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GROWTH FACTORS OF MAJOR CITIES IN THE DACH REGION



RESEARCH REPORT Q1 2022

Growth Factors of Major Cities

A cluster study of key socioeconomic criteria as drivers of real estate market development

Real estate markets do not develop by chance. In addition to fundamental geographical, economic, and political factors, especially **socioeconomic developments** should also be considered major drivers of individual real estate markets. These include parameters such as **population trends, age structure, education, and jobs**, as well as **private income and public finances.** In order to understand a city's growth and real estate market potential, to assess market opportunities and risks, and to forecast development, the key factors upstream from real estate market development deserve a closer look.

This study compares major cities in the DACH region -D (Germany), A (Austria), and CH (Switzerland) - based on their key socioeconomic factors and identifies various clusters of locations with similar characteristics. In some cases, the study revealed interesting alternatives to current target markets that feature similar socioeconomic parameters but receive less attention from investors and therefore offer untapped opportunities. For instance, Bonn and Mainz are two smaller cities that belong to the same socioeconomic cluster as the seven German Class-A cities and Vienna, Austria.

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1. Population forecasts as a key indicator for real estate investments

Population figures are a key driver for every real estate market, both in terms of their levels as well as the pace of growth. A growing population within a city equates to more potential customers for retailers and therefore. generally speaking, more revenue. This ultimately **boosts demand for** leased space and increases the rental income generated. Of course, a similar closely related chain of cause and effect exists for residential space. More offices, manufacturing facilities, logistics properties, and cultural institutions will also be necessary. Correlations of this type are the subject of many research projects mostly based on the analysis of historical time series.

The regional and local population forecasts for the coming years or decades are therefore what is interesting for real estate investors. These projections are prepared by specialized institutes or statistical offices and, at least at country level, are usually available for a long-term horizon of 50 or more years. Since population trends are subject to numerous, as-yet-unknown influences, such models work with scenarios. The forecasts for the DACH region countries provide the foundation for the subsequent differentiated analyses of various major cities and the factors influencing them.

Population trend forecasts at country level (DACH region)

The population **trend forecasts** for Germany, Austria, and Switzerland - the DACH region - each provide projections **up to the end of the century.** A comparative analysis is interesting, because the countries display many similarities on the one hand, while the forecast values, including in percentage terms, also diverge. Figure 1 illustrates the population forecasts for the three countries indexed for a period up to 2100. In addition to the base scenario, there is also an optimistic and a pessimistic scenario.

It is notable that the forecasts for **Germany** are the lowest, both in the comparison of base scenarios and in the best-case and worst-case scenarios. The **median base scenario** assumes stagnation of population numbers up to 2100 (final year at 100.2 percent of today's figure). The **optimistic forecast** assumes growth of around 16.2 percent, which corresponds to some 96.6 million inhabitants, whereas the **pessimistic scenario** posits a decline of approximately 34.2 percent to 54.6 million inhabitants.

For **Switzerland**, the growth forecasts are much higher in all scenarios. The base scenario projects **growth of 41 percent**, and the optimistic case even anticipates 70.2 percent growth. In absolute numbers of inhabitants, this equals 12.0 million to 14.5 million people. Even in the pessimistic scenario projecting a decline, the population is only expected to shrink by ten percent.

The forecasts for **Austria** fall between those for Germany and Switzerland and project a decline of **31.7 percent** in the pessimistic case as well as growth rates of 4.3 percent in the base scenario and 22.0 percent in the optimistic scenario. This corresponds to 6.1 million, 9.2 million, and 10.8 million inhabitants, respectively.

The large delta between the forecasts is attributable to a high degree of uncertainty. The individual **forecasts** make various assumptions about **lifespans**, **mortality**, **fertility**, and



Figure 1: Population forecasts for the countries of the DACH region; source: Eurostat; own calculation and presentation.

migration which, when projected over a horizon of 80 years, will always produce increasingly divergent results. Depending on how life expectancy, births, deaths, and immigration/ emigration develop in the future, the possible range of population numbers is broad.

The reasons for the different development trajectories of the three neighboring countries are many and varied. Switzerland is appealing to international professionals thanks to its high salaries and low tax rates, which is why the **population** there is **forecast** to continue to grow. In contrast, some structurally weak regions in Germany and Austria show a tendency toward outward migration and an aging population. The natural population trend is relatively comparable, however. All three countries display similar demographic changes, with births well under the 2.1 mark required for natural population replacement (Germany: 1.54; Switzerland: 1.48; Austria: 1.46). Subject to additional

effects from migration, this explains the pessimistic scenario in particular, in view of the strong influence of an aging and shrinking population.

In general, the forecast figures in all of the countries are spread across a wide range. This is true as early as the medium term, which is critical for real estate investment decisions. Providing a detailed explanation of the extent to which certain verifiable or preferred assumptions on natural population trends or migration lead to the respective optimistic or pessimistic scenarios is not the subject of this report. Instead, we concentrate on making selections that, in relative terms, focus on more or less promising target markets. Based on the general trend, the following is a granular look at major cities in the DACH region for which forecasts and explanatory data are also available. An important question is whether these are relatively similar or lead to very divergent individual results or clusters.

Population trend forecasts at city level (DACH region)

Population trends are not evenly distributed in the three DACH countries. Among the cities with more than 200,000 inhabitants considered here, a significant disparity was found in the 46 cities in the DACH region (selection of cities: in Germany, over 200,000 inhabitants; in Austria and Switzerland, the three largest cities, respectively). In Germany especially, growth rates had already diverged in the past. Many urban centers exhibited sustained positive growth rates, whereas rural and economically weak regions are experiencing population shrinkage - for instance, in the former East German states, Saarland, and the Ruhr region.

Based on the forecast data (collected uniformly up to 2035 for this purpose),

cities in the Ruhr region in particular will continue to shrink. The forecasts up to 2035 indicate negative growth rates for cities such as Duisburg, Oberhausen, and Bochum. Germany's top seven cities, which are popular among workers and immigrants, will continue to grow, and chief among these will be Frankfurt am Cologne, Düsseldorf, Main, and Munich. Positive growth rates are also expected for the Leipzig and Dresden metropolitan areas in Saxony. Economic catch-up processes and specific structures continue to play a role here, as in recent years. Many other German cities will stagnate in terms of population up to 2035, or experience slight growth.

Expanding our view to the entire DACH region, **Basel, Zurich,** and **Geneva** come out far ahead with projected **growth rates at over 15**



percent; they are among the cities with the highest growth among those studied here. In some cases, the fastexpanding cities are smaller than the densely populated German top seven (as shown by the size of the dots in Figure 2). The already populous cities will also continue to grow according to the forecasts. Population declines are therefore limited mainly to some cities in North Rhine-Westphalia (Ruhr region), as well as more rural areas, smaller cities and towns.

A ranking derived from this data puts Basel, Zurich, and Geneva on the winners' podium, each with doubledigit growth rates up to 2035. They are followed by Linz and Graz in Austria, also with growth in the double digits. Frankfurt am Main, Vienna and Cologne will also continue to grow robustly over the forecast period. In this respect, all three countries in the DACH region are home to fast-growing cities which will give rise to increasing demand for space, which is promising for real estate markets. In Germany, this potential is not limited to one region of the country. Positive growth continues to be anticipated in Munich in Germany's southern region, while good results are expected in the north for Hanover, for instance. In the west, growth is projected in **Düsseldorf** and Cologne, and Dresden in the east holds promise along with Leipzig.

Among the cities considered, those at the top of the ranking for relative growth are in Austria and Switzerland. This corresponds to the increasing urbanization expected in these two countries according to the forecast. For instance, Vienna is currently the only city in Austria with over 300,000 inhabitants. As outlined in a UN study on urbanization, just under 60 percent of the population of Austria currently lives in urban areas and this number is expected to grow to around 70 percent by 2050. Even then, the degree of urbanization will still be lower than the western European average of approximately 85 percent. At the lower end of the list are Bielefeld, Bremen, and Halle (Saale) in addition to many cities in Germany's Ruhr region.

In Switzerland, the number of urban agglomerations has doubled in 20 years. Core cities and their surrounding areas have not just increased in population, they have also expanded geographically. They have come to occupy a more than 11,000 square kilometers, or nearly double as much space, and many agglomerations have grown together. The corresponding analyses concentrate on the streams of commuters traveling between the city centers. The largest agglomeration in Switzerland is Zurich, whose radius extends 35 kilometers from the center into the surrounding areas and which has nearly 1.4 million inhabitants. It is followed by the **agglomerations** of Geneva and Basel, which are each home to around half a million people. According to figures from the Swiss Federal Statistical Office, **nearly half** of all agglomerations there comprise areas with fewer than 50,000 inhabitants. Further growth, especially in these existing centers, is expected due to the appeal of larger cities.

An overview of high-growth and lowgrowth cities from the cities selected for this study is provided in the following Figure 3.

Necessary examination of growth drivers and qualitative characteristics

The growth forecasts fall within a broad range. Additional information and explanations are required to interpret and use this data appropriately. Often, specific individual factors are more usaful for making real estate decisions than heavily aggregated growth forecasts based on numerous other parameters. Conclusions regarding

| Rank | City | Population in 2020 | Pop. forecast 2035 | Forecast growth rate |
|------|-------------------|--------------------|--------------------|----------------------|
| 1 | Basel | 173,863 | 212,480 | +22.2 % |
| 2 | Zurich | 421,878 | 505,700 | +19.9 % |
| 3 | Geneve* | 203,856 | 234,587 | +15.1 % |
| 4 | Graz | 291,130 | 334,945 | +15.0 % |
| 5 | Linz* | 206,552 | 237,044 | +14.8 % |
| 6 | Leipzig | 597,493 | 678,362 | +13.5 % |
| 7 | Frankfurt am Main | 764,104 | 849,638 | +11.2 % |
| 8 | Vienna | 1,911,191 | 2,090,602 | +9.4 % |
| 9 | Cologne | 1,083,498 | 1,179,414 | +8.9 % |
| 10 | Hanover | 534,049 | 580,938 | +8.8 % |
| | | | | |
| 37 | Bielefeld | 333,509 | 330,398 | -0.9 % |
| 38 | Wuppertal | 355,004 | 351,271 | -1.1 % |
| 39 | Mönchengladbach | 259,665 | 256,310 | -1.3 % |
| 40 | Bremen | 566,573 | 555,323 | -2.0 % |
| 41 | Krefeld | 226,844 | 219,456 | -3.3 % |
| 42 | Halle (Saale) | 237,865 | 229,911 | -3.3 % |
| 43 | Gelsenkirchen | 259,105 | 248,901 | -3.9 % |
| 44 | Bochum | 364,454 | 349,475 | -4.1 % |
| 45 | Oberhausen | 209,566 | 198,541 | -5.3 % |
| 46 | Duisburg | 495,885 | 468,993 | -5.4 % |

Figure 3: Highest-growth and lowest-growth cities in terms of population up to 2035, *except Linz (2040) and

Geneva (cantonal data); D (Germany), A (Austria), and CH (Switzerland); source: Federal and State Statistical Offices; own calculation and presentation.

real estate market decisions, such as the potential for investments in existing buildings or construction projects, require this further background information in addition to a general population forecast.

The various **determinants of population growth** are discussed below. The distinction between natural and migration-related population trends (presented in chapter 2) is quite obvious in this context. In regional terms, they make up very different shares of population growth overall.

The reasons for these partial effects

are also diverse. **Migration** waves in particular are often triggered by **booming or shrinking labor markets and corresponding increases or decreases in income potential.** The chapters below will therefore discuss structural differences in various factors such as education level, economic structure, degree of prosperity, and public-sector budgets.

Ranges and clusters are subsequently defined for each group of parameters, which enable the cities to be labeled potentially growing, stagnating, or shrinking centers of population. This research report therefore differentiates between the cities of the DACH region not only using pre-existing population forecasts, but supports decision making in real estate investment by providing additional information about key determinants that trigger or bolster population trends.

2. Natural and migration-related population trends

In forecasting population figures, the essential step is to determine natural and migration-related effects in partial forecasts and then to derive the projected population from these. This chapter investigates the connection between demographic indicators and population forecasts.

Average age of population (age pyramid)

A possible approach to explaining population growth lies in the age structure of the inhabitants. This argument appears plausible for several reasons. For one, a low average age indicates a larger share of children and youth as well as a smaller proportion of seniors in retirement. This has two primary effects on the population trend: On the one hand, mortality rates are lower, and on the other hand, fertility and therefore the potential for starting families is much higher. Furthermore, a younger average age may also be an indicator of the general attractiveness of a city. This would be evident in net migration. For example, a city that has education and employment opportunities that are desirable to younger people will attract immigration which in turn would lower the average age of the population.

Figure 4 illustrates the relationship between the average age and the growth forecast. The values are distributed widely across the city data set, and the diagram shows a negative correlation between the two variables. Particularly **"young"** cities such as Graz, Vienna, Frankfurt am Main, Munich, or Leipzig, with an average age under 43, will likely see **robust growth**, while "older" cities such as Oberhausen or Bochum with an average age over 45 are expected to see their populations shrink.

This correlation is in no way perfect. There are also several examples of "younger" cities with low growth forecasts (e.g., Freiburg im Breisgau, Bielefeld). On the other hand, some cities considered "older" based on the average age of their population are also projected to grow robustly (e.g., Cologne, Düsseldorf). Nonetheless, a negative correlation between average age and growth should generally be assumed.

Births vs. deaths (natural population trend)

A higher average age in a city typically leads to a decline in positive net births. Conversely, cities with a positive net birth number tend to be "younger" than cities with negative net births. Because younger people are more likely to start a family, the average age of the population trends further downward or stabilizes at least (depending on fertility). The negative correlation between average age and positive net births is presented in Figure 5.

Cities with an unfavorable correlation of births and deaths (**above the 45° line** in the chart) tend to have aging populations. Conversely, cities below the line have more births than deaths. Cities on the line are stagnant in terms of the natural population trend.



Average age and forecast growth in number of inhabitants

Figure 4: Growth forecasts up to 2035 and current average age of the population; except Linz (population forecast 2040), Geneva (cantonal data), Switzerland (median age); source: Federal and State Statistical Offices; own calculation and presentation.

Many cities with significantly shrinking populations in Figure 3 appear above the 45° line. This applies, for example, to many cities in the Ruhr region. Nonetheless, this argument is not sufficient to prove growth or shrinkage. For instance, Chemnitz has an average age of 46.9, making it the "oldest" city in the study, and has a high negative net birth figure at -5.29 per 1,000 inhabitants, the worst ratio of births to deaths among all of the cities studied. However, the city's population remains nearly constant with forecast growth of 0.31 percent up to 2035.

The cities below the 45° line have positive net birth figures. These are the top seven cities in Germany, the larger Austrian and Swiss cities, and also some smaller cities such as Bonn, Münster, or Dresden. Strong growth has been forecast for most of these cities up to 2035. Nonetheless, Leipzig, whose population is expected to grow 13.5 percent up to 2035, the highest forecast of all German cities, falls near the 45° line, which indicates a balanced net birth number. This means the high forecast growth in Leipzig can hardly be explained by natural changes in population. In addition, it is evident that there is

a trend with regard to the average age of a city and the respective net births. In other words, "young" cities with an average age between 38 and 41 report a net positive number of births. In contrast, "older" cities with an average age between 44 and 47 more often exhibit a net negative birth figure. In general, this observation gives reason to conclude that natural population trends certainly explain part of the population forecasts, but the degree to which this explanation applies differs by city. It is therefore necessary to research other reasons,

such as population movements and migration.

Immigration and emigration (net migration)

The population trend can essentially be viewed as the **overall effect of net** births and net migration. In other words, a city grows if the total of net births plus net migration is positive. Figure 6 illustrates net migration in the cities studied and permits conclusions to be drawn about the overall impact. The overall impact is

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Births and deaths

generally positive for all cities in the first and second quadrants (i.e., above the zero line), because in these cities either positive natural population trend more than outweighs negative net migration or the net migration figure is so high that it more than balances out possible smaller or even negative net natural population trends (1st guadrant). Overall growth is exhibited mainly by the top seven German cities except Stuttgart, the metropolitan areas in Saxony, and some university and student towns, state capitals, and administrative centers (e.g., Münster, Freiburg im Breisgau, Bonn, Mainz).

Accordingly, the overall effect on all cities in the third and fourth quadrants (below the zero line) is generally negative, because here the effects of both factors are negative, or the net migration figure is not outweighed by the natural population trend. This is true of fewer than ten cities in this analysis.

Cities with a positive net birth figure and negative net migration are relatively rare; this situation occurs only in Wiesbaden and Stuttgart. A large number of cities exhibit the opposite scenario, that is, a negative net birth figure and positive net migration. These include cities in Germany's Ruhr region (e.g., Oberhausen, Wuppertal, Dortmund) and smaller cities in the former East German states (e.g., Erfurt, Chemnitz, Halle (Saale)).

According to forecasts, it is plausible that cities with high positive net migration, including Leipzig and Frankfurt am Main (more than eight net immigrants per 1,000 inhabitants), could grow more than ten percent by the year 2035. Logically, cities with negative net migration tend to shrink (e.g., Bremen, Gelsenkirchen). Nonetheless, there are both cities with low or negative net migration and forecasts of strong growth (e.g., Karlsruhe, Wiesbaden) and, conversely, shrinking cities with higher positive net migration (e.g., Krefeld, Wuppertal, Bochum).

What is notable is that the sometimes high positive net migration occurs even in those cities with overall lower growth forecasts, especially in the Ruhr region. Thus, all cities in and around the Ruhr area, with the exception of Gelsenkirchen, have positive net migration figures. The cities of Wuppertal, Krefeld, and Bochum have high positive net migration amounting to four to six net immigrants per 1,000 inhabitants, which is at or above the level of Germany's top seven cities. The numbers for these cities cover a wide range. Whereas Frankfurt am Main (8.81), Berlin (6.34), and Munich (5,78) report relatively high positive net migration, this figure is under four in the other top seven German cities. Stuttgart's figure is actually negative (-0.18). A possible explanation is that some of these cities offer very few opportunities for moving there due to their price levels and population density, and their population therefore stagnates at a high level.

Since net births in all countries in the DACH region fall below 2.1, positive net migration contributes to stabilizing population figures. In terms of cities and regions, this can, of course, also result from domestic migration if other regions are shrinking. The connection between net migration and the growth forecast shown in Figure 6 has a positive correlation, although the individual figures are quite widely distributed. In an attempt to calculate a regression, the statistical explanatory power (according to R²) proves to be rather low, which indicates that other factors are exerting a strong influence which requires further study along these lines. Moreover, other special factors could exist in individual cases.



Resulting differences, ranges, and clusters

The data regarding the cities and factors investigated in this chapter reveal both similarities and differences. With the help of a clustering process, cities with similar development potential can be identified and allocated to groups geographical independently of location and ingrained patterns. The resulting clusters are shown in Figure 7.

The method applied is singlelinkage clustering, an agglomerative, hierarchical classification process. This involves combining the cities into clusters based upon their statistical distances from one another. The distances here take into account four factors: population, net births, net migration and share of the population over 64 (except Austria and Switzerland). A small difference between cities means they are assigned to the same cluster, while a larger difference means they are not.

Cluster 1 includes many cities in the Ruhr region which have a similar population structure. These cities will tend to shrink and age, because they offer few attractive jobs and little earning potential. **Cluster 2** generally contains cities with a high average population age but which also feature economic development possibilities. For instance, the two state capitals Dresden and Erfurt are undergoing a process of catching up with the established locations. **Cluster 3** mainly comprises cities

primarily known for administrative activities. As a federal city, Bonn is home to several government ministries and federal offices as well as two major corporations (Deutsche Post AG and Deutsche Telekom AG) and, as such, is one of Germany's most important administrative hubs. Geneva is home to the headquarters of many international organizations such as the UN and WTO and therefore is an international-caliber administrative center. Mainz is the capital of the state of Rhineland-Palatinate and is also the location of many public institutions, as is Graz, the capital of the Austrian state of Styria. **Cluster 4** includes other cities in the Ruhr region, the coastal cities of Rostock and Lübeck as well as the city of Braunschweig, which is known for its automotive industry. Although these cities differ economically, they have a similar population structure and generally count among the older cities with lower growth. Cluster 5 comprises the state capitals Hanover. Kiel, Wiesbaden, and Bremen as well as Nuremberg and Karlsruhe, which are cities similar in social structure to those in Cluster 4. Cluster 6 includes cities that, in addition to other features, hold appeal for university students (among others) such as Münster, Freiburg im Breisgau, and Cologne. These cities have high positive net migration and, due to their large numbers of students, a population with a lower average age. Three major cities in Central Germany - Halle (Salle), Magdeburg, and Chemnitz - form Cluster 7. These cities have aging populations and since 1990 have struggled considerably with а population exodus that has caused them to shrink. Cluster 8 comprises four cities with at least one million inhabitants. These cities have grown substantially and will continue to grow due to their attractiveness. Their appeal to a large number of social strata means they often end

up in the average range regarding demographics. Frankfurt am Main and Zurich are considered established financial centers and therefore make up their own cluster: **Cluster 9.** These cities enjoy a high level of positive net migration, particularly by earlycareer professionals. They often offer high potential for starting families, so as a rule, these cities tend to be younger. The fastest growing cities, Leipzig and Basel, form **Cluster 10.** These cities saw robust population growth in the past, and their future growth forecasts are strong.

Figure 7 plots the clusters in a chart that illustrates net migration and net births in the individual cities. Cities that belong to the same cluster generally also appear close together in the chart.



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| Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 | Cluster 6 | Cluster 7 | Cluster 8 | Cluster 9 | Cluster 10 |
|----------------------|-----------------|-----------|-------------------|----------------|--------------------|------------------|--------------|--------------------|------------|
| Duisburg | Bielefeld | Bonn | Krefeld | Hanover | Münster | Halle (Saale) | Ham- burg | Frankfurt a. M. | Leipzig |
| Dort- mund | Kassel | Mainz | Ober- hausen | Karls- ruhe | Freiburg i. Br. | Magde- burg | Vienna | Zurich | Basel |
| Mönchen- gladbach | Linz | Graz | Bochum | Kiel | Stuttgart | Chem- nitz | Munich | | |
| Gelsen- kirchen | Augs- burg | Geneve | Wupper- tal | Nurem- berg | Cologne | | Berlin | | |
| Essen | Mann- heim | | Braun- schweig | Wiesba- den | | | | | |
| | Dresden | | Lübeck | Bremen | | | | | |
| | Aachen | | Rostock | | | | | | |
| | Düssel- dorf | | | | | | | | |
| | Erfurt | | | | | | | | |

Figure 7:

City clusters in the DACH region, analysis based on various types of population data using single-linkage clustering; graphical depiction with net migration, net births, and clustering based on additional parameters; D (Germany), A (Austria), and CH (Switzerland); source: Federal and State Statistical Offices; own calculation and presentation.

3. Impact of employment and education

It is assumed that certain influencing factors are behind the demographic data, particularly the differences in population growth, that lead to higher or lower growth of an individual city or region. This is true, for example, of the migration trends depicted. People normally move in greater numbers to economically prosperous Historically, centers. population structures became urbanized due to industrialization, which brought with it the corresponding opportunities for employment in cities. A more recent example is German reunification, which led to sweeping commuting and migration trends. Even across smaller regions, the opportunities for work and income vary, and these contribute to the attractiveness and therefore growth - of cities. The following chapter investigates how the cities in the DACH region differ in terms of education, employment, unemployment, and income, as well as the conclusions that can be drawn from relationships between these factors and demographic statistics, and how they affect the regional real estate market.

Income from employment

Differences in income in original and target regions typically trigger migration waves. The larger the **gap between incomes in two cities** or between a city and a rural region, the **greater the appeal of moving** to a city with favorable salaries. Distance, transportation options, and real estate costs (i.e., weighing the alternative of commuting to a workplace), can encourage or discourage this development (these factors are not further differentiated here; additional research on these effects may be necessary in certain cases).

The income-related effects will be considered below, especially for the

German cities comparable to each other and Vienna (only the comparable data). Swiss incomes were not reconciled or standardized, because in addition to exchange rates (CH/EUR), an analysis of the real purchasing power across different social and tax systems, price levels, etc. would have been necessary to assure comparability. This complex set of topics could be the subject of separate studies.

In Figure 8, the cities were divided into four equally sized groups (quartiles) by net annual disposable income. What is notable first of all is the size of the quartiles. Quartile 1, the cities with the lowest average income among those studied, covers a bandwidth totaling around EUR 3,200, while Quartile 4, which includes the most prosperous cities, extends across a range of some EUR 7,200. The middle quartiles only cover ranges of approximately EUR 600 (Quartile 2) and EUR 2,400 (Quartile 3). This suggests a concentration of cities around the median with strong outliers above and below in the outer quartiles. The fact that Quartile 4 is more than twice as large as Quartile 1 indicates a positive skew in the distribution. Each quartile comprises ten or eleven of the cities studied.

Quartile 1 includes many cities in the Ruhr region (e.g., Gelsenkirchen and Duisburg), most of the cities in the former East German states (e.g., Halle(Saale) and Leipzig), and the urban centers in Schleswig-Holstein (Kiel and Lübeck). Quartile 2 is made up of some cities in the former East German states catching which have been up economically (e.g., Erfurt and Dresden) as well as less prosperous western German municipalities (e.g., Kassel and Bremen). Quartile 3 mostly comprises stable western German cities (e.g., Augsburg and Karlsruhe) and Quartile 4 contains many Class-A C

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|---|---|--|---|--|
| | Quartile 1 | Quartile 2 | Quartile 3 | Quartile 4 |
| Income | low | below average | above average | high |
| Range of quartile | 19,003 - 22,174 EUR | 22,175 - 22,810 EUR | 22,811 - 25,253 EUR | 25,254 - 32,413 EUR |
| Cities | Gelsenkirchen Duisburg Halle (Saale) Leipzig Oberhausen Rostock Magdeburg Chemnitz Dortmund Kiel Lübeck | Berlin Dresden Kassel Erfurt Mönchengladbach Bremen Aachen Vienna AT Wuppertal Bochum | Mannheim Augsburg Bielefeld Essen Freiburg i Br. Hanover Krefeld Karlsruhe Cologne Nuremberg | Münster Mainz Braunschweig Hamburg Bonn Frankfurt am Main Wiesbaden Stuttgart Düsseldorf Munich |
| Ø Employment in the knowledge- intensive sector | 25.0% | 25.4% | 27.7% | 34.6% |
| Ø share of college-educated inhabitants | 20.1% | 24.7% | 26.0% | 33.7% |
| Ø share of inhabi- tants qualified for higher education | 38.4% | 40.9% | 39.7% | 45.3% |
| Ø unemployment 2020 | 9.8% | 8.9% | 7.9% | 6.4% |

Figure 8:

Breakdown of cities into quartiles according to disposable income, only German cities and Vienna, Austria; source: Federal and State Statistical Offices; own calculation and presentation.

cities (e.g., Munich and Düsseldorf). Whereas some determinants of the income level of a city were identified, the following section outlines the relationship between income level and population growth. **Figure 9** shows a **covariance matrix** with a linear regression line of per capita disposable **income and forecast population growth up to 2035.** The regression line illustrates a positive correlation between the two variables, although the variance is not inconsiderable and raises further questions regarding an explanation.

All shrinking cities have an annual net disposable income of below EUR 24,000 per inhabitant, with this figure in all of the rapidly shrinking cities (shrinkage of more than four percent) falling below EUR 22,000. In contrast, in the growing cities, there is a broad distribution of combinations of growth and income. For instance, Leipzig is a relatively low-income (fourth "poorest") city in this study that expects population growth of more than 13 percent up to 2035, whereas Munich is a high-income ("richest") major German city that will only see growth of somewhat over seven percent. Generally, it can be expected that more prosperous cities can anticipate higher growth rates than less prosperous cities. Nonetheless, this correlation is by no means perfect, and further determinants must be identified. One possible theory which could account for a lower correlation of these factors is that successful and high-income cities generally have a tight and expensive residential real estate market that sharply curtails additional immigration. Prices also play a role, such as when a large portion of the higher income is consumed by a higher cost of living. In cities such as Leipzig, rents are still moderate, and people moving to the city to date have been able to find sufficient unoccupied apartments.

Employment, available jobs

The quantitative and qualitative selection of jobs is an obvious driver of migration. Cities with high unemployment tend to suffer more from a net loss of inhabitants, while cities with robust labor markets tend to benefit from a net influx of residents. In this case,

Correlation between income and population growth



Figure 9: Per capita disposable income and forecast population growth, except Geneva (cantonal data); source.

Federal and State Statistical Offices; own calculation and presentation

employment/unemployment reflect the competitiveness of a region. Emigration and unemployment have a particularly strong impact on regions in which the industry and corporate structures are no longer fit for the future. Conversely, rapid growth in employment and a simultaneous decline in unemployment indicates that a region is home to companies and economic sectors that are highly competitive in international terms and therefore also safeguard the importance of this region in the medium term.

Strong cities today are primarily shaped by knowledge-intensive services, research and development, or high-tech companies. A ranking of employment trends is shown in **Figure 10**.

The **top ten** highest-growth **labor markets** are located in the cities already ranking highly in other

| Rank | City | Employed 2010 | Employed 2020 | Growth |
|------|----------------------|---------------|---------------|---------|
| 1 | Berlin | 1,127,702 | 1,539,285 | +36.5 % |
| 2 | Munich | 694,507 | 897,905 | +29.3 % |
| 3 | Leipzig | 212,374 | 274,019 | +29.0 % |
| 4 | Cologne | 463,323 | 579,638 | +25.1 % |
| 5 | Münster | 140,506 | 174,761 | +24.4 % |
| 6 | Freiburg im Breisgau | 103,877 | 129,036 | +24.2 % |
| 7 | Stuttgart | 344,319 | 423,052 | +22.9 % |
| 8 | Frankfurt am Main | 491,084 | 602,197 | +22.6 % |
| 9 | Dortmund | 201,857 | 246,840 | +22.3 % |
| 10 | Bielefeld | 130,708 | 158,906 | +21.6 % |
| | | | | |
| 37 | Oberhausen | 59,184 | 66,576 | +12.5 % |
| 38 | Geneve* | 328,246 | 368,334 | +12.2 % |
| 39 | Vienna | 765,800 | 859,000 | +12.2 % |
| 40 | Duisburg | 155,746 | 174,630 | +12.1 % |
| 41 | Gelsenkirchen | 73,118 | 81,887 | +12.0 % |
| 42 | Erfurt | 98,944 | 109,632 | +10.8 % |
| 43 | Chemnitz | 107,502 | 116,152 | +8.0 % |
| 44 | Halle (Saale) | 92,376 | 98,072 | +6.2 % |
| 45 | Basel* | 183,183 | 192,450 | +5.1 % |
| 46 | Magdeburg | 103,674 | 108,002 | +4.2 % |
| | | | | |

Figure 10: The highest-growth and lowest-growth cities based on their labor markets 2010 to 2020, *except Geneva (cantonal data) and Basel (2011-2019); D (Germany), A (Austria), and CH (Switzerland); source: Federal and State Statistical Offices; own calculation and presentation.

categories: **Berlin, Munich,** and **Leipzig**. In the **bottom ten,** the ranking of **Vienna, Geneva,** and **Basel** are surprising, however.

Somewhat shorter data sets offer only a partial explanation in the case of Basel and Geneva. Possible reasons for the low job growth there are more likely to be found in the restrictions on space in each city's territory (quantity, prices), the already historically high figures, at the beginning of the period analysed and Switzerland's specific immigration and labor market policies. According to Straubhaar/Werner (2003), at approximately 80 percent, the employment rate in Switzerland at the turn of the millennium was already at the front of the pack of OECD countries (Germany came in at around 66 % at that time). Older age cohorts are also included for reasons explained by economic and labor market policy (e.g., almost no early retirement programs, numerous employment opportunities even for older adults). Almost no further growth is possible for these reasons, except by immigration of qualified workers.

Similar reasons are suspected for Vienna based on various press reports. Increasingly, bottlenecks in residential space and jobs go hand-inhand with positive growth rates. The Austrian Academy of Sciences (ÖAW, Robert Musil) has identified significant structural change in the labor market at the same time. Job growth is occurring primarily in the highly qualified worker segment in industry as well as the dominant service sector. In contrast, job numbers in lower qualified professions are stagnating. This leads to a mismatch in the labor market, e.g., a relatively high level of youth unemployment in Vienna and a pace of job growth that lags behind population growth. Within Austria, the demographic importance of Vienna is increasing, while its economic significance is waning.

In **Germany**, however, there is definitely movement in the regional labor markets, mainly triggered by **domestic migration** to the **topranking cities**, which also explains some of the figures for the cities ranking at the bottom of the list.

In considering the German cities depicted in Figure 10, it is notable that cities with the strongest as well as the weakest job growth are quite heterogeneous in terms of growth and prosperity. The fact that Berlin is the top city in this regard is hardly surprising, because the city also exhibited strong catch-up effects following German reunification. For the other Class-A cities, the reason is likely the sustained appeal of these cities, resulting in robust economic growth in the last ten years. Also experiencing a sharp rise was the number of employed persons in Leipzig (+29%). The grounds for this - catch-up effects - are similar to those in Berlin. The top ten additionally includes **Freiburg im Breisgau and Münster,** two cities beloved by **university students**. This is likely due to their scientific and knowledge-intensive sectors. In contrast, the ranking of Bielefeld and Dortmund in the top ten is surprising. Since no particular industrial or service structures are identifiable as explanations here, other potential factors include growth in the lower-qualified worker sector or a lower starting point in 2010.

The group of cities where job growth is the weakest is also varied. These include the previously mentioned Swiss and Austrian cities, the Ruhr region cities of Oberhausen, Duisburg, and Gelsenkirchen, as well as some smaller cities in the former East German states such as Magdeburg, Halle (Saale), Chemnitz, and Erfurt. The explanation of the ranking of the Ruhr cities is relatively simple: Starting in the 2010s, these locations felt and continue to feel substantial adverse effects from structural change due to the collapse of traditional industries like mining and heavy industry in the area. The cities in the former East German states have been able to lower their unemployment rates by at least three percentage points since 2010, but this is only partly attributable to job growth. For instance, Chemnitz has an average age of 46.7, making it the "oldest" city in the study, which indicates that a slice of the formerly unemployed population has left the labor market due to age. Likewise, emigration explains part of the decline in unemployment. Moreover, the generally good economic performance of recent years has, of course, been a boon to nearly all labor markets, including those in structurally weaker regions. The decline in unemployment can therefore be explained with both economic and demographic factors.

Education level, job sectors

From an economic perspective, education is an investment that can lead to higher productivity (and higher income), because people equipped with a wide array of knowledge, learned skills and competencies can add more economic value. This also enables people to develop new ideas and put them into practice, which in turn can result in technological progress and a greater degree of efficiency of the resources employed. Education is thus an important longterm determinant for a region and its future development.

Figure 11 shows a correlation matrix between various professional/ vocational qualifications and employment in a number of economic sectors. This table makes it clear that there is a positive correlation between the share of the population with vocational training and the share of the manufacturing industry ($\rho = 0.46$) and between the share of the population with a university degree and the share of workers in knowledge-intensive services ($\rho = 0.72$). The converse correlations are strongly negative $(\rho = -0.55 \text{ and } \rho = -0.64)$. In cities where a large share of the population is working without a professional qualification, a greater portion of the population is likewise employed in the manufacturing industry or in the basic service sector (each $\rho = 0.27$), and fewer people work in the knowledgeintensive sector ($\rho = -0.25$). In contrast, working in the public sector does not appear to correlate strongly with professional qualifications, or the lack thereof because the correlation coefficient is below 0.2 in each case.

It is therefore interesting to compare the education levels of the individual cities. Figure 12 illustrates the educational level of the population by various levels of professional gualifications. The Swiss cities studied have a very high percentage of university graduates. This is actually not that surprising, because these cities are appealing on account of their excellent employment opportunities for university graduates, who tend to migrate there in particular. Zurich in particular employs many people in the financial services sector and other services requiring higher qualifications, and by far leads the ranking with a share of university graduates of nearly 60 percent. Notable among the other cities with a strong share of university graduates (over 30 percent) are the top seven German cities as well as cities popular with university students such as Bonn, Münster, and Freiburg im Breisgau.

In contrast in many smaller cities in Germany's eastern regions like Chemnitz or Halle (Saale) and cities

| | Manufacturing | Services | Knowledge- intensive services | Public sector |
|---|---------------|----------|----------------------------------|------------------|
| College/ university degree | -0.64 | -0.39 | 0.72 | -0.13 |
| Vocational/ secondary education | 0.46 | 0.23 | -0.55 | 0.17 |
| No vocational/pro- fessional qualification | 0.27 | 0.27 | -0.25 | -0.09 |

Figure 11:

Correlation matrix between share of the population with the highest level of professional qualification and the share of workers in the economic sectors; source: Federal and State Statistical Offices; own calculation and presentation.

in the Ruhr region, more people hold lower-level professional qualifications. The lower level of qualifications is particularly pronounced in many major urban areas in North Rhine-Westphalia. The last six spots in the ranking of academic qualifications are held by cities in the Rhine-Ruhr region. The situation is made more difficult in the Ruhr area cities studied here by the share of inhabitants without any professional qualification at all, which totals more than 20 percent.

An interesting point is the extent to which qualifications affect the typical job sectors in a region. These would be causative for income levels and therefore also for the type of residential properties in demand in a location. Additionally, this chain of factors indirectly provides several indicators for the opportunities and risks present in real estate markets. Corresponding changes in indicators - at least the direction of the change - also enable downstream forecasts for the relevant real estate market effects.

Figure 13 illustrates the connection between the share of university graduates and the share of people working in knowledge-intensive services. This shows the same picture as the comparison of cities in terms of professional qualifications. Cities with a small share of university graduates likewise have a low percentage of workers in the knowledge-intensive sector. This correlation is a high quality one, because it has a low variance and only a few outliers such as Freiburg im Breisgau. Both percentages tend to be low in the Ruhr region cities and in smaller cities in the former East German states, and tend to be high in the Class-A cities and university towns.

Education level, unemployment

In the age of digital transformation, technological progress is the main driver of economic growth and prosperity. This leads to the assumption that cities and regions with a high share of knowledgeintensive services have an advantage over cities with a large percentage





Figure 13: Correlation between university education and knowledge-intensive services, no data available for Austria and Switzerland; source: Federal and State Statistical Offices; own calculation and presentation.

of labor-intensive economic output. This is also true for individual workers. Provided they have completed a degree with labor market potential, university graduates usually have higher incomes and a lower risk of becoming unemployed than those with lower-level qualifications.

Figure 14 below shows the relationship between the share of university graduates and the unemployment rate. The data points indicate a significant negative correlation. Thus, cities with a very low percentage of university araduates trend toward higher unemployment. This is particularly true for the cities in the Ruhr region, many of which have a share of university graduates under 20 percent and an unemployment rate of more than ten percent. In contrast, cities where more than 30 percent of the population has a university degree often have an unemployment rate under eight percent, and frequently even under six percent, such as in the Class-A cities.

Resulting differences, ranges, and clusters

What is also interesting is the interplay between the indicators studied in this chapter; in other words, whether they have a causal relationship with each other or are interdependent. employment Average in the



Relationship between holding a university degree and unemployment

Figure 14: Relationship between holding a university degree and unemployment, except Geneva (cantonal information), Hanover (share of university graduates 2018); source: Federal and State Statistical Offices; own calculation and presentation.

knowledge-intensive service sector, the percentage of the population with a university degree, and the share of inhabitants with a secondary education in relation to income (Figure 8) are each lowest in Quartile 1 and increase over the quartiles up to Quartile 4 in which the maximum for each parameter is reached. Spanning more than 13 percentage points, the range in the share of university graduates between Quartile 1 and Quartile 4 is particularly pronounced. In addition, the unemployment rate declines steadily from 9.8 percent in the first to 6.4 percent to the fourth quartile. This allows us to draw the conclusion that the share of university graduates, the share of secondary school graduates, and a large percentage of workers in

knowledge-intensive services have a positive impact on disposable income – and therefore on the attractiveness of a city to its current and potential residents – whereas unemployment naturally has a negative effect.

clustering The process used previously on the population data is applied collectively to the data in this chapter. The following six factors are taken into account when determining these clusters: number of employed persons, job growth rate from 2010 to 2020, share of university graduates, unemployment rate, change in the unemployment rate and purchasing power (only for the German cities). The resulting clusters are presented in Figure 15. Because Clusters 4, 5, and 6 each include only two cities, these cities were combined into an expanded cluster.

The first city cluster mainly comprises northern German cities such as Kiel and Rostock. However, the western German cities of Aachen and Bielefeld are also part of this cluster. A similar labor market development can be seen in Cluster 2 in Mannheim, Augsburg, Kassel, Nuremberg, and Wiesbaden. In contrast, it is surprising at first glance that Vienna is relatively similar to the northwestern German cities such as Essen and Bremen in terms of its labor market. This is presumably due to the aboveaverage unemployment in the Austrian capital. However, countryspecific differences in data collection methodology - particularly in labor market statistics - may introduce a certain lack of precision in the comparison.

The expanded Cluster 4 comprises central German cities like Erfurt and Magdeburg. Linz also belongs to this cluster. Cluster 7 comprises cities with a favorable labor market trend, including the Swiss cities as well as Bonn, Mainz, and Karlsruhe. In contrast, Clusters 8 and 9 comprise cities with a much less attractive labor market. They are dominated by cities in the Ruhr region but also include Graz. Cluster 10 is made up of the medium-sized university cities. Finally, cities attractive to university graduates, including Frankfurt am Main, Stuttgart, Hamburg, Munich and Berlin, are assigned to Cluster 11.

The chart in Figure 15 places the **unemployment rate** on the X axis and the **forecast population growth up to 2035** on the Y axis with the plotted clusters. The result of the clustering varies. Whereas some clusters have very little distance between them with respect to the two parameters

(such as 1, 8 and 11), other clusters are much further apart and were not plotted fully to ensure the chart was still readable. For instance, the two Austrian cities Graz and Linz are located a significant distance from the other cities in their cluster. This chart shows that some cities with similar labor market data also have similar population forecast data. Nonetheless, this correlation is not perfect, which is indicated by the fact that some cities fall far outside of their clusters in this chart.



| Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4* | Cluster 7 | Cluster 8 | Cluster 9 | Cluster 10 | Cluster 11 |
|-----------|----------------|------------------------|----------------------|----------------------|-----------------------|-------------------------|--------------------|----------------------|
| Kiel | Mannheim | Essen | Chemnitz | Karlsruhe | Duisburg | Mönchen- gladbach | Münster | Frankfurt am Main |
| Aachen | Augsburg | Bremen | Erfurt | Mainz | Oberhau- sen | Krefeld | Freiburg i. Br. | Stuttgart |
| Bielefeld | Kassel | Hanover | Bochum | Geneve | Gelsenkir- chen | Wuppertal | Braun- schweig | Düsseldorf |
| Rostock | Nurem- berg | Dortmund | Linz | Bonn | | Graz | Dresden | Cologne |
| Lübeck | Wiesba- den | Vienna | Halle (Saale) | Basel | | | Leipzig | Hamburg |
| | | | Magde- burg | Zurich | | | | Munich |
| | | | | | | | | Berlin |
| | Figure 15: | City clusters in the L | ACH region, analysis | based on various typ | es of labor market da | ita using single-linkag | e clustering; | |

FIS: City clusters in the DACH region, analysis based on Various types or halor market oata using single-linkage clustering; graphical depiction with unemployment rate and population growth forecast up to 2035 and clustering based on additional parameters; D (Germany), A (Austria), and CH (Switzerland); source: Federal and State Statistical Offices; own calculation and presentation. /* Aggregation of similar clusters (4,5,6)

4. Impact of economic strength and public finances

According to the results in chapter 3, correlations between population trends and employment factors such as unemployment, income level, and education level are plausible. These indicators are not the only ones that affect the growth of cities, but they do have a material impact. In this regard, the cities studied present a quite heterogeneous picture in terms of these factors.

The general economic strength of the individual cities is an upstream factor that correlates with the labor market. This is typically evident in measured variables such as the GDP generated, and additionally in public finances. We highlight the differences and relationships at this level of analysis in this chapter. Essentially, two directions of effects are possible and interesting for use in forecasts: On the one hand, a robust, dynamically growing economy could be the starting point, i.e., a strong pull factor for immigration, because these cities offer attractive job and income opportunities and generally have an excellent quality of life. On the other hand, immigration could be the jumping-off point for increasing the economic strength of a city, if it includes in-demand, highly qualified professionals, and these workers provide the companies domiciled there with a competitive advantage. Stronger innovative capabilities can also be assumed, culminating in for example, the founding of innovative start-ups.

Economic performance, GDP

Economic strength is closely related to unemployment and income levels. Only cities with strong economies can secure a low unemployment rate C

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Office; own calculation and presentation.

and sustain a high level of income for their inhabitants in the long term, therefore attracting well-qualified workers from other areas.

A frequently used measure of economic strength is gross domestic product (GDP) per capita. **Figure 16** shows the level of GDP per capita in 2009 and 2019 as well as growth in percent over a period of ten years. Coming in around the German average of EUR 41,358 are cities in North Rhine-Westphalia such as Dortmund (EUR 40,713) and Bielefeld (EUR 42,426), as well as eastern German cities like Erfurt and Dresden.

The list of the economically strongest cities is led by Basel, Zurich, and Geneva, which also exhibit the strongest economic growth. Of the German cities, Frankfurt am Main had the highest GDP per capita both in 2009 and in 2019. However, in no other city did GDP grow as slowly as in Frankfurt am Main. Another economically mature city that is hardly showing any growth at this point is Bonn, which held 8th place with a GDP per capita of around EUR 82,100 in 2019, but is also expanding very slowly at a rate of only 11.7 percent.

Other German Class-A cities grew much more rapidly. Examples include Berlin (+41.4 %), Stuttgart (+38.0 %), and Munich (+36.6 %), and catch-up effects also play a role in Berlin. These catch-up effects are especially evident in the former East German cities. The major cities in Saxony in particular have seen very robust economic growth. For instance, economic output in Leipzig grew by 39.7 percent, in Chemnitz by 37.2 percent, and in Dresden by 34.1 percent, which was topped only by Rostock (+41.4 %). Nonetheless, the GDP per capita in the cities in the former East German states remains at a low level. The city with the strongest economy there, Dresden, ranks only 31st in this comparison with a GDP per capita of approximately EUR 42,000.

Cities in the Ruhr region and in North Rhine-Westphalia once again bring up the rear in this comparison. All of the cities in this region place in the lower half of the ranking, with six of these cities belonging to the ten lowest-growth cities in this study. Oberhausen had a GDP per capita of around EUR 27,500 in 2019, making it the only city in this study with a GDP per capita under EUR 30,000. An additional adverse effect on the Ruhr region cities is the fact that their economies not only operate at a low level, but they also make up the group with the lowest economic growth. For example, Essen (+12.9 %), Oberhausen (+16.7 %), and Duisburg (+19.3 %) all have growth rates under 20 percent. However, other cities in the Ruhr region such as Dortmund (+35.3 %), Bochum (+32.9 %), and Mönchengladbach (+32.0 %) report strong growth rates. Other high-growth cities in Germany are Aachen (+37.0 %), Lübeck (+37.0 %), Nuremberg (+36.4 %), and Bielefeld (+36.4 %). The Austrian cities fall in the middle of the pack, placing 19th (Linz), 22nd (Vienna), and 23rd (Graz). Considering the pace of growth in these cities, Vienna's growth of 16.2 % is strikingly weak.

In general, two types of cities are appealing for economically motivated migration: The first type comprises already well-developed cities like the Class-A cities or cities such as Bonn, Braunschweig, Hanover, and Mannheim. The second type includes cities at a low economic level that nonetheless exhibit robust growth, which is true of some cities in the former East German states and the capital Berlin. The Swiss cities are unusual. Here, the financial sector C

is responsible for these cities' great economic strength and strong growth in a liberal economic system, making them extremely attractive for both companies and workers. Naturally, the indicators compared here are presented in purely nominal terms and only calculated using simple currency translation. Still, even using older exchange rates (prior to the sharp increase in the value of the CHF) produces very high numbers for the Swiss cities.

In contrast, cities that have both low GDPs per capita and very low economic growth do not attract the migration of highly qualified workers, and will tend to shrink. Young talent self-selects in this case because highly qualified workers increasingly emigrate both for reasons of education and for employment. This is only true to a limited extent for the shrinking university cities, because education can be obtained on-site in those cities. However even here the companies appealing to highly qualified workers are usually found in up-and-coming regions and not in their shrinking home economic regions. In addition to the already frequently mentioned Ruhr cities, this also applies to cities in the former East German states such as Halle (Saale) and Magdeburg, and some northern German cities like Kiel and Bremen.

Structural differences, industries, sectors

In addition to macroeconomic influences, the economic performance of a city depends largely on regional markets and industry structures. The distribution of employees across various sectors is very heterogeneous in the cities studied. In this context, the sectors with strong added value for highly qualified workers are the most interesting for forecasting economic trends and, indirectly, also population trends, because the highest salaries jobs commensurate and with gualifications expected to be found in these sectors as well.



Share of workers by economic sector, excluding Austria and Switzerland; source: Federal and State Statistical Offices; own calculation and presentation С

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Figure 17 illustrates employment in the various sectors in the cities studied. Distinctions are drawn between the manufacturing industry, the public sector, basic services, and knowledge-intensive services. The primary agricultural sector and other segments not attributable to the aforementioned sectors are subsumed under Other. The cities in the figure are organized according to employment in knowledgeintensive services. The largest share of knowledge-intensive services can be found in the cities of Frankfurt am Main and Munich. Numerous DAX and MDAX-listed companies are headquartered here, especially in the fields of IT, vehicle and mechanical engineering, pharmaceuticals and chemicals, and financial services, all of which produce significant economic value and offer highquality jobs. The other Class-A cities also rank in the top ten for similar reasons. Some other cities stand out due to a high percentage of employment in the public sector. These are often administrative centers such as the federal city of **Bonn** and state capitals like Wiesbaden and Mainz. Typical university towns in which colleges and universities are the largest employers also belong in this category. Examples are Freiburg im Breisgau and Münster. Cities in the former East German states have a smaller share of workers in the knowledge-intensive sector, with the share below 30 percent in all of these cities except Leipzig and Erfurt, much like in the major cities in Schleswig-Holstein. In the cities studied located in the Ruhr region, the share even falls below 25 percent in all cases except Essen. The Ruhr cities, however, often feature a higher share of workers in the manufacturing industry much like Kassel and Augsburg, whose economies also have a smaller proportion of knowledge-intensive services.

In this time of digital transformation and the growing importance of biotechnology in particular, workers knowledge-intensive in sectors create significantly more value than workers in traditional employment such as manufacturing or basic services. Therefore, a large share of workers in knowledge-intensive services can be the foundation for a city's economic prosperity. In terms of **public-sector** employment, a distinction must be drawn between more complex activities in fields such as education and research, for instance in universities, which also indirectly have a positive impact on value creation and productivity, and basic administrative jobs that only account for a small share of the value created, and which will possibly be eliminated in the future due to automation. Likewise, in the manufacturing sector, a distinction must be drawn between basic, traditional production as in heavy industry or mining, and highly specialized and knowledgeintensive production. In the first case, manufacturing will often either be phased out in the coming years or will be exported overseas or automated, whereas highly complex manufacturing will continue to provide a competitive advantage to the areas in which these activities are located and ensure future prosperity.

Public finances, tax revenue

Debt levels and economic output can be determinants of the future development of a city. Municipalities must provide certain public infrastructure and services. For instance, they are responsible for maintaining streets and schools, conducting some public administration activities, providing local public transportation, and services including day care centers and fire departments. Municipalities with strong finances C

REAL EXPERTS. **REAL VALUES.**

| Per Capita pt | ionic dept in euros | GDP per capita in euros | FUDIIC GEDI/ODF |
|--------------------------|---------------------|-------------------------|-----------------|
| Bremen* (D) | 57823 | 48 947 | 1181 |
| Berlin* (D) | 16.307 | 42.886 | 0.380 |
| Geneva* (CH) | 36.414 | 99.166 | 0.367 |
| Hamburg* (D) | 19,181 | 67,017 | 0.286 |
| Basel* (CH) | 21.679 | 180.788 | 0.120 |
| Vienna* (AT) | 3,346 | 52,600 | 0.064 |
| Zurich* (CH) | 4,953 | 173,119 | 0.029 |
| | _ | | - |
| Oberhausen (D) | 8,916 | 27,489 | 0.324 |
| Gelsenkirchen (D) | 4,870 | 31,930 | 0.153 |
| Wuppertal (D) | 5,142 | 37,183 | 0.138 |
| Bochum (D) | 4,731 | 34,862 | 0.136 |
| Essen (D) | 5,725 | 45,013 | 0.127 |
| Mönchengladbach (D) | 3,718 | 34,800 | 0.107 |
| Duisburg (D) | 3,436 | 35,482 | 0.097 |
| Mainz (D) | 5,412 | 57,181 | 0.095 |
| Dortmund (D) | 3,840 | 40,713 | 0.094 |
| Krefeld (D) | 3,001 | 41,132 | 0.073 |
| Aachen (D) | 2,856 | 39,194 | 0.073 |
| Linz (A) | 3,946 | 56,100 | 0.070 |
| Bonn (D) | 5,506 | 82,081 | 0.067 |
| Halle (Saale) (D) | 1,953 | 32,527 | 0.060 |
| Lübeck (D) | 2,507 | 45,098 | 0.056 |
| Kassel (D) | 2,823 | 52,604 | 0.054 |
| Münster (D) | 2,773 | 57,708 | 0.048 |
| Nuremberg (D) | 2,887 | 62,314 | 0.046 |
| Hanover (D) | 3,122 | 68,335 | 0.046 |
| Kiel (D) | 2,179 | 48,835 | 0.045 |
| Graz (A) | 2,302 | 52,400 | 0.044 |
| Cologne(D) | 2,445 | 61,073 | 0.040 |
| Bielefeld (D) | 1,199 | 42,426 | 0.028 |
| Augsburg (D) | 1,365 | 50,641 | 0.027 |
| Frankfurt am Main (D) | 2,597 | 96,670 | 0.027 |
| Mannheim (D) | 1,615 | 67,168 | 0.024 |
| Leipzig (D) | 812 | 38,762 | 0.021 |
| Wiesbaden (D) | 1,153 | 65,559 | 0.018 |
| Freiburg im Breisgau (D) | 898 | 55,284 | 0.016 |
| Rostock (D) | 566 | 38,106 | 0.015 |
| Chemnitz (D) | 525 | 37,673 | 0.014 |
| Magdeburg (D) | 459 | 36,160 | 0.013 |
| Erfurt (D) | 518 | 41,164 | 0.013 |
| Karlsruhe (D) | 819 | 66,579 | 0.012 |
| Dresden (D) | 396 | 41,948 | 0.009 |
| Braunschweig (D) | 567 | 76,567 | 0.007 |
| Munich (D) | 431 | 82,719 | 0.005 |
| Stuttgart (D) | 418 | 91,228 | 0.005 |
| Düsseldorf (D) | 124 | 85,540 | 0.001 |

Per capita public debt in euros GDP n anita ir

Public debt/GDP

Figure 18: Public debt and GDP in euros (2020), by city or alternatively canton (*); except Vienna, Graz, Linz 2016, and Zurich, Geneva, Basel (2019); D (Germany), A (Austria), and CH (Switzerland); source: Federal Statistical Office; own calculation and presentation (in some cases, statistical methods were used to smooth the time series data).

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that both receive a high level of tax revenue from economic activity, and must only make minimal payments on obligations from borrowing funds, can fulfill this mission even beyond the minimum level and provide their residents with additional recreation services and cultural offerings. Municipalities that are not financially strong, however, have difficulty even providing the minimum mandatory services. Cities in the Ruhr region in particular, which have high debt levels as well as low levels of economic activity, will therefore continue to lose their appeal, whereas well-financed cities, primarily in southern Germany, will continue to remain attractive for current and potential new residents.

Public debt is an important indicator but should be used in analyses – particularly cross-border analyses – only in relation to economic output or other benchmarks. Figure 18 shows the gross domestic product per capita and public debt in euros for the cities studied.

Significant geographical differences are evident in per capita public debt. In Germany, all cities in the former East German states, except Halle (Saale), have per capita public debt below EUR 1,000. Also at this low level are Stuttgart and Karlsruhe in Baden-Württemberg, the state capitals Munich and Düsseldorf, and Braunschweig.

The explanations for these sometimes low levels of debt vary. The cities in the former East German states were not part of the Federal Republic during the 1970s and 1980s when the majority of municipal debt in West Germany was incurred. They only began accumulating public debt in the 1990s when political and public opinion had shifted sharply toward austerity. The western German cities in this low-debt category were not in a position requiring massive borrowing

due to their good economies and associated high tax revenue. This is also evident in the fact that the cities in this category have a much higher GDP per capita than the cities in the former East German states.

In contrast, many cities in the Ruhr region have the highest level of debt per capita. Oberhausen has the lowest GDP per capita (under EUR 30,000) and the highest per capita indebtedness (nearly EUR 9,000) in this report. The poor rankings in both of these indicators can be explained by low income levels combined with low tax revenue and ongoing structural change in the region, which began in the 1970s. All other cities exhibit various combinations of the two indicators. For instance, Frankfurt am Main, the city with the highest per capita GDP in this study (EUR 96,700) has per capita public debt of around EUR 2,600, which falls in the middle range. Another economically strong city in this comparison, Bonn, which has a per capita GDP of more than EUR 82,000, has a higher level of debt at around EUR 5,500 per resident. This means that no clear correlation can be determined.

The Swiss cities are not directly comparable with Germany or each other using the preliminary indicators applied here. For example, the highest debt in Switzerland was calculated for Geneva. However, this can be explained by special structures there. In the Swiss federal system, the cantons organize their own public services for education, healthcare, social services, and security, including arranging the funding for these. In some cases, the municipalities have a high degree of autonomy in spending and financing. Other cantons are more centrally structured. This is true in for Geneva, where most public services are the responsibility of the canton. According to Geneva's fiscal authority, the split in responsibility between the

canton and municipalities is around 80/20. Differentiated analyses therefore require aggregate figures for cities and municipalities and their regional administrative bodies (cantons).

Similar difficulties in interpretation arise when considering the debt levels of the German city-states of Berlin, Hamburg, and Bremen. The municipal and state levels here are de facto the same, unlike for the other German cities. Differentiated analyses must therefore take into account the respective public budgets and debt balances at the federal, state, and municipal levels - and then break these down and aggregate them depending on the question at hand and how they are presented. To this extent, the key figures shown here only provide initial, preliminary indicators.

In terms of their impact, proponents of debt argue that their counterparts are real value and services. For instance, possibilities are improved infrastructure, high-quality fixtures and fittings for schools and administrative offices, and more sports and cultural services by the municipalities. Critics point out the financial burden on households and subsequent generations, which will later have to pay the debts arising from the services provided today. Negative consequences such as a gradual decrease in services or increased taxes and levies become more likely for residents and businesses as debt levels rise. This can put a heavy damper on the future development of a city.

Resulting differences, ranges, and clusters

As in the previous chapters, a singlelinkage cluster analysis was conducted on the topic of the economy, which resulted in a breakdown of the 46 cities studied into five clusters. The factors taken into account were GDP in 2019, GDP per capita growth from 2009 to 2019, employment levels in various sectors, and per capita public debt.

Cluster 1 contains the Class-A cities of Munich and Stuttgart, many cities in the Ruhr region, the Upper Austrian capital of Linz, the major Bavarian cities Nuremberg and Augsburg as well as Kassel and Braunschweig. At first glance, it appears difficult to find similarities among these cities, because the cluster includes both prosperous cities such as Munich or Linz but also Ruhr region cities experiencing economic decline. However, one major similarity is the economic structure, because all of these cities feature a strong manufacturing base. Munich, Stuttgart, and Braunschweig are heavily influenced by the automotive sector. In contrast, the cities in the Ruhr region are home to significant heavy industrial activity. The other cities in this cluster are also shaped by manufacturing, although mostly by small and medium-sized companies (Mittelstand).

Cluster 2 comprises many university and administrative hubs such as Münster, Freiburg im Breisgau, Vienna, Mainz, and Bonn; the Class-A cities Frankfurt am Main and Hamburg; the Ruhr center of Essen; and Leipzig, Erfurt, and Halle (Saale) in the former East German states. As in the previous cluster, it is not obvious why these cities belong to the same cluster. One possible reason is low economic growth. As already illustrated in Figure 16, some of these locations are well established and are no longer growing significantly. Others have little growth potential due to their economic structure. Only Leipzig stands out with sky-high growth of 39.7 percent. Leipzig was assigned to this cluster mainly for statistical reasons, as it is otherwise most similar to the average economic structure of the other cities.

Clusters 3 and 4 also have similar production structures. In Cluster 3, this is primarily driven by the share of workers in basic services and in **Cluster** 4, employment in the public sector. The highest growth cities in this study are combined in **Cluster 5.** As mentioned above, Dresden and Chemnitz have been able to generate robust economic growth due to catch-up effects, whereas the Swiss cities again saw strong growth despite starting at a high level in 2009. The other western German cities were able to grow due to their favorable economic situation and local economic structures.

Chart in the right-hand segment of Figure 19 shows the GDP growth from

2009 to 2019 on the X axis and forecast population growth up to 2035 on the Y axis with the plotted clusters. It is clearly evident that the cities in the clusters are relatively far apart. For reasons of readability, only cities a short distance from one another in a cluster were documented. Even so, many cities fall outside of a cluster cloud, thus fitting rather poorly in the cluster. This leads us to the conclusion that GDP growth and general economic indicators provide only minimal information about population trends. In any case, there are some examples of cities with low GDP growth and high population growth forecasts and vice versa.

| Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 |
|-----------------|----------------------|---------------|-----------|-----------|
| Augsburg | Münster | Krefeld | Bielefeld | Hanover |
| Linz | Vienna | Graz | Lübeck | Wiesbaden |
| Kassel | Mainz | Mannheim | Rostock | Dresden |
| Duisburg | Essen | Wuppertal | Bochum | Chemnitz |
| Mönchengladbach | Halle (Saale) | Gelsenkirchen | Dortmund | Aachen |
| Braunschweig | Erfurt | Kiel | Berlin | Zurich |
| Nuremberg | Bonn | Magdeburg | Geneve | Basel |
| Oberhausen | Leipzig | Cologne | Bremen | |
| Stuttgart | Freiburg im Breisgau | Karlsruhe | | |
| Munich | Frankfurt am Main | Düsseldorf | | |
| | Hamburg | | | |

| ows the GDF | growth from |
|-------------|-------------|
| | |



City clusters in the DACH region, analysis based on various types of labor market data using single-linkage clustering; graphical depiction with unemployment rate and population growth forecast up to 2035 and clustering based on ad-ditional parameters; D (Germany), A (Austria), and CH (Switzerland); source: Federal and State Statistical Offices; own calculation and presentation.

5. Overall picture of socioeconomic clusters

Figure 20 illustrates the clustering using the single-linkage method across all sociodemographic data. In total, the 46 cities in the DACH region studied were assigned to 11 clusters in which similarities in the parameters were greatest. This figure also shows the population growth forecast up to 2035 for each.

Cluster 1 includes the high-growth cities in the former East German states (Leipzig, Dresden, and Erfurt), the Austrian urban centers of Graz and Linz, and several smaller major western German cities. These cities are similar with regard to the indicators outlined in chapters 2 to 4, but are extremely varied in terms of their growth forecasts. Whereas Kiel and Erfurt will grow only by around two percent by 2035, the forecast growth for the Austrian cities and rapidly expanding Leipzig ranges from 13 to 16 percent.

Cluster 2 comprises four Ruhr region cities and the Hanseatic city of Bremen. The Ruhr region is generally home to cities that tend to be weak structurally, which is a label that applies to Bremen as well. Although the four Ruhr region cities in this cluster are still the stronger ones in this region, they will all shrink with the exception of Essen.

The seven Class-A cities, the Austrian capital Vienna, the federal city Bonn, and Rhineland-Palatinate's capital Mainz form **Cluster 3**. These cities are characterized by stable, strong structures and are considered well established (except Berlin). All cities in this cluster will see population gains in the coming years. Nonetheless, there is a high degree of variation among them as well. Stuttgart will grow only slightly, whereas Frankfurt am Main will expand by more than ten percent up to 2035.

Other central German metropolitan areas, namely Magdeburg, Halle (Saale), and Chemnitz, make up **Cluster 4**. These cities have not yet reached the average level of Germany as a whole in many indicators and will grow at a slower pace than comparable cities in Cluster 1. They will trend toward stagnation up to 2035.

Cluster 5 includes Dortmund and Mönchengladbach, i.e., the cities in North Rhine-Westphalia that face similar challenges as cities in Cluster 2.

The cities in the Ruhr region that suffer the most from a weak structure are found in **Cluster 6**. This includes Gelsenkirchen, Duisburg, and Oberhausen. These three cities find themselves last in this report in terms of all indicators. They will also have to reckon with strong shrinkage up to 2035.

Clusters 7 and 8 comprise four cities that come in around the average in all categories and whose populations will only change moderately up to 2035.

Cluster 9 is made up of the administrative centers of Wiesbaden (capital of Hesse), Karlsruhe (home to the German Federal Constitutional Court) and Nuremberg (home to the German Federal Employment Furthermore, Agency). these cities and their surrounding areas are shaped by a stable economy dominated by small and mediumsized companies (Mittelstand) as well as some multinational corporations. These cities usually rank above the average in the indicators studied here and up to 2035 will follow a path of moderate growth.

Cluster 10 is made up of cities with active colleges and universities that are therefore home to many students. In the coming years, Münster and

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Freiburg im Breisgau, which are in this cluster, will benefit from the increasing education level of society.

A special role is played by the Swiss cities Zurich, Geneva, and Basel assigned to **Cluster 11**. Except for public debt, these three cities make up the top group in all indicators studied and in most respects stand well apart from the German and Austrian cities in this report. Due to their prosperity, these cities are extremely attractive locations for immigrants and up to the year 2035 will grow by at least 15 percent.



6. Conclusion

Because a place to live is a basic necessity, residential real estate is always required. Larger cities in particular have grown sharply in recent years and decades and therefore generally offer an attractive real estate market not only for rental apartments and condominiums, but also other uses such as retail, office, and manufacturing. The rise of cost for infrastructure, commuting to more rural residential areas (due to carbon taxes and subsequently rising energy and transportation costs), and housing costs will result in growing demand for housing in urban areas which are closer to employment opportunities. This will in turn drive population growth in cities.

The growth of cities and the corresponding population trends are not accidental and do not occur in a vacuum. Instead, many patterns and correlations have been identified by the research presented in the above chapters of this study. In order to help real estate investors make the right decisions on locations for investment, knowledge of these relationships and the associated analysis of upstream demographic, economic, and labor market factors is important.

Longer chains of effects are informative in this regard, and can in part provide key indicators even early on. A major driver of population trends is the labor market. People will continue to move to cities that offer them high-quality, well-paid jobs. An indicator of the attractiveness of a labor market is the typical job structure of the local area in addition to regional average incomes. Cities with a large share of knowledgeintensive services have above-average growth potential. Specialized, very welltrained professionals are needed for digital business models. Companies in the knowledge-intensive sector therefore seek out locations with the appropriate education and population profiles. Cities structured differently will tend to be forced to make structural changes or will experience emigration.

Real estate investors can use this information to do more than just align their investments with market situations arising in the future. They can anticipate trends early on by using the aforementioned socioeconomic conditions described for their strategies. In tight markets especially, taking into account structurally similar locations in other regions can often provide advantageous alternatives. In the cluster analyses provided here, for example, similarities were found not only among Germany's top seven cities, but also in cities in the Ruhr region, cities with major universities, and cities with a dominant service and administrative structure.

An interesting finding is that often clusters of similar locations are not formed based on regional proximity, but instead on their similarity in terms of fundamental demographic, economic, educational, and other structures.

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