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PHOENIX FROM THE ASHES: BOMBS, HOMES, AND UNEMPLOYMENT IN GERMANY, 1945-2011

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Abstract

What shapes an economy's ability to absorb shocks? We test the hypothesis that high homeownership impairs the labour market's ability to absorb shocks through restricting labour mobility. Our results are relevant to the debate on Europe’s high and unevenly distributed level of unemployment. We find that high homeownership hinders the convergence of unemployment rates across a panel of 85 German regions over 1998 to 2011. To deal with endogeneity, we use variation in the timing and intensity of WWII Allied bombing of Germany, which destroyed the country’s housing stock and led to the wide-scale public provision of rental accommodation. We show how bombing during the war created substantial variation in post-WWII housing subsidies and contributed to persistent differences in homeownership across Germany. We find that moving from the first to second quartile in homeownership rates almost doubles the unemployment growth rate. Moreover, we provide evidence that homeownership restricts gross emigration rates, supporting the idea that labour mobility is the key mechanism behind our finding. Housing policies matter for labour markets.

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Phoenix from the Ashes:

Bombs, Homes, and Unemployment in Germany, 1945-2011[1]

November 2016

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Abstract

What shapes an economy's ability to absorb shocks? We test the hypothesis that high homeownership impairs the labour market's ability to absorb shocks through restricting labour mobility. Our results are relevant to the debate on Europe's high and unevenly distributed level of unemployment. We find that high homeownership hinders the convergence of unemployment rates across a panel of 85 German regions over 1998 to 2011. To deal with endogeneity, we use variation in the timing and intensity of WWII Allied bombing of Germany, which destroyed the country's housing stock and led to the wide-scale public provision of rental accommodation. We show how bombing during the war created substantial variation in post-WWII housing subsidies and contributed to persistent differences in homeownership across Germany. We find that moving from the first to second quartile in homeownership rates almost doubles the unemployment growth rate. Moreover, we provide evidence that homeownership restricts gross emigration rates, supporting the idea that labour mobility is the key mechanism behind our finding. Housing policies matter for labour markets.

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1. Introduction

Two striking facts about unemployment in the European Union have put labour mobility at the forefront of academic and policy debates. First, unemployment is high. Seven years after the Global Financial Crisis, the overall unemployment rate is still at 9.7% compared to 5.7% in the United States (Eurostat 2015a). Second, unemployment is unevenly distributed both between and within countries. Spain's unemployment rate is 23.4% compared to 4.7% in Germany (Eurostat 2015a). Within Spain itself, unemployment ranges from 14.9% in Navarra to 34.2% in Andalusia (INE 2015).[3]

Over the past few decades, the European Union has been eliminating barriers to the mobility of goods and factors, and moved towards a common a currency. These institutional changes should have improved the EU's ability to absorb shocks. Looking at unemployment differentials within the United States, Blanchard and Katz (1992: 52) found that labour mobility, rather than job creation or job migration, is unemployment's 'dominant adjustment mechanism.' But recent evidence shows that labour mobility is still today a less important adjustment mechanism to country-specific labour demand shocks in Europe than in the US (Beyer and Smets 2015). Our paper is an effort at understanding why labour mobility is not working in Europe, often not even within European nation states.

Researchers have traditionally explained the rigidities in Europe's labour market through institutions such as employment protection, trade unions, and unemployment insurance (Nickell 1997, Blanchard and Summers 1986). Recent research has shown that the housing market may also be an important driver of labour market rigidities (van Ewijk and van Leuvensteijn 2009; Blanchflower and Oswald 2013). The spatial nature of both, the labour and housing markets, makes them natural complements. If workers are less mobile in the housing market, then their opportunities to find employment in the labour market will also be limited.

In this vein, Oswald (1999) hypothesized that homeownership is a barrier to labour mobility; that after a negative labour demand shock, homeownership discourages movement from low to high employment regions, leading to higher unemployment in aggregate. The underlying reason is

[3] Eurostat numbers refer to January 2015. INE numbers refer to Q4 2014.

that homeowners face higher transaction costs of selling, moving, and buying their homes than renters do. This is especially the case after a *housing* crisis, when house values often drop below mortgage values, making it harder to move home. Mian and Sufi (2014: 68) found there was no net migration response to the United States housing and unemployment crisis among a large sample of counties, but they do not link this to homeownership's effects on labour mobility, blaming nominal wage rigidity instead. Rajan (2010: 198) outlines the Oswald homeownership-labour mobility mechanism, but writes that there is only 'anecdotal' evidence for it.

In fact, the "Oswald hypothesis" has already received empirical support in terms of positive cross-country correlations between homeownership and unemployment (Oswald 1999); micro-level positive correlations between joblessness and homeownership across the United States (Blanchflower and Oswald 2013); and fixed-effects correlations for a sample of German regions (Lerbs 2011). However, all these studies suffer from an identification problem, because homeownership depends positively on employment. A labour demand shock can thus induce a negative association between homeownership and unemployment, which is the opposite of what the Oswald hypothesis predicts. Laamanen (2013) and Blanchflower and Oswald (2013) are the only papers so far that econometrically deal with this issue. For a sample of Finnish counties, Laamanen (2013) uses a legislative change – rental market deregulation – to explain lower rates of homeownership, but it is unclear whether this legislative change is truly exogenous or whether the sample of Finnish counties has external validity. The same applies to Blanchflower and Oswald (2013), who use Ganong and Shoag's (2012) data on land use regulation as an instrument. While this is plausible, they do not test for the strength of their instrument. It remains unclear whether the exclusion restriction – that unemployment is unrelated to land-use regulations – is violated or not.

We provide evidence consistent with the Oswald hypothesis, using modern and historical data on a sample of German regions. Germany is an interesting case for three reasons. First, it has a low level of unemployment that has been in *decline* since the financial crisis, dropping from a peak of 11.2% in 2005 to its current (2015) 4.7% level. At the same time, the dispersion of regional unemployment rates has remained stable with a coefficient of variation on regional unemployment ranging from 0.40 in 1998 to 0.45 in 2011 (Destatis 2015).[4] Second, it has an

[4] Regions: Raumordnungsregionen.

unusually low rate of homeownership: 53.3% versus 77.7% in Spain (Eurostat 2015b). Third, and crucially, it provides an opportunity to deal with endogeneity in what is Europe's largest economy.

More specifically, we estimate unemployment equations on 85 German regions over 1998 to 2011, instrumenting homeownership with variation in WWII Allied "area bombing". The United States Army Air Forces (USAAF) and the Royal Air Force (RAF), partly because targeting individual factories and army buildings was difficult, targeted cities instead to demoralize Germans. This policy, sometimes called "de-housing" by contemporaries, has always been controversial (Hastings 2012: Ch. 5). Churchill, for one, protested area bombing would create '…a great shortage of accommodation for ourselves and our Allies…[and] some temporary provision would have to be made for the Germans themselves' (TNA: CAB 120/303).

Nevertheless, between October and December 1944, 53% of air attacks targeted cities (Terraine 1985: 675). All told, 20% of West Germany's housing was destroyed; another 20% was damaged (Voigtländer 2009: 357). In comparison, only 43% of Bomber Command's ordnance was expended on *industrial* cities (Bashow 2014: 32). Along with refugees from the East, this created a 4.5 million home shortage by 1950 (Voigtländer 2009: 358). Capital scarcity and decimated private capital market made government intervention necessary. By 1959, 50% of all new houses were built with public funds (Voigtländer 2009: 358). Low homeownership persists because the dwellings are high quality, income limits were generous, and the rental market remains heavily regulated (Voigtländer 2009).

We find that high rates of homeownership acts as a break on the convergence of unemployment levels across Germany. Moreover, homeownership decreases gross outmigration of regions, supporting the idea that homeownership acts as a friction on mobility as a labour market adjustment mechanism.

These results corroborate a brief reduced-form study on the topic (Wolf and Caruana Galizia 2015). In the present paper, we provide direct evidence on the mechanisms that first link bombing to homeownership, and next homeownership to unemployment. To this end, we collected city-level data on post-WWII housing subsidies, used to fund rental accommodation, finding it is highly correlated with bombing intensity. This supports the idea that the policy response to bombing created a large social rental sector. We also collected city-level homeownership data for 1927, showing that more intensely bombed cities experienced slower homeownership growth reaching into the late-twentieth and early-twenty-first century, supporting our argument that WWII bombing persistently altered the structure of Germany's housing market. To alleviate concerns about selection bias – that is, bombing was likely higher in dense, low homeownership regions - we implement a matching procedure. Our results are robust to instrumentation, with and without this matching procedure, as well as a set of controls, region and year fixed effects, and subsampling.

These results can link two important facts for Germany – unusually low homeownership and unusually low unemployment – and have wider implications for Europe. Europe's high homeownership countries (Spain and Italy, for example) also have the highest rates of unemployment. In many of these countries, promoting homeownership is an important priority of government policy, supported by tax breaks and subsidies. According to our results, these policies tend to increase the transaction costs of residential mobility and, in turn, impair the flexibility of the labour market. We do not argue that policies supporting homeownership should be altogether abandoned, but that, as Glaeser and Shapiro (2003) suggest for the United States, policymakers need to adopt a broader perspective and should not try to increase homeownership at all costs.

2. Background

2.1. Related Literature

In their well-cited analysis of regional unemployment differentials across the United States, Blanchard and Katz (1992: 52) conclude that

> *[t]he dominant adjustment mechanism is labor mobility, rather than job creation or job migration. Labor mobility, in turn, appears to be primarily a response to changes in unemployment, rather than consumption wages*.

Blanchard and Katz (1992) provided empirical support for the idea, at least as old as Milton Friedman's 1968 address to the American Economic Association, that an economy's natural rate of unemployment depends on the degree of its labour mobility (Blanchflower and Oswald 2013: 3-4). The observation of persistent regional unemployment differentials, then, becomes a question of labour mobility frictions.

Labour mobility within an economy depends on residential mobility. From a micro perspective, it is easier to find a job if you are willing to move residence as your job search would not be restricted to one region. Homeowners are more likely to decline job offers because some of those job offers come from different regional labour markets and are thus unacceptable (if commuting is not an option) or because homeowners demand higher wages to compensate for the transaction costs of selling and buying a new home. Homeowners therefore search longer for employment and enter unemployment faster than renters, who do not face the same transaction costs and are more inclined to move residence for a job (Munch et al 2009; de Graaff et al 2009).

From a macro perspective, which is our approach in this paper, there are three reasons why homeownership may reduce labour mobility (Green and Hendershott 2001). First, when an economy is in recession, housing becomes an illiquid asset. In the euro zone crisis, for example, Spanish regions suffered both severe unemployment shocks and plummeting house prices. This created a scenario where unemployed households had mortgage balances that exceeded the value of their houses. These households could move by either selling their houses and paying the balance due to the lender, or by defaulting. While the second is relatively more attractive, it is still clearly unattractive in an absolute sense. Second, if one of the proximate causes of a recession and unemployment is high interest rates, then households may find themselves searching for employment when they are most "locked-in" to below-market mortgages. Third, high transaction costs (taxes and real estate agent fees) usually associated with homeownership may deter residential mobility. Figure 1 shows that these transactions costs can be considerable. In Europe, they range from 4% of a home's value in the United Kingdom to 19% in Italy, with Germany somewhere in between at 9%.

INSERT FIGURE 1

The literature has provided mixed evidence on the role of homeownership for unemployment: some of it supporting precise mechanisms, and some supporting the reduced form positive correlation between homeownership and unemployment. McCormick (1983) and Hughes and McCormick (1981) found evidence that labour mobility was low and joblessness was high in certain types of public-sector housing, which in effect guarantee tenure. Oswald (1996; 1997) showed simple cross-country positive correlations between homeownership and unemployment. The correlation is especially strong among European countries, but Oswald did not provide any regression results to support these simple correlations. Green and Hendershott (2001) find support for the relationship among US states, but also show that the relationship depends on the age of homeowners: young households, they argue, have little accumulated wealth and have had little time to grow attached to their region. Lerbs (2011) finds a positive correlation between homeownership and unemployment for a panel of German regions, but finds that the economic significance of the relationship is weak.

Blanchflower and Oswald (2013), using macro evidence, find that a doubling of the homeownership rate in a US state is followed in the long-run by more than a doubling of the later unemployment rate. Using micro evidence, they also find that homeownership (1) lowers levels of labour mobility; (2) increases commuting times; (3) and is associated with fewer new businesses, the implication being that residential zoning restricts the establishment of commercial property. Finally, Laamanen (2013) finds that homeowners are less likely to experience unemployment, but that an increase in the homeownership rate causes unemployment to rise. Laamanen (2013) explains this seemingly conflicting result through externalities arising from consumption reductions (house prices were falling, and home-owners were spending less on non-tradeables) and increased job competition.

Laamanen (2013) and Blanchflower and Oswald (2013) are the only papers so far that econometrically deal with endogeneity between home-ownership and unemployment in similar ways. Blanchflower and Oswald (2013) use Ganong and Shoag's (2012) data on land use regulation as an instrument for home-ownership rates. The instrument is a count for annual data since the 1940s of the number of state appellate court cases that contain the words "land use". Yet there is no obvious interpretation of this instrument's effect on home-ownership: a high count could equally mean a large number of appeal cases for tighter or looser restrictions on land use. Neither can we assume that mentions of "land use" led to regulatory action on land use. The opposing effects can net each other out, weakening the instrument's validity. While arguably an empirical question, Blanchflower and Oswald (2013: 45) do not report first-stage results in their instrumental variable regressions table. Laamanen's (2013) strategy relies on rental market reforms that lifted rent ceilings and made eviction easier. As Laamanen (2013: 7) writes, these reforms were a response to 'a serious shortage of rental housing in [Finland]' aimed at encouraging supply in the private rental sector. The exogeneity of these reforms is doubtful since they are likely an endogenous policy response to the state of the housing market. Exploiting the bombing of Germany during WWII, and the widespread provision of rental housing that followed, can help us around this endogeneity problem.

2.2. Area Bombing and the German Housing Market

The first USAAF and RAF air raids on Germany in WWII were not as effective as envisaged. Navigating the skies at night and through air defences was a difficult task. The "GEE" radar-based navigation aid had a limited range and, from August 1942, the Germans were able to jam its signals. Daylight raids led to huge losses of aircraft and aircrew. For the six months leading up to February 1942, for example, the percentage of aircraft actually attacking their target averaged just over 20% (UK TNA 1945). Partly as a response to the difficulty of hitting specific targets like factories, and partly as a response to the German bombing of Rotterdam, the RAF and USAAF changed tactics.

In February 1942, the British Air Ministry issued the *Area Bombing Directive*, which removed important restrictions on bombing cities, and which prioritized attacks on Germany.[5] The Chief of Air Staff, Sir Charles Portal, wrote on 15 February 1942 to his deputy,

> *Ref. the new bombing directive: I suppose it is clear that the aiming-points are to be built-up areas, not, for instance, the dockyards or aircraft factories … This must be made quite clear if it is not already understood* (Hastings 2013: 95-6).

That same month, Sir Arthur Harris, who became known for his support of area bombing, was made head of RAF Bomber Command. The Command was charged with coordinating RAF and USAAF raids on Germany from its headquarters in High Wycombe.

Fresh impetus was given to area bombing on 30 March 1942 by Frederick Lindermann, later Baron Cherwell, the British government's chief scientific advisor. Lindermann sent a memorandum to Churchill, which came to be known as the "dehousing paper" by the Cabinet (Hastings 2012: Ch. 5). The paper argued that, given the reaction of the British population to the Blitz, destroying people's houses was the most effective way of demoralizing them. The paper estimated that re-focusing on housing - destroying about 30% of the housing stock of Germany's 58 largest towns - would break Germany's morale, and consequently lead to an Allied victory.

[5] General Directive No.5 (S.46368/111. D.C.A.S).

The paper was as controversial then as it is now, but after a heated debate among military and scientific advisors, the Cabinet accepted its proposed bombing strategy.

The 1945 US Strategic Bombing Survey, designed to assess the results of the Allied bombardment of Germany, gives us a sense of just how central area bombing was to Allied strategy (USAAF 1945a). Table 1 below reproduces a table from the chapter 'German Civilian Morale' called 'Home destruction and morale' (USAAF 1945a: 96). It shows the morale of German citizens according to the extent of housing destruction caused by Allied bombing. Cross-section A refers to citizens' whose morale was measured by extensive interviews by Allied officials and by Nazi 'morale reports', and cross-section B refers to citizens' whose morale was measured through the analysis of captured mail, escapees' accounts, and interrogations (USAAF 1945a: 95). The author[6] described the results in table 1 as such: 'Morale was just as poor in towns with a moderate proportion of homes destroyed as in towns with a high proportion of such destruction' (USAAF 1945a: 96).

INSERT TABLE 1

While not effective in terms of demoralization, bombing accuracy unsurprisingly improved, going from 60% to 90% between January 1944 and April 1945 (UK NA ref. 16/487), which is when 85% of all tonnage on Germany was dropped (USAAF 1945a: 71). USAAF accuracy averaged 70% (USAAF 1945b: 13). Between October and December 1944, 53% of air attacks targeted cities (Terraine 1985: 675). Only 43% of Bomber Command's ordnance was expended on *industrial* cities (Bashow 2014: 32). Overall, 20% of West Germany's housing was destroyed; another 20% was damaged (Voigtländer 2009: 357). Along with refugees and expellees from the East, this created an estimated 4.5 million home shortage by 1950 (Voigtländer 2009: 358).

This situation was foreseen by Churchill who in 1945 wrote to his Chief Military Advisor that area bombing would create "…a great shortage of accommodation for ourselves and our Allies…[and] some temporary provision would have to be made for the Germans themselves" (TNA: CAB 120/303). The housing shortage in combination post-War capital scarcity made government intervention in the housing market necessary.

[6] John K. Galbraith was a director of the US Strategic Bombing Survey and a noted sceptic of the Allied bombing strategy and its results. Nicholas Kaldor was his 'principal assistant' (Galbraith 1989: 4).

Unlike, say the United Kingdom, Germany's post-War governments focused on influencing the rental market rather than housing construction. They did this through subsidizing the construction of rental homes, providing housing allowances, enacting strict tenancy laws, and controlling rent levels. West Germany's First Housing Law in 1950, "*Wohnungsbaugesetz*", subsidized builders and landlords who agreed to a minimum dwelling size, limited rent levels, and guaranteed access for people with eligibility certificates. The Second Housing Law in 1956 promoted family houses ("*Eigenheim*"). In 1960, a law ("*Gesetz über den Abbau der Wohnungszwangsbewirtschaftung*") was passed that stated landlords must accept a tenant if a municipal residential company decides so. In the 1970s, further laws ("*Miethöhegesetz*") regulated the amount of rent landlords could charge. Already by 1959, 50% of all new houses were built with public funds (Voigtländer 2009: 358).

Germany's policy response to the destruction of its housing stock in WWII ensured that a large rental market persisted up until the late-twentieth century. To be confident in this narrative, we need to know two things: first, that bombing had a persistent effect on homeownership rates and, second, that the policies described above are indeed a response to bombing.

Testing the first condition is difficult, as no data on homeownership rates exist for the pre-War period. The best proxy for pre-War homeownership rates is the percentage of single-apartment residences in the total number of residential buildings from The Housing Census in the German Empire from 16 May 1927 ("*Reichswohnungszählung Vom 16. Mai 1927*") (Statistik des Deutschen Reichs 1978[1930]). This proxy is helpful because before the 1951 Condominium Act ("*Wohnungseigentumsgesetz*"), West German law did not allow the separation of homeownership and building ownership. That is, before 1951 it was not possible to own an apartment in a building that housed other rented apartments: in this case, the apartment owner was the owner of the entire building. For this reason, the ratio of single- to multi-apartment residences should closely correspond to the homeownership rate. The correspondence is not perfect because there may be single-apartment residential buildings that are rented rather than owner-occupied.

The unweighted mean of the 1927 "homeownership rate" series across 90 cities is 24.5%. The unweighted mean of our 1998 to 2011 homeownership rate data is 47.2%. There are two reasons for this large difference. First, our data refer to large regions, comprising both urban and rural areas while the 1927 data refer to cities alone. This means the latter figure is biased downwards, as homeownership tends to be lower in cities. However, note that our measure based on single-apartment buildings should limit this bias. Second, the 72 years between 1927 and 1998 saw fast per capita growth in Germany, which drove the demand for residential property. While at a currently low level, it appears that Germany's homeownership rate has been on an upward trend for the past few decades as it has been in other countries (e.g., Shiller (2007)). The question here is not whether bombing was a permanent negative shock to Germany's homeownership *level*, as in higher before bombing and lower after, but whether spatial variation in bombing had an effect on Germany's long-run homeownership *trend*. If so, we should expect that regional homeownership rates *grew at a slower rate* the more heavily bombed those regions were.

To examine this, we matched the 1927 "homeownership" series to data on bomb tonnage and homeownership cross-sections, giving us a sample of 79 cities. We then ran regressions of the difference between each one of our homeownership cross-sections and the 1927 cross-section on bomb tonnage. The results of this exercise are given in table 2. Panel A with columns 1 to 4 shows the results for the unweighted data. Looking at the R^2 values, the overall correlations are weak: from 0.05 to 0.06. However, the F-statistics are large and the coefficients on bomb tonnage range in significance level from 5% to 1% and are all the same magnitude. The coefficients imply that for every standard deviation increase in bomb tonnage (19,075 tons) the difference (or growth) in a city's homeownership rate drops by 1.9 percentage points (or 0.18 standard deviations).

INSERT TABLE 2

Turning to panel B, we see slightly weaker correlations when the variables are weighted by their cross-sectional means (for example, $bomb_t/\overline{bomb_t}$). The R^2 values range from 0.02 to 0.03, and the F-statistics range from 4.9 to 6.9. Still, the bomb tonnage coefficients are all significant at the 5% level and are in the same order of magnitude. In standardized form, they imply that every standard deviation increase in weighted-bomb tonnage results in a homeownership rate difference that is 0.16 standard deviations lower.

Table 2 shows us that the more intensely bombed a city was, the further behind it fell in relative homeownership growth. This is consistent with our narrative that bombing and housing destruction led to a large subsidised rental sector. To close in on this, we now turn to testing the relationship between bombing and the public provision of housing subsidies.

It was not bombing and housing destruction *per se* that lowered homeownership rates, but the policy response to bombing and housing destruction. Given this, we should expect bomb tonnage to be correlated with the incidence of subsidized housing. We collected data on the number and proportion of subsidized residences ("*öffentlich geförderte Wohnungen*") by city from the Building and Housing Census of 1968 (*Gebäude- und Wohnungszählung* 1968: columns 43 and 44), enumerated at the height of the post-War housing policy response. We matched these data to our bomb tonnage series, and ran simple OLS correlations. The results of this exercise are in table 3. Column 1 uses the absolute number of subsidised residences as a dependent variable. For a sample of 63 cities, we get an R^2 of 0.38, an F-statistic of 14.9, and a t-statistic on bomb tonnage of 3.87, significant at 1%. Column 2 takes the percentage of subsidized residences in total residences weighted by 1000/population as the dependent variable. Missing population data means we are down to 39 cities. Here we get an R^2 of 0.54, and F-statistic of 13.4, and a t-statistic on bomb tonnage of 3.66, significant at 1%. Finally, Column 3 takes percentage of subsidised residences in total residences weighted by 1000/number-of-residences as the dependent variable. Back up to 63 cities, we find an R^2 of 0.31, and F-statistic of 12.5, and a t-statistic on bomb tonnage of 3.54, significant at 1%. These figures are consistent with our idea that housing policies were a response to bombing.

INSERT TABLE 3

It is important to discuss two additional points on the nature of the housing subsidies that are relevant to this narrative. First, as Voigtländer (2009: 359) wrote, the provision of social housing was of good quality and open to most people:

> *…social housing even attracted tenants from the middle classes…income limits were generous since social housing was intended for broad sections of the population and the tenants' income was only checked when they moved in. If the income rose during the term of the rental agreement, it had no consequences for the tenant…it was to the financial advantage of the rising middle class in particular to stay in these dwellings and defer potential plans to create homeownership.*

Second, subsidies like cheap mortgages, tax deductions, and so on were *not* given to existing homeowners, as they were to homeowners in Spain, the Netherlands, or the United States. Unlike the latter countries, Germany did not experience a mortgage credit and house price boom in the run up to the 2007-2008 Crisis (Jordà et al. 2014: 13). Consequently, the incentives to buy a German home based on the appreciation of its value have also been very different. From 1999 to 2008, Germany's house price to income ratio *dropped* by about 20%, while Spain's ratio rose by about 60% (Jordà et al. 2014: 13).

We exploit spatial variation in area bombing to identify the effects of regional homeownership rates. In this scheme, bombing provides a lower-bound effect on homeownership rates since we use it to measure housing stock damage, which is the proximate cause of the provision of rental housing. Using data on damaged housing stocks would give us stronger identification, but these data are unavailable for East German regions (Vonyo 2012). Unsurprisingly, bombing and housing damage are strongly correlated. We collected the km^2 of "built-up area" destruction – not housing damage alone - for a sub-sample of 49 German cities from Hewitt (1983: 266), and matched the series to our bomb tonnage series. The Pearson correlation is 0.71, significant at 1%. The Spearman correlation is 0.70, significant at 1%. Regressing log bomb tonnage on log km^2 built-up area destroyed yields an R^2 of 0.504, a t-ratio with robust errors of 8.5, and an F-statistic of 71.8.

Note that we do not claim that bombing was random. Instead we argue that bombing was not systematically related to homeownership rates. Distance from British airfields – itself exogenous to German homeownership rates - determined the extent of bombing. Vonyo (2012: 107) shows that distance to RAF bomber command in High Wycombe is more strongly correlated with the extent of bombed housing by district than it is with population size, coast and river dummies and, importantly, the rate of industrialization.

Similarly, it can be argued that Allied bombers avoided sparsely populated regions, where homeownership may have been higher. This is not supported by Vonyo's (2012) empirical results and our own data. For example, Münster was the sixth most heavily bombed region in our sample, but had below average 1939 (pre-bombing) population density (Klüsener and Zagheni 2014). The region of "Ost Friesland" received twice the sample mean of bombing tonnage, but had below mean 1939 population density. Both Münster and Ost Friesland are on the western

German border, as close as can be to Britain. Further below we will address the issue of selection into treatment with a matching approach and show that our results are robust to this.

Bomb tonnage data are available for 97 towns, cities, and municipalities of all sizes, from Hamburg to Söllingen. This gives us an average of 1.57 units per region. We aggregated by region (Raumordnungsregionen) the short tonnage of bombs dropped on German cities, from the start of area bombing raids in March 1942 to the end of the War, using Hastings (2013: 328-333) and USSBS (1947: 35, 46). As we are working with a panel on regional unemployment for the benchmark years 1998, 2002, 2006, and 2011, and so need time-variation in our instrument, we interacted these bombing data with the *inverse* number of months from the last raid to our panel's benchmark years, using the daily bombing schedules in Hastings (2013: 328-333) and the EAFHS (2014). The resulting instrumental variable (*bomb*) captures the cross-sectional extent of bombing damage as well as bombed areas' recovery time.

INSERT TABLE 4

Table 4 summarises the data on both of the IV's components. The mean value of months since last raid is 724, with a standard deviation of 58. Mean tonnage is 10,915 with a standard deviation of 23,010, and coefficient of variation of 2.11. The IV itself, an interaction of these two variables, has a coefficient of variation of 2.12. This is our preferred identification strategy as it makes use of observed data and has a real rather than purely technical interpretation.

Most studies seeking to explain panel data with cross-sectional instruments simply interact their instruments with year dummies. We use this strategy, and some variations of it, as a crosscheck, finding very similar results to our preferred identification strategy.

3. Empirics and Data

We aim to measure how homeownership affects adjustment in the labour market. Here we proceed in two steps. First, we document how the variation in unemployment levels is systematically related to variation in homeownership, using bombing as an instrument. Second, we show that homeownership indeed limits regional adjustment in labour markets. The underlying hypothesis here is that in regions with high unemployment homeownership should limit adjustment via mobility. Germany from 1998 to 2011 is well suited for testing this hypothesis.

Germany's unemployment rate went from 11.1% in 1998, peaking at 11.7% in 2005, then dropping to 7.1% by 2011 (Eurostat 2015a). Current explanations for this general decline in unemployment are centred on the introduction of flexible labour market institutions after 2005 (Dustman et al 2014). Yet this general decline in unemployment was highly spatially uneven. According to our data for 85 regions across Germany, the coefficient of variation of regional unemployment rates increased from 0.40 in 1998 to 0.46 in 2011. These two facts – declining national unemployment and uneven regional unemployment – suggest that while regional labour market adjustments were at work their operation was regionally constrained. This fits with our hypothesis: homeownership is low nationally, around 43% (Voigtländer 2009: 355), but highly regionally uneven. According to our data, regional homeownership rates ranged from 15.6% to 69.7% in 2011 (mean=50.6% and standard deviation=9.9%).

To test whether variation in unemployment levels is systematically related to variation in homeownership, we estimate the following equation (1) from Wolf and Caruana-Galizia (2015) on our extended dataset:

$$\ln u_{it} = \alpha + \beta \ln own_{it} + \gamma \boldsymbol{X}_{it} + \vartheta_t + \pi_i + \mu_{it} \qquad (1)$$

where u is the unemployment rate (%) of region i in year t, *own* is homeownership rate (%), under $\boldsymbol{X}$ we control for other potential determinants of unemployment, ϑ and π are region and year fixed effects terms, and α and μ are a constant and error term with standard properties. Note that this specification allows for regional variation in labour market characteristics, such as labour market participation and differences in industry composition. As unemployment tends to lower the affordability of housing, we instrument this equation using the bombing instrument we discussed in the previous section.

Moving to a test of whether homeownership limits regional adjustment in labour markets, we estimate our second equation (2):

$$\Delta \ln u_{it} = \alpha + \beta \ln u_{it-1} + \sigma \ln own_{it-1} + \gamma \boldsymbol{X}_{it-1} + \vartheta_t + \pi_i + \mu_{it} \qquad (2)$$

where all variables are defined above. In line with the levelling-off of regional unemployment differentials within Germany, we expect a negative sign on β, which gives the rate at which unemployment is converging within Germany's economy. Following the Oswald hypothesis, we expect the coefficient of interest, σ, to be positive. That is, we expect that *ceteris paribus* homeownership is associated with slower "unemployment convergence".

Our cross-sectional units are 85 'Planning Regions' ("*Raumordnungsregionen*"), which are delineated as functional labour markets by Germany's Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR). The BBSR provided regional unemployment data for all our benchmark years: 1998, 2002, 2006, and 2011 (Kuhlmann 2014).[7] The gaps between our benchmark years mean we are unable to measure accurately structural shocks to employment that may occur over periods longer than four years. Yet we do not aim to measure the size of shocks and their relation to homeownership. We are interested in the *direction* of the effect of homeownership on unemployment.

The unemployment rate is defined as the percentage of unemployed persons in the working population (including unemployed). Lerbs (2011) provides data on homeownership rates – the owner-occupier proportion of the residential population - for 1998, 2002, and 2006. For 2011, the BBSR provided us with their homeownership rate calculations based on county-level data from the census of Germany's housing-stock differed by residential use (Schürt 2014).[8] The Federal Statistics Office (Destatis 2015) provides population density (persons per km^2) to control for employment agglomeration; high-school dropouts (as a percentage of all high-school graduates) to proxy low-skilled worker shares; sectoral employment data, with which we construct a Herfindahl Index, to control for sector-specific shocks[9]; and age structures (% population over 65) to control for differences in attachment to regions and regional labour markets.

[7] Petra Kuhlmann at the BBSR kindly sent these data to us on 12 December 2014. The file contained *Raumordnungsregionen* unemployment rates in % from 1998 to 2012. They were calculated by relating the unemployed to the sum of working and unemployed population ("*Erwerbspersonen*").

[8] Alexander Schürt at the BBSR kindly sent these data to us on 16 October 2014. Homeownership and the proportion of owner-occupied housing are not covered in the annual official statistics. Lerbs (2011) used microcensus data for pre-2011 data. Schürt calculated the 2011 cross-section using the county-data of the 2011 Federal Census of the housing-stock differed by the residential use .

[9] In German, *Land- und Forstwirtschaft, Fischerei; Produzierendes Gewerbe ohne Baugewerbe; Baugewerbe; Handel, Gastgewerbe und Verkehr; Finanzierung, Vermietung, und Unternehmensdienstl*; *and Öffentliche und private Dienstleister*. The index sums the squares of sectoral employment shares, ranging from 0 to 1, where higher values indicate greater specialization.

INSERT TABLE 5

Table 5 summarises our underlying data. The mean regional unemployment growth rate is negative, consistent with Germany's national decline in unemployment over the period. We can also see that there is a low mean level of homeownership, but a high degree of variation around that with a standard deviation of 10.2%, a minimum of 11% and a maximum of 72%. Variation in population density is also high, indicating the mixture of agricultural and urban regions we have in our sample. The Herfindahl sectoral employment index, bounded between 0 and 1, where higher values indicate greater specialization in one sector, is never higher than 0.31. There is also little regional variation in the degree of sectoral specialization of German regions. Finally, the unemployment rate level shows a high mean value of 9.4% reflecting the weight of the pre-2005 years before the decline in unemployment began. There is considerable variation in regional unemployment with a standard deviation of 4.45 percentage points.

3.1. Is there a systematic link between unemployment and homeownership?

Table 6 contains our OLS estimates for the test of a systematic relationship between unemployment and homeownership. The first column pools all the data without any fixed effects. The coefficient on homeownership is negative and highly significant, contrary to our hypothesis that homeownership impairs the labour market. When we introduce year fixed effects in column 2, the coefficient drops in magnitude slightly but remains significant. When we implement both region and year fixed effects in column 3, the coefficient changes direction and retains significance, indicating time-invariant omitted variables. This result supports the hypothesis that higher homeownership has a negative effect on the labour market, and corroborates the findings in Wolf and Caruana-Galizia (2015), which runs the same specification on a smaller dataset and finds a slightly more significant effect.

INSERT TABLE 6

While supportive of our hypothesis, the OLS estimates in table 6 are still naive, as they do not account for the simultaneity of homeownership and unemployment. We now turn to IV estimations to deal with this issue.

Table 7 contains our IV results, where we instrument the homeownership rate with our IV *bomb*. Column 1 contains the first stage results, where we see that *bomb* has a large negative effect on homeownership rates with a t-ratio of -4.56, when controlling for year and region fixed effects and the standard controls. At 0.730, the first stage R^2 indicates we are extracting a substantial amount of plausibly random variation in homeownership rates. The F-test on excluding *bomb* yields a test statistic of 20.79, significant at the 1% level.[10] Its under-identification test statistic is 9.57, significant at the 5% level.[11] Column 2 contains the second stage results. Here we see a large positive and highly significant effect of homeownership on unemployment. The point estimate implies that a standard deviation increase in the homeownership rate (10.24 percentage points) is associated with a contemporaneous 4.18-percentage point, or 0.94 standard deviations, increase in the unemployment rate. This is a much larger effect than the 0.320 OLS coefficient reported in table 6, which we reproduced in table 7 for comparison. This larger effect is due to two reasons. First, the exogenous portion of variation in homeownership is not biased downwards by confounding variation. Second, the IV coefficient is imprecisely estimated. This is because the biased but more efficient (unmediated) OLS correlation is stronger than the unbiased but less efficient (mediated) first stage IV correlation between *bomb* and homeownership. The IV coefficient's 95% lower bound of the confidence interval is 0.654 and its upper bound is 2.710. The respective OLS lower and upper bounds are -0.070 and 0.723. In short, the growth in the size of the IV coefficient is due to imprecision. Its robust standard error goes from 0.179 (OLS) to 0.523 (IV). Indeed, a z-test for the equality of coefficients - that subtracts the IV from the OLS coefficient and then divides the result by the square root of the sum of their robust standard errors - yields a z-score of 1.62, which is insignificant. The IV result back up the OLS results in table 6: homeownership is systematically related to unemployment.

INSERT TABLE 7

3.2. Does homeownership limit regional labour market adjustments?

Table 8 contains our OLS estimates of the effect of homeownership on regional labour market *adjustments* – the more substantive part of our analysis.. In column 1 we estimate that indeed there is a fast tendency to national convergence in regional unemployment rates. The estimate implies a convergence rate of around 9% per annum with a half-life, the time necessary for

[10] This is the Kleibergen-Paap rk Wald F statistic.
[11] This is the Kleibergen-Paap rk LM statistic.

regions to fill half the initial gap of unemployment inequalities, of around 12 years.[12] In column 2, we find a strong and positive effect of initial homeownership rates on unemployment growth. In column 3, we find an even stronger positive effect of homeownership on unemployment growth *after* controlling for the proportion of high-school dropouts, sectoral employment specialization, the proportion of the regional populated aged over 65, and population density.

INSERT TABLE 8

In column 4 we drop the 17 East German regions in our sample to check whether they substantially bias our estimate of the homeownership effect. The coefficient retains its 1% significance level, and goes from 0.771 (t-statistic=4.41) in column 3 to 1.029 (t-statistic=5.56) in column 4. The estimate is larger, which implies that the relationship between unemployment growth and homeownership rates is weaker in the East than in the West.[13] Column 4 also shows that unemployment convergence was not restricted to the East catching-up to the West: the coefficient on the initial unemployment level is in the same order of magnitude and retains the same level of significance.

In column 5 we implement the same specification as that in column 3, except that none of the variables are expressed in logs. The only notable difference between columns 3 and 5 is the homeownership coefficient: its significance level dropped to 10% and it is smaller in terms of magnitude, with a standardized effect on unemployment growth of 0.27 standard deviations compared to 0.77 standard deviations in column 3. This weaker result is due to the skewed distribution of unemployment rates when not logged: a skewness statistic of 0.98 compared to 0.0004 for the logged variable. In contrast, homeownership rates are much more normally distributed whether logged or not. Non-logged homeownership has a skewness statistic of -0.61 compared to -1.73 for the logged variable.

The OLS results in table 8 show that homeownership acts as a break on the convergence of unemployment levels across Germany. The effects of homeownership on unemployment growth are economically meaningful. A standard deviation increase in the homeownership rate (10.24 percentage points) is associated with an increase in the unemployment growth rate of between

[12] Following Abreu, de Groot, and Florax (2005), the convergence rate for panel model is $\ln(1+\beta)/T$, where T is the number of years in the period. Half-life is calculated as $\ln(2)/\ln(1+\beta/T)$.
[13] Running the same specification as in column 4 for East German regions only gives us a sample of size of only 42. The coefficient on homeownership is 0.536 with a clustered robust standard error of 0.342, and t-statistic of 1.56.

13% and 20% four years later. This would slow the mean unemployment growth rate from -1.38% to between -1.22% and -1.15%.

Table 9 contains our IV estimates. Column 1 contains the first stage results. The instrument, *bomb*, has a large negative effect on homeownership rates as expected with a t-ratio of -2.86, when controlling for fixed effects and the standard set of controls. At 0.396, the first stage R^2 indicates we are extracting a fair amount of plausibly random variation in homeownership rates. The F-statistic on *bomb*'s exclusion in the second stage is 8.21 and its under-identification statistic is 3.45. While the statistic values are low, they pass the technical bar of statistical significance.

INSERT TABLE 9

Column 2 contains the second stage estimates. Here we again see fast and significant convergence in regional unemployment rates. The effect of homeownership is positive, large, and significant. The point estimate implies that a one standard deviation in the homeownership rate (10.24 percentage points) is associated with an increase in the unemployment growth rate of 85% four years later. This is a much larger effect – almost four-times larger - than the OLS point estimate, which we reproduced in column 3 of table 9 for convenience. As with the results in table 8, this is because the IV coefficient is imprecisely estimated. The IV coefficient's 95% lower bound of the confidence interval is 0.215 and its upper bound is 5.734. The respective OLS lower and upper bounds are 0.422 and 1.120. In short, the growth in the size of the IV coefficient is due to imprecision. Its robust standard error goes from 0.175 (OLS) to 1.408 (IV). Indeed, a z-test for the equality of coefficients - that subtracts the IV from the OLS coefficient and then divides the result by the square root of the sum of their robust standard errors - yields a z-score of 1.75, which is marginally significant at the 10% level (p=0.08). The IV results back up the OLS results in table 8: homeownership acts as a break on the convergence of regional unemployment rates across Germany.

As a crosscheck on our identification strategy, we swap our *bomb* instrument for an interaction of bomb tonnage and our year dummies. That is, we instrumented lagged homeownership with *bomb tonnage*×2006 and *bomb tonnage*×2011 (with 1998 excluded due to the lag structure and 2002 excluded as a reference category). The coefficient on homeownership drops marginally in magnitude to 2.931 from 2.975 while its robust standard error also drops to 1.19 from 1.41. It is significant at the 5% level. All other coefficients and their robust standard errors are equally similar. The first-stage results show that both interaction terms have highly significant negative effects on homeownership.[14] F-statistic on the excluded instruments is 5.71, significant at the 5% level. The Hansen J test of the over-identification of both instruments accepts the joint null that the instruments are valid (statistic of 0.067, and p-value of 0.796). We also tried the more simple interactions – *bomb tonnage*×year and *bomb tonnage*×(-1×year), the latter mimicking our preferred instrument of tonnage interacted with months since last raid – finding results identical to those in table 9.[15]

Are the results economically meaningful? Suppose that the mean homeownership rate increases by one standard deviation from 47.2% to 57.4%. Using the IV coefficient of 2.975, this would lead to a 58% rise in the unemployment growth rate (=2.975×ln[57.4]-ln[47.29]). In other words, the mean unemployment growth, at -17%, would accelerate to -9.9%. Such a change in the unemployment growth rate can have substantial effects in the long run. For example, at a constant mean unemployment growth rate of -17%, Germany's unemployment rate would have gone from 11.1% in 1998 to 0.9% by 2011. At a mean unemployment rate of -9.9%, the change would have been from 11.1% in 1998 to 3% by 2011. Of course, the mean rate of -17% comes from an unrepresentative period of fast job growth. The point here is to demonstrate that small changes in homeownership can have meaningful effects on the labour market.

While an improvement on the OLS estimates, the IV estimation is liable to the criticism that bombing is not truly exogenous to homeownership rates. That is, bombers might have targeted regions of high population density to improve their chances of success, and high population density regions tend to have lower homeownership rates to begin with. We deal with this and other concerns about potential selection into treatment using a matching strategy.

3.3. Matching

A concern with our identification strategy is that bombed regions were selected based on their high pre-bombing population density, which reflects homeownership differences then and now. To deal with this threat, we use a standard propensity score matching procedure.

[14] Available upon request.
[15] Full set of results available upon request.

First, we define “treated” regions as those that received any amount of bomb tonnage, and “control” regions as those that were not bombed: treatment=1; control=0. Across our panel of 350 region-year observations, this gives us 136 control regions and 214 treatment regions. In other words, the sample consists of 38.86% control and 61.14% treatment regions.

Second, we use data on regional population density in 1939 to predict the probability of regions being bombed. A probit regression of receiving treatment based on the log of 1939 population density yields a pseudo-R^2 of 0.445, a coefficient of 2.665, significant at the 5% level, and a constant term of -12.351, significant at the 1% level, on the panel of 350 region-years. The estimation indicates that pre-War population density levels are a strong, but not perfect predictor of bombing.

Third, we use the probit regression results to predict propensity scores for each region. A region’s score shows its probability of being bombed based on its pre-War population density. We then apply Becker and Ichino’s (2002) algorithm to split the sample into equally spaced intervals of the propensity score. Within each interval, the algorithm tests that the average propensity score of treated and control regions do not differ. If the test fails, that is if there are differences with intervals, the interval is split in half and re-tested. This continues until in all intervals the average propensity score of treated and control does not differ. Finally, to balance the sample, the algorithm tests that the means of pre-War population density do not differ between treated and control regions. To achieve this, regions outside a range of propensity scores are dropped from the matched sample. This procedure led us to exclude all regions with a propensity score below 0.21. That is, our region of common support – propensity scores for regions with similar pre-War population densities that are in both the treatment (bombed) and control (not-bombed) groups – ranged from 0.21 to 1. This left us with a matched panel of 278 region-years (down from 350), where 64 observations are in the control group and 214 are in the treatment group.

Before starting the OLS and IV estimates on this matched sample, it is important to first asses the matching quality. We provide three tests. First, a good match should reduce the differences in pre-War population density between the treatment and control groups in the matched versus unmatched sample (Rosenbaum and Rubin 1985). In the unmatched sample, a t-test for the differences in means between the control and treatment group yields a t-statistic of -13.32, significant at the 1% level. For the matched sample, the t-statistic drops to -6.49, significant at the 1% level. While there is still a significant difference between the two groups for the matched sample, a 50.8% reduction in the size of t-statistic from the unmatched sample is a definite improvement.

Second, we re-estimate the propensity score on the matched sample, and compare the pseudo-R^2 before and after matching (Sianesi 2004). The pseudo-R^2 shows how well pre-War population density explains the probability of being bombed. After matching, then, there should be smaller differences in the distribution of pre-War density between groups, so the pseudo-R^2 should be lower. Running the same probit regression on the matched sample yields a pseudo-R^2 of 0.219, which is a 51.3% reduction from the pseudo-R^2 of 0.445 in the unmatched sample.

Third, to assess the distance in the marginal distributions of pre-War population density we calculated Rosenbaum and Rubin's (1985) standardized bias measure. It is defined as the difference of sample means in the treated and control subsamples as a percentage of the square root of the average sample variances in both groups. We calculate this for both, the matched and unmatched samples, to check for any reduction in bias. We do not have a clear measure for success in this approach, but 5% is usually seen as sufficient (Caliendo and Kopeinig 2005: 15). We get a reduction from the unmatched standardized bias to the matched of 28%.

INSERT TABLE 10

The OLS and IV results from our matched sample are in table 10. Column 3 contains the OLS results from the same specification as that in table 8. The coefficient on the initial level of unemployment indicates a faster rate of regional unemployment convergence. The half-life according to the estimate in column 3 is 9.8 years compared to 11.3 from the previous OLS estimate in table 8. The coefficient on homeownership is in the same order of magnitude (0.695 versus 0.771) as the previous OLS estimate, and retains its 1% level of significance. The same can be said for the other two significant coefficients – population density and the proportion of people older than 65 – which have similar signs, sizes, and significance levels as the previous OLS estimates. Using a matched sample has not changed the original OLS estimates in any meaningful way.

Moving onto the IV first stage results in column 1, we also see similar results to the unmatched sample estimates in table 9. The coefficient on *bomb* remains negative and significant at the 5% level. Its t-ratio is now at 2.98 from 2.86 in table 7. While the sizes of the F-statistic and the under-identification statistic have increased slightly, from 8.214 to 8.85 and from 3.445 to 4.36 respectively, they remain statistically significant. The first stage R^2 has increased from 0.396 to 0.413, indicating slightly more validity overall with the matched sample. Given the similarities in the first stage results, it is unsurprising that the second stage results in column 2 are also similar. Here again convergence is slightly faster with a half-life of 7.3 years compared to 8.8 years for the second stage estimate in table 9. The coefficient on homeownership is the same in terms of magnitude and significance, with a t-ratio of 2.21 compared to 2.11 in table 9.

In summary, while we were unable to achieve a perfect match, where all differences in pre-War density would be eliminated, we have still reduced the potential bombing selection bias by a large degree. That we were able to do this without affecting our original estimates speaks to the robustness of the positive link between homeownership and unemployment. We now turn to the mechanism underlying this link.

4. Mechanism

The Oswald hypothesis makes no conceptual prediction on precisely how labour mobility is restricted. Oswald (1997) first suggested that homeownership can discourage people from leaving their home region in search of employment. This mechanism is also implicit in some of Rajan's (2010: 198) work, where he writes that homeowners' reluctance to leave their home region is especially severe after a housing crisis when the value of their home drops below that of their mortgage. In later work with Blanchflower, Oswald suggested that homeownership might equally discourage people from entering regions in search of employment due to the unavailability of rental accommodation and due to "NIMBYism" – current home-owners imposing barriers to entry for new firms and business extensions (Blanchflower and Oswald 2013).

Whether homeownership restricts movement into a region or movement out of a region is an empirical question. That both are equally plausible and consistent with the hypothesis means we should look at *gross* rather than *net* migration. We collected data on regional gross inflows, outflows, and net migration (inflows less outflows), all per 1,000 of home population, from the BBSR (2015). A negative correlation between homeownership and inflows is consistent with Blanchflower and Oswald's (2013) idea that homeownership restricts rental accommodation. A negative correlation between homeownership and outflows is consistent with Oswald's (1997) original idea that homeownership discourages people from leaving their home region in search for employment.

INSERT TABLE 11

In table 11 we regress our migration data on homeownership rates and the full set of controls plus fixed effects. Column 1 shows a large positive effect of homeownership on *net* migration, that is, more inflows relative to outflows for higher rates of homeownership. While this seemingly contradicts the hypothesis, a look at columns 2 and 3 shows that the effect of net migration is working completely through a reduction of outflows. The effect of homeownership on inflows is in fact positive, but insignificant, indicating inflows of 1.05 persons per 1,000 population for every 1% increase in the homeownership rate. In column 3 we can see that the effect on outflows is much larger and significant. It indicates that every 1% increase in the homeownership rate is associated with a reduction in outflows of 0.112 persons per 1,000 home population – against a mean of 11.9 persons per 1,000 home population.

The results in table 11 are consistent with Oswald's (1997) original version of the labour mobility mechanism. Homeownership discourages people from leaving their home region. We unfortunately cannot be more specific than this. That is, we cannot empirically show whether people are discouraged from leaving because, in line with Green and Hendershott's (2001) macro explanations: (1) their house values have dropped below their mortgage values, making their home an illiquid asset; (2) they are locked-in to below market mortgage rates; or (3) they face prohibitively high transaction costs of moving. A fourth reason as to why people might be less mobile is variation in rent prices: the lower rent prices are, the less mobile people might be, as they would want to stay in their low-rent residences.

However, we can qualitatively shut down the first two options. First, between 1998 and 2011 house prices remained broadly stable (Jordá et al 2014). Second, Germany's real effective mortgage rate has been high and stable, going from 4.0% in 1997 to 3.0% in 2006 with little variation in between (Voigtländer 2009: 365). As for the fourth option, the limited comparative data we have on land rents for rental housing and owner-occupied, displayed in table 12, housing shows a decline in rent price variation from 1971 to 1988.

INSERT TABLE 12

This leaves the third option open: that transaction costs associated with moving home in Germany discouraged labour mobility. A look back to figure 1 shows that while Germany's transaction costs are not the highest in Europe, at 9% of home values, they are still considerable. De Graaff et al (2009: 62) break this down into 6 percentage points for the tax on transferring residences and the remaining 3 percentage points for real estate agent fees. Considering that between 1999 and 2008 the affordability of German houses declined by 20% (Jordà et al. 2014: 13), as measured by the price to income ratio, an additional 9% transaction cost is not helpful for those looking to move home.

5. Conclusion

This paper analysed the relationship between homeownership and unemployment across a sample of German regions. We tested the "Oswald hypothesis" that homeownership restricts labour mobility, and so increases aggregate unemployment. We provided OLS, IV, and matched estimates of a strong positive link between homeownership and unemployment. We also provided evidence, using regional migration data, consistent with the idea that the effect of homeownership on unemployment works through reducing gross emigration rates. These findings fall in line with a wave of recent work that found evidence for the hypothesis in a variety of different settings. What sets our analysis apart is that we were able to directly deal with the endogeneity between homeownership and unemployment using the bombing of Germany in WWII, which led to widespread housing stock destruction and in turn widespread provision of rental accommodation.

When correctly identified, we find that the effect of homeownership on unemployment growth is statistically significant and economically meaningful. Moving from the mean homeownership rate in the first to second quartile (a 32% increase in the homeownership rate) would reduce unemployment growth by 96%, taking Germany's 1998-2011 mean annual unemployment growth rate of -3.4% to -0.1%. A move from the second to third quartile (a 14% increase in the homeownership rate) would reduce unemployment growth by 42%, taking the national unemployment growth rate to -2.0%.

These results can link Germany's unusually low homeownership rate and its unusually low unemployment rate, but we think that they have wider implications for Europe. Europe's high unemployment countries – Spain and Italy, for example – also have high rates of homeownership. Future research would do well to uncover whether the Oswald hypothesis is also at work in these countries, but our results raise another issue.

In many of these European countries, governments actively promote homeownership through tax breaks and direct subsidies. In the Netherlands, for example, explicit and implicit housing subsidies comprise a large burden for public finances: foregone revenues from mortgage interest deductibility alone amount to around 2% of GDP (Vandevyvere and Zenthöfer 2012: 3). Our research indicates that these expensive policies may have hidden costs; that of increasing the transaction costs of residential mobility and in turn on labour market flexibility. While there are positive externalities associated with homeownership – greater job commitment, for one – they are small (Glaeser and Shapiro 2003) and policies that hinder labour mobility are hard to justify in a context of high and uneven European unemployment. Labour mobility is one of the keys to a successful monetary union, within and between member states.

In September 1992, Olivier Blanchard, Rudi Dornbusch, Stanley Fischer, and Paul Krugman discussed the hopes of the proposed European monetary union at an MIT panel discussion. All four concluded that a common European currency would cause economic distress. Blanchard pointed out that currency union works in the United States because labour can move easily between states: European labour mobility, in contrast, is negligible.

While there has been improvement in intra-European mobility, one of the puzzles of the recent euro zone crisis is the weak response of European migration to labour demand shocks. Here Germany can provide us with a lesson. Whether by historic circumstance or by design, increasing homeownership rates decreases the ability of economy's labour market to adjust to unemployment differentials.

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6. Tables and Figures

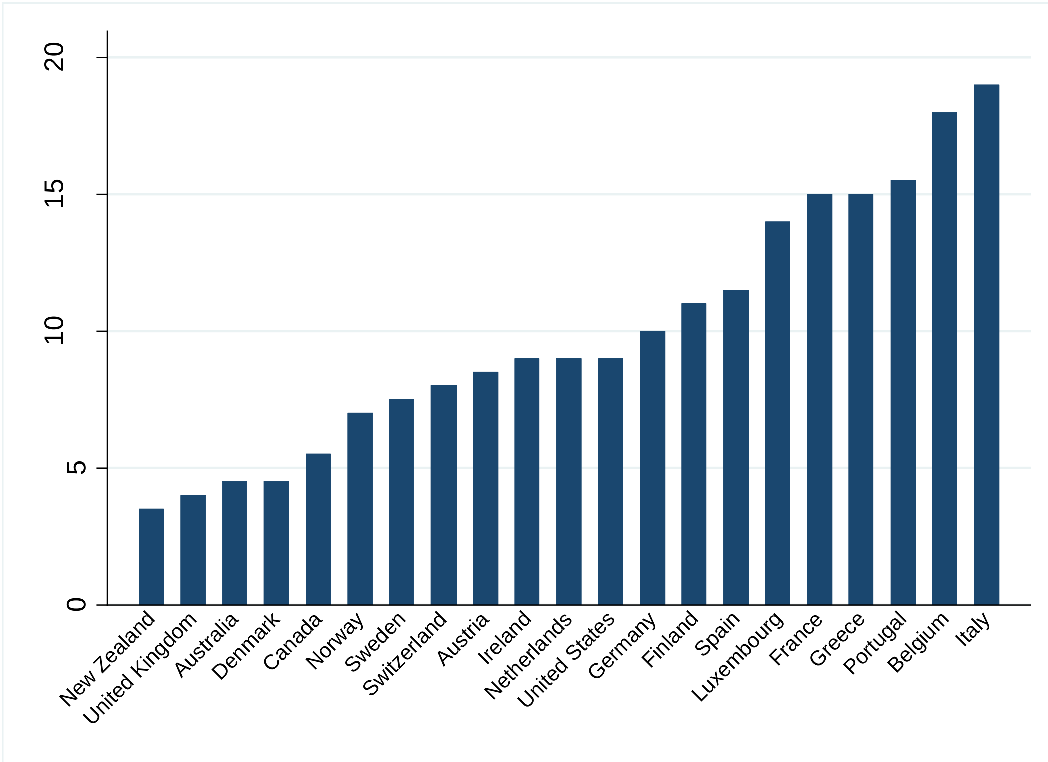

Figure 1: Transaction costs on moving home, 2005.
Notes: From Belot and Ederveen (2005: 11). Transaction cost is sum of tax on transferring residence and real estate agent fees.

Table 1: Home destruction and morale.

		People showing low morale	
		Cross-section sample A	Cross-section sample B
Cities with--		*Percent*	*Percent*
60-80	percent homes destroyed…	55	53
40-59	percent homes destroyed…	58	56
20-39	percent homes destroyed…	59	59
1-9	percent homes destroyed…	43	56
0	homes destroyed…	…	41

Notes: table from the chapter ‘German Civilian Morale’ called ‘Home destruction and morale’ (USAAF 1945a: 96). It shows the morale of German citizens according to the extent of housing destruction caused by Allied bombing. Cross-section A refers to citizens’ whose morale was measured by extensive interviews by Allied officials and by Nazi ‘morale reports’, and cross-section B refers to citizens’ whose morale was measured through the analysis of captured mail, escapees’ accounts, and interrogations (USAAF 1945a: 95).

Table 2: Correlation between bombing and pre- to post-War homeownership rates.

A: Unweighted	(1)	(2)	(3)	(4)
Homeownership rate ppt difference:	1927-1998	1927-2002	1927-2006	1927-2011
Bomb tonnage	-0.0001**	-0.0001***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	14.062***	16.014***	14.659***	19.828***
	(1.463)	(1.461)	(1.335)	(1.368)
N	79	79	79	79
R^2	0.054	0.064	0.049	0.063
F-statistic	10.59	13.34	9.42	10.85
B: Weighted	(5)	(6)	(7)	(8)
	1927-1998	1927-2002	1927-2006	1927-2011
Bomb tonnage	-0.031**	-0.032**	-0.026**	-0.026**
	(0.012)	.(0.012)	(0.012)	(0.011)
Constant	0.009	0.011	0.004	0.004
	(0.048)	(0.045)	(0.044)	(0.044)
N	79	79	79	79
R^2	0.029	0.033	0.024	0.025
F-statistic	6.31	6.91	4.86	5.05

Notes: Estimated using OLS. Robust standard errors are in parentheses. Significance: *** p < 0.01 and ** p < 0.05. Data are city-level ("*städte*"). Dependent variables are percentage point differences between 1927 homeownership rate (%) and the remaining homeownership rate (%) cross sections: 1998, 2002, 2006, and 2011. The 1927 data are the percentage of single-apartment residences in the total number of residential buildings ("*Von je 100 Wohngebäuden enthalten eine Wohnung*") from The Housing Census in the German Empire from 16 May 1927 ("*Reichswohnungszählung Vom 16. Mai 1927*"). The remaining homeownership data re from Lerbs (2011) and Schürt (2014). The data used for Panel B: Weighted are weighted according to cross-sectional means. Bomb tonnage data is short tons of bombs dropped on each city from from Hastings (2013: 328-333) and USSBS (1947: 35, 46).

Table 3: Correlation between bombing and subsidized housing.

	(1)	(2)	(3)
	No. subsidised residences	% subsidised residences, population-weighted	% subsidised residences, residence-weighted
Bomb tonnage	1.946***	0.914***	0.073***
	(0.502)	(0.249)	(0.021)
Constant	13622.61***	4811.36***	456.06***
	(3084.92)	(1257.13)	(114.24)
N	63	39	63
R^2	0.377	0.541	0.31
F-statistic	14.98***	13.38***	12.54***

Notes: Estimated using OLS. Robust standard errors are in parentheses. Significance: *** p < 0.01. Data are city-level ("*städte*"). Dependent variable data from *Gebäude- und Wohnungszählung* 1968: columns 43 and 44. First dependent variable is total number of subsidized resisences ("*offentlich geförderte wohnungen*"), the second is the same variable expressed as a percentage of total residences and weighted by population (=% subsidised×1000/population), and the third is the same variable weighted by the total number of residence (=% subsidised×1000/ No. subsidised residences). Bomb tonnage data is short tons of bombs dropped on each city from from Hastings (2013: 328-333) and USSBS (1947: 35, 46).

Table 4: Summary of bomb tonnage and months since last raid data.

	Bomb Tonnage	Months Last Raid
Min.	0	637
Max.	121,400	837
Std. Dev.	23,010	58
Mean	10,915	724

Notes: Underlying spatial units are 85 regions. Tonnage data from Hastings (2013: 328-333) and USSBS (1947: 35, 46). Dates of raids from Hastings (2013: 328-333) and the EAFHS (2014). IV is an interaction of bomb tonnage and inverse months since last raid data.

Table 5: Summary statistics.

	N	Mean	Std. Dev.	Min.	Max.
Δ Unemployment rate (%)	262	-1.38	2.25	-7.50	3.10
Homeownership rate (%)	350	47.19	10.24	11.00	72.00
Population Density (persons/km^2)	350	309.2	445.5	44.7	3827.4
Highschool Dropouts (%)	336	8.27	2.89	1.93	15.48
Herfindahl Sectoral Employment Index	342	0.24	0.02	0.21	0.31
Unemployment rate (%)	350	9.41	4.45	2.40	22.30

Notes: Underlying spatial units are 85 regions. Panel not perfectly balanced due to missing independent variable data. See text for sources.

Table 6: OLS Results: homeownership and unemployment

	(1)	(2)	(3)
Dep. Var.	ln Un. Rate.	ln Un. Rate.	ln Un. Rate.
Sample:	All	All	All
ln Homeownership rate	-1.083***	-1.019***	0.320*
	(0.148)	(0.129)	(0.179)
ln Pop. Density	-0.156**	-0.142**	0.381
	(0.047)	(0.051)	(0.357)
ln High-school dropouts	0.419***	0.223**	0.082**
	(0.061)	(0.089)	(0.031)
ln Herfindahl Emp. Index	0.346	0.041	1.572***
	(0.341)	(0.334)	(0.240)
ln age 65>%	0.143	1.269***	-0.615**
	(0.140)	(0.337)	(0.197)
Year FE	No	Yes	Yes
Region FE	No	No	Yes
N	336	336	336
within-R^2	0.573	0.653	0.888

Notes: Robust standard errors clustered by region in brackets (* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$). Estimated over four-year intervals. All variables expressed in logs.

Table 7: IV Results: homeownership and unemployment

	(3)	(2)
Dep. Var.	ln Un. Rate	ln Un. Rate
Sample:	All	All
ln Homeownership rate	0.320*	1.680**
	(0.179)	(0.523)
ln High-school dropouts	0.082**	0.088**
	(0.031)	(0.029)
ln Herfindahl Emp. Index	1.572***	0.916
	(0.240)	(0.333)
ln % age 65>	-0.615**	-0.556
	(0.219)	(0.167)
ln Pop. Density	0.381	0.658
	(0.357)	(0.324)
Year FE	Yes	Yes
Region FE	Yes	Yes
N	336	334
within-R^2	0.888	0.852
		(1)
Dep. Var.		ln Owner t-1
Sample:		All
Bomb		-7.98e-09***
		(1.75e-09)
ln High-school dropouts		-0.009
		(0.011)
ln Herfindahl Emp. Index		0.265
		(0.092)
ln age 65>%		0.023
		(0.075)
ln Pop. Density		-0.27
		(0.115)
Year FE		Yes
Region FE		Yes
N		334
within-R^2		0.730
F-statistic		20.79
Under ID Statistic		9.57

Notes: Column 1 is the first stage; column 2 is the second stage; and column 3 is the OLS estimate from table 3. Robust standard errors clustered by region in brackets (** p < 0.05; *** p < 0.01). Estimated over four-year intervals. All variables expressed in logs. The F-statistic is the Kleibergen-Paap rk Wald F statistic and the Under-ID statistic is the Kleibergen-Paap rk LM statistic.

Table 8: OLS Results: homeownership and regional labour market adjustment

	(1)	(2)	(3)	(4)	(5)
Dep. Var.	Δ ln Un. Rate. $_t$	Δ ln Un. Rate. $_t$	Δ ln Un. Rate. $_t$	Δ ln Un. Rate. $_t$	Δ Un. Rate. $_t$
Sample:	All	All	All	West only	All, Non-logged
ln Un. Rate $_{t-1}$	-0.709***	-0.779***	-0.773***	-0.594***	-0.836***
	(0.113)	(0.126)	(0.119)	(0.117)	(0.081)
ln Homeownership rate $_{t-1}$		0.503**	0.771***	1.029***	0.059*
		(0.206)	(0.175)	(0.185)	(0.033)
ln High-school dropouts $_{t-1}$			0.156***	-0.095**	0.137**
			(0.043)	(0.041)	(0.047)
ln Herfindahl Emp. Index $_{t-1}$			0.113	2.221***	-19.667
			(0.437)	(0.498)	(14.504)
ln % age 65> $_{t-1}$			-0.424*	1.064**	-0.882***
			(0.219)	(0.465)	(0.161)
ln Pop. Density $_{t-1}$			0.890*	-0.707	0.034**
			(0.488)	(0.628)	(0.015)
Year FE	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes
N	262	262	250	208	250
within-R^2	0.901	0.905	0.923	0.945	0.919

Notes: Robust standard errors clustered by region in brackets (* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$). Estimated over four-year intervals. All variables expressed in logs, except for column 5 where none are logged.

Table 9: IV Results: homeownership and regional labour market adjustment

	(3)	(2)
Dep. Var.	Δ ln Un. Rate. $_t$	Δ ln Un. Rate. $_t$
Sample:	All	All
ln Un. Rate $_{t-1}$	-0.773***	-0.984***
	(0.119)	(0.186)
ln Homeownership rate $_{t-1}$	0.771***	2.975**
	(0.175)	(1.408)
ln High-school dropouts $_{t-1}$	0.156***	0.154**
	(0.043)	(0.052)
ln Herfindahl Emp. Index $_{t-1}$	0.113	-0.727
	(0.436)	(0.608)
ln % age 65> $_{t-1}$	-0.424*	-0.452
	(0.219)	(0.279)
ln Pop. Density $_{t-1}$	0.890*	0.731
	(0.489)	(0.624)
Year FE	Yes	Yes
Region FE	Yes	Yes
N	250	250
within-R^2	0.923	0.862
		(1)
Dep. Var.		ln Owner t-1
Sample:		All
Bomb		-9.30e-09**
		(3.25e-09)
ln Un. Rate $_{t-1}$		0.069*
		(0.039)
ln High-school dropouts $_{t-1}$		-0.005
		(0.016)
ln Herfindahl Emp. Index $_{t-1}$		0.246
		(0.154)
ln age 65>% t-1		0.067
		(0.078)
ln Pop. Density $_{t-1}$		0.047
		(0.193)
Year FE		Yes
Region FE		Yes
N		250
within-R^2		0.396
F-statistic		8.214
Under ID Statistic		3.445

Notes: Column 1 is the first stage; column 2 is the second stage; and column 3 is the OLS estimate from table 3. Robust standard errors clustered by region in brackets (** p < 0.05; *** p < 0.01). Estimated over four-year intervals. All variables expressed in logs. The F-statistic is the Kleibergen-Paap rk Wald F statistic and the Under-ID statistic is the Kleibergen-Paap rk LM statistic.

Table 10: Matching OLS and IV results.

	(3)	(2)
Dep. Var.	Δ ln Un. Rate. $_t$	Δ ln Un. Rate. $_t$
Sample:	All	All
ln Un. Rate $_{t-1}$	-0.888***	-1.171***
	(0.110)	(0.201)
ln Homeownership rate $_{t-1}$	0.695***	2.998**
	(0.202)	(1.354)
ln High-school dropouts $_{t-1}$	0.079	0.104*
	(0.049)	(0.058)
ln Herfindahl Emp. Index $_{t-1}$	0.209	-0.452
	(0.478)	(0.591)
ln % age 65> $_{t-1}$	-0.599**	-0.872**
	(0.270)	(0.377)
ln Pop. Density $_{t-1}$	1.350**	0.839
	(0.524)	(0.727)
Year FE	Yes	Yes
Region FE	Yes	Yes
N	202	202
within-R^2	0.928	0.862
		(1)
Dep. Var.		ln Owner $_{t-1}$
Sample:		All
Bomb		-9.22e-09**
		(3.10e-09)
ln Un. Rate $_{t-1}$		0.093*
		(0.039)
ln High-school dropouts $_{t-1}$		-0.013
		(0.039)
ln Herfindahl Emp. Index $_{t-1}$		0.117
		(0.171)
ln age 65>% t-1		0.170
		(0.111)
ln Pop. Density $_{t-1}$		0.126
		(0.232)
Year FE		Yes
Region FE		Yes
N		202
within-R^2		0.413
F-statistic		8.85
Under ID Statistic		4.36

Notes: Column 1 is the first stage; column 2 is the second stage; and column 3 is the OLS estimate from table 3. Robust standard errors clustered by region in brackets (** $p < 0.05$; *** $p < 0.01$). Estimated over four-year intervals. All variables expressed in logs. The F-statistic is the Kleibergen-Paap rk Wald F statistic and the Under-ID statistic is the Kleibergen-Paap rk LM statistic.

Table 11: Migration and homeownership correlations.

	(1) Net Migration	(2) Inflows	(3) Outflows
ln Homeownership rate	12.34**	1.05	-11.23*
	(5.39)	(7.41)	(5.94)
ln Pop. Density	27.51**	55.22	27.69
	(10.66)	(34.63)	(37.07)
ln High-school dropouts	1.05*	1.91	0.84
	(0.59)	(3.07)	(3.12)
ln Herfindahl Emp. Index	22.39**	5.48	-17.06
	(8.11)	(16.32)	(16.64)
ln age 65>%	-0.25	9.34	9.71
	(5.52)	(15.87)	(15.04)
ln Un. Rate.	-4.79**	-4.17	0.63
	(1.37)	(3.02)	(2.72)
Year FE	Yes	Yes	Yes
Region FE	Yes	Yes	Yes
N	333	333	333
within-R^2	0.406	0.124	0.054

Notes: Net migration is inflows less outflows of people per 1,000 home population; inflows and outflows also expressed per 1,000 home population. Robust standard errors clustered by region in brackets (* p < 0.1; ** p < 0.05; *** p < 0.01). Estimated over four-year intervals. Independent variables expressed in logs.

Table 12: City-level ratios of rental-housing land rents to owner-occupied land rents.

	Mean	Std. Dev.	Max.	Min.	Median	Coef. Var.	N
1971	1.6	0.9	4.0	0.7	1.2	0.6	22
1988	1.1	0.5	2.8	0.7	1.0	0.4	22

Notes: Underlying data in DM per square metre. Cities: Berlin, Hamburg, Düsseldorf, Hannover, Bremen, Duisburg, Munich, Frankfurt/M, Stuttgart, Nuremberg, Wuppertal, Gelsenkirchen, Bochum, Bonn, Bielefeld, Flensburg, Kassel, Mannheim, Saarbrücken, Regensburg, Karlsruhe, and Kaiserslautern. Source: (Krätke 1992: 266)