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The unfinished convergence between East and West Germany

Patterns of Scale and Agglomeration Effects in East Germany

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Abstract

Since the economic convergence between East and West Germany has come to a halt, the lack of scale and agglomeration effects is assumed to be contributing to this trend of stagnation. This paper studies the development of patterns of these effects in East Germany with an emphasis on the German reunification and economic integration process while accounting for asymmetries between East and West. Existing literature on the reunification process, scale and agglomeration economies theory as well as agglomeration effects studies of East Germany are reviewed and interpolated with quantitative data. The findings have been put in a wider context of economic integration and new economic geography.

The findings reveal that scale and agglomeration economies are scarce and heterogeneously distributed across East Germany due to the Socialist mode of production and the transition period during reunification. The privatisation of the largely unproductive industrial stock in East Germany in combination with large-scale emigration have inhibited the formation of scale effects and industrial agglomeration on par with the West. Therefore, East Germany cannot exploit the effects of scale and agglomeration economies to the same degree as West Germany. It seems to be stuck in a disadvantageous position of economic asymmetry where it remains reliant on West German companies and their monetary and human capital. The urbanised core regions of the East, however, might assume a more central role in the German economy in line with their industrial past in the long term.

Keywords: scale effects, agglomeration effects, economic convergence, East Germany, economic integration, new economic geography

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1. Introduction

27 years ago, the German Democratic Republic and the Federal Republic of Germany reunified after decades of division. The reunification encompassed a political, economic and social integration of the formerly Socialist and Eastern Bloc member East Germany into the Capitalist state of West Germany. The high expectations prior the transition of East Germany into a democratic and free-market state were fuelled by political promises, most notably former Chancellor Kohl (Sinn, 2010: 2). Neoclassical growth theory predicted East Germany, and to a lesser degree other former Socialist states of Central and Eastern Europe, to rapidly catch up to West German living standards¹. Others, for example the economist Barro (1991: 1) expected the process to take a few generations. The views of Kohl and Barro exemplify the huge differences in expectations of the process of reunification. Both predictions have been proven wrong by history. There has been a substantial catch-up in productivity and income per capita, but a considerable gap between the two German parts remains. Currently, the level of productivity is about 70% of the West German level and the GDP per capita has reached 77% of Western standards² (BMW, 2016: 8).

Possible causes and factors of why the convergence has stagnated are fiercely discussed in the political and academic arena. Thus, a sober and empirical analysis of this transformation and integration process of a formerly Socialist entity into a democratic and free-market system is required. Previous research, as will be highlighted in Section 5, has often been guided by neoclassical or institutional perspectives. Furthermore, it focused on specific economic metrics or identified key policies as responsible factors in the convergence process. This paper offers a different perspective as it discusses the German reunification process using concepts associated with economies of scale and agglomeration, such as new economic geography. Economies of scale and agglomeration is a field with a longstanding tradition within economics that has gained increased popularity in recent years. Despite its popularity, its application on the East German case has been scarce and not sufficiently taken into consideration when explaining the stagnation of the catch-up process. I argue that a lack of scale and agglomeration effects in East are in part responsible for the halting convergence process. The patterns and

¹ The shortcomings of this theoretical approach are to be discussed briefly in Section 4.

² In fairness to all economic assessments in the early 1990s, the statistical records of the German Democratic Republic were fundamentally flawed, incomplete or even forged.

effects of this scarcity, such as business size, industrial concentration and networks are analysed both in a long-term and recent historical context. This angle on intra-German economic integration is necessary to understand how the systemic deficiency of scale and agglomeration effects prevent a self-sustaining East German economy. I believe the current academic accounts, even those mentioning agglomeration and economies of scale in an East German context, to be neglecting a more holistic analysis of the East German situation.

1.1. Aim and research questions

The paper aims to provide a more comprehensive picture of the recent development of East Germany by presenting a review and analysis of existing literature. It reconciles insights from research conducted on the East German convergence process with economies of scale theory and its related literature. Moreover, the analysis is showing whether the lack of industrial and business concentration has its roots in history or if more recent factors are coming into play. The paper accordingly contributes to the existing accounts of scale and agglomeration economies by laying the foundation for intensified research in later stages.

As the general research area of “*Why has East Germany failed to catch up to West German economic standards?*” is too vast to be treated adequately within the scope of a paper, a more precise question incorporating economies of scale is required. Since scale and agglomeration effects have a stimulating impact on productivity, one of the main gaps persisting between West and East Germany, existing patterns need to be studied. Hence the main research question for this thesis is titled “*How have patterns of scale and agglomeration effects in East Germany developed since reunification?*”. This main research questions blends into the wider discourse of economic integration between West and East Germany by analysing a specific part of the existing productivity gap. The research question hypothesises the lack of agglomeration effects as a result of lower business and industrial localisation and concentration, inhibiting self-sustained growth and innovation. Due to Germany’s longstanding history of industrialisation, the causes and effects of this scarcity can be either be attributed to historical and thus structural economic trends which persist to this day, but moreover be rooted in recent history. It might be a consequence of the Socialist legacy or the transition period, signalling a more

complex economic history of East Germany. The research further discusses if the prevalent conditions of East Germany hamper agglomeration and consequently higher productivity. It is uncertain whether the lack thereof is capable of turning into a vicious instead of virtuous cycle due to asymmetric internal and external scale effects between East and West. Thus, the sub question researched is titled: *“Has the reunification of Germany mitigated long-term historic trends or has it reinforced a core-periphery relationship?”*. Economic integration does not always occur smoothly and in a mutually beneficial way. It might be possible that the integration process has left East Germany in a disadvantageous position where it is dependable on Western transfers, investments and companies instead of possessing these capacities itself. Researching this relationship can therefore reveal focus points for East Germany’s future economic trajectory

2. Background

2.1. Regional differences within Germany in a historical perspective

Structural economic differences between German regions date back further than the post-World War II division of Germany. While there had certainly been a West-East differential of economic activity and industrial production the typical West-East differential did affect Germany not to the same extent as it does nowadays. What follows is a brief depiction of the regional divergences of Germany pre-World War II to set the basis for the wider historical context in which Germany’s economic divergences were allowed to persist. Key factors of this background will also come into play in the later analysis.

The eastern Prussian provinces of Pomerania, (East and West) Prussia, Posen and to a lesser extent Silesia and Brandenburg were historically shaped by a legacy of feudal remnants and agricultural economic activity throughout the 18th and 19th century. Even though clusters of economic activity, such as Danzig, Stettin and Berlin were significant industrial and trade spots, urbanisation rate, as indicator of increasing economic activity, was lower than in other southern Prussian provinces (Anhalt and Silesia) (Bohler und Franzheld, 2010). While the feudalistic agricultural economic production, due to serfdom and the Junkers, was prevalent throughout Prussia, the relative backwardness of the northern Prussian regions can to a small extent be attributed to the legacies of several military incursions throughout the past centuries, beginning with the Thirty Years’ War,

which set Brandenburg and Pomerania back due to extensive population losses³. This, however, is also applying to previously more agricultural and economically less important regions in southern Bavaria, Baden and the Palatinate which were severely shaped by the French scorched earth policy of the 17th and 18th century. Moreover, low population density-regions in the North and North West of Germany had similarly low rates of physical capital accumulation and urbanisation movements like these Eastern and Southern German agricultural regions. Consequently, while there was a European and minor German West-East differential of industrialisation and agricultural prominence, it was not a clear-cut West-East phenomenon towards the early 20th century (Wyrwich, 2012: 430).



Graph 1, Source: *The German Empire, 1871–1918* (Encyclopædia Britannica, 2017)

To further illustrate the differences of regional economic difference before the end of World War I, one needs to look at the early centres of urbanisation and industrialisation. These were on the one hand linked to local availability of resources and traditional economic production, such as mining and textiles. The Rhineland and Saxony were the earliest centres of industrialisation in Germany due to the abundance of coal and iron ore in the Rhineland area and Ruhr valley. Further, Saxony (both province and formerly Kingdom) and Thuringia emerged as the early innovators in machine-manufacturing in

³ During the Thirty Year’s War, the population of the back then German lands of the Holy Roman Empire (including Bohemia) suffered population losses of about 30-60% (Kamen, 1968: 86), the regions in the North East and South West being the most heavily affected by fighting and famine.

Germany, enabled by local resources such as coal, but further by strong historic traditions in craftsmanship and international trade in the cities of Chemnitz, Dresden, Leipzig, Dessau and the region bordering former Bohemia (Wyrwich, 2012: 427). Similarly, Prussia's historic regions (Brandenburg, mostly) underwent industrialisation in the mid-19th century as a result of industry-oriented policies which were to manifest and reinforce the strong industrial interventionism of the state in the *Gründerjahre*⁴ (Harder, 1969: 78). Related to this, the regions of today's Hesse and Baden-Württemberg similarly emerged as one of the early industrialising regions of Germany, which together with Saxony, Brandenburg (Berlin agglomeration) and the North Rhine-Westphalian region were considered the wealthiest and most industrious regions of Germany towards the onset of World War II. With the establishment of more urbanised areas in these aforementioned regions, clusters were able to develop as the early trends of industrialisation were reinforcing accumulative growth through modern education, one of the key factors of the German industry towards the end of the 19th century (Lee, 1988: 348).

While the accounts of the German post-WWI economy are somewhat unclear and lacking in detail, one can deduct that the trends persistent before the onset of the First World War continued to boost economic growth in West and Middle Germany, with Berlin as the centre of industry in the still predominantly rural province of Brandenburg. However, with transportation networks expanding, rural parts of German got increasingly enclosed and formerly agricultural regions developed industrial centres around their biggest cities (Augsburg, Nuremberg, Munich, Hanover, Brunswick). Thus, it seems clear that the regions dominating the early phase of German industrialisation continued their standing in economic relevance very much until the start of World War II, when industrial activity was dominated by war machinery, which was subsequently depleted after air raids, the dismantling of East German industry by the Soviet Union, or the loss of the East German provinces of Silesia, East Pomerania and East and West Prussia (Eickelpasch, 2015: 445). This brief excursion in Germany industry highlights that Germany did not exhibit the nowadays typical West-East divide. Rather, there have always been economically more advanced regions within Germany, but not necessarily along the same geographical lines as today.

⁴ The *Gründerjahre* refer to the early decades until the 20th century when economic and population growth were fuelled by the unification of German territories, industrialisation and monetary reparations as a result of the Franco-Prussian war, leading to a construction and economic boom.

2.2. The partition and reunification of Germany

This section briefly presents an outline of the German division and reunification process to showcase the initial and resulting political and economic landscape of Germany post World War II until reunification.

After the capitulation of the National-Socialist regime in 1945, the allied powers divided Germany into four sectors under their respective political administration. The three sectors under American, British and French rule were to be transformed into the Federal Republic of Germany (West Germany), whereas the Eastern part turned into the German Democratic Republic (East Germany) under Soviet custody. As noted in the previous section, the former German territories of Silesia, East and West Prussia as well as parts of Brandenburg and Pomerania were incorporated into the new Polish state and Kaliningrad Oblast (Ploetz, 2008: 1493). With the political and economic division of Germany, previous trade and industrial ties were severed and with the subsequent economic and political pathways, the divergence of Germany got further deepened, as the Federal Republic of Germany embraced a democratic and social market economy, whereas the German Democratic Republic followed the Socialist development path of a centrally planned economy. While West Germany was allowed to build up its economy in a competitive, international fashion, East Germany had to suffer from a transfer of industrial capital and production to the Soviet Union as part of reparations⁵. The economic growth numbers for the initial period of this division clearly showcase the economic divergence apparent. West Germany grew on average 5.9% per year in the years 1950 to 1973, East Germany, in comparison, reached similar growth numbers only in the 1950s, with a continuous decline of growth rates afterwards⁶ (Damgaard Hansen, 2001: 360; Ritschl: 1995: 50). Moreover, the West German economy sustained an export-oriented economy with high productivity, whereas East Germany served as main centre for heavy industrial production as part of the COMECON⁷ of Central and Eastern Europe, thereby possessing little of the competitive and diverse economic structure of the West, despite efforts of the respective administrations to win the “system battle” during the Cold War.

⁵ Not only did the Soviet Union extract capital equipment from East Germany, but more importantly, there was a strategic relocation of significant East German companies to the West and South after the Second World War, anticipating the division. This is a major point to be discussed later on in the paper.

⁶ I decided against the use of specific TFP and GDP growth numbers in the case of East Germany due to conflicting data sets and lack of reliability concerning statistical accounts of the German Democratic Republic.

⁷ The COMECON (Council for Mutual Economic Assistance) was an organisation created in 1949 to coordinate economic development between members of the Soviet bloc (Ploetz, 2008: 1468).

Towards the 1980s, the German Democratic Republic, despite democracy movements in the Eastern Bloc, initially continued to pursue a policy of isolation. Due to internal unrest and an economic downturn at the 1980s, however, East Germany could no longer withstand the internal and external pressure and the Socialist regime faltered, resulting in the German reunification of East and West in the beginning of 1990. This reunification process included an economic, monetary, social and political integration of East Germany with West Germany. The economic integration, as debated in this paper, was complex, however, as the infrastructure and capital endowment, on the one hand, and the competitiveness and productivity of East German companies, on the other hand, were far below Western standards. Consequently, the German government introduced the Treuhand agency⁸ to manage the privatisation and modernisation of the East German economy, leading to mass-closures and mass unemployment. The modernisation of East Germany from then on was to be supported by massive monetary transfers from the West as part of the common welfare union which had to absorb the surge of pensioners and unemployed workers. Due to space limitations, the economic development of East Germany since reunification is visualised and summarised in Chart 1. As the calls for similar living standards increased, the monetary integration was politically motivated. An exchange rate on parity with West German levels was established against professional advice (Sinn, 2000). Besides the economic integration, East Germany needed to be politically and socially reunified with West Germany. This entailed absorbing the surge of unemployed workers and pensioners from the East by either transferring Western institutions to the East or by simply absorbing the Eastern population into the existing Western welfare and social system (Ploetz, 2008: 1479).

East Germany (EG) / West Germany (WG)	1991	1995	2000	2005	2010	2015
GDP per capita EG in % of WG	43 ⁹	66	66	68	72	72
Productivity EG in % of WG	-	-	69	71	74	77
Unemployment rate EG in % of WG	165	163	221	187	196	161

Chart 1, Source: *Economic data East Germany* (BMW, 2016: 2; 6; 19)

⁸ The Treuhandanstalt was an agency to manage the selling and restructuring of the publically owned operations (VEBs) of East Germany after 1990 (Ploetz, 2008: 1500)

⁹ The very low number of productivity with subsequent sharp rise is the result of an initial collapse of reunification and the closure of thousands of companies.

3. Research design and methodology

In light of this historical background, this paper reviews the case of agglomeration and scale effects in East Germany from a historical and recent perspective. Due to the peculiarity of the East German case based on its Socialist legacy and the transformation and integration process since the 1990s, the analysis is primarily focused on East, and for comparative reasons, West Germany, as the research aims to provide an answer to the question of “*How have patterns of agglomeration in East Germany developed since reunification?*”. This indicates an exploratory and descriptive research question, and thus does not strictly pursue an inductive or deductive research strategy, as exemplified by the mixed-methodology approach in this research (Bryman, 2012: 631). The subordinate research goal is moreover to shed light on the question “*Has the reunification of Germany mitigated long-term historic trends or has it has reinforced a core-periphery relationship*”. This means that the research goes beyond a simple causal model of assuming a linear relationship between history and agglomeration, but instead leaves space for the possibility of self-sustaining forces. The question implies that agglomeration effects in East Germany may not only constitute an outcome, but can possibly be the cause of negative factors influencing agglomeration, as explained in the theoretical framework.

3.1. Data collection

In a first research step, the theoretical framework has to be established. As this work combines scale and agglomeration effects with context-specific insights from economic integration and economic geography, the most prolific works in this theoretical field are analysed and brought together. They are then finally operationalised for research purposes, while the theoretical context shall later be applied in order explain the quantitative and qualitative findings.

The second step consists of an extensive literature review of the the topics of German reunification in relation to the lack of convergence, agglomeration and scale effects theory, and lastly a brief overview of relevant works combining agglomeration and scale effects in the East German case, if available. An overview of this literature will be presented later, but further central findings from these selected works as well as further research will be included in the main analysis.

Thirdly, the data collection for the main research and review takes place. This includes descriptive quantitative data such as statistics, charts and maps as well as trendlines, but further analytical insights based on secondary research. These will mainly aim to cover the indicators set out in the theoretical framework and can be found as part of official governmental reports (German government or Statistisches Bundesamt), but also as data from previous research, granted it has either been peer-reviewed or verified by a research or higher education institution (Bryman, 2012: 313, Flick, 2009: 50). The research is thus reliant on existing data and literature, which demands caution when using these data sets and a need to account for possible biases and inaccuracies. This also applies to the vast literature included in this research. There is an awareness of the shortcomings of using previous research and secondary data, however, there are neither the resources nor the time available to conduct quantitative assessments on a country-wide scale.

3.2. Data analysis

After the data collection process, the quantitative and qualitative findings shall complement each other in triangulation (Punch, 2005: 240). The quantitative data can thus either serve as mere example or visualisation of an indicator or factor, but it can also act as a focus point of discussion when analysing trends of urbanisation or business size, for example. The analysis consequently does not strictly separate the quantitative from the qualitative analysis of data, as it considers the combination of both as essential to meet the aims of this research. As the research concentrates on the patterns, relationships and to a lesser extent the effects of factors and indicators related to agglomeration and scale effects in East Germany, the literature and research employed will be filtered accordingly. The resulting findings of this extensive literature-based research will be discussed and their relevance to the research question highlighted under the umbrella of the entire theoretical framework, including the concepts of economic integration and economic geography.

3.3. Limitations

The scope of this dissertation does not allow for a full account of all agglomeration indicators presented in the theoretical framework. Furthermore, the research is limited by the time allocated to this paper. The focus will be on the most relevant indicators and

factors, given that data is available and reliable, especially concerning economic statistics from the GDR. The challenge is thus to accumulate the responding data and further link it with the previous research reviewed while sticking to the original scope of this paper.

Even though the thesis aims to provide a historically more holistic picture of the East German case in regards to numerous concepts of agglomeration economics, the validity on and comparability with other countries is limited. Despite East Germany's parallels with other Central and Eastern European countries in transition, the integration with West Germany adds too many particular factors to the analysis.

4. Theoretical background

In this section, the paper at first motivates the choice of the theoretical framework. In a second step, the theoretical framework of economies of scale and agglomeration is outlined in a more general sense to provide a brief overview of the theories and concepts of related theories. Lastly, the application of this theoretical framework is explained in more detail than in the previous Section 3.

The introduction of this paper referred to the shortcomings of neoclassical growth theory in anticipating the struggle of the East German economy to converge after the reunification of 1989/90. Neoclassical growth theory, here exemplified by Solow (1956) and Swan (1956), predicts an equalisation of factor prices due to capital and labour mobility as well as technological transfers. The economic integration of East Germany should have generated high growth rates as there was a massive influx of capital and investment initially and over time as part of transfers from the West to the East. The freedom of movement and labour in a common political state was guaranteed to even out wage premiums and technological transfers from West to East resulted into significant capital accumulation (Burda & Weder, 2017). Further, East Germany was augmented by the high human capital endowments necessary for absorbing the capital and technology transfer. Nonetheless, the convergence process of this economic integration came to an early halt. While accurate prognoses are more than difficult to achieve, the ability of neoclassical growth theory to explain the subsequent problems the German economy faces seems to be limited, as the institutional and economic ramifications of the reunification and economic integration are too distinct (Brakman & Garretsen, 1993). Asymmetric labour mobility can have a negative impact on the distribution of human

capital. Moreover, the analysis of state policies regarding public investment and wages can distort the market forces which are supposed to even development out. Since the German integration process has been defined by state intervention, new factors had to be added to the equation, such as currency parity or wage levels.

Furthermore, an institutionalist approach does not apply, as the institutional transformation of East Germany has been labelled more than a success and a facilitator of the ongoing convergence, considering East Germany rapidly adopted the free market economy, economic institutions and the democratic system. Unlike other transition economies, the Socialist and transition period legacy of high corruption, inequality and low societal trust have been largely avoided in East Germany due to sharing a common culture and a quick social and political integration (Burda & Weder, 2017). The consequences and preconditions of economic integration are accordingly not sufficiently covered by these two prominent approaches in economic historical analysis.

The theory required to identify the patterns and explain some of the causes of these diverging economic performances, as will be presented in detail in Section 6, entails agglomeration and economies of scale theories, since they are a fitting tool to shift the analytical attentions towards macroeconomic features of the German economy, both in past and today. As previous research focused on specific factors of neoclassical growth theory, namely labour movements (Uhlig, 2007) and investment policies and wages (Sinn, 1995; 2000), or simply treated low productivity as a given due to the Socialist mode of production (Darvas, 2013), the focus on agglomeration and scale effects enables the research to combine these factors. These effects, explained in the next paragraph, in theory amount into higher growth and productivity, as they both affect and reinforce these economic factors in an either virtuous or vicious cycle. Further, the emphasis on scale effects points towards possible distortions neoclassical growth theory cannot account for and thus complements the theory by an external factor.

4.1. Theoretical framework overview

The concept of economies of scale and agglomeration shall be combined in this framework. Economies of scale can be factors which decrease the average cost of a product or good as the volume of production through industry size (O'Sullivan & Sheffrin, 2003). These static *internal* scale effects can be further increased by dynamic

factors such as technological change as the production technique is being improved by learning processes, leading to a more efficiently run business. Industry and business size can moreover generate company formation effects as the location attractiveness improves.

External scale effects, also known as *agglomeration*, occur when economic factors such as capital (firms) and people (labour, consumers) locate near another, effectively eliminating transport and communication costs between another (Glaeser, 2010). Agglomeration can be roughly separated into two sub-categories, that of localisation and urbanisation (World Bank, 2009: 129). *Localisation* (Marshall, 1920) indicates a clustering of similar industries in proximity to each other. This leads to market expansion, attracting a high demand due to various sellers and producers. It can also pool the upwards and downstream supply chains for a more efficient specialisation and intensification of production among industries. The proximity between related industries thus further reduces the transport and transaction costs and can eventually, due to a higher location advantage, attract a productivity-enhancing labour force. Knowledge-spillovers are furthermore effects which are frequent in these clusters as a result (Krugman, 2010: 10). *Urbanisation* (Jacobs, 1969) constitutes another degree of agglomeration. The clustering of now diverse, and not only similar industries and sectors, can lead to a diffusion of technology and learning, both due to physical and human capital, creating the foundation for innovation. On top of this, urbanisation, in an economic sense, mixes the strengths of both a strong and diverse supply and demand side inducing endogenous growth, as the attractiveness of and profitability within the location increases (World Bank, 2010: 128, Jacobs, 1969).

The peculiar ramifications of the German case are too complex to be covered by one single theoretical framework. This is ameliorated by taking into account related concepts. In this case, *economic integration* (Siebert, 1990) and *new economic geography* (Krugman, 1991; Brakman & Garretsen, 1993) serve as guidance to strengthen the understanding of historical agglomeration and scale effects in Germany, and in particular East Germany, by putting these into a context of structural adjustment and geographical inequality. The concepts of economic integration aim at explaining the process of integrating two regional economies of different economic, political and social development stages. As neither neoclassical, nor institutional theory can wholly describe the shortcomings of the German reunification process, agglomeration and scale effects

need to be highlighted in light of economic integration. One needs to account for the influence of the economic integration process on these effects, but also vice versa. Economic integration between East and West Germany can increase the capacities of East Germany to exploit scale effects due to increased capital availability, but in contrast can stifle the human and physical accumulation and concentration process arising with different developmental states. The ambivalence of the relationship between these two concepts is thus subject of this research, as they can mitigate and reinforce each other at the same time, blurring any linear causality. This is when new economic geography comes into play, as it helps comprehending the forces which lead to geographical convergence of economies or potentially to core-periphery situations where a region depends on another.

4.2. Theoretical framework application and operationalisation

In practice, the theoretical framework's concepts work as vehicle and filter to gather information on the general subject of reunification and economic performance of Germany. By deciding on common themes and indicators, the research gets narrowed down and provides orientation towards the core literature and research. The main indicators are foremost the most common economic metrics, such as productivity levels and private and public investment patterns. These are used to refer to the economic activity, which the analysis of agglomeration indicators is trying to relate and establish a connection to after the multidimensional patterns of the latter are identified.

Detecting *internal scale effects* can be achieved by researching the average *business sizes* of industries and companies in Germany, and to compare the difference between those in the East and West¹⁰. On top of this, although with limited validity, a closer look at the location of the *biggest companies* in German economic history can reveal early and successive patterns of scale effects of German industrialisation¹¹. Urban economics

¹⁰ It should be noted, as pointed out in the limitations of the research design, that not all indicators are necessarily possessing validity. Average business size of industrial companies in the GDR was higher than in the West, but this did not inherently imply a high productivity, but rather an overemployment. Nonetheless, company size can be a competitive factor as it can facilitate the entry into international markets, as noted in the analysis (Rummel, 1997).

¹¹ In this paper, biggest company is meant in regards to revenue and employment taken together. Furthermore, the seat of headquarters should be taken into consideration, as the managing and research capacities tend to be located there as well.

further stress the related effects of the location of headquarters in terms of entrepreneurial skills and new company formation (Glaeser, Rosendahl & Strange, 2009).

External scale and agglomeration effects are operationalised by focusing on indicators of localisation and urbanisation. As the similarities between these two concepts can easily overlay in an urban context, the indicators used will generally be referred to as indicators of external scale effects, in other words agglomeration. Firstly, *human capital endowments* can be compared across regions as they capture the distribution of skilled labour-pools necessary to boost productivity. Furthermore, another indicator for high agglomeration levels is the private *per capita capital investment and research investment rate*, indicating a high potential for productivity, innovation and capital accumulation not attributed to the state. *Regional industrial clusters* can indicate a localisation of industry of the same or similar kind and point towards specialisation and intensification among suppliers. (Glaeser, 2010; Glaeser, Rosendahl & Strange 2009). Related to this proxy of innovation, a side effect of agglomeration, a spatial account of the location of German *hidden champions*¹² can be made, as they are able to indicate a specialisation and intensification of production. In a more general sense, *urbanisation and population development* are operators for urbanisation effects to identify the core regions of the West and Eastern German economy. These two indicators can be extended by including figures of the change of the *most populous cities* over time to account for the change of the regional economic centres in Germany throughout history, as standardised growth accounting is scarce for the the German economy prior to the 1950s and subject to forgery after the division due to ideological reasons (Burda, 2009). Lastly, *regional service and business clusters* shall be taken into consideration to demonstrate regional diversity and differences between dominant sectors and business types, as services tend to agglomerate and certain industries (capital-intense and innovative) are usually located in proximity to another, whereas light manufacturing companies do not rely on agglomeration effects as much (Rosenthal & Strange, 2004; Illy et al., 2009)

The paper does not cover specific indicators laid out by economic integration or new economic geography theory. Instead, indicators of scale and agglomerations effects are juxtaposed with the concepts from respective literature and research. In case of economic integration, the *allocation and sources of investment* can exemplify whether the

¹² Hidden champions are relatively unknown small to medium-sized businesses highly specialised and dominating in the global market (Simon, 2009: 15).

integration process is reliant on the state or whether economic actors have been contributing to the convergence so far. Moreover, evaluating foreign and domestic business networks can showcase East Germany's interaction within Germany and the rest of the world. *Trade and production ties* are related to the seat of headquarters and clusters. As these have been disrupted by World War II and German partition, their current state can be connected to population and urbanisation trends. This can also reveal the distribution and direction of economic activity between East and West. As local production is reliant on the size of the *home market* (Krugman, 1991), one can deduce whether the initial conditions and effects of privatisation and migration have had a long-lasting negative impact on urbanisation effects in East Germany. A pooling of a skilled labour force, the supply and customer relationships and knowledge-spillovers might hence be concentrated in the West and caused the East to develop into a mere extension of subsidiary production and consumption instead of playing an active part in the German economy (Ellison, Glaeser & Kerr, 2007).

5. Previous research

The following literature review highlights the most prominent works done on the German economic reunification process and the research conducted on agglomeration effects in East Germany. The literature on economies of scale theory is not distinguished here, as they have been employed in the theoretical framework.

The discussion on economic convergence post-reunification in Germany is extremely rich, which is why work related to the productivity-gap, considered one of the main factors for the lack of convergence, is foremost presented. Siebert (1990), similarly to the seminal work of Akerlof et al. (1990), analysed the initial conditions of the East German economy before the transition process, thereby depicting the complexity of the integration and reunification process. Central to his analysis are his findings concerning the low capital stock and the lack of productivity resulting from the monopolistic mode of central planning devoid of competitive forces. He further criticises the impending debate at the time on a rapid versus a slow transformation and integration process, which to this day is hotly discussed. Related to this, although only briefly mentioned, is the forthcoming uneven integration process which would leave East Germany disadvantaged in the long-term. He thus indirectly refers to later findings of economic integration and geography

literature (Brakman & Garretsen, 1993). Lastly, he points out sectorial differences between East and West Germany, and considers the lack of structural change, which was present in Germany and the industrialised nations at the time, to be one of the main hindrances of long-term convergence.

As one of the most prolific authors on this subject, Burda (2001; 2007; 2009) focuses on the effects of reunification on both East and West Germany which have led to a structural adjustment from West Germany in order to finance the transformation process in the East. He, too, recognises that convergence has come to a halt, but believes that as unit labour costs keep decreasing, that parts of East Germany, namely those which used to be productive, industrial centres of Central Germany prior to World War II to gain relevance again. His policy implications, like those of the agglomeration literature, stress the importance of regional support and policies. This topic gains relevance in some of his later works (Burda & Wedel, 2017), where he and his colleague paint a rather optimistic picture of the German convergence process in regards to income and consumption. Further productivity-enhancing investments are required to close the gap to more wealthy German states, as successful East German states such as Thuringia and Saxony catch up with poorer northern West German states.

Contrary to this, Sinn (1995, 2000), renowned for his scepticism and critical stance on governmental policies, mainly attributes the failure of convergence to the wage and investment policies of the government as result of popular demands. Consequently, East German wages lying above the level of productivity were reducing incentives to invest, which is exemplified by stark decline of private investment after 1995. Subject to his criticism is also the focus on construction investment and the ongoing monetary transfers from West to East Germany, based on his assessment that debt-financed subsidies lead to negative economic effects for both West and East. This factor is one of the main focus points in his later analysis (Sinn & Sinn, 2010), where he, unlike Burda (2009), still considers labour costs too high in East Germany, despite being below West German levels for once.

Albeit not being reviewed separately, insights from Ragnitz (2005; 2007), valuable for the holistic analysis of this paper, have emphasised the role of human capital in East German as part of the stagnating productivity. Despite similar educational attainments between East and West, managing and entrepreneurial qualities, factors closely related to network and thus agglomeration effects, are dissimilar. Causes are to be found as part of

the Socialist legacy, renowned for training in operational rather than entrepreneurial and innovative skills, and the transition process 1990, as privatisation and take-over of eastern firms by the West depleted the East of substantial sustainability potential, as existing networks and firm-level relationships got interrupted. These views are moreover echoed by authors such as Rummel (1997), Uhlig (2007) and Maseland (2014). The relevance of these findings, despite not specifically addressing the research question of this paper, can greatly help to understand the interconnecting issues at hand in the East German case and provide the analysis with a contextual foundation.

Concerning specific research and literature on economies of scale and agglomeration economies in the East German case, four major works¹³ are emphasised as the analysis partially builds on the methodology and findings of their analysis. Their brevity in this section can be explained by the fact that these papers are extensively applied in the analysis.

Rosenfeld, Franz & Heimpold's (2007) research identifies clusters in Germany in combination with network effects. Their findings are significant for this research as they essentially accumulate data on the "dependent variable" or outcome of this paper's study, agglomeration effects. Thus, this research can use their cluster and industrial concentration evidence to identify geographic patterns and regional strengths which could possibly be linked back to structural roots or policy interventions. Additionally, they attempt to link cluster formation with innovative activity (patents) and business networks and identified a structural lack of these in many East German regions¹⁴.

Similar to this work, Kronthaler (2005) measures the economic capability of East German regions and delivers congruent findings on the best and worst performing economic regions of Germany. The main difference between his work and Rosenfeld, Franz & Heimpold's (2007) work, however, is that he points out more multidimensional patterns of these regions' capabilities by stressing historical ties, entrepreneurial initiatives, industrial basis and regional accessibility, which are only given in three regions of the East. Nonetheless, the causal analysis of this research is limited to the known factors of

¹³ The research of this paper includes more than just these four articles. Due to limitations regarding the length of this paper, however, work, for example, by Brünow & Blien (2014) and Fuchs & Ludewig (2010) are not separately discussed in this section.

¹⁴ Their research draws on research conducted on the relationship between agglomeration and networks by Johansson & Quigley (2004), which is more general and did not include precise data on East Germany.

headquarter transfers, low R&D investments and a lack of regional focus from governmental policies.

Hornych & Schwartz (2009) pursue a strikingly similar strategy of identifying industrial clusters in East Germany, albeit with the notable difference that they exclusively focus on innovative activities in terms of patent applications. This occurs in combination with reviewing popular investment strategies pursued to foster clustering in the East. More importantly, their conclusion may be of relevance in the East German case considering they believe there is an inverted-U relationship between localisation and innovation, as too much concentration can hamper growth, emphasised in a later joint work of Illy et al. (2009)

As this paper tries to partially tie aspects of economic integration and new economic geography to the main theory of agglomeration and scale effects, the work by Brakman & Garretsen (1993) is helpful in facilitating this process as they highlight the uneven distribution and allocation of growth-inducing industries in Germany as a result of the privatisation in the 1990s. Despite Burda's (2009) positive assessment of consumption converging with West German levels, the demand in East is not enough to attract agglomeration forces of the supply side, as the West is more than able to continue producing while the East merely consumes. This is, as a result, a source of the lack of incentive for former pre-war East German companies to return. They exhibit a rigidity in terms of location, as analysed by Ottaviano & Puga (1997), and since emigration trends, albeit stagnating now, provide no basis for relocation and founding effects.

6. Analysis and discussion

The analysis is comprised of two parts. At first, the earlier introduced indicators for internal and external scale effects are analysed in terms of trends, changes, patterns and current statistics. The internal and thus microeconomic effects of scale economies will be discussed at the beginning. This means that they will mostly be treated separately, but occasionally transcending connections are made to account for the interconnectedness of these factors and their impact on scale effects. Thereafter, the analysis gradually moves towards bigger indicators of external scale economies in order to shed light on localisation and urbanisation effects. Finally, a summarising discussion brings together the preceding findings and analysis. It discusses them in terms of their significance in regards to the

theoretical framework and concepts previously outlined to explain a part of the stagnating convergence process of the German reunification.

6.1. Internal scale effects

6.1.1. Biggest businesses

A closer look at the the location and type of biggest companies can reveal pull-factors of certain regions. As the company size, at least on plant-level, can lead to productivity-enhancing effects, it is important to take the distribution of these companies and their headquarters into account, as the R&D as well as management capacities are closely tied to the location. In the German case, the location of the biggest companies by revenue and employment is heavily Western-centric. Out of the 100 biggest companies (Welt, 2014), only six are currently headquartered in the East, and four out of these six are located in Berlin, which due to its function as capital of Germany is an outlier. In this regard, even Berlin could not regain the economic prominence it possessed throughout the 19th and early 20th century when it was the financial and industrial capital. Instead, many of the most important companies, both in industry and services, can be found in West Germany nowadays, after they were relocated to avoid expropriation by the Soviet Union and Socialist party in the GDR. Well-known companies, such as Siemens, AEG, Telefunken, Borsig, Allianz, Deutsche Bank, all state-owned transport, mail and communication companies (Deutsche Bahn, Post and Lufthansa, for example) originated in Berlin. When it comes to East German companies in general, though, it becomes evident that the East did not possess the prowess of the capital city, but instead seemed, pre-1945, to be renowned for its middle-sized companies¹⁵ (Wyrwich, 2012). While the relocation was certainly disadvantageous for East Germany and Berlin in particular, most of the prominent companies of the West today were already some of the biggest pre-1945. The reparations (60% of the East Germany industrial capacities) and Socialist period did, however, affect the proliferation of existing companies as the lack of international trade and focus on trade with COMECON members did not result into many world-known companies, productivity and innovation deficits aside. As similar business networks and supply chains tend to locate closely together (Glaeser, 2010), the East certainly lacks the

¹⁵ Notable businesses originating from Middle Germany states are Auto-Union (Audi), Dresdner Bank (now part of Commerz Bank) and HASAG (military equipment).

pull-factors accompanying world-leading companies in terms of infrastructure, human capital and revenue. It should be noted that the economic integration process of East and West Germany did not lead to a relocation of now Western-based companies back to their original location in the East, further hampering the scarcity of headquarter-related effects of labour- and skill-pooling. East German company agglomerations, called *Kombinate*¹⁶, existing prior to 1989, split up as a consequence of the vast privatisation wave by the Treuhand agency. Thus, the biggest *Kombinate*, for example Bitterfeld and Robotron, were dismantled into their separate entities and were taken over by Western businesses. This implied an induction of investment in the 1990s, but in turn the headquarters and research facilities were henceforth based in the West in most cases (Burda, 2009: 3; Siebert, 1990).

6.1.2. Average business size

Another way of assessing economies of scale effects is analysing the average business size by employment. Data for West Germany reveals that 27% of the employees work for companies which on average have more than 1000 employees. In comparison, only 11,5% of East German workers work for a company of this category. When comparing middle-sized companies (500-999 employees), West Germany reaches 12% and East Germany 8% respectively (BMW, 2016: 17). This trend has shown to have remained steady, indicating that a change of company size structures after ten years of growth in both parts of Germany has come to a partial halt. These numbers exemplify that East Germany cannot exploit internal scale effects to the same extent as West Germany.

A direct comparison of average employment per industrial business between East and West Germany is even more striking, as it stresses the scale capability of the manufacturing sector specifically. The East (excluding Berlin) only averages 93 employees per industrial company, whereas West Germany averages 145. Even though labour pooling and concentration on plant-level only constitute a part of the scale effects, the difference nonetheless points towards a disadvantage in this regard, especially considering the prevalence of conglomeration during Socialism, where the average

¹⁶ A *Kombinat* is an incorporation of closely tied industrial businesses to one joint business, integrating subgroups vertically and horizontally within one administration (Ploetz, 2008: 1470). They possess a similarity to Korean *chaebol*.

industrial business size increased from 82 to 951 from 1950 to 1988 (Hauer, Kleinhenz & von Schuttenbach, 1993: 17). The average business size of East is nowadays barely above the level of 1950 and about a tenth of its peak in 1988. Comparing the company size over time, however, remains difficult due to the conglomeration of industries (Kombinate) during the last 20 years of the GDR. On top of this, size in the GDR could partially be explained by labour-intensity and low productivity and, again, due to overemployment. Hence it is difficult to estimate the ramifications of a less radical splitting up approach by the Treuhand agency in the 1990s and the subsequently lower industrial business size.

As plant size can correlate with increased productivity, the ability to compete in the globalised economy increases. Further, the increased company size in general can facilitate access to the global markets due to higher marketing and networking capacities. In addition, it allows avoiding escape financial bottlenecks in order to pursue more innovation-oriented market strategies. East Germany lacks these renowned and established companies and consequently, it cannot accumulate additional revenue from abroad (Rummel, 1997: 50). This plays a significant role in Germany's economic structure and emphasis on export-oriented manufacturing and goods, as exemplified by the share of export of the GDP, which is 28% for East and 34% for West Germany, indicating East Germany has made enormous progress in terms of adjusting to the international markets. When considering the share of exports in manufactured products, East Germany still exhibits a considerable gap of 13%, as its export ratio is merely 36%, whereas West Germany's is respectively 49% (BMW, 2016: 10). However, it must be stated that while big companies and brands attract investment and human capital, the German economy does rely on its well-known *Mittelstand*, consisting of small-to-medium-sized companies below 500 employees. Their role and location is to be discussed in the following section of external and localisation effects instead.

6.2. External scale effects

6.2.1. Human capital endowments

Both East and West Germany's educational attainments indicate a trend towards increasing shares in higher education. There is, however, a lag of this higher education trend between East and West Germany since 1993, as in relative terms 5% fewer East

Germans tend to possess university or university of applied science degrees. A wider margin can be observed between lower- and middle-education degrees, *Hauptschulabschlüsse* and *Realschulabschlüsse*, as *Hauptschulabschlüsse* have lost their popularity and usefulness in the past 25 years and never gained significance in the East¹⁷. Alongside this development, middle-education degrees prevail in East Germany due to the high incidence of vocational training (Barbarasch, 2012) instead of students pursuing higher education with the potential for working in knowledge-intensive sectors. On a regional level (federal states), the percentage of the population (fifteen years and older) with a degree in higher education in East Germany, excluding Berlin, is within the range of 14 – 17,5%, which is below the national average of 20%. Only on a county to metropolitan level, East Germany can exhibit endowments of human capital on par with West German counties and regions (Kronthaler, 2005: 745).

Despite noticeable differences in the educational demographics, the average educational attainment has never been completely inferior in comparison with West Germany, but was characterised by a different focus of education. Moreover, when lower- and middle-education-degrees are taken into account and compared over time, the average East German seems to possess higher educational endowments than West Germans nowadays. The relative endowment structure, bar university graduates, is thus less of a problem for labour pooling in agglomeration than the absolute endowments in terms the size of the labour force.

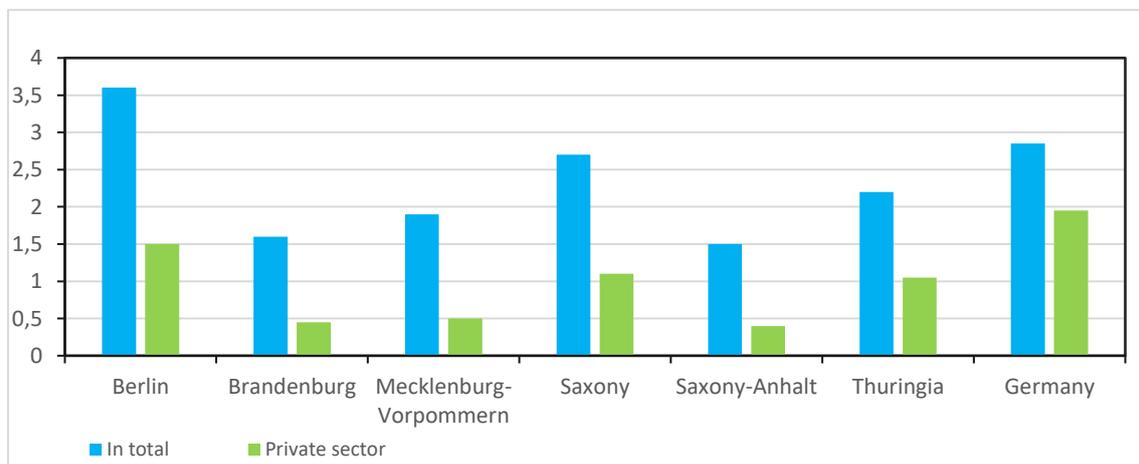
As elaborated in the section concerning urbanisation and population density, emigration has constituted one of the biggest problems the East faces, as emigration between 1950 and 2015 has depleted the population by four million, primarily young and educated people (Statista, 2017; Ragnitz, 2007: 144). Moreover, it has been argued that the current human capital available in East Germany is characterised by a lack of management and entrepreneurial skills (Kronthaler, 2005). This is, on the one hand, due to the scarcity of company headquarters in East Germany in general (Hornych & Schwarz, 2009), as discussed in the previous section, but also due to the Socialist legacy and educational training on the other hand. The Socialist education system and management structure emphasised organisational skills rather than entrepreneurial and managing qualifications,

¹⁷ Both *Hauptschule* and *Realschule* consist of six years of basic schooling with the opportunity to start a vocational training afterwards. The *Realschule*, however, is more theoretical than the *Hauptschule* and enables good graduates to complete their a-levels on Germany's highest secondary school with the chance of studying at university afterwards.

generating few entrepreneurs in all Eastern regions, and thus negatively affects crucial network, marketing and research capacities for agglomerations and business setups (Kronthaler, 2005: 456). Secondly, as Ragnitz (2005) noted, the existing stock of human capital in the East is underused in the current East German economic structure, as human-capital-intensive industries are scarce, further enforcing push factors of emigration.

6.2.2. Capital and research investment trends

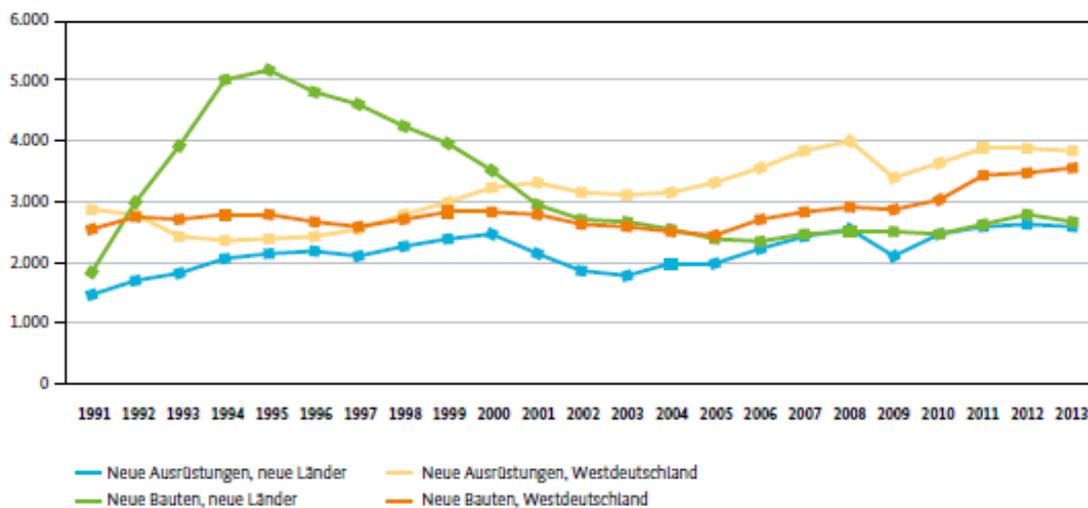
Recent trends for research and capital investments paint a negative pattern of persistently lower per capita investment rates in East Germany. On average, East Germany (incl. Berlin) reached an R&D investment rate of 2.5% of GDP compared to 3% in the West (Germany Trade & Innovation, 2015: 10). Taking Berlin out of the equation, East Germany only reached an investment rate of 2%¹⁸. Graph 2 moreover exemplifies a reliance on public rather than private, and thus less profit-oriented investments, as the contribution of private investments in the East equates to roughly a third of all investments. In comparison, Western Germany averages two thirds of private investment, highlighting the higher incentive for private capital to flow into West Germany.



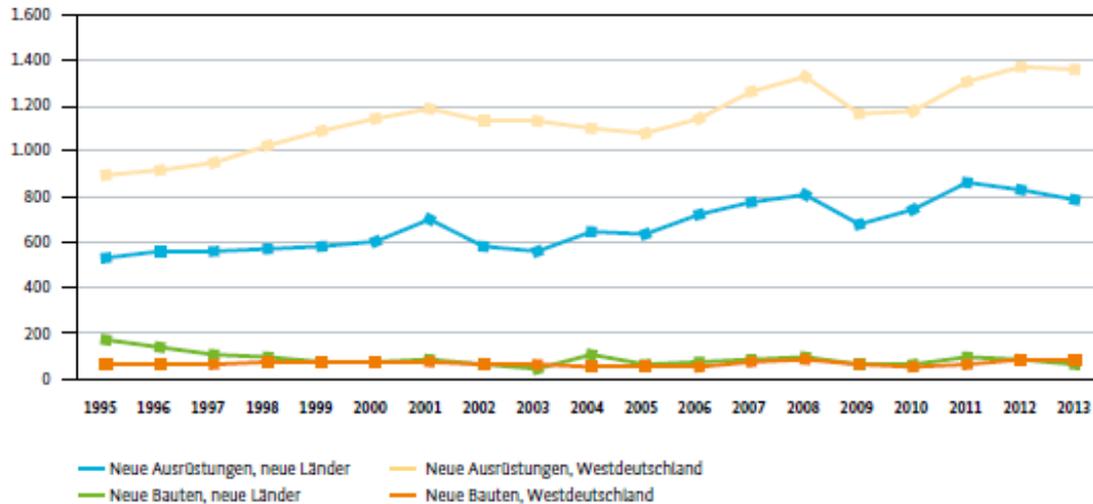
Graph 2, Source: *R&D expenditure as share of GDP in %, 2014* (BMWi, 2016: 10)

¹⁸ Berlin is taken out of the equation here as it has assumed a special role in Germany's economy due to being the political capital and the seat of numerous universities and research facilities as part of its history of division. The high numbers for Berlin are thus not representative of the East.

The long-term trends further illustrate that even during the initial burst of convergence, East Germany exhibited lower per capita investment levels (Graph 3), especially in manufacturing (Graph 4). As agglomeration economies, particularly that of localisation, can to be expected to affect productivity positively, the low rate of private investment and significantly lower level of per capita investment in manufacturing can indicate a slow growth of existing agglomerations in the East and a continuation of the productivity gap in future. These trendlines stress the currently lower attractiveness of East German industrial locations, as West Germany possesses favourable investment opportunities. Interestingly, while there is a consensus on the effects of too low investment levels in the East German economy in general, Sinn (2000) further deducted a mismanagement in existing investment patterns, as *too much* capital equipment had been added to the East German capital stock, resulting into overcapitalisation and consequently an underutilisation of the workforce, as emphasised by Ragnitz (2005), in capital- and knowledge-intense industries. Accordingly, investment incentives into new equipment have remained steadily lower than in the West and solidify the persisting gap (Graph 3 and 4). The continuation of lower investment rate, particularly private capital in R&D might have manifested itself as a result of the few growth- and innovation-generating industrial concentrations in the East, but more importantly, as various authors criticise the overcapitalisation, it had a growth-hampering effect and affected further agglomeration negatively, effectively constituting a cause and an effect.



Graph 3, Source: *Investments per capita in €* (BMW, 2016: 11), blue = new equipment EG, green = new constructions EG, beige = new equipment WG, orange = new constructions WG



Graph 4, Source: *Investment per capita in manufacturing* (BMW, 2016: 11), blue = new equipment EG, green = new constructions EG, beige = new equipment WG, orange = new constructions WG

6.2.3. Regional industrial clusters and localisation

After having established the location of headquarters, conducting a business size comparison and outlining human capital endowments as well as per capita investment trends, the identification and distribution of localisation and cluster effects will reveal the existing patterns. Data and graphs from Rosenfeld, Franz & Heimpold (2007), Kronthaler (2005), Hornyk & Schwarz (2009) and Brenner (2006) will be combined to complement the strengths of each research and point out conflicting findings.

The visualisation (Graph 5) of Brenner’s (2006) industrial clusters in Germany suggest a seemingly evenly-spread pattern of possible localisation effects throughout Germany. Neither East nor West Germany, apart from the Rhine-Ruhr Area and Baden-Württemberg, seem to be characterised by a clear division. It further implies a concentration of cluster and localisation activities in Saxony-Anhalt, Thuringia and Saxony, numerically outperforming Lower-Saxony, Hesse and Schleswig-Holstein. This is mainly due to the methodology underlying the calculations of Brenner (2006). Historical ties to established crafts, such as porcelain or the toy industry, which exhibit lower innovative and knowledge-intense properties, constitute a form of cluster activity due to specialisation in these industries. Nonetheless, the East, especially the southern regions of Western Thuringia, Saxony and southern Saxony-Anhalt, hosts a variety of specialised industries. The region between Leipzig and Halle is renowned for its chemical

industries since the 1960s to this day. Notably, Saxony has regained a few clusters in mechanical engineering, electronics and transportation and vehicle industries (Germany Trade & Invest, 2015: 11), highlighting an almost linear relationship with Middle Germany’s pre-war industrial traditions.

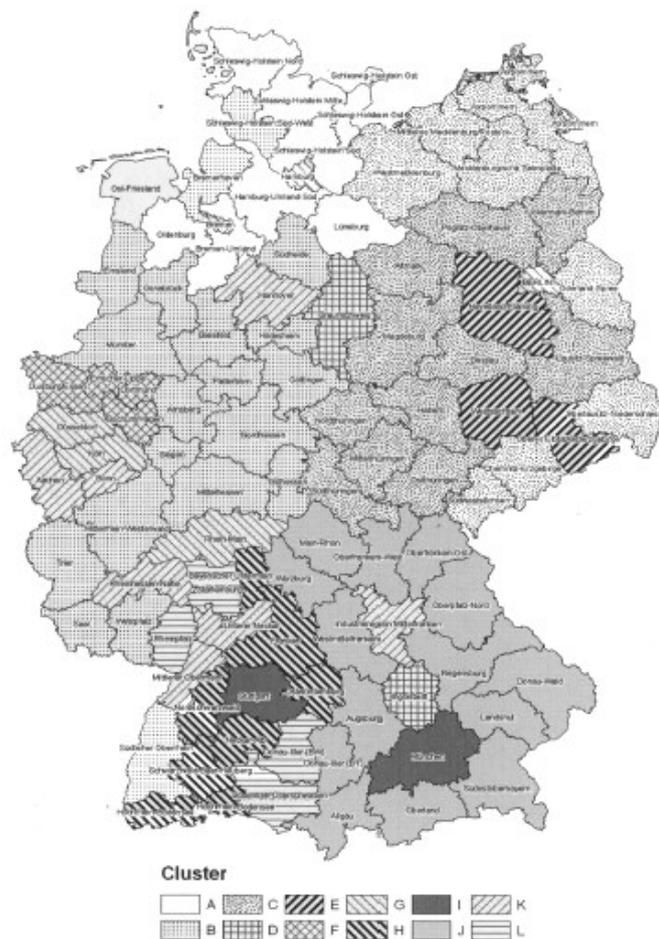


Graph 5, Source: *Industrial clusters* (Brenner, 2006: 1000)

What the calculations of Brenner (2006) do not measure, however, are the entrepreneurial and innovative capacities of these industrial clusters. A more precise account of the location of regional clusters is provided by Kronthaler (2005) and Rosenfeld, Franz & Heimpold (2007), as Kronthaler’s (2005) visualisation is based on a hierarchical ranking of the regional clusters in terms of a variety of indicators of economic capacity¹⁹. Following Graph 6’s legend, A – F symbolise a lower to middle economic capacities, whereas G – L indicate middle to high economic capacities. It thus becomes evident that the East, with the notable exception of Berlin agglomeration, Havelland/Fläming and Upper Elbe Valley (Dresden) and West Saxony (Leipzig + Halle a. d. Saale), possesses

¹⁹ The ranking includes patent applications, entrepreneurs, employees with a university degree, industrial and municipal investments, net migration, net business registrations, employment in industry and services (Kronthaler, 2005).

very little regional cluster activity. The author stresses that in terms of human capital and industrial employment, these few regions do relatively well, but in terms of innovation and industrial structures (Berlin excluded), they fall behind their Western counterparts (Kronthaler, 2005: 745). These capacities and regional cluster activities can be additionally assessed through the lens of networking (Rosenfeld, Franz & Heimpold, 2007: 74) and innovative activities (Hornych & Schwartz, 2009: 514). They underline the fact that the East of Germany, despite instances of industrial activity and clusters, cannot gain the critical mass to generate knowledge spillovers and establish regional customer- and supply chains as outlined in the theoretical framework, as Eastern clusters tend to be too weakly integrated into existing business and industrial networks as a direct result of the division of Germany, cutting century-old economic ties, as well as after reunification, when existing networks, either within East Germany or with other COMECON members were severed and replaced by lopsided networks with Western firms (Ragnitz, 2005; Johansson & Quigley, 2004).



Graph 6, Source: *Economic clusters Germany* (Kronthaler, 2005: 744)

Although not graphically visualised, the location of *hidden champions* can emphasise innovative localisation effects. According to the Handelsblatt (2012), the distribution of hidden champions is following the cluster patterns suggested by Rosenfeld, Franz & Heimpold (2007) and Kronthaler (2005). Saxony exhibits three smaller clusters of hidden champions, Thuringia one cluster and a substantial amount of hidden champion is found in the Berlin agglomeration. West Germany, in comparison, has a much higher degree of spatial concentration and distribution of these innovative middle-sized industrial companies, as they locate around the urban centres of West German cities. It is estimated that only roughly 75 out of approximately 1500 hidden champions are currently located in East Germany, including Berlin (Simon, 2009: 50, Handelsblatt 2012). This can be explained by the low degree of localisation effects, and thus vertical and horizontal specialisation and intensification in East Germany, as hidden champions are highly specialised and dominate in terms of market shares. It is also rooted in the Socialist past, as the average age of a hidden champion company is 67 years (Handelsblatt 2012), and thus precedes the reunification process. The data coverage is fairly static and does not capture any numeric long-term trends. Thus, one can only estimate that the current, low number of hidden champions of East Germany is the result of recent business foundations, as East Germany was characterised by big, interconnected conglomerates. Small-to-medium sized businesses had little incentive and resources to specialise such as Western, mostly family-owned businesses. These, on the other hand tend to express stickiness to their original location, showcasing the importance of historical traditions (Ottaviano & Puga, 1997). The currently existing medium-sized companies in East Germany had either too little time to adjust to the process of adaption in international markets so far, or they have been cut off from competitive forces for too long beforehand (Burda, 2007: 556). Based on the already low levels of agglomeration and related effects, this unequal distribution is likely to persist. Thus, it is not only the reunification process that has hampered the growth of specialised, innovative companies, but it is without a doubt still deeply tied to the aftermath of Socialist economic structures prevalent at the time.

6.2.4 Urbanisation and population development

The population of East Germany has undergone significant changes over the past 70 years. While the development of the population density follows rough historical patterns, with Baden-Württemberg, Saxony, North Rhine-Westphalia and the city states

leading in terms of density, the relative changes since the division are stark. As mentioned in the section on human capital, East Germany has since lost four million inhabitants, two million of these since reunification (Statista, 2017). As urbanisation effects are heavily reliant on available local markets (Krugman, 1991), this downward trend negatively affects incentives for suppliers and firms to locate in the East in general, as other urbanised core regions are more attractive in terms of potential customers.

Indicators	Population per km ²			Population in 1000s		
	1991	2013	%	1991	2013	%
Baden-Württemberg	280	297	6,1	10002	10631	6,3
Bavaria	164	179	9,1	11596	12604	8,7
Berlin	3876	3838	-1,0	3446	3422	-0,7
Brandenburg	88	83	-3,7	2543	2449	-3,7
Bremen	1691	1568	-7,3	684	657	-3,8
Hamburg	2209	2312	4,7	1669	1746	4,6
Hesse	276	286	3,6	5837	6045	3,6
Mecklenburg-Vorpommern	80	69	-13,8	1892	1597	-15,6
Lower Saxony	158	164	3,8	7476	7791	4,2
North Rhine-Westphalia	514	515	0,2	17510	17572	0,4
Rhineland-Palatinate	192	201	4,1	3821	3994	4,5
Saarland	419	386	-7,9	1077	991	-8,0
Saxony	255	220	-13,7	4679	4046	-13,5
Saxony-Anhalt	138	110	-20,3	2823	2245	-20,5
Schleswig-Holstein	168	178	6,0	2649	2816	6,3
Thuringia	158	134	-15,2	2572	2161	-16,0
Germany	225	226	0,2	80275	80767	0,6
East Germany (excl. Berlin)	135	116	-14,1	14509	12398	-13,9
West Germany	248	258	4,0	59967	6244	4,1
City states	2831	2820	-0,4	5826	5826	0,5

Chart 2, Source: *Population density and Population* (Destatis, 2015: 10)

Even as the East is losing population in relative and absolute terms (Chart 2), there is a general urbanisation trend in entire Germany towards the metropolitan cores after the heavy suburbanisation process in the post-war period. While four out of ten of the most populous German cities in 1939²⁰ were in the East, only three out of fifteen are now. This is not too surprising, as East Germany as a whole is less populated than West Germany. Contrary to East German cities, however, West German cities increased their population by a factor of 1,5 to 2 since World War II, whereas Eastern cities have lost a third or a quarter of their population since and are only slowly regaining an upwards trend, most prominently in Berlin, Dresden and Leipzig (Destatis, 2015: 13). The negative trend of net population loss was a direct result of the freedom of movement post-1989, but more importantly connected to the surge in unemployment after 1990 as part of the structural transformation, shock therapy and harsh wage differential (see data overview in Section 1). With opportunities having slightly improved, the trend of population loss has since stopped. Chart 2 moreover showcases that in regards to population density, Thuringia, Saxony and Saxony-Anhalt only match the less populated regions of West Germany. In comparison with the least populated regions of Brandenburg and Mecklenburg-Vorpommern, they still exhibit an advantage in terms of urbanisation.

But even with these three positive examples, East Germany is unable to attract local investment and setups of plants on a greater scale, as East Germany suffers from a too small and stagnating market size (Brakman & Garretsen, 1993: 168) and generally, as there are fewer metropolitan regions in the East, there is consequently a smaller variety of consumer products and inputs, a factor related to productivity increases. Further, as outlined in Section 6.2.5., there is a smaller potential for intersectoral spillovers as suggested by Johansson & Quigley (2008).

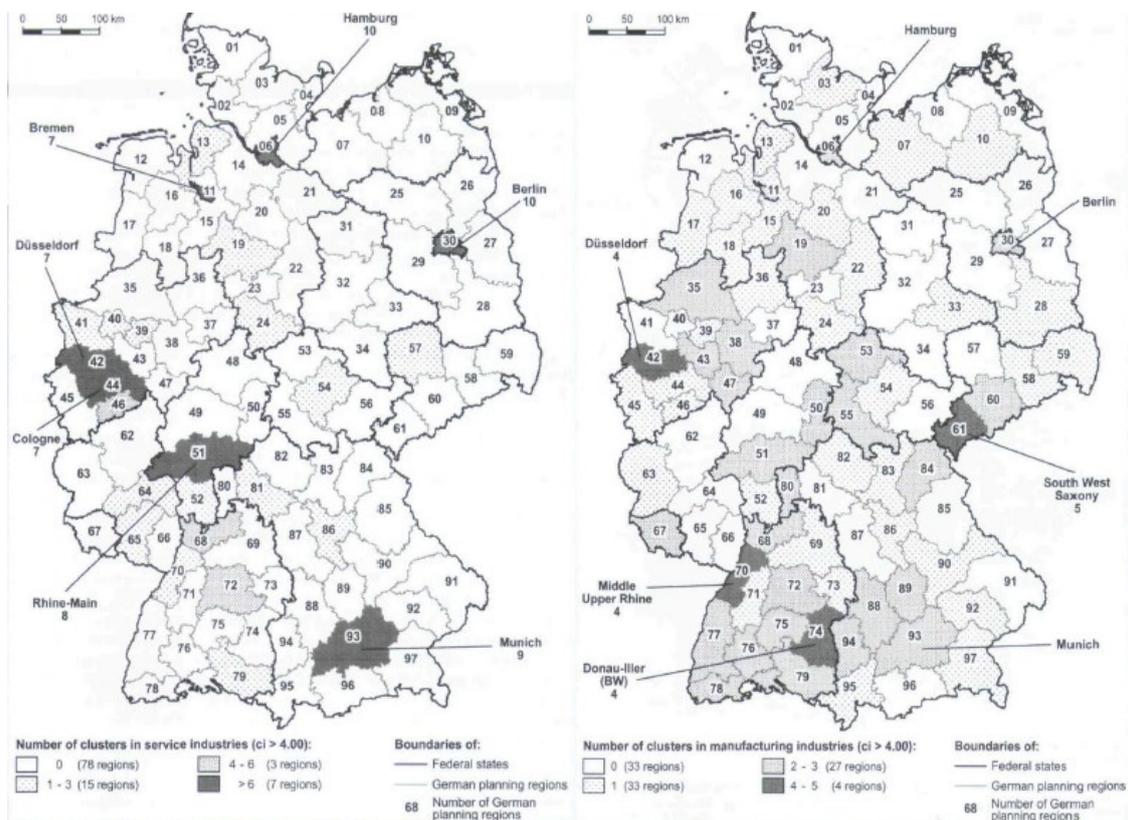
The reunification and closely affiliated migration process have thus perpetuated the net loss of human capital and consumers for the Eastern region, as wages levels and job prospects are only slowly recovering. The patterns at hand reveal a continued rural depopulation, but at least stagnating overall population in East Germany. Furthermore, there is a noticeable decline in absolute population and population density in the North of the Eastern region, which is in line with the historical trends since early industrialisation between rural and urbanised regions in Germany (Wyrwich, 2012). It accordingly mirrors

²⁰ This list includes Breslau, which at the time was still part of the German Reich, but not Danzig, as it was not formally part of German at the time and annexed later on.

the incidences of industrial clusters in the regions of the Berlin agglomeration, Saxony and parts of Thuringia. In terms of innovation, the lower level of living costs in East Germany may constitute a minor advantage over West German cities by attracting young and creative human capital in future, however. (Berthold & Neumann, 2012).

6.2.5. Regional service and business clusters

The section on localisation and cluster effects already identified industrial cluster activities in Germany. But as external agglomeration effects can also occur between different industries and sectors, a visualisation of the core areas of services can be interpolated to reveal congruent patterns of service and industrial agglomerations.



Graph 7, Source: *Distribution of service and manufacturing in German regions*, (Sternberg & Litzenberger, 2004)

The two graphs visualise that service industries are closely located within the major metropolitan agglomerations of Germany. This is not surprising, as cities and

metropolitan spheres attract service industries to a greater extent than less densely populated areas. What is surprising, however, is the lack of congruence of service and manufacturing industries in the East, bar Berlin. While East Germany has a lower share of manufacturing as % of the GDP than West Germany (18% and 24%, BMWi, 2016: 5), the share of services is on par with West at around 68 - 69%. Hence it is more likely that the type of service industries which favour cluster activities are missing in the East. West Germany, except for Berlin, hosts the financial and insurance centres of Germany, as well as a larger share of communication, media and IT businesses. Service sectors tend to cluster or have their headquarters in the metropolitan centres of a country, and even Berlin, in this case, could not regain its status as financial capital, but instead focuses on the creative industry (BMWi, 2015: 6).

The absence of industrial clusters can be explained by the centrally-planned economy and structural change paired with a lack of exposure to the checks of international markets. The lack of service clusters can similarly be explained by the Socialist regime itself too, as creativity was less common as part of the education system (Berthold & Neumann, 2006). Thus, creative human capital was more prominent in West Germany before reunification and the companies stemming from this period were simply adopted by East German consumers. Financial and insurance industries could not develop in a dictatorial system and the media had to be politically conform. The existing, diverse clusters in East Germany are mostly of light or heavy industrial nature and cannot channel the same innovative spill-overs in exchange with other or sectors as in the West. The exceptions are again only Berlin, Leipzig and possibly Dresden in near future as young and well educated people move there. It is important to note, however, that empirical studies suggest that urbanisation effects influence industrial innovation and productivity to a smaller degree than localisation effects (Brünow & Blien, 2014). Moreover, as the productivity gap in East Germany is primarily within manufacturing, the lack of urbanisation effects constitutes less of a factor of the gap than localisation and cluster effects, as discussed in the previous section (Illy et al., 2009). This, nonetheless, does not indicate that urbanisation effects are of little importance in the East German context, as there has been a successive structural change within developed industrialised countries towards services²¹. The data thus points towards already existing structural deficits of the

²¹ To exemplify this change in East Germany, the employment in manufacturing decreased from 4,3 to 1,9 million from 1989 to 1997 alone as part of the transition process, structural change and the dismantling of overemployment in East German companies (Sinn, 2000; Siebert, 1990).

East German economy's tertiary sector in comparison to the West German economy, where spill-overs between sectors and diverse industries are more frequent (Brünow & Blien, 2014: 17, Hornych & Schwartz, 2009: 516). Additionally, as the digital economy has increased in importance for the past 20 years, the divide in the service and digital industries might further deepen between urbanised and less-urbanised regions.

6.3. Summarising discussion

The overall analysis has shown that East Germany faces structural problems of exploiting internal and external scale effects, one can deduce that a part of the productivity gap might be explained by the absence of these effects. As far as *internal scale* economies are concerned, there is a severe lack of administrative headquarters and main seats of the leading German companies, both in services and industry. More importantly, the average business and industry size is only slowly catching up with the West and is still 50% below its level. As a result, productivity gains based on *internal scale effects* cannot be exploited to the same degree as in West Germany (O'Sullivan & Sheffrin, 2003). Further, as business size is related to capital endowments, dynamic technological change is slower to occur. With regards to *external scale effects*, the relative human capital endowments are similar and do not showcase meaningful differences. In terms of productivity-enhancing skills such as management and creativeness, though, the East has experienced a lag due to the Socialist legacy of schooling (Ragnitz, 2005). Concerning capital and research investment patterns, the East could not maintain the early surge in R&D of the 1990s but has since fallen below average per capita levels of the West and thus seems to stagnate in innovation- and research-intensive industries. The East exhibits little potential for unfolding *localisation and urbanisation effects*, such as increased specialisation among industries (Glaeser, 2010). Various authors (Kronthaler, 2005; Rosenfeld, Franz & Heimpold, 2007; Brenner, 2006) have identified that current industrial clusters are unevenly distributed across Germany and as a result, the East cannot take advantage of external scale effects in terms of specialisation and innovation (Glaeser, 2010). Additionally, the existing, innovative clusters in the East are unable to gain the critical mass necessary to attract above average investment levels and labour pooling to reinforce agglomeration (Ellison, Glaeser & Kerr, 2007). Urbanisation is showing positive trends in both East and West Germany, even though East Germany has only slowly recovered from the heavy loss of human capital and population from the 1950s to the 1990s,

benefitting Western agglomerations (Brakman & Garretsen, 1993). Even in services, East Germany does not own meaningful service clusters or industries with the notable exception of Berlin. The few growing cities thus lack the diversity of Western cities to generate cross-industry and sector innovation and channel endogenous growth through size alone (Rosenthal & Strange, 2004, Johansson & Quigley, 2004).

Patterns of agglomeration have thus been characterised by a mixed development. The initial surge of investment has led to a variety of competitive industries in very few locations in the East, but they do not possess the general economic capacities of the West, as the research-intensive affiliations mostly remain tied to their Western headquarters. Further, there is a clear trend from North to South, reminiscent of the historical patterns of industrial activity, with Berlin, Saxony and parts of Thuringia showcasing the greatest potential for general agglomeration effects in the East (Maseland, 2014; Wyrwich, 2012). While the negative effects of Socialist economic planning are feasible in terms of highly productive companies stemming from East Germany, the distortions created by the economic integration cannot be understated. Although the rapid privatisation process of the 1990s was inevitable, it has led to a retardation of self-sustaining growth centres in the East, potentially impossible to overcome without any exogeneous impact. As the economic integration of this scale was without precedent, it is difficult to criticise the approach as it had the task to transform dysfunctional and unproductive conglomerates. Even with lower wage levels, as argued by Sinn (2000), these structural deficiencies would have not been overcome. More importantly, the initial net loss of millions of young workers has severely hindered the urbanisation process in the East and depleted the attractiveness for private investments due to a decreased market size. While there is space for optimism as the average educational endowment is on par with Western levels, (Ragnitz, 2007), it negatively affected the initial conditions the catch-up process was based on due to emigration. The findings parallel conclusions of Uhlig (2007) and Rummel (2017), but oppose Burda's (2009) slightly more optimistic outlook on overcoming these factors in the short-term. Considering Rosenthal & Strange's (2004) analysis on urbanisation effects, a steady positive trend of migration into urban centres might constitute an opportunity for future growth. Further, the obvious absence of headquarters and research facilities, public universities and research aside, implies that the critical mass to develop reinforcing innovative agglomeration is below the threshold to gain location advantages over the West (Brenner, 2006). As stated above, areas around Berlin, Dresden and Leipzig seem best equipped to develop into the centres of the East

once again, should they gain the critical mass of economic capacities analysed by Kronthaler (2005). The research thus echoes findings from Rummel (2013) concerning shifting the focus of investments on metropolitan centres of the East instead of attempting to spread them evenly over East Germany. Nonetheless, the lack of agglomeration activities in the East is likely to persist as long as the indicators outlined in the analysis do not match Western levels.

Hence it seems likely, with a few exceptions, that the East remains in an unsustainable position reliant on transfers, public investments and the knowledge generated by West German companies as the East possesses more subsidiary than original industrial and service businesses. Further, it is natural for an economic entity to have differently performing regions, but given Middle Germany's economic history (Wyrwich, 2012; Burda, 2017), this current development cannot be taken for granted. The West, as a larger market and producer, has little incentive to change anything about this imbalance of economic activities. As the Western clusters have a greater economic capacity (Kronthaler, 2005), they will continue to attract more private and foreign-direct investment. However, what the analysis cannot clarify is whether the slight core-periphery relationship will strictly remain between West and East (Brakman & Garretsen, 1993; Krugman, 2010) in future as it is now, or whether the urbanisation trend will divide between rural and urbanised areas in Germany, indicating a North-South division of industrial capacities (Maseland, 2014). The reunification process has both mitigated and reinforced existing divisions between East and West Germany. It delivered the necessary capital required to rebuild the deteriorated capital stock and infrastructure, but in this process, a lack of long-term planning created a dependency on Western transfers amidst stagnating convergence of productivity. The formation of local, independent clusters has thus been prevented. Simultaneously, onesided production ties from West to East without any significant networks, both vertical and horizontal, within the East and internationally, were induced.

7. Conclusion

Almost 30 years after the reunification of Germany, the convergence process has still not been completed. This may be partly due to a deficiency of scale and agglomeration economies. But how have patterns of scale and agglomeration effects in

East Germany developed since reunification? The patterns of existing scale and agglomeration effects are to a substantial extent remnants of the disruptions of partition after World War II and more importantly of the centrally-planned economy, where business formation and competition was inhibited by a lack of internationalisation and productivity-enhancing capital. Internationally competitive industries could thus not emerge and subsequently, East Germany's initial industrial stock at the turn of reunification was too low to channel productive agglomeration effects. Similarly, the economic and political integration process, however, had a negative impact on agglomerations in East Germany, as human capital flight to and privatisation by West Germany put East Germany in a disadvantageous position. The current industrial and business clusters were consequently not able to properly develop despite huge monetary transfers and investments since 1990. As the innovative, entrepreneurial and capital-rich industries are mostly located in the West, the East is in danger of being stuck in lopsided production ties with the West. Although there has been an increasing potential for scale and agglomeration effects in the three biggest cities of the East, the situation in the Northeast is worsening as the population and human capital availability shrinks. Keeping this in mind, Garretsen & Brakman's (1993) and Krugman's (1991) fears of the economic integration developing an asymmetric relationship were not completely unfounded. Neither a completely vicious, nor a virtuous cycle have as a result been identified, as the patterns observed throughout East Germany are heterogenous. It remains to be seen, however, if the existing clusters and urbanised cores in East Germany can reach the necessary threshold to enhance their economic capacities and compete with Western core regions in future as they used to in the pre-War era. Strategic investments as suggested by academia should consequently be taken into consideration. This might enable at least a part of East Germany to escape stagnation and continue the convergence process.

The research reviewed in this thesis had been limited to the context of the East German experience in view of an economic, social and political integration after the collapse of the Socialist regime. Thus, it is difficult to suggest any implications for similar transition economies in Central and Eastern Europe. The paper, however, has indicated that urbanisation trends are strong agglomeration forces which can contribute to endogenous growth centres in cities and their surroundings in post-Communist states.

The thesis provided a holistic account of the patterns of scale and agglomeration effects in East Germany. Therefore, additional areas of research were indicated particularly in

regards to the question whether recent developments since reunification point towards a continued division between East and West, or if *historical patterns* of North to South are reemerging. Further research should be conducted on *small- and medium-sized businesses* in East Germany. As there seem to be fewer scale effect-exploiting big industries, the focus should be on these businesses in order to assess their potential for turning into hidden champions or at least globally more competitive companies. As the research could not clarify whether there is currently a distinct core-periphery relationship between the East and West in terms of *production ties*, data collection on the business networks in the East itself, but also with the West, should be expanded to identify the industries where the East performs relatively well and in which it does not.

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