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**Article**

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## Two Shades of Urban Shrinkage: Innovation and Economic Structure in Cities with a Declining Population

### INTRODUCTION

More than 55 percent of the world population and 74 percent of the European population is living in urban areas (UN 2018). The ongoing trend towards worldwide urbanization has led to prosperity in many regions. According to the European Commission (2016), urban areas across Europe account for 85 percent of the European GDP. Cities are drivers for economic growth and innovation that control knowledge, capital, and communication on a global level (Sassen 2001; Gereffi 2005). However, socio-economic (employment, technological progress, poverty, social exclusion), demographic (population loss, aging) and physical (infrastructure, housing) factors as well as their interaction are determining the profile of European cities, allowing to describe urban differences in development as a ‘spatial manifestation of globalization’ (Martinez-Fernandez et al. 2012). In addition, the different historical and political background has led to different challenges that European cities face and to different (institutional, financial, economic, social) resources available to appropriately enhance urban growth and resilience.

First, cities that successfully underwent structural change and that manage to deal with technological transformation are experiencing not only the advantages of economic progress, but also negative effects related to congestion, pollution, segregation, etc. Second, there are difficulties with achieving convergence across European areas. Some cities do not manage to benefit from the better economic, social, or cultural structures or from the improved living conditions related to urbanization, and often experience a lack of economic growth, population loss, and poverty. This urban decline is mostly occurring due to economic transformation and structural crisis (Hollander et al. 2009). The relocation and polarization of economic activities caused by the globalization in the last decades have led in many urban areas to a failure to carry out the shift from traditional manufacturing to innovation-driven high-tech industries and modern business-oriented services (Bartholomae et al. 2017). The local firms’ weak absorption capacities of new ideas and technologies, as well as

their limited levels of entrepreneurship, have been reducing the flexibility and risk-taking necessary for enhancing innovation and local economic growth, and have therefore further slowed down the transformation process. Consequently, many cities are facing a reduced fiscal base and financial bottlenecks that slow down the investment in local infrastructure necessary for the improvement of the entrepreneurial ecosystem in urban areas. Thus, traditional socio-economic structure, slower industrial evolution, and production inefficiencies but also missing drivers for innovation such as the accessibility shortcomings of firms’ R&D cooperation with local research institutes, missing knowledge transfers, and personal exchange between firms, etc. determine the level of urban decline and shrinkage.

This paper primarily concentrates on identifying whether innovation activities and differences in economic structure have helped prevent or overcome the economic downturn in shrinking German cities by challenging the widely assumed parallelism between demographic and economic development. Based on the city typology by Bartholomae et al. (2017), who suggest that urban shrinkage is as a combination of both population and economic decline, while showing that some cities manage to enhance economic growth despite losing population, our estimation is carried out using a probit estimation model. This approach allows the factors related to innovation and economic structure that increase the probability of generating growth in cities with population loss to be predicted. The analysis is structured as follows: the next section provides information on urban shrinkage and urban policy in Germany. The third section shows the main findings of the estimation, followed by the fourth section which concludes and discusses the implications of activating and using the endogenous innovation potential in shrinking cities.

### SHRINKING CITIES AND URBAN POLICY IN GERMANY

According to Bartholomae et al. (2017), German cities can be categorized into four groups with respect to their economic and demographic development. Economic development is measured as the change in real gross value added (GVA) and demographic development as a change in population. Cities that experience both economic and demographic growth are classified as ‘growing cities’ while ‘shrinking cities’ face demographic and economic decline. The remaining two types of cities challenge the parallelism between economic and demographic development: ‘smartly growing cities’ manage to achieve economic growth despite their demographic decline. ‘Population magnets’, though, achieve an increase in population without generating more economic growth. As shown in Table 1 in the period 2000–2016,



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**Table 1**  
**Change in Population and Real GVA 2000–2016**

	Total number	Population change (%)	Real GVA change (%)
Growing cities	60	+ 8.7	+ 22.3
Smartly growing cities	36	– 3.8	+ 12.5
Population magnets	3	+ 3.4	– 8.8
Shrinking cities	9	– 8.6	– 3.9

Source: Own calculations based on data from the German Federal Statistical Office.

45 (i.e., 42 percent) of the considered 108 German cities experience population loss. However, only 9 cities (8 percent) face an economic downturn at the same time. In terms of both economic and demographic growth, ‘growing cities’ outperform any of the other types. Despite their constant increase in population, ‘population magnets’ face a higher economic downturn than ‘shrinking cities’.

Table 2 shows that the distribution of several city types is different throughout Germany. Most of the ‘growing cities’ are located in the south of Germany, while most of the shrinking cities are in the west of Germany, mainly in regions with a structural transition like the Ruhr area. Nevertheless, many struggling cities are also in eastern Germany. Looking at the distribution of cities within the regions, only 47.4 percent of eastern German cities and 42.5 percent of western German cities are growing, while the same figures are significantly higher in the south at 73.5 percent, and in the north at 60.0 percent.

The utilized data suggest that while the loss of population does not necessarily lead to urban decline, an increase in population might not be that reliable in predicting urban economic success either. Furthermore, it is important to acknowledge that the multitude of factors such as the post-socialist transformation, deindustrialization, aging, and low fertility rates that hit German cities require differentiated strategic approaches, thus raising the standards in urban policy and planning. In other words, passive shrinkage-oriented policies that aim at increasing or at least maintaining the population size by increasing the local attractiveness for residents more than for businesses (Wiechmann and Pallagst 2012; Lin 2014; Hospers 2014) is not preventing urban decline even if it succeeds in attracting population.

**Table 2**  
**Distribution across Germany by City Classifications**

	East	West	South	North
Growing cities	15.0%	28.3%	41.7%	15.0%
Smartly growing cities	22.2%	44.4%	19.4%	13.9%
Population magnets	0%	66.7%	33.3%	0%
Shrinking cities	22.2%	55.6%	11.1%	11.1%

Note on the definition of regions: East: Berlin, Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony-Anhalt, Thuringia; West: Hesse, North Rhine-Westphalia, Rhineland-Palatinate, Saarland; South: Baden-Württemberg, Bavaria; North: Bremen, Hamburg, Lower Saxony, Schleswig-Holstein.

Source: Own calculations based on data from the German Federal Statistical Office.

As shown in Table 3, federal funding of urban development programs in Germany has been addressing mostly urban regeneration and revitalization programs aimed at preserving historic city centers and improving living conditions in urban areas. As the federal share of

funds is only one-third of total funding, the extent of the shrinkage-oriented urban policies becomes clearer. Only two programs explicitly aim at improving the economic environment in urban areas. If the full amount of these programs is set in relation to the total funding, only 24 percent of funding has been directed towards enhancing the local innovation potential or improving location factors for businesses. In addition, the disproportionate funding of urban programs in eastern German cities is noticeable: almost 48 percent of the total funding is allocated to this region, while in average only about 20 percent of the German population lives in this region. In contrast, the cities in the western part of Germany with a large number of cities and a high proportion of the total German population (about 35 percent) received less than 24 percent of total funds, allowing for further shrinkage (55 percent of cities there are shrinking demographically and economically). It also becomes clear that the funding has not been designed to consider the different factors contributing to urban shrinkage in German cities. The general character of the policy programs can therefore not address the specific needs of urban change in German cities.

However, the relevance of an active, growth-oriented policy in Europe was pointed out stronger in the 2007–2013 funding program by the allocation of funds directed towards urban development programs, allowing for a better achievement of cohesion goals in urban areas. The Urban Agenda was launched in 2016 with the Pact of Amsterdam in order to raise awareness and improve understanding of the opportunities and challenges in European cities given the current structural, demographic, social, and climatic changes that urban areas in Europe are experiencing. The urban policy has become central to the EU regional policy in order to support the potential

for growth, innovation, and creativity related with urban areas, but at the same time to help prevent poverty and segregation that might occur as an accompanying symptom to structural change in cities. Those programs acknowledge that enhancing prosperity in urban areas requires economic dynamism based on

Table 3

**Federal Subsidies for Urban Development of Cities in Germany**

Program	Start	Goal and major orientation	Total federal spending until 2018 (millions of €)			
			East	West	South	North
Social City ( <i>Soziale Stadt</i> )	1999	Urban revitalization investments to improve living conditions Orientation: demographic	407	636	449	266
Urban Reconstruction ( <i>Stadtumbau</i> )	2002/ 2004	Overcoming demographic and economic structural changes and the associated urban development impacts Orientation: demographic and economic	1,990	557	385	217
Urban Heritage Preservation ( <i>Städtebaulicher Denkmalschutz</i> )	1991	Preservation of historic city centers Orientation: demographic	2,471	148	152	69
Active Inner-city Development ( <i>Aktive Stadt- und Ortsteilzentren</i> )	2008	Construction measures to strengthen the diversity of use with measures for participation and involvement Orientation: demographic and slightly economic	228	337	309	139
Smaller Towns and Municipalities – Supra-local Cooperation and Networks ( <i>Kleinere Städte und Gemeinden - überörtliche Zusammenarbeit und Netzwerke</i> )	2010	Providing services for the public in sparsely populated areas Orientation: demographic	109	146	117	63
Future Urban Greenery ( <i>Zukunft Stadtgrün</i> )	2017	Improvement of urban green infrastructure Orientation: demographic	17	26	23	16
Urban Regeneration and Development Measures ( <i>Sanierungs- und Entwicklungsmaßnahmen</i> )	1971- 2012	Adaptation of existing structures in need of renewal from different epochs and typologies to changing needs Orientation: demographic	2,995	2,252	1,645	1,103

Note on the definition of regions: East: Berlin, Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony Anhalt, Thuringia; West: Hesse, North Rhine-Westphalia, Rhineland-Palatinate, Saarland; South: Baden-Württemberg, Bavaria; North: Bremen, Hamburg, Lower Saxony, Schleswig-Holstein.

Source: Own calculations based on data and description of urban development funding by the federal government and the Länder provided by the Federal Ministry of the Interior, Building and Community, <https://www.staedtebauforderung.info>.

sectoral heterogeneity, involvement in global production processes, appropriate entrepreneurial infrastructure, R&D investment, human and social capital while also recognizing the threats of technological transformation for urban resilience. Economic growth, resource efficiency, social inclusion, and ecological sustainability have to be achieved in order to improve urban resilience and support urban development allowing for conditions worth living within and across German cities.

### **INNOVATION AND ENTREPRENEURSHIP IN SHRINKING CITIES**

The aim of our analysis is to check whether cities engaging in more innovation and entrepreneurial activities are more likely to be ‘smartly growing cities’ than ‘shrinking cities’ and to explain their economic growth in spite of the loss of residents. As we want to highlight the special characteristics of smartly growing cities with respect to their innovativeness, we have to divide our sample of German cities into ‘smartly growing cities’ and ‘shrinking cities’. We consider 45 cities between 2000–2016. Since the model outcome is binary (1 for ‘smartly growing cities’ and 0 for ‘shrinking cities’), we chose a probit

estimation that models the inverse standard normal distribution as a linear combination of predictors by using panel data. We estimate the probability that the dependent binary variable is a function of the economic indicators of interest.

We consider the number of patents that have been filed as an indicator for innovation outcome. Furthermore, we also included high-technology patents, which indicate innovation outcomes in this particularly growth-oriented sector. In order to control for the economic structure of the urban economies, we included the manufacturing sector’s share in GVA as well as the share of the business service sector (especially knowledge-intensive business services) in GVA. Business services and their link to the manufacturing sector is a good indicator of regional innovation networks that increase the competitiveness in both sectors and contribute to the urban economic growth. In order to measure business dynamics and the entrepreneurial ecosystem, we included the amount of business registration per 1,000 inhabitants as well as the amount of insolvent businesses per 1,000 inhabitants. While the number of business registrations indicates the entrepreneurial spirit and the willingness of risk-taking in the cities, the number of insolvencies indicates whether

Table 4

**Descriptive Statistics of Shrinking Cities and Smartly Growing Cities**

	Smartly growing cities		Shrinking cities	
	Mean	Std. dev.	Mean	Std. dev.
Manufacturing (% of GVA)	20.7	12.8	21.0	10.8
Business services (% of GVA)	24.2	5.5	21.7	3.3
Registered .de domains	26,262	31,456	13,579	10,543
Patents (all)	33.136	36.860	18.310	22.644
High-tech patents	4.270	5.170	1.969	1.730
Business dynamics	9.190	1.753	8.735	1.299
Insolvency dynamics	0.406	0.165	0.433	0.176

Source: Own calculations based on data from the German Federal Statistical Office.

the urban business environment is beneficial to the growth and success of businesses. Furthermore, innovation is often disruptive and therefore a threat to old firms (see Schumpeter (1942)'s creative destruction), but contributes to an increase in (overall) production, yielding also high numbers in business registrations as well as insolvencies. Finally, we also included the number of registered .de domains to capture an indicator of the digitalized economy.

Table 4 compares the means and the standard deviations of the relevant variables. Applying the t-test shows that business services, registered .de domains, patents, and high-tech patents differ significantly between 'smartly growing cities' and 'shrinking cities', while the difference in business dynamics is only significant at the 10 percent level. Thus, innovation dynamic in 'smartly growing cities' measured in patents and high-tech patents seems to be larger compared to 'shrinking cities'. In addition, the higher importance of the business services sector, which in general enhances more innovation, indicates a positive correlation between innovation and, in our definition, 'smart growth'.

Table 5 reports the estimates of the probit regression. The results suggest that higher innovative

Table 5

**Results of Probit Estimation**

Parameter	Coefficient
Constant	- 5.058*** (1.661)
Manufacturing (% of GVA)	5.304*** (1.738)
Business services (% of GVA)	24.542*** (5.210)
Registered .de domains	2.971E-5** (1.298E-5)
Patents (all)	-0.008 (0.009)
High-tech patents	0.034 (0.063)
Business dynamics	0.146 (0.097)
Insolvency dynamics	- 5.202*** (1.015)
Log-likelihood	- 70.599
N	214

Significance levels: \*\*\* p<0.01; \*\* p<0.05; \* p<0.1

Source: Own calculations based on data from the German Federal Statistical Office.

and entrepreneurial activities increase the likelihood of being a 'smartly growing city'. The estimation shows that cities with a higher share of GVA in the manufacturing sector and a higher share of business services in total GVA are more likely to improve economically despite their population loss. (Knowledge-intensive) business services are

often an indicator for innovation and technological change because they serve as human-capital-intensive intermediary input for other sectors and are a key element in regional innovation networks that enhance firms' accessibility to R&D cooperation and product development. This kind of urban innovation system contains vertical and horizontal relations among firms, research institutions, regional development agencies, and financial institutions (lending bodies).

Since business success is strongly dependent on the cultural and business environment in which it occurs, spatial proximity to a developed business services sector is rather indispensable for a functioning manufacturing sector. While the business dynamics as the number of business registrations per 1,000 inhabitants does not significantly increase the probability of being a 'smartly growing city', the number of insolvencies per 1,000 inhabitants significantly reduces the probability of urban economic growth. This indicates that although there is entrepreneurial activity in 'shrinking cities', the entrepreneurial ecosystem is not developed enough to allow the complementary use of assets from an existing network of third parties (suppliers, competitors, consumers, etc.) and to ensure the survival of companies. In addition, there is a self-reinforcing process: more insolvencies lead to less growth, resulting in poorer economic conditions and more companies having to file for bankruptcy. Exogenous factors, such as an active growth-oriented urban policy, might help overcome this vicious circle.

While the number of total patents decreases the probability of being a 'smartly growing city', a higher number of patents in the high-tech sector leads to a higher probability of overcoming the economic downturn. This points to a higher commercialization potential of high-tech patents and emphasizes yet again the importance of modern industries for urban economic regeneration and growth. However, the estimation results related to patents are not statistically significant.

A significantly higher probability of being a 'smartly growing city' is also induced by a higher number of registered .de domains. Unfortunately, there is no direct distinction as to how the registered domains are divided into private use (e.g.,

family homepages or blogs), business use (e.g., company websites or online sales channels) or use by organizations (e.g., city governments, NGOs, associations). Nevertheless, web-presences indicate a trend towards a more open, dynamic and creative environment that is more likely to initiate innovation and change (Florida 2005). A high number of business domains suggests, on the one hand, a high business activity and, on the other hand, the intention to explore innovative and new business channels as well as models. Domains used by the public refer to innovative administrations that want to offer their services in a more targeted way, thereby shortening administrative paths and creating more room for innovation.

## CONCLUSION

Many German cities are facing population loss caused by structural change, post-socialist transformation processes, low fertility rates, and aging. In this article, the focus was particularly on the comparison of cities facing the loss of population. Despite the often-assumed parallelism of development, many cities experience economic growth in spite of their demographic problems. This analysis has shown that both city types – ‘smartly growing cities’ and ‘shrinking cities’ – differ in terms of economic structure, entrepreneurship, and innovation. If a city has more innovation and entrepreneurship, it can overcome the downward spiral of demographic and economic decline by enhancing endogenous growth. However, federal funding for urban policy mainly focuses on regenerating city centers and residential areas, aiming to attract more residents with improved living conditions. These cities, relying mostly on shrinkage-oriented urban policies, will further encounter difficulties. It is therefore important to identify growth-oriented strategies to increase diversity among sectors by promoting entrepreneurship and attracting new innovative businesses that facilitate knowledge spill-overs within the urban areas as well as employment opportunities. Urban policies should enable competitive entries and entrepreneurial knowledge by reacting to the market development, business needs, and emerging opportunities. Furthermore, rather than the current generic formulation, urban strategies should set priorities with regard to the promotion fields, technologies, and activities in order to help reduce the reluctance of existing businesses to change.

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