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Home-ownership and unemployment: Revisiting the Oswald hypothesis from a regional heterogeneity perspective

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Abstract

Home-ownership may create both positive and negative externalities. As an example of a negative externality, the so-called Oswald hypothesis suggests that a high home-ownership rate creates frictions in the economy and thus increases the unemployment rate. We approach this hypothesis from a novel perspective by taking into account regional differences in population density and dwelling composition. Using municipality-level panel data, we find that although the phenomenon identified by the Oswald hypothesis may not be omnipresent, it may manifest itself, particularly in semi-urban areas where the share of large ownership dwellings is high. We also find that in-migration to these areas is lower, which is consistent with the view that the home-ownership rate may affect migration flows and, thus, economic dynamics.

Keywords: Home-ownership; Unemployment; Dwelling size; Rural area; Urban area
JEL Classification Codes: J20, J61, J64, R10, R20

1. Introduction

High unemployment harms economies and people's well-being (Machin & Manning, 1999). Besides labor market features, such as labor market institutions, other societal characteristics are also likely to impact the unemployment rate. The Oswald hypothesis (Oswald, 1996, 1999, 2009) offers a potential explanation for the cross-country and cross-area differences in unemployment. According to this hypothesis, a high rate of homeownership in a particular area can increase the overall unemployment rate in that region.

Oswald's hypothesis originated from the observation that as owner-occupied housing increased in Western countries, so did unemployment. Further, unemployment tended to be higher in countries with a high homeownership rate. Oswald conjectured that, because owner-occupied households are relatively immobile, the increase in homeownership reduces labor mobility, which in turn increases unemployment, resulting from the reduced ability of firms and workers to match each other (Oswald, 1996). Later, Oswald elaborated on five possible mech-

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anisms that might explain the positive association between owner-occupation and unemployment (Oswald, 1999, 2009). According to Oswald, owning a home may increase the risk of unemployment because homeowners are less willing to move in response to labor market volatility. In addition to this direct effect, Oswald hypothesized that high homeownership may create externalities, which increase unemployment. First, high homeownership may block new workers from entering the labor market if the availability of suitable rental housing is lacking. Second, lower mobility can create a skill-job mismatch, raising production costs and reducing real income, which harms the economy and causes job losses. Third, high homeownership can fuel the "not in my backyard" (NIMBY) attitude that affects e.g., zoning regulations and prevents new businesses from entering the area. Finally, if homeowners are unable to find suitable jobs in their area, they may need to commute. This may cause transportation congestion, which imposes monetary and psychological costs, reducing the benefits of having a job and increasing the attractiveness of not working. Later, two other mechanisms explaining the link between homeownership rates and unemployment were proposed (Laamanen, 2013, 2017). First, high mortgage payments may force homeowners to cut down on other expenditures, reducing aggregate demand in the area. Second, to manage mortgage payments, homeowners may increase their job search activity and lower their reservation wages leading to the displacement of other workers in the region and creating negative externalities on the local labor market.

Empirical studies, using aggregate-level data, have typically found a positive relationship between homeownership and unemployment rates (e.g., Blanchflower & Oswald, 2013; Isebaert et al., 2015; Laamanen, 2017; Oswald, 1996, 1999, 2009; Pehkonen, 1999). These findings have been challenged by individual-level empirical results, which suggest that homeowners are typically less vulnerable to unemployment compared to renters (Broulíkova et al., 2020; Coulson & Fisher, 2002, 2009; Laamanen, 2017; Morescalchi, 2016; Munch et al., 2006, 2008; Van Leuvensteijn & Koning, 2004). These findings suggest that it may not be the direct link between homeownership and unemployment which explains the Oswald's observation but rather the negative externalities of homeownership that increase regional unemployment. Further endorsing the role of such externalities, Blanchflower and Oswald (2013) found that fewer new businesses were created in areas with a high rate of owner-occupied housing, and areas with higher rates of homeownership had lower labor mobility and longer commute times. Simultaneously, Laamanen (2013, 2017) independently found empirical support for the view that reduced consumption and increased job competition may partly explain the conflicting findings at the individual and aggregate levels.

Despite all of the previous research that has examined Oswald's hypothesis, there has been limited exploration of how distinct regional characteristics influence the relationship between homeownership and unemployment. For example, the level of urbanization may affect this relationship in several ways. First, urban areas have more job opportunities; rural areas being more dependent on specific industries can face significant unemployment if these industries experience a downturn. Therefore, labor mobility is likely to be less of an issue in urban areas, where there are better possibilities of finding new employment, and low migration resulting from homeownership may impact the unemployment rate in urban areas less than in rural areas. Second, housing conditions differ between urban and rural areas. Urban areas have higher housing density and smaller dwellings with higher prices, while rural areas have larger dwellings with lower prices. The high share of large owner-occupied dwellings in rural areas can contribute to a higher unemployment rate, as residents may be reluctant to move to the city even if they lose their job fearing a potential decrease in their standard of living. Negative housing equity, which is more common in rural areas, can also reduce homeowners' intentions to move, even when the labor market situation deteriorates (Henley, 1998). Third, political influence opportunities can vary between urban and rural areas. Urban areas tend to have a larger and more diverse population, leading to more complex political dynamics, while rural areas tend to

have a smaller and more homogeneous community making it easier for individuals to engage with local officials. This can result in greater potential for NIMBY-type behavior in rural areas. In conclusion, the high homeownership rate in rural areas may have a more pronounced effect on the unemployment rate there, resulting from both direct and indirect effects.

This study takes a novel perspective on Oswald's hypothesis by considering urban-rural differences and paying attention to the heterogeneity in the local housing structure. Using municipal-level panel data from Finland, we examined the heterogeneity of the relationship between homeownership and unemployment among regions with different population densities and dwelling compositions. Specifically, we explored how the share of different-size-owned dwellings in rural, semi-urban, and urban regions relates to the local unemployment rate. Based on our results, Oswald's hypothesis seems to apply to semi-urban areas where the share of large home-owned dwellings is high.

2. Methods

For our main analyses, we used the natural logarithm of the municipality unemployment rate as the dependent variable. To explore migration flows, we measured in-migration and out-migration as the share of in-migrants (out-migrants) relative to the municipality's total population.

Followinng Blanchflower & Oswald (2013), the explanatory variable of interest was the logarithm of the homeownership rate in the area. To explore housing structure's role, we categorized homeownership by size, indicating the share of different-size-owned dwellings relative to the area's total housing stock: lower small-size (7–29 m^2), upper small-size (30–59 m^2), lower medium-size (60–89 m^2), upper medium-size (90–119 m^2), and large (≥120 m^2). While carrying out robustness analyses with different geographic aggregations, dwelling size was measured by room count given the unavailability of surface area data.

Other control variables were education level, the share of 16–24-year-old residents in the area, the municipality's total net costs, and year and municipality fixed effects. The education measure, formulated by Statistics Finland, represents the average level of education in the area. Each year of education, beyond the compulsory level, is assigned a value of 100 and multiplied by the corresponding population share. The municipality's net costs per capita were calculated by subtracting the operating income from the operating costs and dividing the result by the total population. Net costs reflect the municipality's financial pressures, which can affect the unemployment rate.

We used the fixed-effects method to control for all possible time-invariant heterogeneity across municipalities. Given the high auto-regressivity of unemployment (Blanchflower & Oswald, 2013), our model included a lagged dependent variable. Following Blanchflower & Oswald's (2013) study, we considered four lags in the homeownership rate in our estimations. We estimated separate models for university municipalities (n = 10), other urban municipalities (n = 51), semi-urban municipalities (n = 66), and rural municipalities (n = 209) to explore the heterogeneity in the unemployment-homeownership relationship. The classification was based on Statistics Finland's statistical grouping of municipalities, except for separating university municipalities from other urban areas.

There are two main challenges related to our analyses. First, although high homeownership may cause unemployment reverse causality is possible. Some previous studies have used the instrumental variable (IV) method to address this concern (Coulson & Fisher, 2009; Wolf & Caruana-Galizia, 2015; Laamanen, 2013, 2017). As this study did not use the IV method, our estimates may be downward biased because of reverse causality although the use of lagged explanatory variables could partially mitigate this issue. Second, the appropriate geographic level for data aggregation, in our analysis, is unclear. Our main analyses are based on municipal-level, i.e., local administrative unit-2 (LAU-2) data,[1] which accounts for externalities within

[1] LAU is a term used by the European Union to refer to a territorial subdivision (Eurostat, 2023).

municipal borders. Using municipality-level data is justified, for example, by the fact that zoning decisions are primarily made at this level. However, focusing on relatively constrained geographical areas, such as municipalities, may not be optimal for detecting outcomes resulting from spillover effects that extend to a wider region. Therefore, we also used wider regional aggregation, i.e., the LAU-1 data for additional analyses, which reduced the number of regions in each category as follows: university (n = 10), urban (n = 24), semi-urban (n = 23), and rural (n = 12). This classification of the LAU-1 areas was determined based on the category of the largest municipality (in terms of population) in the area. By using LAU-1 data, wider spillover effects may be uncovered, but the link between homeownership and unemployment could also be diluted, especially if the frictions only affect the unemployment rate in nearby areas.

3. Data

Our longitudinal municipal-level data combined register information from three databases: 1) ALTIKA for unemployment and homeownership rates/housing structures at the LAU-2 level; 2) Statistics Finland's 'Dwelling and Housing Conditions' for housing at the LAU-1 level; and 3) SOTKA for education, age structure, and total net costs of public services per capita. The data cover the years from 1998 to 2011 in our main analyses. In the robustness analyses, using the LAU-1 level data, the data cover the years from 2005 to 2020 due to data availability.

4. Results

Table 1 displays descriptive statistics by municipality type.

Table 1. Descriptive statistics.

	University municipalities **Mean** **(SD)**	**Urban municipalities** **Mean** **(SD)**	**Semi-urban municipalities** **Mean** **(SD)**	**Rural municipalities** **Mean** **(SD)**
Home ownership rate	0.513	0.632	0.674	0.671
	(0.039)	(0.074)	(0.055)	(0.057)
Unemployment rate	12.571	10.279	11.183	10.567
	(3.848)	(4.724)	(4.389)	(5.931)
Educational level	349.050	300.869	264.431	229.740
	(41.681)	(51.788)	(35.790)	(35.705)
Municipal net costs per capita (€)	3 856.179	3 702.262	3 747.718	3 957.749
	(777.674)	(815.966)	(809.641)	(969.665)
Share of 16–24-year-olds	0.134	0.107	0.101	0.093
	(0.011)	(0.013)	(0.013)	(0.016)
Population	166 822	40 107	13 120	4 448
	(145 905)	(36 386)	(5 415)	(3 055)
Out-migration (share)	0.051	0.050	0.050	0.045
	(0.006)	(0.013)	(0.031)	(0.012)
In-migration (share)	0.053	0.051	0.048	0.040
	(0.071)	(0.017)	(0.036)	(0.014)
7–29 m^2 home-owned dwellings	0.007	0.005	0.005	0.006
(share of total housing stock)	(0.006)	(0.003)	(0.002)	(0.003)
30–59 m^2 home-owned dwellings	0.122	0.108	0.099	0.090
(share of total housing stock)	(0.022)	(0.030)	(0.021)	(0.030)
60–89 m^2 home-owned dwellings	0.173	0.188	0.180	0.166
(share of total housing stock)	(0.013)	(0.029)	(0.021)	(0.022)
90–119 m^2 home-owned dwellings	0.122	0.178	0.209	0.210
(share of total housing stock)	(0.026)	(0.043)	(0.030)	(0.036)
≥120 m^2 home-owned dwellings	0.087	0.149	0.176	0.190
(share of total housing stock)	(0.023)	(0.059)	(0.050)	(0.051)
Number of municipalities	10	51	66	209

Note. The means and standard deviations (SD) refer to the average values over the 1998–2011 period.

Homeownership rates in urban, semi-urban, and rural areas range between 60–70% but are lower (around 50%) in university municipalities. The percentage of upper-medium-size and large home-owned dwellings is also smaller in university municipalities. University municipalities have higher education levels, unemployment rates, and in-migration, as well as a younger population. Rural areas experience the lowest levels of both in and out-migration.

First, we regressed the regional unemployment rate on the share of different-size home-owned dwellings using the LAU-2 categorization. The models were separately estimated for university (Table A1, Appendix), urban (Table A2, Appendix), semi-urban (Table 2), and rural (Table A3, Appendix) municipalities.

Table 2. Homeownership rate and unemployment by dwelling size in semi-urban municipalities, 1998–2011.

Dependent variable: ln unemployment (municipal unemployment rate in year *t*)	**(1)**	**(2)**	**(3)**	**(4)**
Panel A: First lag				
Ln home ownership$_{t-1}$ 7–29 m^2	0.013			
Ln home ownership$_{t-1}$ 30–59 m^2	0.064			
Ln home ownership$_{t-1}$ 60–89 m^2	0.036			
Ln home ownership$_{t-1}$ 90–119 m^2	-0.037			
Ln home ownership$_{t-1}$ ≥120 m^2	0.294**			
Panel B: Second lag				
Ln home ownership$_{t-2}$ 7–29 m^2		0.029		
Ln home ownership$_{t-2}$ 30–59 m^2		0.054		
Ln home ownership$_{t-2}$ 60–89 m^2		0.080		
Ln home ownership$_{t-2}$ 90–119 m^2		0.0004		
Ln home ownership$_{t-2}$ ≥120 m^2		0.285**		
Panel C: Third lag				
Ln home ownership$_{t-3}$ 7–29 m^2			0.039	
Ln home ownership$_{t-3}$ 30–59 m^2			-0.113	
Ln home ownership$_{t-3}$ 60–89 m^2			0.091	
Ln home ownership$_{t-3}$ 90–119 m^2			-0.094	
Ln home ownership$_{t-3}$ ≥120 m^2			0.256**	
Panel D: Fourth lag				
Ln home ownership$_{t-4}$ 7–29 m^2				0.032
Ln home ownership$_{t-4}$ 30–59 m^2				-0.132
Ln home ownership$_{t-4}$ 60–89 m^2				0.064
Ln home ownership$_{t-4}$ 90–119 m^2				-0.015
Ln home ownership$_{t-4}$ ≥120 m^2				0.274**
Observations	858	792	726	660
R^2 (within)	0.891	0.869	0.855	0.845

Note. All models controlled for the first lag of unemployment rate, education and age structure, total net costs of public services, year fixed effects and municipality fixed effects. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Homeownership rates and unemployment showed either no significant relationship in university, urban and rural areas or, with a few exceptions, the relationship was negative, contradicting Oswald's hypothesis. However, in semi-urban areas, the results indicated a robust positive association between the share of large (≥ 120 m^2) home-owned dwellings and unemployment. Thus, in semi-urban areas, with a high proportion of large-size home-owned dwellings, the results align with Oswald's hypothesis. We also estimated the Table 2 model, without the net costs variable, as it has not been commonly used in prior research and may be considered a bad control (Angrist & Pischke, 2009: 64–68). The results (Table A4, Appendix) were consistent with those presented in Table 2.

Table A5 (Appendix) presents the results using the LAU-1-level categorization. In urban regions, there seems to be a positive correlation between homeownership and the unemployment rate, which supports Oswald's hypothesis. However, while we found that at the LAU-2 level, a higher share of large, owner-occupied dwellings was related to higher unemployment in semi-urban municipalities, we no longer find consistent significant relationships between the shares of different dwelling sizes and unemployment in either urban (Table A6, Appendix) or semi-urban (as presented in Table A7, Appendix) areas.

The results in Table 3 show the association between the share of large home-owned dwellings and migration flows in semi-urban, i.e., the LAU-2 municipalities. We did not find a significant relationship between the share of large home-owned dwellings and migration flows. Although a higher proportion of large home-owned dwellings was associated with a higher unemployment rate in semi-urban areas, the migration flows at the aggregate level did not appear to account for this relationship.

Table 3. Homeownership rate and migration flow in semi-urban municipalities, 1998–2011.

	ln out-migration	**ln in-migration**
Ln home ownership (≥ 120 m^2 dwellings)	0.221	-0.254
Observations	910	910
R^2 (within)	0.132	0.352

Note. All models controlled for the first lag of unemployment rate, education and age structure, total net costs of public services, year fixed effects, and municipality fixed effects. * Significant at 10%; ** significant at 5%; *** significant at 1%. Information on migration was not available for one semi-urban municipality, resulting in a reduction of 14 observations.

5. Concluding remarks

In this study, we examined the Oswald hypothesis, which states that a high homeownership rate in an area increases unemployment. Specifically, we considered how the proportion of ownership dwellings of different sizes in rural, semi-urban, and urban areas is linked to the local unemployment rate. Our results indicated that in semi-urban municipalities, with a high share of large home-owned dwellings relative to total housing stock, the unemployment rate was higher. Notably, migration at the aggregate level did not seem to explain this relationship.

The semi-urban municipalities in this study are regions with 5,697–29,065 inhabitants.[2] In such regions, the labor market typically relies on a few large employers, population size is declining, and housing prices and liquidity are lower than those in bigger cities. This often results in declining dwelling prices and negative housing equity, which could prevent homeowners from moving even if they become unemployed. Although our results indicated that migration flows at the aggregate level were similar in semi-urban areas with high proportions of large home-owned dwellings and other semi-urban areas, migration patterns may differ among residents in different-size dwellings. Individual-level data would be required to further investigate whether migration patterns of those who live in large homes in semi-urban areas relate to unemployment. Finally, small populations, homogeneous communities, and direct contact with local decision-makers may have resulted in NIMBY behavior in semi-urban areas. This could have hindered the development of these regions in the past, making them more vulnerable to economic shocks over time.

We did not find support for Oswald's hypothesis in remote rural areas, possibly because of the different structure of labor markets in these regions, particularly the central role of agriculture. When using wider regional aggregation at the LAU-1 level, we found support for Oswald's

[2] In 2011, the total population of Finland was 5.4 million (Official Statistics of Finland, 2012).

hypothesis in urban regions but no relationship between dwelling sizes and unemployment in either urban or semi-urban areas. The former finding may be due to some of the LAU-2 semi-urban regions being categorized as part of urban regions at the LAU-1 level. Additionally, the inclusion of semi-urban regions in urban regions most likely dilutes the proportion of large owner-occupied dwellings, which may account for the latter finding. Overall, the relationship between large, owned dwellings and unemployment appears regionally restricted.

Countries often provide subsidies to promote homeownership, as it is believed that homeownership can generate local amenities, increase social capital, and improve well-being (DiPasquale & Glaeser, 1999). Due to potential issues of reverse causality and potential omitted variables, our results may not establish a causal relationship, and more research is needed to confirm this finding. However, our findings do suggest that negative frictions from homeownership can partly offset the benefits, which should be taken into account when homeownership subsidies are considered.

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Appendix: Tables not included in the text

Table A1. Home-ownership rate and unemployment by dwelling size in university municipalities, 1998-2011

Dependent variable: ln unemployment (municipal unemployment rate in year *t*)	**(1)**	**(2)**	**(3)**	**(4)**
Panel A: First lag				
Ln home-ownership$_{t-1}$ 7-29 m^2	-0.122			
Ln home-ownership$_{t-1}$ 30-59 m^2	0.098			
Ln home-ownership$_{t-1}$ 60-89 m^2	-0.278			
Ln home-ownership$_{t-1}$ 90-199 m^2	0.326			
Ln home-ownership$_{t-1}$ ≥ 120 m^2	-0.359**			
Panel B: Second lag				
Ln home-ownership$_{t-2}$ 7-29 m^2		-0.039		
Ln home-ownership$_{t-2}$ 30-59 m^2		-0.025		
Ln home-ownership$_{t-2}$ 60-89 m^2		-0.104		
Ln home-ownership$_{t-2}$ 90-199 m^2		0.073		
Ln home-ownership$_{t-2}$ ≥ 120 m^2		-0.346**		
Panel C: Third lag				
Ln home-ownership$_{t-3}$ 7-29 m^2			-0.172	
Ln home-ownership$_{t-3}$ 30-59 m^2			0.220	
Ln home-ownership$_{t-3}$ 60-89 m^2			0.025	
Ln home-ownership$_{t-3}$ 90-199 m^2			-0.079	
Ln home-ownership$_{t-3}$ ≥ 120 m^2			-0.320***	
Panel D: Fourth lag				
Ln home-ownership$_{t-4}$ 7-29 m^2				-0.102
Ln home-ownership$_{t-4}$ 30-59 m^2				0.515
Ln home-ownership$_{t-4}$ 60-89 m^2				-0.225
Ln home-ownership$_{t-4}$ 90-199 m^2				-0.340
Ln home-ownership$_{t-4}$ ≥ 120 m^2				-0.276
Observations	130	120	110	100
R^2 (within)	0.951	0.938	0.935	0.930

Note. All models control for the first lag of unemployment rate, education and age structure, total net costs of public services, year fixed effects and municipality fixed effects. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table A2. Home-ownership rate and unemployment by dwelling size in urban municipalities, 1998-2011

Dependent variable: ln unemployment (municipal unemployment rate in year *t*)	**(1)**	**(2)**	**(3)**	**(4)**
Panel A: First lag				
Ln home-ownership$_{t-1}$ 7-29 m^2	0.071**			
Ln home-ownership$_{t-1}$ 30-59 m^2	0.156			
Ln home-ownership$_{t-1}$ 60-89 m^2	-0.219			
Ln home-ownership$_{t-1}$ 90-119 m^2	-0.035			
Ln home-ownership$_{t-1}$ ≥ 120 m^2	-0.055			
Panel B: Second lag				
Ln home-ownership$_{t-2}$ 7-29 m^2		0.013		
Ln home-ownership$_{t-2}$ 30-59 m^2		0.047		
Ln home-ownership$_{t-2}$ 60-89 m^2		-0.125		
Ln home-ownership$_{t-2}$ 90-119 m^2		-0.010		
Ln home-ownership$_{t-2}$ ≥ 120 m^2		-0.057		
Panel C: Third lag				
Ln home-ownership$_{t-3}$ 7-29 m^2			0.032	
Ln home-ownership$_{t-3}$ 30-59 m^2			-0.318	
Ln home-ownership$_{t-3}$ 60-89 m^2			0.034	
Ln home-ownership$_{t-3}$ 90-119 m^2			-0.044	
Ln home-ownership$_{t-3}$ ≥ 120 m^2			-0.065	
Panel D: Fourth lag				
Ln home-ownership$_{t-4}$ 7-29 m^2				0.051
Ln home-ownership$_{t-4}$ 30-59 m^2				-0.047
Ln home-ownership$_{t-4}$ 60-89 m^2				-0.639*
Ln home-ownership$_{t-4}$ 90-119 m^2				0.116
Ln home-ownership$_{t-4}$ ≥ 120 m^2				-0.113
Observations	624	576	528	480
R^2 (within)	0.896	0.872	0.868	0.864

Note. All models control for the first lag of unemployment rate, education and age structure, total net costs of public services, year fixed effects and municipality fixed effects. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table A3. Home-ownership rate and unemployment by dwelling size in rural municipalities, 1998-2011

Dependent variable: ln unemployment (municipal unemployment rate in year *t*)	**(1)**	**(2)**	**(3)**	**(4)**
Panel A: First lag				
Ln home-ownership$_{t-1}$ 7-29 m^2	0.022*			
Ln home-ownership$_{t-1}$ 30-59 m^2	0.088			
Ln home-ownership$_{t-1}$ 60-89 m^2	0.202***			
Ln home-ownership$_{t-1}$ 90-119 m^2	-0.362***			
Ln home-ownership$_{t-1}$ ≥ 120 m^2	0.090			
Panel B: Second lag				
Ln home-ownership$_{t-2}$ 7-29 m^2		0.006		
Ln home-ownership$_{t-2}$ 30-59 m^2		0.180***		
Ln home-ownership$_{t-2}$ 60-89 m^2		0.035		
Ln home-ownership$_{t-2}$ 90-119 m^2		-0.315***		
Ln home-ownership$_{t-2}$ ≥ 120 m^2		0.056		
Panel C: Third lag				
Ln home-ownership$_{t-3}$ 7-29 m^2			0.010	
Ln home-ownership$_{t-3}$ 30-59 m^2			0.095	
Ln home-ownership$_{t-3}$ 60-89 m^2			0.090	
Ln home-ownership$_{t-3}$ 90-119 m^2			-0.360**	
Ln home-ownership$_{t-3}$ ≥ 120 m^2			0.042	
Panel D: Fourth lag				
Ln home-ownership$_{t-4}$ 7-29 m^2				0.037**
Ln home-ownership$_{t-4}$ 30-59 m^2				0.041
Ln home-ownership$_{t-4}$ 60-89 m^2				0.178
Ln home-ownership$_{t-4}$ 90-119 m^2				-0.304**
Ln home-ownership$_{t-4}$ ≥ 120 m^2				0.019
Observations	2473	2283	2093	1903
R^2 (within)	0.785	0.757	0.733	0.703

Note. All models control for the first lag of unemployment rate, education and age structure, total net costs of public services, year fixed effects and municipality fixed effects. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table A4. Home-ownership rate and unemployment by dwelling size in semi-urban municipalities without the net costs variable as a control, 1998-2011

Dependent variable: ln unemployment (municipal unemployment rate in year *t*)	**(1)**	**(2)**	**(3)**	**(4)**
Panel A: First lag				
Ln home-ownership$_{t-1}$ 7-29 m^2	0.012			
Ln home-ownership$_{t-1}$ 30-59 m^2	0.051			
Ln home-ownership$_{t-1}$ 60-89 m^2	0.056			
Ln home-ownership$_{t-1}$ 90-119 m^2	-0.077			
Ln home-ownership$_{t-1}$ ≥ 120 m^2	0.331***			
Panel B: Second lag				
Ln home-ownership$_{t-2}$ 7-29 m^2		0.027		
Ln home-ownership$_{t-2}$ 30-59 m^2		0.041		
Ln home-ownership$_{t-2}$ 60-89 m^2		0.094		
Ln home-ownership$_{t-2}$ 90-119 m^2		-0.036		
Ln home-ownership$_{t-2}$ ≥ 120 m^2		0.326***		
Panel C: Third lag				
Ln home-ownership$_{t-3}$ 7-29 m^2			0.035	
Ln home-ownership$_{t-3}$ 30-59 m^2			-0.120	
Ln home-ownership$_{t-3}$ 60-89 m^2			0.102	
Ln home-ownership$_{t-3}$ 90-119 m^2			-0.126	
Ln home-ownership$_{t-3}$ ≥ 120 m^2			0.290**	
Panel D: Fourth lag				
Ln home-ownership$_{t-4}$ 7-29 m^2				0.030
Ln home-ownership$_{t-4}$ 30-59 m^2				-0.145
Ln home-ownership$_{t-4}$ 60-89 m^2				0.076
Ln home-ownership$_{t-4}$ 90-119 m^2				-0.050
Ln home-ownership$_{t-4}$ ≥ 120 m^2				0.306**
Observations	858	792	726	660
R^2 (within)	0.891	0.868	0.854	0.844

Note. All models control for the first lag of unemployment rate, education and age structure, year fixed effects and municipality fixed effects. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A5. The association between home-ownership rate and unemployment in different regions using LAU 1 categorization, 2005-2020

Dependent variable: ln unemployment (regional unemployment rate in year *t*)	**(1)**	**(2)**	**(3)**	**(4)**
Panel A: University regions				
Ln home-ownership$_{t-1}$ (1 lag)	0.109			
Ln home-ownership$_{t-2}$ (2 lag)		-0.125		
Ln home-ownership$_{t-3}$ (3 lag)			-0.077	
Ln home-ownership$_{t-4}$ (4 lag)				0.583
Observations	150	140	130	120
R^2 (within)	0.936	0.936	0.936	0.930
Panel B: Urban regions				
Ln home-ownership$_{t-1}$ (1 lag)	0.802**			
Ln home-ownership$_{t-2}$ (2 lag)		0.889***		
Ln home-ownership$_{t-3}$ (3 lag)			1.022***	
Ln home-ownership$_{t-4}$ (4 lag)				0.690*
Observations	360	336	312	288
R^2 (within)	0.891	0.891	0.882	0.845
Panel C: Semi-urban regions				
Ln home-ownership$_{t-1}$ (1 lag)	-0.585			
Ln home-ownership$_{t-2}$ (2 lag)		-0.605		
Ln home-ownership$_{t-3}$ (3 lag)			-0.746	
Ln home-ownership$_{t-4}$ (4 lag)				-0.993*
Observations	345	322	299	276
R^2 (within)	0.867	0.871	0.870	0.861
Panel D: Rural regions				
Ln home-ownership$_{t-1}$ (1 lag)	1.286			
Ln home-ownership$_{t-2}$ (2 lag)		0.931		
Ln home-ownership$_{t-3}$ (3 lag)			-0.031	
Ln home-ownership$_{t-4}$ (4 lag)				-0.483
Observations	180	168	156	144
R^2 (within)	0.814	0.810	0.791	0.746

Note. All models control for the first lag of unemployment rate, education and age structure, total net costs of public services, year fixed effects and municipality fixed effects. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table A6. Homeownership rate and unemployment by dwelling size in urban LAU 1 level regions, 2005-2020

Dependent variable: ln unemployment (regional unemployment rate in year *t*)	**(1)**	**(2)**	**(3)**	**(4)**
Panel A: First lag				
Ln home-ownership$_{t-1}$ 1 room	-0.187			
Ln home-ownership$_{t-1}$ 2 rooms	0.729*			
Ln home-ownership$_{t-1}$ 3 rooms	-0.332			
Ln home-ownership$_{t-1}$ 4+ rooms	-0.074			
Panel B: Second lag				
Ln home-ownership$_{t-2}$ 1 room		0.118		
Ln home-ownership$_{t-2}$ 2 rooms		0.581**		
Ln home-ownership$_{t-2}$ 3 rooms		-0.856		
Ln home-ownership$_{t-2}$ 4+ rooms		-0.219		
Panel C: Third lag				
Ln home-ownership$_{t-3}$ 1 room			-0.105	
Ln home-ownership$_{t-3}$ 2 rooms			0.600***	
Ln home-ownership$_{t-3}$ 3 rooms			-0.173	
Ln home-ownership$_{t-3}$ 4+ rooms			0.104	
Panel D: Fourth lag				
Ln home-ownership$_{t-4}$ 1 room				0.027
Ln home-ownership$_{t-4}$ 2 rooms				0.772***
Ln home-ownership$_{t-4}$ 3 rooms				-0.958
Ln home-ownership$_{t-4}$ 4+ rooms				-0.674
Observations	360	336	312	288
R^2 (within)	0.895	0.894	0.883	0.850

Note. All models control for the first lag of unemployment rate, education and age structure, total net costs of public services, year fixed effects and municipality fixed effects. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table A7. Home-ownership rate and unemployment by dwelling size in semi-urban LAU 1 regions, 2005-2020

Dependent variable: ln unemployment (regional unemployment rate in year *t*)	**(1)**	**(2)**	**(3)**	**(4)**
Panel A: First lag				
Ln home-ownership$_{t-1}$ .1 room	-0.059			
Ln home-ownership$_{t-1}$ .2 rooms	0.094			
Ln home-ownership$_{t-1}$ .3 rooms	-0.380			
Ln home-ownership$_{t-1}$ .4+ rooms	-0.104			
Panel B: Second lag				
Ln home-ownership$_{t-2}$ .1 room		-0.083		
Ln home-ownership$_{t-2}$ 2 rooms		0.137		
Ln home-ownership$_{t-2}$ 3 rooms		-0.310		
Ln home-ownership$_{t-2}$ .4+ rooms		-0.289		
Panel C: Third lag				
Ln home-ownership$_{t-3}$ 1 room			-0.104	
Ln home-ownership$_{t-3}$ 2 rooms			-0.110	
Ln home-ownership$_{t-3}$ 3 rooms			-0.005	
Ln home-ownership$_{t-3}$ 4+ rooms			-0.300	
Panel D: Fourth lag				
Ln home-ownership$_{t-4}$ 1 room				-0.095
Ln home-ownership$_{t-4}$ 2 rooms				-0.143
Ln home-ownership$_{t-4}$ 3 rooms				-0.309
Ln home-ownership$_{t-4}$ 4+ rooms				-0.0004
Observations	345	322	299	276
R^2 (within)	0.867	0.871	0.870	0.861

Note. All models control for the first lag of unemployment rate, education and age structure, total net costs of public services, year fixed effects and municipality fixed effects. * Significant at 10%; ** significant at 5%; *** significant at 1%.