Does home ownership really cause unemployment? Evidence from German regional data

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Abstract

Using German regional data for 1998, 2002 and 2006, this study reexamines the Oswald hypothesis, the conjecture that high levels of home ownership are linked to inferior outcomes in regional labor markets. Applying a set of controls for regional unemployment rates, three different econometric models are specified and estimated: a cross-sectional model, a pooled data model, and a model taking into account unobserved time-invariant effects on regional unemployment rates. It is found that the link between home ownership and unemployment levels is inverse in cross-section but positive in panel estimations. The economic significance of the relationship is small in both cases, however. Factors like average labor productivity, participation, export orientation and human capital endowment seem to dominate the impact of home ownership on unemployment in German regions.

Key words: Home ownership, unemployment, Oswald's hypothesis, German regions

JEL classification: J61, J64, R23

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1 Introduction

Housing markets are closely linked to other markets in the economy (Muellbauer and Murphy, 2008). One of the most important interactions may be the linkage between housing and labor markets. In the younger past, there has been some intense debate in housing and labor market economics on this issue, especially with regard to the linkage between unemployment and the tenure choice of home ownership. The postulation of a positive link between unemployment and home ownership goes back to a series of contributions by British economist Andrew Oswald (Oswald, 1996, 1999), and has become known as Oswald's hypothesis in the literature. Following the argument of Oswald, high aggregate unemployment, as well as persisting unemployment differentials between regional labor markets, can be traced back to high proportions of interregionally immobile home owners in the population.

The reasoning behind this view is that high costs of selling and buying homes tendentially prevent home owners from job-related moves from regions experiencing declines in labor demand to more prosperous regions. High levels of home ownership may thus slow down interregional migration and eventually hinder regional labor markets to turn back to equilibrium in response to regional labor demand shocks. The idea of a positive relationship between unemployment and home ownership due to increased geographical immobility of labor is closely related to the concepts of spatial mismatch unemployment in the sense of Holzer (1991) or Layard et al. (1991), among others.

Using data for the time period 1998-2006, this study sheds light on the distribution of home ownership and unemployment in Germany and examines if regions characterized by high propotions of home owners in the population really tend to have higher unemployment rates, even if other determinants of unemployment are controlled for. No attempt has so far been made to analyze the relationship between home ownership and unemployment at the regional level in Germany. Evidence to support Oswald's hypothesis in the case of German regions would be of considerable political relevance, given that raising the rate of home ownership remains an important political objective in Germany, as well as in many other countries. If high home ownership rates would be associated with negative effects on labor market efficiency, this could be considered a crucial argument against (further) promotion of home ownership.

According to the results of this study, there is indeed some evidence of a positive, but weak link between home ownership and unemployment levels in German regions.

This result holds true once unobserved heterogeneity of regional unemployment rates is controlled for, as single-year and pooled OLS regressions reproduce the inverse relationship between home ownership and unemployment mostly found in studies relying on purely cross-sectional data. Both in cross-sectional and panel data models, it emerges that the link between home ownership and unemployment is dominated by factors more directly affecting regional labor demand and supply.

The remainder of the article is organized as follows. Section 2 provides a brief overview of the likely mechanisms of interaction between home ownership, mobility and labor market outcomes. It also summarizes the results of previous empirical studies and tackles methodological issues. Section 3 serves to specify the models used for testing the relationship between home ownership and unemployment at the regional level. Data and results are presented in Sections 4 and 5, Section 6 concludes.

2 Home ownership and unemployment at the regional level: The likely mechanisms and results of previous studies

The main mechanism underlying a possible positive link between home ownership and unemployment levels is the impact of tenure choice on geographical mobility. Both theoretically and empirically, it is undisputed that home owners change residence less often than renters, holding other factors constant (Hughes, 1987; Johnes and Hyclak, 1994; Cameron and Muellbauer, 1998; Barcelo, 2006). Because housing location decisions linked to the purchase of a home cannot be reversed without incurring high search and transaction costs, households become increasingly location-bound when they become home owners.[1] Consequently, most households only purchase a home if they plan to settle down in a certain region for an extended period of time (Haurin and Gill, 2002). On the one hand, this form of immobility is supposed to have positive effects on local neighborhood stability and accumulation of social capital (DiPasquale and Glaeser, 1999; Dietz and Haurin, 2003). On the other hand, it may exert negative effects on labor market outcomes due to increased

[1] In Germany, transaction costs associated with the purchase of a detached or row house or a condominium (including taxes, realtor fees and notary fees) may be as high as 10% of the purchase price, compared with a maximum of 5-6 monthly rents in the case of switching rental apartments or houses (Faller et al., 2006).

labor market rigidities in form of less interregional labor mobility.

Because housing and working location decisions are closely intertwined, the site dependency associated with home ownership certainly affects the individual supply of labor. Theoretically, at least two opposing effects are possible. High costs of moving residence may lead to high reservation wages and may prompt unemployed homeowners to quit searching for a new job when no job can be found within commuting reach (Oswald, 1997). At the same time, home ownership is closely tied to individual labor market success. Because labor income constitutes the bulk of most household incomes, the maintenance of a regular job can be seen as a necessary prerequisite for most households to become and stay home owners due to the financial capacity associated with the purchase and maintenance of a home. This implies low reservation wages and an inelastic individual labor supply of home owners in the home (regional) labor market (Flatau et al., 2002). Along with this line of reasoning, some authors have mentionded that owners typically show a high willingness to commute. In principle, increased commuting can be a suitable mechanism for alleviating interregional mobility restrictions posed by home ownership (Cameron and Muellbauer, 1998).

Because the net effect of the mechanisms involved is uncertain, being a home owner may not necessarily imply inferior labor market performances at the individual level. Indeed, most studies at the micro level show that home ownership is even linked to superior labor market performance, despite some obviously negative effects on interregional mobility. At least with regard to the home (regional) labor market, the risk of becoming unemployed, as well as the duration of unemployment, seems to be lower for owners than for renters, even when factors like qualification or age are controlled for (for a comprehensive overview of various studies see Van Ewijk and Van Leuvensteijn (2009)). As a possible explanation, it can be supposed that owners view job-related migration to other regions as a last resort, making them more inclined to accept job offers at the home labor market in order to avoid having to move.

Along with the direct effects of ownership on the labor market performance of home owners, indirect effects affecting the labor market performance of renters are also possible. This clearly complicates the theoretical deduction of an unambiguous net effect at the aggregate level. Coulson and Fisher (2009) outline five different theoretical models which link tenure in the housing market to labor market outcomes. The predictions of the models with respect to the direction of the link between home ownership and unemployment not only differ from model to model, but even

within some models themselves depending on the level of aggregation. Taken these ambigious predictions as an implication, it may be premature to derive effects at the regional or macro-level from micro-level observations.

Regional data have been used for several countries in order to test Oswald's original hypothesis (see Tab. 1 below). So far, the results are not clear-cut. While some studies corroborate the direction and strength of the relationship originally found by Oswald (Partridge and Rickman, 1997; Pehkonen, 1999; Cochrane and Poot, 2007), others contradict his findings or challenge them at least in part (Green and Hendershott, 2001; Flatau et al., 2002; Glaeser and Shapiro, 2003; Garcia et al., 2004; Coulson and Fisher, 2009).

Author and year	Regional units	Methodology	Effect
Oswald 1996, 1999	Different countries/regions	cross-section/first diff.	+
Partridge/Rickman 1997	US states	pooled cross-section/panel	+
Pehkonen 1999	Finnish labor districts	cross-section	+
Green/Hendershott 2001	US states	first differences	+/-
Flatau et al. 2002	Australian regions	cross-section	-
Glaeser/Shapiro 2003	US MSAs	cross-section	-
Garcia/Hernandez 2004	Spanish provinces	cross-section	-
Cochrane/Poot 2007	New Zealand census regions	pooled cross-section/panel	+
Coulson/Fisher 2009	US MSAs	cross-section	-

Table 1: Previous empirical studies analyzing Oswald's hypothesis using regional level data

While the diverging results may partly reflect institutional or cultural differences between the analyzed countries, there is also a tendency towards differing estimates between static cross-sectional models and models relying on panel data. While studies relying only on cross-sectional data predominantly yield negative coefficients for the home ownership rate variable, those applying first differences or panel data methods (notably using fixed effects or related models) generally yield positive estimates.

The deviating results found in previous studies with respect to the relationship between home ownership and unemployment at the regional level may (at least in part) be the result of heterogeneity bias in cross-sectional analysis. Cochrane and Poot (2007) argue that it seems reasonable to expect OLS estimations of cross-sectional data to suggest an inverse relationship between home ownership and unemployment. Following their argument, this inverse relationship is conditioned by cross-sectional composition effects on both the labor supply and demand sides. High home ownership rates and low unemployment rates may coexist in the long term in more prosperous, amenity-rich regions with high average incomes and growth rates, as (especially higher skilled and comparatively wealthy) workers settle down precisely

in those regions in which they expect to work for a longer time horizon. Because these unobserved time-invariant effects are likely to correlate positively with regional home ownership and inversely with regional unemployment levels, cross-section OLS estimates will tendentially be biased downwards. Indeed, it is well established that the within-estimator used in fixed effects estimation mainly reflects short-term (time series) variation within variables, while the standard OLS estimator, which is based on cross-sectional information only, reflects long-term relationships (Baltagi, 2005). Consequently, the within-estimator may rather yield a positive influence than the OLS estimator, as region-specific effects are ruled out by fixed effects estimation and the true Oswald-type positive partial effect of home ownership on unemployment is measured.

Along with the possible omittance of region-specific heterogeneity, two further methodological issues associated with an empirical investigation of the influence of home ownership on unemployment at the regional level have been mentioned in the literature. The first issue regards reverse causality. Because the level of unemployment in a region influences average permanent income or wealth of households living in that region, which by themselves are factors influencing tenure choice and demand for housing services, home ownership and unemployment may be mutually dependent. As a consequence, the home ownership rate may have to be treated as endogeneous. IV techniques and simultaneous equations have been used to overcome this problem (e.g. see Garcia et al. (2004)). Secondly, the existence of spatial autocorrelation can lead to biased estimations and invalid test results (Coulson and Fisher, 2009). Various spatial econometric models have been proposed in order to deal with the problem of spatial dependence explicitely (see Anselin (1988)). Within the framework of this study, IV techniques and lagged ownership rates are used in order to control for the potential endogeneity of the ownership variable, while functionally delineated regions are used in order to alleviate the problem of spatial dependence.

3 Model specification

Modeling the relationship between home ownership and unemployment rates at the regional level requires a consideration of other potential determinants of regional unemployment which may be also correlated with the regional proportion of home owners. Unlike disparities in national unemployment rates, disparities in regional unemployment rates cannot be explained by differences in labor market institutions

like the rate of unionization or labor taxes, as these variables may vary substantially across countries, but not across regions within one country. Consequently, theoretical and empirical work on regional unemployment differentials focuses on regional economic and socio-demographic factors to explain the disparities in question. Isserman et al. (1987) provide a comprehensive overview of regional labor market theory and regional labor market modeling. They identify regional labor market outcomes as functions of demand-side factors like regional productivity or output, wage level and economic structure, supply-side factors like labor market participation and socio-demographic composition of the regional labor force, and spatial interdependencies between regions with respect to migration and commuting.

Based on the propositions of regional labor market theory, a broad range of empirical studies has been conducted to scrutinize the structure and dynamics of regional unemployment disparities (see Martin (1997); Partridge and Rickman (1997); Bradley and Taylor (1997); Badinger and Url (2002), among others). At the same time, only few studies have included housing market variables like the regional level of home ownership as potential determinants of regional unemployment. Models and methodology used in studies on regional unemployment rates and disparities have been surveyed comprehensively by Elhorst (2003), so they will not be discussed in detail. Following the proposals of previous empirical work, as a simple model of the relationship between the regional unemployment rate and the home ownership rate can be written:

$$unempr = \mathbf{y}'\boldsymbol{\beta} + \mathbf{z}'\boldsymbol{\gamma} + \delta_1 propowners + e \tag{1}$$

where *unempr* denotes the regional unemployment rate, $\mathbf{y}$ is a vector of economic control variables and $\mathbf{z}$ one of socio-demographic control variables, *propowners* is the regional home ownership rate (defined as the proportion of households living in owner-occupied homes), and e is a stochastic error term.

The choice of control variables follows Elhorst (2003) and the strategy of related studies. Generally, it can be argued that economically stronger regions are more likely to be characterized by higher levels of home ownership, primarily due to higher average household incomes. The same holds true for more rural regions as well as for regions with higher shares of socio-demographic groups more inclined to ownership in the population. Finally, historic reasons render it reasonable to assume that ownership levels are correlated with the geographical location of the region, especially eastern or western Germany. Following these considerations, the following explanatory variables are included along with the regional home ownership rate:

i: logarithm of regional production output per worker in thousands of Euros (*logprod*). This variable reflects average productivity of labor in a certain region and serves as central indicator of regional labor demand. Unit labor costs in the manufacturing sector were also tested as an explanatory variable to account for regional wage and productivity differentials, but their explanation power was low in comparison to regional productivity levels. As the relationship between regional unemployment and productivity of labor is expected to be inverse, a negative coefficient is expected for this variable.

ii: regional labor market participation (*particr*). This variable serves as central indicator of regional labor supply. The participation rate in a particular region is likely to correlate positively with the educational composition of the regional labor force. At the same time, labor market participation is likely to increase with better employment opportunities, which are related to lower unemployment rates. Thus, the coefficient of this variable is expected to carry a negative sign.

iii: proportion of manufacturing sector employment as a percentage of total employment (*propmanu*). This variable controls for the broad sectoral structure of the region. While local industries account for the majority of employment in most regions, export-orientated industries are fundamental to regional economic prosperity and employment growth (Porter, 2003). Accordingly, the manufacturing employment share should capture at least some of the variation between regional unemployment rates. A negative relationship between this variable and regional unemployment rates is expected.

iv: proportion of persons within the 18-25 and 50-65 years age bracket, respectively, as a percentage of total regional population (*prop1825*, *prop5065*). Like many other studies analyzing regional unemployment levels, we also control for the age composition of the population. The particular age brackets are chosen because both groups potentially face age-related problems at the labor market. However, it should be noted that youth unemployment is not as severe in Germany as in other European countries, with the unemployment rate within the group of young workers deviating only slightly from the overall unemployment rate. Additionaly, unemployment in the higher working-age bracket declined between 1998 and 2006, and even lay below the national average in 2006 (Federal Employment Agency statistics). The expected sign of both variables remains uncertain.

v: proportion of dropouts as a percentage of high school graduates (*propdrops*).

In order to cope with the lack of other data, the share of dropouts is used as a proxy variable for the share of low-skilled workers in the regional labor force. High unemployment rates within the group of low-skilled workers at the national level render it reasonable to assume that a higher proportion of low-skilled workers within a region can be associated with higher levels of unemployment. Consequently, the share of dropouts is expected to affect the regional unemployment rate in a positive way.

vi: logarithm of employed persons per square kilometre of regional area (*logempdens*). Spatial employment density is used to control for regional levels of spatial agglomeration of economic activity. The interplay between the spatial agglomeration of firms and workers and employment has been reexamined intensively since the upcoming of New Economic Geography models (e.g. see Suedekum (2005)). However, the net effect of increased spatial concentration on regional unemployment is ambiguous. Because the economic benefits of firm clustering or labor market pooling may (at least partially) be outweighed by higher wages, prices, taxes, and congestion costs in regions characterized by high levels of spatial agglomeration, the expected sign of this variable is uncertain.

vii: an East/West dummy variable (*D_east*). This variable is zero for western German regions and unity for regions located in the eastern (former German Democratic Republic) part of the country. Since the beginning of the economic transformation process, unemployment rates in most eastern German regions have been notably higher than the national average. Many economic and socio-demographic differences between eastern and western German regions may already be reflected in the other explanatory variables, but there may still be some unexplained structural differences between them. Consequently, the interplay of explanatory variables and regional unemployment rate may occur at different levels. The dummy variable is expected to carry a positive sign.

Considering the full set of control variables, we arrive at the following estimable model for the regional unemployment rate:

$$\begin{aligned} unempr_i = {} & \beta_0 + \beta_1 D\_east_i + \beta_2 logprod_i + \beta_3 particr_i + \beta_4 propmanu_i \\ & + \beta_5 prop1825_i + \beta_6 prop5065_i + \beta_7 propdrops_i + \beta_8 logempdens_i \\ & + \beta_9 propowners + e_i \end{aligned} \tag{2}$$

where i is the region index, β_k denotes the regression coefficients, and e is a stochas-

tic error term. Because production, labor input and participation are determined simultaneously in markets, one-year lagged values of *logprod* and *particr* are applied in each estimation.

In a first step, the fully specified cross-section model of (2) is estimated seperately by OLS for the three individual years for which data were collected. In a second step, (2) is estimated using pooled OLS, including time dummy variables in order to measure the impact of each explanatory variable net of aggregate (nationwide) cylical conditions or trends. Within the pooled OLS framework, three different versions of the model are estimated. First, the fully specified model is estimated for all regions. Subsequently, all eastern German regions are excluded to check the robustness of the derived coefficients. Finally, a slightly altered model is estimated, excluding all insignificant variables but enhancing the model with an interaction term between the home ownership rate and the East/West dummy variable.

The estimations based on single year and pooled data do not explicitely exploit the panel structure of the underlying data set. Due to the existence of unobserved heterogeneity of regional unemployment levels, the estimated coefficients may be biased in cross-sectional and pooled data analysis. In order to overcome this drawback and to further reduce the omitted variable bias, a multi-period unobserved effects model is specified and tested in addition to the previous models. Using the same explanatory variables (except the time-invariant East/West dummy variable), the model can be written as

$$\begin{aligned} unempr_{it} = {} & \beta_0 + \beta_1 logprod_{it} + \beta_2 particr_{it} + \beta_3 propmanu_{it} + \beta_4 prop1825_{it} \\ & + \beta_5 prop5065_{it} + \beta_6 propdrops_{it} + \beta_7 logempdens_{it} \\ & + \beta_8 propowners_{it} + \mu_i + \lambda_t + u_{it}, \end{aligned} \tag{3}$$

where the subscript i denotes the region and t the time index. Moreover, μ_i denote regional and λ_t time (annual) unobserved effects, and u is an idiosyncratic error term. Like in the pooled regression framework, time dummies are included to measure the impact of the explanatory variables on the regional unemployment rate net of aggregate conditions or trends.

The unobserved effects model is estimated using fixed effects. With regard to the question at hand, it seems more appropiate to apply fixed effects rather than random effects for two reasons. First, it is very likely that at least some unobserved time-invariant effects on regional unemployment rates (like accessability or regional supply of public goods) are correlated with the included explanatory variables. Be-

cause fixed effects allow for arbitrary correlation between unobserved effects and the explanatory variables included in the equation, it seems more appropiate than random effects, which assumes these correlations to be zero (Wooldridge, 2002). Second, the underlying observations were chosen deterministicly, instead of being a random sample out of a larger population of regions.

In analogy to the pooled OLS framework, first a fully specified model for all regions is estimated. In order to check the robustness of the results and to test for differences in the relationship between home ownership and unemployment rates in eastern and western regions, another fully specified model excluding all eastern German regions and a reduced model with interaction term between ownership rate and East/West dummy variable are also estimated.

4 Data and descriptive statistics

Regional labor markets seem most appropiate for analyzing Oswald's hypothesis at the regional level. At least theoretically, home owners are able to commute to any workplace within these regions without having to change their place of residence. In the German case, different kinds of functional delineations are used to identify regional labor markets (Eckey et al., 2007). Unfortunately, official and reliable data on home ownership rates are not available for most of those regions. A functionally delineated regional unit for which representative data on home ownership rates are available in Germany are planning regions *(Raumordnungsregionen)*, being defined by the Federal Office of Building and Regional Planning *(Bundesamt für Bauwesen und Raumordnung, BBR)*. Planning regions cover the entire country area and form generously delineated regional labor markets (Schloemer and Bucher, 2001). At the level of planning regions, regional home ownership rates can be calculated reliably from the *Mikrozensus*, a large household-level survey carried out in quadrennial intervals.

The data on regional home ownership rates were merged with data obtained from the *INKAR* database, which is provided by the *BBR* and refers to a variety of national and European primary sources (see appendix for further details). Available observations of the included variables for 87 (71 western and 16 eastern) regions were used for 1998, 2002 and 2006.[2] Tab. 2 below shows some descriptive statistics for the included variables, including all available observations for each variable. 46.4 per cent

[2]Five planning regions were aggregated to form the so-called *Analyseregionen* of Bremen and Hamburg, while seven regions (located in Brandenburg and Berlin) were excluded due to data problems.

Variable	Mean (West/East)	St.Dev (between/within)	Min	Max	N
unempr	11.3 (9.4/19.6)	4.7 (4.6/0.9)	4.9	24.1	259
propowners	46.4 (48.8/36.2)	9.5 (9.4/1.6)	23.2	72.0	259
prod	51.6 (53.9/41.3)	7.2 (6.6/3.0)	35.2	77.5	259
particr	68.7 (70.5/60.9)	6.8 (6.6/1.7)	52.7	88.2	259
propmanu	17.7 (18.6/13.9)	4.8 (4.7/1.1)	7.3	30.1	259
prop1825	8.1 (7.9/9.2)	0.7 (0.6/0.3)	6.9	10.6	259
prop5065	18.4 (18.1/19.8)	1.1 (1.0/0.4)	16.0	21.4	259
propdrops	8.8 (8.3/11.0)	2.1 (1.8/1.0)	4.0	15.6	259
empdens	126.4 (140.7/63.7)	113.1 (113.1/18.7)	18.2	643.7	259
D_east	0.185 (0.0/1.0)	0.4 (0.4/0.0)	0	1	259

Table 2: Descriptive statistics of the main included variables

of all households were owners on regional average, while 11.3 per cent of the regional labor force was unemployed in the mean of the three years included. Both the low nationwide home ownership rate and the relatively high unemployment rate in comparison to other OECD countries are generally attributed to institutional factors on the respective markets. While the low level of home ownership is traced back to high-quality social housing, moderate regulation of private renting and comparatively sparse subsidiation of home ownership (Voigtlander, 2009), high unemployment has been explained by labor market rigidities, a generous welfare state and barriers to entrepeneurship and innovation (Berthold and Fehn, 2003).

International comparisons of nationwide averages tell only half the story, however, as regional differentials within countries are blurred by these numbers. Tab. 2 and a simple scatter plot (see Fig. 1 below) show that a high variation in regional unemployment and home ownership rates is indeed present in Germany, and there are large differences in unemployment and home ownership between eastern and western German regions. While home ownership rates in western German regions (left part of Fig. 1) predominantly lie above 40 per cent (indicated by the two dashed vertical lines) in all three years, the majority of eastern German regions (right part of the graph) is characterized by home ownership rates below this level. With respect to regional unemployment rates, eastern German regions show higher rates than western German ones (with only a few exceptions).[3] Besides the levels of home ownership and unemployment, the economic and socio-demographic differences between eastern and western German regions are also displayed in the other explanatory variables. Eastern German regions show lower levels of average labor

[3]Both the rank order of unemployment and home ownership rates between regions were highly persistent within the time period under analysis. A calculation of the Spearman rank correlation coefficient for both variables (using their values in 1998 and 2006) yields values above 0.9, respectively.

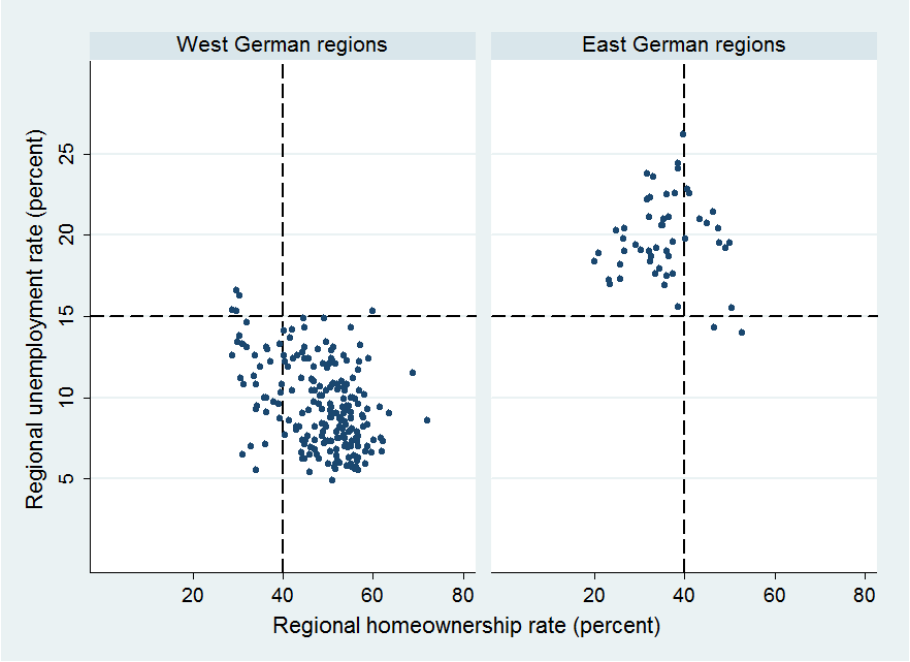

Figure 1: Home ownership rates and unemployment rates in German regions 1998-2006

productivity, labor market participation, manufacturing employment and spatial agglomeration of employment. Furthermore, they are characterized by higher shares of dropouts, job entrants and older workers than western German regions.

A simple regression of the regional unemployment rate on the regional home ownership rate (in per centage values, respectively) for each individual year, including the full sample of regions, yields coefficients between -0.26 and -0.34 and R-squared values of 0.3-0.4. These numbers suggest an *inverse* cross-sectional relationship between the two variables, which is broadly in line with Fig. 1, connecting both parts of the graph. An inclusion of the East/West dummy variable changes the coefficients substantially, yielding (significant) home ownership coefficients between -0.08 und -0.16 and improving the fit of the model to R-squared levels of above 0.7. Including an interaction term between East/West dummy variable and home ownership rate in the simple regression does not significantly alter the coefficients. The interaction variable is insignificant at traditional levels in each regression.

5 Empirical results

Tab. 3 shows the standard OLS regression results of equation (2) using single-year data. The overall fit achieved by the model is notably high in all three estimations, indicated by R-squared values of just under 0.9. The commonly used tests do not reject the standard OLS assumptions of homoskedastic, normally distributed and serially uncorrelated error terms. As indicated by variance inflation factors, the degree of multicollinearity between the explanatory variables is surprisingly moderate in each estimation. As most important finding of the single-year regressions, it

	1998		**2002**		**2006**	
	Coefficients	p-values	Coefficients	p-values	Coefficients	p-values
D_ east	2.8556*	0.086	6.4339***	0.003	2.5183	0.144
	(1.74)		(3.05)		(1.48)	
logprod	-2.9229	0.381	-9.5608***	0.002	-7.4863***	0.009
	(-0.88)		(-3.23)		(-2.68)	
particr	-0.2287***	0.001	-0.0962**	0.043	-0.1380***	0.004
	(-4.94)		(-2.06)		(-3.01)	
propmanu	-0.0892	0.156	-0.1027*	0.077	-0.1120**	0.069
	(-1.43)		(-1.79)		(-1.85)	
prop1825	0.9684	0.268	-1.1733	0.153	-0.2121	0.710
	(1.11)		(-1.44)		(-0.37)	
prop5065	0.4963	0.195	-0.2549	0.545	0.5349	0.205
	(1.31)		(-0.61)		(1.28)	
propdrops	0.1919	0.138	0.2419*	0.060	0.4723***	0.003
	(1.50)		(1.71)		(3.12)	
logempdens	-0.3706	0.497	-0.3778	0.438	0.3003	0.495
	(-0.68)		(-0.78)		(0.69)	
propowners	-0.1151***	0.007	-0.1423***	0.001	-0.1316***	0.002
	(-2.79)		(-3.50)		(-3.22)	
No. of obs.	85		87		87	
R^2	0.8729		0.8975		0.8849	
Adj. R^2	0.8577		0.8855		0.8714	
F-Stat	57.25	0.000	74.93	0.000	65.77	0.000
Breusch-Pagan	0.12	0.7285	1.70	0.1929	0.12	0.7284
Durbin-Watson	1.9806		1.8959		1.9423	
Jarque-Bera	0.0462	0.9772	0.1521	0.9268	0.759	0.6842
Mean VIF	5.20		6.81		4.93	
AIC	340.8911		302.3641		343.0836	

Table 3: OLS regression results of (2) for single year data (t-statistics in parentheses)

emerges that the inclusion of a wide set of control variables does not change the simple cross-section regression result of an inverse relationship between regional home ownership and unemployment rates. The home ownership rate coefficient is negative

and highly significant for all three years, with parameter estimates varying between -0.12 and -0.14. Besides this finding, the coefficients of the included control variables are interesting by themselves. Higher levels of labor productivity, participation and manufacturing employment are associated with lower levels of unemployment, while higher shares of dropouts go along with higher unemployment. The East/West dummy variable is always positive and significant in two of three years, indicating structural differences in unemployment rates between eastern and western German regions which are not captured by the other included explanatory variables. Both age structure variables and the employment density variable are generally insignificant.

To rule out potential endogeneity of the home ownership variable, a Hausman (1978) specification test was performed for each estimation, using the proportion of homes with five or more rooms as a percentage of the regional housing stock in 1995 as an instrument for the regional home ownership rate. The idea is that home ownership should be more prevalent in regions which had high shares of homes with a large number of rooms in 1995, due to only slow changes in regional housing stock composition over time. The strategy assumes that variations in these proportions are not partially correlated with regional unemployment rates several years later, which seems reasonable. In each case, the estimated residuals of the reduced form equations added nothing to the fit in estimating the structural form equations, leading to a rejection of the null hypothesis of endogeneity of the home ownership rate. Additionally, the 2002 and 2006 estimations were repeated using home ownership rates of the previous censuses instead of current home ownership rates. This modification resulted in slightly smaller coefficients for the home ownership rates, but left the results qualitatively unchanged.

In order to obtain more precise results, in a next step equation (2) was estimated using pooled data and time dummy variables. Within the pooled model framework, estimated coefficients are implicitely assumed to be constant over time (Wooldridge, 2002). Tab. 4 shows the pooled OLS regression results of (2) for the fully specified model including all regions (P-1), the same model including only the western German regions (P-2), and the reduced interaction-term version of the pooled model (P-3). Like in the purely cross-sectional model, a notably high proportion of the variation between regional unemployment rates is explained. Again, there are no signs of serious heterogeneity, serial autocorrelation or multicollinearity (in the last version, multicollinearity is slightly higher due to the inclusion of the interaction term).

The parameter estimates reinforce the estimation results based on single-year data. The home ownership rate keeps the negative sign and absolute magnitude,

	(P-1)		**(P-2)**		**(P-3)**	
	Coefficients	p-values	Coefficients	p-values	Coefficients	p-values
D_ east	3.8568***	0.000			2.8443*	0.064
	(4.26)				(1.86)	
logprod	-6.3236***	0.000	-8.6087***	0.000	-6.0829***	0.000
	(-3.84)		(-4.70)		(-3.80)	
particr	-0.1615***	0.067	-0.1336***	0.000	-0.1627***	0.000
	(-6.37)		(-5.06)		(-6.35)	
propmanu	-0.1256***	0.000	-0.1036***	0.002	-0.1281***	0.000
	(-3.75)		(-3.16)		(-3.95)	
prop1825	-0.1331	0.700	-0.5157	0.226		
	(-0.39)		(-1.21)			
prop5065	0.1149	0.528	0.0363	0.872		
	(0.63)		(0.16)			
propdrops	0.3005***	0.000	0.3766***	0.000	0.3265***	0.000
	(3.99)		(4.41)		(4.87)	
logempdens	-0.005	0.985	0.5069*	0.088		
	(-0.02)		(1.71)			
propowners	-0.1259***	0.000	-0.1045***	0.000	-0.1371***	0.000
	(-5.47)		(-4.09)		(-7.91)	
*D_ east*propown*					0.2038	0.516
					(0.65)	
time dummies	yes		yes		yes	
No. of obs.	259		211		259	
R^2	0.8782		0.6411		0.8777	
Adj. R^2	0.8727		0.6232		0.8733	
F-Stat	161.85	0.000	35.73	0.000	198.62	0.000
Breusch-Pagan	2.10	0.1473	0.77	0.3817	1.77	0.1826
Durbin-Watson	1.8732		1.8192		1.8902	
Jarque-Bera	0.9196	0.6314	4.978	0.0933	0.4103	0.8145
Mean VIF	4.20		2.74		8.57	
AIC	1013.66		807.2623		1010.571	

Table 4: Pooled OLS regression results of (2) (t-statistics in parentheses)

and it is highly significant for all three specifications. Average labor productivity, participation, manufacturing employment and dropout share are always significant and again carry the expected negative signs. Like in the estimations using single-year data, a significant East/West dummy variable indicates that there is some substantial unexplained difference in unemployment levels between eastern and western German regions. This might point to some omitted factors favoring the labor market situation in western German regions. An alternative explanation is that there may still be transition problems affecting the East German labor market as a whole. Like in the single-year estimations, the share of 18-25 and 50-65 year olds and the number of jobs per square kilometre of regional area show no explanatory power with regard to

regional unemployment rates. Like in the OLS regressions using single-year data, a Hausman (1978) specification test was used to rule out potential endogeneity of the ownership variable, using the regional proportion 5-or-more-room homes in 1995 as instrument. In analogy to previous regressions, the test rejected the hypothesis of endogeneity of the home ownership rate.

An important issue to be analyzed in the pooled model framework is whether structural differences can be identified between eastern and western German regions regarding the relationship between home ownership and unemployment. Excluding the eastern German regions from the sample (P-2) does not change the results substantially, yielding a slightly smaller coefficient of only about -0.10 for the home ownership rate, compared to -0.13 in the setting including all regions. The other estimated parameters for western German regions alone do not differ qualitatively from the estimations using all regions. The only exception is employment density, which is significant at the 10%-level and carries a positive sign. In the P-3 version, insignificant variables are omitted and an interaction term between home ownership rate and East/West dummy is added. The results show that it is reasonable to assume the home ownership coefficient in eastern and western German regions to be identical, as the interaction term is not significantly different from zero.

Due to the likely existence of unobserved heterogeneity between regions, the results of both the cross-section and the pooled model have to be treated with caution. As unobserved effects on regional unemployment rates are not controlled for in these models, the estimators are possibly biased. In order to control for unobserved heterogeneity, in the next step the unobserved effects model of (3) was estimated by fixed effects, using 1998, 2002 and 2006 data. Tab. 5 below shows the fixed effects regression results for the fully specified model including all regions (FE-1), the same model including only the western German regions (FE-2), and the reduced interaction-term version (FE-3). In all estimations, robust standard errors were used in order to account for heteroskedasticity and within-group correlation (see Wooldridge (2002); Stock and Watson (2008)).

In each estimation setting, the considerable importance of regional heterogeneity becomes apparent. Given the very high values of the respective post-estimation F-statistics, the null hypothesis of identical constant terms for all regions has to be rejected at any significance level. The large importance of region-specific unobserved effects is also shown by very high estimates for *rho*, indicating that a large part of the error variances are caused by individual heterogeneity. The estimations based on fixed effects regression should consequently be preferred to the estimations based

	(FE-1)		**(FE-2)**		**(FE-3)**	
	Coefficients	p-values	Coefficients	p-values	Coefficients	p-values
logprod	-3.1420*	0.055	1.4167	0.361	-3.9951**	0.024
	(-1.94)		(0.92)		(-2.30)	
particr	-0.2041***	0.000	-0.1229**	0.043	-0.1572***	0.000
	(-4.03)		(-2.06)		(-4.07)	
propmanu	-0.5131***	0.000	-0.4123***	0.000	-0.4978***	0.000
	(-5.86)		(-5.96)		(-7.05)	
prop1825	-0.0657	0.819	0.1546	0.620		
	(-0.23)		(0.50)			
prop5065	-0.2603**	0.012	-0.4401***	0.000	-0.2866**	0.012
	(-2.26)		(-4.40)		(-2.57)	
propdrops	0.0824	0.144	0.2099***	0.000		
	(1.47)		(3.79)			
logempdens	2.0538	0.503	-2.1395	0.489		
	(0.47)		(-0.70)			
propowners	0.0545*	0.053	0.0505*	0.079	0.0414	0.148
	(1.96)		(1.78)		(1.46)	
*D_east*propown*					0.0722	0.249
					(1.16)	
time dummies	yes		yes		yes	
No. of obs.	259		211		259	
No. of groups	87		71		87	
R^2 within	0.7085		0.8081		0.7050	
R^2 between	0.3929		0.1066		0.6599	
R^2 overall	0.4049		0.1456		0.6616	
F-Stat	58.31	0.000	67.79	0.000	68.76	0.000
rho	0.9726		0.9743		0.9522	
F (all $\mu_i = 0$)	21.87	0.000	26.89	0.000	22.21	0.000

Table 5: Fixed effects regression results of (3) (t-statistics in parentheses)

on single-year and pooled OLS.

The fixed effects model parameter estimates for the fully specified version (FE-1) corroborate most of the results derived in the previous estimations, but differ in some degree with respect to magnitude and significance of the coefficients. The coefficients of average labor productivity, participation and manufacturing employment on unemployment remain negative and significant. However, the coefficients deviate from to the estimates of the pooled model with respect to their absolute magnitude. The familiar positive sign of the proportion of dropouts is still evident in the fixed effects model, but the coefficient is only of about one fourth of absolute magnitude and insignificant at familiar levels. Like in the previous models, spatial employment density and share of 18-25 year olds add nothing to the fit of the model and can be omitted. The population share of the 50-65 year olds is now significant and

carries a negative sign, indicating that regions with higher shares of older workers are associated with lower unemployment rates. As a possible explanation for this result, it could be supposed the accumulation of working experience improves the the employment opportunities of older workers in comparison to younger ones, all else equal. Another explanation may be increased early retirement of unemployed older workers, letting them drop out of the labor force.

In contrast to previous estimations using cross-sectional data for single years and pooled data, the home ownership rate now carries the positive sign. This is consistent with Oswald's hypothesis, but stands in contrast to the results of most micro-level studies. The coefficient has a magnitude of about 0.05 and is statistically significant at least at the 10%-level. According to the magnitude of the coefficient, regions with 10 percentage point higher home ownership rates are associated with about 0.5 percentage points higher unemployment rates, holding other factors constant. Thus, there is indeed evidence of a positive link between home ownership and unemployment after controlling for unobserved time-invariant effects in addition to the included control variables. As suggested by ex-ante considerations, the divide between the results found using panel and those found using cross-section estimation methods can be explained by the existence of unobserved regional effects which shift the home ownership rate coefficient downwoards in cross-sectional analysis. The size of the coefficient found in fixed effects estimation is only about a quarter of the coefficient originally found by Oswald, however, who stated the coefficient to be around $+0.2$.

Excluding the eastern German regions from the sample in FE-2 slightly alters the magnitude of the coefficients, but does not change the results qualitatively (with the only exception of the productivity variable, which changes sign and loses significance). The home ownership rate retains its positive sign and magnitude, and it is significantly different from zero at the 10%-level. In the third version of the fixed effects estimation (FE-3), insignificant variables were replaced by an interaction term between East/West dummy and home ownership rate. Again a positive home ownership coefficient of similar magnitude is derived, but the coefficient is not statistically significant in this setting. The interaction term is also insignificant. Labor productivity, participation, manufacturing employment and share of older workers remain the only significant variables in this version of the model.

Comparing the panel data model results with the results of the cross-section and pooled model, there is no clear-cut evidence of a positive relationship between the level of home ownership and unemployment at the regional level in Germany.

While cross-sectional analysis indicates an inverse relationship which seems to hold over time and in both eastern and western Germany, panel data analysis indicates a weakly positive partial influence of home ownership on unemployment, also holding in both parts of the country. These deviating results corroborate the tendency evident from previous work, which underlines the importance of differentiating between analysis based only or mostly on cross-sectional data and analysis based on panel data. The results of this study show that the omission of region-specific heterogeneity can be misleading with regard to the question on hand. The existence of time-invariant region effects seems to affect the estimated partial link between home ownership and unemployment in a region heavily, as the coefficient changes its sign once unobserved heterogeneity is controlled for. Due to the clear evidence of individual heterogeneity, the results based on fixed effects regression are should be reliable than the results based on cross-sectional or pooled data. At the same time, the fixed effects regression results still corroborate the interesting divide between micro and macro evidence concercing the linkage between home ownership and unemployment. This divide suggests that there may be indirect effects emanating from high levels of home ownership on regional labor markets in certain regions which are not yet fully understood.

Yet, both estimations relying on cross-sectional data only and estimations exploiting the panel structure of the underlying data set suggest that the economic significance of the link between home ownership and unemployment levels in German regions is not very strong. According to the data, the relationship in question is dominated by factors more directly influencing demand and supply in regional labor markets. Regional levels of average labor productivity, participation and export orientation, and human capital endowment belong to these factors. Against the background of these results, it seems reasonable to assume that potential labor market pressure associated with the choice of housing tenure - especially high or rising rates of home ownership - does not lie at the heart of high unemployment rates within Germany. With regard to our findings, policies that promote regional productivity and export orientation, participation and education seem to be the most promising ways to reduce unemployment.

6 Conclusions

Originating in the ongoing debate on the effects of tenure choice on labor market outcomes, this paper uses German regional data spanning the time period of 1998-

2006 to analyze the linkage between home ownership and unemployment, controlling for a number of well-documented other potential determinants of regional unemployment rates. According to the empirical findings, the link is inverse in cross-section and pooled OLS regressions but weakly positive in fixed effects regressions. In each empirical setting, the strength of the partial effect seems to be of only limited economic importance, as it is dominated by factors more directly related to demand and supply in regional labor markets. The evidence of unobserved individual heterogeneity partly questions the results of previous studies using purely cross-sectional or pooled data only, as these results may be prone to severe heterogeneity bias. As a limitation of the results presented, it should be noted that possibly existing spatial effects between the included regions have not been modeled explicitely within the framework of this study. Although functionally delineated regions were used as units of observation, explicit modeling of spatial autocorrelation would probably improve efficiency and consistency of the parameter estimates. The analysis of Oswald‘s hypothesis at the regional level in Germany within a spatial econometric framework remains a field which would benefit from further research.

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Appendices

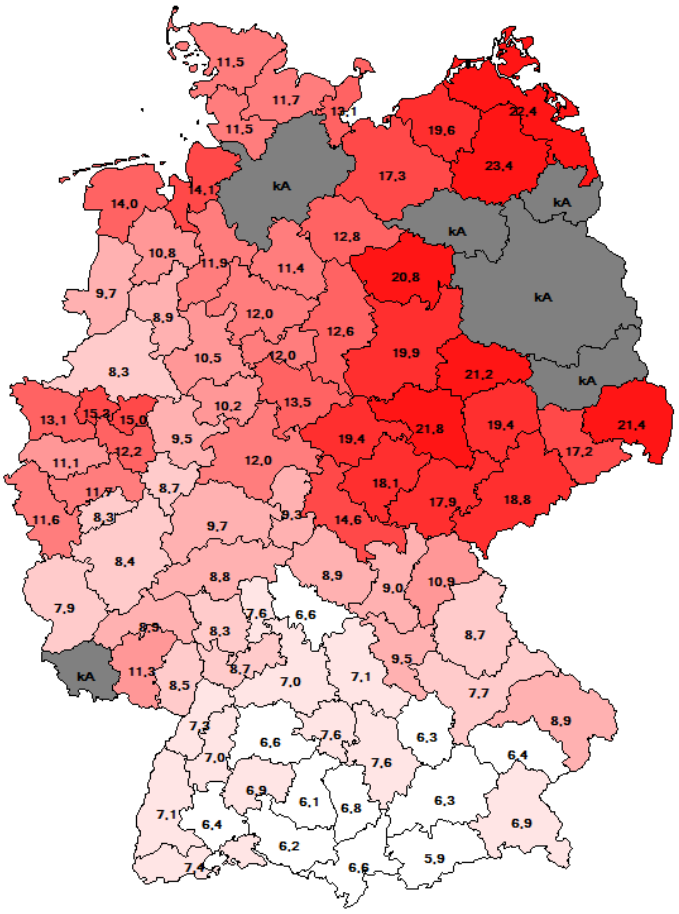

Figure 2: Map of unemployment rates in German regions, average values 1998-2006 (grey-coloured regions: no data available for all three years or other data problems).

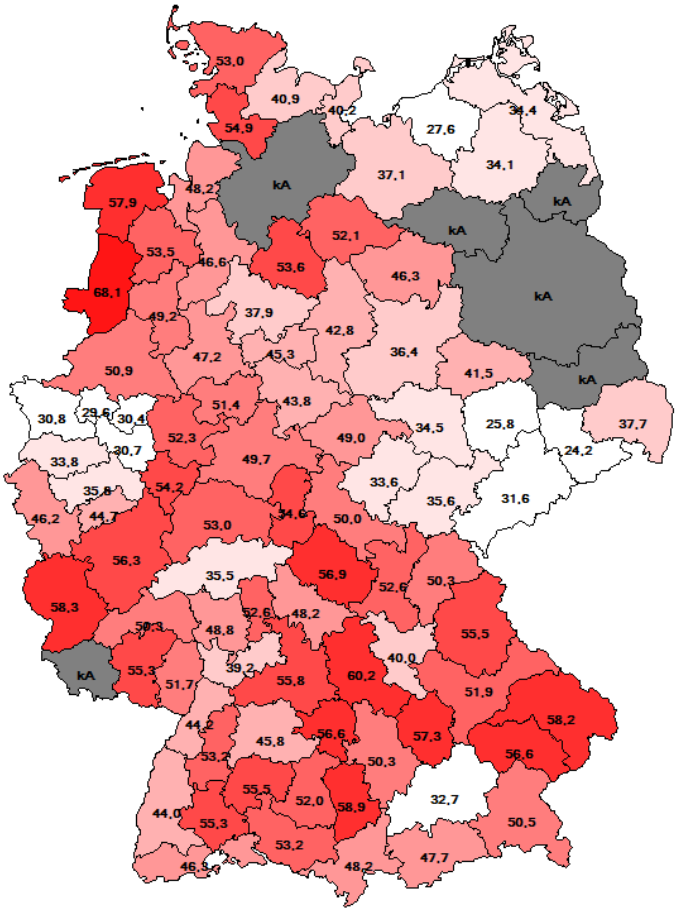

Figure 3: Map of home ownership rates in German regions, average values 1998-2006 (grey-coloured regions: no data available for all three years or other data problems).

Variable	Definition	Primary source
Unemployment rate (*unempr*)	Share of unemployed labor force in per cent of total labor force in region i and year t	Federal Employment Agency, Eurostat Regio Database
Home ownership rate (*propowners*)	Share of households living in owner-occupied dwellings of all households in region i and year t	BBSR Wohnungsmarktbeobachtung, German Mikrozensus
Labor market participation (*particr*)	Share of labor force participants in per cent of total population between 18 and 65 of region i and year t	Federal Employment Agency
Labor Productivity (*prod*)	Regional gross value added per worker in region i and year t	Income accounting of the German Laender
Manufacturing employment (*propind*)	Share of manufacturing employment in per cent of total employment in region i and year t	Federal Employment Agency
Young population (*prop1825*)	Share of population aged 18 to 25 years in per cent of total population in region i and year t	Population statistics of the Bund and the Laender
Older population (*prop5065*)	Share of population aged 50 to 65 years in per cent of total population in region i and year t	Population statistics of the Bund and the Laender
Low-skilled labor (*propnodegr*)	Share of school dropouts in per cent of all graduates in region i and year t	Statistics of general-education schools of the Bund and the Laender
Level of agglomeration (*empdens*)	Regular employment per square kilometre of regional area in region i and year t	Federal Statistical Office
One- and two-family dwellings in 1995 (IV)	One- and two-family dwellings in per cent of total regional dwelling stock in region i in 1995	Federal Statistical Office

Table 6: Data descriptions and primary sources.

Region	East/West	Average home ownership rate 1998-2006	Average unemployment rate 1998-2006
Aachen	West	46.2	11.6
Allgau	West	48.2	6.6
Altmark	East	46.3	20.8
Anhalt Bitterfeld	East	41.5	21.2
Arnsberg	West	52.3	9.5
Augsburg	West	50.3	7.6
Bayrischer Untermain	West	52.6	7.6
Bielefeld	West	47.2	10.5
Bochum/Hagen	West	30.7	12.2
Bodensee Oberschwaben	West	53.2	6.2
Bonn	West	44.7	8.3
Braunschweig	West	42.8	12.6
Bremen	West	46.6	11.9
Bremerhaven	West	48.2	14.1
Donau-Iller (BW)	West	52.0	6.1
Donau-Iller (BV)	West	58.9	6.8
Donau Wald	West	58.2	8.9
Dortmund	West	30.4	15.0
Duesseldorf	West	33.8	11.1
Duisburg Essen	West	30.8	13.1
Emscher Lippe	West	29.6	15.3
Emsland	West	68.1	9.7
Franken	West	55.8	7.0
Goettingen	West	43.8	13.5
Halle Saale	East	34.5	21.8
Hamburg	West	35.3	10.0
Hannover	West	37.9	12.0
Hildesheim	West	45.3	12.0
Hochrhein Bodensee	West	46.3	7.4
Industrier. Mittelfranken	West	40.0	9.5
Ingolstadt	West	57.3	6.3
Koeln	West	35.8	11.7
Landshut	West	56.6	6.4
Lueneburg	West	52.1	12.8
Magdeburg	East	36.4	19.9
Main Rhoen	West	56.9	8.9
Mecklenburg Rostock	East	27.6	19.6
Mecklenburg. Seenplatte	East	34.1	23.4
Mittelhessen	West	53.0	9.7
Mittelrhein Westerwald	West	56.3	8.4
Mittelthueringen	East	33.6	18.1
Mittlerer Oberrhein	West	44.2	7.3
Muenchen	West	32.7	6.3
Muenster	West	50.9	8.3

Region	East/West	Average home ownership rate 1998-2006	Average unemployment rate 1998-2006
Neckar Alb	West	55.5	6.9
Nordhessen	West	49.7	12.0
Nordschwarzwald	West	53.2	7.0
Nordthueringen	East	49.0	19.4
Oberes Elbtal Osterzgeb.	East	24.2	17.2
Oberfranken Ost	West	50.3	10.9
Oberfranken West	West	52.6	9.0
Oberland	West	47.7	5.9
Oberlausitz	East	37.7	21.4
Oberpfalz Nord	West	55.5	8.7
Oldenburg	West	53.5	10.8
Osnabrueck	West	49.2	8.9
Ost-Friesland	West	57.9	14.0
Osthessen	West	54.6	9.3
Ostthueringen	East	35.6	17.9
Ostwuerttemberg	West	56.6	7.6
Paderborn	West	51.4	10.2
Regensburg	West	51.9	7.7
Rheinhessen Nahe	West	50.3	8.9
Rhein Main	West	35.5	8.8
Rheinpfalz	West	51.7	8.5
Saar	West	55.1	10.4
Schleswig Holstein Mitte	West	40.9	11.7
Schleswig Holstein Nord	West	53.0	11.5
Schleswig Holstein Ost	West	30.2	13.1
Schleswig Holstein SuedWest	West	54.9	11.5
Schwarzwald Baar Heuberg	West	55.3	6.4
Siegen	West	54.2	8.7
Starkenburg	West	48.8	8.3
Stuttgart	West	45.8	6.6
Suedheide	West	53.6	11.4
Suedlicher Oberrhein	West	44.0	7.1
Suedostoberbayern	West	50.5	6.9
Suedsachsen	East	31.6	18.8
Suedthueringen	East	50.0	14.6
Trier	West	58.3	7.9
Unterer Neckar	West	39.2	8.7
Vorpommern	East	34.4	22.4
Westmecklenburg	East	37.1	17.3
Westmittelfranken	West	60.2	7.1
Westpfalz	West	55.3	11.3
Westsachsen	East	25.8	19.4
Wuerzburg	West	48.2	6.6

Table 7: Average home ownership and unemployment rates in German planning regions, 1998-2006