with the capability to achieve adaptability tend to be more diverse due to Jacobs' externalities, whereupon Boschma (2015) continues that such regions instead face obstacles to achieve adaptation since this capability is promoted by specialisation through the contrasting MAR externalities. His argument is that resilience is promoted if regions manage to overcome the challenge to achieve both adaptation and adaptability and that this is most likely in the context of related variety since it includes the benefits of both specialisation and diversity. However, given Frenken, van Oort and Verburg's (2007) argument that related variety promotes resilience in specifically urban regions, this leaves the question of non-urban resilience unresolved.

The above reasonings from the specialisation/diversification debate on resilience capabilities are concluded as follows:

**Table 2.1.** Expected resilience capabilities based on context. Source: Boschma (2015); Frenken, van Oort & Verburg’s (2007)

		Capability	Context
Specialisation		Vulnerability	Urban / Rural
Diversification	Related variety	Vulnerability	Rural
		Recovery	Urban
	Unrelated variety	Vulnerability	Urban
		Resistance	Rural

## 2.4. Theoretical framework

A comparison between the two fields reviewed above motivate the approach of economic geography to be more relevant for this thesis for two reasons. While economic development focus more on why economies transform from a shrinking to non-shrinking trajectory and thus from underdevelopment to development, economic geography does not view resilience as an endpoint but as an ongoing process. The first reason it therefore that since this thesis focuses on a developed country, the models from economic geography are deemed to be more relevant. Second, since economic development scholars define resilience solely based on the capability to resist shrinking, neither Ireland overall nor any Irish region would be considered resilient given they all shrunk during the Great Recession (OECD, 2022). Against the background of Martin and Sunely’s (2015) elements of resilience, it may therefore be concluded that to explain Ireland’s post-crisis divergence it is mainly relevant to understand differences in *robustness* to adjust structures and *recoverability* in terms of output. However, it may be argued that recovery is a symptom of resilience while structural transformation, as reasoned Broadberry and Wallis (2017) as well as Andersson, Julia and Palacio (2021), would be an underlying mechanism. Therefore, the empirical analysis will focus on understanding the *robustness* element, manifested as sectoral transformation in the form of either adaptation

or adaptability. Recovering tendencies on the other hand are discussed in the following chapter which introduces Ireland as a case.

To understand the capability to adjust structures, the analysis will be constructed around the theories on how related and unrelated variety affect shrinking resilience. This is because out of the two geographic approaches reviewed, namely shrinking and recovery as cyclical patterns and the resilience-relatedness connection, only the latter may explain resilience as a capability rather than an automatic mechanism which is relevant for understanding the divergence of seemingly similar regions. A second reason for focusing on sectoral relatedness is, as will be argued in the next chapter, that Irish regions do not demonstrate clear cyclical tendencies. Note that, to not confuse changes in the sectoral mix in terms of sectoral variety with structural transformation, which is commonly accepted among economic developers to be defined as the shift of broad sectors in the economy, this thesis will instead label such shift ‘sectoral micro-transformation’.

The study of related/unrelated variety is divided into two sub-measures: variety and relatedness (Boschma, 2015; Frenken, van Oort & Verburg, 2007). Through the number of sectors in a region, this thesis intends to draw conclusions about variety as well as structural composition, and how this potentially changes in relation to crisis. Relatedness on the other hand may testify about the extent new industries entering a region are linked to existing industries, thus providing an understanding of adaptation and adaptability. To analyse such relatedness, this thesis will measure the proximity and linkages between regional industries based on an idea by Hidalgo et al. (2007). Their theory states that economies have a probable capability to develop new industries that benefit from similar factors as existing industries, for example regarding infrastructure, institutional support, human capital, know-how or technological similarity. These are deemed to be relevant variables for this study since Hidalgo et al. (2007) based them on the same premises as the links Boschma discussed regarding related variety.

An implication of this choice of theoretical framework to be reflected upon is that the study will be based on the assumption that all Irish regions are developed in the sense of having reached modern economic growth, solely because Ireland as a state is considered developed. It will not be considered whether regions potentially could fail to achieve Broadberry and Wallis’ (2017) determinants of development and thus contrast the national

level. Agency, which affects how these determinants are reached according to Pritchett, Sen and Werker (2018), could likewise affect regions differently. In a broader study it would therefore be relevant to consider whether low regional resilience in overall developed economies is more affected by local underdevelopment than proximity of regional sectors.

### 3. Introducing the case

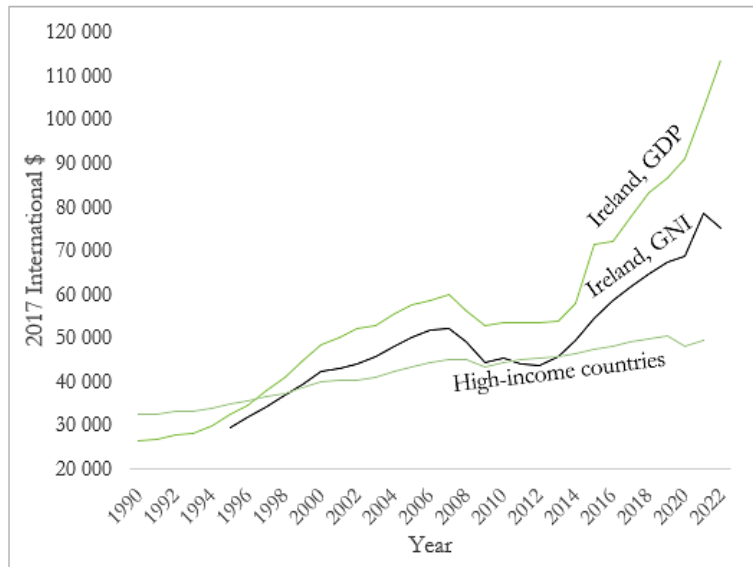
In the 1980s the prospects were considered bleak for Ireland as it was described as a poor country in a rich neighbourhood (The Economist, 16 January 1988). By then Ireland had a GDP per capita equivalent to approximately \$25 488 (in 2017 prices), which may be compared to somewhat less than in current-day Trinidad and Tobago (Feestra, Inklaar & Timmer, 2015). However, already six years after the Economist's gloomy description of poor Ireland, its economy was dubbed a 'Celtic Tiger' to address the similarities with the preceding East Asian rapid development (Gardiner, 1994). This boom lasted until the economy abruptly crashed in 2008 and the country faced Europe's worst deficit (Eurostat, 2023a). However, the economy bounced back with some of the world's highest growth rates, resulting in a GDP per capita of \$113 871 in 2022, currently the second highest in the world after Luxemburg, which may be compared to \$60 170 just before the crash (World Bank, 2023a).

Yet, it should be acknowledged that the large extent of FDI in Ireland makes it problematic to compare its GDP with other countries as an unproportional share of Irish-made profits belongs to foreign investors (CSO, 2023a). Thus, GDP overestimates Irish performance whereupon the recovery after the crisis, which was initiated by a 26% growth rate in 2015, became labelled 'Leprechaun economics' (Krugman, 2016). Figure 3.1 illustrates GDP in comparison with GNI<sup>1</sup>, which is a more appropriate variable for analysing the Irish economy and which reveals an average difference of 30% between these two variables since 2015 (World Bank, 2023a). Although, figure 3.1 also concludes that despite this overestimation, Irish post-crisis growth rate still outperforms other high-income countries.

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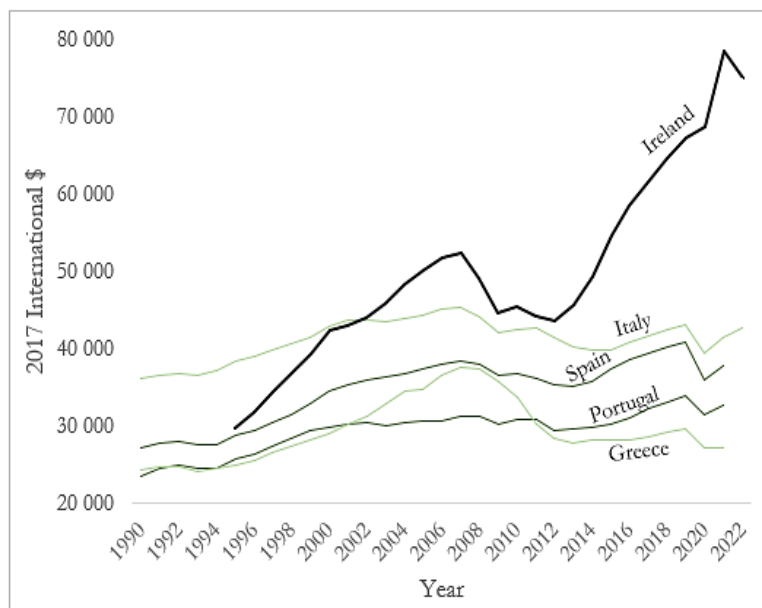
<sup>1</sup> Income earned by nationals rather than income generated within a nation's borders.





**Figure 3.1.** GDP and GNI (PPP) per capita, 1990-2022, Ireland compared to high-income countries. Note that GDP/GNI regarding high-income countries are here indistinguishable. Source: World Bank (2023a)

Irish performance and resilience may also be understood in comparison with the other PIIGS economies (Portugal, Italy, Ireland, Greece and Spain) struggling with large budget deficits during the Great Recession. Figure 3.2 illustrate how each country’s performance after the crisis relates to their respective pre-crisis trajectory. Thus, Ireland and Portugal recovered to or exceeded their former growth trajectory, Italy and Spain grow at a similar pace but from a lower level, while Greece demonstrated a general inability to recover.



**Figure 3.2.** GNI (PPP) per capita among PIIGS, 1990-2022. Source: World Bank (2023a)

Given Martin and Sunley's (2015) element of resilience, it may therefore be understood that while the Irish economy did not demonstrate *resistance* to the crisis, it showed strong *recoverability*. This allows for the theoretical observation that Ireland contradicts Pritchett, Sen and Werker's (2018) observation that developed economies do not grow rapidly, however, their idea is based on the experience among old developed economies while Ireland rather resembles the East Asian catch-up economies (author's observation based on Feestra, Inklaar & Timmer, 2015).

To further understand the context in which the theoretical framework will be applied, this chapter presents a background to Ireland's development policies and how they correlate with the structural transformation. This is followed by a discussion on how regional divergence was amplified after the Great Recession, to finally motivate the use of Midland and South-East as specific case studies for the analysis.

### 3.1. Development policies

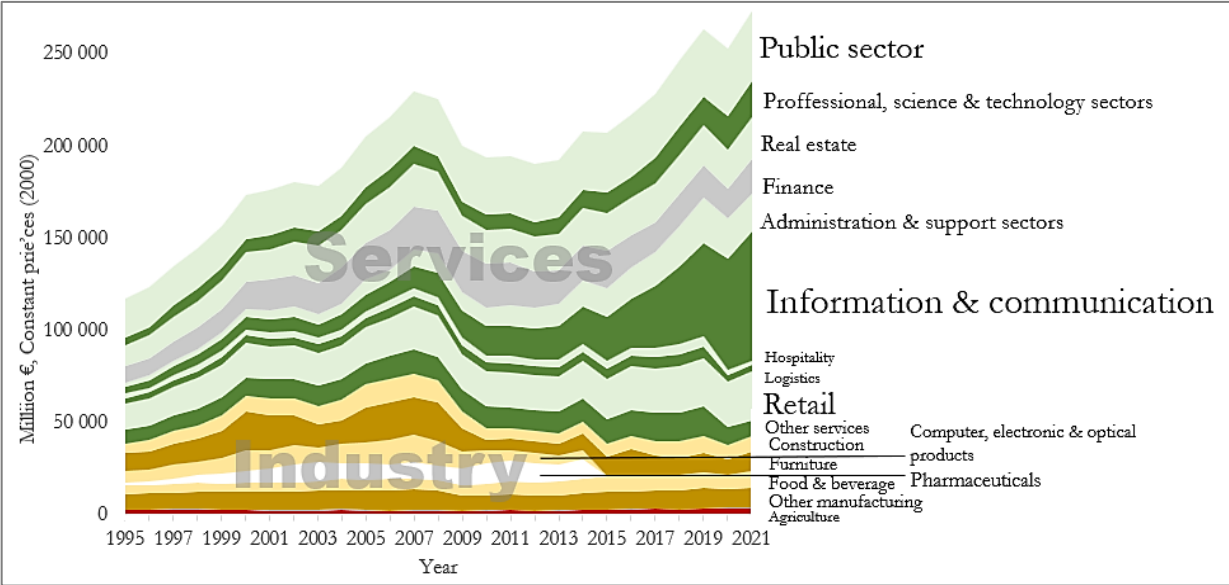
The 'Irish Model' that framed Ireland's development from backwardness to frontier is characterized by FDI-led growth where policymakers took an active role in which sectors to attract (Brazys & Regan, 2017). The model is based on low taxes, institutional organization, the English language and American-like corporate legislation (Barry, 2007). Out of these, several researchers especially highlight the institutional organization which were designed to efficiently implement the development agenda through specific development agencies<sup>2</sup> which had the mandate to re-shape institutions in order to accommodate the need of desired sectors and companies (Barry, 2007; Brazys & Rega, 2017; O'Riain, 2009:74). For example, Barry (2007) describes how these agencies created technical institutes throughout the country where

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<sup>2</sup> These development agencies are IDA, which aims to attract inward investment, Enterprise Ireland, which aims to promote indigenous export, and Údarás na Gaeltachta which aims to preserve the Irish language among others by supporting enterprises in the Gaeltacht (Irish speaking areas).

students gain practical skills required by the desired sectors, resulting in Ireland having one of the world's highest proportions of science and technology graduates. However, the everyday task of the development agencies is to provide support such as funding and business counselling and their client firms hold a considerable weight in the Irish economy, accounting for 75% of exports and 90% of total sales while merely employing 35% of the private sector workforce (DETE, 2021a, 2021b). Thus, the Irish development story is characterized by its state-led design and as will be discussed in chapter 5, this will be reflected in the analysis of this thesis since the use of data reflects specifically agency-assisted firms.

The policy to attract FDI may be derived into four phases, as described by Barry (2007). The first one represents the liberalisation in the 1950s when the economy abandoned protectionism and during this period it was dominated by less complex manufacturing such as textiles/clothing, metal products and pulp/paper/printing while the more semi-complex category of electronics took off. During the 1970s and 1980s, the second phase developed the competitiveness in technological manufacturing and as the level of human capital increased, the economic complexity increased from low- to high-tech. The third phase coincided with the Celtic Tiger and the global tech boom when Ireland began hosting service offshoring. Finally, the current phase with a focus on R&D offshoring was still in the bud when Barry (2007) divided Irish FDI into these four phases but has since increased (IDA, 2021: 12). However, as figure 3.3 illustrates, the information and communication sector, which includes many multinationals, has kept growing and currently holds the major position among sectors.



**Figure 3.3.** Sectoral distribution of value-added, 1995-2021. Note that data are missing after 2014 for computer, electronic & optical products and pharmaceuticals. Source: OECD (2023)

Given the experiences from economic history that state intervention in the form of planning tends to cause backlash and crisis despite any potential initial success (Perkins, Radelet, Lindauer & Block, 2013:138), it may be questioned if the Irish development is sustainable. Rodrik (2004) as well as Mazzucato (2013) argues that the state has a role to play in supporting the private sector but for long-term efficiency, this does not involve picking winners through sector-specific support or tax cuts, which as discussed above are elements of the Irish model (Barry, 2007). While the general criteria to be eligible for agency-assisted support is not sector-specific as it includes all companies involved in tradeable sectors (DETE, 2021b), however, the planning of human capital formations and tax deals with specific tech multinationals (European Commission, 2016) illustrate how the Irish state nevertheless favour specific industries.

While the Irish model made Ireland one of the first countries to apply FDI-led growth policies in the 1950s, it was with the creation of the European single market in the early 1990s that FDI began to noticeably impact employment levels. According to Barry (2007), this was because, with the enlarged market, global investors saw new opportunities whereupon the above discussed elements of the Irish Model came to attract an unproportionally high share of European inward investment to be directed toward specifically Ireland. Thus, market size was the missing piece of the puzzle to make the Irish Model as successful as it has been since the 1990s.

## 3.2. Regional disparity

As Ireland is a country where different regions have demonstrated both strong and weak resilience (OECD, 2022), it is a relevant case study for understanding the underlying mechanisms of this phenomenon. With the Irish development being compared to the Asian Tigers, it has received a fair share of attention from scholars and policymakers eager to understand its growth miracle (Barry, 2007; O’Riain, 2009) as well as resilience miracle (Breathnach, van Egeraat & Curran, 2015; Regan & Brazys, 2017). However, not every part of the country has been part of this story (OECD, 2022) and the causes behind this have been less studied. This section presents a historical account of convergence and divergence between Irish regions.

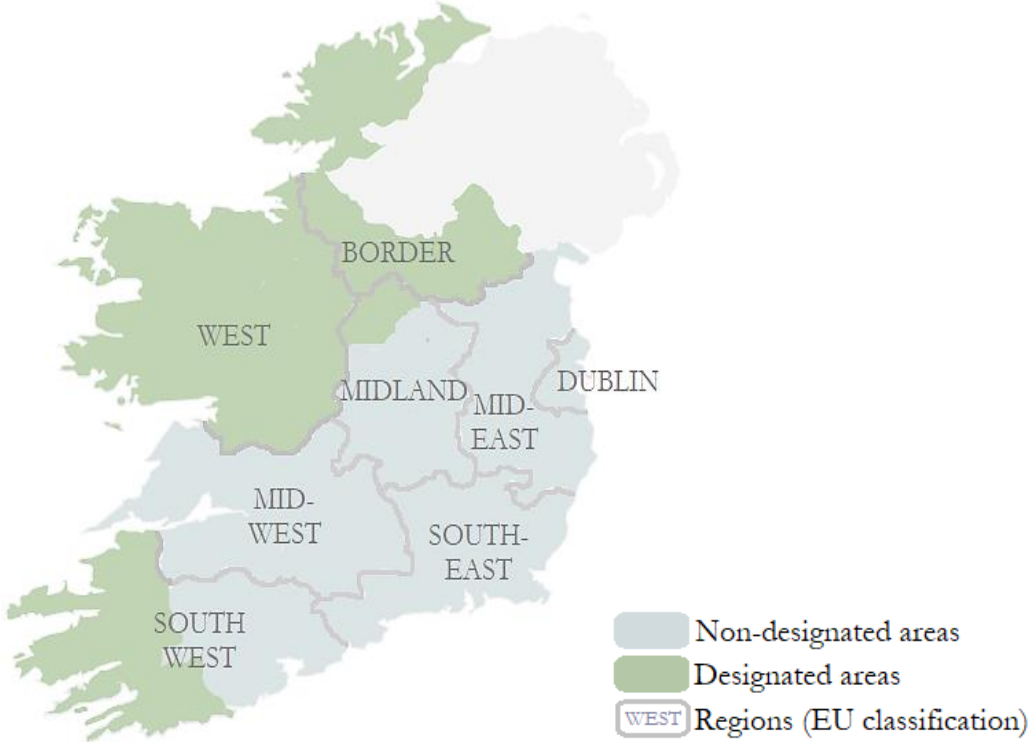
To illustrate the state of Irish regional shrinking and disparity, table 3.1 ranks the European countries where one or several regions have shrunk to be poorer over the past two decades. The comparison shows that the two Irish regions of concern, Midland and West, are outlier cases both in terms of shrinking and divergence from the overall national level. Note that this is based on GDP since GNI is not available on a regional level. However, while it was concluded that Ireland's GDP tend to be overestimated, its growth/shrinking rate is similar to GNI (OECD, 2022).

**Table 3.1.** Regional shrinking in Europe, 2000-2019, measured as GDP per capita, PPP (constant 2017 international \$). Ranked by the level of disparity between regional shrinking and national growth. Source: (author's calculation based on OECD, 2022)

	Number of regions shrinking / total number of regions	% of regions shrinking	Average shrinking among these regions	National growth	Regional- national disparity
Ireland	2 / 8	⇒ 25,0%	-13,7%	78,4%	⇒ 92,1%
Belgium	3 / 44	⇒ 6,8%	-11,7%	20,6%	⇒ 32,3%
Germany	6 / 403	⇒ 1,5%	-4,8%	25,5%	⇒ 30,3%
U.K.	6 / 184	⇒ 3,3%	-7,8%	21,8%	⇒ 29,6%
Netherlands	6 / 40	⇒ 15,0%	-7,4%	19,7%	⇒ 27,1%
Spain	34 / 59	⇒ 5,8%	-8,1%	17,4%	⇒ 25,5%
Switzerland	1 / 25	⇒ 4,0%	-1,9%	21,1%	⇒ 23,0%
France	7 / 101	⇒ 6,9%	-0,8%	15,5%	⇒ 16,3%
Greece	34 / 52	⇒ 6,5%	-9,5%	1,9%	⇒ 11,4%
Italy	79 / 107	⇒ 7,4%	-6,8%	-0,9%	⇒ 5,9%

While the regional disparity has a long history in Ireland, so has the intention to combat this inequality where the Irish Development Authority (IDA) in 1973 began providing specific grants to investment projects in underdeveloped areas, the so-called, designated areas

(Meyler & Strobl, 2000). By investigating the employment movement in these areas and the plants receiving grants, Meyler and Strobl found that between 1972-1996, employment increased more in designated areas than in non-designated areas since existing jobs there were destroyed at a lower rate than in other regions, while new jobs kept being created. However, as their study only takes employment growth into consideration during a 24-year period, these results do not explore whether a potential lack of creative destruction due to this support had long-term implications on structural transformation. Figure 3.4 highlights the areas which were classified as designated areas throughout the whole period 1972-1996.

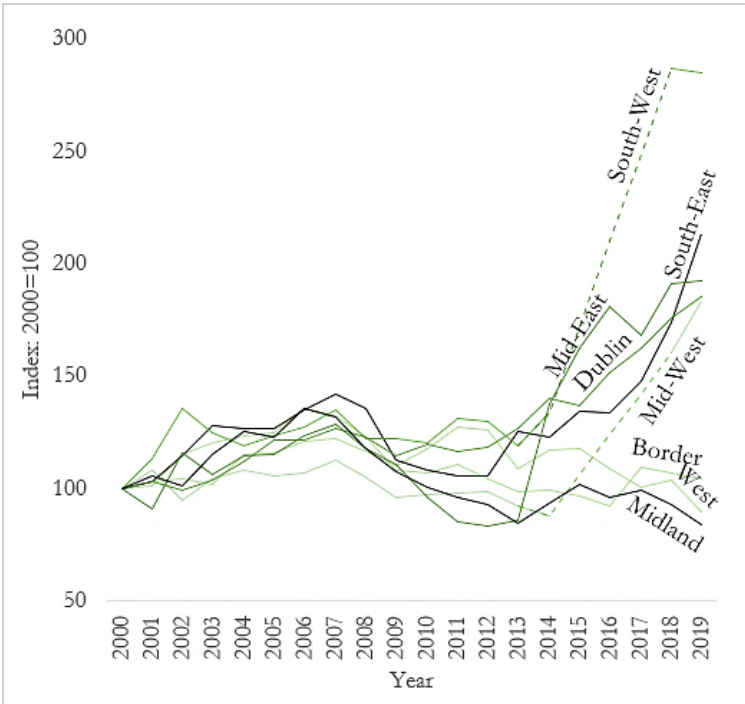


**Figure 3.4.** Designated areas, 1972-1996. Source: Meyler & Strobl (2000)

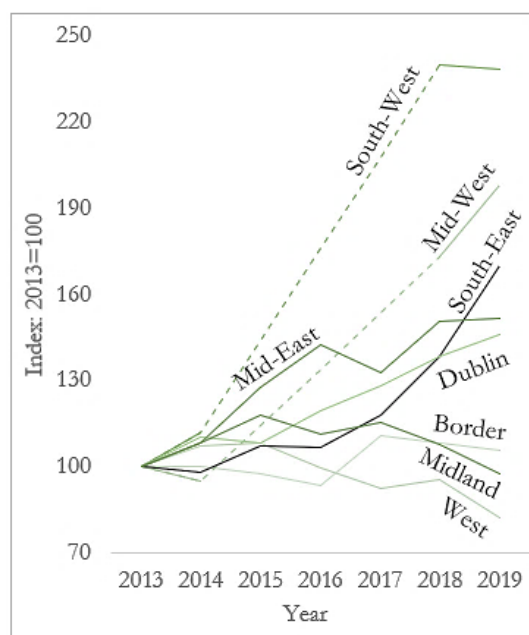
In terms of *robustness*, it may be acknowledged that nine out of twelve counties in the three ‘loser regions’ were classified as underdeveloped DAs until at least 1996 (Meyler and Strobl, 2000), whereupon it may potentially be that these regions were artificially lifted through subsidies without improvements of the underlying productive structure. However, the three counties not classified as designated areas are all in Midland.

Between 2000-2008, Irish regions were following a relatively similar growth trajectory, as shown in figure 3.5a. After this juncture, regions diverged with four ‘winner regions’ demonstrating a capacity to recover to either their previous or higher growth trajectory, while

Midland and West have not yet recovered in terms of output. Despite having demonstrated higher growth rates than the national average during the Celtic Tiger, Midland and West were on average 14% poorer in 2019 than two decades earlier (author’s calculation based on OECD, 2022). However, since Midland and Border, which is another region demonstrating poor performance since the crisis, briefly drove the overall national growth between 2004-2006, it appears that these ‘loser regions’ do not lack an inherent inability to grow but rather an inability to recover. Furthermore, while Dublin was shrinking the least during the crisis and was thus the most resistant region, none of the Irish regions was completely resilient in terms of *resistance* to shrinking.



**Figure 3.5a.** Growth trajectories among Irish regions 2000-2019, measured as GDP per capita, PPP (constant 2017 international \$). Note that the values for South-West and Mid-West for the period 2014-2018 are estimates as data is not published. Source: OECD (2022)



**Figure 3.5b.** Growth trajectories among Irish regions 2013-2019, measured as GDP per capita, PPP (constant 2017 international \$). Source: OECD (2022)

From a cyclical perspective, Irish regions do according to figure 3.5a not demonstrate a clear pattern of temporary divergence as regions drive growth during different phases of the structural cycle as theorised by Henning, Lundquist and Olander (2016), Neffke et al. (2011), Lundquist, Olander and Martynovich (2017). Figure 3.5b more clearly highlights the pattern after 2013 when the overall Irish economy began recovering. Since then, South-West has demonstrated the highest growth rate which correlates closely with the national recovery illustrated in figure 3.1 whereupon it may be concluded that South-West drives Ireland’s post-crisis growth. Potentially may this curve be connected to growth in the manufacture of pharmaceutical products and/or manufacture of computer, electronics and optical products, which are both major sectors in county Cork in South-West, but such a correlation cannot be confirmed as data for specifically these sectors are unavailable for the same period as data for South-West is missing (OECD, 2023). Another potential explanation for South-West’s noteworthy growth might be connected to Apple’s location in Cork, given that IMF (20018: 34) estimates that the intellectual property of the iPhone which was registered in Ireland in 2015, contributes 25% to Ireland’s GDP. It may from figure 3.5b be further observed that Mid-East, Mid-West and South-East have all demonstrated stronger growth than Dublin since the crisis, despite that Dublin hosts a majority of the sectors Lundquist, Olander and Martynovich (2017) theorise to strive after a crisis (IDA, 2023). Thus, it may be concluded



that Irish regions do not appear to align with cyclical patterns based on the lead-lag theories as discussed in section 2.3.

Based on crisis-recovering capabilities, Irish regions may according to table 3.2 be categorised into two groups: winners and losers. Note that since this solely concerns output growth and not structural adaptability, conclusions may not be drawn about *robustness*.

**Table 3.2.** Average annual growth rates before and after the Great Recession, measured as GDP per capita 2000-2018, PPP (constant 2017 international \$). Ranked by post-shrinking growth rates. Source: author’s calculation based on OECD (2022)

	<i>Losers</i>			<i>Winners</i>				
	Midland	West*	Border	Dublin	Mid-East	Mid-West	South-West	South-East
Return to pre-2007 level	–	2011	–	2013	2017	2016	2011	2017
Pre-shrinking growth rates	5,3%	3,2%	5,2%	3,0%	3,9%	1,7%	4,4%	4,9%
Post-shrinking growth rates**	-3,5%	-1,5%	0,2%	6,0%	7,1%	7,5%	8,9%	9,6%

\* West briefly recovered before shrinking yet again.

\*\* Based on the first year of growth after the crisis. Regarding Midland and Border the calculation includes every year since 2007 when they began shrinking.

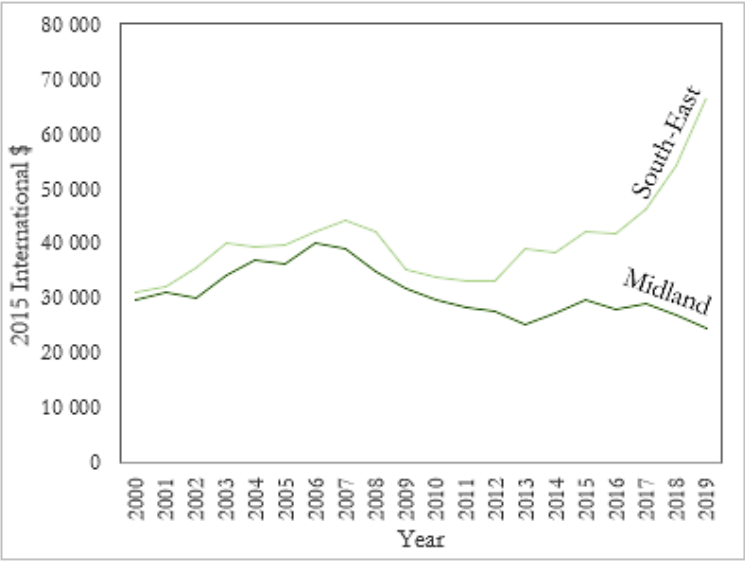
### 3.3. Regional focus

A conclusion of this chapter so far motivates that Midland is of specific interest on the topic of shrinking given its noteworthy lack of resilience in terms of output recovery compared with both other Irish and European regions. In the analysis, it will be compared to South-East since

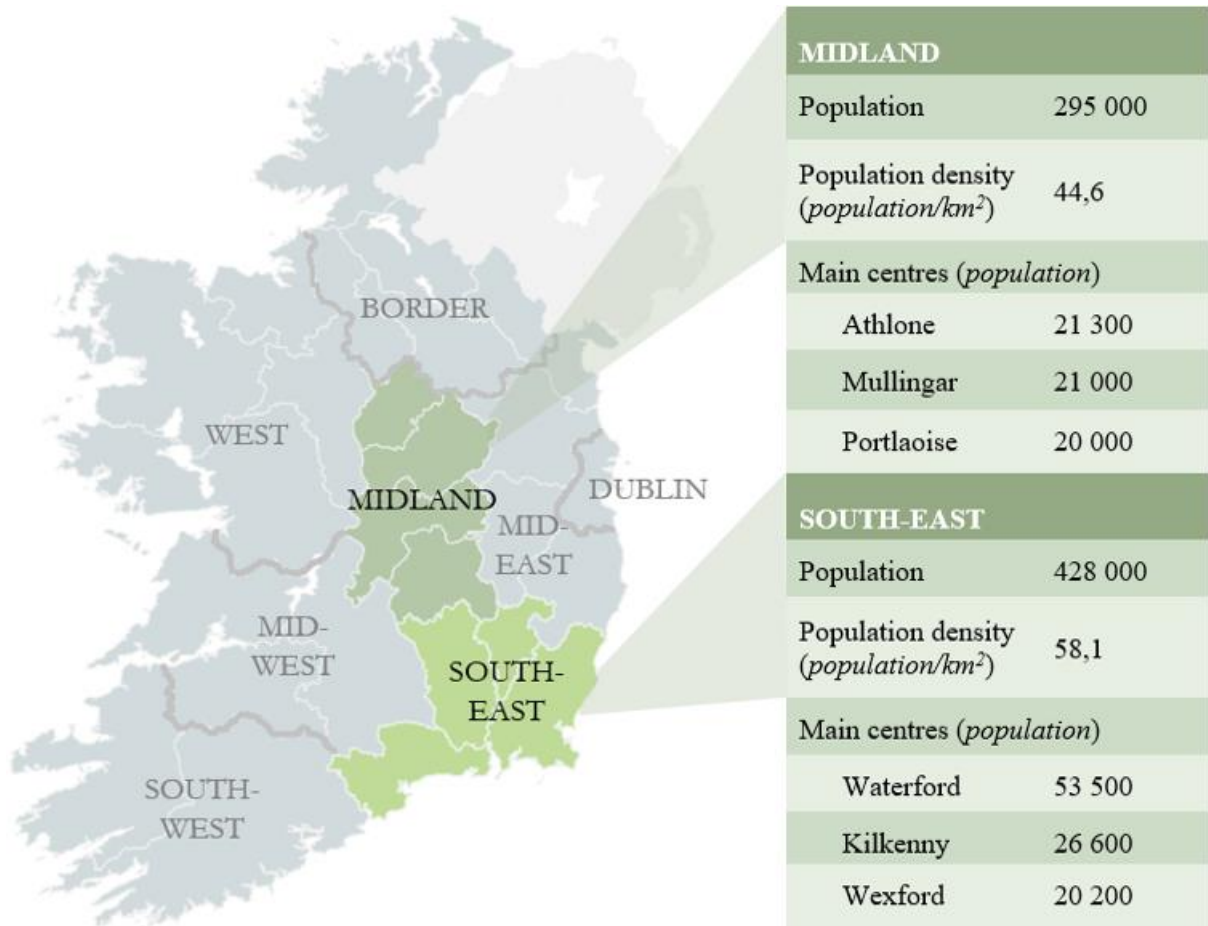
these two regions demonstrated a similar trajectory until 2012 when South-East initiated its recovery while Midland remained non-resilient (OECD, 2022). While it in the previous section was established that Midland has been an outlier in comparison to the rest of Europe, so has South-East like the other Irish ‘winner regions’ but on the other end of the spectrum; between 2013-2019 this region grew 70,4% while the median growth in Europe for the same period was 9,1% (author’s calculation based on OECD, 2022).

Other similarities between these two regions include that prior to the Great Recession, they had a comparable GDP per capita and their respective distance to Dublin metropolitan area is similar (see figure 4.1 and 4.2). Furthermore, unlike in the three western regions, no area in Midland and South-East was in the early 2000s rurally backwards enough to be considered challenging for development (Department of Housing, Local Government and Heritage, 2002). These similarities limit the possibility to jump to the wrong conclusion in the analysis.

On the other hand, differences between Midland and South-East include that Midland are land-locked and somewhat less urbanised (CSO, 2023b). Given Frenken, van Oort and Verburg’s (2007) suggestion that relatedness might only benefit resilience in regions dense enough to achieve spillover effects to counterbalance the risks associated with relatedness, namely the risk of ‘putting all eggs in one basket’, the difference in urbanisation and density is a relevant difference to acknowledge in the analysis (see figure 4.2).



**Figure 4.1.** Midland and South-East comparative trajectories, measured as GDP per capita, PPP, 2000-2019. Source: OECD (2022)



**Figure 4.2.** Midland and South-East comparative characteristics: Population and main urban centres. Source: CSO (2023b)

## 4. Methodology

In line with the theoretical framework, which argued for an emphasis on relatedness, variety and distinction between adaptation and adaptability, the analysis of this thesis will be based upon these variables. After discussing the design of the case study, this chapter therefore discusses a methodology for measuring proximity between sectors as a proxy for relatedness which further allows for defining to what extent a sectoral micro-transformation occurs through adaptation and adaptability as discussed in section 2.3. Finally will a measurement of variety/diversity be discussed.

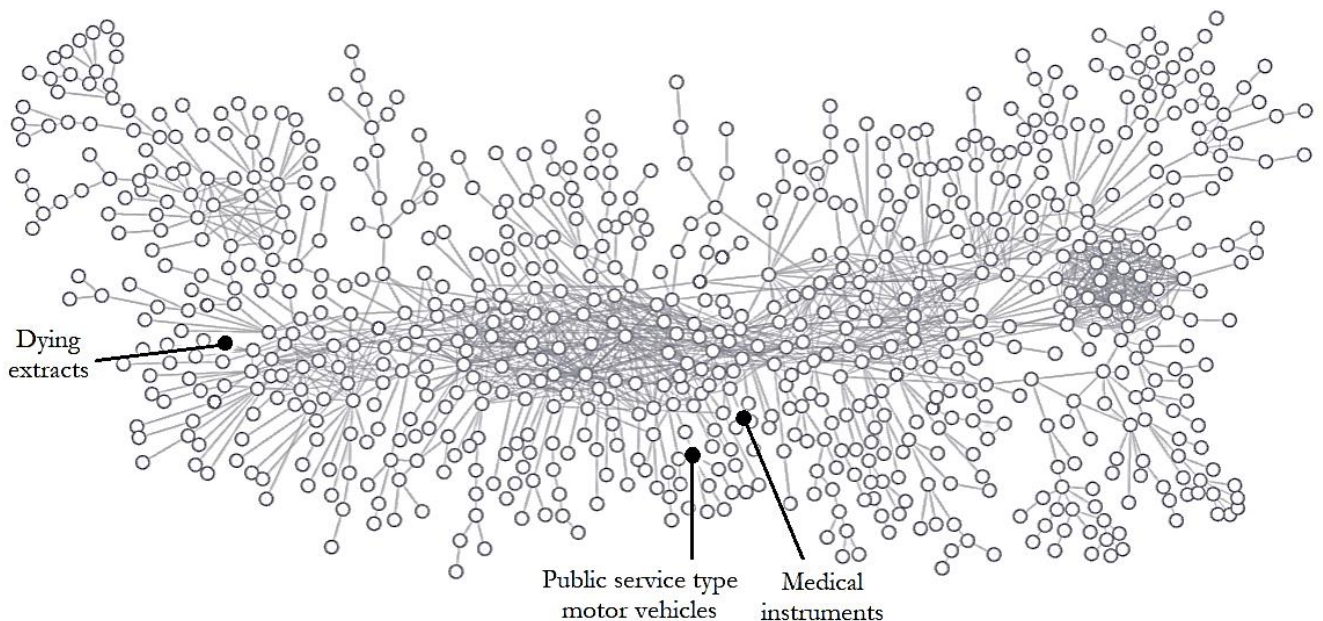
### 4.1. Case study

The outcome of a case study depends on its design. Crowe, Cresswell, Robertson, Huby, Avery and Sheikh (2011) discuss how it may be either *intrinsic*, where a case is chosen due to its unique characteristics, or *instrumental*, where a case instead represents a typical example of a phenomenon. Given the focus on Ireland and Midland which as seen both represent outlier cases, this thesis therefore conducts an *intrinsic case study*. As Crowe et al. point out, the results can therefore not aim to be generalizable, but they may on the other hand contribute to nuancing the theoretical understanding of shrinking resilience as they may limit to what extent typical cases can be generalized.

Yet another approach is the *collective case study* where multiple cases are included in the study and thus allow for either a comparison or replication of results to improve a study's validity (Crowe et al. 2011; Meyer, 2001). This is relevant to limit the researcher's biases impacting the result (Eisenhardt, 1989), given that humans tend to draw intuitive and potentially pre-mature conclusions when data is as limited to solely one case (Kahneman & Tversky, 1973). With the intention to draw unbiased conclusions, South-East is therefore included in the analysis based on the motivation in the former section.

## 4.2. Proximity analysis

As reasoned in section 2.4, this thesis will measure the proximity between regional sectors based on Hidalgo et al. (2007), who propose to measure the probability that a new sector will enter an economy based on its current sectors. For example, a hypothetical economy producing solely dyeing extracts is further from developing the capability to produce public service type motor vehicles than an economy producing medical instruments as the former are less related in the sense of fewer in-between industries sharing the relevant capabilities. This is below illustrated in the Product Space, which is a framework linking nearly 900 goods based on Hidalgo et al.'s (2007) proximity analysis (Growth Lab at Harvard University, 2023).



**Figure 4.3.** The Product Space. Source: Growth Lab at Harvard University (2023)

Thus, given that regions are theorized to be more resilient when achieving both adaptability to transform existing paths and adaptability to develop new paths (Boschma, 2015), conclusions regarding regional resilience may be derived by analysing how sectoral diversity correlates with total proximity between sectors. Thus, when a new sector enters a region, this region demonstrates adaptability if the new sector is linked to existing sectors. Such a linkage is determined by a proximity analysis measuring the likelihood that an economy with revealed competitive advantage (RCA) to export product  $i$ , also has the ability to export product  $j$  (Hidalgo et al., 2007). Thus, the outcome of model 4.1 is assumed to be the proximity ( $\phi$ )

between two products, however, note that the term ‘sectors’ will instead be used throughout this thesis to also include services.

$$\phi_{i,j} = \min \{P(RCA_i|RCA_j), P(RCA_j|RCA_i)\} \quad (4.1)$$

...where RCA is calculated as following for country/region  $r$  exporting product  $i$ , based on value added  $x$  (Hidalgo et al. 2007):

$$RCA_{r,i} = \frac{x(r, i)}{\sum_i x(r, i)} / \frac{\sum_i x(r, i)}{\sum_{r,i} x(r, i)} \quad (4.2)$$

In short, the model reasons that proximity is determined by the observed ability of countries around the world to export both product  $i$  and  $j$ . It may be illustrated through an example where medical instruments are exported by 17 counties and public service type motor vehicles by 25 counties while five of them export both, then the proximity is 0,2 based on the division  $\frac{5}{25}$ . To minimize the risk that the proximity will be overestimated, the denominator is set to 25 rather than 17. The outcome will be a number between 0 and 1, where it could be assumed that a society producing product  $i$  will by default be capable of also producing product  $j$  if they are linked, namely if the proximity is 1, while they otherwise are unlinked. Furthermore, when the proximity between two sectors is set to 0, there are assumed to be no contextual similarity between them. To connect this model with the theoretical framework it may be concluded that when a new sector entering the regional economy is linked to any existing sector ( $\phi=1$ ), the sectoral shift is classified as adaptation while it otherwise is classified as adaptability ( $\phi<1$ ).

Furthermore, while Boschma (2015) did not discuss the possibility of adaptability as a scale, this may be considered with this method. For example, a hypothetical sector entering an economy with a proximity of 0,3 to any existing sector will demonstrate more adaptability than if this proximity had been 0,6 since it is then assumed to have less in common with existing sectors. In this thesis’ analysis, sectors are therefore categorized as either linked or unlinked as well as new or established.

Finally, the sum of all sectoral proximities is divided by the total number of sectoral correlations ( $n$ ) in each region to gets an average sectoral proximity. Note that this step is not

included in Hidalgo et al.'s (2007) paper but is invented for the comparative reason between the regions in this thesis.

$$\bar{\Phi}_{i,j} = \frac{\sum \Phi_{i,j}}{n} \quad (4.3)$$

Hidalgo et al.'s (2007) method contrasts another model used by several researchers which uses official sectoral classifications instead of export data to determine relatedness (Attaran, 1986; Frenken, van Oort & Verburg, 2007; Kort, 1981; Wasulekno & Eriksson, 1978). However, that model does not account for the possibility that different types of sectors may be attracted to the same national/regional context. That means that this thesis' method theoretically determines linkages to geographic contexts rather than between sectors. Thus, it will not be possible to draw conclusions about specifically why or how sectors are linked, whether it is through vertical linkages which rely on similar skillsets or through horizontal linkages which derive from input-output relations (Cainelli, Ganau & Modica, 2019). On the other hand, it may account for the complex and potentially surprising sectoral relations as discussed by Hidalgo et al. (2007) which are overlooked when simply using official sectoral classifications to determine relatedness.

#### 4.2.1. Discussion of implications regarding the proximity analysis

An implication of the chosen method is an imposed bias toward the export sectors. Since this thesis' data selection also largely directs the focus toward export sectors, the effect of this implication will be further discussed in section 5.1.1. There it will be motivated that the exclusion of non-tradeable sectors is not deemed likely to largely impact the ability to understand South-East's recovery and Midland's lack thereof since the trajectory of these sectors has been driving neither shrinking nor growth in these regions (DETE, 2022).

Though, here in the methodology chapter it is argued that since the proximity between tradeable goods and services is universal, it is still possible to use this measure for analysing regional goods and services regardless of if these are traded or not. While this might stir a debate, I reason that given a sector is subject to liberal trade, also non-exporting firms within this sector must demonstrate competitive capabilities to survive. To ensure this competitiveness, and thus presume a sector is not present in a region only due to opportunism

but because of compatibility with regional features, the analysis will only include sectors which survive a minimum of five years in the region. This establishment factor is relevant since the method aims to capture linkages based on regional context (Hidalgo et al. 2007). The time limit of five years is based Meyler and Strobl (2000) who show that the failure rate of Irish industries tends to decline during this period. To thus conclude, the establishment factor is used as a means to overcome the export bias imposed by the original design of Hidalgo et al.'s (2007) method.

### 4.3. Variety

As acknowledged in the theoretical discussion, different kinds of variety have different impacts on the capability to achieve adaptation and adaptability. This will therefore be accounted for in the analysis through a quantitative sector count (SC) for region  $r$ . However, since Midland and South-East differ in terms of population and size, they have different capabilities to host a wide range of sectors. This is solved by taking population density (PD) into account. Thus, sectoral variety (Var) is in this thesis calculated as follows:

$$\text{Var}_r = \frac{\text{SC}_r}{\text{PD}_r} \quad (4.4)$$

This method of defining variety based on the number of sectors present in an economy differs from other methods to capture diversity/specialisation. Palan (2010) summarises these methods as either absolute, that is when variety is based on for example employment data to determine the weight of a sector in an economy, or relative when variety is defined based on the weight of a sector in an economy compared to its weight in other economies. However, such methods assume that for a national or local economy to specialise in a specific sector, this sector must within the economy be a) competitive compared to other economies and/or b) large in terms of for example employment. It does not consider that a sector may provide linkages for new sectors to enter the economy despite neither criteria a) nor b) are being met. For example, say a hypothetical economy hosts a number of sectors of which none are internationally competitive, then the level of variety cannot be defined. Even if one of these sectors accounts for 90% of employment, value-added or any other variable used for



determining sectoral share, this economy cannot be defined as specialised despite that this would intuitively be the case.

Note that while economic geographers emphasise urbanisation (Frenken, van Oort & Verburg, 2007; Jacobs, 1969), and thus finding that productivity increases exponentially with city size (Sveikauskas, 1975), no paper in this field do to my knowledge specifically analyse the impact of population density, which is one feature of urbanisation but not the only one. The implication is a more limited understanding of how scale effects benefit non-urban but densely populated regions. Instead, this is studied by economic demographers who link increasing population density with increasing productivity (Becker, Glaeser & Murphy, 1999; Galor & Weil, 2000). By using population density as a variable rather than urbanisation, this thesis account for a region's increasing capacity to support a larger variety of sectors due to scale (Frenken, van Oort & Verburg, 2007), in urban and non-urban areas alike.

## 5. Data

### 5.1. The Annual Business Survey of Economic Impact

To calculate the proximity of regional sectors, this thesis relies on information gathered from the Annual Business Survey of Economic Impact (ABSEI) for determining the regional presence of NACE-rev2 sectors which is the most detailed level of economic activities in the NACE classification system. This micro-survey is provided by the Department of Enterprise, Trade and Employment (DETE, 2022) and covers approximately 4 200 agency-assisted firms, thus firms that are engaged with any of the government agencies IDA, Enterprise Ireland and Údarás na Gaeltachta, which as discussed in section 3.1 were actively involved in Ireland's economic development. Given Ireland's long-term industrial policy based on agency-led development which has been argued to have played a significant role in the country's structural transformation (Barry, 2007; Brazys & Regan, 2017), this focus is relevant for understanding this case study.

The ABSEI survey is annually collected and includes questions aiming to determine the impact of agency-assisted firms on the overall economy. It targets firms with a minimum of ten employees as well as high-potential start-ups (DETE, 2021a, 2021b) based on their potential to employ at least ten people within three years (Enterprise Ireland, 2022). Thus, this excludes the smallest firms in each region which likely have less potential to influence a sectoral micro-transformation through proximity and linkages. While ABSEI's response rate is 89%, DETE (2021a) has estimated missing answers based on previous responses, region, size, sector and ownership (Irish or foreign).

Especially two variables from ABSEI are of interest to this thesis. First, given the intention to perform a proximity analysis, the main variable is the sectors present in each region. Second, to draw conclusions about the decline and recovery in Midland and South-East, value added is used since it is similar to GDP, which in turn illustrated the respective regional trajectories in chapter 3. Since the dataset provides value added in current prices, a deflator from the World Bank (2023b) will be used to avoid the result being overestimated due to inflation and thus allowing for comparison over time.

### 5.1.1. Discussion of implication regarding data selection

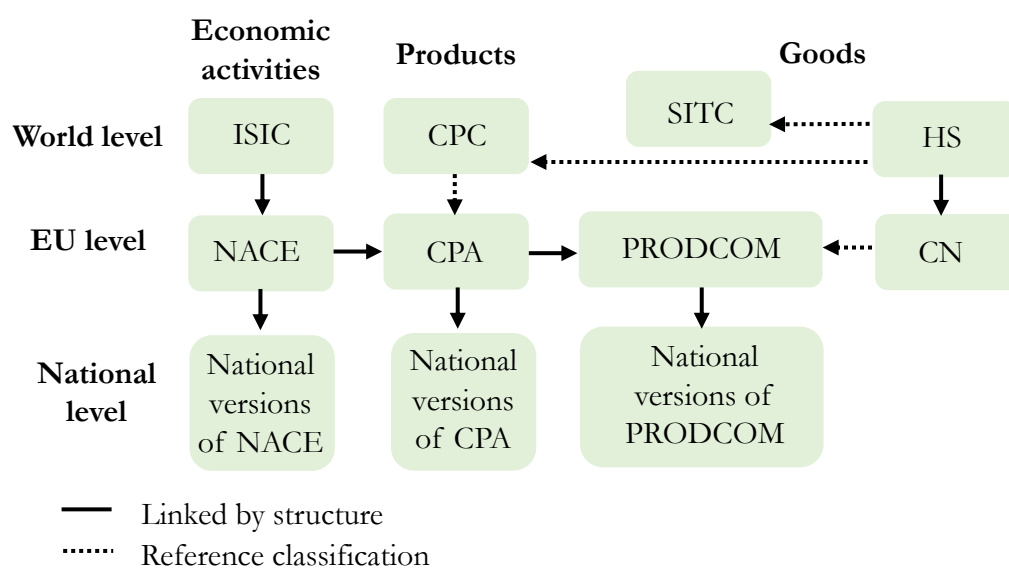
Due to the terms and conditions under which the ABSEI data has been accessed, no data about individual firms may be disclosed or risk being disclosed (CSO, 2023c). For the Department of Enterprise, Trade and Employment (DETE) to ensure such discretion, the microdata is therefore not downloadable for researchers but calculations have been done on the department's computer. Thereafter has the empirical presentation of this thesis been approved by DETE.

Because of these terms and conditions, this thesis does not present specified data about sectors including less than five firms in the regions of interest. This would include information about for example profits, GVA, export or employment as well the existence of a sector in a region which can be sensitive since other firms may potentially be unaware of the competition (CSO, 2023c). By mainly categorizing and presenting sectoral data based on whether they are linked or unlinked to other regional sectors, as discussed in chapter 4, potential empirical limitations based on this constraint are circumvented as such categories includes more than five firms.

The empirical access to detailed industrial data on a regional level through ABSEI results in some other caveats regarding the reliability of the results. As the empirical analysis will be based on tradeable goods and services, the impact and changes in public and domestic sectors will not be accounted for to understand diverging resilience capabilities. However, the study of agency-assisted firms is motivated due to, first, their unproportionally large impact on the economy as they account for 90% of total Irish sales while merely employing 35% of the private sector workforce (DETE, 2021a; 2021b). Second, regarding Midland it may be reasoned that the real estate and public sector, which both fall into the non-tradeable category, did not drive the lack of resilience given that the value of these sectors have declined while their respective shares of total GVA have increased (OECD, 2023). Thus, this indicates that other sectors shrunk even more and thus drove the regional decline. In South-East on the other hand, the recovery was strongly driven by the manufacturing sector (DETE, 2022; OECD, 2023). Therefore, the exclusion of non-tradeable sectors is deemed to not substantially impact the result to answer the research question.

## 5.2. Conversion and supporting data

Since the ABSEI data is based on the NACE system, which is the European classification of economic activities, it is not immediately compatible with Hidalgo et al.'s (2007) method which measures the proximity between goods rather than activities. However, goods are the outcome of activities and as illustrated in figure 5.1, different classification systems are linked which provides an opportunity to convert the data.

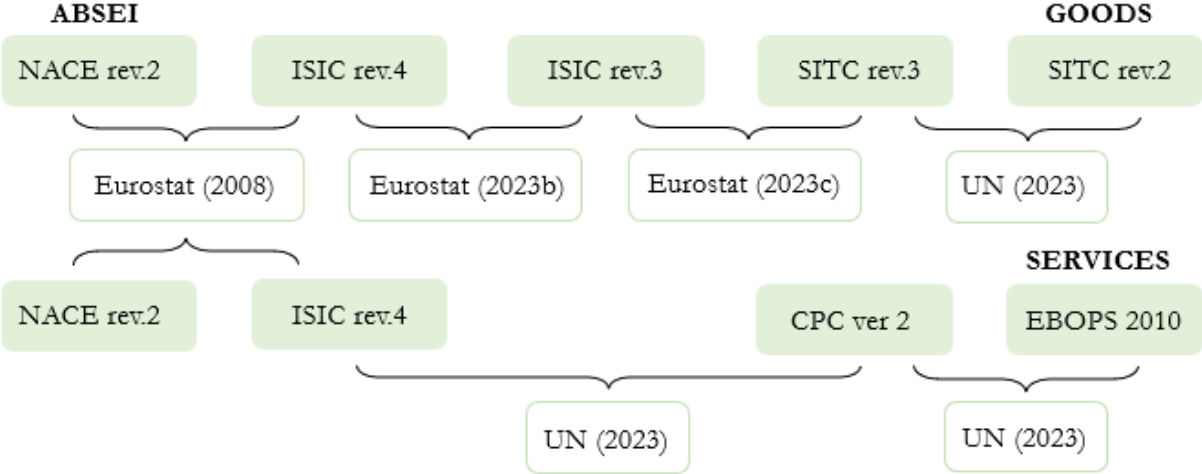


**Figure 5.1.** The international system of economic classifications. Source: Eurostat (2008:13)

For the conversions, HS 1992 and SITC-rev2 have been considered as these systems both allow for presenting the findings within the Product Space framework as it is provided by Growth Lab at Harvard University (2023). I found that NACE-rev2 data may be the most seamlessly converted to SITC-rev2 as this classification includes 2 576 categories in contrast to HS 1992's 6 281 categories (UN, 2023). Although a less detailed system negatively impacts the preciseness of the results, the smaller dimension of SITC-rev2 was found to be more beneficial for the purpose of converting NACE-rev2 data as its level of detail is more similar to SITC-rev2 than HS 1992. Thus, this means that while the classification of goods and services will be less precise for the analysis, it is deemed that this re-coding will result in fewer errors than if employing HS 1992.

Although Hidalgo et al. (2007) developed their model using goods trade data, it is possible to also include data for tradeable services. This is done with the EBOPS 2010 system. As no

conversion table exists to directly convert data from NACE to neither SITC nor EBOPS, the following chain of conversions, including sources, is used.



**Figure 5.2.** Conversion tables

After this re-coding, the trade data required to calculate proximity according to Hidalgo et al.’s (2007) model may be accessed. For goods, this data is provided by the Growth Lab at Harvard University (2023) and by WTO (2023) for services.

## 6. Empirical analysis

To understand how sectoral proximity correlates with regional shrinking resilience capabilities, and more specifically the ability to recover from a crisis, it was reasoned in section 2.4 that it is relevant to analyse transformation, also labelled *robustness*, in the form of adjustment of sectoral structures.

Note that, if not otherwise stated, the data presenting empirical findings about sectoral variety in section 6.1 comes from DETE (2022), while the findings regarding proximity, adaptation and adaptability in section 6.1 and 6.2 are calculated based on data from DETE (2022), Growth Lab at Harvard University (2023) and WTO (2023). Since the Great Recession lasted in terms of shrinking and a following lack of recovery between 2008-2012 in South-East while shrinking began already in 2007 in Midland and had by 2019 not began recovering (OECD, 2022), this is how the crisis is defined in these two regions throughout this chapter.

### 6.1. Sectoral variety and relatedness

In the aftermath of the Great Recession, South-East transformed to be a more specialised region. With the contribution of a single NACE sector, namely the manufacture of pharmaceutical preparations, the region stopped shrinking as the recovery closely correlated with the increase in this specific sector's value added. Of total value added among agency-assisted firms, the pharmaceutical preparation sector increased its share from 26% in 2012 to 77% in 2019 (author's calculation based on DETE, 2022). Figure 6.1 further shows that this was largely at the expense of smaller sectors in the region. In Midland on the contrary, the two strongest sectors prior to the crisis, namely computer programming and the manufacture of medical instruments, have only seen a slight decline in its share of value added during the crisis while a new sector, computer management facilities, has grown to be the leading sector accounting for 15% of the regional value added. With these figures illustrated in figure 6.1 and 6.2, it may be concluded that during its economic recovery, South-East transformed to be more specialised than Midland in terms of value added. However, also before 2012 South-

East was somewhat more specialised with one main sector, while between two and three sectors were sharing the main position in Midland.

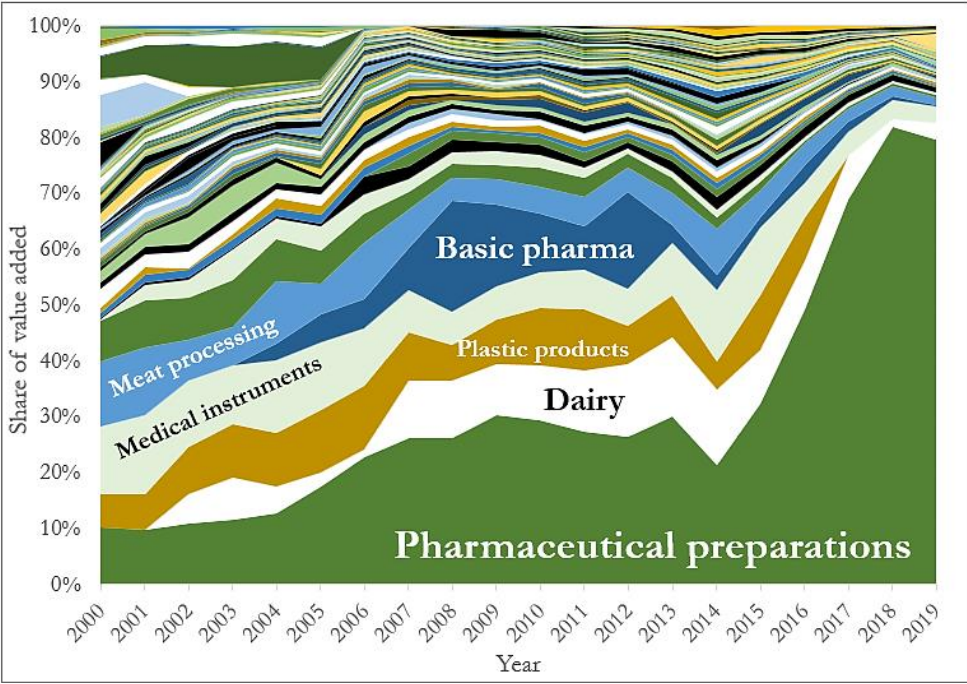


Figure 6.1. Sectoral mix, South-East, 2000-2019. Source: DETE (2022)

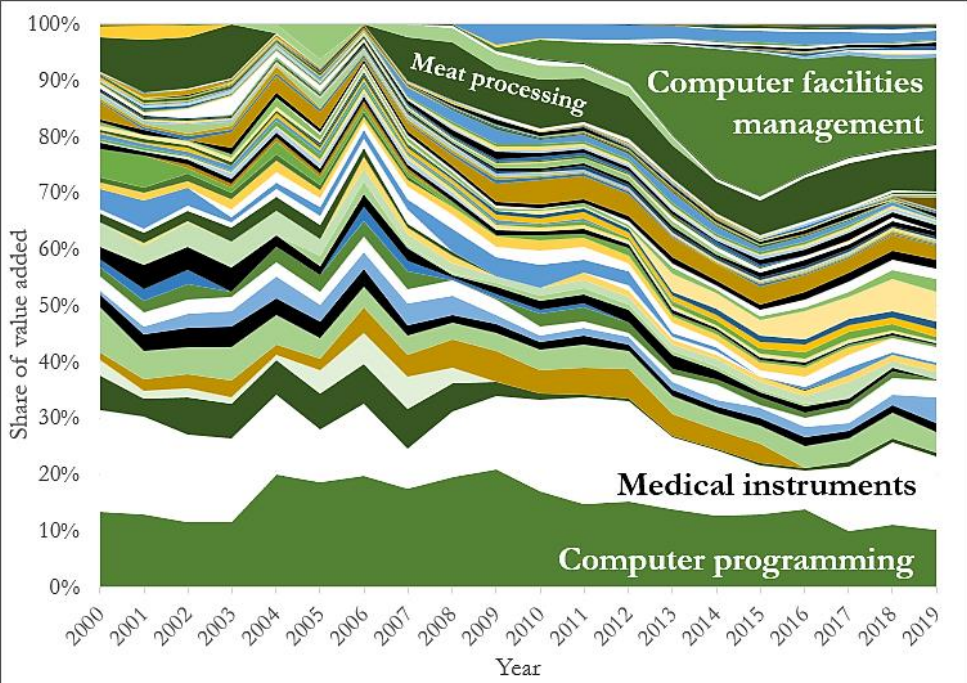


Figure 6.2. Sectoral mix, Midland, 2000-2019. Source: DETE (2022)

As these findings solely includes agency-assisted firms, it is relevant to also observe how the economic structures in the whole economy have transformed since the beginning of the crisis. Since then, South-East has seen a revival of the industrial sector which, including the enhanced pharmaceutical sector, increased its share of GVA per capita from 29% to 51% at the expense of the service sector. This regional development is in line with a current trend among developed knowledge-based economies of a ‘manufacturing renaissance’ (Lafuente, Vaillant & Vendrell-Herrero, 2019). On the contrary, during the period the industrial sector in Midland slightly declined from 26% to 22% on behalf of both agriculture and services (OECD, 2023). This confirms that the structural change was indeed significant in South-East while it was not so much in Midland.

While it is relevant to compare specialisation through such sectoral shares, it may from another approach be argued that Midland is more specialised as it through a strictly quantitative sectoral count, hosts overall fewer sectors. In 2012, the year the two regions began diverging, Midland was home to 1,57 sectors per capita per km<sup>2</sup> compared to 1,79 in South-East<sup>3</sup>. Hence from this perspective South-East was by then 14% more diversified than Midland which demonstrates a divergence since 2008 when the difference between the two regions was just 2%. Based on the reasoning in the next section, it will be argued that this increased disparity in sectoral variety is relevant as it may have impacted the regional capability to further transform.

Based on this, figure 6.3 illustrates the different regional outcomes of the crisis regarding sectoral variety. It shows that in Midland, the variety has been on a declining path since at least 2001, and apart from 2014 this trend toward more specialisations in terms of sectoral count has been generally continuous. On the contrary, in South-East the trajectory of declining variety changed as the crisis hit, before yet again declining when the manufacture of pharmaceutical preparations began growing.

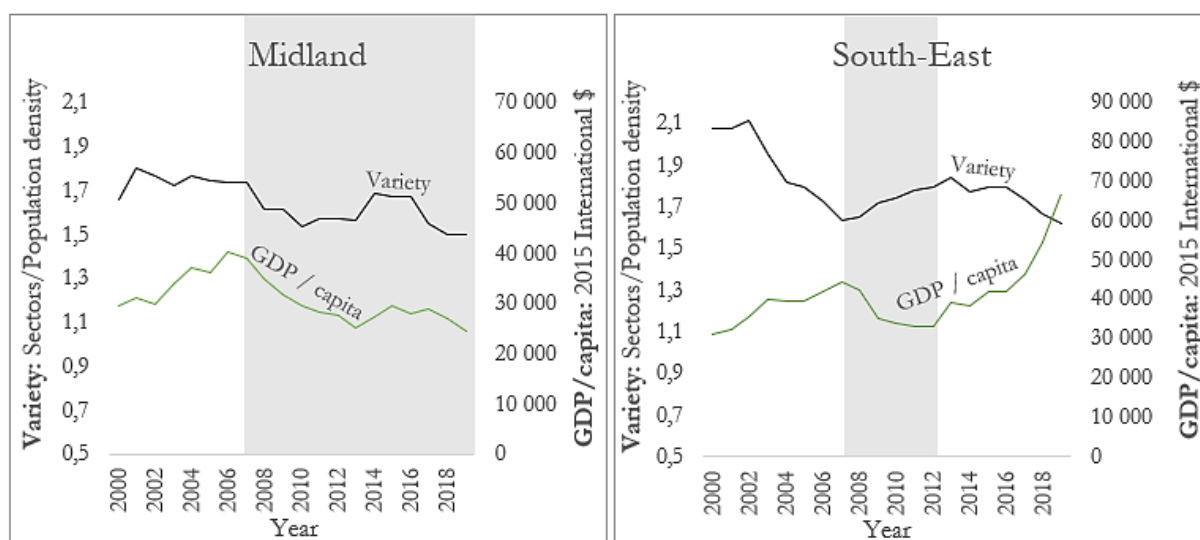
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<sup>3</sup> As discussed in section 4.2.1, this concerns sectors surviving a minimum of five years in each region.





**Figure 6.3.** Sectoral variety and GDP per capita (PPP), 2000-2019. The shaded area highlights the crisis. Source: author’s calculation based on DETE (2022) and OECD (2022)



**Figure 6.4.** Average sectoral proximity compared with sectoral variety, 2000-2019. Note that proximity is measured on a scale from 0 to 1, where 1 is the most proximate. Source: author’s calculation based on DETE (2022), Growth Lab at Harvard University (2023) & WTO (2023)

While the sectoral variety developed different trajectories in Midland and South-East during the crisis, so did the average proximity between the sectors within each region. Although not showing any clear correlation with the crisis itself, figure 6.4 shows that the overall proximity between regional sectors in Midland has been on a decreasing path since before the crisis. This contrasts the increasing proximity in South-East and although it intuitively appears that South-East’s proximity is not generally high given that it in 2019

ranked at the lower end of the scale at 0,4, it may be argued that this is nevertheless high in relative terms given that 65% of all potential sectoral correlations fall below 0,2 (Hidalgo et al, 2007). Note that the average proximity in Midland has fallen below 0,2 since before the Great Recession.

## 6.2. Adaptation and adaptability

This subsection presents empirical evidence on to what extent the distribution and performance of new sectors entering the regional economy are linked to existing sectors, and thus demonstrate adaptation, or whether they demonstrate adaptability by developing new paths when no links exist. Note that the outcome of the proximity ( $\phi$ ) analysis ranges from 0 to 1, where 0 is the least potential proximity while 1 is defined as a link between two sectors.

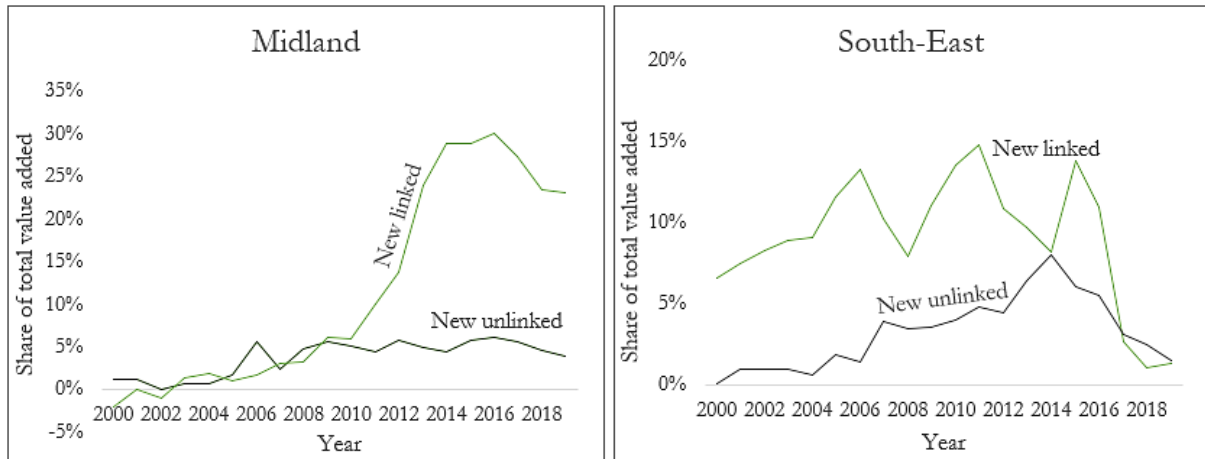
Based on the idea that resilience capabilities are promoted if regional economies manage to achieve both adaptation and adaptability simultaneously (Boschma, 2015), table 6.1 compares the distribution of these different types of sectoral micro-transformations in Midland and South-East. Although it shows that neither adaptation nor adaptability is a distinctly dominant ability in any of these regions, a disparity appears in Midland during the crisis when 60% of new sectors were linked to existing sectors, and during South-East's recovery where the same share of new sectors were on the contrary unlinked so existing sectors. Compared with the findings in the previous section that Midland is more specialised in terms of quantitative sector count, the dominance of adaptation is in line with the logic that specialised regions are more prone to develop around existing sectors (Hassink, 2010). On the other hand, as it was discussed that rather South-East may be classified as the more specialised region after its recovery given the dominating role of the pharmaceutical sector, it is noteworthy that this region demonstrates greater adaptability during the recovery. This suggests an ability to overcome the trade-off between adaptation and adaptability as discussed by Boschma (2015). Potentially the higher variety in terms of sector count is a supporting factor for this.

**Table 6.1.** Adaptation and adaptability based on sectoral count. Source: author’s calculation based on DETE (2022), Growth Lab at Harvard University (2023) & WTO (2023)

		MIDLAND		SOUTH-EAST		
		Pre-crisis 2000-2006	Crisis 2007-2019	Pre-crisis 2000-2007	Crisis 2008-2012	Post-crisis 2013-2019
Number of sectors		63	69	93	97	102
Adaptation	Number of new sectors <b>linked</b> to existing sectors (Share of total sectors)	6 (9,5%)	6 (8,7%)	9 (6,5%)	8 (8,3%)	4 (3,9%)
	Share of total entry	46,2%	60,0%	52,9%	53,3%	40%
Adaptability	Number of new sectors <b>not linked</b> to existing sectors (Share of total sectors)	7 (11,1%)	4 (5,8%)	8 (8,6%)	7 (7,2%)	6 (5,9%)
	Share of total entry	53,8%	40,0%	47,1%	46,7%	60%

As these findings solely reflect the distribution of linked and unlinked sectors, it is further relevant to understand the economic performance of the sectors in each category. Figure 6.5 shows that during the Celtic Tiger when, as previously observed, Midland was among the fastest-growing regions in terms of GDP per capita (OECD, 2022), it demonstrated a relative balance in the distribution of value-added between new linked and unlinked sectors. However, figure 6.5 also shows that this changed after 2009 when linked sectors began growing more and thereby earning a larger share of the overall value added in the region. At the most, new linked sectors accounted for 30% of the regional value added in 2016, while the new unlinked sectors accounted for 6%. Thus, this further suggests that the sectoral micro-transformation in Midland has since the crisis been occurring through adaptation based on existing sectors, although this distribution is yet more unbalanced than it first appears in table 6.1.

Note that the marginal contribution of new sectors in Midland during the early 2000s as illustrated in figure 6.5 is unremarkable given that this graph only included a few newly established sectors during this period which were yet to take off.

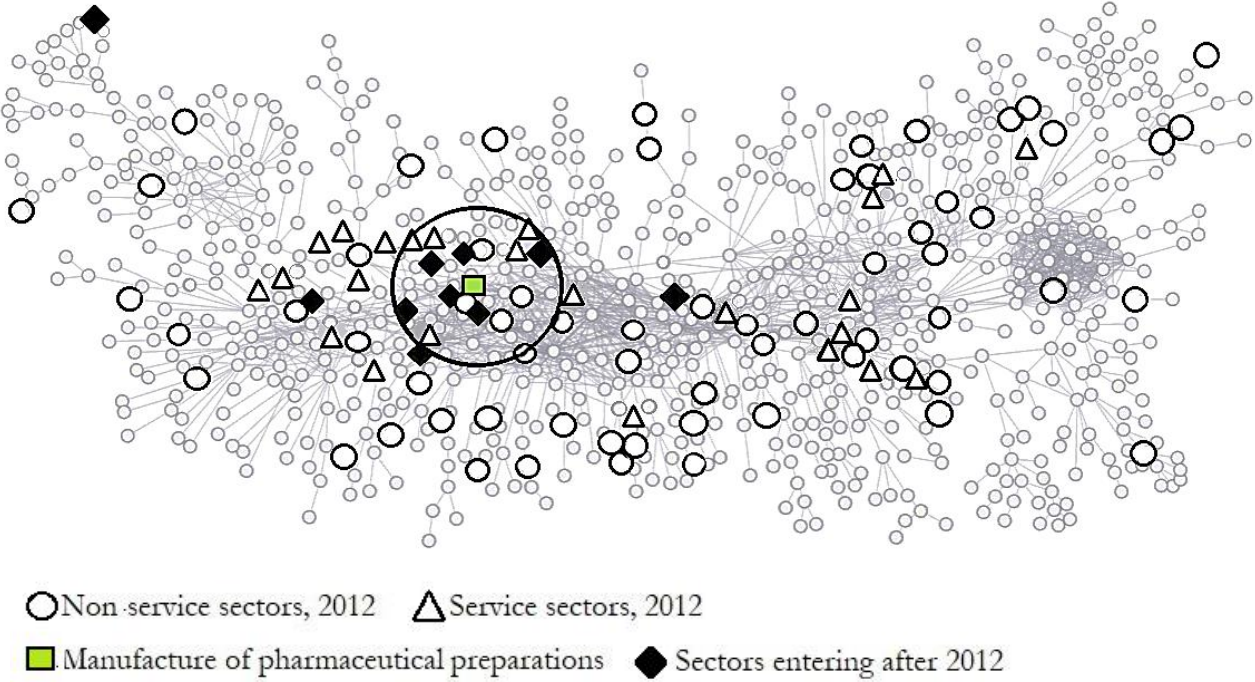


**Figure 6.5.** Adaptation and adaptability as sectoral share of value added in Midland and South-East. Source: author’s calculation based on DETE (2022), Growth Lab at Harvard University (2023) & WTO (2023)

In South-East on the other hand, new sectors entering the region through linkages to existing sectors had according to figure 6.5 a relatively strong performance already from start, though the performance of these sectors were volatile during the crisis. The decline since 2015-2016 of both new linked and unlinked sectors is explained by the growth of the pharmaceutical preparation sector which was pre-existing in the region and thus not included in figure 6.5. However, the main point from this graph is that during the crisis, new unlinked sectors were on average growing more in South-East during the crisis, which is vaguely suggestive about the region’s micro-transformative capabilities.

Given the role of the manufacture of pharmaceutical preparation sector in South-East’s recovery from the crisis, it is relevant to more in-depth analyse its relation to other sectors. While it during the Celtic Tiger as well as during the crisis was linked to just one other sector, namely manufacturing of optical instruments and photographic equipment, in 2013 this sector left the region and since then the pharmaceutical preparation sector has been unlinked. However, linkages to eight other regional sectors made specifically the optical instruments and photographic equipment sector one of South-East’s most linked sectors. The proximity analysis interestingly shows that the dominating, but unlinked pharmaceutical preparation sector has a higher proximity to these eight sectors relative to the average proximity among other unlinked sectors; namely 0,38 compared to 0,26 on the proximity scale. This observation that many of the new sectors entering the region during the recovery period are concentrated in proximity to the region’s dominating sector is illustrated in figure 6.6 where

new sectors entering the region since 2012 are mapped in relation to pre-existing sectors. In conclusion, this suggests that the transformation through adaptability in South-East occurred due to proximity to existing sectors, though the sectors were not proximate enough to be linked as that would instead have classified the transformation as adaptation.



**Figure 6.6.** South-East’s Product Space, 2012-2019. Sectors within the circle have closer proximity to the medical preparation sector than unlinked sectors generally have among each other, namely  $\phi 0,26$  on a scale from 0 to 1 where 0 is the least proximate. Note that since the product space framework does not include services, these sectors are added manually by the author based on their proximity to prevalent manufacturing and primary production sectors. All sectors entering the region after 2012 are service sectors except the single unlinked sector in the upper left corner of the map. Source: author’s calculation based on DETE (2022), Growth Lab at Harvard University (2023) & WTO (2023)

### 6.3. Discussion of result

Based on these findings, this thesis introduces the concept of low-level adaptability to define the transformation occurring when a new sector in proximity to existing sectors enters an

economy. While Boschma (2015) argued that related variety may assist in overcoming the trade-off between adaptation and adaptability, that is when new sectors enter an economy either linked or unlinked to existing sectors, this thesis thus suggests another opportunity where a relatively more specialised region may through proximity to existing sectors overcome inherent obstacles like lock-ins to achieve adaptability. While this mechanism would supposedly be a less challenging path for specialised regions to achieve adaptability to develop new paths, since it resembles the adaptation of developing existing paths, this comparative case study does not illuminate on whether such low-level adaptability in combination with adaptation is an equally strong capability to achieve resilience as when the proximity between new and existing sectors are lower.

While South-East's low-level adaptability developed around its regionally strongest sector, it appears as if the capability of the existing sector was a driver for this transformation. However, based on evidence from solely one case, conclusions cannot be drawn about the relevance of the position of the existing sector for promoting entry of new sectors.

### 6.3.1. Generalisability

It may be noted that all of Ireland's recovering regions, except Mid-West, conform to South-East's pattern of an increasing variety in terms of number of sectors. This contrasts Border, the other region that never recovered, which is rather like Midland in terms of declining variety. It is worth noting that these two regions have demonstrated the most similar trajectory in terms of GDP per capita among the Irish regions, both prior to and during the crisis (OECD, 2022). This finding that Ireland's recovering regions are characterised by increasing sectoral variety in contrast to the non-recovering regions, correlates with Xiao, Boschma and Andersson's (2018) idea that the entry level of new sectors in resilient regions tends to be high or increasing. The consistency with this research is noteworthy given the different choice of method to capture variety/specialisation, where they use a relative method (see discussion in section 4.3).

However, caution should still be made regarding which kind of regions the results in this thesis are generalisable to. For example, while Midland and Border as mentioned show

resemblance, the third un-resilient Irish region, namely West, is different. This region has the second highest diversity of sector after Dublin (DETE, 2022) and its structural transformation was characterised by a revival of the industrial sector at the expense of the service sector, a so called ‘manufacturing renaissance’. This is similar to South-East as well as to Ireland’s other resilient regions except for Dublin and Mid-East (OECD, 2023). This indicates that West and Midland have been struggling since the Great Recession for different reasons, whereupon the results of this thesis cannot be expected to be generalised to regions resembling West.

One prominent difference between Midland and West is the relationship between sectoral variety and population density. Despite that West hosts a large variety of sectors, which are partly concentrated around the city of Galway (DETE, 2022), it is overall the most sparsely populated region in Ireland (CSO, 2023b). As discussed in section 3.2, firms in West, unlike in the majority of Midland, were between 1972-1996 subject to subsidies to support development (Meyler & Strobl, 2000), and it has not been studied whether this had a long-term impact on regional resilience capabilities, for example if the sectoral variety developed for other reasons than fitness with the regional context.

Given that sectoral variety tend to increase with the level of urbanization (Frenken, van Oort & Verburg, 2007), an unproportionally large variety of sectors would be expected to cluster around the city of Waterford in South-East compared to the rest of this region and Midland. Although this is a small city with a population of 53 500, it is nevertheless 2,5 times larger than Athlone which is the largest town in Midland (CSO, 2023b). However, the variety of sectors are distributed fairly evenly across both South-East and Midland after taking population density into account (DETE, 2022). This suggests that other urbanisation factors than population density are not the source of recovery and sectoral micro-transformation in South-East. Therefore, the results of this thesis is suggested to be generalisable to non-urban regions as well as urban regions demonstrating similarly weak urban externalities as the city of Waterford.

## 7. Conclusion

This thesis has on a regional level investigated the relationship between sectoral proximity and capabilities to transform the economic structural system. Previous research has argued that transformation is a key mechanism of resilience (Marin & Sunley, 2015) whereupon this thesis' theoretical framework emphasised two different drivers based on whether new sectors entering a region are linked or not to existing sectors. When a variety of sectors in an economy changes due to such a sectoral shift, the term sectoral micro-transformation is used.

While South-East, unlike Midland, has experienced a structural transformation during its recovery through the growth of one single established, unlinked sector, the empirical evidence also show that the sectoral variety was increased through adaptability, that is by the entry of new sectors unlinked to existing sectors. Against this observation, the first argument of this thesis states that proximity can matter for the entry of new sectors that are unlinked to existing sectors. This thesis has labelled such an unlinked but proximate connection to existing sectors low-level adaptability, and the conclusion is supported by the empirical observations that much of the sectoral micro-transformation of Ireland's South-East region during its recovery from the Great Recession occurred through the development of sectors in proximity to the region's main sector. On the contrary, in the Midland region the sectoral proximity was declining and had by 2019 not yet begun recovering. Thus, a contribution of this thesis is that while Boschma (2015) and Hassink (2010) consider adaptation and adaptability as two distinct ways to achieve sectoral transformation, this study address that it may be relevant to consider the term adaptability as a scale based on how close/distant new unlinked sectors are from being linked.

Based on Hidalgo et al. (2007) who provided the method for measuring proximity as applied in this thesis, the logic behind such a mechanism might be explained by that proximate sectors have some common denominators, for example thriving in the same institutional context or relying on similar technology. However, differences also exist between such sectors whereupon they are still categorised as unlinked despite the similarities. Note that it must be emphasised that due to this method of measuring proximity, the results cannot explain *how* sectors are linked and proximate, for example whether it is through technology, input-output linkages, institutions or something else.



The second argument of this thesis is that the above conclusion that proximity matters for the entry of new unlinked sectors is in turn promoted by the level of sectoral variety in the regional economy. Not only do fewer sectors provide fewer potential opportunities for a region to transform through linkages, a correlation which is illustrated by Midland's lower variety and adaptability, but this is also reasoned to similarly reduce the likelihood of new unlinked but proximate sectors to enter the regional economy. In other words, the number of sectors in an economy would impact the opportunities for a sectoral micro-transformation and thus the potential capability to recover from a crisis.

While it has previously been argued that the type of variety is linked to adaptation and adaptability and thus crisis recovery (Boschma, 2015, Hassink, 2010), this thesis provides an empirical illustration of how this relationship functions as a mechanism for transformation, which was argued to be a driver of recovery from a shrinking crisis.

## 7.1. Recommendations for future research

While the result of this thesis tempts to suggest that regionally strong sectors may act as drivers for low-level adaptability, the evidence based on only one of the two cases studied is not strong enough to conclude this to be a general mechanism. Questions remain to be resolved about whether and how specific attributes of existing sectors impact the capability to drive low-level adaptability.

Given this study's focus on regional sectoral presence on a detailed NACE-rev2 level it has resulted in an understanding of sectoral shifts on the micro-level. However, the results can therefore not explain how such sectoral micro-transformations may lead to a further overall structural transformation. If it is the case that some specific sectors are more prone to promote the entry of new unlinked sectors, are then sectoral changes based on in adaptation and low-level adaptability more likely to promote structural transformation than if new sectoral entries are more distant? Potentially this is the case given this study's observation where the low-level adaptability was relatively focused, whereupon it might hypothetically form a directed path and thus encourage structural transformation. Toward such an understanding of structural change, this thesis therefore provides a small contribution.

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