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# Development perspectives for the City of Hamburg: Migration, commuting, and specialization

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with contributions from Henriette Bunde and Torben Zülsdorf

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## Implications of rising energy and transportation costs for future urban development: Part II - the regional view

### Development perspectives for the City of Hamburg: Migration, commuting, and specialization

Amelie Boje, Ingrid Ott, Silvia Stiller

With contributions from Henriette Bunde and Torben Zülsdorf

The subsequent report is Part II of a research project which is realized in cooperation with alstria office REIT AG.



(See HWWI policy papers 1-14 and 1-17 for the first part of the research project)

## Foreword to the HWWI studies

### Part II: The regional outlook: development prospects for the city of Hamburg

Demography, regional structure, economic activity – a host of different factors are shaping the development and future viability of German cities and conurbations. In order to be able to shape and support urban development successfully, it is necessary to look at and assess development trends. As one of the largest real estate investors in Hamburg, we must create lasting and stable real estate values. Consequently, the possible development scenarios for a city in the long term – and the future viability of Hamburg in particular – are of major importance for alstria office REIT-AG.

Energy prices and transport costs will be important factors influencing urban development in the future and will therefore have an effect on choice of location, investing activity and the building quality sought after in real estate.

Together with the Hamburg Institute of International Economics (HWWI) we have initiated a joint research project to examine the effects of rising transport costs on urban development. The analysis covers several different perspectives: starting with a global view, the project will go on to examine in stages the regional and then the local perspective. In addition, the effects of rising energy costs on the size of Hamburg, on the structure of its city centre and on its economic development will be analysed and trends for the city centre will be concluded from this analysis.

The recommended actions for the city of Hamburg derived from the results of this analysis are intended to show possible courses of development and are based on the guiding principle “Farsighted Growth”.

The examination of the regional outlook (Part II) as it relates to the development prospects for Hamburg has shown that the ongoing trend for people – in particular the highly qualified members of the workforce – to commute long distances to and from their place of work is counteracting rising transport costs. In this context, an efficient regional infrastructure network which is tied into the national transport network is of vital importance. Hamburg is already very active on this front. As a result, one would expect that the city will be able to attract even more well-qualified workers in the future. When developing the infrastructure network further, it is particularly important to pay attention to its efficiency: an efficient infrastructure will mitigate decentralisation tendencies and in particular any trend toward relocation of enterprises’ head offices to other German or European cities, while at the same time strengthening the potential for exploiting the benefits of agglomeration.

## 1. Introduction

Empirical findings highlight the coexistence of multiple large and small economic centers. Some of them are distinctively specialized while others (especially the metropolitan cities) are at the same time specialized in some sectors but diversified if one considers the entire production structures (see e. g. Einig and Zaspel (2008)). The arising structural change which implies a shift from the first and secondary sector to the tertiary sector also affects the emergence and the change of regional production structures.

Decreasing transportation and communication costs which could be observed during the last several decades are a central reason for intensified international division of labor. As a consequence there is a fast growing mobility of factors, not only between sectors but also between cities. They provide a wide range of both final goods and services and play a central role in modern economies. Another stylized fact is the emergence of increased regional specialization. The recent economic literature distinguishes *sectoral* specialization thereby referring to economic branches and *functional* specialization thereby describing regional separation of production and management activities of multi-unit firms.

It is a well known fact that each type of factor is not equally mobile but that mobility especially arises with respect to capital and the highly skilled labor force. Less qualified labor, in contrast, frequently remains quite immobile at a certain location. This suggests that mobility is linked to the existing production conditions and vice versa. Due to their variety of job and production opportunities large cities usually go hand in hand with higher commuting costs and housing rents. As a consequence, urban systems arise with strong economic interdependencies that are characterized by factor mobility between cities of different sizes as well as by inner-city mobility. Transportation costs affect these structures at various points.

Altogether the economic structure of cities and regions results as an outcome of the interaction between agglomeration forces on the one hand and spreading forces on the other hand and in this respect mobility costs play a crucial role. Concentration forces include the relationship between a firm's productivity and its proximity to other market players. This relationship is frequently industry specific, e.g. due to the sharing of information, the existence of a large pool of labor or specialized suppliers and may end up in the emergence of clusters. However, as an economy evolves, diversity also contributes to prosperity (see Jacobs (1961)). Spreading forces include transportation

costs and congestion, which both are at least to some extent a function of the city size. Congestion usually is a catch-all phrase for many drawbacks that are associated with urban agglomeration referring to limited physical space, heavy usage of roads, communication channels and storage facilities, limited local resources (e.g. clean water or air) and environmental pollution. According to the reasoning of the New Economic Geography, from an aggregate viewpoint high transportation costs act against concentration. As a consequence, if dispersion forces dominate, economic activity is equally spread across space.

However, if one takes a less aggregate perspective on the impact of transportation costs on a region's economic structure it becomes obvious that single branches are differently affected by (changing) transportation costs. Private individuals have to overcome the distance between home and working place. In this respect the level of transportation costs affects the outweighing between commuting versus migration. Increasing energy costs affect transportation costs thereby strengthening the spreading forces but also inducing several long-rung adjustment effects.

This paper disentangles the single effects of increasing transportation costs on the arising economic structure and applies them to the regional level of the metropolis of Hamburg. Therefore we begin with a general indexing of the metropolis Hamburg in the context of Germany's ten biggest cities according to some key economic variables. Of major importance are issues of migration, commuting as well as structural change and regional specialization. As will become apparent all these aspects are differently affected by (changing) transportation costs and it is finally the interplay of different forces that shapes the future structure and hence the economic success of the metropolis. From the viewpoint of private individuals, increasing transportation costs affect the outweighing of commuting from home to the working place versus migration. Focusing on the production site, not only direct but also indirect effects that arise from horizontal or vertical relationships gain importance.

The remainder of the paper is as follows. After a short look at some key characteristics of Germany's ten biggest cities in Section 2, Sections 3-5 detail general arguments arising in the context of migration, commuting and specialization which then are applied to the metropolis of Hamburg. Section 6 analyzes how changing transportation costs act in this complex context while Section 7 briefly concludes.

## 2. Taking stock: Some facts on Germany's ten biggest cities

Especially cities possess ideal starting positions to cope with the challenge of structural change towards knowledge-based societies. Nevertheless cities also compete against each other for the acquisition of firms and qualified labor which both are important sources for ongoing economic success. Since there is a strong interaction between demographic and economic development, the corresponding determinants have to be analyzed more precisely.

Table 1 gives a short overview on some economic characteristics of Germany's ten biggest cities and thus helps to rely on Hamburg's specificities in this context. The corresponding implications for future development will be detailed throughout the paper.

Table 1: Some characteristics of Germany's ten biggest cities

City	Population, 2007	Employees, 2006	Productivity (GDP per employee), in €, 2006	Forecast of balance of migration, 2006-2015	Commuting balance, 2008	Headquarters with 200 and more employees, in % of German total, 2008
Berlin	3 407 625	1 081 660	51 272	67 300	97 765	4.31
<b>Hamburg</b>	<b>1 761 711</b>	<b>797 514</b>	<b>80 013</b>	<b>20 700</b>	<b>213 187</b>	<b>3.22</b>
Munich	1 302 376	686 734	75 153	4 800	187 011	0.66
Cologne	991 882	456 912	65 627	6 500	131 991	1.93
Bremen	663 340	239 063	67 742	22 900	84 174	0.95
Frankfurt/ Main	655 338	487 634	84 578	-9 800	257 944	2.12
Stuttgart	595 775	346 433	72 885	8 400	146 132	1.31
Dortmund	587 195	194 965	63 833	-3 200	23 165	0.84
Essen	582 759	213 355	65 334	3 500	42 580	1.05
Düsseldorf	579 075	358 571	81 324	21 500	160 974	1.72

Sources: Arbeitskreis "Volkswirtschaftliche Gesamtrechnungen der Länder" (2008); Bundesagentur für Arbeit (2008, 2009); Statistische Ämter des Bundes und der Länder (2009); Bundesinstitut für Bau-, Stadt- und Raumforschung (2007); Calculations HWWI.

Although all considered cities possess the joint characteristic of being German metropolises it becomes obvious that there are some key differences. There is no clear-cut relation between the sheer size of a city as measured by population or employed persons on the one hand and productivity as measured by income per capita on the other hand. Additionally, the migration balance reveals that there is no automatism on size on the one hand and population growth on the other hand but that there are both growing and shrinking metropolitan cities. Considering the commuting balance the second biggest city, Hamburg, is ranked second while the biggest city, Berlin, is only

ranked seventh.. Moreover, during the last several decades, together with management functions, larger cities have also absorbed business service employment as well as headquarters. Altogether, some 18 % of the headquarters of firms with more than 200 employees are based in Germany's ten biggest cities while, as will become apparent throughout the paper, production is much more equally distributed in space. This supports the hypothesis that the internationally observable trend of spatial separation of production and management activities also applies for Germany (see Chandler (1977), Kim (1999) or Shilton and Stanley (1999)).

These findings highlight that although in the future all cities will face the same challenges, the corresponding implications will probably strongly vary even within the group of the metropolises. Hence it is worth to take a closer look at a single city – namely Hamburg in the context of this paper – to derive clear cut policy recommendations concerning future urban development.

### 3. Demographic change and migration

#### *Demographic change in Germany*

According to the forecast of the Bundesinstitut für Bau-, Stadt- und Raumforschung (2009) and Statistische Ämter des Bundes und der Länder (2008), population size and the number of persons at employable age will decrease in Germany during the next decades. Current age structures, fertility rates and migration balances differ across space. This overall development will affect single regions and cities differently but with the clear consequence that spatial disparities between urban and rural areas will increase. The same occurs to cities where already existing disparities will be strengthened: Cities not coping with structural change will become increasingly unattractive places for population, thereby resulting in a self-reinforcing process of economic downswing. Labor force is shrinking if the number of people at employable age goes down and if at the same time age specific employment rates stay constant. But then, as a consequence, labor force shortages thereby increase potentially impeding knowledge-based structural change.<sup>1</sup>

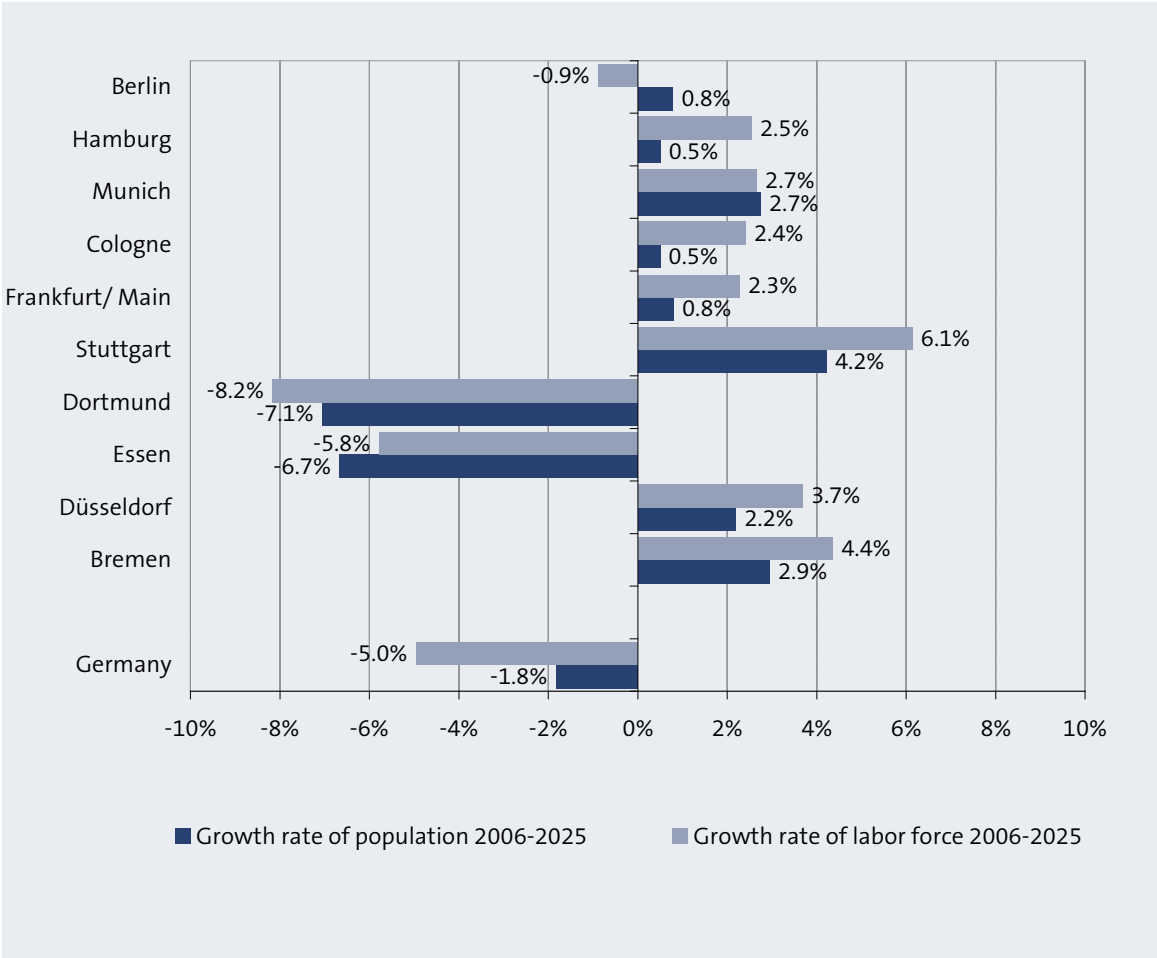
To avoid such a process, cities and regions try to attract people. Being successful in this competition is highly relevant since demographic conditions strongly impact on

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<sup>1</sup> These trends can already be observed in old-industrialized cities in the Ruhr-area and smaller cities in the Eastern part of Germany.

economic development perspectives. Population size increases as long as the sum of the natural population balance (number of birth minus number of death) and the migration balance is above zero.<sup>2</sup> Demography influences local demand for goods and services, infrastructure utilization (schools, cultural offerings, public transport) and the housing market. Additionally, the size of the labor force together with its age structure determine both quality and quantity of labor supply, an important argument for the firms' choice of location. Attractive conditions on labor markets (i.e. a large number of jobs, low unemployment rates and high wages) are also important pull factors relevant to the location decision of private individuals (see Burkert et al. 2008). With respect to all these arguments cities have advantages over rural regions. Nevertheless, a short look at Table 1 already highlights that there arise quite large differences even within the group of Germany's top ten.

Figure 1: Forecast of population and labor force development, 2006 to 2025



Sources: Bundesinstitut für Bau-, Stadt- und Raumforschung (2009); HWWI.

<sup>2</sup> Note that the term migration refers to people moving from one city to another, independent of their national background.

Figure 1 exhibits estimations regarding both the population and the labor force growth until 2025. The national demographic development is characterized by a population decline at a rate of 1.9 % and an even higher shrinkage of persons at employable age by 5.0 %. This is the immediate consequence of the ongoing demographic change. Figure 1 also highlights that the expected development strongly varies across the cities although, with the exception of Berlin, both population and labor force growth go in the same direction. Dortmund and Essen are expected to continue shrinking. Compared to the other top-ten cities, these are economically less successful (see Bräuninger and Stiller (2008) and Table 1) and therefore less attractive for immigrants. Highest growth rates until 2025 are expected to arise in the cities Bremen, Düsseldorf and Stuttgart.

Currently, Hamburg is one of Germany's economically most prosperous cities and exhibits above average growth rates of population.<sup>3</sup> In Hamburg, fertility rates have been distinctly below the replacement level in Hamburg since the 1970s causing an increasing deficit in the natural population balance. Recent demographic forecasts for Hamburg are based on the assumption that fertility rates will not recover in the near future. Hence, Hamburg will only go on growing if the city attracts migrants which compensate for the negative natural population balance. Immigration has already substantially influenced Hamburg's demographic development during the last decades: Net migration amounted to 137 400 persons in the time period from 1991 to 2005. In 2007, altogether 1 761 711 inhabitants were living in Hamburg which has been 92 954 people more than in the year 1991.

In spite of its already big size Hamburg's migration balance is still expected to grow until 2025. Altogether, the size of the population will increase at a rate of 0.5 % and the labor force will grow at a rate of 2.5 %. These developments are clearly in opposition to the overall demographic development in Germany which is characterized by a population decline at a rate of 1.8 % and shrinkage of the persons at employable age by 5.0 %.

To summarize: In the future all cities are likewise confronted with the challenges of demographic change. Since current age structures, fertility rates and migration balances differ across space the overall development will affect the cities differently. In

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<sup>3</sup> But notice that being successful in the future not only depends on traditional "hard" location factors. Migration decisions, especially of highly qualified people, increasingly depend on so-called "soft location factors", like quality of life, family friendliness and attractive offerings concerning the housing market, education system and public infrastructure.

order to cope with these challenges cities compete for qualified labor. If labor force shortages arise, they will impede knowledge-based structural change, a trend that can already be observed in old industrialized cities in the Ruhr area or in smaller cities in East-Germany. The mentioned forecasts in Figure 1 highlight that even Germany's top-ten cities are not equally successful in this respect. For rural areas it is even harder to succeed in this competition and it is widely expected that already existing disparities will be reinforced by demographic change.

#### 4. Commuting

It is obvious that people have to commute to and from work if there exists a spatial distance between housing and working locations. According to urban location theory, it is assumed that rational individuals compare the benefits with the pecuniary and non-pecuniary costs and make utility maximizing location decisions on residential and working place as well as mode of transportation to commute between those places. Commuting behavior depends upon several individual characteristics, such as job and income opportunities, gender, age and working position. Costs of commuting are compensated by benefits from lower rent and/ or higher wages. Private costs of commuting are not only pecuniary, such money spent on commuting, but also involve non-pecuniary costs that involve time spent commuting and further arise from environmental conditions causing negative mental and physical reactions (see Stutzer and Frey (2007) or Schulze (2009) for a recent overview). Commuting costs depend on city size, metropolitan density and development of infrastructure as well as mode of transportation chosen; these costs increase the greater the distance, time and money spent on commuting. Benefits arising from commuting are that more attractive working and living conditions can be chosen than those available in close proximity. People will only accept higher costs of commuting if they are compensated by additional financial benefits gained from higher wages and/ or lower rent or by additional non-pecuniary benefits arising from more favorable working and/ or living environments. In reaction to different individual or external factors, people might change their decision to commute over various time horizons. In the context of increasing energy prices especially the decision between commuting and migration gains importance.

It is a stylized fact that cities in general attract more in-commuters than rural areas do. This can be explained by use of gravitation models, where the extent of commuting

between two locations is explained as a function of the population in the origin region, the supply of employment in the destination region and the distance between the two regions. With increased distance, less commuting takes place (Alonso (1978)). This explains why the proportion of employed people living in neighboring municipalities of large cities and commuting there decreases the farther the municipality is located from the city.

Einig and Pütz (2007) show that high-order centers are the most important centers of employment and therefore both their commuter belts as well as commuting distances have been increasing allowing people to take advantage of better employment possibilities. However, in some regions there has been a trend of increased reverse commuting; the rise in commuting distances of people living in urban areas and working in suburban areas is a sign of increased work opportunities in suburban areas.

<sup>4</sup> Suburbanization might lead to a polycentric structure of a city with multiple employment centers in the environs of the city. A high density of employment opportunities in the city centre usually leads to congestion which increases travel times. Nonetheless, it is possible that the urban infrastructure is of better quality and quantity due to high demand relative to the suburban one; this might cause more people in urban areas and large municipalities to use public transportation as a means to travel to and from work compared to people in rural areas and smaller municipalities.

As argued before qualified labor is more mobile than unskilled workers. This does not only apply considering the migration decision of people. Additionally, the willingness to increase commuting distance or time is greater, the higher the qualification, income and working position. Haas and Hamann (2008) found that the highest percentage of commuters is highly qualified people, particularly in western parts of Germany; low skilled people commute less frequently. Especially centers of employment offer more job opportunities for (highly) skilled people than for low skilled people. Considering the mode of transport, people with higher income and/or a higher working position travel longer distances, use less public transport and more frequently motorized transport (Breiholz et al. 2005).

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<sup>4</sup> See also the reasoning in the context of specialization below.

### *Recent developments of commuting in Germany*

Commuting behavior differs across different German regions because it is determined by the spatial structure and the available infrastructure. Whereas intra-municipality commuters live disproportionately in larger municipalities, inter-municipality commuters live mostly in smaller ones (Breiholz et al. (2005)). There has been a steady increase in the relative number of commuters from 31 % in 1995 to 39 % of all employed people in 2005 despite a decrease in the absolute number of commuters from 7.018 million people to 6.751 million people due to a general fall in employment (Haas and Hamann (2008)). Mobility behavior reveals that 21 % of all daily ways of persons in Germany and 24 % of all passenger-kilometers are covered in the purpose of travelling to and from work as well as to and from education/ training (Follmer et al. (2004)). The recent trend in Germany is an increase in the number of people commuting long distances and a decrease in the number of people travelling short distances to and from their workplace.<sup>5</sup> However, despite a change in the distance commuted, the time spent commuting to and from work has remained nearly constant.<sup>6</sup>

The mode of transportation chosen depends upon the distance and intra- or inter-municipality commuting. According to the Bundesministerium für Verkehr, Bau und Stadtentwicklung (2006), the degree of motorization decreases the larger the population in a municipality due to a better supply of alternative modes, congestion caused by high traffic and scarce parking space. Breiholz et al. (2005) find that the most popular mode of transportation for all distances travelled is the car; it is used by nearly 50 % of all commuters travelling less than 10 km and living in larger municipalities and by more than 80 % of all workers commuting more than 10km or living in smaller municipalities. Public transportation is used relatively independently of commuting distance by approximately 15 % of all commuters. Nearly one third of commuters walks or rides by bike if they live less than 10 km away from their work. The choice of mode of transportation is different amongst male and female commuters and changes with age. On average a higher percentage of female than male commuters in Germany walk, ride bicycles and use public transport and fewer women than men commute by car. The

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<sup>5</sup> Breiholz et al. (2005) find that between 1996 and 2004 the number of people travelling 25 to 50 km to work has increased from 14 % to 17 % whereas the number of workers commuting less than 10km has decreased from 56 % to 52 %.

<sup>6</sup> The daily commuting time is less than 30 minutes for 77 % of workers and between 30 and 60 minutes for 18 % of them and the fraction of workers commuting these times has changed by only 1 % between 1996 and 2004 (Breiholz et al. 2005).

use of public transport decreases with age amongst male workers; it is most popular amongst male and female people aged between 15 and 25 years. The popularity of the car as a means of commuting increases up to people aged between 35 and 45 and thereafter decreases. Walking and riding bicycles decreases up to workers aged between 25 and 35 and thereafter increases.

### *Recent developments of commuting in Hamburg*

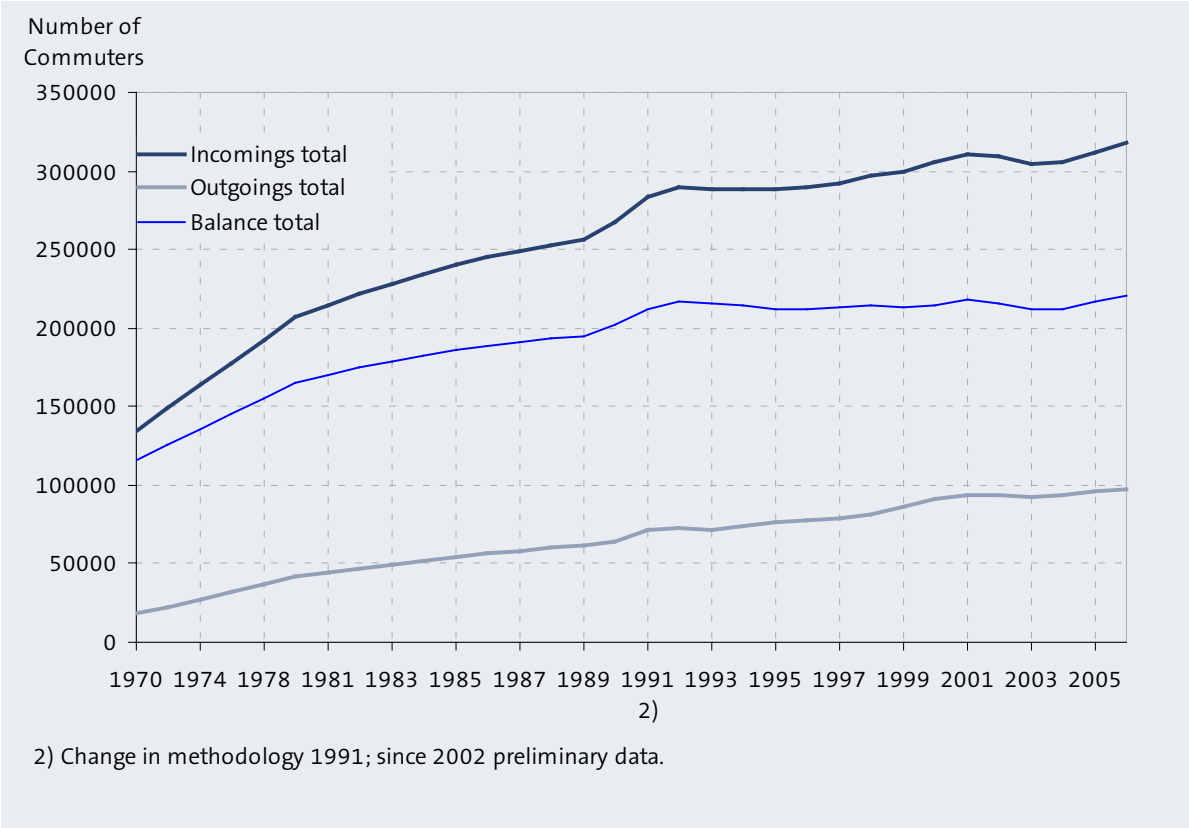
The city of Hamburg is a centre of employment where employment opportunities have steadily increased over time. There is a positive difference between the number of employees working there, which amounted to 797 514 people in 2008, and the number of employees living there, which was 584 327 people in 2008 (Bundesagentur für Arbeit 2008); consequently the number of in-commuters is greater than the number of out-commuters and the commuting balance amounts to 213 187 (see also Table 1).<sup>7</sup>

Contrary to the Germany-wide trend of an overall decrease of commuters, the trend in Hamburg is positive (see Figure 2). From 1970 to 2006 the number of in-commuters in Hamburg more than doubled from 134 500 in 1970 to 318 500 in 2006 whereas the number of out-commuters amounted to 97 900 in 2006 which is more than five times the number of out-commuters in 1970 that was 18 200 (Statistisches Amt für Hamburg und Schleswig-Holstein (2006)).

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<sup>7</sup> Hamburg is mostly considered as a mono-centric city with many in-commuters from suburban areas into the city centre which is due to the fact that the fraction of work opportunities relative to employees is larger in the urban area relative to the suburban area of Hamburg.

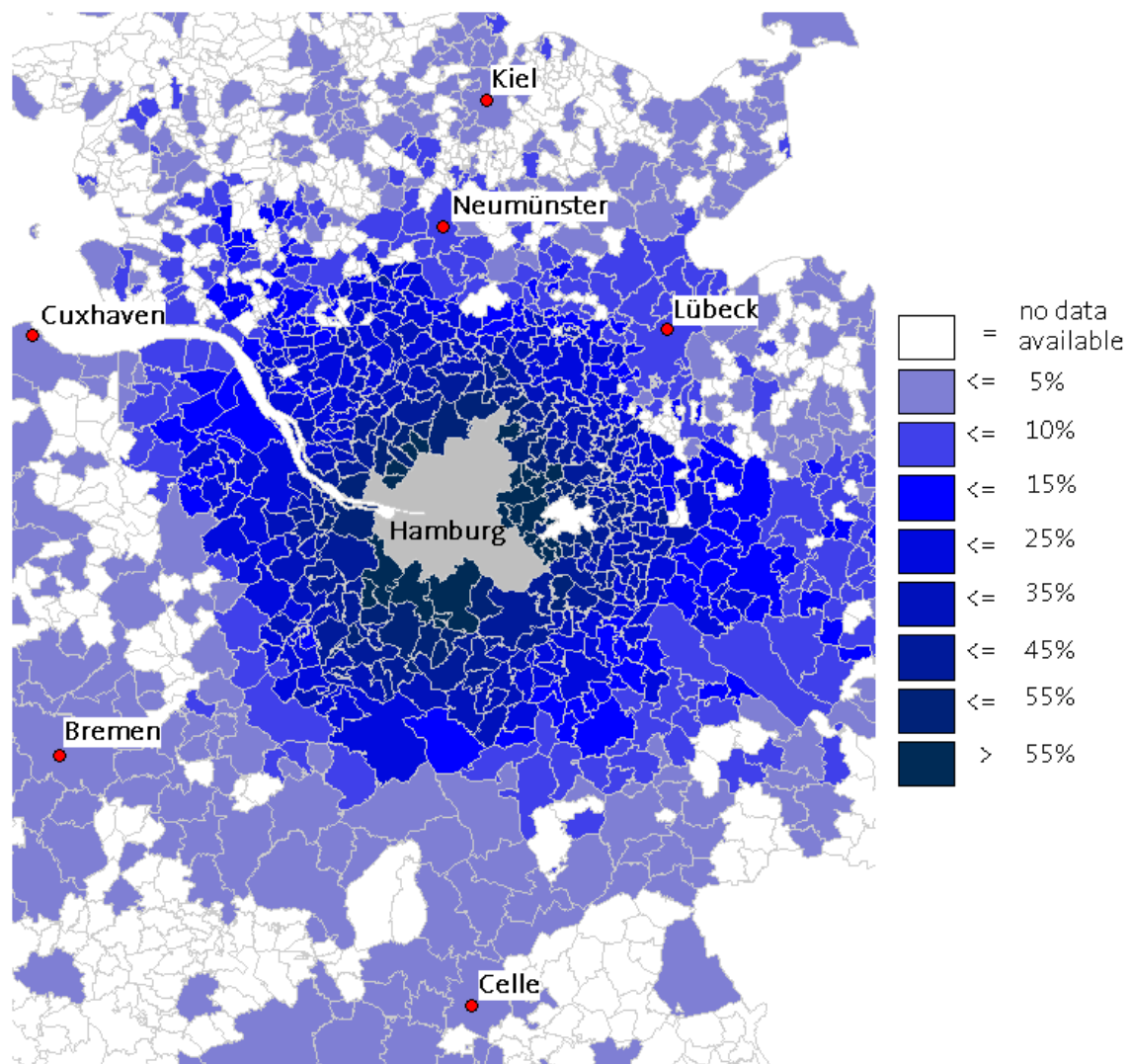
Figure 2: Commuting in Hamburg 1970-2006



Sources: Bundesagentur für Arbeit (2006); Statistisches Amt für Hamburg und Schleswig-Holstein (2006).

A study conducted by Klupp and Schweiger (2006) found that purchasing prices and living costs for privately owned properties in Hamburg decrease the farther the location is distanced from the city centre. However, pecuniary commuting costs to and from the city centre vary extremely depending upon the distance and mode of transport chosen. It was found that using public transport is financially less expensive than commuting by car, however, the additional time costs of using the former rather than the latter means of transport increase considerably the more distanced the housing is located away from the city centre.

Figure 3: Proportion of employed persons of neighboring municipalities commuting to Hamburg in 2008

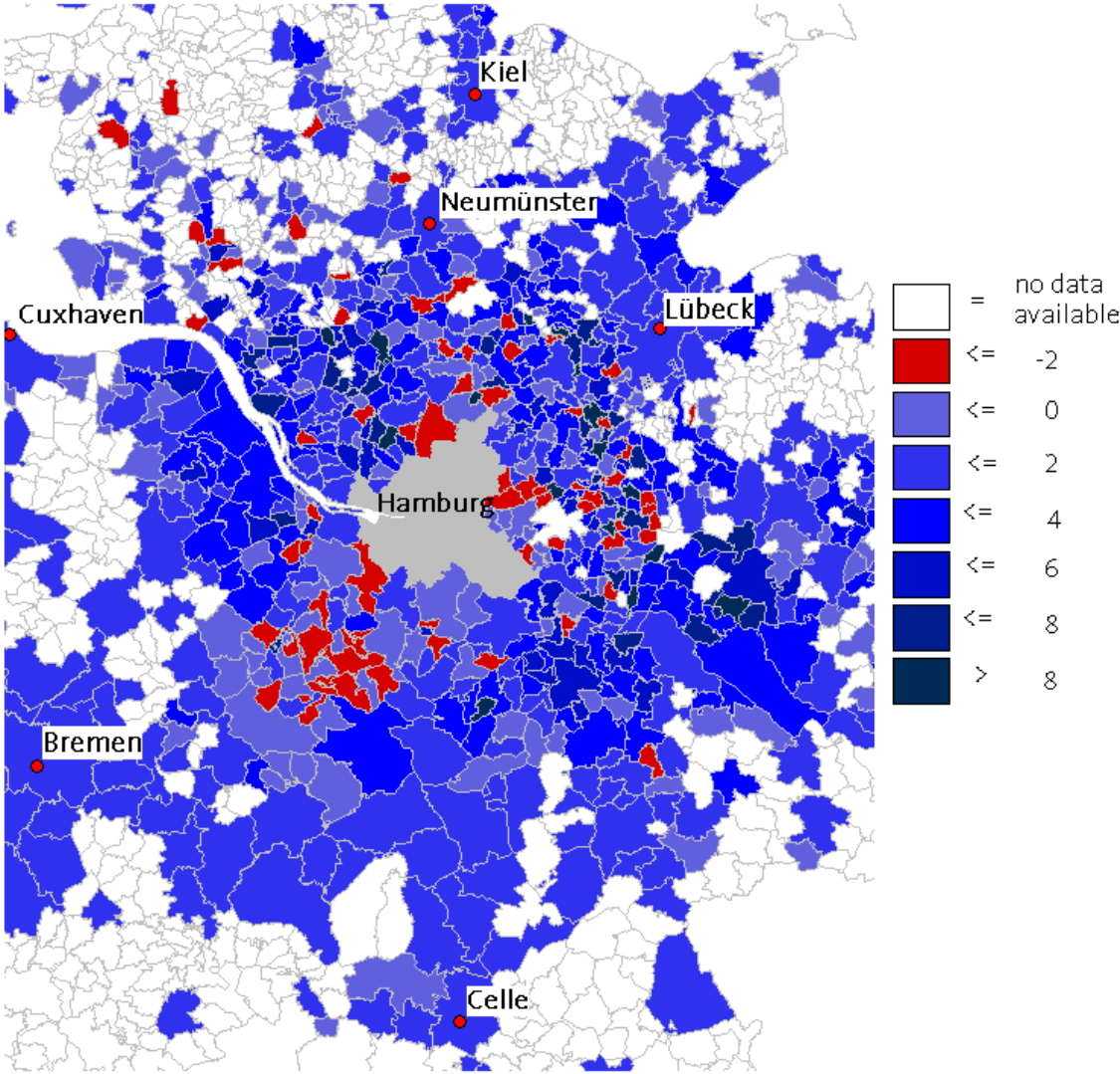


Sources: Bundesagentur für Arbeit (2009); HWWI.

Figure 3 depicts the percentage of employed people that live in neighboring municipalities and commute to Hamburg. It shows that the closer a municipality is located to Hamburg the larger is the fraction of people commuting to Hamburg; people living further away from the city are less frequently commuting long distances.<sup>8</sup>

<sup>8</sup> Commuters are employed persons whose municipality of residence is different from the municipality where the work is located. § 28a Abs.3 SGB IV requires employers to report the address of an employee when registering that employee for national insurance. The law does not specify whether the employer has to report the principal residence or secondary residence. Furthermore, the data does not make specifications on the frequency of commuting. This has to be considered when evaluating long-distance flows of commuters. Additionally, the information could be biased due to misreporting of the firm number; especially when there are branches of one firm located in different municipalities it is possible

Figure 4: Change in proportion of employed persons of neighboring municipalities commuting to Hamburg 1999-2008 (in percentage points)



Sources: Bundesagentur für Arbeit (2009); HWWI.

The change in the proportion of employed persons living in neighboring municipalities and commuting to Hamburg from 1999 to 2008 is depicted in Figure 4. Whereas in most municipalities there has been an increase in in-commuters to Hamburg, in some municipalities the opposite has occurred which might be due to an increase in employment opportunities in suburban areas. It is possible that more firms have relocated to suburban areas to take advantage of lower rents and more available space than in urban areas. Consequently, more people might have considered changing the

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that employees of all branches are reported working at the main branch; see also the reasoning in the context of functional specialization (Bundesagentur für Arbeit 2008).

location of employment and choosing a job closer to their housing location in order to benefit from lower commuting costs.

## 5. Structural change and regional specialization

### *Specialization in Germany*

Since the beginning of the Industrial Revolution the ongoing structural change from the first to the secondary sector and nowadays to the service sector is an undoubted fact. There is broad consensus among economists that this trend will persist during the next several decades thereby amplifying the transition towards knowledge-based societies. Most importantly, in Germany, the service sector is assumed to be the driving force for the development of both employment and productivity of the entire economy – a situation which already could be observed during the last 15 years (see e.g. Bräuninger et al. (2008)). It was accompanied by strong regional specialization thereby relying on two dimensions: *sectoral* specialization refers to a certain branch (e.g., in Hamburg, among others aerospace industries or life sciences) while *functional* specialization arises as a consequence of organizational change and relies on the regional separation of management and production activities of multi-unit firms. This may be motivated as follows: Many manufacturing firms in large cities conduct their business activities at their headquarters located in the central business district (CBD), while their manufacturing plants remain in the suburbs (see Duranton and Puga (2005)). In addition many business firms (e.g. investment banks) in large cities of developed countries have recently moved a part of their office activities to the suburbs. Some activities such as face-to-face communication with other business firms are conducted at the front-office located in the CBD of big cities while the rest of their activities, e.g. back-office activities such as legal and accounting, billing, planning, or employee training, are located in the suburbs (see Ota and Fujita (1993)).<sup>9</sup> Generally a spread of activities across space arises if the relationship between proximity and productivity is not so pronounced as to allow for a compensation of high concentration costs of big cities. Hence the wages paid are not high enough to outweigh congestion costs arising in big cities. This, on its end, also affects the location decision of integrated

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<sup>9</sup> The spatial segregation of a firm's management and production activities is strongly due to the recent development of telecommunication technologies (including computer-related communication technologies).

firms. Usually sectoral and functional specializations go hand in hand, a fact that illustratively will be shown for the metropolis of Hamburg.<sup>10</sup>

Figure 5a: Employed persons in the field industry, without construction, 2007

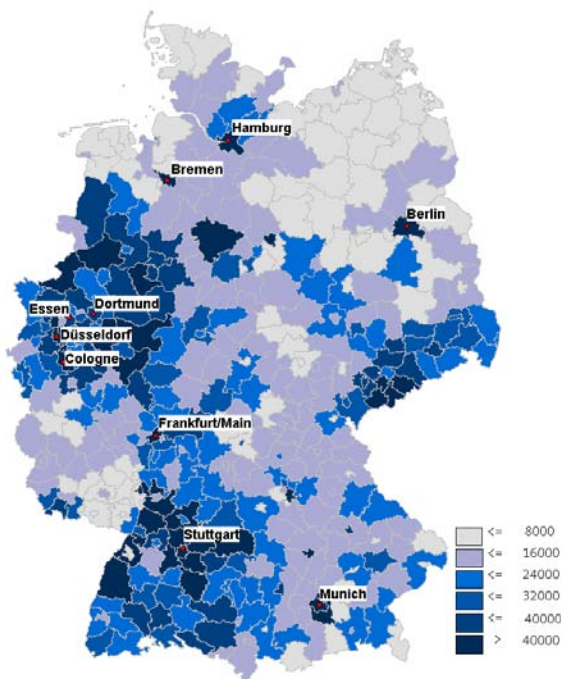
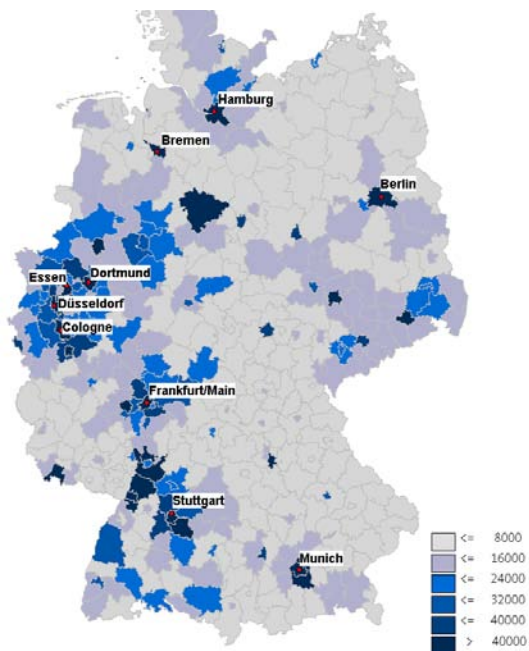


Figure 5b: Employed persons in the field financial intermediation, real estate, renting and business activities, 2007



Sources: Statistische Ämter des Bundes und der Länder (2009); HWWI.

A rather rough measure for the trend to functional specialization is provided if one looks at Germany’s regional distribution of employment in the two fields “industry, without construction” where employment is much more equally distributed across space and “financial intermediation, real estate, renting and business activities” which is mostly concentrated in the big cities (see Figures 5a and 5b).<sup>11</sup>

<sup>10</sup> The following discussion refers to the statistical classification of economic activities in the European Community and the corresponding ISIC (international standard industrial classification) classes. According to this classification the sectors cover altogether six fields each of them including up to 28 branches. See [http://www.fifoost.org/database/nace/nace-en\\_2002c.php](http://www.fifoost.org/database/nace/nace-en_2002c.php) for details (retrieved on August 19, 2009).

<sup>11</sup> Note that although not depicted within Figures 5a and 5b the same reasoning of decentralization applies for back-office activities of firms.

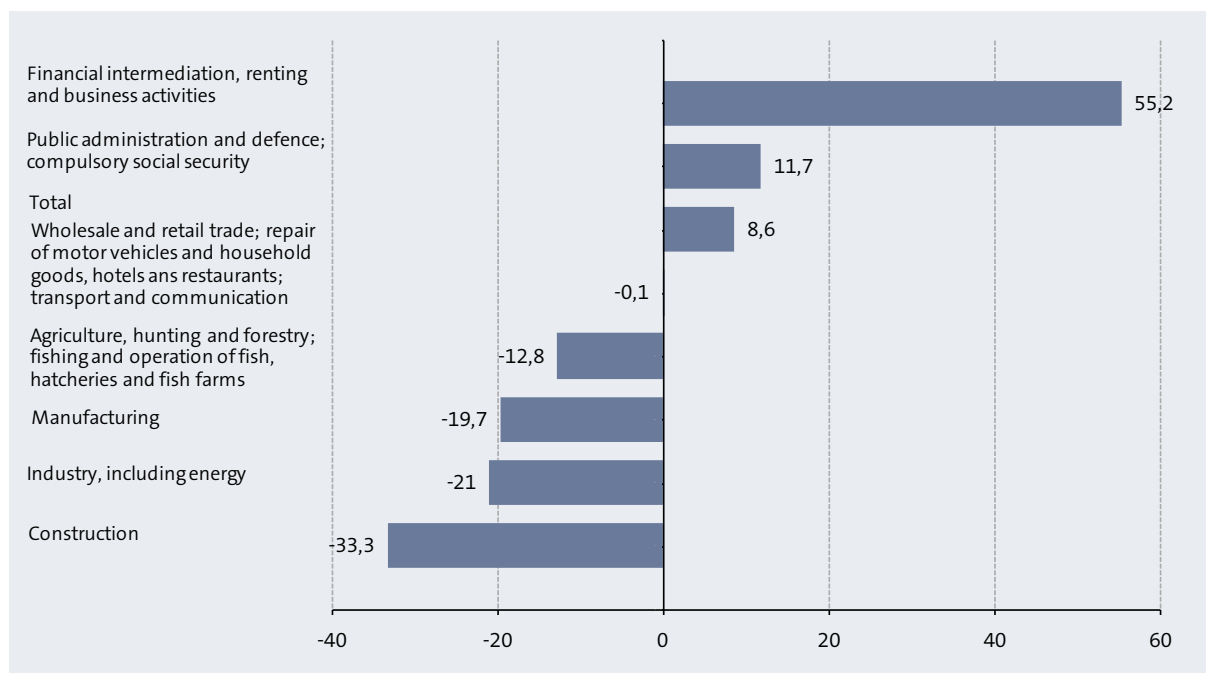
The production plants move away from the big city centers and cluster in suburbs or smaller cities in which the benefits from joint acquisition of intermediates dominate, thereby leading to sectoral specialization. Centralization in the financial branch is mostly the result of the benefits of sharing business service suppliers across firms and sectors thereby also providing job opportunities for services that are closely related to other firm's activities. Hence headquarters from different sectors and business services cluster in a few large cities while there arise suburbs and specialized smaller cities that attract those activities where localization externalities are weaker.

### *Specialization in Hamburg*

Although Hamburg possesses several important industrial enterprises, its most significant economic activities for value added are in the service sector that covers the three fields "financial intermediation" (2008: 38.3 %), "wholesale and retail" (27 %) and "private and public services" (18.1 %). Hence altogether the service sector accounts for 83.4 % of the overall gross value added. In contrast, the industrial sector accounts for 14.2 % while the economic importance of the primary sector with a contribution of 0.2 % is negligible (Statistikamt Nord (2009)). This distribution of economic activity reflects Hamburg's employment changes of the last decade as displayed in Figure 6.

During the period 1996-2008 overall employment in Hamburg increased by 8.6 %. Figure 6 illustrates that the overall increase was solely driven by the tertiary sector with a contribution of 55.2 % of the fields "financial intermediation, real estate, renting and business activities", followed by "public administration and defence" with +11.7 % while "wholesale and retail trade" remained nearly constant. In contrast, the first and secondary sectors were shrinking.

Figure 6: Employment change in Hamburg, 1999-2008



Sources: Statistisches Amt für Hamburg und Schleswig-Holstein (2009); Calculations HWWI.

Taking a closer look at the single branches within a field highlights that they contribute quite differently to value creation of a single sector thereby setting ground for sectoral specialization patterns.

### *Specialization in Hamburg: an even closer look*

For Hamburg it turns out what is also discussed within the literature of urban economics that nowadays it is both, sectoral and functional specializations, that shape the economic character of the metropolis. The major importance of the service sector for Hamburg has been pointed out before. But taking a closer look, the picture within each sector becomes more differentiated and illustrates that Hamburg also possesses some specialization advantages within the field “industry, without construction” and hence in the secondary sector. As will be detailed below the corresponding branches display strong complementarities to strengths in the tertiary sector.

A usual measure for regional specialization is the so called location index. It is an index that measures the ratio between national and regional employment shares of any considered branch and may also be interpreted as an indicator for either the importance of proximity and productivity or first-nature geography advantages. A

value of unity reflects an average occurrence and hence no specialization. The more the value exceeds unity, the more specialized is Hamburg while the contrary applies for values below unity. Table 2 summarizes the national employment share of Hamburg as well as the location quotient for several branches to identify regional specialization advantages more precisely. For the sake of simplicity, Table 2 only shows those branches that refer to a location quotient that exceeds unity.

Table 2 summarizes all but two branches that account for the sector of “financial intermediation, real estate, renting and business activities”.<sup>12</sup> It is obvious that Hamburg has strong specialization advantages in this field with location quotients exceeding unity in nearly all branches. Remarkable are the branches “advertising and market research” as well as “insurance” with each of them accounting for a national wide employment share of nearly 10 % and high location quotients exceeding 3.

Considering “wholesale and retail trade” the special role of the Hamburg harbor becomes apparent.<sup>13</sup> It accounts for a national employment share of 33.86 % and a remarkable location quotient of 11.66 thus highlighting the outstanding specialization of Hamburg. It is followed – but with great distance - by various parts of the entertainment branch.

Considering “public and private services” slightly specialized and non-specialized branches are nearly equilibrated.<sup>14</sup> Remarkable is the branch of creative activities with a share of employees of 5.96 % and a location quotient of 2.05.

The field “industry, without construction” covers 28 branches where Hamburg only possesses specialization advantages in four of them. Considering the metropolis, the label “manufacture of other transport equipment” is mainly composed of aerospace industry and ship building. The strong specialization in the field of “coke and refined petroleum” also is based on Hamburg as a harbor city. This illustrates the complementarity of the branch to the harbor in the service sector, e. g. water transport. In the fields of “construction” and “agriculture” Hamburg clearly possesses no specialization advantages.

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<sup>12</sup> Only two branches have a location quotient that falls below unity: R&D (0.95) and veterinary activities (0.43).

<sup>13</sup> Altogether the field “wholesale and retail trade” is composed of 16 branches from with 13 of them possessing a location quotient that exceeds unity.

<sup>14</sup>The field “public and private services” includes 14 branches; 8 of them possess a location quotient that falls below unity.

Table 2: Specialization patterns in Hamburg 2008

<b>Tertiary Sector</b>		
<b>Financial intermediation, real estate, renting and business activities</b>	<b>Share of employees in %</b>	<b>Location quotient</b>
Advertising and market research	10,32	3,55
Insurance, reinsurance and pension funding, except compulsory social security	9,51	3,28
Other professional, scientific and technical activities	7,66	2,64
Rental and leasing activities	5,74	1,98
Travel agency, tour operator and other reservation service and related activities	5,71	1,97
Activities of head offices; management consultancy activities	5,06	1,74
Legal and accounting activities	4,7	1,62
Security and investigation activities	4,54	1,56
Real estate activities	4,42	1,52
Architectural and engineering activities; technical testing and analysis	4,25	1,46
Services to buildings and landscape activities	4,18	1,44
Activities auxiliary to financial services and insurance activities	4,16	1,43
Office administrative, office support and other business support activities	3,92	1,35
Employment activities	3,86	1,33
Financial service activities, except insurance and pension funding	3,68	1,27
<b>Wholesale and retail trade; repair of motor vehicles and household goods, hotels and restaurants; transport and communication</b>		
Water transport	33,86	11,66
Motion picture, video and television programme production, sound recording and music publishing activities	8,52	2,93
Information service activities	8,26	2,85
Publishing activities	7,62	2,62
Programming and broadcasting activities	7,6	2,62
Warehousing and support activities for transportation	6,07	2,09
Computer programming, consultancy and related activities	4,9	1,69
Air transport	4,56	1,57
Wholesale trade, except of motor vehicles and motorcycles	4,31	1,49
Food and beverage service activities	3,63	1,25
Land transport and transport via pipelines	3,52	1,21
Postal and courier activities	3,15	1,08
Telecommunications	3,13	1,08
<b>Public and private services</b>		
Creative, arts and entertainment activities	5,96	2,05
Libraries, archives, museums and other cultural activities	4,66	1,6
Gambling and betting activities	4,27	1,47
Repair of computers and personal and household goods	3,96	1,36
Sports activities and amusement and recreation activities	3,5	1,2
Activities of households as employers of domestic personnel	3,16	1,09
<b>Secondary Sector</b>		
<b>Industry, including energy</b>		
Manufacture of other transport equipment	16,94	5,83
Manufacture of coke and refined petroleum products	13,76	4,74
Manufacture of tobacco products	6,28	2,16
Sewerage	5,01	1,72

Sources: Bundesagentur für Arbeit (2008); Calculations HWWI.

## 6. Overall impact of rising transportation costs

Ongoing prosperity of a city is determined by the local economic structure and the continuous availability of qualified labor. Since (especially highly qualified) labor is mobile, there is a dual inducement between job creation on the one hand and the quality of the local labor markets on the other hand. In this respect cities and regions compete against each other for qualified labor. It is also broadly accepted that successful cities of the future are those where the service sector continuously evolves over time and where additionally the secondary sector remains playing a significant role.

According to the reasoning in the NEG increasing transportation costs generally act as a dispersion force thereby fostering an overall decentralization of economic activity. Put differently, existing economic structures only persist if increasing transportation costs are compensated by a respective increase in localization economies. At a less aggregate view it becomes obvious that (changing) transportation costs have several impacts: private individuals outweigh the decision to commute against migration thereby bringing together living and working places whereas firms consider the strengths of localized externalities (proximity – productivity; formally measured by the location quotient) and relay them to the extent of transportation costs.

### *Assessment of Hamburg*

*Commuting vs. migration:* Consumers react to an increase in pecuniary transport costs in different ways. There is an income and a substitution effect of rising pecuniary transport costs on choice of residential as well as job location and thus on commuting. On the one hand, commuters might prefer driving less during their free-time, switching to a less expensive mode of transportation or changing consumption of other goods to allocate a larger fraction of their income to mobility if commuting is considered as a good that is hardly substitutable in the short-run. Motzkus (2007) argues that in reaction to increasing petrol prices the demand for petrol decreases substantially initially but increases again as consumers find cost-efficient adaptations eventually. This becomes more difficult the more expensive petrol prices get and the less disposable income consumers have. The more than 50 % increase in petrol prices since 1999 lead consumers to substitute cars with petrol engines for cars with diesel engines because diesel is less expensive and one can drive longer distances with the same amount of fuel, to carpool and drive less during their free-time. It is possible that

people earning low income and living in rural areas and thus usually commuting longer distances are relatively more affected by increased energy costs than people with higher income and lower commuting costs; this is due to petrol costs being more expensive in rural areas and there is less possibility of substitution of means of transportation. The commuting pattern of this group of commuters might be more elastic and thus they might be more induced to change their behavior. It is possible that in reaction to rising costs of mobility, public transportation and non-motorized travel becomes more popular as this is financially cheaper than driving by car.

On the other hand, the increase in cost for travel to and from work causes a decrease in disposable income and consequently people might change place of work and/ or housing to decrease the distance between both locations. Transaction costs restrict residential and job mobility and thus migration might only take place in the long-run. Tight labor as well as housing markets and the spatial structure might make it difficult to minimize distance between working and living locations.

However, if the increase in pecuniary transport costs is compensated by an increase in real income, consumers might not be induced to change their behavior. Oelze et al. (2006) find that within the last 30 years the disproportional increase in prices for transportation has been compensated by an increase in real income so that the fraction of real expenses for transportation has remained constant relative to consumption expenditures of private households. In addition, improvements in technology and in the quality and quantity of the available infrastructure can make transportation faster, causing a decrease in time costs of commuting for which consumers might be willing to accept higher pecuniary costs.

Factors like international accessibility are still relevant for urban development. There are advantages of location in Hamburg which not only result from its harbor that allows access to the North Sea and the Baltic Sea but also from excellent road, rail and air connections allowing high mobility of goods and persons.

The project “Leitbild Hamburg: Wachsen mit Weitsicht” by the Senate of Hamburg aspires to substantially develop the harbor city in Hamburg to create a dynamic, international and growing metropolis (Hamburg Marketing GmbH (2009a)). It is the largest urban development project in Europe. The HafenCity Hamburg is being built in the former harbor covering an area of 1.57 million square meters and will increase the city center by 40 % within the next 25 years. It is projected that until 2020 40 000 people will work and 12 000 people will live in the harbor city. A prerequisite to achieve

a sustainable urban development of the harbor city is to keep pace with the increased demand for transport infrastructure (Hamburg Marketing GmbH (2009b)). Apart from the necessity to build new parking spaces, roads and bridges or to extend existing ones, an efficient public transportation system needs to be developed. Nowadays, there is frequent bus transport to and from the harbor city but only two stops of the underground lines U1 and U3 are located in close proximity to the harbor city. Therefore, two new underground stops will be built until the end of 2011 and a new underground line, U4, will improve the connection of the harbor city by public transportation by 2012 so that the harbor city will be reached from the central station within three minutes. It is expected that 35 000 passengers will use the new underground line U4 per day in 2012 (Borrée (2009)). Despite a change in transportation prices, this urban development project might induce more people to commute into Hamburg and the harbor city in order to take advantage of employment possibilities. Especially the increase in the quantity and quality of the public transportation system might lead workers to use it more frequently or substitute it for driving by car.

*Specialization:* Higher transportation costs affect the existing economic structures via various channels thereby also impacting on sectoral and/ or functional specialization. It becomes apparent that both the extent of localization economies and the role of transportation costs strongly differ across the considered branches (see Table 2). As argued before, a high location quotient is an indication for the emergence of localization externalities, for first-nature geography advantages so that the natural geographical conditions additionally gain importance. This applies clearly to Hamburg's specificities as a harbor city.

In the field "financial services, real estate and business activities" first-nature geography does not matter but these specializations are clearly driven by localization externalities. In most of the branches mentioned, especially ICT affects the firm's organization thereby supporting the argumentation carried out before in the context of functional specialization. Whether or not transportation costs affect firms' location choice depends upon the importance of face-to-face contacts. In addition to the movement of goods, changing transportation costs also gain relevance with respect to transportation of people. In this context, overall transport costs are composed of travel time costs and physical transportation costs. Since an overall increase in transport costs acts as a dispersion force, a region might compensate the spreading tendencies arising

through higher physical transport costs by a reduction of time costs. A precondition is increasing the efficiency of the transport network. In Hamburg this argument gains special importance in the branch of “activities of head offices; management and consulting activities” while e.g. other related activities in the context of functional specialization such as “legal and accounting activities” or “office administrative, office support and other business support activities” will be less or not at all affected by changing transportation costs. Consequently, the recommendation for the city of Hamburg is to proceed in enhancing the efficiency of its public infrastructure, e.g. by better access to the airport or the railway network to reduce the firms’ time costs.

More important, though not the only concentration force, are first-nature geography advantages for all activities in the field of “wholesale and retail trade” which are related to the harbor (see Table 2). Due to complementarities, specialization not only arises in the branch of “water transport” but also concerning “warehousing”, “air transport” and “wholesale trade”. Note that the Hamburg harbor is in strong competition to other European harbors and the entire cost of transportation of goods is composed of the costs for water and inland transport. Due to its geographical location in the midlands and its connection to the highly-productive German infrastructure network, Hamburg has an advantage over other European harbors since the majority of transportation costs arises in the context of transporting goods beyond the sea. But this advantage might become less important if, as a consequence of increasing energy prices, the ratio between land costs and overall transportation costs decreases. Given this, the overall efficiency of the harbor and the corresponding hinterland infrastructure becomes important. Additionally, there arise indirect effects on those branches that are related to the harbor. Taking a look at Table 2, it becomes obvious that this applies to nearly all branches mentioned there in the field of “wholesale and retail trade”. Above, also in the secondary sector, especially “manufacture of other transport equipment” (ship and plane building) and “manufacture of coke and refined petroleum products” is closely linked to the existence and the efficiency of the harbor. However, these branches are mainly dominated by first-order geography arguments or political reasons hence changing transportation costs probably will not affect the industrial composition there.

Considering the field “public and private services” the corresponding branches are not dominated by transportation costs. Hence any changes of them will not impact on the mentioned field.

## 7. Conclusions

The economic landscape is the outcome of the interaction between concentration and spreading force. At an aggregate level, high transportation forces act as dispersion force thereby fostering spatial distribution of economic activity. A less aggregate perspective reveals some more differentiated conclusions, thereby not only focusing on the transportation of goods but also of people. Individuals react to strong increases of transportation costs in the sense that they outweigh commuting from remote regions versus migration to locations that are closer to their working places. This applies mostly to highly qualified labor that is expected to move to the city centers. Their business is mostly characterized by high benefits from face-to-face contacts and at the same time their high wages allow for paying higher housing prices that arise in the city centers. Less qualified people earn lower wages and are less mobile. Hence, whenever it is possible a firm will try to separate its management and production as well as back-office activities. The former become more centralized in some few big cities while the latter ones move into suburban regions or to smaller cities.

The ongoing trend especially of highly qualified people to more long distance commuting is expected to be dampened if transportation costs increase. Overall travel costs may remain constant if higher costs for physical transportation are compensated by lower travel time. In this context a region's endowment with efficient infrastructure and its linking to interregional transport networks are of major importance. In this respect Hamburg already is quite active and consequently is expected to attract even more qualified labor. The migration forecast is positive while commuting, although an overall increase can be observed, also displays some characteristics of the emergence of suburbs in the south-western part of the center (Süderelbe region). Given the emergence of well functioning suburbs, this extends the source of prosperity for the entire metropolitan region which thus becomes even more attractive.

Considering Hamburg's specialization patterns and the interdependencies between the secondary and tertiary sector, the situation of Hamburg is quite promising. The industrial basis is provided by the harbor and the aerospace industry. In these latter cases there are also strong complementarities between secondary and tertiary sector. Additionally there are pronounced specialization advantages in most branches of the service sector. A closer look reveals that the associated fields and branches are quite

differently affected by transportation costs. At the same time there are no first-nature geography advantages that these activities will necessarily remain in Hamburg

The policy recommendation would hence also be to continuously develop the infrastructure network to keep it efficient and so to attract even more firms and hence employees in those branches where the relationship between proximity and productivity is quite distinct. This allows for a reduction of time costs and acts in contra to the spreading forces that are induced by higher transportation costs thereby avoiding migration especially of firm's headquarter to other German or European metropolises.

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## Annex

Share of employees concerning national wide employment in the respective economic branch and location quotient, 2008

Economic branch	Hamburg		Frankfurt on the Main		Düsseldorf		Munich		Cologne		Stuttgart		Berlin	
	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient
*) No data available														
MANUFACTURING														
Manufacture of beverages	1.23	0.42	1.32	0.74	0.52	0.39	2.14	0.85	2.24	1.34	0.74	0.59	1.03	0.26
Manufacture of tobacco products	6.28	2.16					*	*					18.10	4.59
Printing and reprod. of rec. media	2.10	0.72	0.92	0.52	0.82	0.63	3.24	1.30	1.93	1.16	0.84	0.67	3.46	0.88
Manufacture of coke and ref. Petro. prod.	13.76	4.74	*	*	0.27	0.20	2.46	0.98	9.55	5.74	*	*	*	*
Manufacture of chem. a. chem. Prod.	2.47	0.85	2.27	1.28	3.60	2.76	0.97	0.39	0.87	0.52	0.65	0.52	0.71	0.18
Manufacture of basic pharma. prod. a. pharma. Prep.	0.83	0.29	0.34	0.19	*	*	1.23	0.49	0.96	0.58	*	*	7.82	1.99
Manufacture of computer, electronic and optical products	2.77	0.95	1.27	0.72	0.43	0.33	7.03	2.81	0.46	0.28	0.60	0.47	2.49	0.63
Manufacture of electrical equipment	0.24	0.08	0.48	0.27	0.42	0.32	0.98	0.39	0.47	0.28	0.65	0.51	4.58	1.16
Manufacture of motor vehicles, trailers and	0.39	0.14	0.47	0.27	1.09	0.84	4.86	1.94	2.16	1.30	4.24	3.36	0.64	0.16
Manufacture of other transport equipment	16.94	5.83	3.27	1.84	0.55	0.42	0.24	0.10	0.20	0.12	0.13	0.11	2.67	0.68
ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY														
Electricity, gas, steam	2.24	0.77	1.74	0.98	1.38	1.06	3.84	1.54	1.74	1.04	1.22	0.97	3.23	0.82
WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES														
Water collection,	*	*	*	*	*	*	*	*			*	*	11.80	3.00
Sewerage	5.01	1.72	0.20	0.11	*	*	3.59	1.43	0.23	0.14	0.28	0.22	0.91	0.23
Waste coll., treat. a. disp. act.; materials recovery	2.88	0.99	1.23	0.69	0.95	0.72	1.50	0.60	2.27	1.37	0.10	0.08	5.40	1.37
WHOLESALE AND RETAIL TRADE; REPAIR OF MOTOR VEHICLES AND MOTORCYCLES														
Wholesale trade, exc. of motor vehicles and motorcycles	4.31	1.49	1.26	0.71	2.09	1.60	2.10	0.84	2.19	1.32	1.27	1.01	2.37	0.60
Retail trade, except of motor vehicles and	2.89	0.99	1.09	0.62	1.13	0.87	2.17	0.87	1.59	0.96	0.81	0.64	3.99	1.01

Sources: Statistisches Bundesamt (2009), calculations HWWI.

Share of employees concerning national wide employment in the respective economic branch and location quotient, 2008.

Economic branch	Hamburg		Frankfurt on the Main		Düsseldorf		Munich		Cologne		Stuttgart		Berlin	
	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient
TRANSPORTATION AND STORAGE														
Land trans. a. trans. via pipelines	3.52	1.21	1.70	0.96	1.20	0.92	2.15	0.86	2.14	1.29	1.19	0.94	6.84	1.74
Water transport	33.86	11.66	*	*	0.23	0.18			1.10	0.66	0.11	0.09	1.71	0.43
Air transport	4.56	1.57	44.66	25.15	5.78	4.43	0.52	0.21	9.15	5.50	0.77	0.61	4.66	1.18
Warehousing and sup. act. for transp.	6.07	2.09	4.08	2.30	1.45	1.11	0.65	0.26	1.35	0.81	0.43	0.34	1.91	0.48
Postal and courier activities	3.15	1.08	2.77	1.56	0.93	0.71	1.78	0.71	2.07	1.25	0.82	0.65	4.29	1.09
ACCOMMODATION AND FOOD SERVICE ACTIVITIES														
Accommodation	2.66	0.92	2.12	1.19	1.51	1.16	3.32	1.33	1.75	1.05	1.02	0.81	5.47	1.39
Food and beverage service activities	3.63	1.25	2.67	1.50	1.69	1.29	3.46	1.38	2.15	1.29	1.13	0.90	6.42	1.63
INFORMATION AND COMMUNICATION														
Publishing activities	7.62	2.62	2.98	1.68	1.79	1.37	8.04	3.22	2.41	1.45	3.97	3.14	6.02	1.53
Motion pict., vid. a. television prog. prod., sound rec. a. music publ. act.	8.52	2.93	1.88	1.06	1.84	1.41	9.44	3.77	12.36	7.43	0.79	0.63	17.21	4.37
Prog. a. broadc. act.	7.60	2.62	4.49	2.53	0.83	0.63	7.31	2.92	16.15	9.70	0.31	0.25	8.39	2.13
Telecommunications	3.13	1.08	3.32	1.87	6.64	5.08	3.31	1.32	4.22	2.54	2.38	1.88	9.05	2.30
Computer prog., cons. a. related act.	4.90	1.69	2.96	1.67	1.99	1.52	5.06	2.02	2.60	1.56	3.03	2.40	5.35	1.36
Information serv. act.	8.26	2.85	5.57	3.13	2.17	1.66	5.10	2.04	2.19	1.31	1.08	0.86	4.94	1.25
FINANCIAL AND INSURANCE ACTIVITIES														
Fin. serv. act., exc. Insurance a. pension funding	3.68	1.27	8.71	4.90	3.00	2.29	4.33	1.73	2.02	1.21	2.40	1.91	3.06	0.78
Insurance, reins. a. pension funding, exc. comp. soc. sec.	9.51	3.28	3.11	1.75	4.74	3.63	10.64	4.25	11.39	6.84	4.97	3.94	2.67	0.68
Activities aux. to fin. serv. a. insurance act.	4.16	1.43	7.18	4.04	2.18	1.67	5.99	2.40	3.79	2.28	3.97	3.15	6.09	1.55
REAL ESTATE ACTIVITIES														
Real estate activities	4.42	1.52	4.87	2.74	2.53	1.94	4.24	1.70	2.18	1.31	1.59	1.26	11.73	2.98
PROFESSIONAL, SCIENTIFIC AND TECHNICAL ACTIVITIES														
Legal and accounting activities	4.70	1.62	4.00	2.25	3.39	2.60	5.20	2.08	2.51	1.51	2.18	1.73	5.06	1.28
Act. of head offices; man. cons. act.	5.06	1.74	5.39	3.03	3.73	2.86	5.55	2.22	3.46	2.08	6.58	5.21	6.73	1.71
Architec. a. enginee. act.; techn. test. a. analysis	4.25	1.46	1.40	0.79	1.29	0.99	4.02	1.61	2.34	1.40	2.57	2.04	4.86	1.23
Scientific research and development	2.76	0.95	5.51	3.10	0.56	0.43	5.06	2.02	1.79	1.08	1.60	1.27	8.34	2.12
Advertising and market research	10.32	3.55	5.63	3.17	6.38	4.89	6.28	2.51	4.36	2.62	2.31	1.83	6.21	1.58
Other profes., scient. a. techn. act.	7.66	2.64	1.67	0.94	2.41	1.85	6.51	2.60	3.91	2.35	1.62	1.29	6.53	1.66

Sources: Statistisches Bundesamt (2009), calculations HWWI.

## Share of employees concerning national wide employment in the respective economic branch and location quotient, 2008

Other profes., scient. a. techn. act.	7,66	2,64	1,67	0,94	2,41	1,85	6,51	2,60	3,91	2,35	1,62	1,29	6,53	1,66	
Economic branch	Hamburg	Frankfurt on the Main	Düsseldorf	Munich	Cologne	Stuttgart	Berlin								
	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	Share of employees in %	Location-quotient	
ADMINISTRATIVE AND SUPPORT SERVICE ACTIVITIES															
Rental a. leasing act.	5,74	1,98	4,24	2,39	2,41	1,85	3,19	1,27	2,72	1,64	0,99	0,79	5,20	1,32	
Employment act.	3,86	1,33	1,99	1,12	1,47	1,12	2,49	1,00	1,99	1,19	1,18	0,93	4,16	1,06	
Travel agency, tour operator and other res. serv. a. rel. act.	5,71	1,97	5,70	3,21	2,61	2,00	6,03	2,41	3,60	2,16	1,55	1,23	5,99	1,52	
Security and investigation act.	4,54	1,56	7,62	4,29	3,15	2,41	3,24	1,29	2,98	1,79	1,46	1,16	8,37	2,13	
Services to buildings and landscape act.	4,18	1,44	2,36	1,33	1,50	1,15	3,50	1,40	1,60	0,96	1,24	0,98	6,41	1,63	
Office admin., office support a. other business support act.	3,92	1,35	2,03	1,14	2,21	1,69	2,16	0,86	2,18	1,31	0,90	0,71	6,32	1,60	
PUBLIC ADMINISTRATION AND DEFENCE; COMPULSORY SOCIAL SECURITY															
Public admin. a. defence; comp. social security	2,37	0,82	1,07	0,60	1,56	1,19	2,19	0,88	1,39	0,84	1,39	1,10	4,91	1,25	
EDUCATION															
Education	2,12	0,73	1,27	0,72	0,66	0,50	2,52	1,01	1,54	0,93	1,22	0,97	6,20	1,57	
HUMAN HEALTH AND SOCIAL WORK ACTIVITIES															
Human health	2,41	0,83	1,03	0,58	1,00	0,77	2,36	0,94	1,44	0,86	0,99	0,78	4,25	1,08	
Social work act. without accom.	2,42	0,83	2,09	1,18	1,22	0,93	2,52	1,01	1,83	1,10	1,61	1,28	8,08	2,05	
ARTS, ENTERTAINMENT AND RECREATION															
Creative, arts and entertainment	5,96	2,05	2,21	1,24	1,83	1,40	6,38	2,55	3,01	1,81	3,28	2,60	10,90	2,77	
Libraries, archives, museums and other cult. act.	4,66	1,60	3,20	1,80	0,52	0,40	4,20	1,68	1,69	1,01	3,24	2,56	13,85	3,52	
Gambling and betting act.	4,27	1,47	0,83	0,47	0,84	0,65	1,75	0,70	1,80	1,08	1,59	1,26	3,80	0,97	
Sports act. a. amusement a. recreation act.	3,50	1,20	1,69	0,95	0,72	0,55	2,72	1,09	2,11	1,27	0,93	0,74	5,61	1,42	
OTHER SERVICE ACTIVITIES															
Activities of membership organisations	2,53	0,87	2,53	1,43	1,92	1,47	5,22	2,09	2,07	1,25	2,60	2,06	7,33	1,86	
Repair of comp. a. pers. a. household goods	3,96	1,36	1,84	1,03	0,71	0,54	1,80	0,72	1,72	1,04	0,82	0,65	3,12	0,79	
Other personal service act.	2,48	0,86	0,70	0,39	0,76	0,58	1,68	0,67	1,16	0,70	1,19	0,94	4,72	1,20	
ACTIVITIES OF HOUSEHOLDS AS EMPLOYERS; UNDIFFERENTIATED GOODS- AND SERVICES-PRODUCING ACTIVITIES OF HOUSEHOLDS FOR OWN USE															
Act. of househ. as employers of dom. personnel	3,16	1,09	1,55	0,87	1,45	1,11	4,75	1,90	2,13	1,28	1,06	0,84	3,32	0,84	
Undifferentiated goods- and serv.-prod. act. of priv. househ. for own use	*	*	*	*			*	*	*	*	*	*	7,14	1,81	
ACTIVITIES OF EXTRATERRITORIAL ORGANISATIONS AND BODIES															
	0,63	0,22	2,12	1,19	0,69	0,53	1,48	0,59	0,08	0,05	1,78	1,41	5,79	1,47	

Sources: Statistisches Bundesamt (2009), calculations HWWI.

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