The Impact of Institutional Change on Urban Growth and Decline

Lessons from East Germany (1990-2015)

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Abstract

Institutions have become relevant factors in explaining the growth or decline of regions and cities. Situations of drastic institutional change may, therefore, be used as an experimental setting for the empirical identification of the impact that institutions have on the economic performance of cities. Since the rise of the Iron Curtain in 1989, the East German urban system has been influenced by several strong and overlapping forces of institutional and economic change, including the rapid transition from a socialist planning system to a market economy, numerous political and administrative reforms, and European integration. This has led to relevant changes within the hierarchy of East Germany's mainly small- and medium-sized cities. Although the example of the German division has, in the past, often served as a natural laboratory for all kinds of quasi-experimental studies, the spatial effects in East Germany — particularly at the urban level — have not yet been extensively researched. This dissertation intends to fill this research gap by applying a relatively heterodox set of quantitative and qualitative empirical methods to identify and analyse the local effects of the aforementioned institutional changes.

The results presented in this dissertation are not only of empirical relevance regarding East Germany's specific post-socialist context, but also contribute to a diversified body of theoretical literature aiming at a better understanding of the general drivers and spatio-temporal dynamics of urban growth and decline. Furthermore, some important implications for policymaking at the local as well as supra-regional level can be derived.

The dissertation basically consists of four autonomous essays which are all dedicated to particular aspects of institutional change. Chapter 2 provides descriptive analyses on the spatial and temporal patterns of urban population growth and decline in East Germany since 1990 and examines the driving forces using cross-sectional growth regressions. Aside from estimating the impact of several important factors, such as local labor markets and amenities, the models involve exogenous variables that are of particular interest with regard to the East German transition process. A special focus lies on the long-run effects of the socialist central planning policies approximated by historical population growth rates under socialism. A significant negative effect of those growth rates can be estimated. This indicates that the socialist central planning policies were not sustainably successful in changing the long-term trajectories of the East German cities.

In addition, the two following chapters are dedicated to particular aspects of institutional change that could not be identified within the cross-sectional framework of Chapter 2. Both contribute to a growing body of quasi-experimental studies which allow for the causal

identification of certain ‘treatment effects’ on urban development. Chapter 3 builds on a strand of literature that is dedicated to the effects of holding a particular administrative status on urban growth. Observing changes in the regional capital status due to several county reforms that occurred in East Germany since 1990, it can be estimated that losing a county seat has a significantly negative effect on urban population growth.

Further, the spatial effects of the EU eastern enlargement in 2004 are examined in Chapter 4. As suggested by theoretical models of the New Economic Geography, a significant positive effect on the population growth rates of towns located within a maximum travel distance toward Germany’s eastern border can be found. However, this does not offset the, generally, poorer population development of border towns compared to interior towns. Moreover, the integration effect appears to strongly depend on initial local conditions mainly benefitting towns with a high specialization in service industries.

Complimentary to the negative correlation between historical population growth rates during times of the GDR and recent patterns of urban growth and shrinkage found in Chapter 2, Chapter 5 addresses the long-term consequences of socialist planning policies for the post-socialist development of four selected East German cities in a more qualitative manner. In-depth case studies reveal a bundle of measures and factors mostly related to strong investments in local industries, but also changes in the administrative status, and socialist urban planning policies which were able to create path-dependencies for urban development that are, at least in part, still relevant today. Some of these path dependencies seem to act as limitations to urban economic development, while in other cases, heritage from socialism also has exerted a positive impact on the local economy even after the breakdown of the central planning system.

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Index of Abbreviations

ANOVA	Analysis of Variance
CEE	Central Eastern Europe
CEFTA	Central European Free Trade Agreement
DDD	Triple Differences
DID	Differences in Differences
GDR	German Democratic Republic
GIS	Geographic Information System
LM Test	Lagrange Multiplier Test
NEG	New Economic Geography
OLS	Ordinary Least Squares
RESET Test	Regression Equation Specification Error Test
SAR	Spatial Auto Regression
SARAR	Spatial Auto Regression with autoregressive disturbances
SCPP	Socialist Central Planning Policy

Chapter 1

Institutions and Institutional Change as Factors Driving Urban Growth and Decline

1.1 Introduction

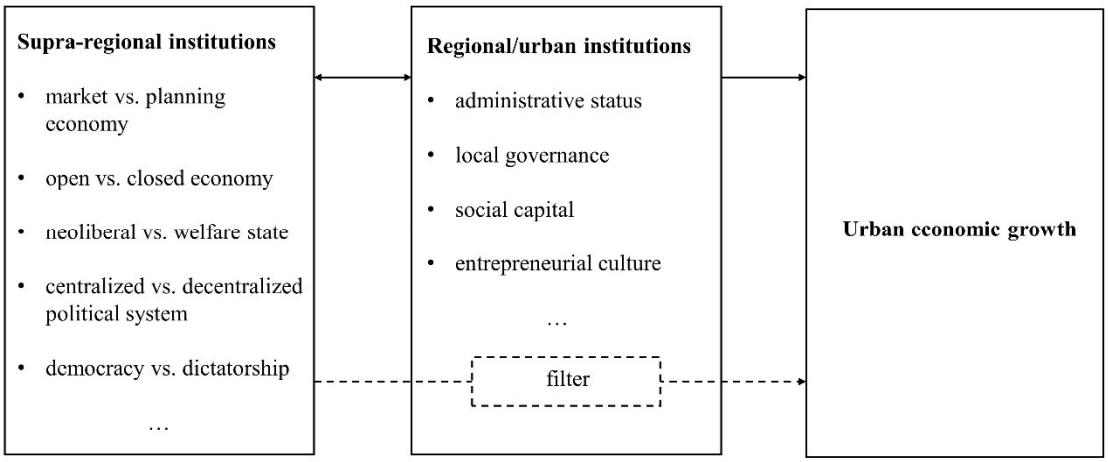
Since the rise of New Institutional Economics, institutions and institutional change have become an important category for explaining long-run economic growth (e.g., Davis and North 1970; North 1989, 1990, 1994; Rodrick et al. 2004; Acemoglu et al. 2005; Acemoglu and Robinson 2010). In the words of North (1994: 359), "Institutions form the incentive structure of a society, and the political and economic institutions, in consequence, are the underlying determinants of economic performance." The scientific debate about institutions as fundamental causes for (macro-) economic growth further led to a growing body of empirical studies examining the relationship between (changes in) institutions and regional development (e.g., Helliwell and Putnam 1995; Blume and Sack 2008; Rodríguez-Pose 2013; Ketterer and Rodríguez-Pose 2016) or urbanization and urban growth (e.g., Blume and Blume 2007; Henderson and Wang 2007, Glaeser and Redlick 2009; Kim and Law 2012, 2016). If institutions and institutional change explain urbanization, institutional arrangements may have an impact on the differences in the growth rates between cities and on the changes in the so-called 'urban hierarchy' within a country.[1]

One must consider that the relationship between institutions, institutional change, and local economic growth has in fact two dimensions. The first dimension includes variations in local institutions that might lead to persistent differences in economic performance and diverging growth trajectories between cities. These local institutions involve different interrelated categories like public sector institutions, entrepreneurship, social capital, or the quality of local governance (Karlsson 2012). The second dimension includes national or even supra-national institutions. Supra-regional institutions include aspects such as the general organization of the economy (e.g., central planning vs. market economy), political and administrative systems (e.g., dictatorship vs. democracy, centralized vs. de-centralized systems, neoliberal states vs. welfare states), or international relations (e.g., isolationism vs. economic and political integration). Changes in supra-regional institutions could lead to adjustments in spatial economies and urban hierarchies. Supra-regional institutions are, therefore, crucial in explaining local growth trajectories. Of course, it should be acknowledged that local, regional, and supra-regional

[1]Within the economics literature, the term urban hierarchy refers to the population size distribution of cities (see Section 1.2).

institutions are interdependent in influencing local development.[2] The way in which local or regional institutions are constituted could determine a city's adaptability toward changes in supra-regional institutions (Storper 2010). Therefore, local institutional arrangements act as sort of a filter for national or even global processes of economic or institutional change. Changes in national institutions might, on the other hand, be initiated by local institutions themselves (e.g., via bargaining within federal-democratic systems). The interdependencies between supra-regional and local institutions can be summarized as in FIGURE 1.1.

FIGURE 1.1. SUPRA-REGIONAL AND LOCAL INSTITUTIONS AND URBAN ECONOMIC GROWTH.



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A major issue of most empirical studies that aim at the identification of institutional effects on urban or regional economic growth is that the differences in institutions, as a result of their mostly qualitative nature, are difficult to measure and operationalize (Glaeser et al. 2004). This is particularly true for sub-national levels of aggregation, where data is scarce. The issue is even more pronounced when a researcher wants to examine the effects of supra-regional institutions on urban or regional development. The empirical identification of those effects requires valid natural experiments and historical case studies involving drastic institutional change. For such studies, the development of the East German urban system after the opening of the Iron Curtain can serve as a highly interesting case. The German reunification, entailing an exceptionally abrupt transition from a central planning to a market economy, was accompanied by various

[2] The relationship between regional and supra-regional institutions can also be described as a relationship between "society" and "community", as defined by Farole et al. (2011).

territorial reforms and changes in the administrative system. At the same time, the reunification was also the starting point of the process of European integration which cumulated in the EU Eastern enlargement in 2004. All of these transformational processes could have resulted in changed patterns of urban growth and decline. The overall goal of this cumulative dissertation is, therefore, to use the East German urban system as a laboratory to study how specific categories of institutional change have influenced the growth paths of East German cities since 1990.[3]

Scrutinizing the changes within the East German urban system adds three major contributions to the existing urban growth literature. First of all, it aligns the discussion on the driving factors of urban development to a post-socialist context. Even though there is relatively broad literature on the post-socialist cities of Central and Eastern Europe, this literature is strongly focused on intra-urban processes like urban sprawl (Nuissl and Rink 2005), re-urbanization (Kabisch et al. 2010), or gentrification (Bernt 2016), and appropriate policies which are required to tackle these issues (Franz 2000). Systematic evidence on the economic driving forces of urban growth and decline in post-socialist countries is still scarce.

An important question in this respect is whether the driving forces of urban growth and decline in post-socialist East Germany fundamentally differ from those in the more extensively researched western developed countries where non-economic factors like climate and amenities have played an increasingly important role in determining growth differentials across cities and regions since the end of World War II (see e.g. Glaeser et al. 2001; Cheshire and Magrini 2006; Rappaport 2007; Rodríguez-Pose and Ketterer 2012; Rickman and Wang 2017) as well as from developing countries of the global south where the patterns of urban growth can largely be explained by agglomeration economies and. regional labor market characteristics (see e.g. Da Mata et al. 2007; Duranton 2016). Of course, one also has to acknowledge that even within post-socialist Central and Eastern Europe (CEE), East Germany represents an outstanding example. The German re-unification in 1990 was the only case where a former central planning economy became integrated into an existing market economy. Therefore, the transformation of fundamental economic, political, and social institutions happened much faster compared to other post-socialist countries. Consequently, the economic consequences at the macro, the regional, and local level were particularly drastic. Some authors have argued that due to this rapid transition, urban development trends in East Germany can serve as a frame of reference

[3] The main focus is laid on population growth and shrinkage as the dependent variables. This is not only the best available approximation for urban economic development within the observed period but also has been proven to be a very suitable indicator in a lot of previous empirical studies (e.g., Glaseser et al. 1995; Davis and Weinstein 2002; Redding and Sturm 2008).

for future developments in other CEE countries (Steinführer and Haase 2007: 183). While one could also argue that East Germany must be viewed as a non-representative "hybrid" form of a post-socialist economy with overlapping characteristics typical of post-socialist as well as western contexts (Haase et al. 2017: 353), an examination of East German cities certainly offers the rare opportunity to observe many transitional developments and their spatial economic consequences in "fast forward" (Berentsen 1996: 616). Hence, it provides an excellent research field to study how an urban system behaves under the influence of drastic economic and institutional change.

Secondly, a study of the East German urban system sheds light on a relevant group of cities that have – with a few exceptions (e.g. Partridge et al. 2008) – often been neglected within the urban economics literature. As only 15 East German cities had more than 100,000 inhabitants at the time of German reunification, and even this number has sharply declined to date, most of the cities under observation qualify as small- or medium-sized cities. The factors and dynamics determining growth and decline in these cities might fundamentally differ from the extensively researched metropolitans and second-tier cities. While large metropolises are supposed to generate agglomeration benefits such as labor-market pooling and knowledge spillovers (see e.g. Duranton and Puga 2004) 'on their own', and are furthermore embedded in global networks of capital and knowledge transfer (Sassen 1991; Bathelt et al. 2004), small and medium sized cities have often only very limited opportunities to benefit from globalization. Their economic fate, therefore, not only depends on their own economic, socio-demographic, and institutional structure, but also on their on their geographical proximity to other large cities (Portnov 2004; Sohn 2012) as well as on their embeddedness within regional city networks to generate synergies compensating for the lack of own agglomeration forces (Meijers 2005). This turns the examination of growth dynamics into a particularly spatial challenge which requires empirical methods that take those spatial interdependencies between cities into account.

Last but not least, the individual chapters of this dissertation address very specific aspects of institutional change that are not only interesting with regard to the urban dynamics in certain transition economies but are of high relevance for urban theorists and policymakers alike. For example, Chapter 3 and 5 both examine the impact of changing the administrative status of a city on urban growth trajectories. Hence, they contribute to a growing body of literature dedicated to the role of the public sector within urban agglomeration economies (e.g. Dascher 2000; Becker et al. 2015). In addition, the results have important implications for policymakers at different administrative tiers who aim to influence the spatial distribution of public sector activities. Moreover, Chapter 4 analyses the impact of the EU eastern enlargement in 2004 on

the growth trajectories of border cities. The results are therefore not only relevant for theoretical scholars at the intersecting point between international trade and economic geography but also have very current policy implications in times of reinforced tendencies of isolationism across many western industrialized countries.

A special feature of this dissertation is that it takes an explicitly interdisciplinary view, lending its ideas from a wide range of subdisciplines within regional research which range from urban economics to urban planning studies and evolutionary economic geography. Therefore, it also seeks to contribute to the exchange of knowledge between geographical economists and economic geographers which has, in the past, been scarcely fruitful due to fundamentally different epistemological and methodological approaches. (see e.g., Martin 1999; Amin and Thrift 2000; Rodríguez-Pose 2001; Overman 2004; Brakman et al. 2011; Hassink et al. 2016). This work wants to contribute to the small but growing body of approaches which aim to show that both disciplines can complement and learn from each other in order to derive proper explanations for the dynamics of spatial agglomeration (e.g. Sjöberg and Sjöholm 2002; Marchionni 2004; Duranton and Rodríguez-Pose 2005; Garretsen and Martin 2010; Rodríguez-Pose 2011). This is achieved not only by using both econometric methods and in-depth case studies but also by incorporating and confronting both disciplines' views and hypotheses toward the key questions of the individual chapters.

Before proceeding with the empirical studies, an introduction on the general theories of urban growth, the evolution of urban systems, and the role of technological or institutional change within these processes is necessary. A short review on these topics will be given in Section 1.2. Furthermore, Section 1.3 will present the different aspects of institutional change that have been affecting the East German urban system since 1990. The general structure of the dissertation will then be explained in Section 1.4.

1.2 Urban Growth and Changes in the Urban System: Theory and Evidence

A fact that was well-observed by urban historians as well as urban economists is that the spatial distribution of population within a country — the so-called 'urban hierarchy' — appears to be relatively stable over time (see e.g. Bairoch 1988; Hohenberg and Lees 1995; Eaton and Eckstein 1997; Davis and Weinstein 2002; Bosker et al. 2008). Hohenberg (2004: 3051) states: "[T]aking both the resistance and the resilience of cities together, it is perhaps not surprising that the European system should rest so heavily on places many centuries old, despite the enormous increase in the urban population and the transformation in urban economies."

One central question of regional and urban economics has always been the explanation for the evolution of this seldom changing city size distribution. In their seminal paper, Davis and

Weinstein (2002) identified three principal schools of thought with regard to this question: 'Random growth', 'locational fundamentals', and 'increasing returns'. The first strand of theory suggests that an urban hierarchy with different city sizes emerges from simple stochastic processes (Simon 1955; Gabaix 1999). The main benefit of these 'random growth' theories is that they are able to explain the existence of a common empirically observed Pareto distribution of city sizes within a country. This power law originates from the ideas of the German physicist Fritz Auerbach (1913) and it became prominent in its refined version as Zipf's Law for cities (Zipf 1949). The law essentially states that a city's population is inversely proportional to a city's population rank among other cities within a country. Evidence for this distribution has been found in a large number of countries, at different points in history, and for different geographical delineations of cities (e.g., Rosen and Resnick 1980; Soo 2004; Rozenfeld et al. 2011).[4] The most recent advances in this strand of research build on Gabaix (1999), and suggest that the evolution of the city-size distribution follows Gibrat's law meaning that the population growth rate of a city is orthogonal to its initial size (e.g., Ioannides and Overman 2003; Eeckhout 2004; Giesen and Suedekum 2011). The main issue of these theories is that they do not offer proper economic explanations for urban growth processes and are, therefore, very unsatisfactory particularly with regard to their implications for local and national urban policymaking.

In a deviation from 'random growth' theories, the proponents of 'locational fundamentals' argue that the city growth itself is not random but the economic conditions of each location are randomly distributed over space. A fully specified model in this tradition would include differences in Ricardian technology coefficients and location-specific Heckscher-Ohlin endowments. Given the assumption that these location-specific characteristics are distributed in the same way as described in Gabaix (1999), 'locational fundamentals' theories could account for the existence of Zipf's law; in contrast to 'random growth' theories, however, they predict that the relative size of a city should be robust even to very large temporary shocks. Empirical evidence for 'locational fundamentals' has been found by Gallup et al. (1999) as well as by Rappaport and Sachs (2003) by discovering the different channels through which geography affects productivity and the quality of life. Moreover, Davis and Weinstein (2002) found evidence for the remarkable persistence of regional population density throughout history in the case of Japan. Bosker et al. (2008) observed similar patterns for historical city growth in Italy (1300–1861). Aside from relying on the simplistic assumption that the determinants of

[4] For a comprehensive survey on the empirical literature on city size distributions and Zipf's law see Gabaix and Ioannides (2004) as well as Nitsch (2005).

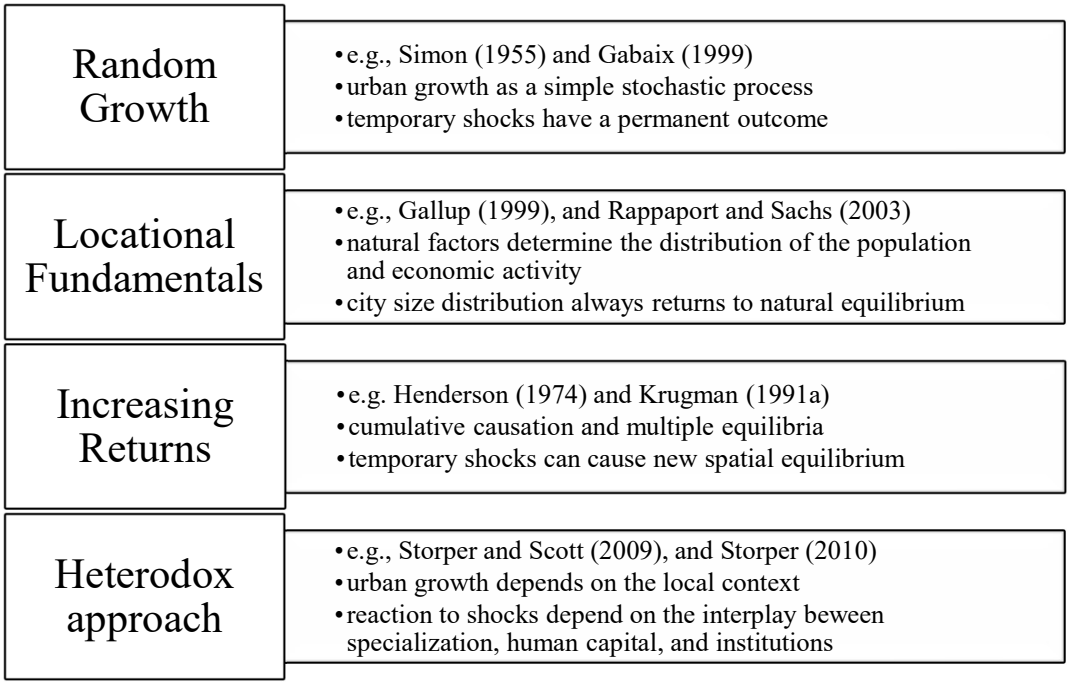
urban growth are somehow randomly distributed by nature and persistent throughout time, 'locational fundamentals' theories like theories of 'random growth' lack any sophisticated economic explanation for urban growth and decline.

The 'increasing returns' school of thought is probably the most advanced in terms of economic sophistication but in contrast to the aforementioned theories, it cannot explain the existence of Zipf's law (Krugman 1996). Scholars arguing in this line basically suggest that locational advantages arise from labour-market pooling, knowledge spillovers, and the proximity between suppliers and demanders in a world where transport costs matter. Urban hierarchies with cities of different sizes are, therefore, a product of different industries with individual technological characteristics (Henderson 1974) or the tacit competition among locations for mobile production factors (Krugman 1991a). Many important contributions within this strand of literature are related to the dawn of the New Economic Geography and stress the role of multiple equilibria (Krugman 1991a; Krugman and Venables 1995; Fujita et al. 1999), historical accidents, and path dependency (Krugman 1991b; Arthur 1994). In their seminal paper on the evolution of port cities, Fujita and Mori (1996), furthermore, show how initial geographical characteristics that are highlighted by 'locational fundamentals' and 'increasing returns' could possibly interact.

Even though 'increasing returns' theories cannot account for any kind of power laws in city size distributions, they are the only approaches with the ability to explain why certain subsets of cities ascent (or decline) over time. These changes within urban hierarchies are following changes in international trade patterns (Hanson 1998, 2001) or certain technological developments (Desmet and Rossi-Hansberg 2009, 2014). A very well-observed evolution of an urban system with overlapping technological and institutional forces is the so-called 'sunbelt-frostbelt dichotomy' in the US. Since the end of WWII, the highly industrialized cities of the North-Eastern and Mid-Western US were facing severe urban and industrial decline while cities in the American South and West were significantly gaining importance in terms of population and economic activity. This development was often linked to the relative productivity increase of firms in the southern region in comparison to the old industrial north. Researchers have offered different explanations for the rise in productivity levels in the South. The list includes greater capital accumulation in once backward-places (Barro and Sala-I-Martin 1992), an increasing structural transformation in the South from agricultural jobs to non-agricultural jobs due to reduced costs of education (Caselli and Coleman 2001), the decreasing relevance of the dense northern transport infrastructure due to reduced transport costs (Glaeser and Kohlhase 2004), and changes in state policies due to increased political competition (Besley et al. 2005).

Other authors stress on the increasing role of climate (Graves 1976, 1980; Rappaport 2007) and urban amenities (Glaeser et al. 2001) in their contribution to individual welfare. Finally, a third group of studies suggests that the rise of the sunbelt has less to do with the sun itself but is more involved with higher elasticity in housing supply, related to pro-development regulatory systems in the southern states (Glaeser et al. 2006; Glaeser and Tobio 2008).

FIGURE 1.2. THEORETICAL APPROACHES TOWARD URBAN GROWTH AND THE EVOLUTION OF CITY SIZE DISTRIBUTIONS



Source: Author's illustration

These different explanations for the 'sunbelt-frostbelt dichotomy' caused an intense and long-running scientific debate about the driving forces of urban growth and decline, and led to the central question of whether people follow jobs or jobs follow people (Partridge 2010).[5] Within this discussion, Storper and Manville (2006) as well as Storper and Scott (2009) strongly argue against the dominant spatial equilibrium theories and state that most of the common explanations for urban growth are actually less exogenous than often claimed. From this viewpoint, universal explanations like amenity migration cannot account for distinct recent phenomena like urban decline, urban emergence, and urban resurgence. Consequently, Storper (2010, 2013) proposes an alternative view on urban growth that is more idiosyncratic and place-based. Within this framework, cities represent regional production systems where technological changes and trade costs lead to the cumulative processes of agglomeration and specialization.

[5] For the different positions and the empirical contributions in the debate on the U.S. urban population development, please also refer to Greenwood and Hunt (1989), Partridge and Rickman (2003), Kemeny and Storper (2012), and Rickman and Wang (2017).

Moreover, Storper emphasizes the role of human capital and the formal and informal institutions that shape these urban economies. In addition to the three aforementioned theoretical strands identified by Davis and Weinstein (2002), Storper's approach on urban growth can be interpreted as a fourth and more heterodox school of thought (see FIGURE 1.2), which combines elements from the 'increasing returns' theories with insights from further disciplines of regional research like (institutional) economic geography (e.g. Saxenian 1994) and political science (e.g. Logan and Molotch 1976).

The still unsolved question for the causes of the transformation of urban systems does not only ask for a coherent theory that is able to connect the different mechanisms of urban growth and decline but also for valid 'natural experiments' in order to isolate the singular impact factors of urban growth. Certain quasi-experimental studies have already been mentioned above. Davis and Weinstein (2002) analyzed the resilience of the Japanese urban system toward the exogenous shock caused by US bombing during WWII and found that within less than 20 years, the spatial distribution of the population returned to its initial state before the war. This kind of resilience, as predicted by the 'locational fundamentals' theories, could also be confirmed for West German cities after WWII (Brakman et al. 2004) and US cities after the American Civil War (Sanso-Navarro et al. 2015).

A second group of empirical studies was dedicated to the adjustments of spatial systems as a consequence of economic integration and the fundamental changes in international trade patterns. Hanson (1998) demonstrated that the economic integration between Mexico and the US has substantially contributed to the decentralization of the Mexican economy from the Mexico City area to the regions near the US border. At the same time, economic integration could account for large shares of employment growth in US border cities (Hanson 1996; 2001). In the same line of thought, Redding and Sturm (2008) estimated that the division of Germany during the second half of the 20th century led to a relative decline in population growth in the West German border cities, while the reunification in 1989 led to relative increases. This evidence can be confirmed for similar 'natural experiments' such as the opening of the 'Iron Curtain' in Austria (Brühlhardt et al. 2012) or European integration (Brakman et al. 2012).

Further quasi-experimental studies, focusing on changes in administrative hierarchies and the (re-)location of government functions in certain cities, find evidence for the concentration of public sector activities that exert positive effects on local employment growth (Dascher 2000, Becker et al. 2018). Evidence on spatial economic effects, however, have also been found for even less drastic and rather unusual 'natural experiments', such as international town twinning

in Germany after WWII (Brakman et al. 2015)[6] or the hosting of the Summer Olympic Games (Nitsch and Wendland 2017)[7].

1.3 East Germany as a Natural Laboratory for Studying the Determinants of Urban Growth

As stated in Section 1.1, the primary purpose of this dissertation is to use the East German urban system as a kind of 'natural laboratory' to study the influence of institutional change on urban growth dynamics. Even though the German division into a socialist eastern and a capitalist western part after World War II and the reunification in 1989 represent a strong 'natural experiment' that has been extensively researched with respect to its effects on economic and social behaviour (see e.g. Fuchs-Schündeln and Schündeln 2005; Alesina and Fuchs-Schündeln 2007; Ockenfels and Weimann 1999; Brosig-Koch et al. 2011), the spatial economic effects have not yet been extensively analyzed. Yet, the development of the East German urban system in post-socialist times involved many quasi-experimental features.

After the end of WWII, for more than 40 years urban development in the GDR was almost completely uncoupled from the trends and drivers that were shaping urban trajectories in West Germany. The development of the urban system under the premise of the socialist "shortage economy" (Kornai 1979) followed a completely different logic in comparison to the capitalist West. According to Sjöberg (1999), urbanization under central planning was driven by three major factors: socialist-type patterns of investments, the hoarding of labour, and patterns of economic and political 'priority'.[8] Centrally planned, mostly resource-based green field investments in combination with the striking labour intensity of the socialist economy have often been a starting point for explosive growth processes or the emergence of completely new cities. In the long run, certain patterns of sectoral and spatial priority have been equally important. Those also involve political and other non-economic factors, such as defence-related considerations, the goal to 'proletarize' a 'bourgeois' city, or other forms of political symbolism (Sjöberg 1999: 2224f). In the case of the former GDR, Bröcker and Richter (1999) identify four dominant trajectories of urban population growth: significant relative growth of district capitals, urbanization without extensive suburbanization, strong relative growth in cities of the north, and extreme growth in certain cities as a consequence of major green field investments. The

[6] The end of WWII gave rise to a growing number of legal or social agreements between so-called twin towns in order to foster international and intercultural exchange. Using IV estimations, Brakman et al. (2015) find a positive effect of the number of European twin cities on the local population growth.

[7] Nitsch and Wendland estimate a negative effect of hosting (or applying for) the Summer Olympic Games on future population development.

[8] It has been well observed that central planning tends to induce overstaffing. However, there are diverging explanations for this phenomenon as it always results in urban labour pools, which are quickly exhausted and pose a strong demand for in-migration.

authors conclude that rapid industrialization and urbanization in some places resulted in fragile settlement systems, with a high concentration of structural problems during the final phases of the GDR (Bröcker and Richter 1999: 135).

After the breakdown of the Soviet Union, major sales markets of the East German industries ceased and most of the investments between 1949 and 1989 had subsidized 'old' labor-intensive industries with low-innovative and competitive potential. This resulted in a sharp decline of employment in manufacturing industries and a persistent outmigration toward more economically prosperous regions, mainly in West Germany (Burda 1993; Berentsen and Cromley 2005), accompanied by a harsh drop in birth rates (Eberstadt 1994). On the other hand, newly emerging employment opportunities in the service sectors were often located in completely different places as the old industrial centres of the GDR. Therefore, German reunification not only induced a complete transformation of the East German economy but also should have resulted in an adjusted urban hierarchy (Berentsen 1996: 625). To date, however, there has been only few empirical research on the changing economic positions of East German cities following the opening of the Iron Curtain.

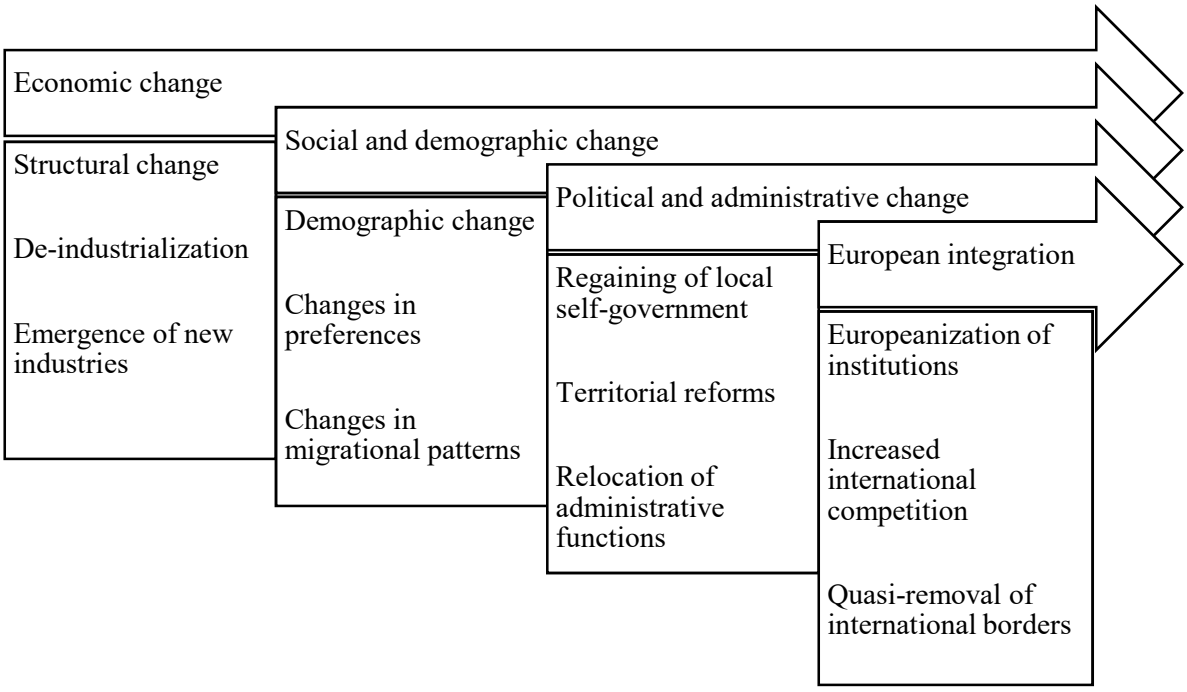
Further, the institutional and economic transition after socialism was not the only development affecting the evolution of the East German urban system after 1989. Parallel to economic re-structuring, the institutional transition was characterized by a number of administrative reforms. In 1990, the 14 former GDR districts became subsumed within five re-established federal states. Consequently, nine cities lost their former statuses as district capitals, resulting in significant differences in the economic performance between present and former capital cities (Kauffmann 2009). The reforms at the upper administrative tier were followed by several reforms at the county level, with a relatively large number of county seat relocations. To date, there have only been a few and rather descriptive empirical studies on the impact of these changes.

In addition to the administrative transition, for East Germany, the reunification was also the starting point of European integration, cumulating in the EU enlargement in 2004 when two neighboring countries of former East Germany, Poland and the Czech Republic, joined the European community. According to several simulation studies, the enlargement should have induced new trade patterns, increased the competition for mobile production factors, and led to changes in the regional market potential with significant effects on the distribution of economic activity within several affected countries (Brülhart et al. 2004; Niebuhr 2006, 2008). Thus far,

however, there has been no ex-post empirical research on the outcome of the opening of the borders on East German cities.

Since all of these aforementioned, overlapping processes of economic and institutional change, as illustrated in FIGURE 1.3, should have altered urban development patterns, one can conclude that East Germany represents an outstanding case for examining the driving factors of urban growth and decline in the light of the aforementioned theories. However, since each of these changes requires specific theoretical and methodological approaches, the empirical part of this thesis is divided into four individual essays. The general structure and the primary goals of each chapter will be described in the following.

FIGURE 1.3. OVERLAPPING FORCES OF ECONOMIC AND INSTITUTIONAL CHANGE AFFECTING THE EAST GERMAN URBAN SYSTEM SINCE 1990.



Source: Author's illustration

1.4 Structure of the Dissertation

Since there have been many overlapping forces of institutional change affecting East German cities since German reunification (as illustrated above), each of the following four chapters is dedicated to the analysis of one particular aspect. In reference to the aforementioned literature on spatial equilibria and urban hierarchies, the major dependent variable will be changes in local population.

Although some authors argue that population growth is not an ideal measure for describing the economic prosperity of a city (Bartholomae et al. 2017), it is a well-established component of many standard models in urban and regional economics (see e.g. Henderson 1974; Fujita et

al. 1999; Duranton and Puga 2004), which was successfully used in many empirical studies (see e.g. Davis and Weinstein 2002; Redding and Sturm 2008). In support for this line of argument, neoclassical spatial equilibrium models by Rappaport (2004) have shown that even relatively small changes in local levels of productivity or quality of life in combination with small frictions to labor and capital mobility can cause highly persistent population flows. Wages and house prices, on the other hand, reach their new steady state relatively quickly. Consequently, Rappaport suggests that cross-sectional regressions of local population growth can help to identify past and present changes in the determinants of household welfare. Hence, population change should represent a very well-suited measure to study the development of an urban system under the influence of economic and institutional change.

It is perhaps needless to state that focusing on urban population change as primary dependent variable integrates the effects of intra-national within and international migration to Germany. In recent years the latter has become an increasingly important source of urban population growth due to demographic shrinkage and increased labor mobility across the countries of the EU. Thus, the reinforced role of international migration for urban development can be viewed as a direct effect of European integration and globalization.

Rather than following the roughly chronological order of institutional changes, as illustrated in FIGURE 1.3, chapters are ordered according to the methodological contribution of each empirical study (see TABLE 1.1). Chapter 2 has the task of providing an empirical introduction into the topic. It entails descriptive analyses on the spatial and temporal patterns of urban population growth and decline in East Germany since 1990, and it examines the driving forces using cross-sectional (urban) growth regressions in the tradition of Barro (1991) and Glaeser et al. (1995). Aside from estimating the impact of several important factors, such as local labor markets and amenities, the regression models involve exogenous variables that are of particular interest with regard to the East German transition process. A special focus lies on the long-run effects of the socialist central planning policies approximated by historical population growth rates under socialism. Although a causal interpretation is often difficult in case of cross-sectional estimations, this chapter provides some important insights about the general dynamics driving the post-socialist development of the East German urban system.

Chapters 3 and 4 then contribute to a growing body of quasi-experimental studies within urban and regional economics[9] that allow for the causal identification of certain 'treatment effects', which could not be directly addressed within the comprehensive cross-sectional regression models of Chapter 2. Chapter 3 builds on the abovementioned literature that is

[9] For a comprehensive overview of those studies and methodologies see Baum-Snow and Ferreira (2015).

dedicated to the effects of holding a certain administrative status on urban growth. In contrast to Dascher's previous cross-sectional study (2000) on the West German county reforms during 1970, this study uses panel data and a differences-in-differences (DID) approach to identify the effect of losing a certain administrative status during one of the various county reforms which happened in East Germany between 1990 and 2015. Aside from its methodological improvement in effect identification, this study is also the first work to account for the time dimension of the diverging growth paths, following the county seat relocations.

Methodologically in the same vein, but addressing a different kind of treatment effect, Chapter 4 is deeply related to New Economic Geography literature and the aforementioned articles that use exogenous changes in trade integration to estimate the effect of the (changing) market potential on urban growth. Therefore, the well-suited DID approach by Redding and Sturm (2008) is applied to the case of the EU Eastern enlargement along Germany's Eastern border. A major contribution to the existing literature includes the examination of particular channels of the integration effect.

TABLE 1.1. SYNOPSIS OF THE EMPIRICAL CHAPTERS – TOPICS AND METHODS

Chapter	Explanatory Category for Urban Growth	Data	Methodology
2	Agglomeration economies Demography Labour market conditions Climate Amenities History Public sector institutions	Panel and cross-sectional data	Cross-sectional regression
3	Changes in administrative status (county seat)	Panel data	Differences-in-differences
4	Eastern EU enlargement (impact on border towns)	Panel data	Differences-in-differences
5	Long-term impact of socialist central planning policies	Semi-structured interviews	Qualitative case study analysis

Source: Author's illustration

Chapter 5 is perhaps the most heterodox portion of the dissertation with regard to its theoretical and methodological approach. It is linked to the above-mentioned central finding from Chapter 2 that recent population growth rates are negatively correlated to growth rates during times of the GDR. Given the lack of availability of reliable data from these times, the causal channels of this potential effect can hardly be assessed in a quantitative way. Combining in-depth case study research, mainly based on interviews with local experts, and theoretical

approaches from urban theory and the literature on regional path dependence (Martin and Sunley 2006), this chapter addresses the long-term consequences of socialist central planning policies (SCPP) for the post-socialist development of four selected East German cities. The main goal is to examine if and how different SCPP measures were able to create path dependencies that are still relevant for today's urban economic performance.

Finally, in Chapter 6, the empirical results are summarized in a short synopsis followed by a discussion in the light of the aforementioned urban growth theories and some conclusions for policymaking at different regional and administrative tiers as well as for future research.

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Chapter 2

What Drives the Population Growth and Decline of East German Cities?

BASTIAN HEIDER

ABSTRACT This paper examines the patterns and drivers of urban population development in a post-socialist context. Most cities in East Germany experienced drastic shrinkage between 1990 and 2014, but in recent years some have stabilized or even switched toward new growth paths, while others have continuously been declining. A descriptive analysis of subgroups of cities with diverging population growth trajectories reveals that this recent phase of urban resurgence accounts to a large share to the growth of large cities and some smaller cities in their surrounding areas and is strongly related to the revealed residential preferences of families and young adults. Furthermore, spatial regression models show that recent patterns of urban population development are the result of a wide set of determining factors including urban density, fertility rates, labor market conditions, and quality of life related aspects measured in touristic attractivity and the accessibility of certain amenities. However, the relevance of these factors differs strongly with respect to the population dynamics in different age groups. In addition, a significant negative influence of population change rates from socialist times can be found, indicating that socialist planning policies were in general not sustainable in changing the long-term trajectories of urban development.

2.1 Introduction

Urban scholars have developed numerous theoretical and empirical approaches to explain why cities grow in terms of economic activity and population. The scope of explanatory factors ranges from rather traditional economic explanations, such as agglomeration externalities (e.g. Fujita et al. 1999) and human capital (e.g. Glaeser and Saiz 2004; Shapiro 2006), through factors related to climate and the availability of certain urban amenities (Graves 1979; Glaeser et al. 2001; Carlino and Saiz 2008) to different kinds of formal and informal institutions (Storper 2010). However, there has been significantly less effort in explaining why cities shrink. Most approaches on urban shrinkage take a rather processual perspective and emphasize the role of globalization entailing an increased competition for mobile production factors (Martinez-Fernandez et al. 2012) or the phasing out of industrial lifecycles and cumulative negative feedbacks resulting in long-term economic and demographic decline (Friedrichs 1993). While most of these factors and processes explaining urban population growth and shrinkage are of universal relevance, they are not evenly distributed over space and/or are filtered through different national, regional, and local contexts (Hoekveld 2012) resulting in highly fragmented maps of urban growth and shrinkage (Kabisch et al. 2012). Identifying the specific push and

pull factors that attract people into certain cities is therefore not only of high policy relevance but also a key component to the understanding of the spatio-temporal patterns of urbanization in different institutional and historical contexts.

A group of cities still underrepresented in the debates around the driving factors of urban growth and shrinkage are the post-socialist cities of Central and Eastern Europe (CEE). Throughout a long period in the 20th century, the spatial patterns of urbanization in these countries followed completely different types of logic compared to the capitalist West. Rather than market forces, urban growth and shrinkage in these cities was driven by the political and economic priorities of centralist governments. After the breakdown of the Soviet Union and the opening of the Iron Curtain, CEE cities were faced with massive problems in repositioning themselves within a market economy. The breakdown of the formerly prioritized industries led to drastic job losses and a persistent outmigration toward economically more prosperous regions in Western Europe (Burda 1993; Berentsen and Cromley 2005). This development was accompanied by a harsh drop in fertility rates, known as the second demographic transition (Eberstadt 1994), and a huge wave of residential suburbanization, a phenomenon which was more or less unknown under socialist rule. The neglect of old housing stocks in inner city residential areas during the socialist era led to a rapid loss of attractiveness compared to suburban environments (Häussermann 1996; Nuissl and Rink 2005). Although population shrinkage has been the dominant trajectory in cities all over Eastern Europe since the opening of the Iron Curtain, these developments were relatively differentiated over time and space with less sharp downturns especially in capital cities and other important regional centers (Mykhnenko and Turok 2008).

Within the general framework of post-socialist cities, the former German Democratic Republic (GDR) represents a special case. Owing to the abrupt German re-unification in 1990, the integration into a market economy (and the European Union) happened much faster than in other countries of CEE. Therefore, the economic and demographic consequences were particularly harsh. Between 1990 and 2015, the 125 largest East German cities lost more than 11% of their population (around two million inhabitants). However, of late, there is a trend of stabilization and even urban resurgence in some of those cities. Although some East German cities, such as Leipzig, extensively served as case studies for both urban shrinkage (Bontje 2004) and urban resurgence (Kabisch et al. 2010; Haase et al. 2012) in the past, comprehensive statistical analyses of the spatio-temporal patterns and particularly the drivers of urban population growth and decline in East Germany or post-socialist cities in general are with the

exception of some rather descriptive studies (e.g. Herfert and Lentz 2006; Mykhnenko and Turok 2008) still missing.

This paper tries to fill this research gap by providing an explorative as well as a regression-based approach to examine the patterns and determinants of urban population development in East Germany's small- and medium-sized cities since 1990. The goal is to identify the determining factors why some cities entered a phase of population resurgence within recent years while many others are continuously declining. Besides addressing the more traditional determinants of urban growth, such as agglomeration effects, local labor markets, and amenities, this study sets a special focus on the role of historical path dependence from socialist and pre-socialist times. How are recent urban population trajectories related to population development during GDR times when inter-regional migration was mainly the product of centralist planning policies? Furthermore, this paper also addresses the fundamental role of demographic change for East German urban development by decomposing total population change into growth rates of different age groups. Thereby, it can be addressed how diverging residential preferences across different life cycle stages have influenced spatial patterns of urban growth and shrinkage.

Answering those questions is not only of regional relevance, but also has important implications for urban change in other transition countries. Some authors argued that East Germany can be seen as kind of a forerunner with regard to urban development trends in other CEE countries (Steinführer and Haase 2007: 183). Although the empirical evidence for this hypothesis is rather ambiguous (see e.g. Schmidt et al. 2015; Bernt 2016), one can definitely claim that East Germany offers the rare opportunity to observe many transformational developments in "fast forward" (Berentsen 1996: 616). It therefore represents an excellent case study for examining the driving forces of urban population change under conditions of drastic economic, social and institutional change. Furthermore, analyzing the patterns as well as the determinants of urban population development in East Germany does not only contribute to the debate on drivers of urban growth and shrinkage by setting it in a post-socialist context, but also represents one of the few approaches focusing on population dynamics in small and medium sized cities[10] which have, with some exceptions (e.g. Portnov 2004; Partridge et al.

[10] Apart from the three largest agglomerations Berlin, Dresden and Leipzig, all cities in East Germany have less than 500 000 inhabitants and can therefore categorized as 'small or medium sized'.

2008; Sohn 2012; Barreira et al. 2017), also been widely neglected in the quantitative urban studies literature.

The paper is structured as follows: Section 2.2 provides a short review of the existing literature on the determinants of urban growth and shrinkage while Section 2.3 describes the specific historical and institutional backgrounds of the East German case. Next, Section 2.4 provides some comments on the dataset followed by a descriptive and explorative analysis of the spatio-temporal patterns of urban growth and shrinkage in East Germany (Section 2.5). Section 2.6 proceeds with the econometric analysis on the determinants of population development. Some final conclusions and policy implications are derived in Section 2.7.

2.2 Literature Review

The empirical literature on the driving factors of urban population growth has a strong focus on North American cities and is dominated by an ongoing debate on whether local quality of life such as a pleasant climate and the availability of certain cultural amenities or economic opportunities are the main drivers of urban population growth (see e.g. Greenwood and Hunt 1989; Ferguson et al. 2007; Kemeny and Storper 2012).[11] The idea of climate-driven regional population growth can be traced back to the seminal works of Phillip Graves (1979) who, rooted in spatial equilibrium theory, argued that quality of life related factors such as climate become more and more important in explaining inter-regional population flows in times of rising income. Graves's idea has been widely linked with the rise of cities in the south of the U.S. in contrast to the declining 'old' industrial centers in the north. Although the narrative of amenity-led growth has been criticized by some scholars (Storper and Manville 2006; Storper and Scott 2009; Kemeny and Storper 2012), many studies following Graves have found empirical evidence on the impact of climate (Rappaport 2007) as well as cultural and consumption amenities (Glaeser et al. 2001; Carlino and Saiz 2008) on urban population growth.

Regarding European cities, the empirical literature is far less focused on climate or amenities. Instead, agglomeration economies and market potential (as emphasized by the New Economic Geography) have been examined to be a major cause behind city growth. Although some studies for large cities in Germany (Buch et al. 2014) and mostly small and medium sized cities in Portugal (Barreira et al. 2017) found that climate and amenity related variables may be important push or pull-factors regarding urban labor migration and population growth, authors examining the European system of cities as a whole have come to more ambiguous conclusions. Observing large city regions across the EU12, Cheshire and Magrini (2006) estimated that

[11] At the core of this debate lies the 'chicken or egg' question whether jobs follow people or people follow jobs.

climate related indicators can significantly account for differences in urban population development compared to national averages, but fail for the EU12 as a whole. Other factors like changes in market potential due to EU integration have proved to be more robust predictors of urban population growth.

Around the beginning of this millennium, the barely neglectable trend of persistent urban population shrinkage in European cities (see Mykhnenko and Turok 2008; Kabisch et al. 2012; Wiechmann and Wolff 2017), has inspired a new strand of literature that sets itself apart from the growth-centric literature in regional and urban economics. Although the general causes of urban shrinkage are well understood, comprehensive quantitative empirical studies on the individual drivers of urban population shrinkage are surprisingly scarce. Most theoretical explanations for urban shrinkage take a macro-perspective by emphasizing large-scale socio-economic developments like demographic change (Steinführer and Haase 2007), a global shift in industrial production and increased competition for mobile production factors (Martinez-Fernandez et al. 2012), and political system changes (Wiechmann and Pallagst 2012). While those universal developments generally can explain the occurrence of urban shrinkage, especially in old industrial regions or in transition economies such as CEE, they cannot account for the great variety of shrinkage (Haase et al. 2016) and the spatial differentiation of urban population developments within those regions (Hoekveld 2014). There are only a few recent empirical approaches accounting for these differentiations. Hoekveld (2015) and Hoekveld and Bontje (2016) applied a mix of quantitative and qualitative methods to examine the differences in municipal population decline in two old industrial regions in the Netherlands and Germany. Their findings suggest that industrial factors that boosted population development in former times have lost their importance. Instead, the accessibility of amenities and housing opportunities are steering intra-regional population dynamics. Moreover, their results for both regions show that the recent population decline can be explained as a backlash of the past when industrialization resulted in a massive population boom in certain hotspots.

This article wants to contribute to the abovementioned literature by the quantitative analysis of the patterns and drivers of population dynamics across the East German urban system after the German reunification. Therefore, it combines diverse data sources and categories of explanatory variables, including agglomeration effects, demographic conditions, labor markets, climate, amenities and historical path dependence. Particularly, the latter category has as far as known to the author not often been considered as determinant of urban population development, but should have played a prominent role, given East Germany's specific historical background.

2.3 Historical Context

As stated above, East Germany certainly represents the most extreme case of a post-socialist transition economy. Almost overnight, East German cities had to cope with various overlapping forces affecting their demographic and economic development. Rapid institutional change and intensifying uncertainty and insecurity in people's lives, in combination with the new opportunity to move toward West Germany, radically altered the patterns of reproduction and migration. Some of the general socio-economic trends affecting post-socialist urban shrinkage, such as de-industrialization, decreasing fertility rates, and sub-urbanization, have already been mentioned above, but in addition a proper understanding of urban population trajectories during GDR times should be required to examine the spatial differentiations of those general trends.

In strong contrast to many other CEE countries urban development in the GDR took place against the background of a relatively continuous shrinkage of the total population from around 18 million inhabitants in 1949 to around 16 million inhabitants in 1990. Additionally, unlike many other socialist countries, the GDR was already relatively strongly urbanized and had a balanced urban system with a few big cities and many medium-sized and small towns after the end of WWII. However, similar to other CEE countries between 1945 and 1989, urban population development in East Germany was primarily the result of the political and economic policies of the centralized socialist government (Berentsen 1996: 618). A theoretical model of urbanization under socialism, involving different development phases, has been presented by Sjöberg (1999), who emphasizes the role of major investments in combination with the propensity of producers to hoard labor as a decisive factor in generating long-term urban employment and population growth. Sjöberg additionally introduced the term 'landscapes of priority' to account for the regional differentiation of such urbanization processes. Regarding East Germany, the 'priorities' of socialist planning policies and the resulting patterns of urban population development from 1946 to 1989 have been well documented by Bröcker and Richter (1999) who have reported four leading trajectories: 1.) the remarkable growth of administrative district capitals; 2.) urbanization without sub-urbanization; 3.) strong growth of northern cities compared to cities of the south; and 4.) extreme growth of certain cities resulting from mega-investments, particularly in resource-based 'heavy' industries.[12] Besides those planned developments, the spatial distribution of population and economic activities has been highly static as inter-regional and inter-urban migration has been strongly constrained by centralist planning policies. Shortage of housing and evenly distributed spatial patterns of wages and

[12] These investments involve the establishment of more or less completely new 'socialist planned' cities like Eisenhüttenstadt or Hoyerswerda.

consumer amenities led to very low migration rates from the 1950s onwards (Berentsen 1996: 621).

This suppression of internal migration in combination with strong population growth in certain 'prioritized' cities leads to the question as to how those cities performed after the breakdown of the socialist economy in 1989. What is the interrelation between urban population development under socialism and population change under post-socialism? It is well known that some of the industrial cities (e.g. Hoyerswerda, Lauchhammer, Schwedt, Senftenberg, Weißwasser) which got massively subsidized during GDR times were strongly declining after the German re-unification. Similar things can be said about some of the former GDR district capitals (e.g. Suhl) that lost their status after the reintroduction of the five East German federal states. On the other hand, there are some cities (e.g. Rostock, Jena) that could have substantially benefited from their 'prioritization' under socialism even after the return to a market economy. Even though this does not lead to a clear hypothesis regarding the interrelation between socialist and post-socialist population development, it shows that historical trajectories must be necessarily considered when it comes to the recent population dynamics in East German cities.

2.4 Data

Before proceeding with the empirical analysis, a few remarks on the database should be made. The most important base for the following descriptive as well as inferential statistical analyses are annual population figures for all 125 East German cities which had at least 20,000 inhabitants[13] in 1990. Those figures are published by the Federal Statistical Office Germany (DESTATIS 2016) and comprise two important issues regarding their comparability over time.

First of all, the period following the German reunification was a time of ongoing territorial reforms at the municipal level. These reforms were implemented to increase the efficiency of public services (Blesse and Baskaran 2016) and to compensate for massive urban sprawl, which was happening in most East German cities (Schmidt 2011; Schmidt et al. 2015). Consequently, during the observed period, many of the cities in the sample drastically increased in territory. To correct for these territorial changes, the population figures had to be adjusted to the most recent state of administrative boundaries following the method introduced by Kauffmann (2015). For the first time, this allowed for a scrutiny of the 'real' population development of East German cities since 1990. [14] The second issue with the dataset is that it is mainly based on the annual updates of the Federal Statistical office, but these figures show a severe dip between

[13] In Germany 20,000 inhabitants is the lower bound for cities to be categorized as „medium-sized".

[14] Note that not all East German cities increased in administrative territory. Hence, using the most recent jurisdictional boundaries still reveals some methodological shortcomings.

2011 and 2012 after the conduction of the first German population census since 1987. Hence, with regard to the following statistical analyses, population change rates were only calculated for pre-census and post-census years.

Besides the above-mentioned population data, the regression analysis makes use of a broad set of further variables from different sources and different points in time. Most of them were taken from the INKAR database published by the Federal institute for Research on Building, Urban Affairs, and Spatial Development (BBSR 2017). However, the dataset also contains information from the German Federal Agency of Labor (BA 2018), the German Weather Service (DWD 2017), the statistical annuals of the German Reich (Statistisches Reichsamt 1927, 1941), and the GDR (Ministerrat der Deutschen Demokratischen Republik 1968), and the author's own research based on address data from the German association of theaters (Deutscher Bühnenverband 2018) and the commercial cinema portal KINO.de (STRÖER Media Brands GmbH 2018). A comprehensive overview of all variables and data sources is provided in TABLE 2.1 in the Appendix. A detailed discussion on the choice and generation of single explanatory variables follows in Section 2.6.1. All statistical analyses in this paper were implemented using the software package STATA 14.

2.5 Patterns of Urban Population Development

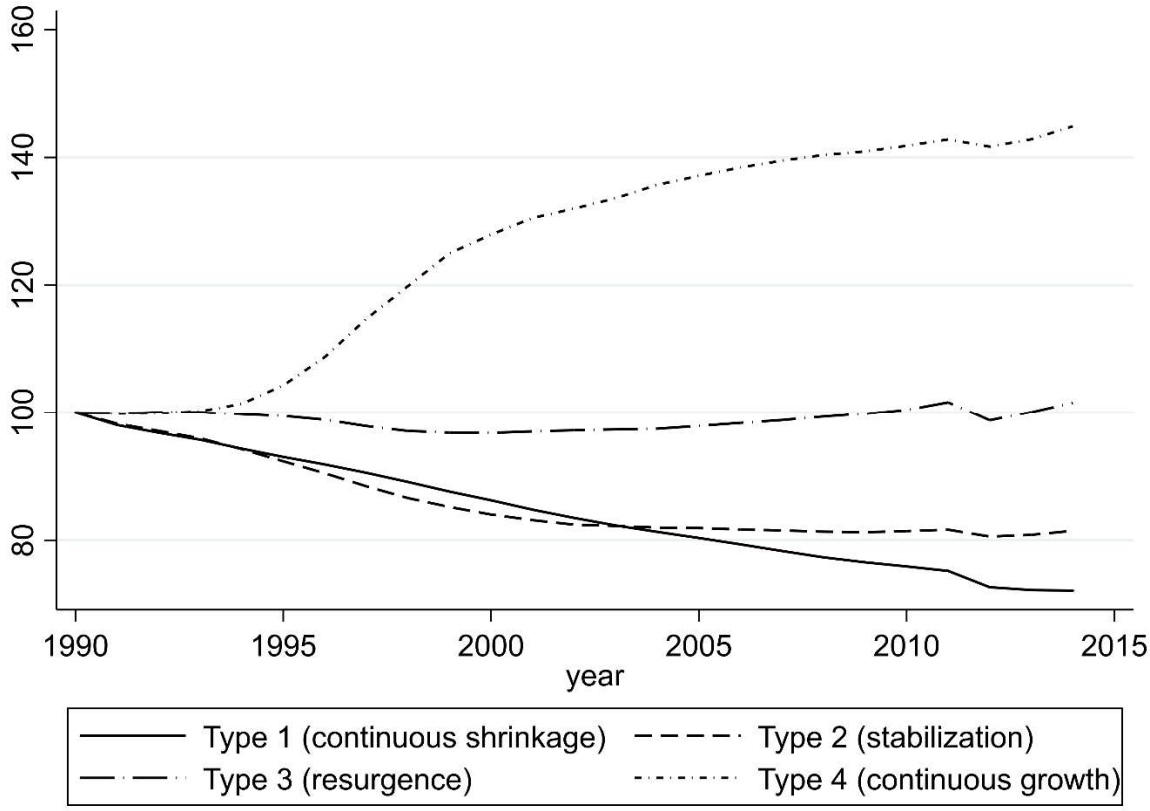
The goal of the explorative and descriptive analysis in this paper is to discover spatial as well as temporal patterns within the East German urban population trajectories since German reunification. The empirical strategy for identifying trajectories is similar to Kabisch et al. (2012) examining large European cities. The population trajectories of each of 125 cities with over 20,000 inhabitants are divided into five-year periods (1990–1994, …, 2010-2014)[15]. Based on those periods, four types of urban population trajectories can be distinguished in a relatively simple way: (1) cities showing permanent population shrinkage; (2) cities with net decline between 1990 and 2014 but at last one period of positive population development (mostly within later periods after 2000); (3) cities with net population growth between 1990 and 2014 but at least one period of period of shrinkage (mostly in earlier periods before 2005); (4) cities showing permanent population growth.

FIGURE 2.1 illustrates the indexed cumulative population development of those defined subtypes of cities starting from the base year 1990. During the 1990s, the development paths of type 1 and type 2 were almost identical. Both types of cities registered drastic population

[15] Since the population development for 2015 was strongly influenced by the immigration of refugees from the Middle East and therefore barely representative, for the final period only the annualized growth rate between 2010 and 2014 was computed. Note that due to the German population census, changes between 2011 and 2012 were also subtracted.

shrinkage during that time. It was not before the advent of the new millennium that their trajectories started to deviate. While the development path of type 2 hints at 'stabilization', type 1 registered 'continuous shrinkage' throughout the decade. However, since 2012, both types show a relatively stable level of population development. While type 1 and 2 recorded a strong negative trend, particularly during the 1990s, the population development of type 3 was relatively stable and registered a slightly positive tendency since around 2003. However, it must be considered that the trajectories within this cluster of cities are relatively heterogeneous compared to the other subtypes. While some cities, particularly those in the surrounding area of Berlin, registered relatively stable growth, other cities (e.g. Leipzig) show a more U-shaped population development curve with sharp decline during the 1990s and a more positive tendency in recent years. In summary, cities of type 3 can be classified as 'resurging'. Finally, type 4 can be regarded as sort of an 'outlier'. It consists of only three cities near the northern fringe of Berlin (Bernau, Falkensee, and Oranienburg), which strongly benefitted from tendencies of suburbanization and therefore registered massive population growth, especially during the second half of the 1990s. Those cities are finally subsumed as 'continuously growing'.

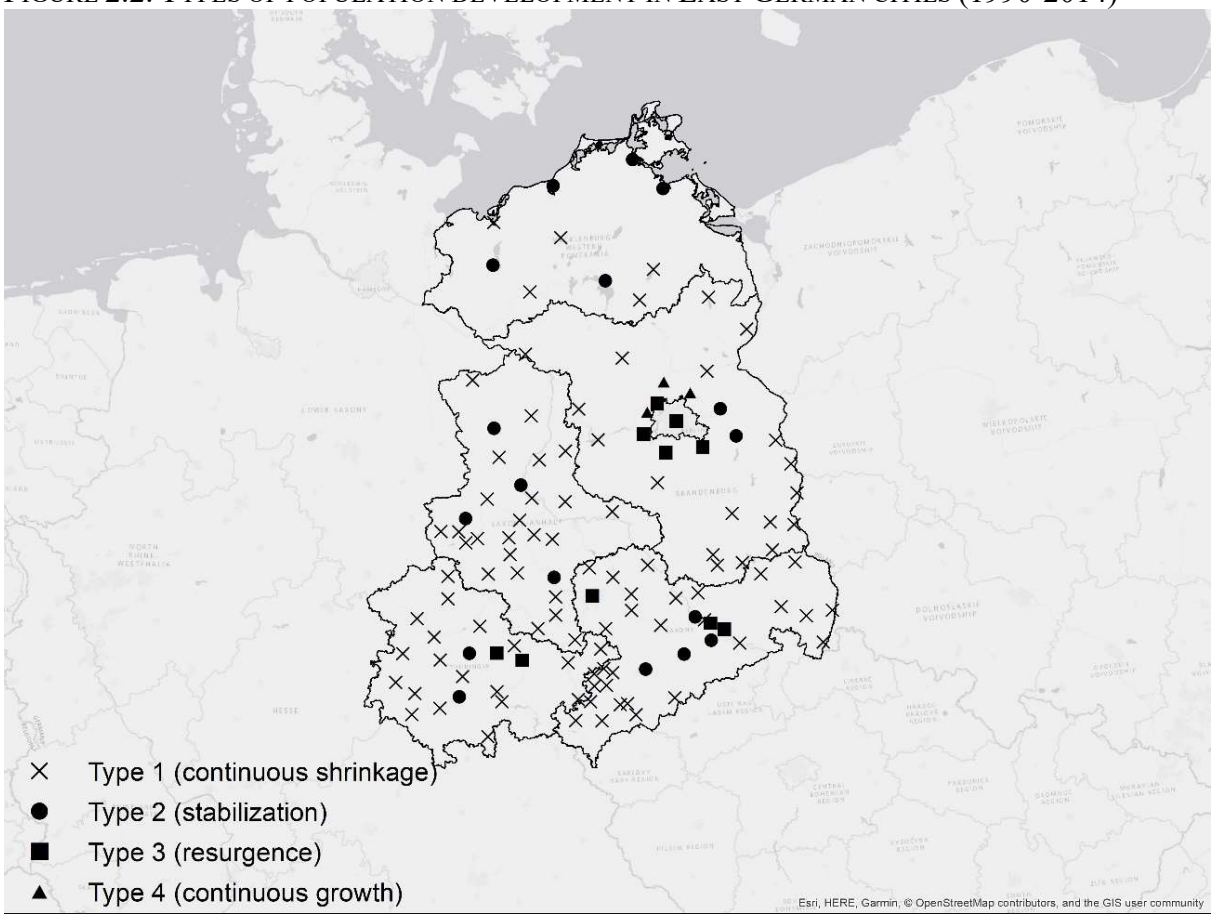
FIGURE 2.1. DIVERGING POPULATION TRAJECTORIES OF EAST GERMAN CITIES (1990-2014)



Notes: Y-axis represents the indexed cumulative population (1990=100%) of each subgroup of cities. Source: Author's illustration based on DESTATIS (2016), adjusted to recent administrative boundaries.

Supplementary, FIGURE 2.2 maps the spatial distribution of the diverging population growth trajectories and reveals a strong spatial clustering of urban population trajectories. While the dominant trend of 'continuous shrinkage' is distributed relatively even, urban growth and resurgence (type 3 and 4) are strongly concentrated around the three largest East German cities (Berlin, Leipzig, and Dresden). The latter finding is consistent with some studies, claiming that location and particularly proximity to large metropolitan areas is a strong predictor of population growth in small and medium-sized cities (Portnov 2004; Sohn 2012). A resurgent trend can also be found for two major cities in the state of Thuringia (Weimar and Jena). Even though those cities are relatively small compared to the previously mentioned ones, they are located near each other and share important leading functions within their federal state as economic (Jena) and cultural (Weimar) centers. Last but not least, the trajectory of 'stabilization' is concentrated in state capitals such as Schwerin, Magdeburg and Erfurt and similar 'third tier' regional centers as well as some smaller university cities (e.g. Greifswald, Freiberg, Illmenau).

FIGURE 2.2. TYPES OF POPULATION DEVELOPMENT IN EAST GERMAN CITIES (1990-2014)



Source: Author's illustration based on DESTATIS (2016).

TABLE 2.1. SUMMARY STATISTICS FOR EAST GERMAN CITIES WITH DIVERGING POPULATION GROWTH TRAJECTORIES (1990-2014)

TRAJECTORY	Type 1 (continuous shrinkage)			Type 2 (stabilization)			Type 3 (resurgence)			Type 4 (continuous growth)		
VARIABLE	1990	2002	2014	1990	2002	2014	1990	2002	2014	1990	2002	2014
Total population	40,037	33,424	28,879.1	115,837	95,477.5	94,371	492,948.9	479,046	500,732	27,889	36,813	40,406
	(23,219.6)	(18,246.2)	(16,740.5)	(11,0831.7)	(8,794.2)	(10,526.3)	(10,526.4)	(10,396.2)	(10,626.6)	(8,080.59)	(3,294.1)	(3,388.3)
Population (<=17 years)		5,107	3,705		14,525	12,417		72,863	71,204		6,718	6,751
		(2,664.8)	(2,071.8)		(12,549.4)	(11,306.6)		(165,904.1)	(155,746.4)		(801.3)	(1602.9)
Pop. share (<=17 years)		15.28%	12.83%		15.23%	13.02%		15.21%	14.22%		18.25%	16.67%
		(0.85)	(0.94)		(1.07)	(0.89)		(0.96)	(1.20)		(1.94)	(3.36)
Population (<=18-29 years)		4,740	3,154		15,180	14,067		78,085	73,908		4,881	6,736
		(2,820.6)	(2,294)		(13,310.8)	(14,878.7)		(162,645.3)	(169,623.1)		(1076.1)	(575)
Pop. Share (18-29 years)		14.18%	10.92%		15.90%	14.75%		16.30%	14.76%		13.62%	10.52%
		(1.13)	(1.50)		(1.71)	(3.73)		(2.38)	(4.01)		(2.66)	(1.11)
Population (<=30-64 years)		17,036	14,246		47,910	45,721		244,889	244,758		19548	20,862
		(9,438.1)	(8,169.4)		(45,278.6)	(41,443.4)		(550,730.7)	(533,522.1)		(1705.9)	(1834.2)
Pop. share (30-64 years)		50.97%	49.33%		50.18%	47.94%		51.12%	48.88%		53.10%	51.63%
		(1.31)	(1.50)		(1.26)	(2.30)		(2.02)	(2.28)		(1.78)	(0.91)
Population (>=65 years)		6,541	7,771		17,845	22,923		83,210	11,0812		5,533	8,558
		(3,474)	(4,344)		(17,035.8)	(21,390.8)		(160,595.7)	(203,990.2)		(881.1)	(673.2)
Pop. share (>=65 years)		19.57%	26.91%		18.69%	24.29%		17.37%	22.13%		15.03%	21.18%
		(1.86)	(2.38)		(2.04)	(2.40)		(1.87)	(2.31)		(1.24)	(1.48)
N		95			17			10			3	

Notes: Means for different subgroups of cities; standard deviations in parentheses. Source: Author's own calculations based on DESTATIS (2016) and BBSR (2017) adjusted to current administrative boundaries.

In addition, to the classification and mapping of population development trajectories, TABLE 2.1 reports the summary statistics for some basic demographic indicators for the different subgroups at different points in time. The population changes and shares across four different age groups are used to address the question how demographic change and different residential preferences in different personal life cycle stages have influenced the above described diverging trajectories of urban shrinkage and growth. The four groups are (1) children and teenagers (<=17 years) whose residential mobility should strongly depend on the preferences of their parents and reproductive behavior, (2) highly mobile young adults (18–29 years) at the beginning of their working career (3) middle-aged persons (30–64 years); and (4) retirees (>=65 years). The latter two are expected to become decreasingly mobile with increasing age. Particularly the residential preferences of retirees are expected to be relatively unrelated to traditional economic factors such as labor market characteristics. Unfortunately, population figures decomposed by age were not available for the 1990s, so the descriptive analysis has to rely only on changes within the second half of the total observed period (2002-2014). However, since the trajectories of continuously shrinking and stabilizing cities started to diverge around 2002 (see FIGURE 2.1), this period should be of particular interest.

Type 1 (continuous shrinkage) comprises by far the greatest share of cities within our sample (N=95). Those are, on average, relatively small (~40,000 inhabitants in 1990; ~29,000 in 2014) and had the highest share of retirees in 2002 as well as in 2014. Moreover, this group registered the strongest decrease in the population share of young adults and the highest increase in the share of retirees. In total, 17 cities belong to type 2 (stabilization). Those cities are, on average, larger (~115,000 inhabitants in 1990; ~94,000 in 2014) than the cities of type 1 and had a relatively high and stable share of young adults between 2002 and 2014. Comprising East Germany's three biggest cities (Berlin, Dresden, and Leipzig), as well as some smaller cities within their metropolitan areas, the cities of type 3 (resurgence) are, on average, distinctly larger than those of the other types (~492,000 inhabitants in 1990; ~501,000 in 2014). The share of young adults (and underaged) was relatively high and relatively stable, while the absolute and relative increases in the number of retirees was less strong than for the former types. Last but not least, type 4 represents sort of an 'outlier' consisting of three relatively small but strongly growing cities. The most distinguishing characteristics of those cities beyond total population growth are a high share of children as well as of middle-aged persons, indicating that these cities near the outer fringe of Berlin were particularly attractive for families.

The summary statistics presented in TABLE 2.1 support the hypothesis that demographic change has played a major role for East German urban population development. Different

growth trajectories are certainly associated to different rates of population ageing and the share of people older than 65 years was strongly increasing in 'continuously shrinking' cities. Moreover, the descriptive statistics indicate that the residential mobility of young adults between 18 and 29 years has contributed to the strong fragmentation of the East German urban system. While the share of this demographic subgroup was relatively stable in 'stabilizing' or 'resurging' cities, it strongly decreased in shrinking cities. The following regression analysis will provide a more comprehensive view on the potential drivers of urban population change across the different age groups.

2.6 Determinants of Urban Population Development

2.6.1 Estimation Strategy

To examine the driving factors of East German urban population development, a cross-sectional urban growth regression will be applied (see e.g. Glaeser et al. 1995). The percentual average annual population growth rate $\Delta pop_{i,t_1-t_0} = [(\frac{pop_{i,t_1}}{pop_{i,t_0}})^{\frac{1}{n}} - 1] * 100$ is regressed on a broad set of (initial) city characteristics[16]:

$$\Delta pop_{i,t_1-t_0} = \alpha + \sum_k \beta_k x_{k,i,t_0} + \upsilon_i. \quad (2.1)$$

Owing to the lack of data availability regarding many important independent variables for the 1990s, the observed period $(t_1 - t_0)$ has to be restricted from 2004 to 2014. Although this is a quite limiting factor regarding the goal of an examination of overall population trends since German reunification, the descriptive analysis in Section 2.5 has shown that urban trajectories started to diverge around the turn of the millennium. Thus, a closer scrutiny of this period should be of particular interest.

As has been shown above, demographic change plays a major role in East Germany's shrinking cities and the patterns of population development vary strongly with regard to different demographic groups. In addition, Siedentop et al. (2018) have shown that recent tendencies of re-urbanization in Germany are largely driven by the inflow of young adults. The factors steering the migration behavior and urban population development may therefore strongly vary across different personal lifecycle stages (see e.g. Graves 1979; Ferguson et al. 2007; Chen and Rosenthal 2008). Following this line of argumentation, a decomposition of population development into different demographic groups should reveal interesting insights.

[16] In order to avoid potential issues of simultaneity, most of the independent variables are lagged by 3-4 years depending on data availability (see TABLE 2.4).

Hence, the regression model expressed in Equation (1) is not only estimated for the total population change, but also for the population change within the five different age groups described in Section 2.5.

The set of independent variables in equation (2.1), $\sum_k \beta_k x_{k,i,t_0}$ (for a detailed description, see TABLE 2.4), can roughly be classified into seven major categories: (1) agglomeration characteristics; (2) demographic conditions; (3) labor market conditions; (4) climate; (5) amenities, (6) history and (7) public sector institutions. While the first five categories of regressors have been extensively used in previous studies examining the driving factors of urban population change (see section 2.2), the latter two are less common and refer to the specific historical and institutional circumstances of the East German case.

Given the descriptive findings from Section 2.5, agglomeration externalities, as emphasized by the New Economic Geography (e.g. Fujita et al. 1999), should play an important role in explaining urban population growth. To account for different forms of those agglomeration economies, two complementary measurements will be used: Population density and population potential. While density reflects the high potential for social and economic interaction in strongly urbanized locations, population potential also takes into account the agglomeration spillovers from all surrounding locations. The latter is a well-established metric in the regional science literature (see e.g. Pooler 1987) and is calculated as the sum of the inverse-distance weighted population from all locations *j* within a certain radius from location *i*: $pp_i = \sum_{j \neq i} \frac{pop_j}{d_{ij}}$. There are many slightly different definitions of population potential in the literature. The version used in this paper refers to the official definition of the BBSR (Spangenberg 2003) which employs a negative exponential distance decay function $\sum_j pop_j * e^{\beta d_{ij}}$ with $\beta = 0.0693$ and a threshold radius of 100km. The inclusion of population potential as an explanatory variable also reflects some contributions within the regional science literature, stressing the importance of the so-called "borrowed size" (Camagni et al. 2017) or "agglomeration shadows" (Partridge et al. 2008, 2009), which are considered to be particularly relevant for the development of small and medium-sized cities.

As stated above, urban shrinkage in East Germany after 1989 was not only caused by de-industrialization and sub-urbanization, but also by the so-called second demographic transition. Consequently, natural population development should have played an important role and thus lagged values (2000-2004) of mean annual birth rates and death rates per 1000 inhabitants are included in the set of independent variables. While both determinants are certainly important for explaining total population change, they should be irrelevant regarding the population development within certain age groups (particularly young adults).

Of course, any examination of the drivers of urban population development would be incomplete without considering the role of local labor markets. Unfortunately, there is only limited availability of data for labor market conditions in German small- and medium-sized cities. Important indicators like GDP or wages are only available for higher-tier administrative aggregates. Nonetheless, local labor market characteristics are included by using initial unemployment rates (*Unemployment*), lagged employment growth rates during 2000–2004 (Δ*Employment*), the share of employees with an academic degree (*Education*) and the initial employment share of the manufacturing sector (*Manufacturing*). The latter is of particular interest. Since the decline of former GDR manufacturing industries is thought to be one of the main causes for East German urban shrinkage, high employment in manufacturing should exert a significant negative effect on urban population development.[17]

The fourth and fifth category of independent variables relate to the extensive literature on quality of life related factors of inter-regional migration mentioned in Section 2.2. While average January and July temperatures[18] and annual precipitation are subsumed under the category 'climate', the vector of 'amenities' involves a rather diverse set of indicators such as touristic appeal approximated by the annual amount of overnight stays in hotels and guest houses per capita (*Tourist stays*) and recreational area per capita (*Recreation area*). Further, since many of the small- and medium-sized cities are rather poorly equipped with certain consumer amenities like cinemas or theaters, it is difficult to measure the quantity of such amenities. In this case, the availability of amenities can at best be expressed by access costs (e.g. travel distance). Hence, area-weighted distances[19] to the nearest hospital, cinema hall, theatre and football stadium (*D hospital*, *D cinema*, *D theater, D stadium*) are also added to the set of regressors. Those distance measures are also in line with the literature on 'borrowed size' and 'agglomeration shadows', which claims that places near large cities have fewer consumer amenities than isolated places of similar size (Burger et al. 2015). Although the set of indicators for amenities is relatively small and arbitrarily chosen due to the limited availability of appropriate address data, the measured distances should provide a relatively good

[17] Note that the share of the tertiary sector was omitted because of collinearity issues. Since we only observe urban municipalities, the share of the primary sector was usually very low, resulting in a high collinearity of secondary and tertiary sector shares. Hence, a significant negative coefficient for *Manufacturing* can also be translated into a positive effect of service sector employment.

[18] High January temperatures as well as low annual temperature ranges have in several studies proven to be amongst the most robust predictors of urban and regional population growth (see e.g. Cheshire and Magrini 2006)

[19] Note that the access to hospitals, which stems from the INKAR database (BBSR 2017), is measured in estimated travel time, while the access to cinemas, theaters and football stadiums, stemming from the author's own research, is measured in simple road distance. Thus, the estimated coefficients should not be interpreted in the same way.

approximation of the general access to medical supply as well as cultural/consumption activities, since similar kinds of amenities are expected to be spatially clustered.[20]

As stated above, the sixth category of explanatory variables addresses the specific historical context of East German cities. As claimed in Section 3, the developments from GDR times may have exerted strong negative or positive effects on recent local population dynamics. Thus, a fifth category called 'history' gets introduced, including the compound annual population growth rate from GDR times (1946-1990; $\Delta pop\ 1946\text{-}89$) as well as the change rate prior to WWII (1925-1939; $\Delta pop\ 1925\text{-}39$). The objective of including the latter is to control for historical path dependency from earlier times.[21]

Finally, the set of regressors is complemented by two dummy variables for university cities as well as state capital cities. Universities are considered to attract high numbers of students and have positive effects on local levels of human capital as well as cultural amenities. In addition, several studies (e.g. Dascher 2000; Turner and Turner 2011) have shown that the status of being a capital city exerts positive effects on local employment and population development. This is particularly relevant for East Germany where the former GDR districts became replaced by six federal states and the concentration of public sector institutions in the remaining state capitals was reinforced. Hence, both institutions should be considered important factors regarding local population development.

To check the validity of the above presented model it is first estimated using simple OLS. Afterwards a couple of econometric tests are performed (see TABLE 2.5 and 2.6 in the appendix). Since many of the explanatory variables are likely to be correlated, variance inflation factors (VIF) are calculated to test for potential issues of multicollinearity. Since all VIF are considerably below ten, which is commonly perceived as critical threshold value (Hair et al. 2010), multicollinearity should not bias the results (see TABLE 2.5). Further, the Breusch-Pagan test (Breusch and Pagan 1979) for heteroscedasticity, the Shapiro-Wilk test for normal distribution of the residuals (Shapiro and Wilk 1965) as well as the regression equation specification error test for functional form (Ramsey 1969) are not able to reject their specific null hypotheses. While the aforementioned tests suggest that the OLS should yield valid estimates, a Moran's test for spatial autocorrelation and a spatial LM Test (Anselin 1988) using a row-normalized inverse distance matrix based on simple 'beeline' distance reveals spatial autocorrelation in the dependent variable as well as in the residuals of the OLS model (see

[20] E.g. medical practices and pharmacies are often in close proximity to a hospital, cinemas are often located in shopping malls with other kinds of consumption activities and theaters are mostly located in inner cities close to other kinds of cultural amenities.

[21] For empirical evidence on the historical persistence of city growth in Germany see e.g. Brakman et al. (2004).

TABLE 2.6). Hence, the OLS estimates might be severely biased. To account for this potential bias the baseline model in equation (2.1) is extended to a spatial autoregressive model with autoregressive error terms (SARAR):

$$\Delta pop_{i,t_1-t_0} = \alpha + \sum_k \beta_k x_{k,i,t_0} + \rho \sum_j W_{i,j} \Delta pop_{j,t_1-t_0} + \lambda \sum_j W_{i,j} \tau_j + \upsilon_i. \qquad (2.2)$$

Within this specification $\sum_j W_{i,j} \Delta pop_{j,t_1-t_0}$ refers to the spatially lagged value of the endogenous variable, $\sum_j W_{i,j} \tau_j$ represents the spatial autoregressive error term and $W_{i,j}$ is the above mentioned spatial weights matrix. Following Drukker et al. (2013), the SARAR model is estimated using the maximum likelihood method.

2.6.2 Results

TABLE 2.2 shows the results of estimating equation (2.2) for total population change and population change in different age groups. Nine observations from the initial sample had to be discarded due to lacking data availability regarding several explanatory variables for some of the smaller cities in the initial sample. Hence, the final sample consists of only 116 cities.

The explanatory power of the model, as expressed by the Nagelkerke Pseudo R-squared (Nagelkerke 1991), varies with respect to the different age groups. While it is relatively high for total population growth (0.812) and population growth of the underaged (0.825), it is relatively low for retirees (0.635).

Regarding total population change, population density, birth rates, unemployment rates, employment growth, the share of skilled labor, the share of manufacturing employment, touristic stays, and travel distances to cinemas and football stadiums are significant regressors ($p<0.05$) and all coefficients have the expected sign. Moreover, a significant negative ($p<0.1$) effect of population growth during GDR times and a very small but significant positive effect of population growth prior to WWII can be estimated, indicating that recent urban development was influenced by historical patterns of urbanization.

For some variables, there are strong differences between certain age groups. Particularly the coefficients for July temperatures are ambiguous (negative for young adults; positive for children and middle-aged). Moreover, an unexpected significant negative estimate for population potential, regarding the subgroup of citizens under 18 years can be found. This could be interpreted as a rather counter-intuitive preference of families with underaged children for highly urbanized areas and an aversion for cities at the fringe of large metropolitan areas. Further evidence for this hypothesis can be found in the result that the underaged are

surprisingly the only demographic group, where a positive effect of *Education* and the capital city dummy can be found.

TABLE 2.2. SARAR ESTIMATION: DETERMINANTS OF URBAN POPULATION DEVELOPMENT IN EAST GERMANY (2004-2014)

VARIABLES	AGE GROUP				
	total (1)	<=17 years (2)	18-29 years (3)	30-64 years (4)	>=65 years (5)
Population density	0.239**	0.645***	0.811**	-0.0859	-0.0961
	(0.121)	(0.197)	(0.318)	(0.133)	(0.201)
Population potential	-0.161	-0.580**	0.0789	-0.0221	0.466**
	(0.161)	(0.226)	(0.735)	(0.159)	(0.220)
Birth rate	0.102**	0.242***	-0.0247	0.302***	-0.206**
	(0.0510)	(0.0865)	(0.143)	(0.0590)	(0.0915)
Mortality rate	-0.0403	-0.0168	0.0155	-0.00781	-0.264***
	(0.0259)	(0.0436)	(0.0994)	(0.0290)	(0.0467)
Unemployment	-0.104***	-0.165***	-0.0793	-0.111***	-0.0767***
	(0.0170)	(0.0284)	(0.101)	(0.0208)	(0.0291)
Δ*Employment*	0.0742***	0.0630	0.293*	0.0573**	0.0180
	(0.0250)	(0.0420)	(0.158)	(0.0275)	(0.0445)
Education	0.0244**	0.0798***	0.0267	0.00852	0.0349
	(0.0121)	(0.0206)	(0.0577)	(0.0136)	(0.0217)
Manufacturing	-0.00954**	-0.00678	-0.0340	-0.0109**	0.00160
	(0.00426)	(0.00700)	(0.0222)	(0.00496)	(0.00697)
Jan temperature	0.0127	-0.0866	0.294	-0.0167	-0.185**
	(0.0597)	(0.0936)	(0.361)	(0.0677)	(0.0918)
Jul temperature	0.0618	0.226***	-0.298**	0.135**	0.0228
	(0.0581)	(0.0826)	(0.130)	(0.0631)	(0.0781)
Precipitation	-0.00173	-0.00301	-0.000902	-0.00146	-0.00550***
	(0.00129)	(0.00204)	(0.00319)	(0.00148)	(0.00199)
Tourist stays	0.0455***	0.107***	-0.0247	0.0418**	0.0714**
	(0.0155)	(0.0263)	(0.0453)	(0.0175)	(0.0278)
Recreation area	0.00221	0.00485	-0.00428	0.00263	0.00798*
	(0.00231)	(0.00393)	(0.00759)	(0.00259)	(0.00420)
D hospital	0.00124	0.00671	-0.00187	0.00504	-0.00709
	(0.00541)	(0.00918)	(0.0211)	(0.00604)	(0.00977)
D cinema	-0.0128***	-0.0252***	-0.00574	-0.00794	-0.0290***
	(0.00491)	(0.00821)	(0.0218)	(0.00546)	(0.00906)
D theater	-0.00178	-0.00446	0.000551	-0.00203	0.00600
	(0.00209)	(0.00360)	(0.00928)	(0.00241)	(0.00559)
D stadium	-0.00229**	-0.00539***	0.00193	-0.00281**	0.000661
	(0.00107)	(0.00171)	(0.00387)	(0.00119)	(0.00188)
Δ*pop. 1925-39*	0.000103**	0.000154**	5.94e-06	9.02e-05*	0.000228***
	(4.15e-05)	(7.33e-05)	(0.000124)	(4.91e-05)	(7.61e-05)
Δ*pop. 1946-89*	-0.0264*	-0.0639***	-0.0161	-0.0417**	0.0594**
	(0.0138)	(0.0233)	(0.0502)	(0.0164)	(0.0243)
University	0.0726	-0.285	1.611***	-0.145	-0.375*
	(0.118)	(0.203)	(0.401)	(0.133)	(0.210)
Capital	0.132	0.447*	0.123	0.128	-0.153
	(0.153)	(0.261)	(0.434)	(0.177)	(0.276)
Spatial lag	0.846***	0.761***	0.515	0.724***	0.552*
	(0.148)	(0.214)	(1.834)	(0.271)	(0.294)
Spatial error	0.0588	-0.864	-2.299	-0.166	-1.923*
	(0.964)	(1.108)	(8.090)	(1.322)	(1.152)
Pseudo R-squared	0.812	0.825	0.707	0.724	0.635
Observations	116	116	116	116	116

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Source: Author's own calculations.

Young adults, on the other hand show a strong preference for densified cities, while the coefficients for the labor market characteristics (except for employment growth) as well as amenities and historical population growth rates are all insignificant. As expected, also a strong positive effect of the university dummy can be found for this age group. Opposite 'revealed preferences' can be observed for the 'middle-aged' population where labor market variables, amenities and historical growth rates have significant coefficients ($p<0.05$), while the estimates for agglomeration effects are insignificant. Rather surprisingly, also a positive effect of birth rates can be found, indicating that this group might be particularly attracted to places providing preferable opportunities to raise children. The estimates for the population development of retirees are at least partially unexpected. While it seems reasonable that labor market characteristics are less relevant for explaining the locational preferences of this subgroup and quality of life-related factors such as precipitation, touristic appeal and recreation area play a more important role, rather unexpected significant negative coefficients for birth rates, January temperatures ($p<0.05$) and the university dummy ($p<0.1$) can be found. Moreover, the estimates highlight a significant positive correlation between population change during socialism and recent population change among retired citizens, probably reflecting the residential stickiness within this age group.

2.6.3. Robustness Test

The above presented results refer to the population development of almost all East German cities with more than 20,000 inhabitants in 1990. Most of these cities can be categorized as small or medium-sized, but at least three cities, Berlin, Dresden and Leipzig, distinctly stand out regarding their size and metropolitan functions. According to Herfert and Lentz (2007) the largest East German cities represent islands of growth within an area of drastic population decline. Moreover, Berlin represents a very atypical kind of a post-socialist city, as its western half has never been part of the socialist GDR and it became the capital of re-unified Germany soon after the rise of the iron curtain. Since this study puts a particular emphasis on the population dynamics of small and medium-sized cities, it seems reasonable to exclude the three largest cities from the regression analysis to test for the robustness of the above presented results.

TABLE 2.3. SARAR ESTIMATION: DETERMINANTS OF URBAN POPULATION DEVELOPMENT IN EAST GERMANY (2004-2014; EXCLUDING BERLIN, DRESDEN AND LEIPZIG)

VARIABLES	AGE GROUP				
	total (1)	<=17 years (2)	18-29 years (3)	30-64 years (4)	>=65 years (5)
Population density	0.298***	0.688***	1.053***	-0.124	0.111
	(0.113)	(0.191)	(0.310)	(0.145)	(0.205)
Population potential	0.634***	0.301	1.925***	0.0819	1.253***
	(0.231)	(0.355)	(0.533)	(0.299)	(0.349)
Birth rate	0.0984**	0.239***	-0.0814	0.312***	-0.243***
	(0.0489)	(0.0819)	(0.137)	(0.0631)	(0.0909)
Mortality	-0.0508**	-0.0294	-0.0325	-0.00860	-0.277***
	(0.0240)	(0.0407)	(0.0709)	(0.0289)	(0.0466)
Unemployment	-0.0796***	-0.133***	-0.0296	-0.103***	-0.0582**
	(0.0160)	(0.0268)	(0.0443)	(0.0232)	(0.0288)
Δ*Employment*	0.0695***	0.0501	0.262***	0.0540**	0.0112
	(0.0229)	(0.0386)	(0.0724)	(0.0272)	(0.0437)
Education	0.0136	0.0650***	-0.00271	0.00518	0.0302
	(0.0114)	(0.0194)	(0.0338)	(0.0138)	(0.0218)
Manufacturing	-0.00953**	-0.00492	-0.0292***	-0.0107**	0.00389
	(0.00380)	(0.00622)	(0.0104)	(0.00506)	(0.00682)
Jan temperature	0.0554	-0.0173	0.370**	-0.000191	-0.163*
	(0.0532)	(0.0866)	(0.153)	(0.0670)	(0.0880)
Jul temperature	0.0610	0.223***	-0.344***	0.147**	-0.00357
	(0.0447)	(0.0734)	(0.117)	(0.0663)	(0.0762)
Precipitation	-0.000312	-0.000775	0.00140	-0.000555	-0.00541***
	(0.00113)	(0.00190)	(0.00304)	(0.00159)	(0.00192)
Tourist stays	0.0418***	0.100***	-0.0288	0.0390**	0.0769***
	(0.0156)	(0.0244)	(0.0428)	(0.0178)	(0.0272)
Recreation area	0.00257	0.00437	-0.00267	0.00193	0.00981**
	(0.00216)	(0.00368)	(0.00607)	(0.00259)	(0.00406)
D hospital	-0.000984	0.00260	-0.00657	0.00393	-0.00935
	(0.00519)	(0.00849)	(0.0150)	(0.00602)	(0.00957)
D cinema	-0.0105**	-0.0208***	0.00260	-0.00692	-0.0260***
	(0.00453)	(0.00762)	(0.0130)	(0.00546)	(0.00859)
D theater	-0.000248	-0.00345	0.00340	-0.00211	0.00830
	(0.00217)	(0.00335)	(0.00560)	(0.00269)	(0.00554)
D stadium	-0.000286	-0.00307*	0.00762***	-0.00268*	0.00304
	(0.00110)	(0.00178)	(0.00295)	(0.00137)	(0.00201)
Δ*Population (25-39)*	0.000101***	0.000158**	-3.47e-05	9.38e-05*	0.000227***
	(3.85e-05)	(6.55e-05)	(0.000115)	(4.86e-05)	(7.50e-05)
Δ*Population (46-90)*	-0.0265*	-0.0653***	-0.0200	-0.0395**	0.0507**
	(0.0148)	(0.0224)	(0.0386)	(0.0179)	(0.0238)
University	0.120	-0.241	1.802***	-0.161	-0.242
	(0.111)	(0.189)	(0.317)	(0.135)	(0.210)
Capital	0.211	0.695***	0.311	0.223	-0.0842
	(0.153)	(0.260)	(0.447)	(0.186)	(0.295)
Spatial lag	0.886***	0.808***	0.590	0.768***	0.561*
	(0.116)	(0.181)	(0.402)	(0.258)	(0.294)
Spatial error	-0.709	-0.881	-2.442	-0.318	-2.410**
	(1.686)	(1.105)	(1.742)	(1.831)	(1.107)
Pseudo R-squared	0.815	0.821	0.689	0.764	0.655
Observations	113	113	113	113	113

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Source: Author's own calculations.

TABLE 2.3 reports the results of estimating equation (2), when Berlin, Dresden and Leipzig are excluded. Most of the estimates do not widely differ from TABLE 2.2. The most obvious effect of the sample reduction is that now a significant positive effect of population potential on total population growth can be found. This means that the strong results for population density compared to population potential were largely driven by the largest cities. When only small and medium-sized cities are considered, not only the agglomeration benefits within a city itself, but also agglomeration spillovers from nearby areas matter for urban population development. In addition, the robustness test reveals a significant negative effect ($p<0.01$) of relative manufacturing sector size on the development rate of young adults.

2.7 Conclusion

The descriptive analysis of the trajectories of East German urban population growth since 1990 has shown that more and more cities have recently left their path of long-term shrinkage and entered a phase of stabilization or even resurgence. However, those recent trajectories are still very unequally distributed over space with (re-)growth in the largest cities (mainly Berlin, Dresden, and Leipzig) and some smaller cities in their surrounding regions, stagnation in 'third-tier' and medium-sized cities and ongoing shrinkage in most of the small and more peripheral cities. Furthermore, the diverging population trajectories are strongly related to demographic change and diverging population change rates in different age groups. Urban population shrinkage is strongly related to an ageing society and decreasing shares of children and young adults.

Furthermore, a cross-sectional spatial regression analysis for the period 2004–2014 reveals that recent patterns of urbanization are determined by a complex set of factors, differing strongly with regard to population change of different age groups. While young adults between 19 and 29 years are mostly attracted by large and dense cities regardless of traditional labor market factors and amenities, older generations (30-64 years, >=65 years) seem to prefer less populated and more peripheral cities. Amenities like the touristic appeal of a city, and access to certain leisure activities also play an important role for the latter groups. The estimates on climate-related variables are very ambiguous and seem to confirm that climate has not played a major role for East German inter-urban migration and population growth. This finding is in contrast to previous studies scrutinizing the population growth of European cities (e.g. Cheshire and Magrini 2006; Barreira et al. 2017)

On the other hand, a relevant and significant negative correlation between past population change rates from GDR times and recent population development can be found, indicating that today's urban population dynamics are to some degree still determined by socialist trajectories

and the harsh structural break occurring in 1989. The latter findings resemble the results of some studies examining the intra-regional population dynamics in other shrinking regions under the influence of economic restructuring (Hoekveld 2015; Hoekveld and Bontje 2016). Moreover, a slight but significant positive correlation between pre-WWII and recent trajectories can be found, indicating that urban growth in East Germany has been remarkably persistent over time. This also means that the policies of 'prioritization' under centralist planning were not successful in sustainably changing the development of the East German urban system.

From the perspective of local policymakers these results are rather discouraging. Providing a favorable climate for economic development as well as promoting certain consumption amenities are common strategies of local policymakers to improve the attractiveness of a city particularly for the young and highly skilled. But since many of the significant independent variables (like agglomeration effects and historical path dependence) are outside the area of influence of local policymaking, the opportunities of shaping urban population trajectories are severely restricted. Thus, in many cases of small and more peripheral cities, strategies coping with the consequences of urban shrinkage might be more promising than the traditional growth-oriented approaches (Bernt 2009).

Of course, some caveats of the results presented above should be considered. Owing to the focus on small- and medium-sized cities and the availability of restricted data regarding those cities, the estimations lack certain important and interesting independent variables (e.g. information about wages, housing markets, pollution, etc.) that could lead to an even more comprehensive assessment of the urban growth determinants in East Germany. Moreover, although the above-mentioned cross-sectional approach uses initial (and partially lagged) city characteristics as independent variables, it does not finally resolve any endogeneity issue pertaining to certain demographic and economic factors (e.g. employment growth, the share of employees with an academic degree). Consequently, beyond contributing to the debate on the drivers of urban growth and decline by setting it against the barely researched post-socialist context, this study cannot finally resolve the already discussed 'hen–egg' problem—whether jobs follow people or the contrary. As the cross-sectional framework applied within this paper is not able to identify the direct effects of the various economic and political changes that occurred during this period (e.g. administrative reforms, European integration) and particular channels of path dependencies from socialist times, the assessment of such changes and channels will require new datasets and more sophisticated identification strategies.

Last but not least it would be interesting to compare the results presented in this paper to results from further CEE countries. East Germany certainly represents a hybrid form of a post-

socialist economy due to its abrupt integration into the Federal Republic of Germany. Therefore, it cannot be taken as granted that the above discovered patterns and drivers of urban population development can also be observed in other post-socialist countries.

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APPENDIX

TABLE 2.4. DESCRIPTION OF VARIABLES AND DATA SOURCES

VARIABLE		Year	Source
Δ*Population*	Annualized population change rate	1990-2014 2004-2014*	Federal Statistical Office of Germany (DESTATIS 2016)
Population density	population density (1000 inhabitants per km²)	2000	Federal Statistical Office of Germany (DESTATIS 2016)
Population potential	Distance weighted measure of population (within 100km radius from the municipalities centroid)	2000	Federal institute for Research on Building, Urban Affairs and Spatial Development (BBSR 2017)
Birth rate	Births per 1000 inhabitants	2000-2004	Federal institute for Research on Building, Urban Affairs and Spatial Development (BBSR 2017)
Mortality rate	Deaths per 1000 inhabitants	2000-2004	Federal institute for Research on Building, Urban Affairs and Spatial Development (BBSR 2017)
Unemployment	unemployment rate	2001	Federal institute for Research on Building, Urban Affairs and Spatial Development (BBSR 2017)
Δ*Employment*	employment growth (adjusted to 2015 territorial boundaries)	2000-2004	Federal Statistical Office of Germany (DESTATIS 2016)
Manufacturing	manufacturing share of total employment	2001	Federal institute for Research on Building, Urban Affairs and Spatial Development (BBSR 2017)
Education	Share of employees with academic degree	2001	Federal Agency of Employment (2018)
Jan temp	avg. January temperature	1981-2010	German Weather Service (DWD 2017)
Jul temp	avg. July temperature	1981-2010	German Weather Service (DWD 2017)
Precipitation	avg. annual precipitation	1981-2010	German Weather Service (DWD 2017)
Tourist stays	annual overnight stays in hotels and guest houses per capita	2001	Federal institute for Research on Building, Urban Affairs and Spatial Development (BBSR 2017)
Recreation area	recreational area per capita	2000	Federal institute for Research on Building, Urban Affairs and Spatial Development (BBSR 2017)
D hospital	area-weighted travel time (by car) to nearest hospital	2017	Federal institute for Research on Building, Urban Affairs and Spatial Development (BBSR 2017)
D cinema	area-weighted road distance to nearest cinema	2017	author's own research (based on STROER STRÖER Media Brands GmbH 2018)
D theatre	area-weighted road distance to nearest theater	2017	author's own research (based on Deutscher Bühnenverein 2018)
D stadium	area-weighted road distance to the nearest football stadium	2017	author's own research

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Δ*pop 1925-39*	pre-WWII population development	1925-1939	Statistisches Jahrbuch für das Deutsche Reich (1927, 1941)
Δ*pop 1946-90*	population development during GDR times	1946-1990	Bevölkerungsstatistisches Jahrbuch der Deutschen Demokratischen Republik (1968)
University	dummy=1 for university cities	2017	author's own research
Capital	dummy=1 for federal state capitals	2017	author's own research

Source: Author's own research. *Population change rates in the descriptive analysis in Section 2.5 cover the whole period 1990-2015. The regression analysis in Section 2.6 only covers the period from 2004-2014.

TABLE 2.5. VARIANCE INFLATION FACTORS

VARIABLE	VIF	1/VIF
Population density	4.34	0.230639
Precipitation	3.99	0.250421
Population potential	3.35	0.298382
January temperature	2.74	0.365081
Education	2.70	0.369961
University	2.53	0.395854
Unemployment	2.43	0.412129
Mortality rate	2.26	0,442953
Birth rate	2.13	0.470499
July temperature	2.10	0.477176
Δ*pop 1946-90*	1.76	0.569183
Manufacturing	1.66	0.601253
D stadium	1.66	0.603704
Capital	1.63	0.612028
Δ*Employment*	1.58	0.633737
Recreation area	1.53	0.654675
Tourist stays	1.47	0.679209
D theater	1.47	0.681426
D cinema	1.39	0.721748
D hospital	1.11	0.901268
Δ*pop 1946-90*	1.11	0.90265
Mean VIF	2.14	

Notes: VIF for all explanatory variables of the regression model (equation 1) in order of their decreasing magnitude. Source: Author's own calculations.

TABLE 2.6. REGRESSION DIAGNOSTICS

AGE GROUP	total (1)		<=17 (2)		18-29 (3)		30-64 (4)		>=65 (5)	
TEST	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value	Statistic	p-value
Breusch-Pagan test:										
Chi^2	2.310	0.129	0.040	0.837	2.460	0.110	0.200	0.654	1.130	0.288
Ramsey RESET test:										
F	1.890	0.136	0.530	0.660	1.930	0.132	0.150	0.929	2.730	0.2485
Shapiro-Wilk test:										
Z	-0.273	0.608	-0.470	0.681	0.856	0.176	0.859	0.150	0.653	0.257
Spatial error:										
Moran‘s I	42.480	0.000***	2.464	0.014**	1.399	0.162	3.694	0.000***	0.871	0.384
Lagrange multiplier	1.371	0.242	0.054	0.817	0.108	0.743	0.773	0.379	0.368	0.544
Robust Lagrange multiplier	4.554	0.033**	4.238	0.040**	0.429	0.512	1.904	0.168	3.200	0.074*
Spatial lag:										
Lagrange multiplier	16.108	0.000***	6.383	0.012**	0.000	0.995	6.552	0.010***	0.774	0.379
Robust Lagrange multiplier	19.292	0.000***	10.567	0.001**	0.321	0.571	7.683	0.006***	3.606	0.058*

Notes: Post-regression statistics for estimating equation (1) for the population change rate of different age groups as dependent variable by OLS. The Shapiro-Wilk test refers to non-nomality in the residuals. Source: Author’s own calculations.

Chapter 3

Does Administrative Status Matter for Urban Growth? – Evidence from Present and Former County Capitals in East Germany*

BASTIAN HEIDER, ALBRECHT KAUFFMANN† and MARTIN T.W. ROSENFELD‡

ABSTRACT Public sector activities are often neglected in the economic approaches used to analyze the driving forces behind urban growth. The institutional status of a regional capital is a crucial aspect of public sector activities. This paper reports on a quasi-natural experiment on county towns in East Germany. Since 1990, East German cities have demonstrated remarkable differences in population development. During this same period, many towns have lost their status as a county seat due to several administrative reforms. Using a differences-in-differences approach, we compare the annual population development of former county capitals to population change in towns that have successfully held on to their capital status throughout the observed period. The estimations show that losing county capital status has a statistically significant negative effect on annual changes in population. This effect continues to increase over time after the respective reforms have been implemented.

* *This chapter has been published under the same title in Growth and Change 49 2018: 33-54. The concept for the paper has been developed by all three authors. Bastian Heider has conducted the literature review (section 3.1:.61ff) and the empirical analysis. The construction of the dataset (involving territorial adjustments) has been carried out by Albrecht Kauffmann. Martin T.W. Rosenfeld has been responsible for the theoretical section (3.2).*
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3.1 Introduction: Cities as Nodes in the Network of Public Sector Activities

As Roos (2004: 412) explicitly states, economic approaches that analyze the driving forces behind urban economic growth mostly ignore the impact of public sector activities. Yet, the public sector is responsible for basic formal institutional choices within the economy and it influences the economic process through fiscal (taxes, expenditures) and regulative instruments. By making use of these instruments, governmental units and decision makers at all regional levels frequently try to alter the spatial allocation of resources so that they are in line with specific political ideas (Funck 1995).

A relatively long-term and stable public impact on the spatial allocation of resources can be derived by assigning the competencies of administrative functions to a specific location, thus determining its position within the governmental hierarchy or administrative ranking of locations. This assignment of functions is always linked to the decision of locating public facilities to a certain place. Given a certain function and a certain range of competencies, the

larger the administrative area is, the more centralized the position of this public facility becomes. This may also be regarded as an attempt to – in the words of Krippner (1993) – "prescribe the position of a city within the hierarchy of central places". In practice there are two ways of assigning public functions to a certain place. Firstly, the general structure of public administration has to be considered. In most countries, there is more than one level or tier of government. In Germany, for example, there are four governmental levels: central or federal level, state level, county level and municipal level. The 'main seat' or 'main domicile' of administration at each of these levels is always located in a certain place. Secondly, governments at all levels have often created 'secondary domiciles' for some branches of their administration and/or regional subdivisions. For instance, the Federal Agency of Labor is located in Nuremburg rather than in Berlin, and the agency is subdivided into several regional and many local agencies.

The concentration of administrative bodies in a certain place may generate positive effects on overall local demand and produce positive externalities for private households and businesses located at this place. As part of the debate on institutions as relevant factors of local economic growth, Storper (2010: 2037f) mentions the importance of allocating formal governmental competencies within metropolitan regions. This is in line with Krugman (1996: 19ff), who argues that political centralization (concentrating public facilities in a certain place) plays an important role in the agglomeration process. There is currently only little empirical evidence for these interrelations. Caroll and Meyer (1982) find that state capitals in the US grow faster (measured in population and infrastructure growth) than other cities, when state expenditures grow dynamically. Ades and Glaeser (1995) show that, in a cross-section of 85 primate cities, the populations of these cities are 42% higher when they are also national capitals. They also link this concentration of the national population in capitals to the degree of political instability and dictatorship. This finding is largely in line with Kim and Law (2012), who observe an exogenous distribution of political institutions in the Americas caused by a variation in the European colonial experience. They suggest that political centralization at the national level contributes to urban primacy and a size distribution of cities favoring large cities. Furthermore, when Kim and Law (2016) compare city growth in Canada and the US, they find that the state capital city effect rose significantly in both countries throughout the 20th century reflecting increasing political centralization. However, the state capital city effect in Canada strongly increased over the second half of the 20th century whereas the state capital effect in the US remained constant. Kim and Law relate this to diverging paths of political centralization at the sub-national level in both countries.

Using panel data from the German state of North Rhine-Westphalia, Dascher (2004) estimates that changes in a county's budget affect the rate of employment in towns with the seat of a county government (so-called 'Kreisstädte' ['county towns']), even when public sector employment is excluded. This is consistent with the findings of Turner and Turner (2011) who estimate a significantly positive relationship between state expenditure and the income of US state capital city residents relative to residents in the rest of the government's jurisdiction. Moreover, Turner (2014) shows that government employment and government expenditures per employee decrease as distance to the state capital increases.

One approach for detecting the impact of public facilities on the local economy is to study the effects of the relocation of public facilities from one place to another. This can be regarded as a type of 'natural experiment'. Becker et al. (2015) study the impact of the relocation of the German Federal Government to Bonn in the wake of the Second World War and find that Bonn experienced significant increases in population and total employment compared to a synthetic control group of German cities. Beyond this paper there are only few descriptive empirical studies on such 'natural experiments'. For example, Wilk (2004) shows that, based on the case of the voivodship reforms in Poland in 1999, there is a "certain relationship" between losing the status of regional capital and a weakened economic position for some cities. Applying cluster analysis, Kauffmann (2009) shows similar results for former GDR district capitals in East Germany which did not become federal state capitals subsequently to German reunification.

Relocating federal or state capitals happens much more infrequently than smaller administrative reforms. The relocation of regional or county capitals allows for a broader empirical base. Interpreting case studies from Franconia (a region in the state of Bavaria), Krippner (1993) is unable to identify any negative effects for towns that lost the status of a county town. Based on a broad survey of private businesses and households, Holtmann et al. (1998) come to the conclusion that the county reform in the German state of Saxony-Anhalt in 1993 negatively impacted cities that lost their status as county towns, and positively impacted the remaining county towns; however, these effects were relatively low, at least in the initial years following the reform. Finally, Dascher (2000a) compares 155 West German towns, which held the seat of county government until at least 1987, with 176 former county towns (cities which lost the county seat between the late 1960s and the mid-1970s). By applying a cross-sectional regression using a broad set of control variables, he estimates that the status of being a county town positively affects local employment growth. The study does not include county

towns that, in addition to being the seat of a county, are a county in their own right ('Kreisfreie Städte' or 'Free Towns').

However, Dascher's (2000a) empirical approach raises some questions. The dependent variable is employment growth (excluding public sector employment) based on census data on German employment at only two points in time (1970 and 1987). Since the West German county reforms were not over by 1970, this cross-sectional approach may ignore the time dimension of adjusting growth paths, as well as mix up employment growth before and after losing the county capital status. In addition, Dascher does not explicitly control for changes in the territorial size of these cities[22], but the reforms at county level went along with changes in territorial boundaries at the municipal level.

With regard to the county reforms in East Germany after the German reunification, Dascher (2000b: 126f) argues that these reforms could, in general, represent a good field for testing his findings for West Germany. However, he expresses severe doubts as to whether such a test could be successfully implemented, since the public sector in East Germany played a key role in East German employment, at least at the turn of the 21st century. From the authors' point of view, this has changed in the last 15 years, although the public sector in East Germany still has more employees per capita than in West Germany. Moreover, in contrast to the previous reforms in the West, the explicit goal of county-level reforms in East Germany was to increase public-sector efficiency.[23] This means that they were not linked to an increase in public expenditure at the municipal level. Furthermore, during the last decade politicians – particularly in East Germany – have been increasingly discussing adjusting public administration spatial patterns in light of new socioeconomic conditions, namely changes in demographics and rising fiscal stress within the public sector. For the process of political decisions about relocating public functions and public facilities in general, it would be beneficial to know more about how the localization of public facilities impacts local economic development, or at least if there is any impact at all. This is especially relevant for East Germany, where the urban hierarchy has changed drastically since 1990 and policymakers at all tiers of government are busy devising measures to support cities that have lost their economic potential. This question also has high political relevance today (2017) since there is an ongoing political debate in two East German

[22] See Dascher (2000a: 382) where he states that "… few variables were updated by the statistical offices", but does not state explicitly which variables these are.

[23] The goal of West Germany's territorial reforms in the 1960s and 1970s was mainly to adjust the level of public activities in regions lagging behind the situation in the wealthier parts of the country (see Rosenfeld 1989: 36).

states (Brandenburg, Thuringia) regarding plans by their state governments to reform the government at county level, including changing the administrative status of cities.

Following these explanations, we use data from the 'laboratory' of East German county reforms to test the general hypothesis that being a capital city positively impacts urban growth. Our results indicate that losing county capital status has a statistically significant negative effect on annual changes in population and that this effect is increasing over time. The paper is organized as follows: In Section 3.2, we will look at theoretical approaches for explaining how the location of public utilities within a region influences the urban economy. Section 3.3 presents our estimation strategy and econometric model. Some comments on our dataset and descriptive statistics are provided in Sections 3.4 and 3.5. The estimation results follow in Section 3.6. Finally, we draw some conclusions for future research and discuss the policy implications of our findings (Section 3.7).

3.2 Urban Growth and the Role of County Towns in Theory

As previously discussed, the focus of this paper lies on understanding the implications of a city's status (or change in status) as a 'county capital' or 'county town'. The county level of government in Germany is located between the municipal level (the lowest level of government) and the state level. States decide on the concrete institutional settings of counties and municipalities, while the central (federal) level of government has no direct responsibility for organizing counties and municipalities. Larger municipalities or cities have the status of "free towns" (kreisfreie Städte), making them a county in their own right with all the competencies of a municipality and a county. All German state capitals are free towns with the exception of Saarbrucken in West Germany. In principle, a state capital or a free town may also be chosen as a county capital. This is currently not the case in East Germany.[24] German counties are mainly financed by subsidies from the state government and a 'county tax' ('Kreisumlage') which is paid by the municipalities. The level of county tax is determined by the county councils. The counties' primary responsibilities lie in the areas of secondary schools, adult education centers, theaters, museums, hospitals, public transportation, social services, consultancy services for private firms, public saving banks, rescue services, waste disposal, county roads, and the general promotion of economic development (Thieme 1984; Zimmermann 1999).

[24] However, in the past, some cities were both a free town and a county capital.

In Germany, the status of a county town is either determined by the state government or by the county councils.[25] Being a county capital implies first and foremost that public facilities are highly concentrated within the county town. Of course, not all of a county's public facilities have to be located within the county town. A certain degree of spatial de-concentration and the localization of some public facilities in other cities of the county is quite common. In addition, the division of competencies between the county administration and the municipal level of government may also differ from county to county. Secondly, the county's most relevant steering or governance functions are more or less always completely located in the county town.

From a theoretical point of view, the status of a city as a county-capital may contribute to urban growth in the same way as public facilities may generally affect the local economy (Forslid 2004). Public facilities have *demand effects* and *supply effects*.[26] Demand effects are generated by the expenditures of a public facility for different inputs (labor and capital goods).[27] *Supply effects* arise when a public facility (making use of these inputs) generates benefits for private households or private businesses. In addition to this quite common general differentiation, the localization of the county administration within a certain city may also lead to relevant *externalities* which are not directly influenced by the functions of the county administration. Different theoretical approaches have been used to try to explain the local economic effects of having capital city status. While Dascher (2000a), mainly rooted in the literature on local public economics, focuses on the (distance-sensitive) supply effects of public facilities, Becker, Heblich and Sturm (2015), building on New Economic Geography models, analyze productivity and amenity spillovers created by the local public sector.

Demand effects include the direct employment effects of a public facility and the multiplier effects of the employment effect resulting from private expenditures made by the employees. These are followed by positive effects on local taxes and additional employment effects resulting from higher local public spending.[28] Most county employees will reside within the county town or quite close to it. Therefore, the county towns benefit more from the employment effects than other municipalities within a county. The level of benefits depends on the marginal propensity to import inputs for the county administration from other municipalities or regions

[25] A referendum was held in some states to determine the seat of the county administration instead of a decision by the county councils.

[26] This differentiation is quite similar to the one proposed by Dascher (2000a: 376), differentiating between benefits from the "production" and benefits from the "consumption" of publicly provided goods and services.

[27] There will always be some migration towards the county town when a city is initially declared to be a county capital or when the capital function is relocated from one town to another. Some county administration employees will always choose to reside near their workplace. This is akin to a "natural rate of migration towards a county town".

[28] For empirical evidence see Turner (2014)

(Dascher 2000a: 375f). People visiting the city where a public facility is located create an indirect employment effect (demand for hotel rooms, restaurants, retail shops etc.). The county's governing function may particularly attract persons wanting to negotiate with, or lobby, the county authorities. Again, this indirect employment effect is followed by multiplier effects and the positive effects of increased expenditures by the local public sector in the county town.

The *supply effects* of a public facility vary according to the public tasks or functions that it has to fulfill. In terms of county seat functions, some functions may produce benefits which decrease as the distance to the county town increases (Jurion 1983; Sakashita 1987; Dascher 2000a). In contrast, the benefits of other functions may spill over, more or less equally, to all of the municipalities within a county ('distance insensitive functions'). In the case of county-level government, most county functions should be distance insensitive, as the task of the county, within the context of the German federal system, is explicitly to reduce interregional disparities. But several county functions that are highly important for private households and firms can be characterized as distance-sensitive functions, e.g. secondary schools, adult education centers, museums, theaters, hospitals, public transportation, social services, consultancy services for private firms, public saving banks, and rescue services. Households within or close to a county town may benefit more from increased accessibility to such goods and services than people elsewhere in the county. Moreover, private businesses in the county town may also benefit more from distance-sensitive functions than businesses in other parts of the county. Consequently, private households and private businesses should have an incentive to move to the county town because of the good accessibility of these distance-sensitive functions within the county town. As distance is also relevant for lobbying, one may assume that the local policymakers from the county town also have easier access to county-level policymakers than local policymakers from other parts of the county. Face-to-face contact to a county administration might be particularly important for private businesses in times of changing public regulations and/or a high degree of public impact on the private economy (for the possible channels of supply effects of a regional capital see Reichart 1993; Wilk 2004). Both conditions existed in East Germany, where the institutions for municipalities and private businesses were newly created after 1990, and where very high amounts of federal subsidies had to be allocated to municipalities and private businesses.

A positive externality of the county town is that, over the longer run, higher levels of government may have the tendency to orient the construction of roads and railways towards the capital (Dascher 2000a: 378). Higher levels of government may also tend to concentrate their

financial support of local institutions, like museums or theaters, to the county capitals or to the free towns, as long as these cities are centrally located within the county. In addition, state governments sometimes allocate extra grants – within the system of general subsidies – to their county towns.[29] Last but not least the county administration may – at least for reasons of prestige – care more about the development of the county town than about municipalities in the political hinterland. Ultimately, the factors described above hint at a preferential treatment of county towns and may improve their position within interregional competition. Finally, politicians and higher-ranking civil servants tend to participate in the social and cultural life of their community. Therefore, they may contribute to the formation of local networks and social capital as well as cultural amenities, making the city more attractive for other citizens and businesses.

Having only discussed the positive impacts of county capitals so far, one should, of course, also take into account that there may be some negative externalities on local economic growth as well. It may be assumed that cities dominated by the public sector are much less dynamic than other cities because people within those cities have become accustomed to living off of public resources that are financed by people and businesses from other parts of the county. As Krippner (1993: 69) puts it, some of these cities may have turned into "sleeping beauties". There is also a certain marginalization of private activities when the best space in a city is occupied by public activities. However, these arguments may mainly be relevant for cities with a very dominant public sector. In general, we do not assume that the negative effects of public utilities are stronger than the positive effects.

All of the positive effects of being a county town, as described above, may result in incentives for in-migration to a county town. Above all, the supply effects for private households may operate in this direction, as households benefit directly from all of the distance-sensitive public functions explained above. This incentive, caused by the allocation of public facilities in a county town, is augmented by the system of financing counties. Financing counties in Germany does not take into account the distance between private households or businesses and the seat of the county administration, where most of the county's public facilities are located. From the perspective of public economics, this may be interpreted as a violation of the "principle of fiscal equivalence", which requires a spatial congruency between the people benefiting from a public service and those who are involved in financing this service (Olson 1969).[30]

[29] At present in East Germany this only occurs in the state of Brandenburg.

[30] As already mentioned, counties in Germany are substantially financed by the 'county tax' (Kreisumlage) which municipalities in the county pay according to their fiscal capacity. As municipalities with good economic performance have a better fiscal capacity, a form of indirect compensation for the advantages from living in a

One could argue that causality works the other way around – the hypothesis being that cities, which are already economically strong and have the potential to grow and to attract people, are chosen to become county capitals.[31] This might have been the case when the county towns were initially selected decades or even centuries ago. But within this study we only observe county reforms, where one former county town is chosen to be the new and future county town, while one or more other county towns lose this status. Hence, at least for East Germany, there is no evidence to support this hypothesis. In some cases, (e.g. in the state of Brandenburg, but also in parts of Saxony), policymakers even explicitly selected cities with a relatively weak economic position to become the new county capital in order to support their development (Büchner and Franzke 2001). But as far as we know, impacting the regional economy was generally not a primary goal of county reforms. The intention of improving the efficiency and effectiveness of the county administration was a much more relevant factor.

In conclusion Hypothesis I is derived as part of a preliminary summary: *The status of being a county town generally supports the private economic activities within this town and results in higher growth rates than in cities without this status.*

As stated above, a free town has a special type of county capital status. The administration of a free town provides goods and services only for the private households and private businesses which are located within the administrative borders of the city, not for a larger area (a whole county).[32] Therefore, a city might be less negatively impacted by losing its 'free town' status than losing its 'county capital' status. But one has to consider that a free town has just one administration. This leads to a reduction in inter-administrative transaction costs and transaction costs for private households and businesses which have to contact the administration. Losing the status of a free town may, therefore, lead to negative implications (higher costs) for the private sector. In addition, free towns have more autonomy than regular county towns. This institutional setting most likely results in advantages that attract new businesses, as long as the congestion costs within the cities are relatively small. The latter is the case for most East German free towns because there is plenty of free space everywhere as a result of the general consequences of the transition process. One advantage of a city belonging to a county is that the county may contribute to reduce the 'exploitation' of a core city by households and businesses in adjacent municipalities. But similar positive effects may result from other institutional settings, such as intermunicipal cooperation in urban and regional

county capital does exist, but this is not perceived by the private households and therefore not integrated into the decisions they make regarding their location.

[31] For this line of arguments see Jacobs (1984: 142)

[32] Of course, free towns often produce externalities for adjacent municipalities as well.

planning between a free town and its neighbors. In such a setting, the free town may have a stronger position for negotiating than a regular county town.

Taking these considerations into account, Hypothesis II is derived: *The status of being a free town will ceteris paribus support the private economic activities within this town more than the status of being a county town. This will result in stronger urban growth.*

3.3 Estimation Strategy

3.3.1 Baseline Model

The basic estimation is roughly based on the formal setup presented in Dascher (2000a: 379ff). A dummy variable is used to account for the 'distance-sensitive utility' towards a 'capital good'. One may argue that a dummy insufficiently measures the actual distance between city *i* and the current county capital, but in the case of East German counties, differences in distances between former and current county capitals are usually almost irrelevant (less than 50 km driving distance in most cases). Hence, a dummy that captures whether the distance to the capital stays at zero or increases is, in our view, a sufficient measure.

The main difference between our approach and Dascher's is that we use panel data and differences-in-differences (DID) to estimate the effects of changes in administrative status as a form of policy measure. Although DID is a very popular methodology with respect to all kinds of 'natural experiments', as far as the authors are aware, this is the first time it has been applied to a setting where the administrative hierarchy of towns changed over time. Thus, in contrast to all previous studies, this is the first attempt to really compare urban growth before and after losing capital status through the use of a control group of towns that consistently maintain regional capital status.

Based on the reflections made above, we construct a baseline two-way fixed effects model:

$$\Delta pop_{it} = \beta\ treat_{it} + \mu_i + \lambda_t + \nu_{it} \qquad (3.1)$$

The left hand variable is the annual percentual population growth rate: $\Delta pop_{i,t} = (\frac{pop_{i,t} - pop_{i,t-1}}{pop_{i,t-1}}) * 100$. Though population growth is hardly equivalent to economic growth, there are four good reasons to rely on this variable. First, population growth doubtlessly is in line with a distance-sensitive utility function, where the individual is better off living in the capital than in the political hinterland due to better access to certain public goods and services. Second, population size is the most common measure for identifying a city's position within urban hierarchies. An individual's decision to move to or leave a city should strongly correlate with the city's economic situation. This is often expressed by the term 'voting by feet' (Tiebout

1956). Third, urban population development has a strong relevance for policy, especially for small and medium sized cities in East Germany which face massive emigration and demographic change. Last but not least, population size is the only indicator that has been constantly available for East German municipalities since 1990. Due to the amount of administrative reforms after the German reunification, a lot of municipal data, for example on employment and income, for the early 1990s has not been reported by the German Statistical Office. Using other endogenous variables would delimitate the benefits of the panel data approach used in this paper.

As stated above, the coefficient of interest β is related to a DID-estimator $treat_{i,t} = group_i * post_t$ where the dummy variable $group_i$ is equal to one if city i belongs to the treatment group of cities losing administrative status within the observed period and the dummy $post_t$ denotes one after the respective administrative reform. Hence, $treat_{i,t}$ takes on the value of one after town i loses its county seat and the value of zero if the city maintains its status. Since negative treatment effects on population change are expected, β should be negative. The dummy variable $group_i$ does not distinguish between the status of a free town and a county capital. If a free town loses its former status and becomes a county capital, the dummy variable remains zero, if it becomes incorporated within a county without becoming the capital, it takes on the value of one. As stated above, free towns play a special role within the German administrative hierarchy. Most of them differ fundamentally from the regular small to medium-sized county towns in our sample. This issue is addressed by computing regressions based on different samples that include and exclude free towns (Sample A and Sample B). A regression that is only based on free towns is also calculated (Sample C). Therefore, $treat_{i,t}$ is changed in such a way that it takes on the value of one for cities that lose free town status but still maintain county capital status. In this case, free town status rather than county seat status is the crucial explanatory variable with respect to Hypothesis II.

Due to the limited amount of data for the early 1990s no further (time variant) control variables that account for e.g. regional industrial structure, infrastructural accessibility, or human capital are included in the regression. Instead this important factor is addressed by using town-fixed effects μ_i, assuming that effects of this kind are usually more or less time-invariant (at least for the observed period). Moreover λ_t defines year-fixed effects, controlling for any overall time variant trend.

One might argue that a two-way-fixed effects model like in equation (3.1) needlessly eliminates a great amount of variation in the explanatory variable $treat_{i,t}$. To provide some more evidence on the efficiency of the estimator, a random effects model is also estimated:

$$\Delta pop_{i,t} = \alpha\ group_i + treat_{i,t}\beta + x_i + \lambda_t + \nu_{i,t} \tag{3.2}$$

This random effects model also allows the dummy $group_i$ to be included which is omitted in the fixed effects model. At the same time, a bundle of time-invariant covariates denoted by the vector x_i can be controlled for. These variables mostly refer to different measures of accessibility provided by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR). These include the estimated time it takes (by car) to get to the nearest highway access, travel time to the nearest airport, and the average time needed to reach the centers of the three nearest agglomeration areas. Furthermore x_i includes dummies for state capitals, university towns and each of the five East German Federal States.

3.3.2 Time Profile of the Treatment

The panel structure of the dataset not only allows a distinction to be made between former county capitals before and after they lose administrative status, it also enables the effect of this loss to be tracked over time. Based on general equilibrium theory, one may assume that the difference in population growth between former and present county capitals will decline over time, since the urban hierarchy reaches a new stable equilibrium. However, based on anecdotal evidence, the relocation of public facilities and administrative bodies can be a very slow process. Furthermore, the loss of county capital status might affect future decisions about the allocation of certain public facilities or amenities relating to county-level administration. Therefore, the effect of losing capital status is likely to remain for a long time and might even increase as years go by.

To account for the time dimension of $treat_{it}$ we divide it into five-year periods after the treatment year. This results in the following regression models:

$$\Delta pop_{i,t} = \sum_{p=1}^{n} \beta_p treat_{i,t}^{p} + \mu_i + \lambda_t + \nu_{i,t} \tag{3.3}$$

$$\Delta pop_{i,t} = \alpha\ group_i + \sum_{p=1}^{n} \beta_p treat_{i,t}^{p} + x_i + \lambda_t + \nu_{i,t} \tag{3.4}$$

The dummy estimator $treat_{i,t}^{p}$ now only takes on the value of one within defined periods after town i loses its county seat. In all other cases its value is zero. Thus $treat_{i,t}^{1}$ only takes on the value of one between year one and year five after the loss of the county seat, $treat_{i,t}^{2}$ between year six and year ten and so forth.

Bertrand, Duflo and Mullainathan (2004) demonstrated the importance of using cluster-robust standard errors in DID regressions based on panel data, adjusting for serial correlation. Following Cameron and Miller (2015: 323) the standard errors in all of our models are clustered in cities.

3.3.3 Spatial Dependence

One of the main shortfalls of the models presented above is that they cannot control for idiosyncratic trends due to the lack of appropriate time-variant control variables. Another way of controlling for such trends is to assume that these trends are spatially correlated. In other words: If city *i* experiences a shock in its population development (e.g. caused by large investments in local industries) this shock should also have consequences for the population development of all nearby towns. Baltagi and Pirotte (2010) show that hypothesis testing, based on standard panel data estimators that ignore this spatial dependence, can lead to misleading inference. To make use of the spatial features of the available dataset and to provide some more evidence on the robustness of the estimated βs from equation (3.1), (3.2), (3.3) and (3.4), these will be additionally estimated using spatial autoregressive models (SAR)[33] based on the following equations:

$$\Delta pop_{i,t} = \beta\ treat_{i,t} + \rho \sum_{j,t} W_{i,j}\, \Delta pop_{j,t} + \mu_i + \lambda_t + \nu_{i,t} \tag{3.5}$$

$$\Delta pop_{i,t} = \alpha\ group_i + \beta\ treat_{i,t} + x_i + \rho \sum_{j,t} W_{i,j}\, \Delta pop_{j,t} + \lambda_t + \nu_{i,t} \tag{3.6}$$

$$\Delta pop_{i,t} = \sum_{p=1}^{n} \beta_p treat_{i,t}^{p} + \rho \sum_{j,t} W_{i,j}\, \Delta pop_{j,t} + \mu_i + \lambda_t + \nu_{i,t} \tag{3.7}$$

$$\Delta pop_{i,t} = \alpha\ group_i + \sum_{p=1}^{n} \beta_p treat_{i,t}^{p} + x_i + \rho \sum_{j,t} W_{i,j}\, \Delta pop_{j,t} + \lambda_t + \nu_{i,t} \tag{3.8}$$

In these specifications the term $\rho \sum_{j,t} W_{i,j}\, \Delta pop_{j,t}$ refers to the spatially lagged value of the endogenous variable $\Delta pop_{i,t}$, where $W_{i,j}$ is an inverse distance weighting matrix of based on great circle distances towards the centroids of the 15 nearest neighboring towns from the centroid of each town *i*. Of course, the introduction of a spatially lagged endogenous variable induces an endogeneity problem. If population growth in city *j* influences population growth in city *i*, population growth in city *i* consequently also impacts population growth in city *j*. This

[33] See e.g. Anselin (2001).

issue is tackled using maximum likelihood estimations as initially proposed by Ord (1975).[34] All statistical analyses in this paper were implemented using the software package STATA.

3.4 Data

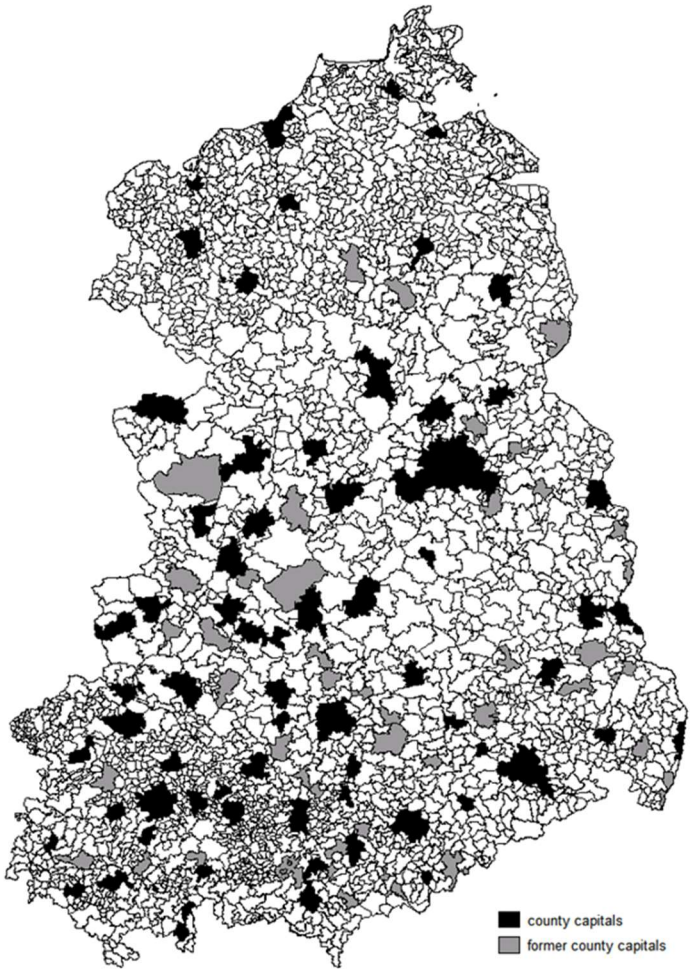
The dataset consists of municipal-level administrative data for the time period from 1991 to 2013 which is freely available from the Federal Statistical Office of Germany (Regional Database Germany) and the Federal Institute for Research on Building, Urban Affairs and Spatial Development (INKAR Database). Observations from 2012 were dropped due to irregularities within the dataset caused by the German population census in 2011. In order to make the sample of cities more homogenous, towns with an initial population size (in 1990) of less than 20,000[35] were also excluded. These towns probably lost their administrative status because they were too small. Deciding whether they should maintain or lose their capital status in these cases might have been endogenous. Finally, the sample consists of 113 East German towns which are, or have been, county capitals or free towns. Of the 85 county capitals in the sample, 41 ultimately lost their status within the observed period. In contrast, 44 held onto their county seat status. Only two of the 27 free towns were unsuccessful in maintaining any kind of special administrative status. Seven lost their free town status and became capitals of the counties into which they got incorporated. Most of the county reforms were implemented during the mid-1990s (Brandenburg 1993, Mecklenburg-West Pomerania 1994, Saxony 1994/1996, Saxony-Anhalt 1994, Thuringia 1994) but there were also some later reforms in Saxony-Anhalt in 2007, in Saxony in 2008 and in Mecklenburg-West Pomerania in 2011.

One of the crucial characteristics of the dataset is that variables are adjusted to the constant jurisdictional boundaries of 2013.[36] During the observed period, not only did the counties and county capitals change, but in many cases the territories of the municipalities within the sample also drastically increased. Therefore, using constant territorial jurisdictions avoids any distortions in the measurement of local population growth. Additionally, since most of the cities in East Germany have increased their territories, the impact of urban sprawl and suburbanization should play less of a distorting role.[37] Adjusting the data to the most recent

[34] For a detailed description of the estimation procedure and the software package used see Belotti, Hughes and Mortari (2017)
[35] In Germany 20.000 inhabitants is the minimum size to be officially categorized as medium-sized city.
[36] For the method of territorial adjustment see Kauffmann (2015).
[37] After the end of the socialist economy, suburbanization was a major force of urban development in East Germany since the spatial borders of the cities were more or less “frozen” under the old regime (Franz 2000:137).

administrative boundaries should at least partially reduce the usual impediments of observing administrative territories instead of 'real' agglomeration areas.[38]

FIGURE 3.1. SAMPLE OF 113 CURRENT AND FORMER EAST GERMAN COUNTY CAPITALS (INCL. FREE TOWNS) WITHIN TERRITORIAL BOUNDARIES OF 2013



Notes: Author's illustration based on the German Federal Agency for Cartography and Geodesy (2013)

3.5 Descriptive Statistics

To be confident that the East German county reforms represent a valid and well-randomized natural experiment, it is necessary to show some descriptive statistics for the treatment as well as the control group prior to the treatment year. Since the county reforms took place in six different years between 1993 and 2011, this is not an easy task, especially since – at least on the municipal level – a lot of useful information is missing for the early years after the German reunification. For the sake of simplification, two waves of county reforms can be identified. The first wave took place between 1993 and 1996 while the second wave lasted from 2007 to

[38] Note that data on agglomeration areas is not available since county towns in Germany are usually relatively small.

2011. In the following section, only descriptive statistics for two pre-treatment years (1993 and 2007) are presented.

TABLE 3.1. PRE-TREATMENT MEANS AND ANOVAS COMPARING TREATMENT AND CONTROL GROUP (SAMPLE A / ALL TOWNS)

	1993			2007		
VARIABLES	Treatment	Control	p>f	Treatment	Control	p>f
Population	28,752	109,271	0.29	27,948	119,263	0.33
Population growth	-0.73	-1.07	0.11	-1.45	-0.89	0.00
Population >=65*				24.97	23.47	0.01
Unemployment rate*				15.01	13.46	0.01
Primary sector*				1.40	1.09	0.20
Secondary sector*				27.44	23.27	0.02
Tertiary sector*				71.16	75.63	0.01
Business tax*				155.62	146.03	0.70
Highway	20.82	16.93	0.17	20.37	15.93	0.16
Airport	53.81	49.61	0.38	52.22	48.86	0.52
Agglomerations	113.00	110.26	0.55	104.12	112.03	0.07
Observations	24	89		20	69	

Notes: Calculations based on data from the German Statistical Offices and Federal Institute for Research on Building, Urban Affairs and Spatial Development adjusted to 2013 adminstrative boundaries. Population ≥ 65 refers to the percentage of the population aged 65 and over; primary, secondary and tertiary sectors refer to sectoral shares of total employment; business tax refers to real taxable capacity. Variables marked with * are not available for 1993 and refer to 2007 administrative boundaries.

For sample (A) TABLE 3.1 shows the means of the following demographic, economic and accessibility indicators which are possibly related to future population growth (for empirical evidence see e.g. Glaeser et al. 1995; Da Mata et al. 2007): Population in the pre-treatment year, population change in the pre-treatment year, percentage of total population for persons aged 65 and older, unemployment rate, sectoral shares of total employment, taxable capacity of the business tax[39], travel time (by car) to the nearest highway access, travel time to the nearest airport, and average travel time to the centers of the three nearest agglomerations in Germany and neighboring countries. To test if there are any statistically significant differences between the means of the treatment and the control group ANOVA p-values are also reported. As stated above, a lot of indicators were unfortunately not available for the early treatment period starting in 1993. For this point in time no statistically significant differences comparing the means of

[39] Since data on income is not available at the municipal level, the taxable capacity of the business tax can serve as a proxy for the economic strength of a town.

the treatment and the control group can be found. The p-values for all observable indicators exceed the 10% level. Nonetheless, cities in the control group were much larger on average (109,271 inhabitants) than in the treatment group (27,582 inhabitants). Surprisingly the rate of population shrinkage in 1993 was lower in the treatment group (-0.73%) compared to the control group (-1.07%). For the second treatment period starting in 2007, statistical differences can be observed in several city characteristics. Compared to the control group, towns within the treatment group had on average significantly lower rates of population change, higher percentages of older people, higher unemployment rates and less service oriented local economies. These indicators possibly hint at lower future population growth rates for the treatment group. On the other hand, the average travel time to agglomerations was significantly higher in the control group. In conclusion, the descriptive statistics for Sample A show that being selected to the treatment group might have not been completely randomized. Estimations based only on this sample might therefore result in misleading inferences.

As stated in Section 3.2, the inclusion or exclusion of free towns is crucial in controlling for a potential selection bias. Free towns are generally much larger than most of the other small and medium sized towns in our sample and thus generate different agglomeration externalities and competitive advantages. TABLE 3.2 lists the descriptive statistics for Sample B. Excluding free towns seems to substantially reduce the possible selection bias. Except for the initial population in 1993 and the accessibility of agglomerations in 2007, no significant differences between the means of the treatment and the control group can be found. Since Sample B seems to be relatively well randomized with regard to all observable city characteristics, additional matching is not deemed necessary. Moreover, one can reject the hypothesis of a biased selection given how the remaining capitals were chosen. As stated in Section 3.1, the political intention of reducing the number of counties, and consequently relocating county capital functions, was to increase administrative efficiency and not to subsidize the more central and thriving towns. With regard to the political decision-making processes, in the face of fears by local politicians that their town would lose its economic base as stated above, there are serious indications that, in many cases of county mergers, the town with less economic potential was successful in maintaining its county seat status. If the selection of capitals was biased in this way, this would strengthen rather than impair our estimation results.

Finally, TABLE 3.3 lists the descriptive statistics for Sample C including only free towns. Note that the treatment group in this sample consists of cities losing free town status and not county capital status. Like Sample A, the treatment and control group differ significantly when the means of several indicators, which are considered to be relevant for future population

development, are compared. This holds true for both observed pre-treatment years. Therefore, the hypothesis that the selection into the treatment group might be biased in one or more ways cannot be rejected.

TABLE 3.2. PRE-TREATMENT MEANS AND ANOVAS COMPARING TREATMENT AND CONTROL GROUP (SAMPLE B / EXCL. FREE TOWNS)

	1993			2007		
VARIABLES	Treatment	Control	p>f	Treatment	Control	p>f
Population	26,873	35,198	0.00	27,231	31,032	0.12
Population growth	-0.83	-1.05	0.35	-1.37	-1.20	0.25
Population >=65*				24.78	23.98	0.12
Unemployment rate*				14.97	14.31	0.31
Primary sector*				1.43	1.40	0.92
Secondary sector*				28.06	25.57	0.14
Tertiary sector*				70.51	73.02	0.14
Business tax*				158.43	153.03	0.86
Highway	20.02	19.37	0.84	19.39	19.37	1.00
Airport	52.09	51.92	0.97	51.78	51.98	0.97
Agglomerations	112.05	110.27	0.71	103.75	113.08	0.07
Observations	22	63		19	44	

Notes: Calculations based on data from the German Statistical Offices and Federal Institute for Research on Building, Urban Affairs and Spatial Development adjusted to 2013 adminstrative boundaries. Population ≥ 65 refers to the percentage of the population aged 65 and over; primary, secondary and tertiary sectors refer to sectoral shares of total employment; business tax refers to real taxable capacity. Variables marked with * are not available for 1993 and refer to 2007 administrative boundaries.

In conclusion, the descriptive statistics presented in TABLES 3.1 – 3.3 hint at potential selection biases in Samples A and C. In terms of the estimations in Section 6, this means that the results for those samples have to be treated with caution. Any statements about causal inference should be limited to Sample B, which – at least in terms of all observable information – seems to be well-randomized.

FIGURE 3.2 compares the mean population growth rates between both groups of present and former capitals over time. One must acknowledge that speaking of 'urban growth' in the case of East German cities after 1990 is rather euphemistic. Apart from very few exceptions, almost all East German towns had to deal with severe shrinkage. Nonetheless we observe that the group of former capitals had, on average, higher rates of population change in the early 1990s but was outperformed by the group that was successful in maintaining capital status after the implementation of county reforms during the first half of the 1990s.

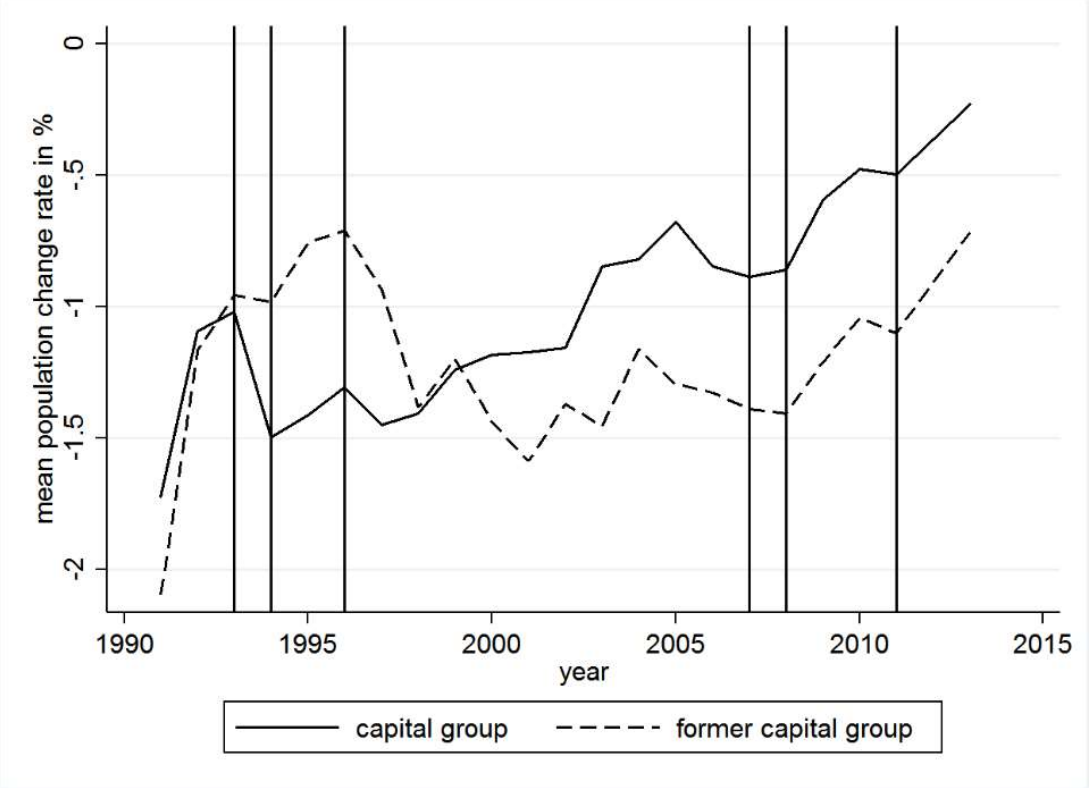
TABLE 3.3. PRE TREATMENT MEANS AND ANOVAS COMPARING TREATMENT AND CONTROL GROUP (SAMPLE C / ONLY FREE TOWNS)

	1993			2007		
VARIABLES	Treatment	Control	p>f	Treatment	Control	p>f
Population	49,417	288,753.9	0.62	61,038.8	356,500.2	0.30
Population growth	0.41	-1.11	0.02	-0.89	-0.24	0.12
Population >=65*				24.15	22.20	0.12
Unemployment rate*				13.86	11.32	0.00
Primary sector*				0.70	0.51	0.15
Secondary sector*				22.76	17.45	0.06
Tertiary sector*				76.55	82.05	0.05
Business tax*				118.45	138.72	0.25
Highway	29.55	11.00	0.00	15.48	9.02	0.02
Airport	72.75	44.01	0.05	58.86	37.41	0.01
Agglomerations	123.50	110.23	0.43	124.98	103.67	0.02
Observations	2	26		8	18	

Notes: Calculations based on data from the German Statistical Offices and Federal Institute for Research on Building, Urban Affairs and Spatial Development adjusted to 2013 adminstrative boundaries. Population ≥ 65 refers to the percentage of the population aged 65 and over; primary, secondary and tertiary sectors refer to sectoral shares of total employment; business tax refers to real taxable capacity. Variables marked with * are not available for 1993 and refer to 2007 administrative boundaries.

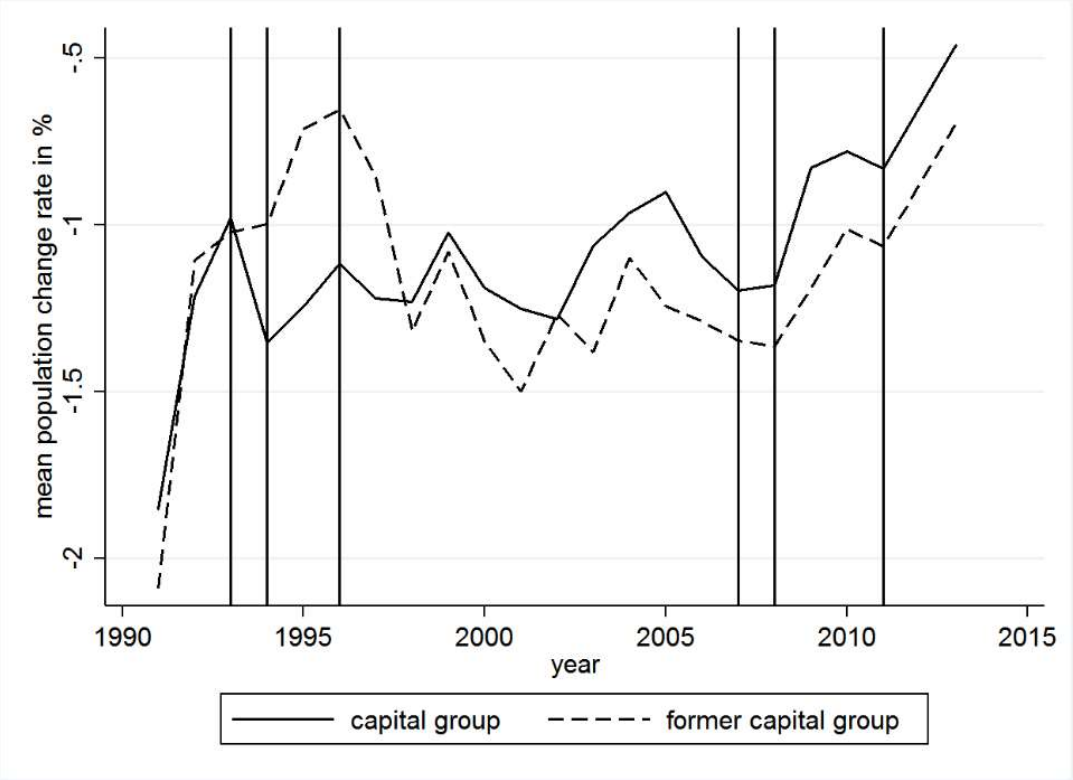
This picture, though less clear, remains true when free towns are excluded from the sample (FIGURE 3.3). Another insight resulting from this comparison is that the effect of the early county reforms (1993-1996) seems to be higher than the effect of the later reforms (2007-2011). While the mean rate of population change of the former county seats significantly decreased after 1996, both lines have followed a more or less parallel trend since 2007. The comparison is less conclusive for the 27 free towns (FIGURE 3.4). The group of existing free towns has, on average, higher population growth rates throughout the observed period. Although the difference between the two groups increases in the wake of the early reforms, both follow a more or less similar trend after the start of the new millennium

FIGURE 3.2. AVERAGE POPULATION DEVELOPMENT OF PRESENT AND FORMER EAST GERMAN COUNTY CAPITALS OVER TIME (SAMPLE A / INCL. FREE TOWNS)



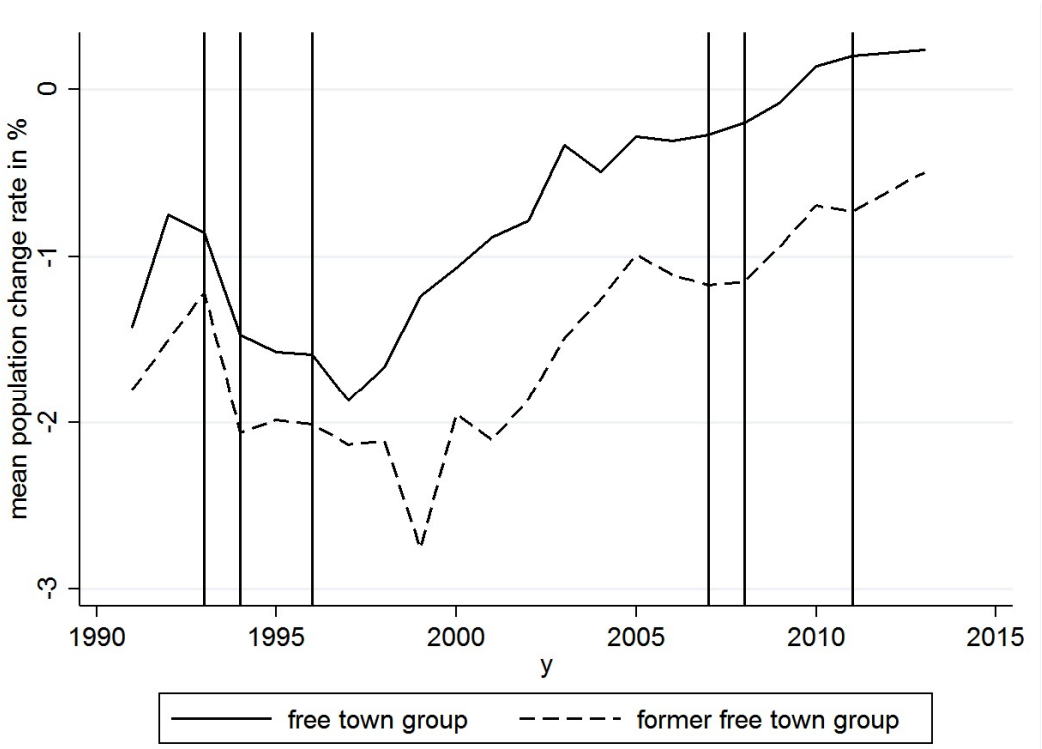
Notes: Author's illustration based on data from the German Statistical Offices, adjusted to 2013 municipal boundaries. Vertical lines represent territorial reforms at the county level.

FIGURE 3.3. AVERAGE POPULATION DEVELOPMENT OF PRESENT AND FORMER EAST GERMAN COUNTY CAPITALS OVER TIME (SAMPLE B / EXCL. FREE TOWNS)



Notes: Author's illustration based on data from the German Statistical Office adjusted to 2013 municipal boundaries. Vertical lines represent territorial reforms at the county level.

FIGURE 3.4. AVERAGE POPULATION DEVELOPMENT OF PRESENT AND FORMER EAST GERMAN FREE TOWNS OVER TIME (SAMPLE C / ONLY FREE TOWNS)



Notes: Author's illustration based on data from the German Statistical Office, adjusted to 2013 municipal boundaries. Vertical lines represent administrative reforms at the county level.

3.6 Estimation results

TABLE 3.4 reports the estimation results for the two baseline models. Losing county capital status can be observed as having a significant negative effect on annual population growth for the samples including and excluding free towns (A and B). The estimates for β do not vary much when estimating either a fixed effects or a random effects model. The coefficient is higher when free towns are included, indicating an annual population growth rate that (when all other factors remain constant) is around 0.37 percentage points lower after a town loses its county seat. For Sample B, excluding free towns, the treatment effect still takes on a value of around -0.25 percentage points. The estimators of losing free town status in the third sample also indicate a lower annual growth rate of around 0.17 percent for towns losing free town status. But, in contrast to the estimations in Samples A and B, the coefficient is not statistically significant.

The estimates for the treatment group dummy in the random effects models in A and B are insignificantly positive indicating, on average, slightly higher population growth rates for towns losing their county seat over the entire time span under observation. In addition to the descriptive statistics in Section 3.5, this can be interpreted as a sign that the selection of the remaining capitals was not biased towards the more prosperous towns since, in the latter case,

the ‘losers’ of the county reforms should have performed worse in terms of population development even before they lost their status. With regards to the additional control variables in the random effects model, strong and significant positive effects can be found for the university as well as the state capital dummy. The significance levels of the coefficients of the above described accessibility indicators vary across the three different samples.

TABLE 3.4. ESTIMATION RESULTS – IMPACT OF LOSING COUNTY CAPITAL STATUS ON ANNUAL POPULATION GROWTH

SAMPLE	All towns (A)		Excluding free towns (B)		Only free towns (C)	
MODEL	FE (1)	RE (2)	FE (1)	RE (2)	FE (1)	RE (2)
Treatment group		0.136		0.157		0.112
		(0.126)		(0.127)		(0.25)
Treatment	-0.386***	-0.363***	-0.251**	-0.239**	-0.17	-0.194
	(0.115)	(0.116)	(0.116)	(0.116)	(0.321)	(0.323)
Highway		0.00197		0.00325		-0.0341**
		(0.00584)		(0.00560)		(0.0161)
Airport		-0.00724*		-0.00833*		-0.00221
		(0.00373)		(0.00433)		(0.00391)
Agglomerations		-0.00950*		-0.00506		-0.0188***
		(0.00537)		(0.00706)		(0.00542)
University		0.552***		0.233**		0.844***
		(0.120)		(0.0932)		(0.128)
State capital		0.635***				0.787***
		(0.152)				(0.136)
Year-fixed effects	yes	yes	yes	yes	yes	yes
State-fixed effects	no	yes	no	yes	no	yes
Town-fixed effects	yes	no	yes	no	yes	no
No. obs	2,486	2,486	1,870	1,870	616	616
No. towns	113	113	85	85	28	28
R-squared	0.147	0.222	0.134	0.178	0.435	0.603

Notes: For sample (C) the dummy indicates the loss of free town status instead of county seat status. Standard errors in parentheses are heteroscedasticity-robust and adjusted for a clustering of cities. * denotes significance at the 10% level, ** at 5% level and *** at 1% level.

In conclusion, focusing on the estimates for Sample B, H_0 in the case of Hypothesis I, can be rejected, but no clear conclusion can be drawn for Hypothesis II. On the one hand, the results seem to support the hypothesis, since the effect of maintaining county capital status is also greater when free towns are included in Sample A. But due to the small number of free towns and the possible selection bias in Samples A and C, the possibility that free town status has no growth effect at all cannot be ultimately rejected.

TABLE 3.5. ESTIMATION RESULTS – DEVELOPMENT OF THE IMPACT OF LOSING COUNTY CAPITAL STATUS ON ANNUAL POPULATION GROWTH OVER TIME

SAMPLE	All towns (A)		Excluding free towns (B)		Only free towns (C)	
MODEL	FE (3)	RE (4)	FE (3)	RE (4)	FE (3)	RE (4)
Treatment group		0.211		0.201		0.247
		(0.135)		(0.139)		(0.241)
1-5 years after treatment	-0.232*	-0.203	-0.213	-0.198	-0.122	-0.0718
	(0.133)	(0.136)	(0.129)	(0.133)	(0.239)	(0.251)
6-10 years after treatment	-0.589***	-0.540***	-0.306**	-0.281*	-2.141***	-1.982***
	(0.165)	(0.166)	(0.152)	(0.151)	(0.398)	(0.383)
11-15 years after treatment	-0.762***	-0.707***	-0.416***	-0.387***	-1.755***	-1.597***
	(0.158)	(0.147)	(0.156)	(0.143)	(0.439)	(0.420)
>15 years after treatment	-0.891***	-0.830***	-0.583***	-0.549***	-1.472***	-1.304***
	(0.178)	(0.161)	(0.185)	(0.167)	(0.214)	(0.215)
Controls	no	yes	no	yes	no	yes
Year-fixed effects	yes	yes	yes	yes	yes	yes
Town-fixed effects	yes	no	yes	no	yes	no
No. obs.	2,486	2,487	1,870	1,870	616	616
No. towns	113	113	85	85	28	28
R-squared	0.164	0.223	0.141	0.177	0.490	0.614

Notes: For sample (C) the dummies indicate the loss of free town instead of county seat status. Controls include dummies for university towns and state capitals, accessibility of highways, airports and the three nearest agglomerations as well as state dummies. Standard errors in parentheses are heteroscedasticity-robust and adjusted for a clustering of cities. * denotes significance at the 10% level, ** at 5% level and *** at 1% level.

TABLE 3.5 reports the results for estimating equation (3.3) and (3.4) comparing the population development of the treatment and the control group over time. Unlike the results presented in TABLE 3.4, the estimated coefficients now vary slightly depending on whether a random or fixed effects model is used, with distinctly stronger results for the latter. In all three samples one can observe insignificant (or weakly significant in the case of model A.1) negative effects within the first five years after the loss of the county seat. But these negative effects appear to grow over the subsequent periods. For the most reliable Sample B, the values of ß take on their strongest value 16 or more years after the respective county seat relocation, indicating a population change rate that is between 0.55 and 0.58 percentage points lower in comparison to the remaining capitals. These findings hint at a treatment effect which is slowly developing over time and are in line with anecdotal knowledge about the time-consuming implementation of county seat relocations. It often took more than one step to relocate administrative bodies and public facilities. Indeed, in some cases it took more than 15 years

before all administrative functions were finally relocated and concentrated in the present county capital.

TABLE 3.6. ESTIMATION RESULTS – IMPACT OF COUNTY LOSING CAPITAL STATUS ON ANNUAL POPULATION GROWTH (SAR MODELS)

SAMPLE	All towns (A)		Excluding free towns (B)		Only free towns (C)	
MODEL	FE (5)	RE (6)	FE (5)	RE (6)	FE (5)	RE (6)
Treatment group		0.152		0.173		-0.124
		(0.122)		(0.124)		(0.249)
Treatment	-0.387***	-0.362***	-0.252**	-0.239**	-0.166	-0.206
	(0.114)	(0.114)	(0.114)	(0.113)	(0.312)	(0.314)
Highway		0.000899		0.00243		-0.0341**
		(0.00569)		(0.00535)		(0.0156)
Airport		-0.00706**		-0.00826**		-0.00226
		(0.00359)		(0.00417)		(0.0038)
Agglomerations		-0.00928*		-0.00523		-0.0189***
		(0.00523)		(0.00685)		(0.00535)
University		0.547***		0.203**		0.855***
		(0.118)		(0.0925)		(0.124)
State capital		0.618***				0.785***
		(0.151)				(0.131)
Spatial rho	0.102	0.167*	0.122	0.178**	0.0684	0.0610
	(0.102)	(0.0948)	(0.0871)	(0.0833)	(0.173)	(0.167)
State-fixed effects	no	yes	no	yes	no	yes
Town-fixed effects	yes	no	yes	no	yes	no
No. observations	2,486	2,486	1,870	1,870	616	616
No. towns	113	113	85	85	28	28
Pseudo R-squared	0.146	0.226	0.134	0.182	0.434	0.603

Notes: For sample (C) the dummies indicate the loss of free town instead of county seat status. Standard errors in parentheses are heteroscedasticity-robust and adjusted for a clustering of cities. * denotes significance at the 10% level, ** at 5% level and *** at 1% level.

A slightly different temporal pattern can be observed when current free towns are compared with former free towns (Sample C). The difference is insignificant in the first five years after free town status had been lost. This is followed by a much higher disparity in the following period with annual population growth rates for former free towns more than 1.9 percentage points lower six to ten years after the loss of status. The difference then moderately decreases over the following time periods, but remains strong and significant. Again, the results for Samples A and C have to be treated with caution due to the small sample size and the possible selection bias.

TABLE 3.7. ESTIMATION RESULTS – DEVELOPMENT OF THE IMPACT OF LOSING COUNTY CAPITAL STATUS ON ANNUAL POPULATION GROWTH OVER TIME (SAR MODELS)

SAMPLE	All towns (A)		Excluding free towns (B)		Only free towns (C)	
MODEL	FE (7)	RE (8)	FE (7)	RE (8)	FE (7)	RE (8)
Treatment group		0.228*		0.218		0.236
		(0.132)		(0.136)		(0.237)
1-5 years after treatment	-0.233*	-0.203	-0.212*	-0.195	-0.126	-0.0593
	(0.132)	(0.134)	(0.128)	(0.130)	(0.231)	(0.249)
6-10 years after treatment	-0.589***	-0.535***	-0.310**	-0.284*	-2.160***	-1.946***
	(0.163)	(0.161)	(0.150)	(0.148)	(0.404)	(0.390)
11-15 years after treatment	-0.765***	-0.705***	-0.422***	-0.392***	-1.773***	-1.560***
	(0.156)	(0.142)	(0.154)	(0.138)	(0.443)	(0.420)
>15 years after treatment	-0.894***	-0.830***	-0.588***	-0.552***	-1.488***	-1.264***
	(0.176)	(0.158)	(0.183)	(0.163)	(0.211)	(0.231)
Spatial rho	0.109	0.171*	0.136	0.189**	-0.0676	-0.0304
	(0.100)	(0.0932)	(0.0869)	(0.0833)	(0.204)	(0.194)
Controls	no	yes	no	yes	no	yes
Year-fixed effects	yes	yes	yes	yes	yes	yes
Town-fixed effects	yes	no	yes	no	yes	no
No. observations	2,486	2,486	1,870	1,870	616	616
No. towns	113	113	85	85	28	28
Pseudo R-squared	0.164	0.226	0.140	0.182	0.491	0.614

Notes: For sample (C) the dummies indicate the loss of free town instead of county seat status. Controls include dummies for university towns and state capitals, accessibility of highways, airports and the three nearest agglomerations as well as state dummies. Standard errors in parentheses are heteroscedasticity-robust and adjusted for a clustering of cities. * denotes significance at the 10% level, ** at 5% level and *** at 1% level.

In terms of spatial dependence, TABLE 3.6 and TABLE 3.7 present the estimation results for equations (3.5), (3.6), (3.7) and (3.8). Since the spatial coefficient rho is only significant in the random effects estimations, spatial autocorrelation seems to be only a cross-sectional issue. Moreover, the results for the SAR models strongly support the findings presented above. Referring to the coefficients of the DID estimators from equations (3.1), (3.2), (3.3) and (3.4), no clear deviations can be found. All estimators are robust against the introduction of the spatial lag term.

3.7 Conclusion

DID-estimations using the East German county reforms as a natural experiment show that losing county capital status has a statistically significant and relevant negative effect on annual population growth. The existence of regional governmental and administrative units within a city seems to be an important factor in local development. This is consistent with the hypothesis

that the status of being a county capital positively affects a city's private sector as well as household utilities and hence leads to stronger population growth than in cities without any capital status. The estimations also show that the differences in population development between present and former county towns distinctly increase over time after the respective county reform has been implemented. This finding illustrates that the county seat relocations not only led to short term adjustments in population growth, but fundamentally changed the growth paths of towns. Since former county towns have obtained – for the first few years after the loss of the county seat – quite generous financial compensation from the state government in more or less all German states, one could expect that without these subsidies the negative development of former county towns would have been much worse than our estimations have shown.

Of course, capturing changes in the geographical allocation of governmental and administrative functions using a capital city dummy is a very crude measure that does not take into account the number of administrative functions that were really relocated. However, since there is a tendency to compensate for the loss of capital status by maintaining some administrative functions in the former capital, the real effect might even be greater. For a more detailed analysis of the effects of specific governmental and administrative functions, a more detailed database, as well as an in-depth case study analysis might be helpful. Unfortunately, the former is difficult to come by for East Germany. The conclusions that Holtmann et al. (1998) drew from their case studies on ten former and present county capitals in the state of Saxony-Anhalt is that the real economic effects of losing the county seat were actually very low. But as this study was done only four years after the respective reforms were implemented, they could not account for long-term effects. A re-evaluation of these case studies would be interesting but difficult to achieve.

From a policy perspective, the results above are grist to the mill for those local politicians who fear substantial negative effects from losing county seat status. The aim of the territorial reforms in East Germany was to increase the efficiency of administration and public services. Economic side effects of relocating county capital functions did not play an important role within these objectives. In future county reforms, policymakers should be aware that relocating capital functions can indeed affect the local economy and agglomeration dynamics. Hence, they should carefully consider which city is in greater need of getting an extra boost by having a county seat status. Concentrating administrative and governmental functions in the more central and 'economically strong' cities would perhaps foster interaction and common dynamics

between the private and the public sector, but this would also marginalize the more peripheral, 'economically underdeveloped' cities.

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Chapter 4

The Impact of EU Eastern Enlargement on Urban Growth and Decline – New Insights from Germany's Eastern Border*

BASTIAN HEIDER

ABSTRACT This paper uses the quasi-experimental setting of the 2004 EU enlargement, as well as town-level data along the affected German border, to estimate the effect of economic integration on border town population development. Using a differences-in-differences approach, we find that the accession has had a significant positive effect on the rate of population change after 2004. However, this does not offset the, generally, poorer population development of border towns compared to interior towns. Moreover, the integration effect appears to strongly depend on initial local conditions. No effects were found for Polish towns on the opposite side of the border.

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4.1 Introduction

The EU eastern enlargement in 2004 is one of the greatest examples in history of international trade integration and quasi-removal of border impediments between countries. Based on economic theory, one could assume that the institutional shock induced by EU integration should have affected the internal economic geography of the new as well as the old member states, particularly those sharing a border with at least one of the new members. Border regions and border towns are, therefore, of particular interest as part of this scenario. Several simulation studies, conducted around 2004 and based on the new economic geography (Krugman 1991; Helpman 1998; Fujita et al. 1999) and market potential literature (Harris 1954), predicted that border regions would particularly benefit from the accession. Brülhart et al. (2004) simulated the impact the changes in relative market access would have on the economy of peripheral regions, comparing a situation where the EU remains at its pre-2004 borders with scenarios where the EU grows to 25 and then 33 countries (the latter case includes eight potential future members in southeastern Europe). Their findings suggest that the positive effect of enlargement on regional per capita income and manufacturing employment should be stronger the closer a region is located to the accession countries and the farther it is to alternative large centers of economic activity. Similar simulations, with weaker assumptions about the border impediments, were applied by Niehbuhr (2008) and Pfaffermayr et al. (2011), who also predicted a significantly stronger impact of EU integration on market potential and income changes for border regions compared to non-border regions.

Other authors were more modest in their expectations. Topaloglou et al. (2006) proposed a typology of border regions within the enlarged EU and concluded that border regions in the core EU and the western parts of the new member states had the greatest potential to benefit from the 2004 enlargement, while the more peripheral border regions would remain low-performance areas. Bröcker (1990) as well as Niebuhr and Stiller (2004) concluding on comprehensive literature surveys on the regional effects of European integration point out that the theoretical view that border regions may profit from integration because they are closer to foreign economic centers, highlights only one aspect. The authors show that such positive developments are rare and that the results of integration remain inconclusive in some regions. This is line with the suggestions derived by Barjak and Heimpold (2000) and Stiller (2004) after the descriptive analysis of economic potentials and developments for regions along the German-Polish border before the accession in 2004. Particularly strong arguments in this direction were made by Krätke (2002) as well as Krätke and Borst (2007), claiming that economic interrelations between east and west are stronger by far between economic centers than in the structurally weak and sparsely populated cross-border regions. Arguing along the same lines, Petrakos and Topaloglou (2008) stated that existing patterns of cross-border interaction might result in "tunnel effects" which could further marginalize the development of border regions and towns. Moreover, the authors emphasized that informal border impediments and path dependencies are important factors undermining the economic potentials of integration in cross-border regions.

The general motivation for this paper is that, nearly 15 years after the enlargement, it might be time for a reassessment. Did the accession of new EU member states lead to an increased attractivity of the formerly peripheral border regions for businesses and citizens? If so, were there any differences between different types of border locations and what were the channels of this effect? Those questions are not only of historical and theoretical interest but also can contribute to very recent debates, as the UK's 2016 vote to leave the EU gave rise to a growing body of scientific papers, discussing the potential regional economic effects of the 'Brexit' (Chen et al. 2018; Figus et al. 2018; McCombie and Spreafico 2018) as well as potential further EU dismembering processes (Capello et al. 2018b).

To answer these questions this article takes a particular urban perspective. It is based on one of the fundamental concepts of urban economics and spatial equilibrium theory, stating that any shift in the perceived attractiveness of a place translates into a change in demand (Nitsch and Wendland 2017). Therefore, under perfect labor mobility, any changes in the local utility level will result in adjustments in population size. In this light, this study uses the quasi-experimental

setup of EU integration along the German border to the east to examine the spatial adjustments after the enlargement in 2004, as measured by local population development. Analyzing a large panel of border and non-border towns with a differences-in-differences (DID) approach indicates a significantly positive effect of EU integration on the population development of German border towns. However, this effect only applies to a relatively small distance - within 30 minutes of travel time to the nearest border crossing - and does not offset the generally poorer population development in border towns. A major contribution of this paper in contrast to former studies is the examination of potential channels of the integration effect. Applying triple differences (DDD) estimations, it can be found that the effect is rather heterogenous, particularly benefitting those towns that are specialized in service industries. Estimations based on a second sample, which also includes towns on the Polish side of the border, hint at asymmetric effects of European integration, as no adjustments regarding Polish border towns can be identified.

4.2 Literature Review

4.2.1 Theoretical Background

The growing interest of empirical researchers in the development of border regions was strongly related to the rise of the NEG during the 1990s. But long before the inception of modern NEG models, traditional location theory (Christaller 1933; Lösch 1940; Hoover 1948; Giersch 1949) suggested that borders restrict the spatial market area of firms. Hence border regions will only have limited economic activities and only attract firms that require a small market area. Reversing the arguments made by those theorists leads to the assumption that reducing international trade barriers (up to and including a total removal of the border) would change the economic situation of the border regions in question. Better access to the foreign market would increase the market area of the border regions and foster the settlement of firms close to the national border. In addition to traditional location theory, trade theory argues that "exterior" regions and cities would particularly benefit from international trade. Modeling the internal structure of a country, with cities as the basic spatial units and the existence of per-unit distance transportation costs, Rauch (1991) showed that in case of strong international trade integration population size, wages and rents decline the further one moves inwards from a coastal port.[40]

Though the basic NEG models (e.g. Krugman 1991; Helpman 1998; Fujita et al. 1999) do not formally address the role of border regions within the re-organization of the internal

[40] Rauch uses the term 'port cities' for cities with low external trade costs. This term could easily be substituted by 'border cities'.

geography caused by international economic integration, considerations based on these models suggest that border regions could indeed have a geographic advantage within trade agreements. These models typically determine that the distribution of workers and firms across regions/cities are the outcome of a tension between so-called centripetal and centrifugal forces. The centripetal effects are a 'home market effect', implying that firms tend to concentrate close to large markets due to increasing returns to scale and transport costs, and a 'cost of living effect' which implies lower living costs for individuals and households in proximity to large markets due to a consumer preference for variety and transport costs. The centrifugal forces are the 'market crowding effect', where transport costs imply that firms close to large markets face a large number of low-price competitors, and the 'congestion effect', implying higher living costs for individuals close to large markets due to higher prices for non-traded amenities such as housing.

As one of the first NEG approaches, Villar (1999) explicitly considered differences in international market access as a decisive factor for the spatial distribution of the national economy. Within this framework, trade integration might affect the relative strength of centrifugal forces, resulting in changing patterns of economic activity within the integrating countries. Particularly in small countries, where internal transport costs are low, this might result in the growth of cities in close proximity to the external border. Furthermore, Crozet and Koenig (2004) as well as Brülhart et al. (2004) adjusted the seminal NEG model by Helpman (1998) to explicitly study the effects of trade integration and declining cross-border transaction costs. Their models predict that regions with lower transportation costs to foreign markets achieve the highest gains from economic integration. Finally, the quantitative spatial model developed by Redding (2016) is perhaps the most advanced approach for analyzing the effects of exogenous shocks, such as trade integration, on the spatial distribution of economic activity. This model predicts that trade integration leads to the relocation of population to border locations until land prices adjust so that finally all locations experience the same welfare gains from trade.

Although most of the economic theories mentioned above hint at a positive effect of trade integration on border regions, it is also plausible that there are negative effects or no effects at all. Some NEG models show that the relationship between economic integration and spatial industrial concentration is not monotonic, but rather takes the shape of an inverted u (Krugman and Venables 1996; Puga and Venables 1997). Thus, an increase in trade integration could – depending on an economy's initial state of integration and specialization – indeed lead to an increase of industrial concentration within central agglomerations. Arguing in this direction

Tsiapa (2014) particularly emphasized the divergent patterns of economic concentration between old and new EU member states. While the former can be characterized by a shift of industries towards more peripheral (and border) regions, the dominant trend in the latter can be best described by increasing concentration in economic centers.

In addition, a general shortcoming of most NEG models is that they measure external trade costs and market access based solely on geographical proximity. But established spatial patterns of cross-border interactions, as mentioned by Krätke (2002), and international trade hubs (Bathelt et al. 2004) that are not located near the border might be even more important. Given the, in most cases, low economic potentials on both sides of the border, one could assume that removing border impediments does not result in significantly increased market potential for those regions (Topaloglou et al. 2006). Moreover, path dependence and hysteresis could play a crucial role. Long-time suppression of cross-border interactions – like in the case of many former socialist countries in Central and Eastern Europe – might result in a strong inward orientation of economic, cultural and social relations in the border regions which could not be offset 'overnight' by a formal reduction in border impediments. Informal barriers might prove to be much more persistent (Krätke 1999; Petrakos and Topaloglou 2008). This is in line with more recent advances in the literature, distinguishing between different forms of border impediments (e.g. physical, institutional, socio-cultural), which create distinguished obstacles towards economic development in cross-border regions (Capello et al. 2018d).

Finally, adverse effects of increased competition are considerable, particularly in low-wage industries. As Niebuhr (2008) points out, enlargement might potentially make border regions less attractive as production sites. This 'market crowding effect', already identified by NEG models, could therefore potentially result in asymmetric integration effects along the border.

4.2.2 The Empirical Evidence

The empirical literature on border regions and trade integration is strongly related to NEG frameworks and the literature based on Harris' (1954) influential market potential function. Harris' key idea was that the demand for goods produced at a location is the sum of the purchasing power in all surrounding locations weighted by transport costs. This early ad-hoc concept of market potential became widely popular in regional science and urban economics (e.g. Clark et al. 1969; Keeble et al. 1982) and was later derived from formal spatial models by Fujita et al. (1999). This revival of the market potential function led to a broad range of empirical literature explaining spatial divergence in income and the distribution of economic activity (see Redding 2010). Within this strand of literature, some approaches were explicitly dedicated to the explanation of urban growth, combining the NEG with the more traditional

urban economics literature (e.g. Black and Henderson 2003; Au and Henderson 2006; Da Mata et al. 2007; Gonzáles-Val et al. 2017). All of those estimations find a strong positive relation between market potential and urban population and/or income growth. However, most of them revealed severe endogeneity problems with market potential itself being a function of local growth.

A second strand of empirical literature studies the impeding effects of borders on inter-regional trade flows (and therefore regional market potential as defined by Harris 1954). Thereby, the so-called 'border effect' measures the extent to which domestic regions trade more intensely than interacting with foreign regions. This literature was established by McCallum (1995) and Helliwell (1997), who analyzed interregional trade patterns between Canadian provinces and US states within a gravity framework and identified extreme border effects with a factor larger than 20. Those seminal investigations gave rise to a large amount of papers estimating border effects. Due to more sophisticated applications of the gravity model the estimated effect in the initial Canada-US example was later substantially reduced to a factor around 10 (Anderson and van Wincoop 2003). Furthermore, while some authors found that border effects in North America (Brown and Anderson 2005) as well as in Europe (Nitsch 2000) were declining, other studies suggest that a total reduction of border effects might be illusory, as defunct historical borders have persistent effects on trade, even when formal political barriers are absent (Nitsch and Wolf 2013). The most recent advances in this strand of literature were dedicated to the decomposition of border effects and the examination of how the different obstacles posed by political borders (e.g. physical, institutional, cultural) impede economic development in cross-border regions (Capello et al. 2018a, 2018c, 2018d).

Pioneering contributions, linking the literature on market potential to the 'border trade' literature, were conducted by Gordon Hanson, who studied the geographic effects of the liberalization of North American trade along the border between the US and Mexico. Hanson (1998) estimated that during the process of liberalization in the 1980s distance to the US has played an increasing role for Mexican regional employment growth. He furthermore showed that the expansion of export manufacturing in Mexican border cities can account for a substantial share of employment growth in neighboring US border cities (Hanson 1996; 2001).

Building on Hanson, a third strand of literature explicitly stresses the quasi-experimental features of trade integration and compares a treatment group of border regions or cities to a control group that is presumed to be much less affected by the exogenous trade shock. Since this paper is very closely related to this kind of literature TABLE 4.1 provides a comprehensive overview on those studies and their results. Perhaps most prominently Redding and Sturm

(2008) using DID estimations examined the long-term effects of German division and reunification on the population development of cities within a certain threshold distance from the border. The authors found strong evidence that the division led to a significant decline in population development in West German border cities, while the reunification was followed by relative increases in population growth. However, even one year before Redding and Sturm, Buettner and Rincke (2007), using the same natural experiment (of German re-unification) and a similar DID strategy, came to quite contrary conclusions. While finding that the border removal has resulted in employment growth for West German counties near the former border, the authors also estimated that increased labor market competition due to workers commuting from East Germany led to a decrease in wages and an increase in unemployment rates. In sharp contrast to Redding and Sturm, Buettner and Rincke additionally estimated a negative effect on border population.[41] Moreover, Brülhart et al. (2012) applied the seminal DID approach used by Redding and Sturm to study the effects of the rise of the Iron Curtain in Austria, distinguishing between how quantity (employment) and price (wages) adjusted to changes in market access. Their results imply that wages adjust earlier to increasing market size than employment, but the cumulative effect on the latter is around three times higher. Most recently in this line of DID studies, Partridge et al. (2017) found a negative effect of the split of the Chinese Sichuan province (1997) on population growth in the newly established border counties.

When it comes to EU integration the evidence on regional adjustments in any category of economic outcomes is quite ambiguous. Brakman et al. (2012) applied the seminal approach by Redding and Sturm to the quasi-experimental case of all EU enlargements since the 1970s. Their results suggest that the removal of European border impediments had significant positive effects on population growth in border cities and border regions but did not offset the generally weaker population development of those cities and regions compared to more centrally located ones. Quite contrary, using the synthetic control method, Wassmann (2016) found no overall significant effect of the 2004 enlargement on GDP growth of EU NUTS2 regions in old member states that share a border with the new accession countries. Instead heterogeneous effects on individual regions based on their initial economic conditions and import volumes were identified.

[41] Note that the approaches by Buettner and Rincke (2007) and Redding and Sturm (2008) differ in observed spatial units (counties vs. cities) as well as outcome variables (log of levels vs. change rates). Hence, the results are hardly to compare.

TABLE 4.1. QUASI-EXPERIMENTAL STUDIES ON THE REGIONAL ECONOMIC EFFECTS OF BORDERS AND TRADE INTEGRATION

Authors	**Quasi-experiment**	**Treatment group/ unit of analysis**	**Outcome (effect)**
Hanson (1996, 2001)	US-Mexico trade liberalization	Demand-links between border cities	Employment growth (+)
Hanson (1998)	US-Mexico trade liberalization	Mexican regional economies (distance to the U.S. as explanatory variable)	Employment growth (+)
Buettner and Rincke (2007)	German reunification	Counties at the former inner-German border	Unemployment (+) Log employment (+) Log population (-) Log wages (-)
Redding and Sturm (2008)	German division and reunification	West German cities near inner-German border	Population growth division (-) reunification (+)
Brülhart et al. (2012)	Rise of the 'Iron Curtain'	Austrian municipalities near the eastern border	Wages (+) Employment (+)
Brakman et al. (2012)	EU integration since 1970	European border cities and regions	Population growth (+)
Wassmann (2016)	EU eastern enlargement (2004)	EU NUTS2 regions at the former eastern frontier	GDP growth (no significant effect)
Partridge et al. (2017)	Division of Sichuan province (1997)	Counties near the new provincial border	Population growth (-)

Source: Author's own research.

Both empirical approaches have their potential shortcomings. While Wassmann herself (2016: 26) states, EU NUTS2 regions might be too large to be used as geographical units when studying the spatial effects of EU enlargement, the results of Brakman (2012) reveal some questions surrounding their empirical validity. For example, the authors do not control for changes in administrative territories and provide only few robustness tests with regard to the underlying assumptions of their DID estimations.

Since there is yet to be any clear evidence of the spatial effects of EU enlargement to the east, this paper aims to fill in this research gap. Focusing on Germany and a relatively large sample of mostly small and medium sized towns in consistent territorial borders enables some important methodological contributions to be made to the existing literature. Including small

and medium sized towns creates a broader empirical base and results in a sample that is generally more balanced between the treatment and the control group, since most border towns are relatively small. Moreover, this paper expands the DID approach established by Redding and Sturm (2008) into a triple differences (DDD) approach where the treatment interacts with certain municipal characteristics. This enables to examine some channels of the integration effect, which have not been addressed before. Including towns at both sides of the border also accounts for the potential asymmetries of adjustments between old and new EU member states.

4.3 The EU Enlargement as a Natural Experiment

As stated above, the EU enlargement in 2004 was the largest and most drastic expansion in the history of the EU. In May 2004 eight countries from the former Eastern bloc, namely the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia, as well as the two island states of Malta and Cyprus, joined the EU. The economic and political integration of these countries in 2004 was the most important step in a long integration process which started in the early 1990s. As early as 1992, the so-called Visegrad countries - Czech Republic, Hungary, Poland, Slovakia - formed the Central European Free Trade Agreement (CEFTA) which was later rounded off by Slovenia in 1996. From then on, tariffs between CEFTA countries and the EU were gradually reduced (Adam et al. 2003). The enlargement in 2004 by far exceeded these earlier agreements. Almost all formal barriers to cross-border interaction, like technical regulations, were removed and the implementation of the acquis communautaire helped to overcome institutional and administrative disparities (Dangerfield 2006). In economic terms, and based on the theoretical framework mentioned above, the 2004 enlargement resulted in a reduction in cross-border transaction costs. This reduction can be regarded as an external shock, which should have triggered noticeable increases in the trade of goods and services as well as in the movement of capital and labor.

However, it should be mentioned that the 2004 enlargement was not the final step in the integration of the states neighboring Germany to the east. Border controls were not completely abolished until 2007, when Poland and the Czech Republic joined the Schengen agreement, and the total free movement of labor was not implemented until 2011. One also has to consider that, before 2004, the borders between old and new member states – unlike the former inner-German border – were not completely impermeable. Hence, the actual effects of integration were much less drastic. Moreover, unlike previous natural experiments, such as the rise of the Iron Curtain, the EU enlargement had been planned long in advance and was anticipated by the economic actors in the border regions and towns (Buettner and Rincke 2007).

Despite the aforementioned caveats, it seems plausible to treat the 2004 EU enlargement as a kind of a natural experiment, particularly affecting towns within close proximity to the quasi-abolished border. Even though the EU enlargement was anticipated, the experiment can be considered valid. Because the treatment group of border towns is defined on the basis of sheer geographic location, the idea of any kind of selection bias can be rejected. Moreover, the definition of the treatment group is stable over time.

4.4 Empirical Strategy

As already mentioned, the basic estimation strategy follows the DID approach first applied by Redding and Sturm (2008), which compares a treatment group of border cities to a control group of cities farther away from the border. The outcome variable is the annual rate of population change in percent. Though one could argue that population growth is hardly equivalent to economic growth, it is doubtlessly in line with the majority of theories mentioned above. Following Krugman (1991) and Fujita et al. (1999), migration is proportional to the real wage gap between cities.[42] Hence, an exogenous shock like the EU enlargement would finally result in adjustments of migration rates. Increased market potential would raise the productivity of firms and therefore the nominal and real wages in a city. Similarly, higher market access would reduce the costs of consuming manufacturing varieties, which also raises the real wages, making the city a more attractive place for living. Adjustments in real wages would then result in increased population growth until a new spatial equilibrium has been reached.[43]

The outcome is then regressed on the interaction between a dummy, equaling one if it is a border town (within a certain threshold distance to the border), and a dummy which equals one after the EU enlargement in 2004. Consequently, the estimated coefficient of this interaction term measures how, after the EU enlargement, the population in the treatment group of border towns evolved differently than in the control group of more interior towns. The baseline regression therefore takes the following form:

$$\Delta pop_{i,t} = \beta(border_i * integr_t) + \lambda_t + \mu_i + \upsilon_{i,t}, \tag{4.1}$$

where $\Delta pop_{i,t}$ is the annual percentual population growth rate $(\frac{pop_{i,t} - pop_{i,t-1}}{pop_{i,t-1}}) * 100$, β is the DID estimator for the interaction term ($border_i * integr_t$) as described above, λ_t denotes year fixed effects (to control for any temporary overall shocks to municipal population development,

[42] Apart from the NEG, the relationship between real wage differences and migration is also the key element of similar urban growth theories (e.g. Henderson 1974).

[43] For a detailed description of the underlying NEG model and its implications for the existence of a border see Redding and Sturm (2008)

including the impact of the 2004 enlargement on all cities), μ_i represents town fixed effects (to control for any constant differences in local population development) and $\upsilon_{i,t}$ is a stochastic error term.

According to all previous studies, the effect of integration rapidly decays with increasing distance to the border. A very simple and straightforward way of addressing this kind of distance sensitivity is to use different definitions of the treatment group by defining different threshold distances. Hence, the estimations described above are tested using two different treatment groups defined by different threshold distances from the border (30 and 45 minutes)[44]. In addition, diverging effects for different national borders have to be considered. Therefore, we also estimate an alternative version of our baseline equation, distinguishing between towns at the Polish and the Czech border:

$$\Delta pop_{i,t} = \beta_{cz}(cz\_border_i * integr_t)+\beta_{pl}\,(pl\_border_i * integr_t)+\lambda_t+\mu_i+\upsilon_{i,t}. \qquad (4.2)$$

The following model specifications account for different channels through which the "border-integration effect" may work. The first channel, agglomeration size, was already addressed by previous studies. While, in the case of the Iron Curtain, Redding and Sturm (2008) as well as Brülhart et al. (2012) found stronger elasticities for small towns, Brakman et al. (2012) in the case of European integration estimated stronger effects for large cities. A second channel, sectoral specialization, has not yet been addressed in previous studies. Border cities specialized in manufacturing might be less affected by local changes in market potential than other cities because firms are embedded in transnational distribution networks. On the other hand, border cities that are highly specialized in services such as retail or tourism might be more exposed to the effects of the EU enlargement due to their dependence on local market potential. All of these channels are addressed by dummies for different city-type subgroups. Consequently, four subgroups are defined: 1) large cities, including all cities within the upper tercile[45] of the population size distribution within our dataset; 2) small cities, comprising all cities in the lower tercile of city size distribution; 3) manufacturing cities within the upper tercile of the distribution of manufacturing shares of local employment; and 4) service cities, including all cities within the upper tercile of the distribution of tertiary sector shares in local employment. The selection into subgroups is based on data from 2003, but the composition of

[44] The maximum threshold distance of 45 minutes travel time should be roughly in line with the previous studies by Redding and Sturm (2008; 75 km 'beeline' distance) and Brakman et al. (2012; 70 km road distance).

[45] In Germany large cities ("Großstädte") are officially defined by a minimum population size of 100.000 inhabitants. Since there are only very few cities of this size in the East German border region, using terciles as definition criterium for the different subgroups provides a more sample-based solution. The same method is applied for economic specialization.

groups is fixed over time independent of any potential changes in population or economic specialization that occurred after the EU enlargement. The effects of the EU enlargement on the different subgroups of border towns are then estimated separately using triple differences (DDD) models of the following form:

$$\Delta pop_{g,i,t} = \beta_0 (border_i * integr_t) + \beta_g (group_g * integr_t) + \gamma_g (group_g * border_i * integr_t) + \lambda_t + \mu_i + \upsilon_{i,t}, \quad (4.3)$$

where the DID estimator (β_g) refers to general post-treatment trends for the different the city-types and the DDD estimator (γ_g) indicates if and how these trends differ between border and non-border towns within the subgroup in question.

As mentioned in Section 2, asymmetric effects on both sides of the border have to be considered. Therefore, the sample must be extended to include towns from countries bordering Germany to the east. Focusing on the border between East Germany and Poland, potential asymmetric effects of the border and its quasi-removal in 2004 are estimated using the following DDD specification:

$$\Delta pop_{c,i,t} = \beta_0 (border_i * integr_t) + \beta_c (country_c * integr_t) + \gamma_c (country_c * border_i * integr_t) + \lambda_t + \mu_i + \upsilon_{it}, \quad (4.4)$$

whereby $\beta_{country}$ is a DID estimator for country-specific urban growth trends in the post-enlargement period, and $\gamma_{country}$ is the estimator for the specific effect of ($border_i$*$integration_t$) in East Germany or Poland. The theoretical expectations regarding the effect asymmetry are rather ambiguous. One the one hand, since the macroeconomic and regional welfare gains of EU enlargement were expected to be larger in the new member states (Bröcker 1998; Niebuhr and Schlitte 2009), the spatial adjustments should have also been larger in those countries. On the other hand, whilst the 2004 enlargement might have contributed to the spatial de-concentration of industries in Germany, it could also have fostered the trend of regional concentration in Poland, given the different economic development stages of both countries (Tsiapa 2014).

In their seminal paper Betrand et al. (2004) demonstrated the importance of using cluster-robust standard errors in DID estimations based on panel data, accounting for all plausible co-variance patterns. However, the debate on the appropriate clustering unit has not yet come to a final conclusion. The standard suggestion is to cluster around individual units of observation (Cameron and Miller 2015), but since the error terms might include some form of spatial autocorrelation, all equations are estimated using two different forms of standard errors,

clustered around municipalities and EU NUTS2 regions. Clustering on the regional level should be able to at least partially account for the spatial features of our estimations and therefore potential autocorrelation in the error terms. All statistical analyses in this paper were implemented using the software package STATA.

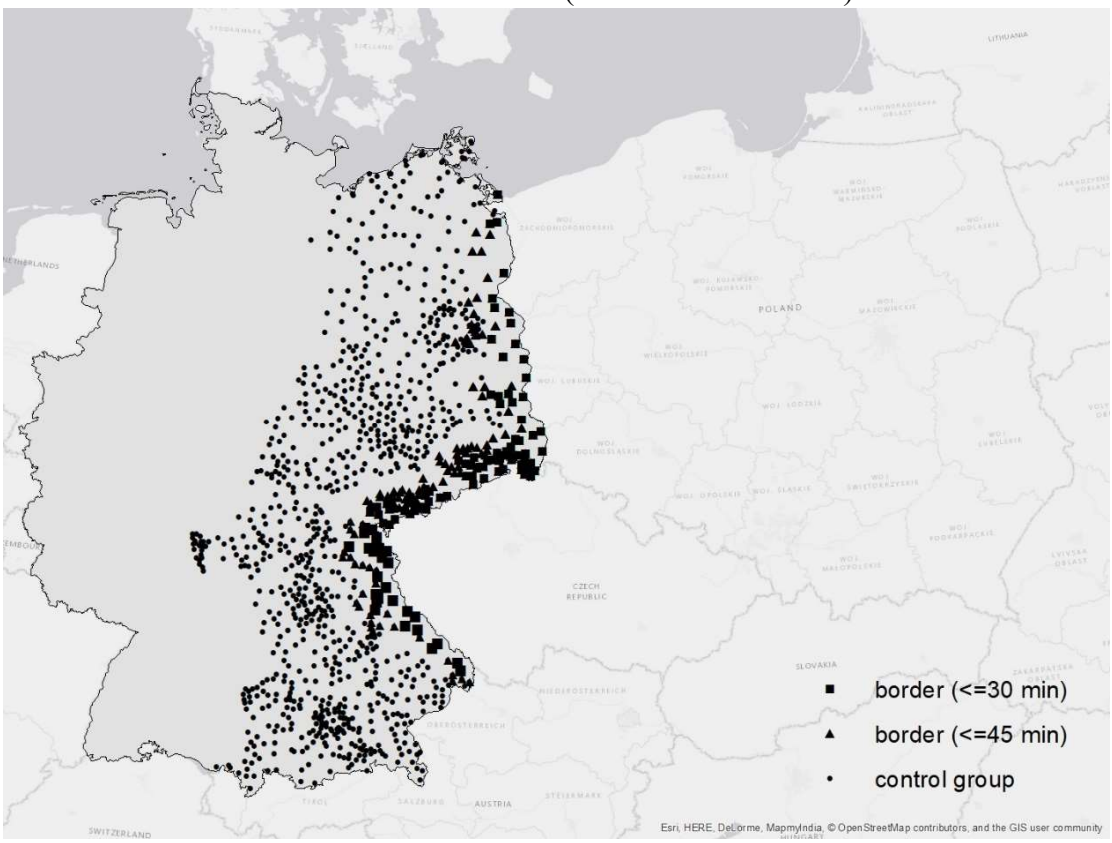
4.5 The Dataset: Treatment and Control Group

The empirical base for this paper is a panel of municipal-level data on a large set of German towns with at least 5,000 residents[46]. This data is provided by the Federal Statistical Office Germany (2016) and the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR 2016). The panel contains annual population figures for a time span extending from 1995 to 2013. Hence, the observations are almost symmetrically distributed around the year of EU enlargement. Since this paper focuses on the borders that were directly affected by the 2004 accession, the sample does not include towns in Western Germany bordering EU countries other than the new member states to the east. This solves for potential problems of identification resulting from 'non-treated' border towns in these regions. To obtain territorial units that are comparable over time, the data was adjusted to the constant territorial boundaries of 2013.[47] These adjustments are crucial for any further analysis since, within the observed period, many towns in the sample drastically increased in territory as a result of several administrative reforms. Observations from 2012 were discarded from the panel due to irregularities in population levels caused by the German population census in 2011. Ultimately, Sample I comprises 17,969 observations from 1,057 towns (see FIGURE 4.1 and TABLE 4.2).

[46] In Germany 5,000 inhabitants is the official minimum size for a town to be categorized as small town ("Kleinstadt")

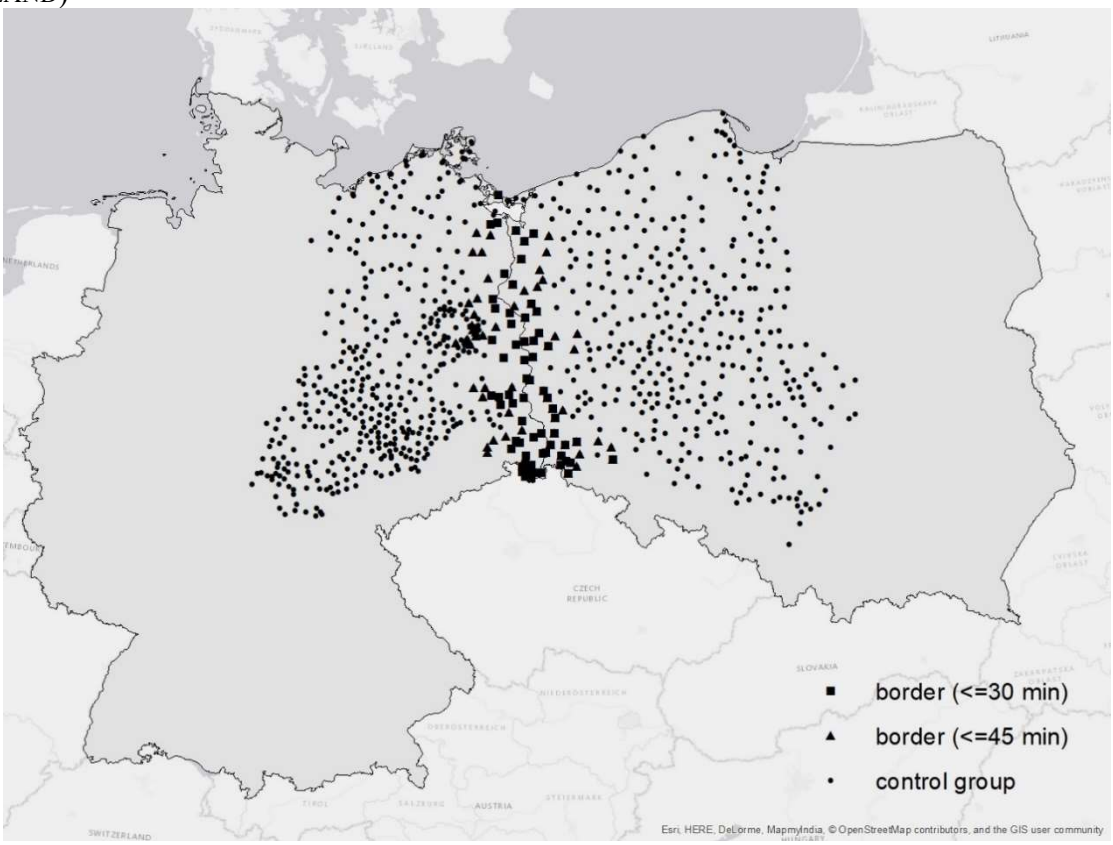
[47] For a detailed description of the methodology of territorial adjustments see Kauffmann (2015).

FIGURE 4.1. TREATMENT AND CONTROL GROUPS (SAMPLE I: GERMANY)



Source: Author's illustration based on Eurostat (2013) and Geofabrik (2016)

FIGURE 4.2. TREATMENT AND CONTROL GROUPS (SAMPLE II: EAST GERMANY AND WESTERN POLAND)



Source: Author's illustration based on Eurostat (2013) and Geofabrik (2016)

Unlike Redding and Sturm (2008) who use simple beeline distance and Brakman et al. (2012), using road distance, this study uses a GIS network analysis tool to estimate the travel time (by car) to the nearest border crossing in order to define treatment and control groups. Thus, the road distance is weighted by the estimated speed at which each road can be traveled. Geodata for the travel time estimation has been obtained from EUROSTAT (2013) and OpenStreetMap (Geofabrik 2016), Finally, two different treatment groups are defined consisting of towns located within 30 or 45 minutes of estimated travel time from a border crossing (see Figure 4.1).

As described in Section 4, observations from neighboring countries also have to be included in order to estimate the potential asymmetries of the integration effect along the affected border. Therefore, a second sample (Sample II) of East German and Polish cities with at least 5.000 inhabitants is used. Data on Polish towns was obtained from the Central Statistical Office of Poland (2017). Bavarian towns and towns from eastern Poland[48] were discarded from Sample II as focus was only on the German-Polish border. Moreover, all towns within 60 minutes of travel distance from the Czech border were discarded to ensure that the results were not disturbed by any other border that was more or less affected by the enlargement (see FIGURE 4.2). Observations from 1999 and 2011 also had to be discarded due to some irregularities in the Polish data, probably caused by the administrative reforms in 1999 and the population census in 2011. In the end, Sample II comprises 870 towns and 13,050 observations.

TABLE 4.2 depicts some descriptive pre-treatment (2003) statistics on the demographic and economic structure of towns within the treatment (<=30 min) and the control group of Sample I and Sample II. Major differences in some municipal characteristics can be observed. In Sample I border towns are smaller on average, less densely populated, and had higher unemployment rates than their counterparts in the control group. This is not surprising. Given the aforementioned theoretical background, one must assume that the long-term presence of the border resulted in low economic performance and an unfavorable socioeconomic structure in border towns. However, differences in the sectoral structure (measured in employment shares) are less significant. On average, the proportion of the primary and the secondary sector was only slightly higher in the border towns than in the control towns. Consistent with economic theory and the aforementioned statistics, mean population growth rates before 2004 in the control group were distinctly higher than those of the border towns.

[48] The sample contains towns from the Polish voivodeships Zachodnio-Pomorskie, Pomorskie, Lubuskie, Wielkopolskie, Kujawsko-Pomorskie, Dolnośląskie, Łódzkie, Opolskie and Śląskie.

TABLE 4.2. DESCRIPTIVE STATISTICS FOR TREATMENT AND CONTROL GROUPS

SAMPLE	(I) East Germany and Bavaria		(IIa) Western Poland		(IIb) East Germany	
GROUP	Border <= 30 min	Control > 30 min	Border <= 30 min	Control > 30 min	Border <=30 min	Control >30 min
Population	18267.2	21513.7	30792.5	26733.7	18414.3	27589.6
	(48376.6)	(120530.3)	(77310.1)	(71270.5)	(21066.5)	174928
Pop. density	260.19	339.13	939.25	1103.8	270.08	276.49
	(269.15)	(407)	(585.99)	(668.71)	(236.61)	(352.33)
Primary sector	3.15%	2.79%			4.28%	4.42%
	(4.37)	(3.94)			(6.21)	(5.05)
Secondary sector	39.63%	38.91%			32.79%	34.23%
	(15.34)	(15.5)			(14.41)	(13.78)
Tertiary sector	57.22%	58.29%			62.92%	61.34%
	(15.13)	(15.79)			(14.82)	(15.26)
Unemployment	12.15%	8.86%	29.57%	24.48%	15.89%	13.35%
	(4.56)	(5.05)	(5.35)	(6.65)	(3.15)	(3.69)
~ Pop. dev. before 2004	-0.768%	0.197%	-0.318%	-0.174%	-1.201%	-0.126%
	(1.576)	(1.785)	(1.131)	(1.164)	(1.734)	(2.401)
N	105	952	27	368	39	387

Notes: Means and standard deviations (in parentheses). Total sample of towns with at least 5,000 residents comprising the total territory of the former GDR and nine Western Polish voivodeships. Reference year: 2003. Source: Author's calculations based on Federal Statistical Office Germany, Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) and Polish Statistical Office.

Moreover, TABLE 4.2 separately depicts the descriptive statistics of Sample II for East Germany and Poland. In the latter case, statistics on shares of sectoral employment were not available. In Poland, border towns have a higher population on average than their counterparts in the control group, but the variance is very high. Noticeable differences in population density between Polish and German towns can be explained by different administrative definitions in both countries. While the official statistics for Poland clearly distinguish between urban and rural areas, the German definition is less specific. Unemployment rates in border towns have been distinctively higher in both countries while the specialization in service industries was more pronounced in the border towns than in the control towns in East Germany. Again, the

annual rate of population growth before 2004 was higher on average within the control group. In conclusion, since all observable pre-treatment statistics hint at lower population growth rates for border towns than for non-border towns in both samples, the possibility of a potential bias due to these factors cannot be ultimately rejected. However, all of the differences between the treatment and the control group are in line with our theoretical assumptions and can be explained by the existence of the border.

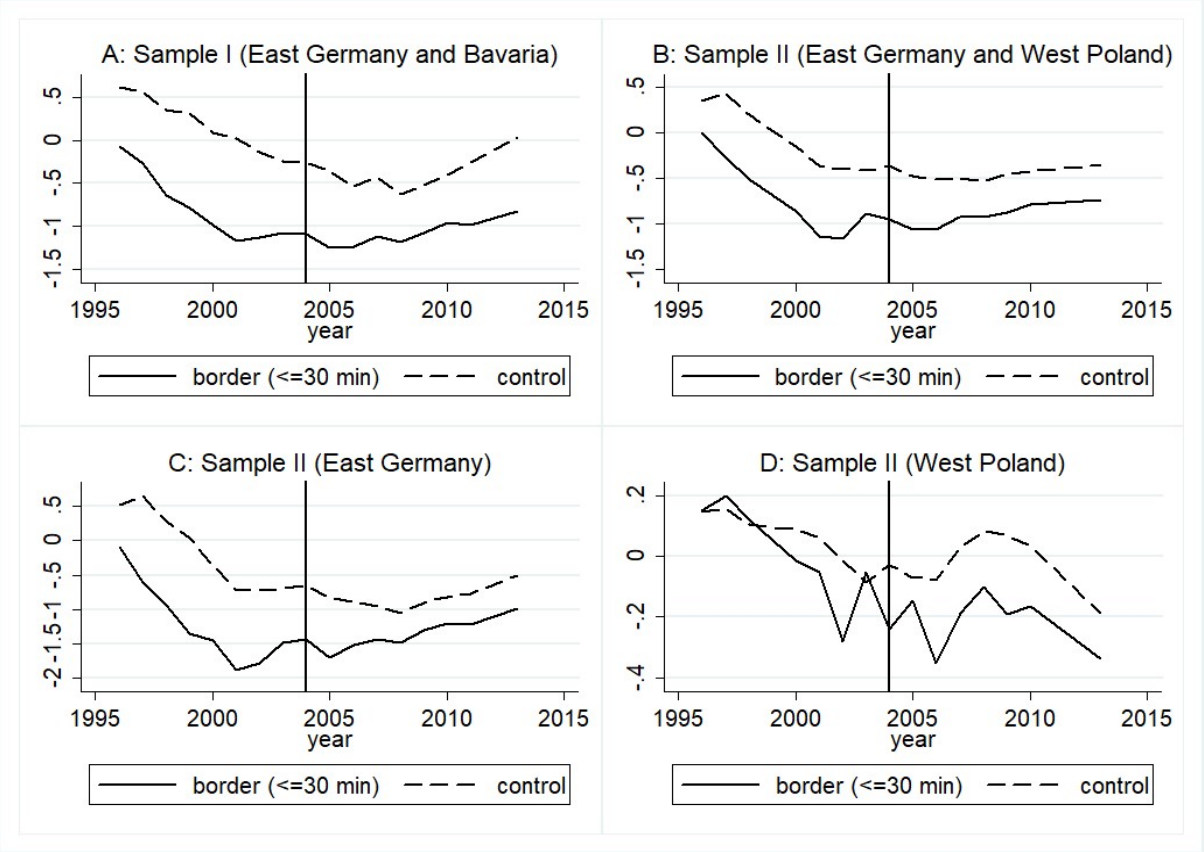
4.6 Results

4.6.1 Descriptive Results

Panel A in FIGURE 4.3 shows the development of mean annual rates in population change in the treatment (<=30 min) and the respective control group over time for Sample I. Over the entire period under observation, average rates are distinctly higher in the control group. The performance of both groups sharply decreased from 1996 to 2001, but the rate is slightly higher for the treatment group. Nonetheless, up to this point it appears that the DID framework's underlying assumption of parallel trends roughly applies. Starting in 2002 the trend for the treatment group begins to stabilize while rates of change in the control group continue to decrease. This 'anticipation effect' is in line with the character of the EU enlargement as an anticipated event and must be taken into account with respect to the estimation results, indicating a violation of the parallel trends assumption. The difference between both curves continues to decline up until 2010. From then on, the population development of border towns indicates a slightly more negative trend than for towns in the comparison group. Similar patterns of population growth can be found for Sample II in total as well as for the East German towns in Sample II (panel B and C).

While the adjustments in growth rates following the enlargement were pretty distinct for East Germany, no clear adjustments and no parallel trends at all are visible for the Polish part of the Sample (panel D). This strongly suggests that any treatment effects, estimated for Polish towns are not reliable and should be interpreted with caution, since the parallel trend assumption does not hold for this subsample. In summary, FIGURE 4.3 at least for Germany hints at a positive effect of the EU enlargement on the population growth of border towns compared to towns within the control group. However, the mean population change rates of the control group were higher over all of the observed period and the positive trend of border towns started even before 2004 and did not last very long. The following estimation results test for the significance of those basic findings and address the spatial and structural heterogeneity of the integration effects.

FIGURE 4.3. MEAN ANNUAL POPULATION GROWTH RATES OF THE TREATMENT AND THE CONTROL GROUP FOR DIFFERENT SAMPLES AND SUBSAMPLES



Notes: Treatment group includes towns within 30 minutes of road travel time to the nearest border crossing. Vertical lines represent EU enlargement in 2004. Source: Author's own calculations.

4.6.2 Estimation Results

The results for baseline equation (4.1) support the hypothesis that the EU enlargement has had a positive effect on border town population growth. As reported in TABLE 4.3, towns within 30 minutes of travel time from the border experienced a significant relative increase of about 0.26 percentage points subsequent to the 2004 enlargement. These results do not hold up when the treatment group is broadened to include towns located within 45 minutes of travel time from the border. In this case, the estimated β becomes statistically insignificant. Moreover, distinguishing between 'treated' towns at the Polish and Czech border (equation 4.2), it shows, that the estimated effect is stronger for the first group of border towns (0.46), while no significant effect for towns near the German-Czech border can be found. There are many possible explanations for these regional differences. On the one hand, the structurally weaker towns along the Polish border might have profited more from changes in market access following the 2004 enlargement. On the other hand, German-Czech cross-border interactions might have been well established even before 2004, resulting in less distinct changes after the enlargement. However, a more profound interpretation of those results would require an in-

depth analysis of both regions, which could not be conducted within the narrow framework of this article.

TABLE 4.3. BASELINE DID ESTIMATIONS

TRAVEL TIME	<= 30 min		<= 45 min		<=30 min	
MODEL	(1a)	(1b)	(1c)	(1d)	(2a)	(2b)
VARABLES	Annual population change					
*border * integr*	0.256**	0.256**	0.088	0.088		
	(0.104)	(0.114)	(0.08)	(0.084)		
*pl_border * integr*					0.462**	0.462**
					(0.224)	(0.123)
*cz_border * integr*					0.151	0.151
					(0.101)	(0.157)
Year fixed effects	yes	yes	yes	yes	yes	yes
Town fixed effects	yes	yes	yes	yes	yes	yes
No. observations	17,969	17,969	17,969	17,969	17,969	17,969
No. towns	1.057	1.057	1,057	1.057	1,057	1.057
R-squared	0.126	0.126	0.125	0.125	0.127	0.127

Notes: Treatment groups are defined as towns with a maximum road travel time of 30 or 45 minutes to the nearest border crossing. Standard errors in parentheses are heteroscedasticity consistent and adjusted for town-level (1a, 1c, 2a) or region-level (1b, 1d, 2b) clustering. *: p<0.1; **: p<0.05; ***: p<0.01. Source: Author's own calculations.

In addition to those baseline results TABLE 4.4 reports the results for estimating equation (4.3) for certain subgroups of 'treated' towns. While large cities in general experienced a significant positive trend after the EU enlargement, indicating a tendency for urban concentration in the post-enlargement period, no significant integration effect for large border cities can be identified. Furthermore, the estimations do not confirm any significant integration effects (neither for $group_i * integration_t$, nor for $group_g * border_i * integration_t$) for small towns and towns specialized in manufacturing. More interesting are the results for towns specialized in services. While the estimated β_0 turns insignificant and the positive effect for $group_i * integration_t$ is only significant, when standard errors are clustered around municipalities, a significant and relatively strong positive effect of $group_g * border_i * integration_t$ (0.51) can be found, which indicates that the positive effect of integration was only relevant for the latter group of border towns. The findings for sectoral specialization are

consistent with the theoretical considerations mentioned above. Service industries might be more exposed to changes in local market access and therefore should yield higher gains from EU integration, finally resulting in stronger population growth in municipalities specialized in those industries.

TABLE 4.4. DDD ESTIMATIONS (DIFFERENT TREATMENT EFFECTS FOR DIFFERENT TOWN TYPES)

GROUP	Large		Small		Manufacturing		Service	
MODEL	(3a)	(3b)	(3c)	(3d)	(3e)	(3f)	(3g)	(3h)
VARIABLES	Annual population change							
*border * integr*	0.203*	0.203*	0.351**	0.351*	0.337**	0.337**	0.092	0.092
	(0.115)	(0.098)	(0.139)	(0.241)	(0.144)	(0.139)	(0.122)	(0.108)
*group * integr*	0.489***	0.489***	-0.068	-0.068	-0.004	-0.004	0.209***	0.209
	(0.069)	(0.065)	(0.06)	(0.156)	(0.058)	(0.175)	(0.081)	(0.197)
*group * border * integr*	0.333	0.333	-0.212	-0.212	-0.258	-0.258	0.511**	0.511*
	(0.218)	(0.2)	(0.206)	(0.381)	(0.177)	(0.19)	(0.208)	(0.248)
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Town fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
No. observations	17,969	17,969	17,969	17,969	17,969	17,969	17,969	17,969
No. towns	1,057	1,057	1,057	1,057	1,057	1,057	1,057	1,057
R-squared	0.14	0.14	0.127	0.127	0.127	0.127	0.131	0.131

Notes: Treatment groups are defined as towns with a maximum road travel time of 30 minutes to the nearest border crossing. The interaction term *group* refers to different subgroups of towns (large, small, specialized in manufacturing or services). Standard errors in parentheses are heteroscedasticity consistent and adjusted for town-level (3a,3c,3e,3g) or region-level (3b,3d,3f,3h) clustering. *: p<0.1; **: p<0.05; ***: p<0.01. Source: Author's own calculations.

What makes the 2004 enlargement stand out against previous EU enlargements is that there were and are large structural differences between the new and old member countries. From this point of view a comparison of the $border_i * integration_t$ estimator between different countries should lead to insights into the heterogeneous impact of EU integration at different sides of the border. Regressing equation (4.4) for Sample II leads to the results presented in TABLE 4.5. The DDD-estimates indicate significant differences between East German and Polish border towns with a significant negative effect for the latter group. This finding is broadly in line with Tsiapa's (2014) hypothesis of increasing economic concentration in the

new EU member states of Central and Eastern Europe. However, a sound interpretation of those results is impossible without further in-depth analysis of the regions in question.

TABLE 4.5. DDD ESTIMATIONS: TREATMENT EFFECTS IN DIFFERENT COUNTRIES (SAMPLE II)

COUNTRY	Germany		Poland	
MODEL	(4a)	4b)	(4c)	(4e)
VARIABLES	Annual population change			
*border * integr*	-0.134**	-0.134*	0.449**	0.449***
	(0.056)	(0.071)	(0.198)	(0.146)
*country * integr*	-0.591***	-0.591**	0.591***	0.591**
	(0.068)	(0.247)	(0.068)	(0.248)
*country * border * integr*	0.583***	0.583***	-0.583***	-0.583***
	(0.207)	(0.162)	(0.207)	(0.161)
Year fixed effects	yes	yes	yes	yes
Town fixed effects	yes	yes	yes	yes
No. observations	13,050	13,050	13,050	13,050
No. towns	870	870	870	870
R-squared	0.116	0.116	0.116	0.116

Notes: Treatment groups are defined as towns with a maximum road travel time of 30 minutes to the nearest border crossing. Standard errors in parentheses are heteroscedasticity consistent and adjusted for town-level (4a, 4c) or region-level (4d,4e) clustering. *: p<0.1; **: p<0.05; ***: p<0.01. Source: Author's own calculations.

4.6.2 Robustness Tests

The above described estimation results mostly hint at a positive effect of the EU enlargement on the growth of border towns but of course some potential caveats of these estimations need to be addressed. The selection of a city into the treatment group was due to its distance to the nearest border crossing measured in estimated travel time. However, this travel time estimation was based on the state of the road network in 2013. It might be the case, that some roads have changed throughout the observed period resulting in changing travel times to the border for certain towns. This would entail that the selection criteria between the treatment and the control group in some cases might not have been stable over time. To overcome this potential shortcoming, all observations between 30 and 45 minutes of travel time are discarded from Sample I and Sample II in order to obtain a definition of the treatment group (<=30 min) and the control group that is more robust against potential changes in the road network. Estimating equation (4.1) and equation (4.4) then leads to the results presented in TABLE 4.6. As the

estimates barely differ from those in TABLE 4.4 and TABLE 4.5, a potential bias due to changes in the road network can be rejected.

TABLE 4.6. ROBUSTNESS TESTS: DID AND DDD ESTIMATIONS FOR ADJUSTED SAMPLES

SAMPLE	(I) East Germany and Bavaria		(II) East Germany and West Poland			
COUNTRY			Germany		Poland	
MODEL	(1a)	(1b)	(4a)	4b)	(4c)	(4d)
VARIABLES			Annual population change			
*border * integr*	0.248**	0.248**	-0.137**	-0.137*	0.436**	0.436***
	(0.105)	(0.116)	(0.056)	(0.071)	(0.056)	(0.199)
*country * integr*			-0.581***	-0.581**	-0.581***	-0.581**
			(0.071)	(0.251)	(0.071)	(0.251)
*country * border * integr*			0.573***	0.573***	-0.573***	-0.573***
			(0.207)	(0.165)	(0.207)	(0.165)
Year fixed effects	yes	yes	yes	yes	yes	yes
Town fixed effects	yes	yes	yes	yes	yes	yes
No. observations	16,320	16,320	12,420	12,420	12,420	12,420
No. towns	960	960	828	828	828	828
R-squared	0.122	0.122	0.112	0.112	0.112	0.112

Notes: Treatment groups are defined as towns with a maximum road travel time of 30 minutes to the nearest border crossing. Control groups are defined as towns with a minimum travel time of 45 minutes to the border. Standard errors in parentheses are heteroscedasticity consistent and adjusted for town-level (1a, 4a, 4c) or region-level (1b, 4b, 4d) clustering. *: p<0.1; **: p<0.05; ***: p<0.01. Source: Author's own calculations.

Furthermore, although a 'real' selection bias can be rejected since the inclusion into the treatment group was exogenously determined by a town's location, the estimated effects could have been mainly driven by differences in certain town characteristics and not by changes in market access. In particular, the results presented in TABLE 4.5 show that these town characteristics could have played a prominent role, since the integration effects differ distinctly between different types of cities. One method usually applied to overcome the potential bias between the treatment and the control group is DID matching or conditional DID as introduced by Heckman et al. (1998). Comparing the results described above with estimations based on matched samples should yield greater confidence in the robustness of our findings.

TABLE 4.7. DESCRIPTIVE STATISTICS FOR TREATMENT AND CONTROL GROUP (MATCHED SAMPLES)

SAMPLE	(I) East Germany and Bavaria		(IIa) Western Poland		(IIb) East Germany	
GROUP	Border <= 30 min	Control > 30 min	Border <= 30 min	Control > 30 min	Border <=30 min	Control >30 min
Population	18267.2	18619	30792.5	30995.1	18414.3	17606.5
	(48376.6)	(52708.2)	(77310.1)	(86434.1)	(21066.5)	(19743.6)
Pop. density	260.19	270.09	939.25	952.48	270.08	268.05
	(269.15)	(286.31)	(585.99)	(598.37)	(236.61)	(246.95)
Primary sector	3.15%	2.97%			4.28%	4.23%
	(4.37)	(4.33)			(6.21)	(4.30)
Secondary sector	39.63%	39.78%			32.79%	33.16%
	(15.34)	(15.5)			(14.41)	(15.04)
Tertiary sector	57.22%	57.25%			62.92%	62.61%
	(15.13)	(15.49)			(14.82)	(16.16)
Unemployment	12.15%	9.26%	29.57%	27.03%	15.89%	13.99%
	(4.56)	(4.91)	(5.35)	(6.77)	(3.15)	(3.48)
Pop. dev. before 2004	-0.768%	0.197%	-0.318%	-0.332%	-1.201%	-0.296%
	(1.576)	(1.785)	(1.131)	(1.168)	(1.734)	(1.833)
N	105	105	27	27	39	39

Notes: Means and standard deviations (in parentheses). Total sample of towns with at least 5,000 residents comprising the total territory of the former GDR and nine Western Polish voivodeships. Reference year: 2003. Data Source: Federal Statistical Office Germany, Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) and Polish Statistical Office.

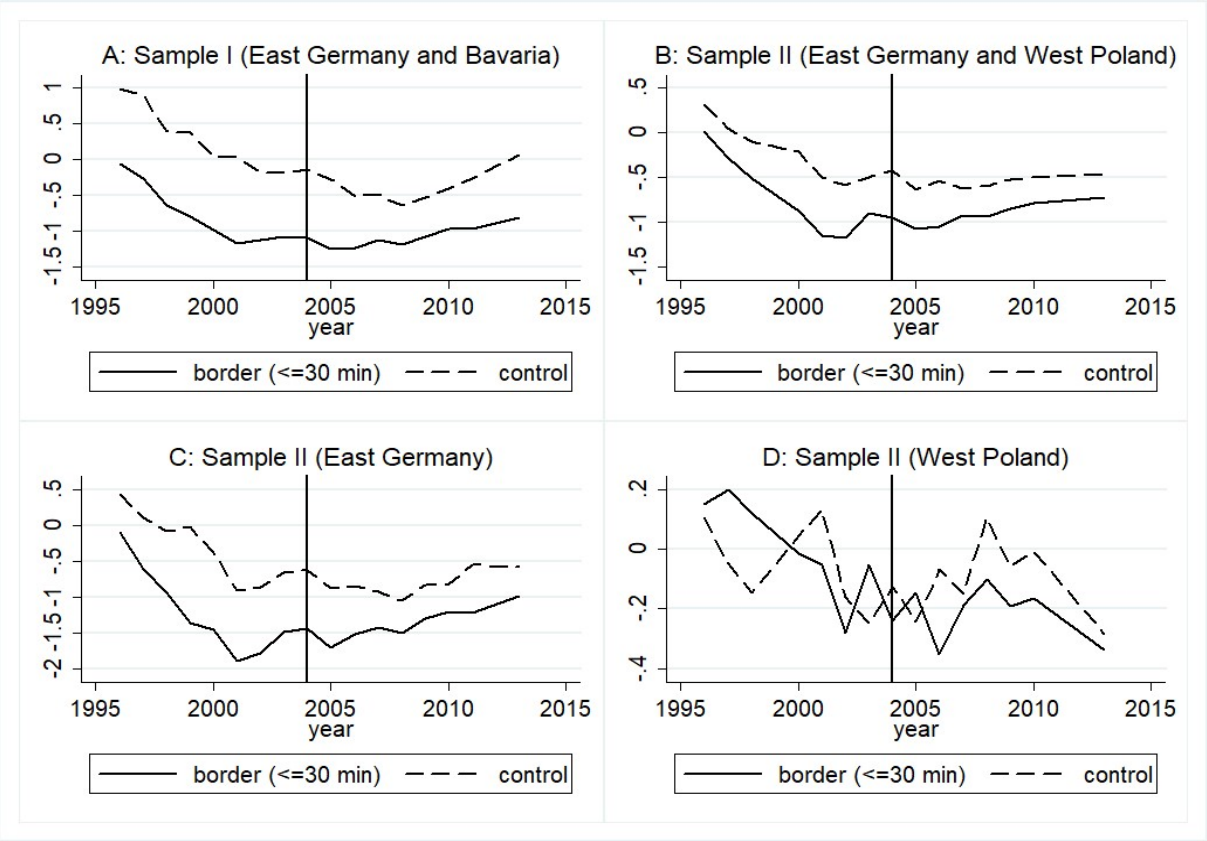
Our matching procedure is based on town characteristics one year before the treatment (2003) as shown in TABLE 4.2, but the selection of the matched control groups is fixed over time. As the number of available covariates is relatively small, nearest neighbor matching based on Mahalanobis distance seems to be a very straightforward and suitable method (see e.g. Stuart 2010). One crucial aspect mentioned in the literature (Chabé-Ferret 2017) is not to match based on the outcome variable or variables that might be directly affected by the treatment (such as unemployment). Hence, only five of the variables presented in TABLE 4.2 are suitable for matching: Population size, population density and sectoral employment shares. In case of Sample II matching is implemented for each country separately. As information on sectoral

employment shares are not available for Polish municipalities, the matching procedure for the Polish subsample is only based on population size and density.

TABLE 4.7 presents the descriptive statistics for the treatment and control groups within matched samples equivalent to TABLE 4.2. The matching exercise was overall successful in minimizing the differences between both groups. Except for unemployment rates, noticeable deviations between the treatment and the control group cannot be observed. Furthermore, FIGURE 4.4 shows the time trends of mean annual population growth rate for matched treatment and control groups in different subsamples equivalent to FIGURE 4.3. Obviously, at least for Germany, the matching procedure was not only successful in improving the sample balance with regard to different observable characteristics, but also regarding pre-treatment trends of outcome. Particularly Panel A shows that the 'anticipation effect', which could be observed in FIGURE 4.3, has dissipated after matching and that pre-treatment trends are now more or less perfectly parallel. While similar effects of matching can be reported for Panel B and C, the matching exercise was not successful for Polish towns (Panel D). The trends for both groups look more or less completely random and do not show any signs of concurrency. This means that a DID estimation of the 'border-integration' effect is probably infeasible for the Polish subsample and clear conclusions regarding this part of our estimations cannot be drawn.

TABLE 4.8 presents the results for baseline equations (1) and (2) based on Sample I, which has been matched based on agglomeration characteristics and sectoral structure. The estimates seem to be strongly consistent with the baseline results presented above. Though the total sample size is drastically reduced, the estimated β is significant and almost 0.1 points higher than in TABLE 4.3. The results for equation (4.2) accounting for differences between the German-Polish and the German-Czech border also seem to confirm the previous findings.

FIGURE 4.4. MEAN ANNUAL POPULATION GROWTH RATES OF THE TREATMENT AND THE CONTROL GROUP FOR DIFFERENT SAMPLES AND SUBSAMPLES (AFTER MATCHING)



Notes: Treatment groups includes towns within 30 minutes of road travel time to the nearest border crossing. The control groups have been ex-ante matched by nearest neighbor matching. Vertical lines represent EU enlargement in 2004. Source: Author's own calculations.

TABLE 4.8. BASELINE DID ESTIMATIONS (MATCHED SAMPLE I)

MODEL	(1a)	(1b)	(2a)	(2b)
VARIABLES	Annual population change			
*border * integr*	0.338** (0.153)	0.338*** (0.109)		
*pl_border * integr*			0.526** (0.23)	0.526*** (0.112)
*cz_border * integr*			0.229 (0.140)	0.229 (0.155)
Year fixed effects	yes	yes	yes	yes
Town fixed effects	yes	yes	yes	yes
No. observations	3,570	3,570	3,570	3,570
No. towns	210	210	210	210
R-squared	0.136	0.136	0.139	0.139

Notes: Treatment group is defined as towns with a maximum road travel time of 30 minutes to the nearest border crossing. Control group has been ex-ante matched by nearest neighbor matching. Standard errors in parentheses are heteroscedasticity consistent and adjusted for town-level (1a, 1c) or region-level (1b, 1d) clustering. *: p<0.1; **: p<0.05; ***: p<0.01. Source: Author's own calculations.

Further, TABLE 4.10 presents the results for estimating equation (4.3) based on the matched Sample I. The estimates mostly support the initial findings, but in contrast to the results shown in TABLE 4.4 a significant negative integration effect on border cities specialized in manufacturing can be identified. This is in line with the theoretical assumption, that manufacturing industries in the border region might face increased competition, resulting in lower employment and consequently population growth in those towns. Finally, the results for estimating equation (4.4) for the matched Sample II (TABLE 4.10) again indicate no major deviations from our previous findings. Nonetheless, since the parallel trends assumption in case of Polish towns probably does not hold, the latter results might be even less reliable than those presented in TABLE 4.6.

TABLE 4.9. DDD ESTIMATIONS: TREATMENT EFFECTS FOR DIFFERENT TOWN TYPES (MATCHED SAMPLE I)

GROUP	Large		Small		Manufacturing		Service	
MODEL	(3a)	(3b)	(3c)	(3d)	(3e)	(3f)	(3g)	(3h)
VARIABLES	Annual population change							
*border * integr*	0.289*	0.289*	0.487**	0.487**	0.477**	0.477**	0.094	0.094
	(0.175)	(0.116)	(0.204)	(0.221)	(0.219)	(0.117)	(0.15)	(0.124)
*group * integr*	0.486**	0.486**	-0.109	-0.109	0.172	0.172	-0.033	-0.033
	(0.246)	(0.127)	(0.201)	(0.193)	(0.183)	(0.183)	(0.315)	(0.364)
*group * border * integr*	0.336	0.336	-0.389	-.0389	-0.435*	-0.435**	0.754**	0.754*
	(0.321)	(0.253)	(0.282)	(0.359)	(0.248)	(0.151)	(0.369)	(0.368)
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Town fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
No. observations	3,570	3,570	3,570	3,570	3,570	3,570	3,570	3,570
No. towns	210	210	210	210	210	210	210	210
R-squared	0.157	0.157	0.138	0.138	0.138	0.138	0.149	0.149

Notes: Treatment groups are defined as towns with a maximum road travel time of 30 minutes to the nearest border crossing. The control group of non-border towns has been ex-ante matched by nearest neighbor matching. The interaction term *group* refers to different subgroups of towns (large, small, specialized in manufacturing or services). Standard errors in parentheses are heteroscedasticity consistent and adjusted for town-level (3a,3c,3e,3g) or region-level (3b,3d,3f,3h) clustering. *: p<0.1; **: p<0.05; ***: p<0.01. Source: Author's own calculations.

In conclusion, most of the estimates based on matched samples seem to be consistent with the baseline findings presented above. Although the matching exercise for Polish towns was

not successful in balancing the pre- and post-treatment trends, at least for German towns, the idea of a relevant 'selection bias' due to observable city characteristics can be rejected.

TABLE 4.10. DDD ESTIMATIONS: TREATMENT EFFECTS IN DIFFERENT COUNTRIES (MATCHED SAMPLE II)

COUNTRY	Germany		Poland	
MODEL	(4a)	(4b)	(4c)	(4d)
VARIABLES	Annual population change			
*border * integr*	-0.167*	-0.167	0.278	0.278
	(0.093)	(0.104)	(0.198)	(0.139)
*country * integr*	-0.428*	-0.428*	0.428*	0.428*
	(0.2)	(0.238)	(0.2)	(0.238)
*country * border * integr*	0.445*	0.445**	-0.445*	-0.445**
	(0.283)	(0.174)	(0.283)	(0.174)
Year fixed effects	yes	yes	yes	yes
Town fixed effects	yes	yes	yes	yes
No. observations	1,980	1,980	1,980	1,980
No. towns	132	132	132	132
R-squared	0.123	0.123	0.123	0.123

Notes: Treatment groups are defined as towns with a maximum road travel time of 30 or 45 minutes to the nearest border crossing. The control groups have been ex-ante matched by nearest neighbor matching. Standard errors in parentheses are heteroscedasticity consistent and adjusted for town-level (4a, 4c) or region-level (4b, 4d) clustering. *: $p<0.1$; **: $p<0.05$; ***: $p<0.01$.

4.7 Discussion

Despite all robustness tests, the above presented estimations of course entail some further caveats which have to be discussed. One potential issue is that the relative increase in population development of border towns was not due to the EU enlargement and changes in market potential but to some confounding events occurring at the same time as the enlargement. One potential confounding development with regard to the above presented estimations might have been particular EU structural funds, which were possibly introduced after 2004.[49]

[49] A simple way to test for the role of EU structural funds for border regions, would be to include a further treatment group of border towns, which were not affected by the EU enlargement (e.g. at Germany's Western border). This would require an expansion of the original dataset.

Indeed, border regions are a special objective within EU regional policy. Since 1990 the INTERREG program serves as a tool to promote transnational and cross border cooperation as well as the economic development of border regions. But as this program has been active for a long time before the 2004 EU enlargement and makes up only for a very small amount of total structural funds, this should not impair the above presented results at least for Germany. In addition, from 1994 to 2004 cross border cooperation was also supported by the PHARE program which was especially addressed to the future member states in Central and Eastern Europe (Wassenberg et al. 2015). Consequently, since EU funding for border regions was accessible in all countries and over the whole observed period, it should be a factor which can be neglected with respect to the above presented estimations. Moreover, there were as far as known to the author no further events which could have resulted in diverging trajectories of border and non-border towns.

A more severe issue is that the outcome of population change – though in line with spatial equilibrium theories – approximates only one aspect of the potential adjustments following European integration. Buettner and Rincke (1997) have already shown that a border removal entails multiple shocks for the former border regions. The demand shock due to increased market potential might be complemented by a labor supply shock, which could entail negative effects on wages. Alternative outcomes like GDP growth, unemployment rates or wages would strongly benefit the analysis of these potentially heterogenous spatial adjustments following European integration. Unfortunately, such variables are at least on the municipal level and for the observed period not continuously available. Moreover, ongoing territorial reforms are a further impediment for the long run analysis of municipal developments in the observed area. Using larger territorial units like counties or regions would on the other hand neglect the strong distance decay of the enlargement effect (see Wassmann 2016). A suitable identification strategy of spatial integration effects on other forms of outcome would therefore require further case studies with more detailed datasets.

4.8 Conclusion

Examining the ‘natural experiment’ of the 2004 EU enlargement and the case study of Germany’s eastern border, this article contributes to a growing body of literature, finding that economic integration exerts positive effect on the population development of border towns. However, in contrast to previous studies the results show how the potential gains in population growth differ widely depending on local economic characteristics. While cities and towns near the German-Polish border as well as towns specialized in service industries have strongly benefited, no significant or even negative effects were found for towns near the German-Czech

border as well as municipalities specialized in manufacturing. Surprisingly, also no effects could be estimated for Polish towns near the border to Germany. Although this 'effect heterogeneity' is broadly consistent with economic theory, it is mostly neglected in the literature dealing with the spatial effects of economic integration. Hence, most authors tend to overemphasize the potential benefits of increased market access for former peripheral regions. In conclusion, the results presented in this paper support the view of those authors who suggest that the effects of EU integration for most border regions and cities are relatively modest, and who emphasize the economic and institutional heterogeneity of these locations.

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Chapter 5

Was Socialist Central Planning Policy Able to Change the Long-Term Development Paths of Cities? – Insights from Case Studies in East Germany*

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This paper analyses different categories of heritage from socialist planning policies and their potential to create path dependencies for urban development. Did the decisions made during the time of socialist central planning impact local economic development and have there been long-term consequences for these cities even after their return to a market economy? Drawing from our case study analysis of four East German cities, we identify different categories of socialist policy measures that have partially resulted in lock-in developments in the local economic systems. Especially the 'softer' strategies of socialist planning (urban renewal, changes of administrative status) have worked in this direction. However, our findings also suggest that socialist planning policies did not necessarily result in economic stagnation or decline once socialism ended. How and to what extent a city benefits from its socialist heritage strongly depends on the specific industrial and institutional context.

**The concept and the theoretical framework of the paper has been developed by both authors. Martin Rosenfeld has been responsible for the case studies in Rostock and Suhl as well as the discussion of the results. Bastian Heider conducted the literature research and the case studies in Chemnitz and Weißwasser. The Authors like to thank Peter Haug and Daniel Koesling for their assistance in conducting the interviews.*
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5.1 Introduction

After the rise of the 'Iron Curtain', cities in Central and Eastern Europe had to develop new strategies for coping with the conditions of interregional competition within a market economy. Under these new conditions, some cities have been more successful than others in increasing their interregional competitiveness and attracting or retaining businesses and residents. This paper focuses on a set of factors that has not yet been systematically analyzed within the discussion on the diverging economic development trajectories of post-socialist cities. We look at various categories of socialist heritage and their impact on path dependencies in urban development.

The theoretical framework of this paper was inspired by the work of scholars from regional and urban science, who have stressed the importance of historical accidents and path-dependencies (Arthur 1994; Krugman 1991; Martin and Sunley 2006) and aimed to develop an 'evolutionary' approach for explaining the spatial pattern of the economy (Boschma and

Frenken 2006). Following these approaches, we look explicitly at changing situational factors under the socialist regime. During more than 40 years of socialism, politicians of the central government tried to create new conditions for the economic development of cities and regions. These new conditions followed the logic of centralist planning and were based on the specific needs of socialist countries. They stemmed from the countries' rejection of an international division of labor as well as from pure ideological ideas. The allocation of specific economic and political functions to certain cities was accompanied by a shift of financial resources to those cities considered most relevant for the socialist economy (Sjöberg 1999).

The questions we want to address in this paper focus on the long-term consequences of these measures. Was socialist central planning policy (SCPP) able to create new development trajectories and path dependencies for cities and regions which are still relevant today, nearly 30 years after the return to a market economy? If so, how strong is the degree of non-reversibility created by those measures, and how much leeway did local policies have within the boundaries inherited from socialism? Were the consequences of SCPP after 1989 always an impediment or were some cities able to turn their socialist heritage into new opportunities for local economic development?

We want to answer these questions for a selection of cities in East Germany (the former German Democratic Republic, GDR) which received special policy treatments during the time of socialism. While, apart from Berlin, Dresden and Leipzig, the vast majority of East German cities can be categorized as 'medium-sized' as well as 'slowly growing' or 'shrinking' cities, after the rise of the Iron Curtain, drastic changes occurred within the East German urban hierarchy which still need to be explained. Our approach should therefore contribute to the debate on inter-regional and inter-urban economic disparities in post-socialist countries (see e.g. Ahrend 2005; Goloubchikov 2006) by taking a look beyond the more traditional explanations like agglomeration economies and human capital and explicitly take into account the "hybrid spatialities" (Goloubchikov et al. 2014) of post-socialist cities, which resulted from the interplay of socialist path dependence and recent capitalist conditions.

The paper is structured as follows: First, we give a brief overview of the existing empirical literature on the role of history and path dependence for regional and urban economic growth and the driving forces behind urban development in Central and Eastern European cities since 1990. This is followed by a theoretical discussion on different categories of historical heritage and path dependence in a post-socialist, urban context. After some short remarks on the methodology and the selection of the case studies, we present empirical results on the impact

of changes during the time of socialism. In the final section, we discuss these findings and draw conclusions for future research.

5.2 Literature Review

5.2.1 The Empirics of 'History Matters'

The seminal works of Paul A. David (1985, 1994) and W. Brian Arthur (1989, 1994) spread the general idea of positive feedbacks of historical events and path dependence. They have provoked a good deal of fruitful discussion and criticism (Martin 2010) within the fields of regional economics and economic geography as well as a steadily growing body of empirical literature emphasizing the historical determinants of regional economic growth. This literature strongly varies with regard to the concepts of history and path dependence as well as the empirical approaches (for a survey see Henning et al. 2013). It is based on various schools of thought, stressing different aspects of path dependence, hysteresis and historical persistence, such as urban economics and new economic geography (Fujita and Mori 1996; Redding et al. 2011), evolutionary economic geography (Boschma, et al. 2011, 2013, Neffke et al.; 2011) or the literature on regional entrepreneurship (Fritsch and Wyrwich 2014, 2016).

From this heterogenous pool of research, our approach might be mostly related to studies analyzing structural change and lock-in situations in old industrial districts like the German Ruhr Area (Grabher 1993) or Northern England (Hudson 1994). Particularly influential was the term "the weakness of strong ties", established by Grabher (1993), who identified three different forms of lock-in (cognitive, functional and political) which caused the once successful networks of the local steel and coal industries to disregard the global development of an industry shift towards low-wage countries. Going against the common trend and increased international competition, investments in the region's steel industry grew during the 1970s. Glasmeier (1991) found a similar reaction by the watch industry in the Jura region of Switzerland, which heavily promoted the innovation of mechanical technologies while global industry shifted towards microelectronics.

Several other studies focus more on how lock-in situations like the ones described above can be overcome. By comparing an automotive and a metal industry cluster in Styria, Austria, Tödtling and Trippl (2005) find that industry structure and the degree of regional specialization (mono-structure) are two major factors impacting the adaptive capabilities of a regional innovation system. Hassink (2010) compared the case studies of regional shipbuilding and textile clusters in Germany and Korea and concluded that the strength of a lock-in is hardly determined by the structure of an industry or the degree of local specialization alone. In each

case a unique set of institutional impact factors at the regional as well as the national and supra-national levels shaped the process of local path dependence.

Although the division and reunification of Germany has served as a 'natural experiment' in plenty of studies in empirical economics (e.g. Redding and Sturm 2008; Redding et al. 2011), evidence for path dependencies created by the heritage of the GDR industrial policy as well as such policies in other post-socialist countries is quite rare. At least on a macroeconomic level the findings of Blum (2013) suggest that, even after reunification, East Germany has followed a relatively stable growth path extending from the 1950s and 1960s. Despite a short period of adjustment in the early 1990s, East Germany has never managed to overcome its structural deficits stemming from its socialst heritage and the loss of company headquarters, human capital and innovative capacities.

On the regional or local level one has to consider that path dependencies and lock-ins in postsocialist countries are hardly comparable to those in traditional market economies. While the processes of the latter are strongly place-dependent (Martin and Sunley 2006), path dependencies in socialist and postsocialist economies are, to a large extent, the product of SCPP. This does not mean that local institutional arrangements, like the "strong ties" explored by Grabher (1993), were irrelevant for the lock-in development of (post) socialist cities and regions, but they were strongly dependent on ideology and decisions made by SCPP.

Empirical studies on regional economic path dependence in the framework of post-socialist transition have been limited to a few case studies, primarily dealing with intra-firm, intra-cluster or intra-industry adaption processes. For example, Bathelt and Boggs (2003) analyzed the evolution of the old (book publishing) and new (television/filmmaking) media clusters in the East German city of Leipzig. Their findings suggest that development paths of cities or regions are not homogeneous; instead they consist of bundles of various technological trajectories. Moreover, Bathelt (2009, 2013) studied the re-bundling process of firms within the chemical industry cluster in the East German region of Bitterfeld-Wolfen. Although he concludes that the region on the whole was unsuccessful in leaving the path of broad de-industrialization after German reunification, Bathelt emphasizes the role of individual actors in network building and stimulating a collective regional spirit, which may lead to a modernization of the regional economy in the future.

5.2.2 The Transformation of Post-Socialist Cities

As the majority of the aforementioned studies focus on firms, clusters or industries, there is a research gap with respect to more integrated perspectives on a regional and, especially, urban level. Since this article aims to take a comprehensive urban perspective, it also needs to be set

in the context of the literature on the transformation and economic re-positioning of post-socialist cities.

What generally distinguishes post-socialist cities from other cities in market economies is that the transition from Fordist to post-Fordist modes of production was a form of "shock therapy" rather than a gradual process. Particularly in East Germany (the only case where a former planning economy became integrated into a capitalist country virtually 'overnight'), cities had to catch-up with various economic and social developments that took place in Western countries between 1945 and 1990 (Kovacs 1999; Bontje 2004). Most state-owned enterprises did not survive the re-privatization process. This breakdown of old industries led to drastic job losses and a persistent outmigration towards economically more prosperous regions in Western Germany (Burda 1993; Berentsen and Cromley 2005). This development was accompanied by the sudden impact of the so-called "second demographic transition" that resulted in a sharp decline in fertility rates (Eberstadt 1994; Berentsen 1996).

Further, new investors preferred to establish new business parks in suburban areas rather than redevelop the poorly accessible and highly polluted industrial districts of the inner city (Burdack and Rudolph 2001). This development was accompanied by a huge wave of residential suburbanization, a rare phenomenon under socialist rule (Nuissl and Rink 2005). The neglection of old housing stock in inner-city residential areas during socialist times meant they rapidly became less attractive than suburban environments. This again resulted in population losses of core cities and a strong polarization of housing markets (Häussermann 1996).

Although population shrinkage has been the dominant trajectory in almost all Central and Eastern European cities since 1989 (Mykhnenko and Turok 2008), the above-mentioned transition process also created cities that were "winners" and "losers". Tsenkova (2009) mentioned a fragmentaion in the post-socialist urban hierarchy with the rise of new commercial and industrial centers located mainly in capital cities and cities functioning as important economic hubs. At the same time, many small and medium-sized cities are experiencing ongoing decline. Following Tsenkova, cities with a particularly strong industrial heritage will have to make a considerable effort to improve their economic competitiveness and urban quality.

However, these efforts have often been hampered in the past by urban governance issues. Franz (2000) identified a clash between urban regimes of conservation and globalization in East German cities that has strongly hindered development and resulted in a lack of cooperative solutions. From a more evolutionary perspective and based on a relatively broad sample of case

study cities, Liebmann and Kuder (2012) concluded that, in most cases, no dominant trajectories can be discerned in local modes of regeneration strategies. Instead, many new and old pathways of urban development are competing for limited local financial resources.

5.3 Theoretical Framework

5.3.1 SCPP and channels of urban economic change

For explaining our general theoretical framework, we have to clarify two central questions: (1) Which means or (in the language of central planning) "economic levers" did SCPP use to change the economic situation of certain cities? (2) How and how strongly do such historic decisions generally affect a city's long-term economic performance?

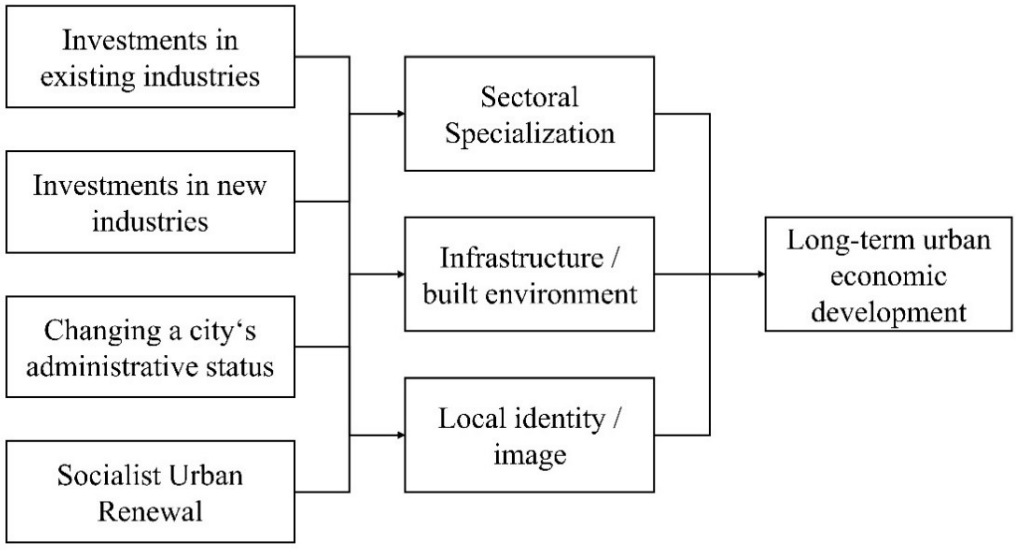
The core independent variables of our analysis are measures by SCPP that were implemented in order to voluntarily change the development path of certain cities. We do not look at the more general policies which affected all cities and regions within the GDR, like the nationalization of businesses, discrimination against entrepreneurship or the permanent presence of the intelligence service. Instead we examine very place-specific treatments following the strong "prioritization" (Sjöberg 1999) of certain industries and places by SCPP. Given the extensive labor demand by the socialist economy, these measures often resulted in strong growth in economic activity and population in the treated cities and therefore led to changes within the GDR's urban hierarchy. Bröcker and Richter (1999) identify four major trends directing those changes: (1) A prioritization of administrative capitals resulting in strong population growth; (2) a concentration of urban growth in core cities and the absence of urban sprawl; (3) the industrialization and urbanization of more rural places in northern East Germany; and (4) extreme growth in some cities as a consequence of mega investments in certain - mainly resource-based - industries. These SCPP measures have probably not only altered the overall economic geography of East Germany, but also strongly affected the local socio-economic systems[50] which determine the long-term growth paths of the cities in question. Building on Bröcker and Richter, we propose that four basic strategies of SCPP to change the development paths of East German cities can be identified: (1) large investments in existing industrial clusters, (2) the establishment of completely new industries in formerly rather undeveloped places and (3) changes in the administrative status of cities due to the complete restructuring of administrative territories resulting in new districts and district capitals. In addition, these measures were often accompanied by efforts of SCPP to transform the land use

[50] Following the theoretical framework of Storper (2010) these systems can best be described as an interplay between economic specialization, human capital, as well as formal and informal institutions.

and built up environment of cities according to the ideas of socialist urban planning. Those measures involved infrastructure investments as well as the restructuring of inner cities and the establishment of new residential areas. Although these measures were implemented in more or less all East German cities, they had a much larger scope in cities "prioritized" by SCPP[51]. Thus, we add a further category (4) socialist urban renewal to our list of SCPP measures.

By which channels could those four categories of SCPP have had an influence on the long-term economic performance of cities? According to the literature, there is a cornucopia of factors determining urban economic performance. The interplay of these factors is quite complex and researchers have in the past developed numerous approaches to subsume those determinants (see e.g. Storper 2010, 2013). For our purpose we use a rather pragmatic approach and stick to those categories, which could have been actually more or less directly affected by the actions of SCPP. Hence, we subsume three categories of determinants for long-term urban economic growth which may have been affected by one or more of the aforementioned SCPP measures: (1) Sectoral specialization; (2) infrastructure and the built environment; and (3) local image and identity.

FIGURE 5.1. SCPP MEASURES AND CHANNELS OF CHANGE WITHIN THE URBAN ECONOMIC SYSTEM.



Source: Author's illustration

[51] Strong interventions in the historically grown built-up structures were linked to the goal of creating socialist model cities.

Sectoral specialization has always been considered as one of the core components of urban economic growth (Kemeny and Storper 2014). Increasing the size of a local economic activity should yield positive agglomeration externalities as specified by models of the New Economic Geography (see e.g. Duranton and Puga 2004). Those externalities include the sharing of input suppliers, a regional labor pool matching the demand of local businesses, and technological or learning spillovers between firms. On the other hand, a high level of specialization can also be dangerous for a local economy, especially in times of global economic change. Under these conditions, a high level of specialization can result in strong regional lock-ins (Grabher 1993), a high dependence on one or few industries and consequently circular cumulative processes of deindustrialization and urban decline (Friedrichs 1993).

Similar to specialization, the relationship between infrastructural endowments and local economic growth is relatively well researched (see e.g. Démurger 2001; Cantos et al. 2005). Accessibility and the quality of the infrastructure are obvious locational factors for cities to attract businesses and citizens. In addition, the structure and visual appeal of the built-up environment might be an important factor in ensuring a high quality of life for the local population and attracting tourists.

Unlike the foregoing two channels affected by SCPP, local identity and image is more of a fuzzy category. Local identity can be linked to the well-known concept of social capital (Putnam 1993; Raagma 2002). Strong identification with a city's social and cultural structures might foster people's incentive to participate in local networks and development processes and a high level of civic engagement may in the long run result in positive economic outcomes. Local identity can on the other hand also be linked to the notion of 'entrepreneurial culture'. Empirical studies by Fritsch and Wyrwich (2014, 2016) have shown that the level of entrepreneurial activity across regions is remarkably persistent over time and that a rich entrepreneurial tradition of a certain city or region might be an important cause for long-term economic performance. Last but not least, local identity is also a major factor for the outside perception of a city. Therefore, it serves as an important asset for 'place branding' strategies (Clifton 2011; Cleave et al. 2016), which become more and more important in the inter-regional competition for citizens, investments and tourists.

It is perhaps needless to say that all of three abovementioned channels are strongly interrelated. Hence, each of the four defined SCPP measures does affect more than only one of those channels. E.g. the level of economic specialization is strongly related to local identity (Romanelli and Khessina 2005). Efforts to change this specialization by investing in certain industries will therefore also exert effects on local identity. Finally, the causal relationships

between SCPP measures, economic channels and long-term economic development are summarized in FIGURE 5.1.

5.3.2 Degrees of path dependence for urban economic development

According to the existing literature, a path dependence in the most general sense can be identified as an "increasingly constrained process that cannot easily be escaped" (Vergne and Durand 2010: 736). Many authors, particularly within the literature on organizational path dependence (see e.g. Sydow et al. 2009), argue against such a broad definition and propose a much more rigid definition. They regard path dependence as a "… process which obtains under two conditions (contingency and self-reinforcement) and causes lock-in in the absence of exogenous shock" (Vergne and Durand 2010: 737). With our subject, we prefer to stick to the broader definition in the simple sense of 'history matters', but distinguish between different degrees of historical pre-determination and non-reversibility, as illustrated in TABLE 5.1.

TABLE 5.1. IMPACT OF HISTORICAL DECISIONS ON LONG TERM URBAN ECONOMIC PERFORMANCE

Relevance	**Degree of non-reversibility**		
	Low (just heritage)	Intermediate (increasingly constrained)	Strong (lock-in)
Sector level			
City level			

Source: Authors's illustration

If a historical circumstance may play a relevant role in the city's present situation but there are no signs of an increasingly constrained process, we would classify such an impact on a city's development as a simple form of 'just heritage' without path dependence. Moreover, one could argue whether path dependence always has to result in a lock-in (as in the definition by Vergne and Durand) or whether a lock-in is just one possible outcome of path dependencies, describing a final stage or a situation where escape from a certain development trajectory is more or less impossible. The literature assumes that path dissolution can only occur if there is an exogeneous shock. Following this, different reactions are possible: (1) The local structures are successful in adapting to new growth paths, or (2) the local economy fails to create new opportunities for economic development (Martin 2010; Simmie 2012). Only the second option would qualify as a lock-in and therefore represents the strongest form of path dependence as defined within our framework.

The basic model of path dependence according to David (1985) describes path dependence as a process from path creation towards the final lock-in. Hence, what we have categorized as

'just heritage' may – under certain conditions – develop in the direction of a lock-in. But some categories of heritage from the past will probably just remain history and nothing more. In some cases, this simplest form of historical pre-determination may be more relevant for a certain city than a strong lock-in which only affects a small share of the local economy. We therefore also have to distinguish between historical legacies only affecting the sectoral level and those which are relevant for the local economy as a whole.

5.4 Empirical Methodology and Selection of Case Study Cities

As mentioned by Henning et al. (2013), the empirical literature on the impact of history and regional path dependence is very heterogenous and strongly varies between the different notions on the subject as well as quantitative and qualitative research designs. This paper forms part of the historical and qualitative strand of the literature and is based on four case studies on East German cities that were affected by the centralist economic policy of the GDR in different ways: Chemnitz, Rostock, Suhl and Weißwasser.

The selection of case cities followed our aforementioned theoretical considerations on possible SCPP measures to support local economic development. All case cities played a very significant role in the GDR economy and received some form of special treatment by the GDR regime. This resulted in significant growth of economic activity and population between 1946 and 1989. Our sample involves two larger cities with a population today of around 200,000 residents. We also included two smaller cities that experienced extreme population growth during the GDR (see FIGURE 5.2). A comprehensive overview of the initial conditions in our case study cities, the major SCPP measures, and the cities' development since 1990 are provided in TABLE 5.2.

Chemnitz is the largest city in the southern part of the state of Saxony (~300,000 inhabitants in 1990). Since the city has always been an important industrial location, it received particular attention by SCPP. During socialist times its name was changed to Karl-Marx-Stadt in order to create a type of model socialist city. Until 1989 the city and its surrounding region played an important role as the GDR's major industrial production site. After a relatively long period of deindustrialization and population shrinkage following the German reunification, Chemnitz can now be classified as a slowly growing city.

Rostock is the largest city in the northern state of Mecklenburg-Western Pomerania and had around 250,000 inhabitants in 1990. During socialist times it was the GDR's most important port city and an international sea port. Massive investments were made in its infrastructure and fixed assets in the ship building industry. Following a period of drastic shrinkage after the German reunification, the number of inhabitants in Rostock has seen a continuous rate of

increase in the last 15 years.

Suhl is a small city in southwestern Thuringia (~54,000 inhabitants in 1990). It has a tradition of arms production and is also known for its construction of bicycles, motorcars and light motorcycles. Despite its small size, Suhl was chosen to be the capital of a GDR administrative district. In addition, electric household appliance manufacturing moved to Suhl in the 1970s. After German reunification, the loss of the district seat as well as the collapse of the local industries were accompanied by a quick decline in population. Today the city can be characterized as stagnating.

Last but not least, Weißwasser is a small city (~35,000 inhabitants in 1990) in the northeastern part of Saxony near the Polish border. During the first half of the 20th century, the town had become an important location for the German glass industry due to natural resources in the surrounding areas. SCPP expanded the local glass industry, making Weißwasser one of the most important glass producing clusters in Europe. A second wave of industrialization resulted from the emergence of the lignite mining and energy industry nearby, leading to a massive influx of workers. After German reunification, the glass industry vanished almost totally, and the energy industry was massively downsized. Weißwasser became one of the most drastically shrinking cities in East Germany.

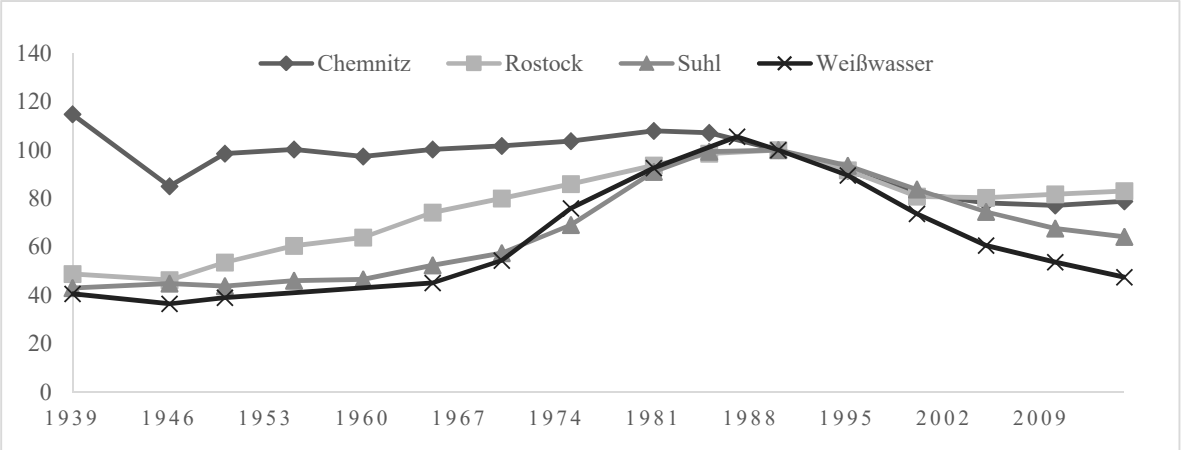
Since the availability of 'hard' data on local economic developments in East Germany is strongly limited for times of the GDR, but also for the early phase of the post-socialist transition, our empirical findings are mainly based on qualitative research methods. Between summer 2015 and winter 2017, a total of 33 semi-structured interviews were conducted with mayors, city councilors, representatives of local job agencies, business development agencies, business associations, heads of local museums and major local businesses as well as local scientists and journalists (see appendix). We took extensive notes during the interviews and subsequently wrote interview protocols. As far as possible, the selection of interviewees followed the principle of triangulation (Denzin 1970). Our goal was to compare different viewpoints (e.g. from different political stances, from former and present decisionmakers, etc.) on past and recent local developments to obtain a more comprehensive and valid picture on the observed phenomena. Furthermore, documents, such as town chronicles, newspaper articles, local urban development strategy papers and existing scientific studies on the cities in question, were used to complement and verify the data collected during the interviews. The collected material was finally systematically scanned and analyzed according to the theoretical framework in section 5.3.

TABLE 5.2. SYNOPSIS OF CASE STUDY CITIES, THEIR MAIN CHARACTERISTICS AND DEVELOPMENT PATHS

City	Initial characteristics (1946)	Measures of SCPP	Return to market economy (1990s)	Regeneration (~since 2000)
Chemnitz	• ~250.000 inhabitants • Strong industrial tradition: textile, engineering, automotive • Entrepreneurial culture • Strong war devastations (historical center as well as industrial sites)	• Investments in all three existing industries • Name changed into Karl-Marx-Stadt • City reconstruction according to socialist ideas • Assignment of district capital status	• Massive job losses in all major industries • Return to old name but loss of local identity as industrial city • Low attractivity for consumption activities • Loss of district capital status (some functions remained)	• successful re-privatisation of engineering firms • revival of entrepreneurship culture • partial revival of industrial tradition • still negative perception from outside
Rostock	• ~115.000 inhabitants • Long tradition in shipbuilding • Important location of the aerospace industry • Large manufacturing businesses • Regional port	• Establishment of an international sea port and massive investments in the maritime industries • Reconstruction of parts of the historic city (new buildings citing hanseatic style) • Assignment of district capital status	• Sea port lost its competitiveness • collapse of shipbuilding and fishing industry • Loss of district capital status (some functions remained)	• Harbour as base for new economic opportunities: ferry traffic, cruise line tourism, manufacturing of port equipment • New industries: wind power, medical equipment
Suhl	• ~25.000 inhabitants • Tradition in the arms and automotive industry • Relatively high share of manufactural workers in the population	• Investments in the two existing industries • Assignment of district capital status • Urban renewal according to socialist ideas • Construction of large "socialist style" amenities	• Breakdown of the automotive industry • Downsizing of the arms industry • Loss of district capital status	• De-industrialization • High maintenance costs for cultural amenities • Negative perception from outside • Unwillingness of neighboring cities to cooperate
Weißwasser	• ~13.000 inhabitants • Important location for glass production (natural resources) • Lignite deposits in the nearby area	• Investments in the glass industry • Massive investments in the lignite and energy industry in the surrounding region • Massive investments in new residential areas and public infrastructure	• Total collapse of the glass industry • Massive job losses in the lignite mining and energy industry	• strong de-industrialisation and ongoing population decline • High infrastructure maintenance costs • Very few private investments

Source: Author's own research.

FIGURE 5.2. INDEXED POPULATION DEVELOPMENT OF THE CASE STUDY CITIES BEFORE AND AFTER GERMAN REUNIFICATION 1939-2015



Notes: 1990=100%; population figures before 1990 refer to GDR municipal territories; population figures after 1990 refer to municipal territories of 2015. Authors calculations based on Federal Statistcal Office Germany (2017) and Ministerrat der Deutschen Demokratischen Republik (1983)

5.5 Empirical Results

5.5.1 Investments in Existing Industries

One crucial strategy of the GDR was to conglomerate and expand existing industrial clusters, which were prioritized within the scope of SCPP. All of our case study cities were the headquarters of important industrial conglomerates which formed out of the nationalization of existing firms. This includes the production of automotive parts, machine tools, household appliances and textile fabrics in Chemnitz, the shipping, shipbuilding and fishing industry in Rostock, the production of mopeds and guns in Suhl, and the glass industry in Weißwasser.

Chemnitz and Rostock are the most interesting examples for this strategy. Since large portions of the local production sites had been destroyed during WWII, and parts of the remaining machinery were dismantled and shipped to the Soviet Union as reparation payments, high investments were needed to restore Chemnitz' leading role in East German manufacturing. In contrast to other regions of the GDR, the nationalization of local firms was relatively superficial. Even though the many small and medium-sized companies were merged to form large industrial conglomerates, small-scale, historically grown structures remained intact below the surface (c.f. Interview I.b; I.c). Despite the strong regulation by SCPP and a lack of access to the world market and Western technology, some of the products and technologies from Chemnitz did achieve international success, particularly on the markets of Eastern Europe. Apart from Chemnitz's important role within the overall national economy, a strongly dominating industrial sector combined with the approach to build a model socialist city resulted in an ambiguous external perception of Chemnitz as a rather technocratic city with low cultural appeal even compared to other GDR cities.

Unlike in Chemnitz, where investment in existing industries resulted in only a modest population growth, the expansion of local maritime clusters in Rostock led to continuous growth up until 1989. Rostock's rise was strongly related to the strategic decision by the GDR government to create a state-owned commercial fleet of ships and to establish an international sea port in order to become independent from neighboring countries in international trade. This development could only be achieved through massive investment into new docks, port facilities and train connections as well as roads between the port and the hinterland. Moreover, the need for new ships resulted in massive investment in the shipbuilding industry in Rostock, while the aircraft industry, an important local sector up to the end of WWII, was completely shut down. In addition, SCPP aimed to support the fishing industry by expanding the East German fishing fleet.

The stock of labor and human capital was insufficient in Rostock to implement all these plans, and workers, particularly engineers were needed. Relevant qualifications could mainly be found in the southern parts of the GDR. Therefore, SCPP offered special incentives to migrate to Rostock: New and modern dwellings near the Baltic coast and far away from old industries and air pollution, as well as particularly high salaries. The newly established international harbor strongly affected the city's image. Rostock was regarded as the "GDR's Gate to the World". Migrants from other regions endorsed this image and soon developed a strong personal identification with the city and its harbor. SCPP supported this development further by introducing the annual "Baltic Sea Week", an international cultural event.

With the end of socialism came the end of competitiveness for almost all traditional industrial clusters in our case study cities. This led to plant closures and massive job losses. The reasons for this were manifold, including low productivity[52], a lack of Western technology standards in East German manufacturing[53], the breakdown of major sales markets in Eastern Europe, general structural change (changes in private demand, the shift of production to low wage countries), East Germany's entry to the German currency union[54] and, last but not least, individual mistakes during the process of re-privatization.

In Suhl, and particularly in Weißwasser, the crisis of the traditional local industries following 1990 led to a drastic cycle of de-industrialization and population shrinkage. Nowadays, the

[52] For example, most GDR conglomerates had an extremely high depth of production, compared to Western firms (c.f. Interview I.h; I.i).

[53] For example, the shipbuilding industry in Rostock remained at the technological level of the 1950s and modern equipment parts had to be imported from Western countries (cf. Interview II.d). Similarly, the machinery for producing textiles in Chemnitz was far behind Western standards of technology (c.f. Interview I.h).

[54] One strategy of SCPP was to sell products to Western countries below world market prices with the aim of maximizing foreign currencies. After the currency union, prices of East German products like guns, mopeds and glassware immediately became far too expensive for consumers (c.f. Interview III.a; III.c; IV.j).

economic relevance of the once dominant industries in both cities is more or less limited to the preservation of these traditions in local museums and a very few small and medium sized firms.

Although the two larger cities within our sample of case studies were also hit by the economic shock following German reunification, they showed some adaptive capabilities and, in the long run, managed to resurge after a decade of economic crisis.

In Chemnitz the partial collapse of three major industries - engineering, automotive and textiles - caused a severe "identity crisis" for the city and its inhabitants. Though the city changed its name back to Chemnitz after a local referendum, the end of socialism and the downturn of the local economy during the first half of the 1990s severely destroyed the faith of the city's citizens in its once so proud industrial tradition and entrepreneurial culture. For a relatively long period of time local economic development strategies almost neglected the manufacturing sector (c.f. Interview I.h). However, starting in the early 2000s, Chemnitz began a slow resurgence that followed old industrial pathways. The rather superficial conglomeration process during GDR times, which saw persistent small-scale firm structures under the surface of the large conglomerates, meant the re-privatization process was more successful here than in other East German regions (c.f. Interview I.b). Some of the former directors within the industrial conglomerates, or in some cases even the employees themselves,[55] took charge and, after a long period of economic struggle, were able to successfully reposition their businesses within the global market economy. This revival of entrepreneurial culture was accompanied by several outside investments which were partly promoted by managers with strong historical and/or personal ties to the city.[56] Today, the local economic structure is again dominated by small and medium sized firms, with the automotive industry and mechanical engineering being core sectors supplemented by related industries like microsystem technology, material and coating technology, metal processing and automatization engineering.

While the regeneration of local industries took a relatively long time, the regeneration of local identity took even longer. 20 years after German reunification, local decision makers were turning their faces back towards Chemnitz' rich industrial heritage in terms of place branding strategies. Finally, in 2009, the marketing label "modern city" was established, reflecting the slow rediscovery of the city's industrial tradition.

[55] An excellent example of this kind of reprivatization is UnionChemnitz, a machine tool manufacturer which, after its insolvency in 1996, was re-established as an "employee company" with high individual risks for all shareholders (c.f. Interview I.i).

[56] Perhaps the most prominent example of these kind of ties is the company Niles-Simmons, which was acquired by a German-American investor rooted in the region and is now the world's market leader in the manufacturing of machine tools for railway wheelsets (c.f. Interview I.a; I.b).

Unlike in Chemnitz, where economic resurgence can be linked to the adaptive resilience of small-scale structures in the local engineering cluster, the local economy of Rostock in around 1989 was dominated by a few large conglomerates in the shipping, shipbuilding and fishing industries. Although these industries quickly collapsed after German reunification[57] and the international seaport lost its competitiveness to the much larger and better accessible ports in Western Germany and the Netherlands, general structural changes after 1990 worked in Rostock's favor. European integration and globalization tendencies resulted in the emergence of ferry traffic as a rapidly growing sector all around the Baltic sea. Thanks to the docks built in GDR times and the city's favorable location, Rostock was able to attract a relevant share of this ferry traffic. A second category of positive structural changes was the evolution and strong growth of the cruise line business. The old ferry harbor was rebuilt into a terminal for cruise liners. As the East German fleet of commercial ships (DSR shipping company) was already active in the cruise line business before 1990, one part was privatized and turned into a special shipping company for cruise liners. This company later became the "AIDA shipping company" and its headquarters remained in Rostock. Today Rostock is one of Europe's most important ports for cruise ships. Finally, another structural change that favored Rostock was the increasing global demand for sea port equipment. Once one of the port basins of the (former) international harbor was refilled, it was possible to develop a site for manufacturing industries, particularly for building dockside cranes. The plans to restructure the harbor, and in particular to transform the harbor basin into a production site for dockside cranes, were quite controversial and faced strong resistance from local initiatives, reflecting a kind of mental lock-in created by SCPP; but the city was able to overcome this resistance and to reorient its economic development strategies.

Although the structural problems after 1990 led to massive unemployment and the migration of many people to West Germany, the general image of the city remained quite positive. To some extent, the effects of GDR propaganda persist today. Moreover, its tradition as a former "Hanseatic City" was very helpful in shaping the image of Rostock today.

5.5.2 Investments in New Industries

Apart from boosting the development of existing manufacturing clusters, SCPP also invested in the emergence of completely new regional production systems to satisfy the needs of the

[57] Although the federal and state governments initially tried to support shipbuilding through massive subsidies (c.f. Interview II.a).

socialist planning economy. Examples of these new clusters can be found in all of our case studies (e.g. automation technology in Chemnitz, electric household appliances in Suhl, etc.), but most of them did not take a leading role in the cities' long-term economic development trajectories. In Suhl, for example, the household appliances industry was completely unable to survive international competition within a market economy. An important long-term impact of these strategies, enduring the end of socialism, can on the other hand be discovered in Weißwasser.

The town's impressive population growth since the 1960s (see FIGURE 5.2) can be closely linked to the strategy of GDR regime to become self-sufficient in the field of energy supply and therefore exploit the lignite deposits in the region of Upper-Lusatia. Key to this was the establishment of a power plant in nearby Boxberg, which, at its peak in the 1980s, was the largest power plant in the GDR (Kabisch et al. 2004). Although the lignite mining and energy industry were not located within the city itself, Weißwasser received massive investments in new residential areas, cultural amenities and local infrastructure aimed at workers in the nearby industries. According to the number of workers living in the city, the lignite and energy industry became the most important sector by far for Weißwasser.

Unlike the development of the local glass industry, which almost completely vanished soon after German reunification, the slow structural decline of the lignite and energy industry has been an ongoing process (c.f. Interview IV.j). The power plant and regional mining areas were taken over by the Swedish corporation Vattenfall and later transferred to the Czech EPH group. Although the job cuts were (at least in relative terms) less drastic than in the glass industry, the lignite and energy industry shaped the economic landscape in and around Weißwasser in a much more influential way. Large areas occupied by the lignite mining industry have even reinforced the city's peripheral location. In particular, infrastructure development in the surrounding region is severely restricted due to the low load-bearing capacity of the ground (c.f. Interview IV.e). As a result of these restrictions, Weißwasser today is not only truncated from Germany's economic centers, but also from closer regional centers like Cottbus, Bautzen and Görlitz. Moreover, the lignite and energy industry has contributed to an unfavorable image of the region in terms of quality of life. This partially suppresses potential tourism which, according to the local development strategy, is seen as an important future development path (Planungsgruppe Petrick 2015). Finally, the rapid rise of Weißwasser during GDR times resulted in a rather difficult relationship with some of its neighboring municipalities whose representatives are unwilling to accept the city's central position within the region and therefore restrict opportunities of municipal mergers or intermunicipal cooperation (c.f. Interview IV.g).

5.5.4 Changing a City's Administrative Status

One goal of SCPP was to dismantle the historic administrative structures. After 1952, 14 new districts ("Bezirke") replaced the states and provinces that had emerged historically. This was in line with the rational economic ideas of central place theory. An additional goal of these territorial reforms was to reduce the importance of old capital cities like Dresden and territorial states like Saxony. According to Bröcker and Richter (1999), the assignment of district capital functions strongly impacted urban growth patterns in the GDR. From our sample of case studies, Chemnitz, Rostock and Suhl are examples of newly established district capitals. Suhl is a good illustration of a relatively small, peripheral town that strongly benefited from its new status as an administrative capital. The city was chosen over the traditional capital city of Meiningen due to its industrial tradition and its relatively high proportion of manufacturing workers among its population. The status of district seat was combined with a strong influx of workers, the construction of new dwellings, and the creation of expensive "GDR-style" cultural amenities like a congress hall and a concert hall with its own philharmonic orchestra.

After German reunification, the 14 GDR districts were replaced by six federal states that reflected the institutional set-up before 1952. Thus, eight cities, including all three district cities in our case study sample, lost their formal administrative status. The effect was rather inconsequential for Chemnitz and Rostock, which remained important regional centers. In contrast, Suhl was much more severely affected by its loss of administrative status. Because the rise of this small city during GDR times was very strongly linked to its assignment of district capital functions, the same can be said for its continuous downturn since 1989. Due to its relatively peripheral location within Germany and the end of the local moped production in 1996, Suhl was unable to compensate for the loss of centrality and public functions caused by the change in its administrative status.

The city's dependence on the public administration sector during GDR times has led to several forms of lock-in, which today still pose severe barriers to adapting to new paths of urban economic development. First of all, after 1989 local policymakers wanted Suhl to remain a central hub for the entire region, with a strong focus on the public and private service sector. This meant that they neglected to support new investments in the field of manufacturing (c.f. Interview III.a).

Secondly, the extensive GDR infrastructure, designed for a population of nearly 100,000 inhabitants, and the extraordinary social and cultural amenities still generate exorbitant maintenance costs for the small city (today ~35,000 inhabitants). This prevents it from making important investments in future urban development. Although some of the amenities, like the

philharmonic orchestra, have already been dismantled, any potential reductions in public infrastructure maintenance costs face strong opposition from the local population which, due to 40 years of district city status, has become accustomed to an outstanding level of cultural amenities compared to other regions in Thuringia. Even a great amount of public money had to be spent on modernizing the congress hall building during the GDR. Although the congress center may be much too expensive for a small city, it is presently being used for several live national TV shows per year. This can be interpreted as an attempt to re-use the heritage from socialism in a new way by promoting the name of the city nationwide and attracting tourists to Suhl.

The resistance to changes in the cultural amenities also illustrates the strong mental costs of this form of GDR heritage. While the inhabitants and local decisionmakers in Suhl retain their elitist ideals of being the capital city of Southern Thuringia, neighboring municipalities are unwilling to cooperate with the 'red Suhl' because it had been prioritized by the GDR regime. This impedes intermunicipal cooperation in the field of business development which is an important policy tool for tackling today's local challenges.

5.5.3 Socialist Urban Renewal

Instead of rebuilding the inner cities in a way that would retain their traditional character, the GDR's planning policies after WWII often aimed at building completely new inner cities that reflected the ideas of socialist urban planning. This included broad streets, large squares for mass events and large modernist buildings like event halls. This was mostly the case in cities that were largely destroyed during the war, but also occurred in cities that incurred little damage from the war. The socialist notion of inner-city renewal was often complemented by the emergence of new residential areas with huge pre-fabricated housing blocks.

While in Rostock and Weißwasser, those measures were mainly directed at developing completely new districts outside the historical core cities, Chemnitz and Suhl are two very good illustrations of 'socialist urban renewal'. Due to their largely industrial character both cities were chosen as a form of model socialist city, demonstrating the triumph of the industrial working class over old commercial and "bourgeois" structures. In Chemnitz, the process of socialist urban rebuilding was closely linked to the change in name to 'Karl-Marx-Stadt' in 1953 and to it being assigned the status of a district capital (see next section for this measure). While the first period of the reconstruction process during the late 1940s and early 1950s was aimed at maintaining pre-war structures and reconstructing historical buildings, from this period onward the city was rebuilt according to the ideas of socialist planning. This resulted in the demolition of some of the few remaining historical structures within the city center that had

survived allied bombing (Viertel and Weingart 2002). During the 1970s, the renewal of the inner city was abruptly halted and resources were funneled into the emerging new socialist-style residential area “Fritz Heckert”, one of the largest prefabricated building settlements in the GDR. The reconstruction of the inner city was never accomplished.

Like Chemnitz, the transformation of Suhl’s city center was closely linked to its assigned status of district capital; another factor was the rapid population growth since the 1960s. Although the inner city was not severely damaged during WWII, the historical structures (of a small country town with small, unpretentious buildings) were torn down and replaced by completely new socialist style buildings during the 1970s.

After the collapse of the GDR the strongly transformed inner cities severely impeded the successful regeneration of those cities. The results of socialist urban reconstruction made it difficult for the inner cities to attract tourism and other kinds of consumer activities and therefore hampered the emergence of new growth paths in retail and services. They also had negative long-term consequences for the internal and external perception of those cities and their attractiveness as a location for firms and private households. Chemnitz and Suhl continue to suffer from their image as ‘old’ and ‘grey’ industrial cities with a lack of urbanity and historical sites. In the words of one of our interviewees, “Chemnitz has been destroyed twice, first by allied bombing and then by reconstruction under the socialist regime.” (c.f. Interview Ia)

The opportunities of local policymakers and planners to tackle this kind of post-socialist legacy were limited. In most cases, the complete reconstruction of the old buildings and urban structures was too costly for the financially strapped small and medium-sized cities of Eastern Germany and there was often a lack of alternative concepts that met the diverging interests of the various stakeholders. For example, in Chemnitz during the 1990s and early 2000s, local planning policies mainly focused on the controversial dismantling of old Wilhelminian buildings as a reaction to urban population shrinkage and on channeling resources into the upvaluation of residential areas established during socialist times. Today these neighborhoods are perceived as socially deprived problem areas. The tendency to preserve socialist urban structures, which could also be observed in Suhl, may be seen as a form of cognitive lock-in (Grabher 1993) created by socialist urban planning. Both citizens and local policymakers were devoted to conserving the building heritage of the GDR. It ultimately took more than ten years before local policymakers in Chemnitz were able to implement new plans on revitalizing the central business district through a combination of pre-war, GDR and post-GDR architecture. Since 2009, Chemnitz has used the label “modern city” for marketing purposes, primarily

referring to its industrial history but also to its modernist cityscape which had been deeply shaped by SCPP. This marketing offensive was a way of creating a more positive image by utilizing the GDR heritage, which had contributed to a negative (self-) perception of the city for a very long time.

5.6 Discussion and Conclusion

How can our three questions listed in Section 1 be answered in light of the empirical evidence, presented so far? With regard to the first question, the results from our case studies show that each of the four categories of a city's special treatment by SCPP has a more or less relevant impact on the economic performance of our case study cities today. The 'least successful' strategy (in the long run) was the attempt to change a city's previous sectoral specialization and to launch completely new industries within a city. Most of the results of this strategy did not survive the socialist era. Moreover, as the case of Weißwasser illustrates, this strategy may have incurred high follow-up costs for the present economic performance of these cities.

Supporting the old local industrial specialization has led to different long-term outcomes, depending on the relevance of general structural change on the local industries in question. Our two smaller cities inherited industries which became far from competitive under the conditions of a market economy. As SCPP had not been able or willing to modernize them, according to changing global conditions, those structures have also almost totally vanished, apart from some small niche market players and the display of old industrial products and production facilities in industrial museums. With regard to the two larger cities, their traditional industries were less negative or even favorably affected by structural change than our two smaller case study cities. Especially in Chemnitz, the traditional pattern of specialization was quite in line with the general development of demand for industrial products. In addition, the phenomenon of a "quasi-conservation" of pre-socialist structures of businesses within the large combines and some local remainders of pre-socialist entrepreneurial culture have contributed to Chemnitz's slow economic revival over the last decade. This also means that historical structures, which evolved long before the socialist era, were, in this case, much more persistent than the structures created by SCPP. Unlike Chemnitz, more similar to Suhl and Weißwasser, the maritime industries in Rostock were heavily affected by structural change. But some specific elements of structural change (the rise of new sectors) have also worked – by chance – in the city's favor and enabled policymakers after 1990 to innovatively re-utilize the mega-investments in maritime infrastructure made by SCPP.

Interestingly, the 'softer' strategies of SCPP (and their mental consequences) may have a more relevant impact on today's local economic performance than the 'hard' measures in the

area of sectoral specialization. SCPP measures in the field of socialist urban renewal still exert negative effects on the present internal and external perception of cities, as a relevant soft locational factor. In the case of the changes in administrative status of cities, especially in Suhl, a large proportion of the local population is still not ready to mentally accept the new role. In addition, citizens from neighboring municipalities today still hold a grudge against the 'red city' of Suhl (which was privileged by SCPP). The relatively positive image of Rostock and the high rate in which its inhabitants identify with their city was also a soft locational factor resulting from the mega-investments in the maritime industries established by SCPP. Ironically, Rostock's positive image is probably more linked to the wish of many GDR citizens to live next to the GDR's "gate to the (capitalist) World", while SCPP's general aim was to provide economic autarchy and isolation from the capitalist West.

Our second question was focusing at the degree of path dependency created by SCPP. Many of the industrial policy measures during the time of socialism resulted in lock-in situations that were comparable to old industrial regions in Western countries (see e.g. Grabher 1993) and which led to cycles of strong de-industrialization. But since most of these industries have almost completely vanished today, the impact of those categories of SCPP treatments may now be qualified as "just heritage" with no signs of self-reinforcement. On the other hand, recent outcomes of socialist urban renewal strategies have components that are mental (people and policymakers are devoted to preserving the socialist building structures) and fiscal (sunk costs of existing structures, e.g. in Suhl). Especially the mental component may qualify as a cognitive lock-in, which might even survive the generation that actually lived under socialism. In addition, the impact of SCPP on the image of a city shares some characteristics of a lock-in, although there are – at least today – no strong mechanisms of self-reinforcement.

With regard to our third question, it should be noted that the legacy of SCPP may not always be seen as an impediment for the present development of our case study cities. The example of Rostock illustrates that in some particular cases a city may still benefit today from historical decisions made in times of SCPP (in this case: infrastructure for maritime industries, positive image of the city).

What knowledge from our investigations can be applied to local policy today, under the conditions of a market economy? If citizens and local policymakers within a city, as well as people from the neighboring local units, are devoted to maintaining a city's specific image or identity, there are few chances to voluntarily change the local path of development in the short run. One example where the SCPP measures resulted in less restrictive outcomes was the re-utilization of a harbor basin in Rostock. It shows that the willingness of local policymakers to

reinvent and give up established industrial structures is a necessary ingredient of adapting to new growth trajectories in the urban economy.

With regard to future research, a broadening of the empirical base of our findings, especially by looking at cities in other countries which have experienced SCPP, would allow us to come to some more general conclusions. Because East Germany is the only case of a post-socialist country, which became immediately integrated into an established western economic and political system, the results presented in this paper might not be directly translatable to other post-socialist contexts. A particularly interesting question in this regard is, how the trajectories established by SCPP fared under more ‘neoliberal‘ post-socialist regimes than the relatively decentralized and regulatory German welfare state.

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APPENDIX: INDEX OF INTERVIEWS

I. Chemnitz
   a. Dr. Barbara Ludwig, Mayor
   b. Sören Uhle, Chief Executive, Business Development Corporation Chemnitz
   c. Hans Joachim Wunderlich, Chief Executive, Regional Chamber of Industry and Commerce (IHK) Chemnitz
   d. Angelika Hugel, Chief Executive, Job Center Chemnitz
   e. Christoph Ulrich, Leading Editor of the Politics and Economics Department, Freie Presse Chemnitz (local newspaper)
   f. Dr. Christoph Scheurer, County Commissioner, Zwickau County
   g. Gabriele Hofmann-Hunger, Saxony Business Association, Chemnitz regional office
   h. Achim Dresel, Research Associate, Museum of Industry Chemnitz
   i. Thomas Hormes, Head of the Working Group on Regional Industrial History, Museum of Industry Chemnitz

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   b. Professor Dr. Martin Benkenstein, Chair of Service Sector Management, University of Rostock
   c. Dr. Wolfgang Kraatz, Deputy Chief Executive of Rostock County
   d. Christian Fink, Chief Executive, Economic Development Agency of Rostock County
   e. Manuela Balan and Rainer Horn, Regional Federation of Businesses
   f. Dieter Neßelmann, City Councillor for the Christian Democratic Union (CDU)
   g. Susanne Schimke, Rostock Business Club (regional marketing initiative)

III. Suhl
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   b. Peter Arfmann, Director of the Suhl Arms Museum
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IV. Weißwasser
   a. Thorsten Pötzsch, Mayor
   b. Thorsten Rennhak, City Administration, Department of Economic Development
   c. Holger Freymann, Head of the Office for County Development, Görlitz county
   d. Heike Zettwitz, County Councillor, Görlitz county
   e. Dr. Peter Heinrich and Dr. Robert Koch, Regional Planning Association Upper-Lusatia and Lower-Silesia
   f. Thomas Berndt, Regional Job Center, Bautzen
   g. Bernhard Waldau, City Councillor of the Christian Democratic Union (CDU)
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   i. Sven Mimus, Chief Executive, ENO, regional development company
   j. Horst Fasold, Glass Museum Weißwasser

Chapter 6

Synopsis and Final Conclusions

This dissertation examined the driving forces of urban growth and decline under the influence of strong institutional change. Using the case study of the East German urban system (1990–2015) as a 'natural laboratory', different overlapping forces of institutional change could be identified as follows: The transition from a socialist central planning economy to a market economy (including the economic as well as social consequences), the transformation of the political and administrative hierarchy of cities, and the process of Europeanization and European integration. These different forces were examined in four individual empirical chapters.

In Chapter 2, the general patterns and determinants of urban population growth and shrinkage in East Germany since 1990 have been analysed. Four types of population growth trajectories could be identified: continually shrinking cities, cities with strong shrinkage during the 1990s but some tendencies of stabilization within recent years, cities with population shrinkage during the 1990s but resurgence since the dawn of the 21st century, and finally a small group of cities which registered continuous population growth since the 1990s. It can be concluded that the dominant trajectory of drastic urban shrinkage has come to an end and that the largest East German cities and some cities in their surrounding area are entering a phase of urban resurgence. Furthermore, a cross-sectional regression for the period 2004–2014 reveals that urban population growth cannot be explained by urban size or density alone. Yet, it requires a diverse set of factors from different categories including agglomeration economies, demographic characteristics, labour market characteristics, amenities, and historical path dependence to account for the strong differences in urban population development. Most interestingly in light of the post-socialist transition process, recent population growth trajectories have been significantly negatively correlated to trajectories from the times of the GDR, revealing that socialist central planning policies were not successful in changing the long-term development paths of cities. This hypothesis is additionally supported by a significant — but relatively weak — correlation between recent population growth rates and the growth rates before World War II.

Complementary to this first comprehensive overview on the determinants of urban population growth and decline in East Germany, Chapters 3 and 4 aimed at finding causal inferences between urban growth trajectories and institutional changes that could not be directly addressed within the comprehensive cross-sectional framework of Chapter 2. Those chapters

draw on two different 'natural experiments' that occurred in East Germany during the observed period. Chapter 3 focused on the effects of several territorial reforms at a county administrative-tier and the subsequent relocation of county capital functions. Applying a DID-estimation with a treatment group of cities losing county capital status in comparison to a control group of cities, which remained the county capital throughout the entire observed period, a significant negative effect of the loss of administrative status on the annual population change rates could be found. This effect has, moreover, been increasing over time after the implementation of the actual administrative reforms, which hint at the persistent and highly relevant effects of administrative status and public sector activities on urban growth. The empirical results have implications for urban theorists and policymakers alike. They show that decisions made by policymakers at higher levels of government about the spatial distribution of administrative functions and public employment have relevant implications for local development. These findings contribute to a relatively small but growing body of literature, showing that political and economic geographies are related. Such effects should be considered in case of future efforts to change the spatial division of administrative functions.

Applying a very similar method to a different kind of natural experiment, Chapter 4 aimed to identify the spatial economic effects of the EU eastern enlargement in 2004. DID-estimations revealed that EU enlargement had a significantly positive effect on the population growth rates of a treatment group of towns located within 30 minutes of travel time toward Germany's Eastern border. However, this effect was rather modest in size and did not offset the generally weaker population development of 'treated' towns in comparison to the control group. Moreover, it was found that the treatment effect particularly benefitted towns near the German–Polish border (compared to the German–Czech border) and towns with high specialization in service industries. No significant effect could be estimated for Polish border towns. The estimation results contribute to an established strand of literature, examining how institutional impediments to the international flow of goods and people affect the internal economic geographies of countries. Those spatial effects of national borders and economic integration have very current policy relevance. In times of reinforced tendencies of isolationism in some EU countries, the local consequences of a potential dismemberment process – especially for border regions and towns – must be necessarily considered.

In contrast to the preceding studies which were searching for statistical evidence for the effects of the different categories of institutional change on the urban growth trajectories, Chapter 5 took a methodologically different approach. With the help of in-depth case studies and semi-structured interviews from four different East German cities (Chemnitz, Rostock,

Suhl and Weißwasser), the chapter aimed to identify path dependencies created by socialist central planning policies (SCCP) which have exerted an influence on urban economic development that is still relevant to date, more than 25 years after the return to a market economy. Basically, four categories of SCCP that had a long-term impact (at least partially) on urban development could be identified: (1) investments in existent industries, (2) investments in new industries, (3) changes in the administrative status of cities, and (4) changes in urban built-up structures. In most cases, these policies left very unfavourable conditions in the cities in question which resulted in cumulative processes of urban decline that were barely stoppable by local policymaking. In certain cases, the legacy from socialist times even resulted in lock-in developments which are still relevant today. However, the case study of Rostock particularly reveals that heritage from SCCP was not necessarily a negative asset for creating new opportunities for urban economic development. How and to what extent a city can benefit from its socialist heritage is strongly dependent on the specific local, industrial, and global institutional context.

What do the above summarized empirical results mean in light of the urban growth theories listed in Chapter 1? First of all, the negative correlation between city growth during the GDR times and the recent urban population development, which indicates that the SCCP were not sustainably successful in changing urban trajectories (Chapter 2), may be interpreted as evidence that 'locational fundamentals' or 'natural' assets play a fundamental role in explaining urban growth. Additional support for this hypothesis can be found in the estimated positive correlation between recent growth rates and population development prior to World War II. However, these correlations must not necessarily be interpreted as determined by 'natural' assets; they could also be attributed to historical path dependencies that were able to survive the strong distortions created by the SCCP. This would be an argument in favour of theoretical approaches emphasizing 'increasing returns' in urban and regional economic development. The 'increasing returns' school of thought also finds strong support in the empirical results presented in Chapters 3 and 4. Institutional shocks, such as the East German county reforms and the EU Eastern enlargement, were able to significantly change the spatial patterns of population development within the East German urban system.

Moreover, in Chapter 4 in particular, significant variations of the estimated effect of the EU enlargement, depending on the town characteristics, could be found. While an average effect on border towns was estimated, towns with an unfavourable economic structure could mostly not profit from the enlargement. This underpins the difficulty of deriving generalized rules with regard to the impact of institutional change on urban growth which can also be derived from

the empirical results presented in Chapter 5. How the drastic changes implemented by SCCP influenced urban economic development in the long run always depends on the specific local (as well as sectoral) context. If and how a city could benefit from the dynamics of changing national or supra-national institutions is, therefore, largely determined by a complex set of local and regional factors. This supports the view of those authors who take a more place-based and heterodox approach for explaining urban economic growth. A future comprehensive theory of urban growth would, therefore, require the serious effort of combining the existing approaches to further analyze the interplay of the different explanatory factors.

The latter finding is perhaps also the most relevant lesson for local and supra-regional policymaking. Especially, the results presented in Chapter 5 clearly show that 'one size fits all' solutions are doomed to fail. Efficient policy measures should always take into account the very specific local context. Moreover, the results presented in Chapters 3 and 4, in particular, reveal that policy measures and institutional changes at supra-regional tiers (such as administrative reforms or the opening of a border) could exert local effects at the local level. Policymakers at higher administrative tiers should acknowledge that certain measures might have negative effects for economically 'weaker' and/or peripheral cities, which eventually require special compensation schemes.

Of course, one has to acknowledge that the results presented in the empirical chapters of this dissertation stem from a very specific historical experience. Although some more general conclusions were drawn, many of the above presented findings cannot be easily translated into other national or historical contexts. Even within the rather narrow scope of post-socialist CEE East Germany represents a very special case. The transition process from a central planning to a market economy not only happened much faster than in all other former socialist countries of CEE but was also strongly regulated by well-established West German institutions, including a relatively decentralised political and administrative system, a hierarchical but flexible spatial planning system with strong emphasis on the regional level, and a relatively strong welfare state compared to other capitalist countries. This special institutional setup should have at least partially worked against the strong tendencies of polarization within the (East) German urban system. The resulting spatio-temporal patterns of urban growth and shrinkage could therefore strongly differ from those in other post-socialist countries, especially those, where the transition happened under more 'neoliberal' regimes. Hence, it should be of high added value to compare the different results presented throughout this dissertation to experiences in further post-socialist countries. Future research on this topic must necessarily take a cross national-perspective to come to a more comprehensive perspective on the spatial economic effects of

institutional change. Especially interesting in this regard might be the question whether administrative reforms that occurred in other post-socialist countries (e.g. Poland) had similar effects as the East German county reforms (Chapter 3).

Moreover, the empirical chapters of this dissertation had a relatively narrow focus on population growth to account for differences in urban economic growth. Though population change is a well-established proxy for regional welfare differences in the urban economics literature and has a high policy relevance, especially for East Germany, it certainly does not capture all dimensions of local economic development. A city with a stagnating or even shrinking population could attain significant gains in productivity and/or individual welfare. This holds particularly true in times of economic restructuring and overall demographic shrinkage. For future research, it should, therefore, be of high relevance to make use of a more diverse set of indicators to come to a more comprehensive view on urban economic development. Unfortunately, this goal is hard to come by for East Germany's cities due to strong limitations in the data availability, particularly for the early phase of the transition process. This also underlines the need for comparative research from further transition countries and similar 'natural experiments'.

Last but not least, the empirical exercises conducted within this dissertation take a strong focus on the effects of supra-regional institutional change on urban growth trajectories. Questions on the role of local institutions and how they filter the dynamics of global economic and institutional change remain (with the exception of Chapter 5) broadly unanswered. Since the availability of appropriate data on local institutional arrangements is still strongly limited, especially in a longitudinal perspective, the identification of the effects of local institutional change on urban growth and decline provides a great challenge for future research.

Eidesstattliche Erklärung

Hiermit erkläre ich an Eides statt, dass ich diese Arbeit selbstständig und ohne fremde Hilfe verfasst, keine anderen als die von mir angegebenen Quellen und Hilfsmittel benutzt und die den benutzten Werken wörtlich oder inhaltlich entnommenen Stellen als solche kenntlich gemacht habe.

Dortmund, September 2019

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