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The Moderating Effect of Absorptive Capacity upon Related and Unrelated Variety vis-a-vis Regional Growth

The Case of Swedish Regions

by

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Abstract: Empirical evidence for the growth effects of the concepts of related- and unrelated variety have been inconclusive since the introduction in 2007. This thesis contributes to the field by suggesting how the concepts of related- and unrelated variety may be moderated by the absorptive capacity found in a region. Absorptive capacity is suggested to work as a diffusion mechanism in relation to related- and unrelated variety. A panel ordinary least-squares (OLS) regression model was introduced to assess the effects empirically for the 21 Swedish counties between 2005 and 2015. I find related variety to have positive effects and unrelated variety negative effects on both regional GDP growth and employment growth. Absorptive capacity did moderate the negative effects of unrelated variety and the positive effects of related variety. These results provide implications for regional development and the smart specialisation strategy.

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1 Introduction

Whether a region benefits from a diversified or specialised industrial structure has very much been a subject of debate for decades. Marshall (1920) suggested that knowledge spillovers prosper in a specialised environment where ideas spreads seamlessly. Jacobs (1969) did on the other hand argue for the importance of a diversified industrial structure. When the issue was assessed empirically, there was often a lack of general trends and the results could be described as discordant (De Groot, Poot & Smit, 2016).

Since its introduction in 2007, the concept of related variety has raised interest for the possible link between industry structure and knowledge spillovers or economic performance in general. Frenken, van Oort and Verburg (2007) argued that the debate until that point had been a too simplistic dichotomy, only considering the effects of either specialisation or diversity. Therefore, diversification was transformed into related- and unrelated variety. Knowledge spillovers is suggested to positively impact employment growth of industries which are related since they are cognitively proximate. When the authors studied Dutch regions at a NUTS 3 level, they found that related variety caused growth in employment but slowed growth in productivity. Unrelated variety was negatively associated with unemployment growth in accordance with predictions regarding a possible regional portfolio effect, where unrelated sectors are more resistant against a general decline in demand.

The concept of related variety has further been discussed by policymakers and public servants. The task of issuing policy recommendations is a difficult one since the empirical evidence still could be described as somewhat inconclusive. The EU cohesion policy is although an example of an actual policy initiative promoting the importance of smart specialisation in European regions. The initiative is considered to promote related variety regarding reformation of regional industrial structures (Foray, 2015; McCann & Ortega-Argilés, 2016). In the case of Sweden, the Ministry of Finance have identified regional development to be of great importance in securing the future welfare of Sweden. In a report compiled by the Ministry, the difference or economic polarisation between urban- and peripheral regions is expected to persist. This trend poses a threat to regional development since it is suggested that all Swedish regions should be provided with the opportunity of achieving growth, despite different capacities or preconditions (SOU 2004:34).

By thinking about the nuances that related- and unrelated variety may provide in the context of regional industrial structures, this could possibly indicate why certain industrial structures have benefitted some regions by generating economic growth. Could it be that these regions are equipped with some level of absorptive capacity which enables them to gain greater economic growth from the industrial structure? By stating so, I'm not diminishing the complexity of this issue. The discussion might need some frames in order to move forward on this matter. A conceptual framework which tentatively suggests how related- and unrelated variety is influenced by absorptive capacity is useful in this context. This thesis could in this

regard increase our understanding for the development of these concepts over time. Does the absorptive capacity reinforce or moderate related- and unrelated variety? In what respects do the different concepts overlap and how may they differ?

1.1 Research Problem and Questions

Related- and unrelated variety may influence the emergence of knowledge spillovers. While the study of Frenken et al. (2007) provided some empirical evidence, the results from the studies that followed could although be described as inconclusive. While this may pose as a motivation for further research, there is another issue that is potentially more serious. Literature on related variety has partly overlooked the possible impact of absorptive capacity. Arguably, knowledge spillovers should have a more limited impact in regions which exhibits lower levels of absorptive capacity. This might lead to an oversimplification of the relationship between industrial variation and regional development. This will likely cause an upward bias where the effects of related- and unrelated variety on economic growth are inflated. There is then a possibility that variety is accredited for more growth effects than what it is causing while neglecting the possible moderating effect of absorptive capacity on growth. If there is lacking capacity to absorb the knowledge spillovers created by related- and unrelated variety, these concepts should a lower effect. By considering the regional level of absorptive capacity, we might more clearly assess the actual impact of variety on regional growth. Since policymakers have started to take an interest in the concept of related variety, they will need more accurate descriptions of the relationship between sectorial or industrial variation and growth. Otherwise, policy initiatives might be based on inaccurate premises which in the worst case could be detrimental for regional growth.

The research questions posed in this thesis is therefore:

How might the concept of absorptive capacity be conceptually different from related- and unrelated variety?

This first question recognises the possibilities of some overlap between the concepts. Since it is my assumption that these concepts need to work in tandem to enable stronger flows of knowledge spillovers, it is important to more clearly establish in what respects they are similar or different. This first research question is more of a theoretical nature.

How does the absorptive capacity of a region affect the way related- and unrelated variety influence regional growth?

The second question is posed to gain theoretical and empirical legitimacy regarding the possible connection between the two concepts in a common framework. The empirical setting to answer this second research question will be Swedish counties.

1.2 Aim and Scope

This thesis pertains to contribute to the literature on related variety by filling the knowledge gap on how absorptive capacity may possibly influence economic growth generated by related- and unrelated variety on a regional level. The concepts of related- and unrelated variety and absorptive capacity will be combined in a united framework or model. By doing so, this thesis somewhat relates to the work of Fritsch and Kublina (2016) who analysed the relationship between related- and unrelated variety and employment growth, controlling for absorptive capacity in West German regions. They found that the moderating variable of absorptive capacity only had a significant effect in the relationship with unrelated variety. In that study, regional absorptive capacity was introduced in the shape of R&D intensity (Fritsch & Kublina, 2016).

However, this measurement should be but a mere proxy and cover only one part of the concept of absorptive capacity. I will argue that regional absorptive capacity is a wider regional phenomenon that cannot be captured just by R&D operations. Building upon the reasoning of Fritsch and Kublina (2016), I therefore suggest that the regional absorptive capacity is constituted by two dimensions. The first one being an internal dimension which moderate local knowledge spillovers of various relatedness. The second dimension moderate extra-regional knowledge spillovers entering the region. This other dimension acknowledges that valuable information always will emerge outside the region. For this information to reach the region, it needs to be open.

To fulfil this aim, I will first theoretically assess the concepts of related- and unrelated variety as well as absorptive capacity. Subsequently, a model will be formulated to be able to empirically analyse the matter. The results that emerge will be discussed and provide both practical implications as well as suggestions for future research. This thesis will raise awareness for the concept of absorptive capacity and its relation to related- and unrelated variety which might improve our understanding for the concepts. These insights might be useful, not only for regional development in Swedish regions, but also for European regions in general since so many European nations are affected by the smart specialisation initiative implemented by the European Commission. The initiative could be considered influenced by the ideas of related variety. While it is often denoted as connectivity in smart specialisation strategy documents, it represents the same belief as the concept of related variety. The relatedness can both emerge vertically in the interaction between customers and supplier as well as due to similar knowledge production, i.e. horizontally (Iacobucci & Guzzini, 2016).

1.3 Outline of the Thesis

Section 2 will cover a theoretical review of the Jacobs- vs. MAR-externalities, related- and unrelated variety as well as the concept of absorptive capacity. While related- and unrelated variety has gained massive attention after its introduction in 2007, it is however not common

for studies to also consider the possible impact of absorptive capacity. This is why both concepts will be considered in a common analytical framework. In Section 3, I will review the empirical data used as well as raise methodological considerations. There will be a discussion of the variables and two regression models will be presented. Section 4 will discuss the results, both focusing upon descriptive statistics and the results stemming from the OLS-regressions. Finally, Section 5 concludes and relates the results to some practical implications as well as raising the limitations and suggesting avenues of future research in the field.

2 Theory

Over a considerable period, there have been an ongoing debate on how different types of industrial structures may affect economic performance. The externalities of Marshall-Arrow-Romer (MAR), advocates for the importance of a specialised structure where firms in similar industries may benefit from each other just by being collocated. This generates a pool of specialised labour and intra-industry knowledge spillovers that may flow seamlessly (Boschma, Minondo & Navarro, 2011; Arrow, 1962; Romer; 1986).

The other side of the debate has very much been influenced by the views of Jacobs (1969). A diversified industrial structure is crucial since various knowledge spillovers may spread between firms and industries which should give rise to new ideas and innovations. While Jacobs (1969) believed that cities created this environment, Glaeser, Kallal, Scheinkman and Shleifer (1992), argues that it is not perhaps the cities itself but rather a city with a diverse set of industries that may exhibit high economic growth. Porter (2003) was one of the first scholars to ask for a refinement of the Jacobs externalities. According to Jacobs (1969), innovations and advancements spurs when a variety of different industries is present in a region. Porter (2003) deemed that clusters better captured externalities between related industries rather than focusing upon the industries themselves. It is therefore knowledge spillovers which flow between related industries within a cluster that probably will induce performance and innovation.

There have been many studies which have pertained to empirically asses the importance of the MAR-externalities on the one hand and the Jacobs externalities on the other. Glaeser et al. (1992) studied employment growth in American cities for the period of 1956-1987, where growth was significantly higher in cities which provided a more diversified environment which thus speaks for the importance of Jacobs externalities. Henderson, Kuncoro and Turner (1995) did on the other hand empirically find the importance of specialisation. When analysing growth in American metropolitan regions in the period of 1970 until 1987, specialised regions were found to be conducive for relatively higher economic growth.

The following figure clearly illustrates the empirical incongruity which exists regarding the importance of different types of externalities to provide growth. The review of De Groot, Poot and Smit (2016) revealed that specialisation and diversity exhibited a positive effect on growth in a similar number of occasions. The difference in empirical results turned out to be from studies indicating a negative effect, where specialisation more often have found to affect economic growth or performance negatively. It is although worth mentioning that diversity has more cases of insignificant results. This incongruity does also convey the importance of further empirical studies of the matter as well as conceptualisations. Studies which also focus on comparable empirical settings.

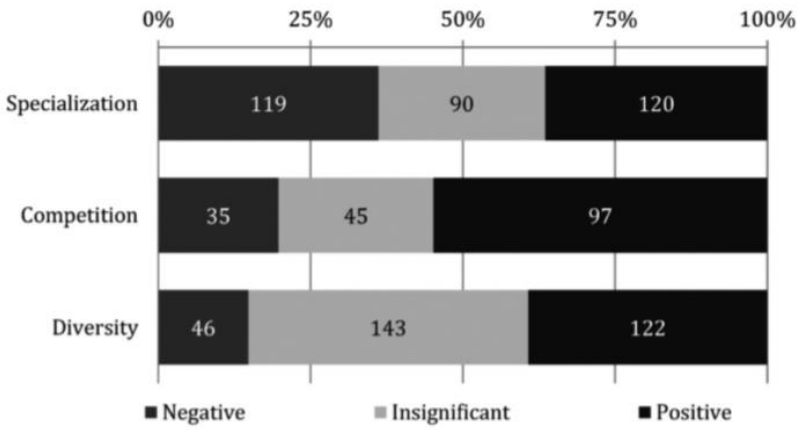

Figure 1: *Empirical results from the assessment of MAR- (specialisation) vs. Jacobs externalities (diversity). In this review, competition is also introduced as a complementing concept of explanation. Source: De Groot, Poot and Smit (2016).*

2.1 Theoretical review

2.1.1 Related- and unrelated variety

Frenken et al. (2007) argued that there are three ways in which variety may affect regional growth. Firstly, variety may induce spillovers and growth. Variety could therefore be considered as a source of economic growth (Jacobs, 1969; van Oort, 2004; Glaeser et al., 1992). Differences in regional structures should therefore lead to various regional growth rates where the joint presence of complementary sectors will induce growth. A region which specialises in these complementary sectors is therefore expected to enjoy relatively higher growth rates (Frenken et al., 2007). Secondly, variety could be considered as a protective strategy against extra-regional shocks. By diversifying into several sectors, a region may become more resilient against negative shocks and therefore preserve growth and employment. In the case of low sectorial variety or different sectors exhibiting correlated demand, a negative shock may cause a serious slowdown to the regional economy (Attaran, 1986; Haug, 2004; Frenken et al., 2007). Thirdly, a region that fails to increase sectorial variation may in a long-term perspective experience structural unemployment and may therefore stagnate (Pasinetti, 1993). Since new sectors often appear in urban regions, it is also here that most new jobs emerge. This process often results in labour migration to urban regions. Although, exceptionally long time-series would be needed to empirically assess this last thesis (Frenken et al., 2007).

Urbanisation and variety often tend to be positively related. A statement that is supported by the fact that variety requires local demand both regarding intermediate inputs as well as the final products being produced. Since variety is also positively related to economic growth, urbanisation will also exhibit a positive relationship with economic growth. A diversified urban region will also provide a fruitful environment for Jacobs externalities (Frenken et al., 2007).

Unrelated variety represent effects which are more towards but not equal to Jacob externalities. It represents sectorial variation in which there is very dissimilar sectors. The knowledge and expertise found in these different sectors are radically different from each other. When Frenken et al. (2007) proposed the concept of related variety, the authors claimed that a major factor for growth is not the variation in itself, but cognitively proximate variation. This makes it relatively easy to find complementary use for knowledge given that it may be transferred between related industries. Related variety would then more represent externalities towards but not equal to MAR-externalities. This is because MAR-externalities represent an extreme case of related knowledge within a specific industry rather than as related variation between industries. If we view the Jacobs and MAR-externalities as opposite extreme points, related variety could represent the middle-ground. Unrelated variety would be found close to the Jacobs externalities. There is of course a sliding scale, but this provides a rough understanding of what related- and unrelated variety may represent.

Related- and unrelated variety could also be of importance in explaining the difference in

emergence of incremental and radical innovations. Related industries tend to induce incremental innovations which is the product of frequent interactions and knowledge spillovers. Unrelated industries are on the other hand expected to generate more radical innovations stemming from diverse knowledge spillovers (Boschma & Capone, 2014). These predictions are in accordance with the discussion of Jacobs externalities inducing radical innovations and localisation economies inducing more incremental innovations. Unrelated variety will therefore give rise to processes of diverse knowledge and technologies which leads to the creation of new products, a process Schumpeter referred to as 'Neue Kombinationen' (Schumpeter, 1939). The impact from related variety will accordingly be more about productivity increases as a result of incremental innovations.

When Frenken et al. (2007) empirically assessed related- and unrelated variety in the Netherlands between 1996 and 2002, related variety turned out to be significant providing employment and productivity growth. Unrelated variety improved the regional resilience against unemployment while related variety did not have any effect in this respect.

In a study on Norwegian regions, Aarstad, Kvitastein and Jakobsen (2016) found that unrelated variety had a negative impact on productivity. Related variety was considered important for innovative activities given that it increased the propensity for enterprises within the region to innovate. Population dense regions are often associated with an industrial structure that is related variety, but population density couldn't alone increase the propensity for innovation. The negative impact of unrelated variety on productivity growth could be explained by how unrelated variety impedes the use and deployment of factor inputs which are to be considered complementary. In the production of services and goods, the enterprises cannot deploy each other's inputs given that they are from unrelated sectors. If a region exhibits low levels of unrelated variety, it is likely the region is industrially specialised. This would enable economies of scale and inducing competition between the enterprises, resulting in productivity increases. Also, low levels of related variety would indicate regional specialisation. However, related variety had no effect on regional productivity. The negative impact of population density on innovativeness might appear strange but indicate the importance of idiosyncratic characteristics on a regional level. In Norway, sparsely populated regions have often excelled in sectors which are innovative, such as in the maritime industry or in the industries of oil and gas. The correlation between related- and unrelated variety was rather low with a coefficient of .186, possibly indicating that they are separate paths for regional development. It is although important to note that Aarstad, Kvitastein and Jakobsen (2016) only considered effects on product innovation.

In the case of Austria, Firgo and Mayerhofer (2016) found an unrelated industrial structure to offer greater advantages compared to a more specialised one. Related- as well as unrelated variety caused positive effects on employment dynamics. Unrelated variety was however the ultimate causing factor of employment growth between 2000 and 2013 in Austria. Although, this result is in line with the empirical results of Van Oort, de Geus and Dogaru (2015) focusing on European regions, it goes against Frenken et al. (2007). Firgo and Mayerhofer (2016) argues that this contradiction in results might be due to regional characteristics that cannot be observed. The effects of unrelated variety on employment were not consistent over different regions or sectors. From their study, they concluded that regions which are relatively

technologically advanced and urban may benefit in terms of employment growth as a result of related variety. More rural regions should instead try to induce unrelated variety and thereby exploit knowledge spillovers that arise.

Hu and Liang (2018) investigated the effects of related variety in U.S. commuting zones. Firstly, related variety did benefit manufacturing sectors to a greater extent. This is because production innovations are important in this sector. Innovations which Hu and Liang (2018) expected to benefit from knowledge spillovers that arise between sectors due to related variety. Secondly, Hu and Liang (2018) focused upon the link between the dichotomy of agglomeration economies, i.e. variety and specialisation or MAR-externalities. The debate in the literature has previously mostly focused upon whether economic spillovers are induced by firms across different sectors (variety) or within a sector (specialisation) (Hu & Liang, 2018; Glaeser et al., 1992). More recent accounts suggest that they are effects of agglomeration economies which are to be perceived as complementing each other in a regional setting. According to this perspective, specialisation may increase the efficiency of production while related variety induce product innovation and the creation of new technologies. The two concepts may therefore be connected through a positive interaction effect which in the end results in economic growth (Hu & Liang, 2018; Boschma & Frenken, 2011).

In Finland over the period of 1993 to 2006, regions exhibited increasing levels of related variety. The trend was although changing slowly. Unrelated variety did not exhibit a trend and was relatively stable over the period. In general, related variety did not affect the regional level of growth. It was only when focusing on high-tech sectors that related variety influenced the growth of the region positively. Thereby, it seems that regional technological intensity matters for if related variety will affect the growth of a region. Hartog, Boschma and Sotarauta (2012) did although not found the reason for this. Additionally, the results might be driven by the fact that the Finnish economy experienced a relatively rapid structural transformation. Individual firms such as Nokia did achieve a significant role during the period which may have biased the results indicating a positive effect for high-tech sectors in the Finnish economy (Hartog, Boschma & Sotarauta, 2012).

The common theme for the studies reviewed above is incongruity regarding the results. Firgo and Mayerhofer (2016) discusses the possible impact of regions which are relatively technologically advanced, while Hartog, Boschma and Sotarauta (2012) discuss the impact of a technological intensity on a regional level. Alternatively, Aarstad, Kvitastein and Jakobsen (2016) proposed that sparsely populated regions could compensate this by promoting sectors which are highly innovative. Could there be some other concept which is at play here and dictates the functionality of related- and unrelated variety in the regions?

2.1.2 Absorptive capacity

The concept of absorptive capacity was first introduced by Cohen and Levinthal (1989, 1990, p. 128) and can be defined as: “the ability of a firm to recognise the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities.” This concept acknowledges the importance of outside sources of knowledge

within the process of innovation, which also has been noted by other scholars. Both Asheim and Isaksen (2002) as well as Bathelt, Malmberg and Maskell (2004) believe that nonlocal linkages, i.e. external to the region, is a crucial medium for transferring knowledge and new ideas into a region. Additionally, March and Simon (1959) argued that borrowing rather than the introduction of inventions are of most importance for the innovation process. Therefore R&D-processes could be of importance since firms which actively perform R&D operations is expected to find better use for acquired external information (Tilton, 1971; Allen, 1977; Mowery, 1983). For absorptive capacity to work, there needs to be some prior knowledge in the region which has already been accumulated. This knowledge will increase the capacity of placing new knowledge into memory (Cohen & Levinthal, 1990). The absorptive capacity of a region is expected to be affected by what kind of people and institutions that are active there. Institutional change or changes in the human capital skill base is therefore the factors that affect the level of absorptive capacity. This is because learning mainly does stem from people or institutions, i.e. the learning curve. In this context, learning is the how a regional system may absorb, diffuse or create new knowledge (Boschma & Iammarino, 2009).

The concept of absorptive capacity (ACAP) has later been recognised in several disciplines such as strategic management and organisational economics among others (Zahra & George, 2002; Lane & Lubatkin, 1998; Nahapiet & Ghoshal, 1998; Glass & Saggi, 1998). When Zahra and George (2002) reviewed the concept, they deemed its definition to be unclear. Therefore, they proposed a conceptualisation with two parts, potential and realised absorptive capacity. The potential relates to acquisition and assimilation of knowledge whereas the realised part is about exploitation and transformation of knowledge which may create competitive advantages. The potential absorptive capacity is more about how the firm may evolve and adjust to changes, referred to as strategic flexibility. There is a difference between the dimensions since a firm may possess access to knowledge of value, but that is not the same as the firm using and exploiting that knowledge, i.e. realised absorptive capacity.

There are however alternative concepts to consider when discussing absorptive capacity. Henning, Lundquist and Olander (2016) were interested in the presence of systemic time lags between regions that experience transformation and those that experience diffusion of growth. In concurrence with Bresnahan and Trajtenberg (1995) and the theory of general purpose technologies (GPT:s), the authors argue that these technologies induce renewal and growth in the economy with the emergence of new sectors as well as revitalisation of incumbent sectors. The effect of GPT:s is not occurring in all sectors simultaneously but at different phases. They therefore propose that different industries serve different roles in the process of technology shifts. The authors do also acknowledge the fact that (Henning et al., 2016, p. 152): “Regions are differently equipped with the ability to develop, absorb, implement and commercially translate the growth forces of the technology shift (process and product innovation).” This can be thought of as regional receiver and development competence (Lundquist & Olander, 2001; Svensson Henning, 2009). The study showed that growth in progressive and dynamic industries are rather modest in smaller regions which are low in the hierarchy of regions. Henning et al. (2016) further argues that the industrial structure in these regions therefore are more vulnerable.

Regional economic growth is supported by increasing returns caused by both internal- and

external scale effects but also factors such as transaction costs and local comparative advantages (Krugman, 1991; Fujita, Krugman & Mori, 1999). It can be argued that the concept of regional receiver and development competence is closely related to the concept of regional endogenous capacity which determine if and how regions may receive and exploit technology, information, ideas and how to induce innovations (Jaffe, Trajtenberg & Henderson, 1993; Boschma & Lambooy, 1999).

Larger regions are expected to provide conditions which are favourable to more advanced regional receiver and development competence since size effects provide economies of scale at a relatively early stage. More advanced human capital resources are also often found in these regions. What are the implications for smaller regions that cannot provide these conditions, and which therefore exhibits a weaker receiver and development competence? Smaller regions might although still exploit this since the conditions is expected to give rise to a relatively lower cost structure. When technologies mature, and larger regions is started to get seriously affected by congestions, sectors may relocate to these smaller regions providing them with opportunities from the technology shift (Henning et al., 2016; Lundquist & Olander, 2011). This should in the end give rise to a lead-lag relationship between sectors and some sort of hierarchy between larger and smaller regions. The process is therefore suggested not to be evenly distributed across space (Henning et al., 2016).

Higher levels of absorptive capacity may arise in larger regions due to size effects similarly to how receiver and development competences arise. Absorptive capacity might although arise in smaller regions for them to exploit knowledge spillovers and compensate for what they lack in size. It could possibly also enable a region to engage with novel technologies and innovations. The development of a regional absorptive capacity may then allow also smaller regions to compete in innovative activities, and not just by a lower cost structure stemming from untapped production capacities and the lack of congestions. A lead-lag relationship between regions would then emerge as a result of various degrees of absorptive capacities. The most likely cause is a combination of size effects and different levels of absorptive capacities.

The concept of regional receiver and development competence is perhaps more broad fitting than the concept of absorptive capacity. The concept seems to incorporate how regions adapt during longer processes such as a technology shift in order to translate product- and process innovations into economic growth. Absorptive capacity could probably be more described as the competence at more specific point in time. A snapshot describing the ability of a region which aids the exploitation or transformation of internal and external information or innovations. However, since regional development in a longer time dimension over a technology shift is not the primary focus of this thesis, I will apply the concept of absorptive capacity rather than regional receiver and development competence. This application should therefore be of a good and narrow fit. The application of regional receiver and development competence may however very well provide answers which are more about how these processes evolve over significantly longer periods at a regional level.

Few studies consider both the concepts of related- and unrelated variety and absorptive capacity. This is regrettable since absorptive capacity may influence the impact of related-

and unrelated variety on economic growth. In a state of low absorptive capacity, knowledge spillovers stemming from related- or unrelated variety will arguably tend to be less effective. The effects on growth of these two concepts might therefore be lower. There is simply no capacity to absorb the information or knowledge provided (Cohen & Levinthal, 1990; Fritsch & Kublina, 2016). It can further be argued that national aggregates do not tell the full picture of processes of economic development on a regional level.

2.2 Analytical framework

At this stage, the following questions could be posed: How are the concepts of related- and unrelated variety and regional absorptive capacity connected, and how do they differ? Why should these processes be examined at the level of aggregation which in this case is regions? This section will focus upon the first research question. It will discuss related- and unrelated variety as well as suggesting how one internal and one external dimension of absorptive capacity may function as moderators.

2.2.1 Related- and unrelated variety

Related- and unrelated variety basically indicates how varied the employment is in terms of sectors present in a region. They represent some element of diversity of various relatedness which have different effects on productivity and employment growth (Frenken et al., 2007).

Why should then the absorptive capacity be considered relevant when discussing related- and unrelated variety? Lane and Lubatkin (1998) speak of firms which they denote as student- and teacher firms, where the student firms are recipients of knowledge which originates in co-located teacher firms. This discussion could therefore be considered to extend the thinking of Cohen and Levinthal (1989, 1990), which targeted the individual firm and its internal capabilities or characteristics. With the concept of relative absorptive capacity, Lane and Lubatkin (1998) proposed that learning is enhanced when student- and teacher firms share basic knowledge but also exhibit unique areas of expertise (i.e., some kind of relatedness – author's remark). While related- and unrelated variety could be thought of as the colocation of sectors which are more or less related, the possible relationship between student- and teacher firms could perhaps represent something more than just the colocation of these firms. For instance, this could be about common ownership or management structures which links these firms together and which enables knowledge to be shared within these networks. Something which cannot be explained just by colocation or the effects of related- and unrelated variety.

New knowledge is created in the interaction and variation of related- and unrelated firms. Varieties of related and unrelated firms in a region can therefore be argued to constitute possible student- and teacher firms. The absorptive capacity should facilitate the exploitation and transformation of this knowledge, thereby working as an enabler of related- and unrelated variety. Related- and unrelated variety would then constitute the potential absorptive capacity, as discussed earlier, and the processes of acquisition and assimilation of knowledge. Both

mechanisms have their distinct role in the processes of knowledge creation and diffusion, where knowledge is created in teacher firms and diffused through student firms. This possible mutual dependency between related- and unrelated variety and absorptive capacity could be considered one of the strongest arguments for why both concepts are to be considered relevant and introduced in the same model.

Another way to picture this mutual dependency is that related variety induces knowledge spillovers which both could be related but also of a novel kind, while unrelated variety just induces knowledge spillovers which are completely novel and idiosyncratic. The diffusion of this various type of knowledge will be easier and stronger if they can be spread through a medium such as through a network. These networks are a way to visualize what the absorptive capacity potentially could represent.

The broad definition of absorptive capacity provided by Zahra and George (2002) could be related to the existence of various competencies within firms that may yield different competitive advantages. In this context, a competitive advantage could be defined as a strategy which generates value for a firm. A strategy which is not implemented in other competing firms (Barney, 1991). It is my belief that such strategies in aggregate could affect the regional absorptive capacity and thereby the economic performance of regions. Suppose a region exhibits poor absorptive capacity. In that case, I would like to argue that the industrial structure will be less effective in inducing knowledge spillovers. The region will be less able to make use of knowledge spillovers which emerge as a result of the coexistence of firms with different sets of skills and of different sectors. Thereby regions and firms may fail to induce a strategy in order to exploit the possible competitive advantage that may arise due to the specific industrial structure of that region, i.e. related- and unrelated variety.

Excellent absorptive capacity, i.e. manifested by networks which enable a high capacity to make use of information, is although not enough in the ability of a region to transform knowledge into knowledge which may be exploited and applied locally. In addition, relatedness also plays an important part in this process. The information should be complementary but not too similar in order for knowledge spillovers to have an effect. Even regions with a high absorptive capacity may struggle to acquire information which is completely unrelated. Although even if it could be possible to acquire such knowledge, it would probably not create any advantages or value given the difficulty in finding complementing use for this knowledge locally. The same goes for knowledge which is too similar. While it may be acquired locally, it is expected not to bring any valuable input to the existing regional knowledge base (Boschma & Iammarino, 2009). The cognitive distance then first determines if related- or unrelated knowledge spillovers may be associated with benefits or values for the receiver (in this context a region). Whether these potential benefits or values may be successfully exploited locally is dependent on what kind of absorptive capacity that exists in the region.

Cohen and Levinthal (1990) suggests that prior knowledge will tend to comprehend a mix of both more and less related knowledge. It is the relatedness that enables a successful assimilation of new knowledge and can be thought of as a requirement for knowledge spillovers of assimilated knowledge. It can be argued that this discussion could be merged

with the one of similarities and complementarities. Knowledge may transfer between bodies of knowledge which are related and thereby similar. Harlow (1959) also notes that problem-solving methods of individuals are very much constituted by their prior knowledge which helps them acquire capabilities to solve related problems. This may also have implications for the learning of organisations in a region, where prior knowledge and the knowledge base affects if and how new knowledge may be assimilated. Going back to the conceptualisation of Zahra and George (2002), relatedness is associated with the process of knowledge assimilation. Higher degrees of relatedness would imply a greater likelihood of knowledge becoming assimilated. In contrast, learning is by far more complex in novel domains (Cohen & Levinthal, 1990). This could indicate that absorptive capacity is more strongly connected to the concept of related variety than unrelated variety, given that related knowledge is an important and central element found in both concepts.

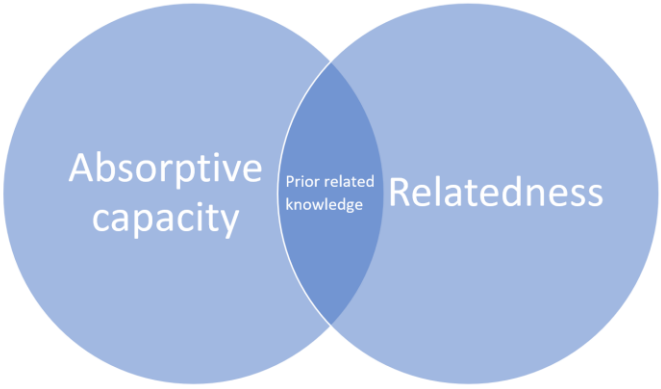

Figure 2: *Venn diagram depicting the possible association between the concepts of absorptive capacity and relatedness. Source: Author's illustration.*

However, there are both empirical and theoretical indications that diversity or elements which are more towards unrelated variety also may be influenced by absorptive capacity. When Fritsch and Kublina (2016) reviewed the potential moderating effect of absorptive capacity upon related- and unrelated variety, it did only moderate the effects of unrelated variety. This could have several explanations. For instance, it could simply indicate that the process of unrelated variety is more depending on and connected to the concept of absorptive capacity. Alternatively, the overlap between absorptive capacity and related variety may make it difficult to disentangle the effects between the concepts. The significant moderating association between absorptive capacity and unrelated variety could then indicate that these concepts exhibit less of an overlap.

In addition to the empirical support that unrelated variety may be moderated by absorptive capacity, the following quote from Cohen and Levinthal (1990) indicates the possible

importance of knowledge diversity and variety:

diversity where knowledge is of a complementing nature is also underlined as a vital element of learning:
… diversity of knowledge plays an important role. In a setting in which there is uncertainty about the knowledge domains from which potentially useful information may emerge, a diverse background provides a more robust basis for learning because it increases the prospect that incoming information will relate to what is already known. In addition to strengthening assimilative powers, knowledge diversity also facilitates the innovative process by enabling the individual to make novel associations and linkages (Cohen & Levinthal, 1990, p. 131).

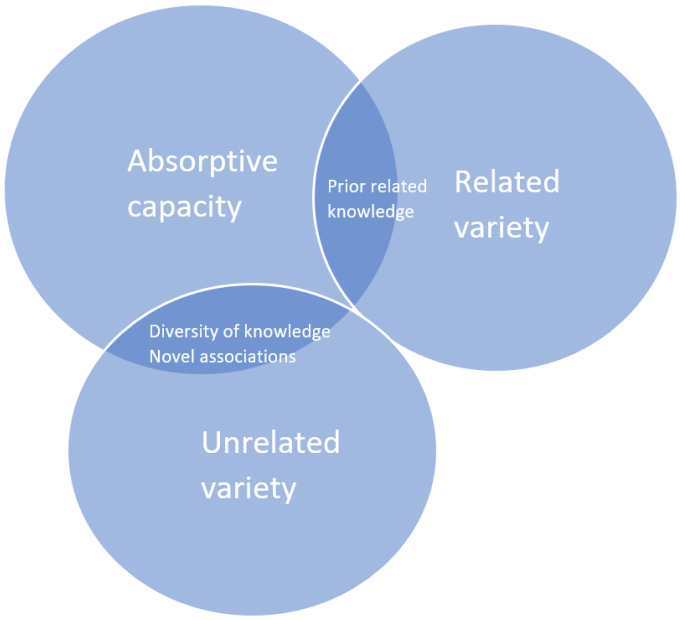

Figure 3: *Venn diagram depicting the possible association between the concepts of absorptive capacity and the different degrees of relatedness. Source: Author's illustration.*

In the figure above, unrelated variety is also suggested to be moderated by absorptive capacity. As suggested by Cohen and Levinthal (1990), diversity may strengthen the powers of assimilation. Given that related variety is about assimilation, diversity or elements of an unrelated nature may support the effects of related variety. This way of depicting the concepts of related- and unrelated variety as mutually reinforcing each other is similar to the reasoning of Hu and Liang (2018) as well as Boschma and Frenken (2011), which was mentioned earlier in the theoretical part on related- and unrelated variety. That is, both related- and unrelated variety should have an impact on the processes of assimilation and acquisition of knowledge.

Therefore, it can be argued that absorptive capacity may provide inward-looking as well as outward-looking elements. If the organisation (or region – author's remark) becomes too inward-looking, that is becomes too dependent on just internal language and specialisation, it will struggle to incorporate valuable external knowledge. This is a situation often referred to as the syndrome of not-invented-here (Cohen & Levinthal, 1990). Both related- and unrelated

elements are necessary for the learning process of organisations (or regions – author's remark), while the sole dominance of one of them will create a state of dysfunction (Cohen & Levinthal, 1990). I therefore consider this a supplement to the discussion above. Absorptive capacity may very well relate both to internal knowledge within the region as well as extra-regional knowledge. As will be discussed later, there are many similarities between the concepts of absorptive capacity and related variety. Almost partial overlapping in some cases. Why this makes it more difficult to distinguish them more clearly in a common framework, it also possibly indicates that they should be relevant for each other. Something which is in line with the overarching theory of this thesis.

2.2.2 The internal dimension of absorptive capacity

The first dimension of absorptive capacity is related to the internal setting of a region and the actors that are present in that actual region. This can be thought of as being in line with the discussion of Freeman (1987) regarding a local network and the interactions between private and public institutions. A network that connects actors which are holding together and upholds related- and unrelated variety and coordination of different degrees between firms which are active in the region. As discussed previously, a network in which knowledge may be diffused could arise as a result of a common management- or ownership structure which tie firms together. Such networks could represent a systemic absorptive capacity on a regional level and be something else than just the absorptive capacity of firms. When Fritsch and Kublina (2016) introduced absorptive capacity in their study of German regions, they proxied the concept by R&D intensity at a regional level. This might capture this first dimension. Higher level of research could indicate that the internal setting has provided good preconditions through the network of actors, i.e. the absorptive capacity has enabled higher intensities of knowledge spillovers to flow within the region. A higher R&D intensity then may prove the existence of a local diffusion mechanism of knowledge spillovers, i.e. internal absorptive capacity of the region. These spillovers may be more or less related depending on the industrial structure which prevails in the region.

2.2.3 The external dimension of absorptive capacity

The second external dimension of absorptive capacity is about the function of absorptive capacity in relation external information which is being moderated. This dimension is in line with the thinking of Abreu (2011) in how external information may be productively applied within the region as well as Bathelt et al. (2004) regarding the importance of global pipelines which transfers external knowledge into the region. Bathelt et al. (2004) further remarks that new knowledge and knowledge of value will always emerge in other parts of the world and that the acquisition of such knowledge can give rise to comparative advantages. No matter if external knowledge is transferred directly between related- or unrelated firms or through other regional actors, the absorptive capacity should have a moderating saying either way. This second dimension should be related to the economic openness of a region. The reasoning here being that a more open setting enables higher levels of external information reaching the

region. A more open setting would be associated with higher likelihoods of encountering knowledge flows of both related- and unrelated variety and the existence of relationships beyond the region. One possible way to proxy this is by imports and exports in relation to the total GDP of a region. This measurement has often been applied as a proxy for openness (Roine, Vlachos & Waldenström, 2007; Hedberg, Karlsson & Häggqvist, 2017; Capie, 1994; Lindert, 2004; Espuelas, 2012). A simpler proxy would be the regional export intensity. Given that a region has engaged with an international setting, it may also obtain experience or external relationships which might provide value domestically for a long time. For instance, compensate something which the region is lacking internally. This could influence the management, routines and the overall ability to deal with a large variety of actors then present in the local community. This dimension also bears similarities with the discussion regarding size dimensions with respect to regional receiver and development competences as mentioned earlier. Higher intensities of export would then possibly indicate the existence of economies of scale effects which the region exploits.

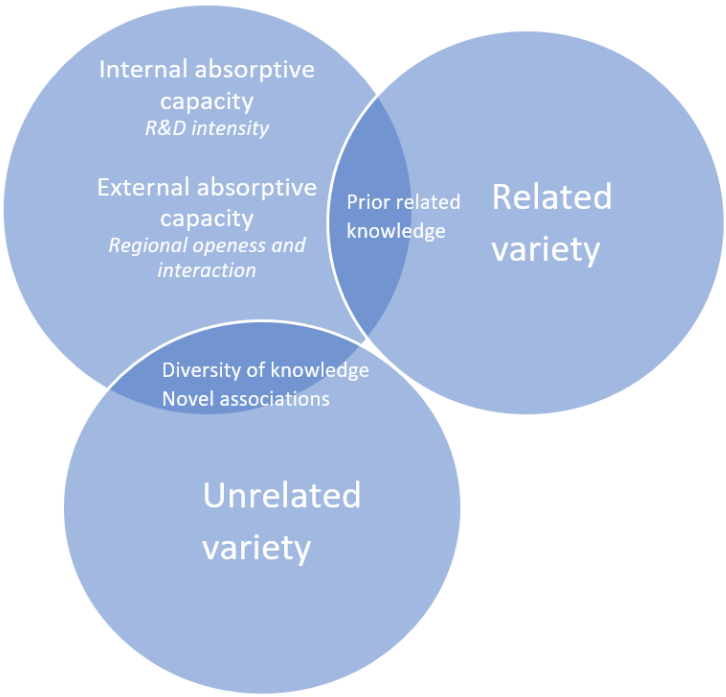

Figure 4: *Venn diagram depicting the possible association between the two dimensions of absorptive capacity and the different degrees of relatedness. Source: Author's illustration.*

2.2.4 The dimensions working together

My assumption is that absorptive capacity moderates the information coming from an external setting which penetrates the outer boundary of a region as well as information that flows between and within actors and networks of a region. Actors could be for example: universities, regional governmental organisations, incubators, science villages, regional infrastructure and export-/trade councils. These are organisations which are active in a wide internal setting of the region and are necessary to uphold a coexistence of firms (variation).

Between these actors there are in many regions a presence of firms organised in sectors and networks. Sectors that could be considered more or less related. The concepts of absorptive capacity and related- and unrelated variety should be sensitive to time but of different reasons. The absorptive capacity should change since the accumulated experience of the different actors and networks could be affected by new collaboration structures within the region or because of new conditions in the external surrounding regions. The related- and unrelated variety should naturally be affected by the current mix of sectors and companies active within the region. New companies may establish themselves in the region or companies may disappear due to bankruptcy, strategic reasons or mergers.

Going back to the reasoning of Zahra and George (2002) regarding potential and realised absorptive capacity, this divide might be useful when considering the different dimensions at work. The potential part consists of related- and unrelated variety since these concepts should represent the knowledge itself. Some of which may be regarded as valuable. This knowledge may be more easily transformed into knowledge spillovers when being realised by the two dimensions of absorptive capacity. The first dimension then moderating such knowledge flows locally and the second externally.

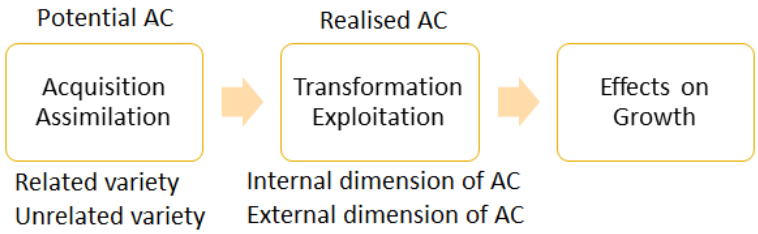

Figure 5: *The proposed step way process. The internal and external dimensions of absorptive capacity moderates the effects of related- and unrelated variety on growth. Source: Author's illustration.*

The realised absorptive capacity dictates what value that may arise due to related- and unrelated variety. If a region possesses relatively strong capacities regarding the internal- and external dimensions of absorptive capacity, this may enable higher growth effects and stronger flow from left to right in figure 5. This way of depicting the concepts in a sequence will be indicative to how the concepts later may be empirically assessed in a regression model. The internal- and external dimensions of absorptive capacity will therefore accordingly be introduced in this model as moderating variables.

While the proposal that related- and unrelated variety may constitute a potential absorptive capacity could give rise to a possible problem of endogeneity when combining the concepts of regional absorptive capacity and related- and unrelated variety, it may help us understand the underlying theoretical processes of regional development. When discussing regional openness, Jiang (2014) established that knowledge should not just be defined in a narrow fashion only reflecting the physical technological element. It should arguably also reflect resource endowment and institutions, that is region-specific factors. The proposed concept of regional absorptive capacity in two dimensions could successfully be applied to represent

these effects since it reflects these wider knowledge effects. This is because the proposed concept recognises capabilities which are beyond just technological knowledge, such as relationships and networks. Since the internal- and external dimensions of absorptive capacity moderates knowledge stemming from related- and unrelated variety, it may represent capabilities for learning at a regional level. While related- and unrelated variety could more represent the technology, which induce and generate new knowledge, the dimensions of absorptive capacity connect more to how this knowledge may be diffused and applied. While this divide might be somehow theoretically concise, the empirical task to derive the separate effects from these concepts on the overall economic performance or outcome of a region, should be highly arduous. It should however not come as a surprise since my arguing has been that both these processes need to be in place in the region, working in tandem. Additionally, we can ask ourselves if there is any real value in a successful derivation of the concepts of related variety and absorptive capacity? The overall performance of a region should always be the most interesting fact.

2.2.5 Level of aggregation and remarks

Lastly, we arrive at the matter of aggregation or the empirical unit used to examine the possible effects. Although the first applications of absorptive capacity as suggested by Cohen and Levinthal (1989, 1990) was directed at a firm level, this might very well be a relevant concept also at higher levels of aggregation. Abreu (2011) suggest that the concept might be directly related to areas of regional policy such as development of human capital and provisions of actors which function as gatekeepers moderating the amount of external information which reach a region. Abreu (2011) further suggest that the literature on the innovation system, as introduced by Lundvall (1992) and Edquist and Johnson (1997), as well as the extension of the regional innovation system (RIS), could be introduced in this setting. The concept of the RIS is found within a defined geographical setting and highlights the existence of institutions, both private and public ones, which are connected through a regional local network (Freeman, 1987). The local network could be discussed in different dimensions. For instance, in the relationship between universities and private firms which are present in the region. A university could thereby act as a forum where economic actors come together with the intention of commencing collaboration. While this process takes place within the set boundaries of a region, the ideas of Bathelt et al. (2004) extends the discussion to an extra-regional setting as well. The local relationships between firms or between firms and universities could be defined as local buzz or interactions. Bathelt et al. (2004) does however also acknowledge the importance of global linkages or pipelines which bring about external information to the different actors of a region. A region should therefore be a relevant unit of analysis for the empirical investigation.

2.2.6 Summary

In sum, I propose that the industrial structure of a region may give rise to knowledge spillovers and thereby the effects of related- and unrelated variety. One dimension of the regional absorptive capacity moderates these knowledge spillovers locally. The other

dimension of the regional absorptive capacity moderate extra-regional knowledge spillovers that enters the region, either through firm-firm interactions or through other actors or institutions which are part of the local network found in the region. The uniqueness of this proposition is the fact that the absorptive capacity is composed of two dimensions which either moderates local or external effects of related- and unrelated variety. The concept of absorptive capacity is thereby interpreted in a wider sense than suggested in previous studies while still being linked to the concepts of related- and unrelated variety, working as a diffusion mechanism.

3 Data and Methodology

3.1 Method

As presented in the introduction, this thesis aims to investigate the impact of related- and unrelated variety on economic growth moderated by the impact of regional absorptive capacity in two dimensions. The investigation will be performed through data gathering and analyses by the application of econometric methods, namely regression models. Since quantitative methods value objectivity, it is important to reveal the research process in a clear and logic fashion. This enables the reader to assess the objectivity as well as enabling replication and further examination of the results. Replication could be considered among the most effective processes to assess objectivity and a natural part of quantitative research (Bryman & Bell, 2005; Creswell, 2009). In a long-term perspective this also enables progress in the field and an accumulation of facts and hypotheses regarding how related- and unrelated variety as well as the concept of absorptive may influence economic growth and development on a regional basis, not just in Sweden but also internationally in other settings.

3.1.1 Limitations

One of the major sources for uncertainty in this study is the fact that the concept of absorptive capacity is rather unknown in the context of related- and unrelated variety. There is a rather small body of research on the concept itself and an even smaller one when it comes to introducing absorptive capacity in this context. The operationalisation of the concept by one internal- and one external dimension used in this thesis does not necessarily have to represent the final approach to depict the concept empirically.

The ideal case of a quantitative investigation is of course to be able to present the studied processes in a general fashion. Although, when speaking of regions, they may vary greatly depending on the level of national development. In emerging or developing economies there might be other processes such as the quality of governance or fundamental infrastructure rather than the composition of the industrial structure that might have the greatest effect on economic growth. Since this thesis investigates regions located in Sweden, caution should be taken when assessing the role of the industrial structure outside the context of a developed economy.

3.1.2 Validity

The matter of theoretical validity discusses if measurements truly measure the aspect that they are designed to measure. Validity may however be divided into different shapes. Face validity is about how well a measurement reflects the process which are of interest. A way to ensure face validity is to let experts judge the validity of measurements (Bryman & Bell, 2005). Another way could be to apply established measurements which have been developed and used in for instance journal articles.

Construct validity discusses the conceptual validity. The hypotheses should be relevant for the matter in question and the deduction should be a logic extension of theory (Bryman & Bell, 2005). Additionally, the analysis should not be based on hunches which support the standpoint or view of the researcher. This action is not compliant with a high standard of research and should therefore be avoided.

In the case of this thesis, variables such as growth in regional GDP, employment growth, related- and unrelated variety and population density are widely used in journal articles which focuses upon the effects of the concepts of related- and unrelated variety on growth. Such variables could therefore be argued to exhibit theoretical validity. These measurements have been discussed intensively and there is literature which establish the conjunction with theory. However, there is less theoretical validity regarding the variables of absorptive capacity and the divide into one internal and one external dimension. In this context this represents a new theoretical approach.

3.1.3 Reliability

The reliability of a study has several meanings. A first one is the matter of stability. This refers to if the used measurements will yield stabile results over time. The ideal case is results which do not fluctuate. A second meaning is inter-rater reliability. This applies to cases with subjective assessments. For example, when data is to be translated into categories, there needs to be a consistency in the way this data is translated. If there are several researchers doing this work, it is very important that the categorisation is coordinated and that there is a sense of consistency in the translation of data (Bryman & Bell, 2005).

In this thesis, the data handling process is therefore critical. By using data from a recognised source of a good standard, the data should exhibit the desired stability regarding data collection and classification. The main source of data used in this study is Statistics Sweden which is an official supplier of data. This agency should be of a high standard. The regression results were consistent between two independent models with different regressands over time.

3.1.4 Ethical considerations

Good research practice includes to consider what kind of ethical implications that may emerge as a result of a study or its results (Hesse-Bieber & Leavy, 2006; Creswell, 2009). What these implications are will of course differ depending on the type of research method, research question, aim etc. In the case of this thesis, the data collection process will not target individuals because of the use of secondary data on a regional level. It is although of importance that the results of this study are analysed and presented in an objective way. This is because regional governments could potentially be interested in how they may organise their industrial structure in creating growth. By presenting and analysing misleading results, this might in the extreme lead to policy interventions which might be unimportant or even detrimental in creating regional economic growth and prosperity.

3.2 The Approach and justification for a quantitative study

Quantitative research aims at examining theories by assessing relationships among variables. Variables which often are estimated by instruments which enables statistical procedures to be performed on the data. The process could be described as deductive and recognises the importance of controlling against the existence of alternative explanations and bias as well as the possible replication of results (Creswell, 2009). In this thesis, the theories of related- and unrelated variety as well as absorptive capacity may be regarded as central and very much the focus of query. Since I intend on examining the relationship between these concepts while controlling for all other effects, a quantitative approach is deemed suitable. By applying a deductive approach, my results may be used for comparison (Bryman & Bell, 2005). The quantitative approach is however not lacking criticism. One aspect that have been criticised is the collection process of data which is argued to vigorously limit the amount of processed information. This can lead to a situation where researchers just find what they are looking for while neglecting other useful information (Jacobsen, 2002).

The research method could be entirely viewed as a product of the research problem at hand. Creswell (2009) argues for the use of a quantitative approach when there is a need to investigate the existence of factors and how these might affect an outcome. Alternatively, this study could have applied a qualitative or mixed methods approach. These approaches could be of great use if there is rather limited knowledge on a concept or relationship. This is a situation when some or all variables of interest are unknown. In this study, it can be argued that this is not the case. The three main concepts of absorptive capacity, related- and unrelated variety dictate a suggestive importance of a set of variables. What is left to investigate is if these variables matter and to what magnitude.

By analysing the theory of related- and unrelated variety in combination with the concept of absorptive capacity, my intention is to increase the versatility in the discussion of how variety affects economic performance in different contexts. The sources of this study have mainly been collected from journal articles and books. These sources are widely cited and is therefore considered to be of great importance. Additionally, such sources have often been examined in a peer review-process. This fact vouches for that these are to be considered academic sources of quality. The process of finding relevant articles has mostly been done in Google Scholar and LUB-search which is a search engine provided by the libraries at Lund University.

At this stage it is however important to note that the incongruity of results regarding variety could be due to other reasons than the effect from a possible omitted variable such as regional absorptive capacity. This could arise due to different theoretical approaches, methodologies or differences when it comes to the time and space context.

3.3 Operationalisation

In this section, the operationalisation of the dependent- as well as independent variables will be introduced and discussed. Together, they will form a regression model aimed at investigating individual effects from the variables as well as moderating effects.

Dependent variables
Regional economic performance is the variable of interest. This is given by my research question focusing upon the possible impact of related- and unrelated variety on regional growth moderated by regional absorptive capacity in two dimensions. Regional economic performance is introduced in the shape of regional GDP (bruttoregionprodukt, ENS2010) as defined by Statistics Sweden. Growth is defined as the yearly percentage change in volume. The variable is collected on a yearly basis between the years of 2005 and 2017 in million Swedish SEK in current prices. The level of analysis is the 21 counties of Sweden.

In studies upon the effects of related- and unrelated variety on regional performance, another variable often used to proxy economic performance is the growth of employment. I intend to also test my variables against this alternative indicator in a second regression model. The variable is constituted of data from Statistics Sweden and the annual records of the Labour Force Surveys (LFS). This survey accounts for the total population, the total number of unemployed, the total number of people outside the labour force and the total number of people employed for any given county. Therefore, the level of analysis is for this alternative regression model also the 21 counties of Sweden. Caution should although be taken when comparing the trend of this variable in comparison with the regional GDP given that this variable is only available for the years of 2006 until 2017. The growth of employment is in this case measured as the annual percentage change of the total number of people employed in the respective county.

Independent variables
Related- and unrelated variety:

The first two independent variables will account for related- and unrelated variety. These two variables measure the variety of the industrial structure in the respective Swedish county. Frenken et al. (2007) accordingly suggests a method for the calculations of the variables. Unrelated variety is often referred to as entropy and is measured as follows:

$$\text{Unrelated variety} = \sum_{g=1}^{G} P_g \log_2\left(\frac{1}{P_g}\right)$$

Formula 1: *Definition of the calculation of unrelated variety (UV). Source: Frenken et al. (2007); Fritsch and Kublina (2016).*

P_g is defined as the share of employment in a two-digit sector S_g (g = 1, …, G) divided by regional total employment. The share has a minimum of 0, this is when the regional employment is concentrated to just one two-digit sector, and a maximum of $log_2(G)$, a situation when the regional employment is spread equally in all of the sectors which are present in the region.

The measurement for related variety is on the other hand made up by a weighted sum of entropy within every one of the two-digit sectors in the following fashion:

$$\text{Related Variety} = \sum_{g=1}^{G} P_g H_g \quad \text{where} \quad H_g = \sum_{i=1;\, S_i \epsilon S_g}^{I} \frac{p_i}{P_g} \log_2\left(\frac{1}{p_i/P_g}\right).$$

Formula 2: *Definition of the calculation of related variety (RV). Source: Frenken et al. (2007); Fritsch and Kublina (2016).*

As in the formula for unrelated variety, P_g is defined as the share of employment in a two-digit sector S_g (g = 1, …, G) in relation to regional total employment. P_i is defined as the share of employment in a four-digit sector S_i, where (I = 1, …, I), associated with the same two-digit sector S_g. The measurement has a minimum of 0, this is when employment in a two-digit sector is concentrated to just one four-digit industry, and a maximum of log_2(I) - log_2(G), when there is an equal spread of employment in all of the four-digit industries. Therefore, related variety can in this instance be indicated by a significant spread of employment across different industries.

There had to be a correction of the data coming from 2005 and 2006. This due to related- and unrelated variety being calculated from data based on the old SNI2002. SNI being the Swedish standard for industrial classification. The values from the old system were inflated in relation to the following years. I therefore calculated a ratio between the years where data was available both in SNI2002 and SNI2007. The average of this ratio was used to transform the years of 2005 and 2006.

The data used for calculating the employment shares only included persons in the ages of 16-64 and which were employed/self-employed (förvärvsarbetande).

Internal absorptive capacity:

In accordance with Fritsch and Kublina (2016), this dimension is proxied by R&D intensity. While they measured this as the regional share of employees engaged in R&D, such data was although not available at a county level for Sweden. I therefore measured R&D intensity as the ratio between regional expenses of R&D and the level of regional GDP. When Cohen and Levinthal (1990) assessed the concept of absorptive capacity, they proposed that absorptive capacity may emerge as a by-product of a firms R&D operations. Thereby, I propose that higher R&D intensities in a region may be associated with a higher level of internal absorptive capacity.

External absorptive capacity:

As discussed in the analytical framework, the second external dimension of regional absorptive capacity will be measured as the intensity of regional exports. The measurement is based on production value.

Data on a county level for Sweden for a longer time period did however not exist. Therefore, national data was used which was then transformed into county data as follows:

First, the national export intensities were calculated for sectors:
1) Export and sales data at a 5-digit level were merged between SNI and SPIN (product classification according to branch) from the classification systems of 2002 and 2007.
2) Export intensity was defined as the country export in sector i divided by sales in sector i.
3) A problem occurred for some sectors when the export intensity was greater than 1 or missing for sectors which did actually export. In aggregate, the sectors where these issues occurred make up a very low share of the total production value. This problem was remedied by calculating the export intensity at a 3-digit level instead while using the same methodology as described in step 1 and 2. If this also yielded the same problems as above, the export intensity was assumed to equal 1.

Secondly, these values were used to calculate the county level data:
Based on the export intensity for different sectors at a national level, an average export intensity was calculated for each county. This calculation adopted sector shares of production value at a 5-digit level with county levels used as weights.

This measurement may proxy the extent of international interaction in a given region. The thesis is here that higher intensities indicates a relatively open setting which enables a region to gain knowledge and understanding on what goes on beyond through external interactions. These interactions may in the long turn yield long-lasting external relationships which might yield other benefits, compensating what might be missing internally.

At the same time, this proxy is rather simple and it yields potential issues. Firstly, it is manufacturing oriented which will inflate the international interactions of counties with heavy manufacturing while deflate the international interactions of more knowledge-oriented service counties. For instance, the county of Stockholm is not scoring as high as one would assume. Secondly, it might reflect the industrial structure of a county rather than describe the actual

capacity to engage in international relationships. Lastly, as described above. This is not a true measurement for the regional level. National intensities were transformed and allocated to a regional level. A county which is very unlike from the average national intensities might be affected by this methodology.

Control variables
Population density:

Population density is introduced as a control for the effects of urbanisation economies (e.g. Hartog, Boschma & Sotarauta, 2012; Fritsch & Kublina, 2016; Aarstad, Kvitastein & Jakobsen, 2016). The data is provided by Statistics Sweden and is calculated by relating the population figure for a given county on the 31st of December with data of the land area on the 1st of January in the following year. It is measured as the population figure per square kilometre (population/km^2).

Metropolitan region dummy:

In Sweden, the cities of Stockholm, Gothenburg and Malmö are often referred to as the three metropolitan cities. When examining the population figures as well the recorded economic activity (GDP figures in current prices) for the counties in which these cities are situated, the difference in relation to other Swedish counties is noticeable. Since there are clear size differences, it could be interesting to investigate whether this effect is significant and constitute an alternative effect of urbanisation economies. I'm therefore introducing this dummy variable which takes the value of 1 for the counties of Stockholm, Västra Götaland, Skåne and otherwise 0.

The proposed regression models

Model 1:

$$Regional\ GDP\ growth_{i,t} = \beta_0 + \beta_1 UV_{i,t} + \beta_2 RV_{i,t} + \beta_3 R\&D\ int_{i,t} + \beta_4 Exp\ int_{i,t} + \beta_5 Pop.density_{i,t} + \beta_6 Metro.dummy_{i,t} + \beta_7 UV_{i,t} * AC1_{i,t} + \beta_8 RV_{i,t} * AC1_{i,t} + \beta_9 UV_{i,t} * AC2_{i,t} + \beta_{10} RV_{i,t} * AC2_{i,t} + \varepsilon_i$$

Model 2:

$$Regional\ Employment\ growth_{i,t} = \beta_0 + \beta_1 UV_{i,t} + \beta_2 RV_{i,t} + \beta_3 R\&D\ int_{i,t} + \beta_4 Exp\ int_{i,t} + \beta_5 Pop.density_{i,t} + \beta_6 Metro.dummy_{i,t} + \beta_7 UV_{i,t} * AC1_{i,t} + \beta_8 RV_{i,t} * AC1_{i,t} + \beta_9 UV_{i,t} * AC2_{i,t} + \beta_{10} RV_{i,t} * AC2_{i,t} + \varepsilon_i$$

4 Empirical Analysis

With this chapter my aim is to present the empirical results that emerged with an emphasis on both descriptive results and regression results. Various alternative specifications based on models 1 and 2 will be introduced. This has been done with the motive to assess the robustness of the results that might emerge.

4.1 Results

Descriptive statistics of the sample and variables:

The analysis is based upon the counties of Sweden which are listed below with the respective county code.

The 21 Counties of Sweden
01 Stockholms län
03 Uppsala län
04 Södermanlands län
05 Östergötlands län
06 Jönköpings län
07 Kronobergs län
08 Kalmar län
09 Gotlands län
10 Blekinge län
12 Skåne län
13 Hallands län
14 Västra Götalands län
17 Värmlands län
18 Örebro län
19 Västmanlands län
20 Dalarnas län
21 Gävleborgs län
22 Västernorrlands län
23 Jämtlands län
24 Västerbottens län
25 Norrbottens län

Table 1: *Swedish counties*.

Variable	Obs (N)	Mean	Std. Dev.	Min	Max
Average GDP growth	231	1.671573	0.952447	-0.28333	3.6
Unrelated variety	231	5.155288	0.085615	4.92121	5.377604
Related variety	231	1.874156	0.1191	1.679673	2.123317
R&D intensity	221	0.015405	0.011431	0.000322	0.049646
Exp intensity	231	0.241631	0.074827	0.03724	0.387424
Pop. density	231	45.92121	65.63586	2.5	342
Metro. dummy	231	0.142857	0.350687	0	1

Table 2: *Descriptive statistics of the variables of Model 1.*

The number of observations is given by the 21 counties in relation to 11 years of data between the years of 2005 and 2015 which together yields 231 individual observations. This is true for all variables except for R&D intensity, since there were missing values in the data from Statistics Sweden regarding regional expenses for R&D.

Variable	Obs (N)	Mean	Std. Dev.	Min	Max
Average Emp growth	210	0.674355	0.862669	-1.56122	2.03106
Unrelated variety	210	5.149517	0.083746	4.92121	5.353081
Related variety	210	1.876384	0.118168	1.691378	2.123317
R&D intensity	202	0.015333	0.011467	0.000322	0.049646
Exp intensity	210	0.240871	0.07545	0.03724	0.387424
Pop. density	210	46.15429	66.16637	2.5	342
Metro. dummy	210	0.142857	0.350763	0	1

Table 3: *Descriptive statistics of the variables of Model 2.*

The variable of regional employment by county was based on data between the years of 2005 and 2015. Although, since this data was in aggregate numbers, the year of 2005 was lost when transforming these numbers into annual growth figures. This resulted in 210 individual observations for all variables part from R&D intensity, given the missing values as mentioned before.

Descriptive analysis of some key variables:

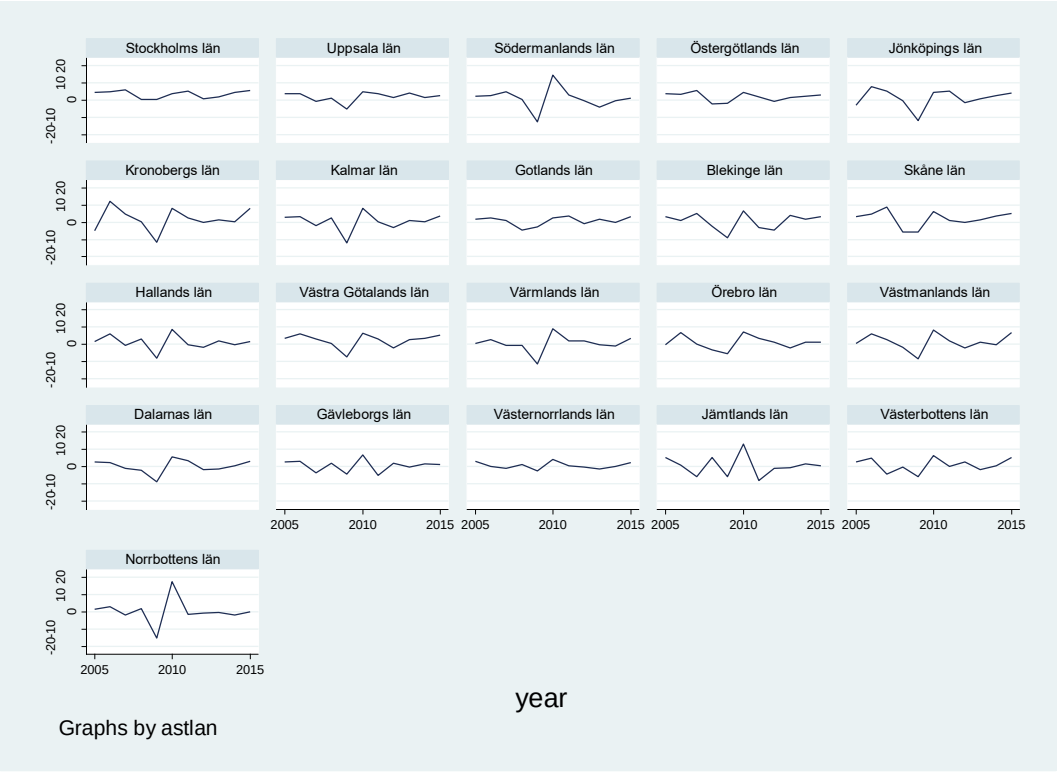

Figure 6: *Development of regional GDP growth by county.*

As can be seen from figure 6, the growth of GDP for most counties experienced a significant decline around 2008. A highly speculative general reason for why that is could be the Great Recession of 2007-2008, which likely affected most Swedish counties. Although in the case of Stockholms län, Uppsala län, Östergötlands län and Gotlands län, the development was more stable. Maybe indicating that they were less affected. Additionally, many of the counties that exhibited a decline experienced a significant boom in the GDP growth rate in the year following the decline. There was a general trend for the last years before 2015 where all counties experienced stable growth. While this growth was mostly positive, the counties of Jämtland and Norrbotten, showed a negative development for the last years. Indicating a trend which was unique for two nothern counties. Södermanland, Jönköping and Bleking exhibited a catching-up trend from negative growth rates over the final years. The levels of growth did not indicate any particular families of growth such as metropolitan counties or nothern counties. Counties all over Sweden experieced both high positive and low negative growth rates. There was no clear divide regarding north-south or metropolitan-rural in that matter.

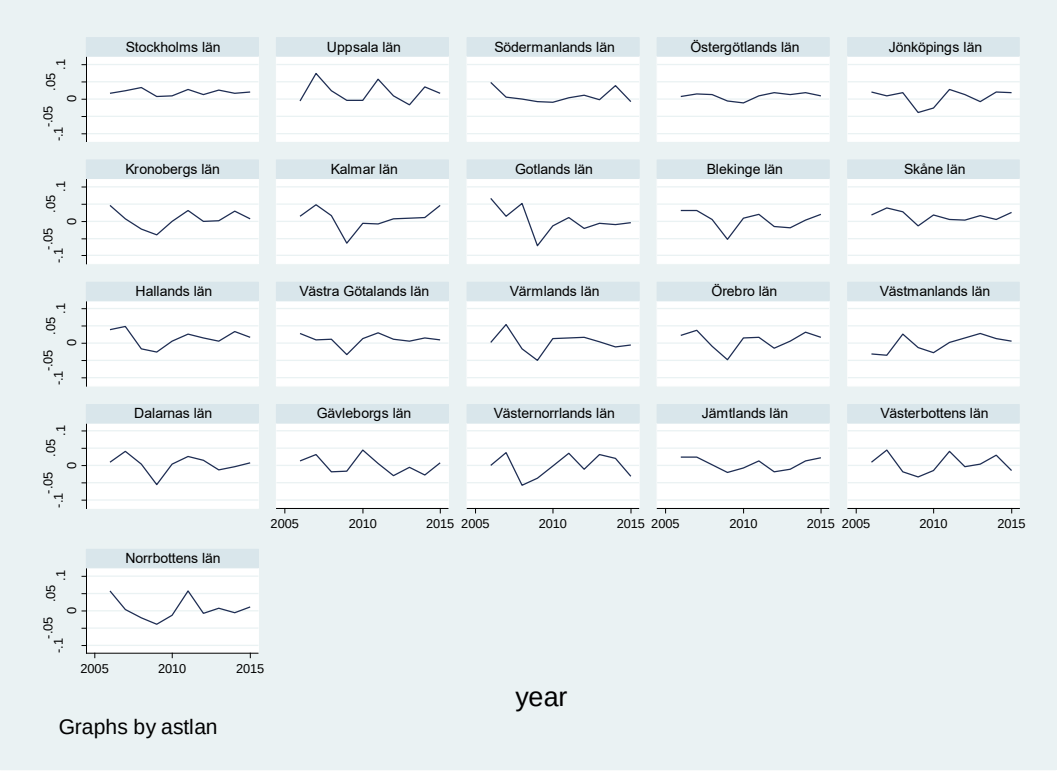

Figure 7: *Development of the regional employment growth by county.*

From figure 7, many counties exhibit a trend which somewhat resembles the decline around 2008 in GDP growth. The exceptions being Stockholms län, Södermanlands län and Östergötlands län. This gives more support for that the development was very stable for the counties of Stockholm and Östergötland. Considering the time period in full, many counties experienced a slight decline in employment growth. This was however not true for Stockholms län, Östergötlands län, Jönköpings län, Kalmar län, Skåne län and Jämtlands län, which returned towards the initial levels. The implication being that stable growth rates of employment over a longer time period more often are found in southern counties. Given the levels, there are no particular group of counties that stands out.

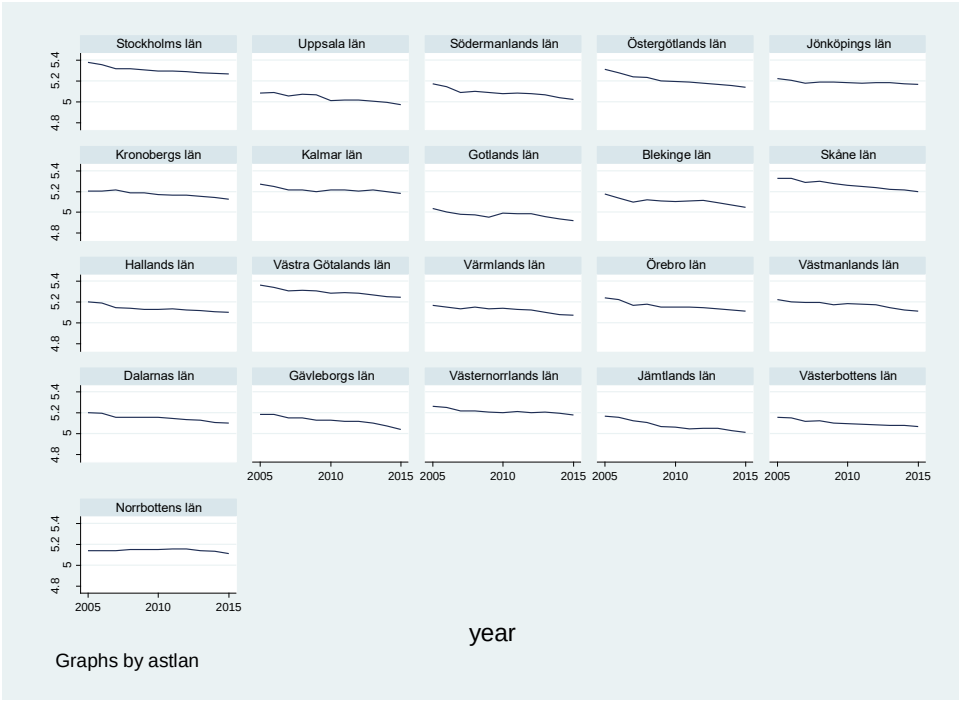

Figure 8: *Development of unrelated variety for the respective counties.*

It is interesting that there is a general trend for all counties with declining levels of unrelated variety over time. This indicates that the industrial structure of people employed in the counties exhibit less of an equal spread over the different two-digit sectors found in each region. A possible implication of this being that the counties will be less likely to generate novel knowledge spillovers between unrelated sectors.

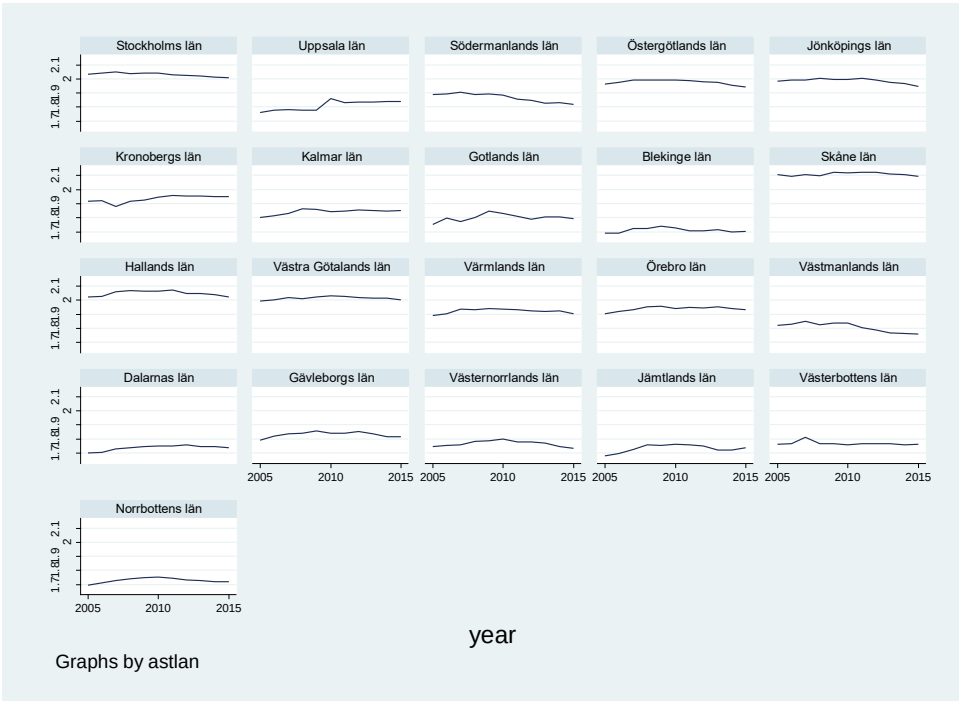

Figure 9: *Development of related variety for the respective counties.*

Related variety does not seem to exhibit a similar trend as was the case for unrelated variety. Considering the full period between 2005 and 2015, eventual trends and peaks are smoothened out and often returning to the initial levels. The results points towards the fact that employment at a five-digit level is exhibiting a stable spread on average within two-digit sectors of the respective counties.

The most striking is the big variation in terms of level between the counties. More southern counties such as Stockholm, Skåne, Halland and Västra Götaland exhibit very high levels of related variety. A possible implication is that higher levels of related variety are found in the metropolitan counties. This bears some similarities with the study of Aarstad, Kvitastein and Jakobsen (2016) on Norwegian regions. Population dense regions was in this study the ones that exhibited relatively higher levels of related variety. Since both counties such as Blekinge and Gotland as well as northern counties such as Västerbotten and Norrbotten exhibit low levels of related variety, there seems to be both a metropolitan-rural and north-south divide.

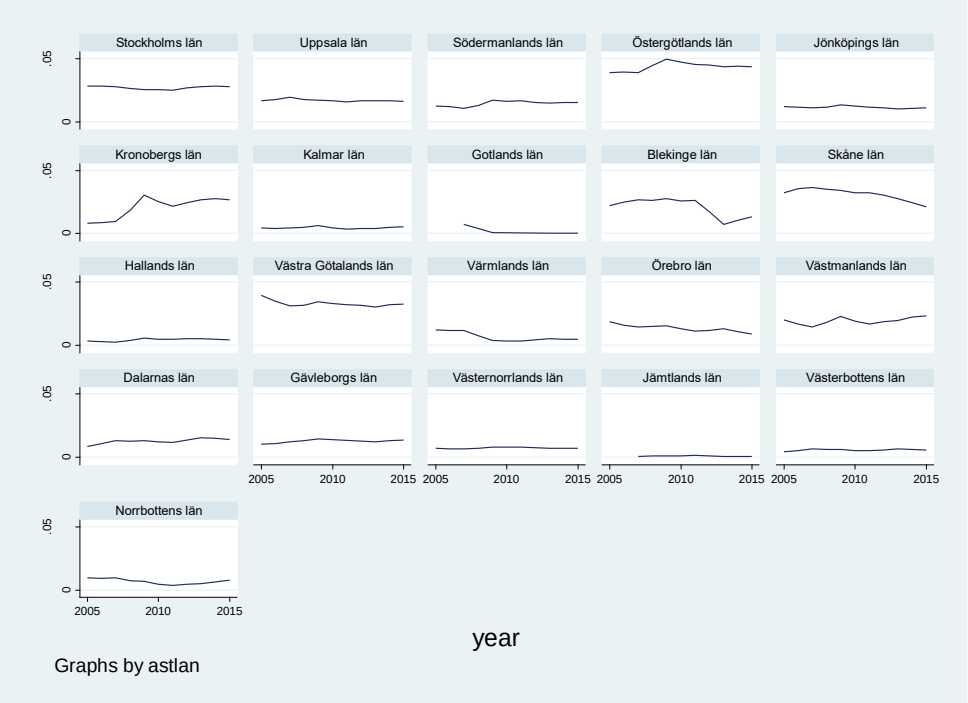

Figure 10: *Development of R&D intensity which serves as a proxy for the internal absorptive capacity for the respective counties.*

The general trend for the measured level of R&D intensity is a slow decrease. This also holds for the metropolitan counties of Stockholm, Skåne and Västra Götaland. There is although a big difference in levels between the counties, where Stockholm, Östergötland, Skåne and Västra Götaland all have relatively higher R&D intensities. Many of the northern counties such as Västernorrlands län, Jämtlands län, Västerbottens län and Norrbottens län, exhibit relatively low and stable levels. This is although not that surprising given that these counties do probably engage much less sectors which are knowledge intensive. For a clearer indication of its possible moderating purposes, the proxy needs some stability. I argue that the variable

for most cases do exhibit such a stability but will take a cautious approach later when analysing the effects given the knowledge of variation for some specific years and counties.

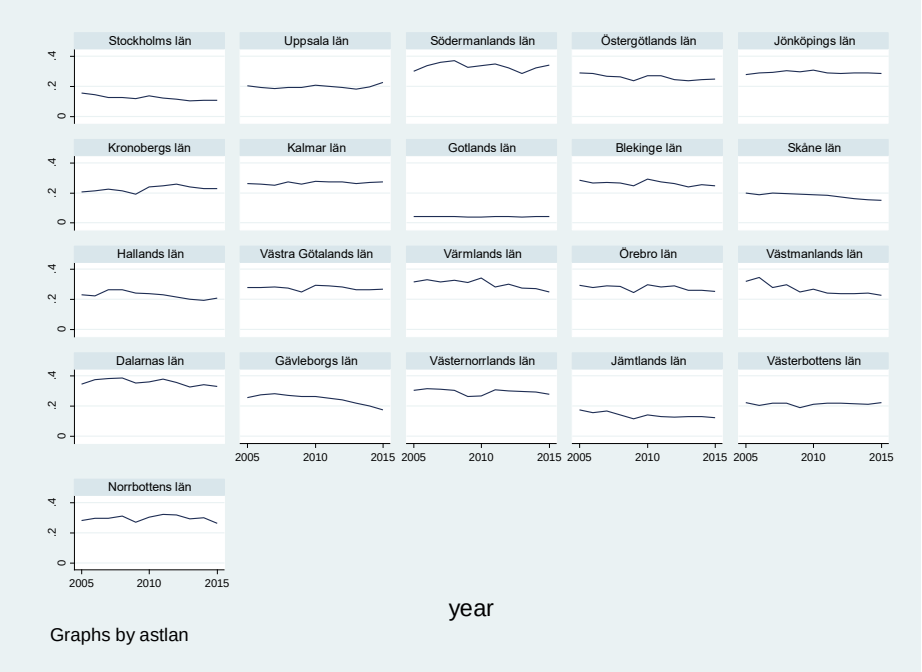

Figure 11: *Development of export intensity (production intensity) which serves as a proxy for the external absorptive capacity for the respective counties.*

The export intensity exhibit relatively less variation in comparison with the R&D intensity. The variable appears to be mostly stable over the time period of 2005 and 2015. It is interesting that higher levels of export intensity are found both in some southern and northern counties of Sweden. There is not the same divide between the north and south as were the case for R&D intensity. A hypothetical implication being that some northern counties which scored low on R&D intensity enjoys replacement effects by maintaining a relatively high export intensity. Alternatively, the measurement may be biased to some extent as discussed in the operationalisation.

Regression results:

	(I)	(II)	(III)
	Average GDP growth	Average GDP growth	Average GDP growth
N	221	221	221
Intercept	1.358221*** (.0747394)	1.323412*** (.0916987)	1.511526*** (.0916416)
Unrelated variety	-4.64858*** (.9583471)	-5.240432*** (1.004774)	-4.811599*** (.9356837)
Related variety	2.28046*** (.5500626)	2.659973*** (.584952)	1.850745*** (.5611948)
R&D intensity	17.10529*** (5.487973)	14.22281** (6.126363)	16.70802*** (5.335771)
Exp intensity	1.461331 (.9607276)	1.630254 (1.097228)	-.2095571 (1.166333)
Pop. density	.0049553*** (.0011939)	.0055207*** (.0013786)	.0026281* (.0015868)
Metro. dummy	.6792329** (.2600059)	.6357798** (.312926)	.876718*** (.2577822)
Unrelated variety * R&D intensity		-111.5142 (75.68285)	
Related variety * R&D intensity		104.3348* (60.20193)	
Unrelated variety * Exp intensity			-35.82814*** (9.410592)
Related variety * Exp intensity			17.7596** (8.734723)
Mean VIF	2.32	2.91	2.83
R-squared	.4233	.4339	.4625

Table 4: *Model 1 with alternative specifications. Statistical significance level: p-value: ***: sign. at 1%, **: sign. at 5%, *: sign. at 10%.*

I have estimated three different regression models based on model 1. This have been done with the intention to investigate a baseline model and compare these results with Fritsch and Kublina (2016), but also Frenken et al. (2007) who first introduced the measurements of related- and unrelated variety. Regression model II introduces the effect of the internal dimension of absorptive capacity multiplied with related- and unrelated variety respectively to yield the first moderating variables. Regression model III introduces the second external dimension to absorptive capacity and its relation to related- and unrelated variety. This stepwise introduction was due to concerns regarding multicollinearity.

When VIF-diagnostics were applied on the initial regression models, the mean VIF was very high. This was driven by the interactions between unrelated variety, related variety, R&D intensity and export intensity. I therefore decided to mean-centre these variables to remedy the multicollinearity issue. This was also done for the regression models based on model 2. The VIF-values after this transformation did not indicate a problem with multicollinearity for the regression models and is reported in the second to last row.

Unrelated variety did exhibit a consistent significant negative effect on average GDP growth. Related variety did on the other hand exhibit a consistent significant positive effect upon average GDP growth. The level of R&D intensity had a significant positive effect in all the regression models. Although, when it comes to export intensity, there was no significant for the base effect upon average GDP growth. Population density were exhibiting a positive significant effect on the average GDP growth and the same goes for dummy variable of metropolitan counties. Regarding the significance of moderating effects, the moderating effect of the first internal dimension in relation to related variety was found significant and positive. Regarding the second external dimension of absorptive capacity, it had a significant moderating effect on both unrelated variety and related variety with opposite signs. On unrelated variety it exhibited a negative significant effect and on related variety a positive significant effect. The absorptive capacity did therefore reinforce the effects, but in different directions.

	(IV)	(V)	(VI)
	Average Emp growth	Average Emp growth	Average Emp growth
N	202	202	202
Intercept	.4030396*** (.0790902)	.4504876*** (.0955134)	.591332*** (.0956276)
Unrelated variety	-4.246518*** (1.040597)	-5.052258*** (1.100975)	-4.761854*** (1.028671)
Related variety	2.121535*** (.5745242)	2.509852*** (.6106517)	2.16981*** (.5858105)
R&D intensity	5.451357 (5.621605)	4.780614 (6.217896)	5.281958 (5.498746)
Exp intensity	.9942472 (.9788169)	.1513753 (1.112885)	-1.469493 (1.213398)
Pop. density	.0043823*** (.0012289)	.0038751*** (.0013998)	.0007076 (.0016571)
Metro. dummy	.4486506* (.2709235)	.7734582** (.323091)	.5771978** (.2716374)
Unrelated variety * R&D intensity		-258.8188*** (88.31561)	
Related variety * R&D intensity		76.24502 (63.09039)	
Unrelated variety * Exp intensity			-30.44741*** (9.960751)
Related variety * Exp intensity			-4.3086 (9.022066)
Mean VIF	2.34	3.02	2.90
R-squared	.2892	.3195	.3286

Table 5: *Model 2 with alternative specifications. Statistical significance level: p-value: ***: sign. at 1%, **: sign. at 5%, *: sign. at 10%.*

Model 2 have also been used to formulate three different regression models with a stepwise introduction of the moderating variables. Similarly to the models estimated by Fritsch and Kublina (2016), the model is based upon average employment growth rather than average

GDP growth. Due to the different regressands, some caution should be taken when comparing the results of these regression models in relation to the results yielded by the three regression models based on model 1.

Unrelated variety did exhibit a negative significant effect on average employment growth across all models. Related variety did also turn out to be significant across all regression models, affecting the average employment growth positively. R&D intensity was not found significant in any regression model. In the case of export intensity, there was also no significant effects from the variable upon average employment growth. The variable of population density was for the most part positively significant and the metropolitan dummy variable was positively significant in all regression models which could be expected. For the moderating variables of model 2, the first internal dimension of absorptive capacity on unrelated variety was found negatively significant. Regarding the second external dimension of absorptive capacity, it was also negatively significant in relation to unrelated variety. There were however no significant effects for the two moderators of absorptive capacity on related variety.

4.2 Discussion

The results from both regression models provide evidence of the positive effect of related variety upon county GDP growth as well as county employment growth for Sweden between the years of 2005-2015 and 2006-2015 respectively. This positive significant effect is in line with results provided by Frenken et al. (2007). When the case of the Netherlands was assessed, they found that positive effects on growth in productivity and employment was provided by related variety.

If we look at the development of the level of related variety over time for Swedish counties in figure 9, no clear increasing trend at slow pace emerged as was the case for Finnish regions over the time period of 1993 – 2006 (Hartog, Boschma & Sotarauta, 2012). If anything, the level of related variety does appear to be rather stable over time. The most striking is the clear distinction in levels between metropolitan and rural counties as well as northern- and southern counties. In the case of the development of the level of unrelated variety accounted for in figure 8, the level of unrelated variety seems to slowly decrease in all Swedish counties. In the case of Finland, the level of unrelated variety exhibited a more stable trend over time. This was explained by the fact that during the studied period the Finnish economy experienced an exceptional structural transformation, where high tech sectors rapidly became more dominant in the economy. Individual companies like Nokia were rather prominent in this process (Hartog, Boschma & Sotarauta, 2012). Given the stable pattern of related variety for Swedish counties, such exceptionally rapid transformation did not occur in Sweden over the same time period. A transformation where firms in the high-tech sectors branched out significantly into related sectors of the economy. The overall implication of the trends from Swedish counties

could be that they are becoming increasingly specialised given that the level of unrelated variety declines over time.

Evidence gathered from U.S. commuting zones provided by Hu and Liang (2018), indicated that related variety was relatively more beneficial for manufacturing sectors. The authors reasoning is that this is due to product innovations being more prominent to this sector. Product innovations were expected to be greatly affected by intersectoral knowledge spillovers which are ultimately caused by related variety. The results from this study although indicates that related variety is beneficial to a wider set of sectors of the Swedish economy, not just manufacturing per se. This is because related variety provided positive significant effects on economic performance in regression runs based on many more sectors than just manufacturing.

The implication of these results being that related variety appears to be favourable to the Swedish regional economy. Both with regards to generating growth and employment. A region therefore seems to need related variety and thereby processes of branching out into complementary and related sectors. I believe that related variety may induce sectorial variation which could result in a region evading a situation of structural unemployment and economic stagnation in the long run (Pasinetti, 1993).

Unrelated variety did on the other hand negatively affect both county GDP growth and employment growth for the same periods. Although unrelated variety also yielded a negative coefficient in relation to employment growth in the study by Frenken et al. (2007), it was not significant in this study. This is surprising results. Additionally, there is a rather striking distinction to results provided by Fritsch and Kublina (2016), given that they found that unrelated variety did positively impact regional employment growth. They relate this result to studies from the UK and Italy where unrelated variety have been a positive source of growth but mainly for manufacturing industries (Bishop & Gripaios, 2010; Mameli, Iammarino & Boschma, 2012). One possible reason for the diverging results could then be that this study has not examined the effects upon individual sectors such as the manufacturing industry. Another reason is the difference in the type of studied regions. Whereas this study focused on the county-level, Mameli, Iammarino and Boschma (2012) studied the effects on Italian labour markets areas. Such regions are often defined through commuting pattern relationships between urban centres and the hinterland (Eurostat, 2019). It might be the case that counties are too large in order to catch any potential positive effects stemming from unrelated variety, given that counties both cover areas of cities and the hinterland. A hypothetical prediction is that a smaller setting might make it easier to find productive use for unrelated knowledge.

The results which emerged out of the regression models based on model 2 is also conflicting the results of Firgo and Mayerhofer (2016). Between the years of 2000 and 2013, regional employment dynamics in Austria were positively affected by both unrelated- and related variety. For growth of employment, the results did actually indicate that employment growth was ultimately caused by unrelated variety for the same years. One of the implications for regional development that did stem from the study of Firgo and Mayerhofer (2016) was that urban regions should exploit related variety in providing growth of employment, provided that the region is relatively technologically advanced. Similarly, Hartog, Boschma and Sotarauta (2012) proposed related variety to generate positive growth effects only for high-

tech sectors. The implication being that regional technological intensity is important for a region to positively benefit from related variety in growth terms. I will return to these claims after discussing the results from my moderating variables.

The proxy for the internal absorptive capacity, R&D intensity, was not significant in the regression models based on model 2. It was however significant in relation to regression models based on model 1. When the coefficient was significant it emerged with a positive sign which could be expected. Regarding that R&D intensity was significant only in the relationship with GDP growth could possibly be explained by that R&D operations have a more direct effect on economic activities. The creation of jobs might come as a lagged effect to the economic growth. This reasoning is although speculative given the difficulty in detecting the casual link.

Export intensity which was introduced to proxy the external dimension of absorptive capacity was in itself as a base effect not significant. This was the case both in regression models based on model 1 and model 2. In itself, a more export intense environment on a regional level does not seem to induce any benefits in terms of GDP growth or growth in employment.

Population density did for the most yield a significant positive but small effect on both county GDP growth and employment growth. The effect for the metropolitan dummy did exhibit a relatively stronger significant positive effect. We must not forget that there may be other causes of growth effects than sectorial variation at work that we need to consider when discussing the development of regions. Effects of urbanisation economies seems to exist in Swedish counties. In general, it seems that more densely populated counties are positively related to growth and even more so for the metropolitan counties of Stockholm, Skåne and Västra Götaland. This could perhaps represent the simple benefits of the colocation of economic activities no matter the sectorial variation or composition (Hartog, Boschma & Sotarauta, 2012). The potential disadvantages from higher population density such as capacity shortages and congestions at a regional level seems to be overweighed by positive effects of urbanisation economies.

Lastly, we turn to the implications of the significant moderating variables. In the regression models based on model 1, a positive significant moderating effect of the internal absorptive capacity upon related variety emerged. The external absorptive capacity was however significant both in relation to related- and unrelated variety. In the case of related variety there was a positive sign and in relation to unrelated variety a negative sign appeared. This means that generally, the higher internal absorptive capacity, the larger positive effect of related variety upon average GDP growth. Speaking of the external absorptive capacity, the higher capacity, the larger positive (negative) effect of related variety (unrelated variety) upon average GDP growth. The positive (negative) base effect of related variety (unrelated variety) upon GDP growth and employment growth was amplified when considering the impact of the absorptive capacity.

In the case of the regression models based on model 2, both the internal and external absorptive capacity amplified the negative effect of unrelated variety upon employment growth. There seems to be empirical support for the idea that absorptive capacity works as a kind of mechanism that reinforces the effect of unrelated variety. Both through internal

networks within the region and in relation to the openness and external impact of the region. In relation to related variety, there was however no significant moderating effects. These results do in some respects support Fritsch and Kublina (2016). In their study the results indicated that absorptive capacity only moderated effects of unrelated variety upon the growth of employment in West German regions. The results from this study indicates that higher R&D intensities and export intensities may induce knowledge spillovers between unrelated industries when assessing employment growth. However, in terms of GDP growth, R&D intensities and export intensities induce knowledge spillovers between both related- and unrelated industries. Although, there is a striking difference with Fritsch and Kublina (2016), since only related knowledge spillovers are beneficial in terms of regional growth.

In my analytical framework, I discussed back and forth whether absorptive capacity would be more closely related to related- or unrelated variety. On the one hand, there could be a relatively larger conceptual overlap with related variety given that relatedness and cognitive proximity arguably is central to both concepts. On the other hand, diversity of knowledge and new linkages would also be beneficial for the development of absorptive capacity. The results do indicate that the relationships between the different concepts are far more delicate and complex than I previously believed, since related- and unrelated variety emerged with different signs. As suggested in the analytical framework, the conceptual overlap between related variety and absorptive capacity might potentially challenge the task to disentangle the individual effects of the concepts. This could be the reason for why there are no significant moderating variables in relation to related variety in regression models based on model 2.

I therefore suggest that these results do not necessarily go against the claims made by Firgo and Mayerhofer (2016) as well as Hartog, Boschma and Sotarauta (2012). Some sort of technological advancement or intensity, what I would perhaps refer to as internal absorptive capacity, can accentuate the effects of related variety. It is although interesting that the same type of technological advancement or intensity may have detrimental effects on regional growth when reinforcing the negative effects of unrelated variety.

5 Conclusion

This thesis focused upon how absorptive capacity could be conceptually differed from related- and unrelated variety. The analytical framework found overlapping parts between the three concepts. In order to separate them, absorptive capacity was proposed to work as a mechanism which moderates the effects of related- and unrelated variety. This moderation is offered by one internal- and one external dimension of the absorptive capacity. Another aim of this study was to investigate how absorptive capacity as a moderator might affect how related- and unrelated variety affects regional growth. These aims were founded in the inconclusive results that followed the study of Frenken et al. (2007) regarding the effects of related- and unrelated variety. Additionally, the potential impact of absorptive capacity on these effects have largely been overlooked. Regional data was collected from all 21 Swedish counties between the years of 2005 and 2015 to investigate this empirically. In addition to the empirical investigation, a tentative analytical framework was also developed to fulfil the aims of this study. Generally, related variety emerged as a positive driver and unrelated variety as a negative driver of county GDP growth and employment growth. Results that is in line with Frenken et al. (2007) regarding regional growth of employment. A unique proposition of this study is that related- and unrelated variety have similar effects upon regional GDP growth as well. Absorptive capacity did appear to moderate both related- and (unrelated) variety, accentuating the positive (negative) base effects. In relation to employment growth did both dimensions of absorptive capacity affect the negative base effect of unrelated variety. In terms of GDP growth, the external dimension of absorptive capacity did affect both related- and unrelated variety, but the internal dimension did only moderate the effect of related variety.

5.1 Concluding remarks

It seems that Swedish counties benefit from a very specific type of variety, related variety. It provides economic benefits over time to these regions. Unrelated variety did have the opposite effect pinpointing the importance that related variety brings, new elements of variation but also related and similar at the same time. Knowledge spillovers which may be combined and complemented.

These results question the mechanism behind how related- and unrelated variety works. In the literature, unrelated variety is also proposed as an important source of growth while inducing radical innovations. In the case of Swedish counties, the task of finding practical use for unrelated knowledge does not seem to provide economic benefits since higher levels of unrelated variety reduces the growth rates of regional GDP and employment. The negative effect in terms of employment growth might also be explained by the difficulty in finding

other qualified jobs within a similar sector or industry in the region, given that there are high levels of unrelated variety.

I proposed that a way to differentiate absorptive capacity was to regard it as a diffusion mechanism which thereby moderates related- and unrelated variety, both locally within the region and with respect to external linkages. This could be proven for Sweden given that absorptive capacity did accentuate the effect of related- and unrelated variety. In the case of Swedish counties, unrelated variety reduced economic growth between the years of 2005 – 2015 and reduced employment growth between the years of 2006 – 2015. Related variety did on the other hand increase economic growth between 2005 – 2015 and increase the growth in employment between 2006 – 2015.

5.2 Practical implications

These results which indicate the advantages of related variety, supports the regional development framework of the smart specialisation strategy. A region should focus upon its core competences, maintain low export rates and branch out into sectors and activities which are related to these. The current core competencies should be the guiding factor in how regional development and diversification should take place. In the case of Swedish counties, such an approach to regional development may provide both growth of GDP and employment over time. The cohesion policy of the European Union seems valid and might be a way to enable all Swedish counties to achieve growth despite if the polarisation between urban and peripheral regions continues. The goal to provide growth for all regions of Sweden was articulated in the report SOU 2004:34 compiled by the Ministry of Finance.

5.3 Future Research and Limitations

One of the limitations of this study is the length of the studied time period. Regional development strategies often stretch over longer time periods than ten years. Future studies might go back longer in time and provide more answers regarding how these concepts relate to each other over longer time periods. A challenge with such an approach is that industrial classifications often are revised and vary therefore for different time periods. In this study, data had to be transformed since the studied period stretched over both the SNI2002 and SNI2007 systems of the Swedish Standard Industrial Classification. Future research could also focus on case studies on specific types of Swedish regions (metropolitan or rural) as well as specific sectors to investigate whether the results that appeared in this study are stable. There could also be studies at other levels of aggregation such as labour market regions. Could relatedness be measured in an alternative way than through related- and unrelated variety and SIC-codes? Maybe through tracking patent citations or collaboration structures? Lastly, while it seems relevant to think of absorptive capacity in two dimensions, I could not provide significant moderating results in all regression models. I raised potential issues with the county export intensity data in the operationalisation. Are there alternative methods to

proxy the external dimension of absorptive capacity which might yield more stable significant results?

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