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# Do smaller labor market entry cohorts really reduce German unemployment?

Alfred Garloff<sup>1</sup>, Carsten Pohl<sup>2</sup> and Norbert Schanne<sup>3</sup>

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## Abstract

In this paper we study the effect of smaller labor market entry cohorts on (un)employment in Western Germany. From a theoretical point of view, decreasing cohort sizes may on the one hand reduce unemployment due to “inverse cohort crowding” or on the other hand increase unemployment if companies reduce jobs disproportionately. Consequently, the actual effect of cohort shrinking on (un)employment is an empirical question. For our investigation we use regional population data from the Federal Statistical Office of Germany and (un)employment data from the Federal Employment Agency and the IAB for the years 1978 to 2008. We account for the likely endogeneity of cohort size due to migration of the (young) workforce, using lagged births as instruments. In addition, we allow for spatial autocorrelation across Western German regions. Our empirical analysis provides ambiguous news for the (Western) German labor market: small entry cohorts are indeed likely to decrease the overall unemployment rate and thus to improve the situation of job seekers. However, with regard to the employment rate our preferred model suggests that employment is negatively affected by a decrease in the youth share.

Keywords: Demographic change, cohort size, labor market.

JEL Classification: C23, J21, J82, R23

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## 1. Introduction

In this paper we analyze the consequences of smaller labor market entry cohorts on (un)employment in Western Germany. Given the sharp decline in birth rates since the beginning of the 1970s the baby boom generation was followed by a baby bust generation. In addition, Germany will also experience significant demographic changes in the decades ahead. Not only will the population shrink by almost 17% until 2050 but there will also be a dramatic shift in the age distribution due to the low fertility rate and increased life expectation. Since Germany faces a relatively high unemployment rate (7.8% in 2008) the question whether the shrinkage and the aging of the working population will have any effects on the labor market is of high interest. In order to study the effect of cohort size on (un)employment we use regional population data from the Federal Statistical Office of Germany and social security and unemployment data from the federal employment agency and the IAB for the years 1978 to 2008.

As a main result, we find that in accordance with most of the public discussion demographic change in Germany will improve the situation of the job seekers and decrease the overall unemployment rate. Put it differently, a ten percent decrease in the youth share results in an 8% decrease of the unemployment rate. This result is robust for various econometric specifications. With regard to the employment rate our preferred model suggests that the employment rate is negatively affected by a decrease in the youth share. Controlling for spatial autocorrelation in the analysis turns out to be important.

The remainder of this paper is organized as follows. In section 2 we briefly review the related literature on labor market effects of demographic change. In section 3 the used data sets and descriptive statistics on demographic change, unemployment and employment in western Germany is provided. In section 4 we present our econometric specifications as well as the empirical findings for the relationship between the youth share in the labor force and (un)employment. Finally, section 5 concludes the paper.

## 2. Related Literature

The consequences of demographic change have been studied before. There are numerous investigations that analyze the effect of relative cohort sizes on earnings (e.g. Berger, 1985; Easterlin et al., 1990; Katz and Murphy, 1992, Macunovich, 1999 and Sapozhnikov and Triest, 2007). Other papers study population aging and the associated changes in the demand for goods (Lührmann, 2005) that eventually translate into employment effects across different sectors in the economy (e.g. Macunovich, 1998 and Thiessen, Kholodilin and Siliverstovs, 2008). In another strand of the literature the relationship between the labor market entry of the baby boom generation and retirement behaviour of the elderly is investigated (e.g. Macunovich, 2009a,b).

In our paper we are interested in the relationship between labor market entry cohort size and (un)employment in order to find out how demographic change affects the labor market. This strand of literature can be grouped into two categories which either focus on direct or indirect impacts. The direct effect of cohort size on (un)employment is simply the result of changes in the composition of the workforce given that weighted age-sex-specific (un)employment rates are used to calculate the overall (un)employment rate. In particular, since the aggregate (un)employment rate is the product of age-sex-specific weights and age-sex-specific (un)employment rates (participation rates) changes in the overall (un)employment rate may stem from two sources. First, cohort sizes may increase or decrease, i.e. the age-sex-specific weights may change, or second, age-sex-specific (un)employment rates may vary across years.

Perry (1970) as well as Flaim (1979, 1990) provided weighted unemployment rates for the United States in order to explain how changes in the labor force may alter the unemployment rate. In particular, Flaim (1979) shows that the actual unemployment rate was almost 0.8 percentage points higher in the period 1957 to 1977 only due to changes in the population composition as well as in labor force participation. Distinguishing the compositional component from the participation effect Flaim (1979) shows that the latter effect only plays a minor role for changes in the aggregate unemployment rate.

Shimer (1998) also uses age-sex-specific fractions of the workforce as weights for the calculation of the aggregated unemployment rates in the United States. According to his

calculations the unemployment rate has risen by 0.74 percentage points in the period 1954 to 1978 and has decreased by 0.73 basis points from 1978 to 1997 due to the cohort structure. As an explanation for this development Shimer (1998) suggests that the aging of the baby boomer explains to a large extent the decline of the unemployment rate since 1979. Combining these pure age effects with changes in labor force participation (of women) shows that the overall impact is somewhat higher, i.e. a 0.96 percentage point increase of the unemployment rate in the period from 1954 to 1978 and a decrease by 0.80 percentage points between 1978 and 1997.

Apart from the direct effect discussed so far the majority of the literature has focused on a second (indirect) effect. According to the cohort crowding hypothesis workers are supposed to perform worse (better) on the labor market if they belong to bigger (smaller) cohorts. Easterlin (1961) was among the first to note that the relative size of the birth cohort is negatively correlated to labor market opportunities. The underlying idea is that a bigger size of the entry cohort may entail an increase in unemployment due to higher competition among the workforce. Korenman and Neumark (2000) provide a good overview on this literature and also perform a cross-national analysis on cohort crowding and youth labor markets. They use OECD data for fifteen countries for the years 1970 to 1994 and conduct their investigation on a national level.<sup>4</sup> Overall, they find evidence of cohort crowding on youth unemployment but only a very small effect on youth employment.

Whereas the argument of cohort crowding on unemployment seems straightforward at first glance this hypothesis has been challenged by recent empirical works. Shimer (2001) uses state-level data for the United States from 1978 to 1996 and shows that the labor market entry of large cohorts entails positive effects not only for the same birth cohorts but also for prime aged workers, i.e. a decrease in unemployment and an increase in employment, respectively. As an explanation for this empirical finding Shimer (2001) provides a theoretical model showing that companies have an incentive to create more jobs in regions with flexible, vivid labor markets. However, vivid labor markets can be found in regions with large labor market entry cohorts. In the model, this outweighs the effect of a larger workforce and thus overall unemployment declines. Foote (2007) augments the investigation conducted by Shimer (2001) by controlling for spatial autocorrelation in the state-level data and by extending the

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<sup>4</sup> The following countries are considered in this investigation: Australia, Canada, Japan, United States and 11 European countries (Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden and United Kingdom).

sample period until the year 2005. In contrast to Shimer (2001) but in line with the cohort crowding literature, Foote (2007) confirms that the youth share effect (cohort crowding) on unemployment is positive.

The relationship between cohort size and unemployment has been studied extensively for the United States whereas it has been neglected in Europe for a long time. Nordström-Skans (2005) performs a similar analysis as Shimer (2001) for the Swedish labor market. He finds that young workers benefit from belonging to a large cohort. However, in contrast to the study for the United States Nordström-Skans (2005) does not find any positive effects for older workers in Sweden.

Given the demographic change in Germany it comes as a surprise that the consequences on the labor market have been ignored for a long time. A notable exception is Zimmermann (1991) who investigates cohort effects on unemployment in Western Germany using national data for the period 1967 to 1987. The results of his investigation suggest that in the long-run young cohorts do not experience higher unemployment rates if their cohort size is relatively large. However, in the short-run Zimmermann (1991) finds a positive impact of relative cohort size and relative cohort age on unemployment. Börsch-Supan (2003) does not explicitly investigate the relationship between aging and unemployment. The focus is on the question how demographic change affects the age structure of the labor supply and demand as well as how these structural changes impact the productivity of the German economy. Börsch-Supan (2003) shows that shifts in the age structure will affect the demand for goods that eventually translate into employment effects. In addition, he suggests that labor productivity has to increase in order to mitigate the negative effect of population aging and shrinking on domestic production. Ochsen (2009) concentrates on the question how the aging labor force in Germany affects unemployment. In contrast to Zimmermann (1991) he uses regional data for 343 German districts for the years 2000 and 2001 and explicitly controls for spatial autocorrelation. Ochsen (2009) shows that aging of the workforce and a declining share of younger job seekers increases the regional unemployment rates. In particular, although both job destruction and job creation are positively affected by the aging workforce, unemployment increases due to decreasing shares of young job seekers in local and surrounding areas.

Since demographic change proceeds quite differently in the German regions we exploit regional variation in the age structure of the (un)employed as well as regional differences in population development. In addition to the above mentioned studies for Germany, we have access to an extensive panel data set which not only contains all 327 western German districts as our cross-section unit but also a long time period, i.e. the years (1978) 1994 to 2008. This rich data set enables us to perform various econometric specifications such as ordinary least squares (OLS), instrumental variable (IV) techniques and regression models where spatial autocorrelation across districts are taken into consideration. Moreover, in contrast to previous German studies we are able to explicitly study the effect of smaller labor market entry cohorts on (un)employment. The baby boomer generation was followed by a baby bust generation – as we will see in the following section – given that the size of the young labor market entry cohorts has declined significantly since the beginning of the 1990s.<sup>5</sup>

Hence, our paper contributes to the existing literature in two important aspects. First, we will show how declining cohort sizes affect the labor market. These effects do not have to be necessarily symmetric to cohort crowding. From a theoretical point of view smaller cohort sizes may on the one hand have beneficial effects on the labor market if there is a reduction in unemployment and/or an increase in employment. On the other hand, decreasing cohort sizes may also entail negative effects on the labor market if companies anticipate declining birth cohorts and cut jobs disproportionately. Second, the results of our analysis are particularly important for (European) countries in which demographic change is characterized by a declining and aging population. In this respect, our paper completes the picture for Germany where the relationship between demographic change and the labor market has been neglected.

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<sup>5</sup> In Germany the baby boomer generation is considered to be born during the mid 1950s until the mid 1960s implying that these individuals have entered the labor market (predominantly) during the mid 1970s until the mid 1980s. In the United States the baby boom has already started one decade ahead, i.e. from the mid 1940s until the mid 1960s.

### 3. Data and descriptive statistics

For our empirical investigation we use alternative data sources. Since our unit of analysis is the regional level we use as cross-section observations on all western German districts, i.e. the 327 NUTS-3 regions (the “Landkreise” and “Kreisfreie Städte”).<sup>6</sup> With regard to the population we have data from the Federal Statistical Office of Germany that enables us to distinguish between seven mutually exclusive age-groups, i.e. individuals aged 15-24, 25-29, 30-34, 35-39, 40-49, 50-59 and 60-64. The population data comprises the time period from 1978 to 2008. In Table 1 we provide descriptive statistics on the development of the alternative age groups of the population in order to demonstrate how demographic change in Germany affects the age composition and the total number of the labor force.

**Table 1: Development of age-groups in Western Germany 1978-2008**

	15-24	25-29	30-34	35-39	40-49	50-59	60-64	15-64
<b>1978</b>	9,489,338	4,354,821	3.843,088	4,848,006	8,480,682	7,297,659	2,397,826	40,711,420
<b>2008</b>	7,951,673	4,186,660	4.019,540	4,809,276	11,748,538	9,243,874	3,553,995	45,513,556
<b>2008-1978</b>	-1,537,665	-168,161	176,452	-38,730	3,267,856	1,946,215	1,156,169	4,802,136
<b>in %</b>	-16.2	-3.9	4.6	-0.8	38.5	26.7	48.2	11.8

Source: Federal Statistical Office of Germany, own calculations.

Overall, the population aged 15-64 has increased by almost 4.8 million in the period 1978 to 2008, i.e. an increase by almost 12%. However, the development has been quite heterogeneous across the age groups. From 1978 to 2008 the number of young individuals aged 15-24 has decreased by over 1.5 million persons (-16%) whereas we find a relatively small reduction in the age group 25-29 (-3.9%). In 2008 the majority of the baby-boom generation is already older than 40 which in turn explains the strong increase of these age groups. For instance, there has been an increase by 38.5% in the group of individuals aged 40-49, i.e. in absolute numbers this class has gained 3.3 million individuals. In addition, the number of individuals in the age group 50-59 has risen by almost 27% which is also mainly due to the baby-boomer generation. The strongest (relative) increase can be observed in the age group 60-64 (+48.2%). In contrast to the aforementioned age-groups this increase cannot

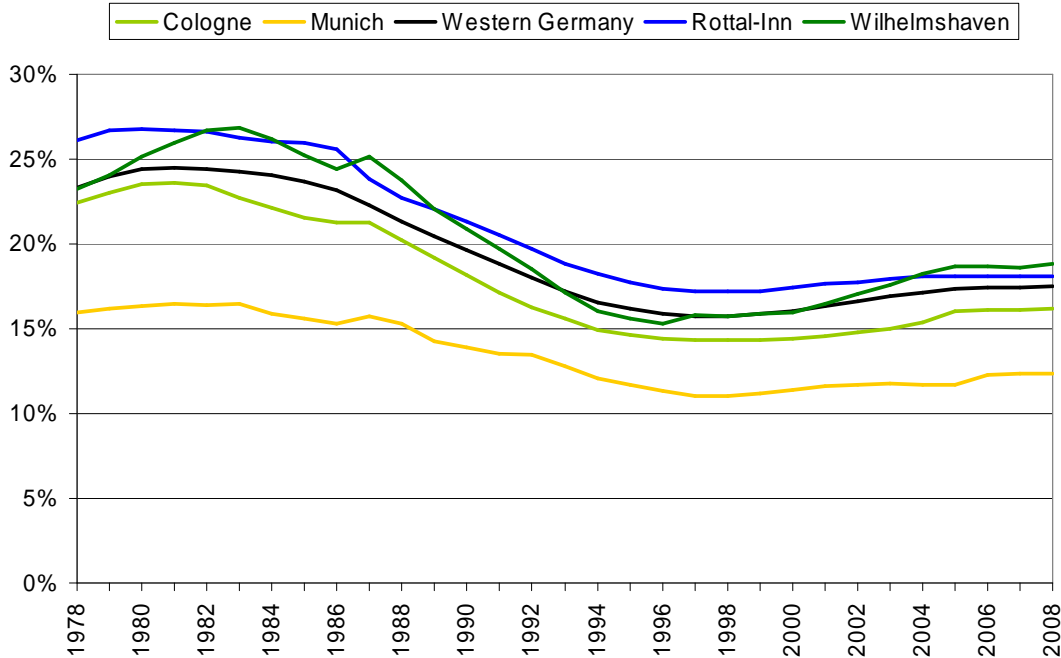
<sup>6</sup> We only consider data for Western Germany (including Berlin) because of data availability, i.e. we have access to a long time series from 1978 to 2008 and there only have been minor changes in the definitions of the NUTS-3 regions in western Germany. In contrast, significant changes were made in Eastern Germany



be explained by the baby-boom generation since these individuals were born in the late 1940s until the mid 1950s. The explanation for this strong increase is rather that former so-called guest workers, i.e. foreigners that have immigrated Germany between 1955 and 1973, now belong to the age group 60-64.<sup>7</sup> Altogether, demographic change over the last three decades can be characterized by a relatively strong decline within the younger age groups, especially for the group aged 15-24, whereas there has been a strong increase in the elderly workforce.

However, demographic change did not proceed the same across the western German regions. Some districts have seen their youth share decline much faster than other parts due to differences in birth rates, life expectancy and migration patterns. In order to illustrate these heterogeneities we use selected rural as well as urban districts as examples in Figure 1 (see also Figure A1 and A2 in the appendix). The black line indicates the share of the population aged 15-24 over the population aged 15-64 for Western Germany and thus represents the average development. Between 1978 and 2008 this share declined from 23% to 17%.

**Figure 1: Population aged 15-24 over population aged 15-64 in selected western German districts (1978-2008)**



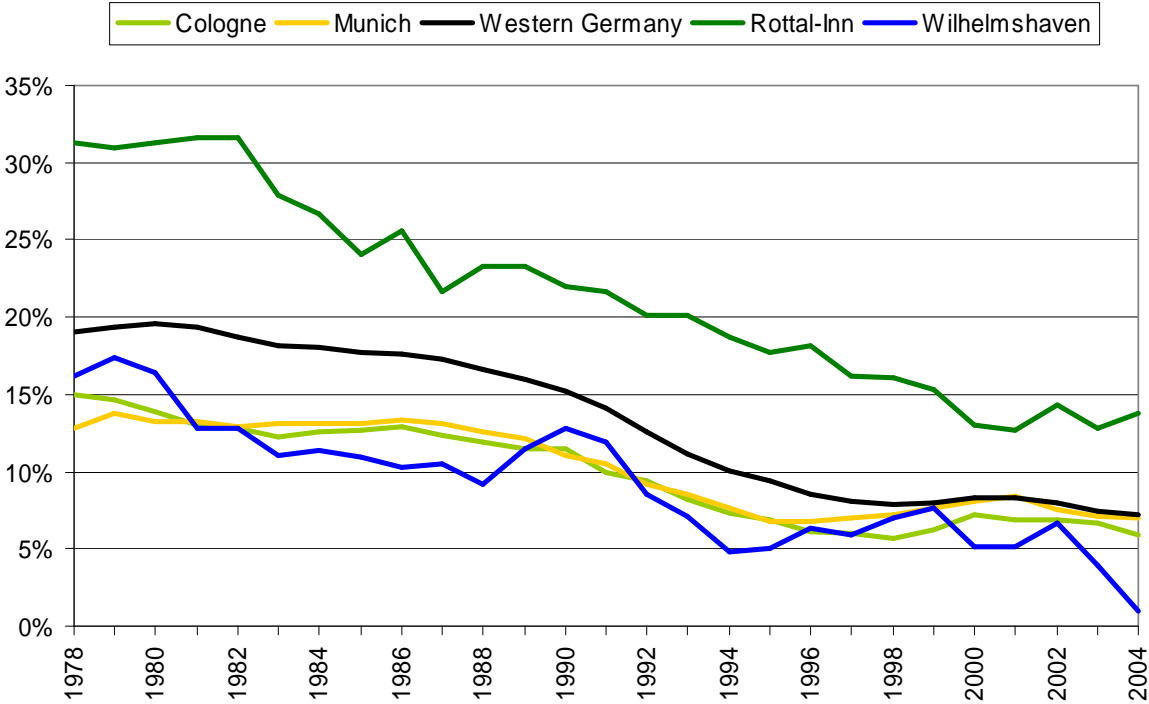
Source: Federal Statistical Office of Germany, own calculations.

<sup>7</sup> Due to the shortage of labor in the years of the German "Wirtschaftswunder" the government initiated a guest-worker program. Foreign employees were hired abroad in order to work in assigned jobs in the German industry. In 1955 the first bilateral contract was concluded with Italy. At the beginning of the 1960s recruitment agreements were signed with Spain, Greece and Turkey followed by other countries from the Mediterranean.

The yellow line reflects that this share was much lower in Munich at the beginning of our observation period and has declined further (from 16% to 12%). In Cologne, we also observe a decrease by 6 percentage points (from 22% to 16%) but the level in 1978 was much higher when compared to Munich. With regard to regions with a lower population density such as Rottal-Inn and Wilhelmshaven we observe a higher level of the youth share. But, these districts are more affected by demographic change, e.g. in Rottal-Inn a decrease from 26% to 18%.

Due to the fact that demographic change does not only alter the composition of the population but also the age structure of the labor force we have depicted the share of the young workers (aged 15-24) over the total number of workers aged 15 to 64 in Figure 2. Since the beginning of the 1980s we observe a downward trend, i.e. the share of the young workforce in Western Germany (black line) has declined from almost 20% to around 8% in the year 2004. This observation corresponds to the strong decrease in cohort sizes at the end of the baby boomer generation.

**Figure 2: Development of the employed aged 15-24 over the number of employed aged 15-64 in selected cities from 1978-2004.**



Source: Federal Employment Agency of Germany, own calculations.

In addition, similar to the regional heterogeneity in population development we also find these differences in the labor market. The share of the young workers has been slightly over 31% in the rural district Rottal-Inn but only 13% in Munich in 1978. Over the last decades this share has decreased significantly in Rottal-Inn, i.e. by almost 18 percentage points, whereas the decline is less pronounced in Munich (-6 percentage points). Wilhelmshaven is among the German cities with the lowest share of young workers, i.e. only 1% in 2004.

Since the share of the younger population as well as the share of young workers has decreased in the last decades the question is how this change is reflected in (youth) unemployment. For this purpose we present the (youth) unemployment rate in Figure 3. The comparison of the official unemployment rate and the youth unemployment rate shows that at the beginning of the 1980s the younger workforce was more exposed to unemployment than prime aged workers.<sup>8</sup>

**Figure 3: Total unemployment rate and youth unemployment rate from 1982 to 2008**



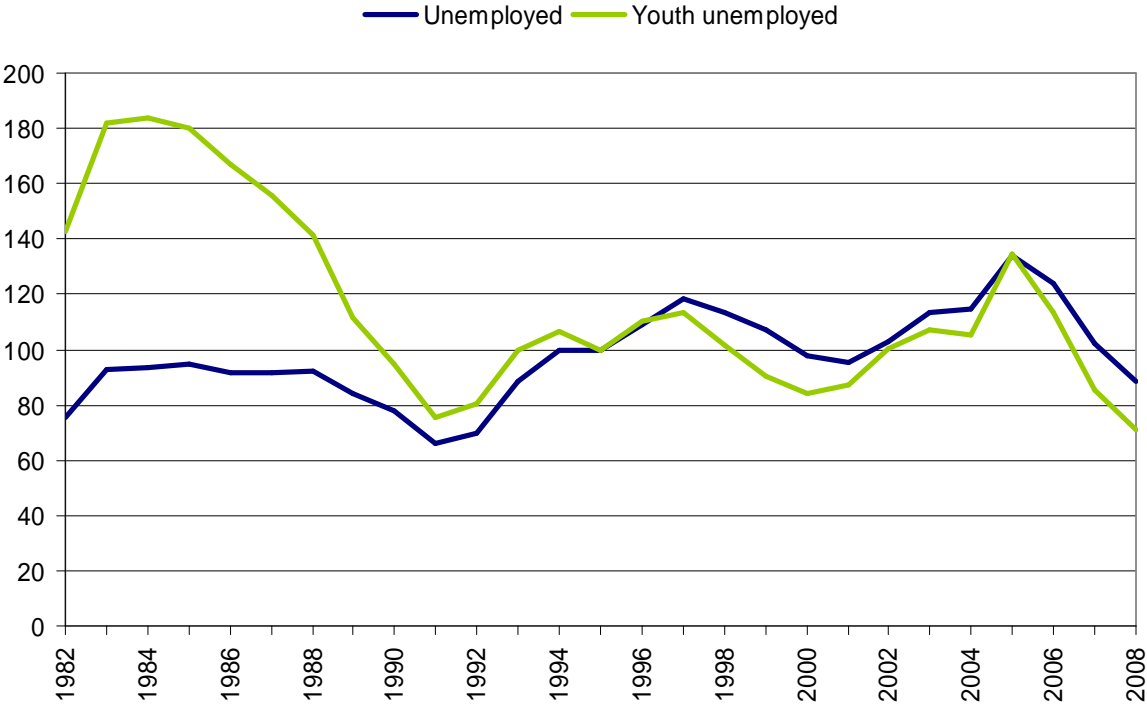
Source: Federal Employment Agency of Germany, own calculations.

<sup>8</sup> Note, that no data on the youth unemployment rate is available for the years 1989 to 1991.

However, since 1987 the labor market situation of the young has significantly improved, i.e. at a time when smaller cohort sizes have entered the labor market. Thus, it seems that cohort crowding is negatively correlated to unemployment whereas cohort shrinking corresponds to positive developments.

This conclusion is supported if we consider the total number of unemployed and youth unemployed in the same time period (see Figure 4). In order to compare the development of both time series we have indexed the total number of the unemployed where 1995 represents our basis year (1995=100). Again, the strong decline of the youth unemployed characterizes the period 1985 to 1991. The recession in 1992 – due to the first Gulf war – has been followed by an increase in unemployment affecting both younger as well as prime aged workers. Since 1995 the change in youth unemployment has been below the change of total unemployment.

**Figure 4: Development of the total number of unemployed and youth unemployed from 1982 to 2008 in Western Germany (1995=100)**



Source: Federal Employment Agency of Germany, own calculations.

Overall, the descriptive evidence presented so far suggests that demographic change in Germany is associated with labor market developments. From 1978 to 2008 the number of the younger population (15-24) has decreased by 1.5 million persons. At the same time we

observe a strong increase in the age groups 40 and above which obviously reflects the aging of the baby boomer generation. Comparing the youth shares across selected cities shows that demographic change proceeds differently across the German districts. With regard to the labor market unemployment and employment data indicate that the youth labor market has improved. In line with these findings the share of the younger workforce on the total workforce has dropped significantly since the beginning of the 1980s. However, the descriptive evidence presented so far does not permit to infer a causal relationship between declining birth cohorts and labor market developments. In order to identify a causal effect we exploit regional variation in the youth share as well as in the workforce and perform various econometric specifications.

## **4. Empirical investigation**

Transferring the ambiguous results from the cohort crowding literature to cohort shrinking implies on the one hand that unemployment could fall due to less competition on the labor market. On the other hand, theory also suggests that companies may create fewer jobs in regions with a low birth rate so that overall unemployment increases. Thus, the actual effect of cohort crowding on unemployment is an empirical question. In the following, we first present our econometric approach in order to study the effect of cohort size on employment and unemployment in western Germany. In a second step, we provide our estimation results and discuss the robustness of our empirical analyses.

### **4.1 Econometric specifications**

In order to analyze the effect of cohort shrinking on (un)employment in Western Germany we check whether there is a statistically significant relationship between the population share of young inhabitants (aged 15 to 24 years) in a particular region and the (un)employment rate in the same region. The dependent variable,  $\log rate_{it}$ , is either the natural log of the unemployment rate or the natural log of the employment rate, respectively. We conduct this analysis at a highly disaggregated regional scale for all western German districts (NUTS-3 level or “Kreise”;  $i = 1, \dots, 327$ ) and consider the period from 1994 to 2008 ( $t = 1994, \dots, 2008$ ). The coefficients  $\alpha$  captures regional and the coefficients  $\beta$  time effects. The random disturbance term is represented by  $\varepsilon$ . The coefficient of interest  $\gamma$  – the elasticity of  $rate_{it}$  with

respect to the local youth share – indicates the sign and the size of the youth share effect on the unemployment or employment rate, respectively:

$$\log(rate)_{it} = \alpha_i + \beta_t + \gamma \log(share)_{it} + \varepsilon_{it} \quad (1)$$

$$\text{with } \log(share)_{it} = \log\left(\frac{population(15-25\text{ years})}{population(15-65\text{ years})}\right)_{it} = Y_{i,t}$$

When estimating with OLS, identification of the coefficient  $\gamma$  as causal effect requires that the share of the youth population on the overall population does not depend on the unemployment rate. However, the youth share in specification (1) is likely to be endogenous since individuals relocate across regions due to disparities in labor market conditions. In order to address this endogeneity, we instrument the local current cohort size by the cohort size of the same people 15 years ago, i.e. when both the persons in the numerator and the denominator were 15 years younger. Since we consider the population aged 15 to 24 years as the entry cohort, we estimate equation (1) with IV, with the following equation (2) as first stage regression:

$$\log\left(\frac{population(15-24\text{ years})}{population(15-64\text{ years})}\right)_{it} = \delta_i + \phi_t + \mu \log\left(\frac{population(0-10\text{ years})}{population(0-50\text{ years})}\right)_{i,t-15} + \psi_{it} \quad (2)$$

However, the estimates in specification (1) are very likely to have serially and spatially correlated residuals – or to be determined by a serially and spatially lagged dependent variable<sup>9</sup> – because of the persistence and the spatial distribution of the (un)employment rate in Germany. Since ignoring serial correlation would provide inefficient estimates of our coefficient of interest  $\gamma$  as well as biased standard errors we check for serial correlation in the error term. Put it differently, we account for the fact that changes in the (un)employment rate only gradually vanish over time.

In order to gain efficiency and to account for autocorrelation in the error term, we use a feasible generalized least square (FGLS) estimator which can be implemented as Prais-Winsten (PW) and/or Cochrane-Orcutt (CO) approach. Shimer (2001) uses this procedure to account only for serial correlation. However, as our data is observed at a highly disaggregated

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<sup>9</sup> Note that, according to Wold's Theorem, an AR-1 process can be transformed into an MA-process of infinite order by premultiplying the equation with the inverse of the lag operator  $(1 - \alpha L)$ . Likewise, a spatial lag process can be transformed into a spatial error process.

regional level it is likely that the estimations are also affected by spatial correlation, e.g. due to commuting or because of events commonly affecting neighbour regions. Then, observations can not be considered independent, and estimates may turn out to be, at best, inefficient or, at worst, biased. Thus, in order to establish robustness of our analysis, we estimate alternative specifications allowing for various forms of spatial autocorrelation. Let the basic specification of equation (1)  $\ln rate_{i,t} = Y_{i,t}\gamma + \alpha_i + \beta_t + u_{i,t}$  in matrix form be

$$rate = Y\gamma + A + B + u \quad (3)$$

with  $rate = (rate_{1,1}, \dots, rate_{1,T}, rate_{2,1}, \dots, rate_{N,T})'$ ,  $Y = (Y_{1,1}, \dots, Y_{N,T})'$ ,  $A = (I_N \otimes I_T)\alpha$ ,  $B = (I_N \otimes I_T)\beta$  and  $u = (u_{1,1}, \dots, u_{N,T})'$ . Then, the model with a serially correlated error term  $u_{i,t} = \varphi u_{i,t-1} + \varepsilon_{i,t}$  and  $L$  as the lag operator – is given by

$$rate = Y\gamma + A + B + (I_N \otimes (I_T - \varphi L))^{-1} \varepsilon \quad (3a)$$

the model with a spatially correlated error term (for the detailed estimation routine see Kapoor, Kelejian and Prucha 2007) – with  $W$  as the spatial link matrix – is

$$rate = Y\gamma + A + B + ((I_N - \lambda W) \otimes I_T)^{-1} \varepsilon \quad (3b).$$

When accounting for error correlation, we apply Cochrane-Orcutt (CO) and Prais-Winston (PW) transformations on the data, respectively: We use the residuals of a first (inefficient) regression to estimate the parameters determining the error correlation, premultiply  $rate$ ,  $Y$  and the dummies with  $(I_N \otimes (I_T - \varphi L))$  or  $((I_N - \lambda W) \otimes I_T)$ , respectively, and then get the final, efficient estimation from the transformed variables.

As an alternative to the spatial error model when accounting for spatial autocorrelation, we also provide the coefficient estimate of a spatial filter regression (e.g. Griffith 2000). In this specification, a demeaned transformation of the spatial connectivity matrix,  $C = \left(I_N - \frac{1}{N} \mathbf{1}\mathbf{1}'\right) \frac{1}{2} (W' + W) \left(I_N - \frac{1}{N} \mathbf{1}\mathbf{1}'\right)$ , is decomposed into its eigenvectors which are orthogonal to each other and which reflect (as they are components of the link matrix) specific mapping patterns, i.e. characteristics of the geographical relation between regions. These eigenvectors

can be added as variables to the regression which control for all (time-constant) information related with space, i.e. for spatial correlation in the explanatory variables as well as for spatial correlation in omitted variables which otherwise would be present in the residual. Note that it is not possible to include regional dummies in the spatial filter equation

$$rate = Y\gamma + B + E_c\delta + \varepsilon \quad (4).$$

## 4.2 Empirical results

In the second line of Table 2 we present the results from our OLS estimation where we regress the log (un)employment rate on the log youth share as defined above. Due to the log-log specification the coefficients can be interpreted as elasticities. Our estimation results indicate that a 10 percent increase in the youth share of the population – at the moment an increase of roughly 1.7 percentage points – is correlated with an 8.2 percent increase in the unemployment rate (roughly equivalent to a shift of the unemployment rate from 7.3 percentage point to 7.9 percentage points). With respect to the employment rate we find a negative relationship, i.e. a 10 percent increase in the youth share corresponds with a 0.1 percent decrease in the employment rate. Hence, the OLS estimation confirms the inversed cohort crowding hypothesis that smaller labor market entry cohorts do indeed improve the situation of the job seekers. The unemployment rate declines whereas at the same time employment increases.

However, a causal interpretation of the youth share effect on (un)employment requires a (strictly) exogenous explanatory variable. Model 2 represents the analogue to Model 1 with the exception that we use the lagged births cohorts – the entry cohort span covers ten years (aged 15 to 25), thus the term “birth cohort” denotes the share of people aged 0 to 10 – as an instrument for the explanatory variable (see specification (2)). The estimated coefficient for the youth share effect on the unemployment rate is smaller compared to the basic specification (Model 1). The reported elasticity in Table 2 indicates that a 10 percent increase in the youth share translates into a 7.6 percent increase in the unemployment rate. The estimated coefficient is highly statistically significant and somewhat smaller compared to the OLS estimation. With respect to employment the elasticity becomes positive indicating that a 10 percent increase in the youth share entails a 1.1 percent increase in the employment rate. The switch of the sign in the IV estimation compared to the OLS estimation suggests that



decreasing birth cohorts may come along with an increase in regional mismatches between labor supply and labor demand so that overall the employment rate declines.

Our results suggest that there is a positive relationship between the youth share and the unemployment rate. In this respect, our results support the cohort crowding hypothesis, namely that large (small) labor market entry cohorts positively (negatively) affect unemployment, i.e. an increase (decrease) in the unemployment rate. Consequently, since demographic change in Germany is characterized by declining birth cohorts these estimation results suggest that a reduction in cohort size has a positive impact on the western German labor market. However, with respect to the youth share effect on unemployment we found mixed results so far. For this reason we perform robustness checks where we account for serially or spatially correlated residuals.

In particular, in Model 3a we check for autocorrelated residuals since the (un)employment rate is very likely to change only gradually. In fact, according to information criteria (AIC, BIC, Hannan-Quin) regression of the residuals of specification (1) on its lagged values shows an autocorrelation process of degree one. In order to arrive at consistent and efficient estimates as well as unbiased standard errors we apply the PW as well as CO transformation. Both estimators provide virtually the same results. However, since the PW estimator does not lose its first observation in the transformation as the CO estimator we report the results of the PW estimator in Table 2. The regression of the (log) unemployment rate on the (log) youth share shows a positive relationship. Compared to the OLS estimator the coefficient is relatively small, i.e. a 10 percent increase in the youth share corresponds to a 1.2 percent increase in the unemployment rate. With regard to employment the negative relationship between the youth share with respect to the employment rate is even more pronounced (-0.8) when compared to the first specification. In Model 3b we correct for spatial error correlation applying the PW transformation. The regression coefficient with respect to the unemployment rate is positive but insignificant whereas the elasticity between the youth share and the employment rate indicates a negative relationship of magnitude -0.5.

Finally, in Model 4 we perform a spatial filter regression in order to identify the effect of the youth share on (un)employment. The estimation result shows that a 10 percent increase in the youth share corresponds to a 4.3 percent increase in the unemployment rate. With respect to

the employment rate we find a positive coefficient (2.9 percent) which is statistically significant.

Overall, the estimation results for the relationship between the youth share and unemployment are quite robust across the alternative specifications. However, given that the IV specification provided a smaller elasticity in magnitude than the OLS estimation it may be that young workers move to low unemployment districts (see Shimer, 2001). This interpretation of the estimation result is supported when we consider the IV estimated elasticity of the relationship between the youth share and the employment rate: cohort size is positively related to the employment rate or a smaller cohort size decreases the employment rate. When applying a spatial filter regression (Model 4) we also find a positive relationship between the youth share and the employment rate. Since the instrumental variable approach also provides this positive effect and explicitly takes into account the endogeneity issue of the explanatory variable our preferred specification is Model 2.

**Table 2: The effect of young workers on the unemployment and employment rate**

<b>Explanatory Variable:</b>	<b>Log unemployment rate</b>	<b>Log employment rate</b>
<b>Log youth share</b>		
<b>Model 1</b>	0.8244*	-0.0110*
OLS	(0.0251)	(0.0128)
<b>Model 2</b>	0.7683*	0.1164*
IV-Estimation	(0.0538)	(0.0162)
<b>Model 3a</b>	0.1284*	-0.0880*
Correction for serial error correlation	(0.0281)	(0.0218)
<b>Model 3b</b>	0.0566	-0.0483*
Correction for spatial error correlation	(0.0464)	(0.0179)
<b>Model 4</b>	0.4303*	0.2867*
Spatial Filter	(0.0576)	(0.0654)

An asterisk \* marks coefficients significant at the 1 % level. Standard errors are in parentheses.  
 Remarks: Model 1 estimates using data from 327 western German districts from 1994 to 2008. All regressions (except Model 4, see Section 4.1) include district and year fixed effects. Model 3a corrects for AR(1) residuals with an estimated autoregression parameter of 0.8458 (unemployment rate) and 0.8442 (employment rate) using Prais-Winston correction. Model 3b uses coefficient estimates for the spatial correlation parameter  $\lambda$  of 0.6435 (unemployment rate) and 0.1722 (employment rate). Unemployment and employment data are taken from the Federal Employment Agency. The youth share is the number of individuals aged 15-24 divided by the number of individuals aged 15-64 in the same district.

At first glance the positive relationship between the youth share and the unemployment rate on the one hand as well as between the youth share and employment rate seem contradictory. One would expect that if unemployment declines that employment would also decrease (and

vice versa). A possible explanation for our finding is that on the one hand smaller birth cohorts indeed reduce unemployment as expected in the cohort crowding literature. For this relationship we have found a relatively strong relationship. On the other hand, the reduction in birth cohorts has a small negative effect on employment. This negative relationship may stem from mismatches on regional labor markets. Although, the overall unemployment in Germany is relatively high (7.8% in 2008) there are significant discrepancies across the German districts. For instance, in some western German districts the unemployment rate is only about 3% whereas in other regions it is around 14%. Declining birth cohorts may explain the reduction in unemployment but at the same time also explain the reduction in employment if companies are not able to find adequate personnel. In particular, since technical change is skill biased, i.e. companies show an increasing demand for higher qualifications, low-skilled workers have difficulties to integrate into the labor market. Hence, combining the trend of skill-biased technical change with the demographic development in Germany may result in a reduction in the unemployment rate but also in a decline in the employment rate.

## 5. Conclusion

Demographic change in Germany has significantly changed the composition of the labor supply over the last three decades. Although, the population aged 15-64 has increased by 4.8 million in the period 1978 to 2008 there are quite heterogeneous developments across the age groups. Whereas the number of young individuals aged 15-24 has decreased by over 1.5 million persons (-16%) in the considered period we observe a strong increase in the age groups 40 and above. This development is due to the sharp decline in birth rates at the beginning of the 1970s when the baby boom generation was followed by a baby bust generation. At the same time Germany faces a relatively high unemployment rate (7.8% in 2008) so that the question whether the shrinkage of the young population will have any effects on the labor market is of high interest.

Against this background, we studied the effect of smaller labor market entry cohorts on (un)employment using regional data for the years (1978) 1994 to 2008. With regard to unemployment we found that the youth share is positively associated with the unemployment rate. Given that Germany experiences declining cohort sizes among the young demographic change is likely to improve the situation of job seekers and thus decrease the overall unemployment rate. This result has been very robust across all our econometric specifications.

The estimation results for the youth share effect on the employment rate first suggested that smaller labor market entry cohorts are negatively associated with the employment rate. This is exactly what the previous cohort crowding literature has found. However, in our preferred specification where we explicitly control for endogeneity since individuals may react to differences in local labor markets the effect of the youth share on employment becomes positive. Put it differently, decreasing labor market entry cohorts corresponds to a lower employment rate. The explanation for this positive effect is that on the one hand demographic change in Germany in fact improves the position of the job seekers. As a result, the unemployment rate declines. On the other hand, the labor market also faces bottlenecks of workers in specific industries and/or qualifications. In western Germany a decreasing youth share implies a lower employment rate since the unemployed do not match regional requirements of the hiring companies.

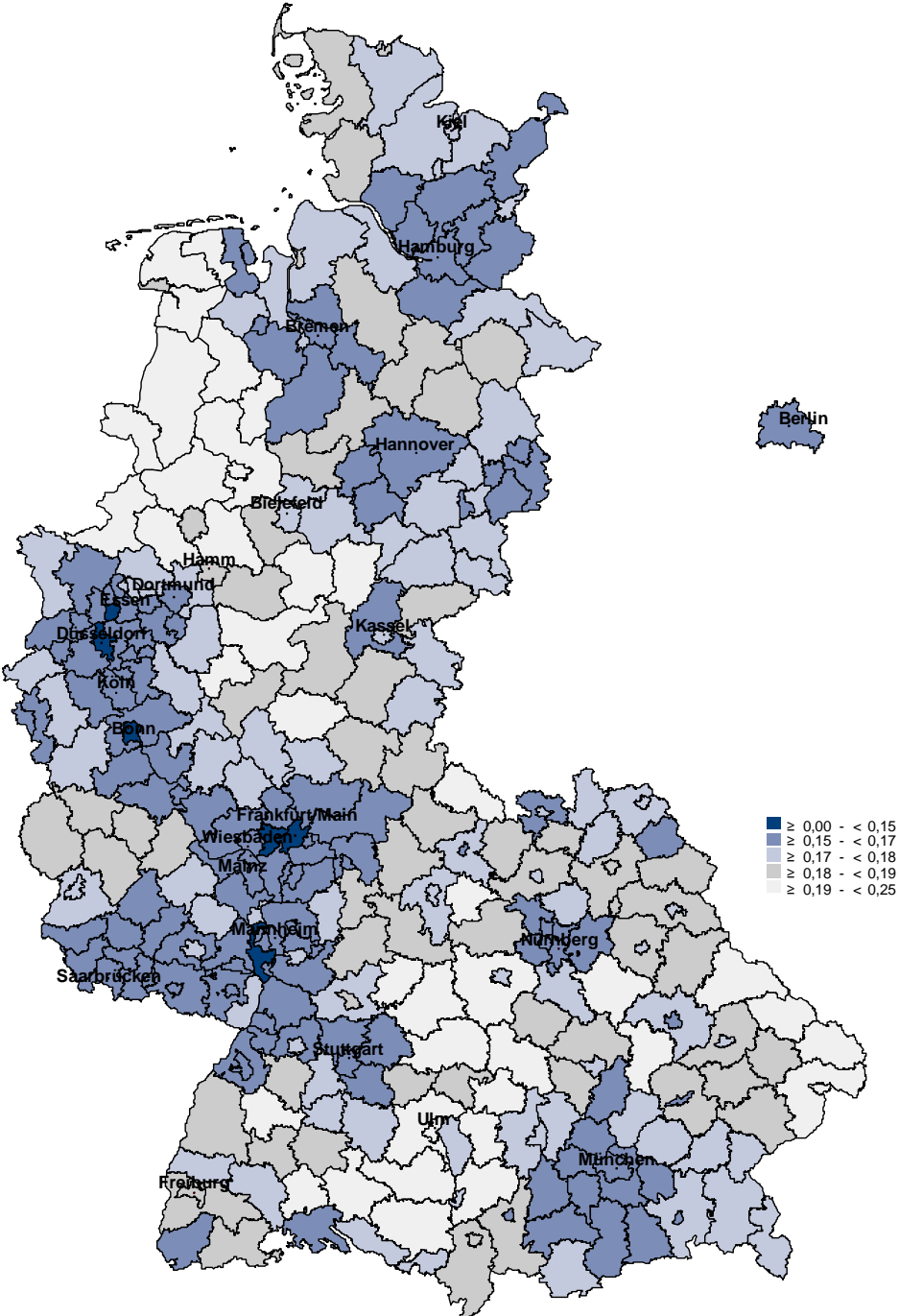
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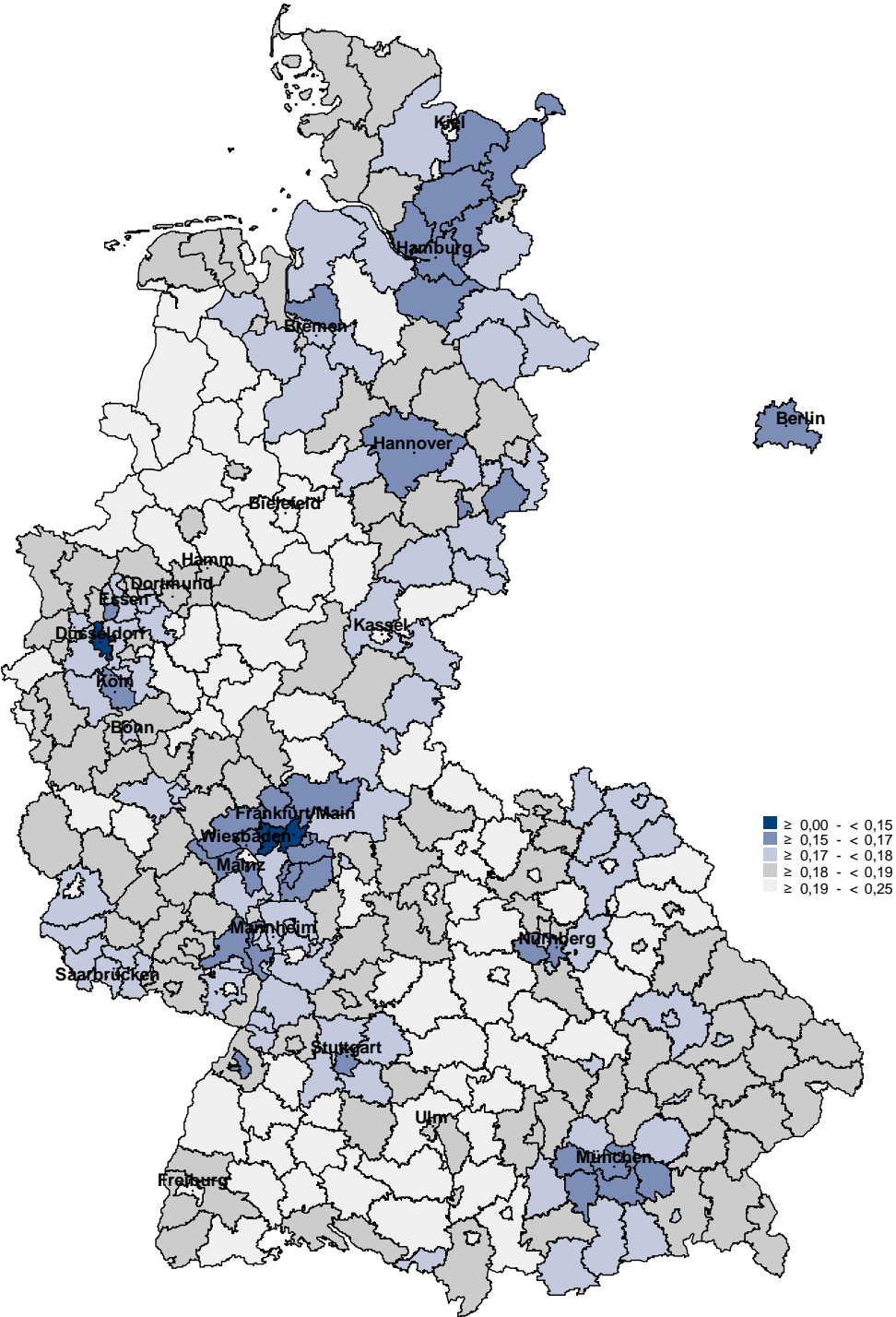
# Appendix

Figure A1: Youth share (individuals aged 15-25 over individuals aged 15-65) in western German districts in 1994



Source: Federal Statistical Office of Germany, own calculations.

**Figure A2: Youth share (individuals aged 15-25 over individuals aged 15-65) in western German districts in 2008**



Source: Federal Statistical Office of Germany, own calculations.