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Does social housing hinder the development of a high-skilled labor force?

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Abstract

Social housing is allocated to low-skilled workers using non-market mechanisms, which distorts the location decision of low-skilled and high-skilled workers. We investigate empirically whether social housing limits the possibilities for high-skilled workers to become resident of a city. Using unique longitudinal panel data for 40 cities in the Netherlands over the years 1981–2006, we find evidence that social housing reduces the percentage of high-skilled workers in a region. Ceteris paribus a ten percentage point increase of the rent-controlled housing stock is found to reduce the percentage of high-skilled workers in a region by 1.8 percentage points. These results suggest that social housing reduces the ability of cities to benefit from agglomeration economies or skill complementarity

Keywords: Social housing, skill-composition, regional labor markets

JEL classification: J24, J31, R23, R31

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1. INTRODUCTION

In a perfectly competitive economy the size of cities and their skill composition will depend on the relative productivity of workers and house prices (Moretti, 2011).[1] Yet social housing, a substantial share of housing in some cities, is subject to rent control and not allocated in accordance with market mechanisms. Glaeser and Luttmer (2003) have shown that this results in substantial misallocation costs. In addition, social housing is known to reduce mobility (Munch et al., 2002) and to increase unemployment spells (Svarer et al., 2005). Yet, we argue that the economic costs of social housing exceed the costs of misallocation and reduced mobility. Because social housing is not allocated in accordance with market mechanisms, it distorts the location decision of low-skilled *and* high-skilled workers. This might reduce their potential to benefit from geographical sorting according to skill. As vacant social housing is allocated mainly to low-skilled workers, we foresee that cities which inherited a large social housing stock from the past, might be insufficiently suited to accommodate the inflow of high-skilled workers.

The effect of social housing on sorting according to skill is important as the skill composition of firms and cities is an important driver of productivity.[2] Furthermore, all workers in a city benefit from sorting (Moretti, 2004a, 2004b) and these benefits seem to become more important over time (Groot et al., 2009; Melo et al., 2009). The upshot of these studies is that cities, which are better at facilitating the process of sorting of workers, will realize higher levels of economic welfare. In this paper we argue that social housing might hinder sorting in the labor market, which might frustrate the development of agglomeration economies.

We focus on the prevalence of social housing in the Netherlands to study the relationship between local housing market composition and city-labor-force composition. In the US and other European countries, social housing is most prevalent in dense cities (New York, Paris, Amsterdam) and its stock is adjusted only

[1] The adjustment of local housing prices can restore equilibrium in local housing and labor markets, even though housing is durable and subject to high costs of conversion (Glaeser et al., 2006).

2 Among many others, important contributions are Ciccone and Hall (1996), who investigate the relationship between density and productivity, Combes et al. (2008) who study sorting of workers across locations and firms and Eeckhout et al. (2013) who argue that both low-skilled and high-skilled workers live in large cities because of skill complementarity. See Rosenthal and Strange (2004) for a review and Melo et al. (2009) for a meta-analysis reviewing the empirical literature.

slowly.[3] Social housing is rented out at below market prices to enable low-skilled workers to live in otherwise too expensive cities. Thus social housing contributes directly to the availability of low-skilled workers, which may be at odds with the necessity of having skilled workers interacting in a city to generate agglomeration economies. In addition, rent control of social housing limits the outflow of workers if house prices rise. As a result, the share of social housing is expected to have a negative effect on the share of high-skilled workers in a city.

Measuring the causal effect of the social housing stock on local skill composition poses an empirical challenge. The local skill equation includes explanatory variables on economic activity, wages and housing prices at the regional level. In addition, the skill equation includes unobserved local consumer amenities that influence the location decision of workers (Glaeser et al., 2001), such as theaters (Buettner and Janeba, 2014) or historic city centers (Brueckner et al., 1999). This creates a statistical endogeneity problem, because these amenities provide a compensating differential for local wages and local house prices.[4]

We use unique longitudinal panel data of 40 NUTS 3 regions in the Netherlands (in Dutch: *corops*, hereafter referred to as cities) to study the relationship between social housing and local skill composition. Our data set is based on individual household information from the Dutch national housing surveys - starting from 1981 up to and including 2006 - that we aggregated to the city level. An advantage of this level of aggregation is that all cities in the Netherlands have a substantial share of social housing, whereas the longitudinal dimension of the data ensures that the share of social housing varies within cities over time. These data are matched with city-level information on productivity and employment for eight industries. This allows us to estimate the effect of social housing on the share of the labor force that is highly skilled, while we condition on city-specific time-invariant (unobserved) effects, the local skill premium, local house prices and local job density. As mentioned before, both the local skill premium and local house prices might be endogenous variables, because they provide a compensating differential for unobserved location amenities.

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[3] For instance, in the Netherlands the share of social housing has fallen from about 46 percent in 1981 to about 39 percent in 2006. In an economically strong region such as Amsterdam, however, the social housing stock equals about 60 percent, which exceeds the national average by far.
[4] See the seminal papers by Rosen (1976), Roback (1982, 1986) and a recent extension by Moretti (2011).

Therefore, we instrument these variables by information on vote shares received by left-wing parties, the structure of the local economy and by historic data on housing density and the social housing stock. Also, we explicitly control for the influence on skill composition of social housing and economic condition in nearby locations.

Social housing is built to house poor households. Hence, one should not be surprised to find a negative relationship between social housing and the share of the workforce that is highly skilled. However, the strength of this relationship is unknown. First, social housing could increase the competition for market housing between middle-skilled and high-skilled workers in such a way that middle-skilled workers are driven out of the city. If so, one would observe a strong, negative relationship between social housing and the share of the labor force that is middle-skilled, whereas this relationship would only be modest for high-skilled workers. Unfortunately, limitations of the data allow us to test for a relationship between social housing and the prevalence of high-skilled workers only.

Second, it might be that social housing is to some extent accessible to high-skilled workers. For instance, in the Netherlands taking up accommodation in social housing is conditional on income, but workers are not forced to leave social housing if their income rises. As a result, some high-skilled workers might have access to social housing while studying or at the beginning of their career. In the Netherlands, the share of social housing inhabited by workers earning more than the modal wage ranges from about 15 to 40 percent (Van Daalen et al. 2012). Hence, whether social housing really hinders the development of a high-skilled labor force is not clear ex-ante.

Our empirical evidence indicates that a larger fraction of the social housing stock reduces the percentage of high-skilled workers in a city. More specifically, a ten-percentage-point increase of the social housing stock is found to reduce the percentage of high-skilled workers in a region by 1.8 percentage points. As this figure is relatively small, we conclude that social housing has a modestly negative effect on the development of a high-skilled labor force. We expect that social housing mainly reduces the access of middle-skilled workers to housing in a city.

Our results suggest that local housing market composition influences labor market outcomes by changing the supply of labor within cities. Previous studies focused mainly on the individual labor market effects of housing market tenure type. It is hypothesized that the geographical mobility of owner-occupied workers and workers living in social housing is reduced, because housing market transaction costs increase the reservation wage for job offers that require a move.[5] Munch et al. (2002) find that transaction costs of social housing reduce mobility. Also, these authors conclude that social housing increases unemployment duration (Svarer et al., 2005).[6] If housing market tenure type increases unemployment duration, one would expect that mobility-constrained workers have lower wages. However, mobility-constrained workers are less likely to leave the firm, and might therefore receive more training. Also, these workers might put more effort into their work in order to prevent becoming unemployed. Therefore, the effect of housing market tenure type on wages is ambiguous. This ambiguity is reflected in the empirical literature that finds that homeowners earn higher wages (Munch et al., 2008) as well as lower wages (Coulson and Fisher, 2009) compared to tenants of market housing.

The literature survey above considers the relationship between a worker's type of housing and his labor market position. According to this view, social housing creates externalities on the labor market that affect its inhabitants. In contrast, we find that the size of the social housing stock influences city skill composition by hindering high-skilled workers in taking up residence. As sorting according to skill is an important determinant for the productivity of cities, this finding implies that the productivity of all workers is affected by the stock of social housing. If so, social housing generates externalities on the labor market that affect all workers in a city, whether they live in social housing or not.

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[5] See Munch et al., 2006,2008; Svarer et al., 2002, 2005. Reviews of this literature are given by Van Ewijk and Van Leuvensteijn, 2009 and Havet and Penot, 2010.

[6] For homeownership results differ between macro-economic and micro-economic studies. Although macro-economic evidence for a positive relationship between the home-ownership rate and unemployment rate is often found, micro studies on this subject find that home-owners are less likely to move house, but also less likely to be unemployed, see Van Ewijk and Van Leuvensteijn, 2009; Havet and Penot, 2010.

2. THEORETICAL FRAMEWORK

The intuition behind our framework is that the location decision of workers living in social housing is distorted, because rent control prevents the adjustment of rents after productivity shocks. Our model shows that social housing increases house prices of market housing, which influences the location decision of high-skilled workers.

We base our theoretical model on a modification of the theoretical framework described by Moretti (2011). We consider an economy with two cities *a* and *b* and high-skilled workers N_H and low-skilled workers N_L. Log indirect utility of workers in city $c = a, b$ is a function of local wages w_{cT}, local housing costs p_{ic}, the worker-type specific valuation of local amenities A_{cT} and a worker specific preference for each city, e_{ic}.

$$U_{icT}=w_{cT}-p_{ic} + A_{cT} + e_{ic}, \qquad \text{where } T=H,L;\ c=a,b \qquad \text{(T1)}$$

For simplicity, it is assumed that high and low-skilled workers work in separated firms.[7] Assume that production is Cobb-Douglas. Assume the supply of capital is infinitely elastic and capital is applied such that the marginal productivity of capital equals the rent *r*. The wage workers earn equals the marginal productivity of labor. Thus log production is given by $y_{cT} = X_{ct} + hN_{cT} + (1\text{-}h)K_{cT}$, such that the marginal return to labor is equal to:[8]

$$w_{cT} = X_{cT} - (1\text{-}h)N_{cT} + (1\text{-}h)K_{cT} + h$$

Housing is rented out to workers by profit-maximizing landlords with deep pockets who reside outside the economy. Housing supply equals the number of workers in the city and is an increasing function of the price: $p_c = m+k_c(N_c)$. All housing is rented out against market rents p_c, however N_{Lv} workers receive a housing voucher that enables

[7] Substitution between skill types in production is assumed away. This simplifies the model, but it is not crucial for its outcome.

[8] Similarly, in equilibrium the marginal product of capital equals marginal costs $r = X_c^T + hN_c^T -hK_c^T +(1-h)$.

them to rent housing at the controlled rent *m* in any city. Assume housing vouchers are randomly distributed among low- skilled workers only. Thus all N_H high-skilled workers and some N_{Lm} low- skilled workers rent against the market rent, whereas N_{Lv} low-skilled workers rent housing against the controlled rent. Finally, it is assumed that the relative worker specific preference for city *a* over city *b* is i.i.d. uniformly distributed (regardless of skill), such that e_{ib}-e_{ia} ~$U[-s,s]$.

Workers locate in city b if $u_{ib} > u_{ia}$, which depends on the real wage rate, the relative presence of local amenities and on relative worker specific preference. The economy contains three marginal workers who are indifferent between living in city *a* or *b*: one high-skilled worker, one low-skilled worker without a housing voucher and one low-skilled worker with a housing voucher. As relative preferences for the cities are uniformly distributed we can solve for the number of people of type T in b. Equations (T2a) –(T2c) denote labor supply as a function of wages, prices and location amenities and preferences. We assume that preferences, productivity and amenities are distributed such that each city has high-skilled workers and low-skilled workers with and without a housing voucher.[9]

$$N_{bLV} = N_{Lv}\,[(w_{bL}-w_{aL})+(A_{bL}-A_{aL})+s]/2s \qquad \text{(T2a)}$$

$$N_{bLM} = N_{LM}\,[(w_{bL}-w_{aL})-(p_b-p_a)+(A_{bL}-A_{aL})+s]/2s \qquad \text{(T2b)}$$

$$N_{bH} = N_H\,[(w_{bH}-w_{aH})-(p_b-p_a)+(A_{bH}-A_{aH})+s]/2s \qquad \text{(T2c)}$$

Labor demand is a function of location productivity X_{cT} and the labor intensity of production *h*. As workers earn their marginal productivity and capital is perfectly elastically supplied at the rate r, local wages do not depend on local labor supply as shown in equation (T3). Housing supply is a positive function of the housing price. Equilibrium at the housing market is reached if local housing demand equals local housing supply. Equations (T2a) –(T2c) also describes demand for housing in city *b*. Hence, relative inverse housing supply is given by equation (T4).

[9] Think of this condition as resembling the “no black hole condition” in New Economic Geography, as it prevents that workers of a particular skill concentrate in one region (see Fujita et al. 1999).

$$w_{bT}\text{-}w_{aT} = (X_{bT}\text{-}X_{aT})/h \qquad (T3)$$

$$(p_b\text{-}p_a) = k_b(N_{bH}+N_{bLM}+N_{bLV})\text{-} k_a(N_{aH}+N_{aLM}+N_{aLV}) \qquad (T4)$$

Add equations (T2A) and (T2b) to find the number of high-skilled and low-skilled workers in city *b*.

$$N_{bL} = N_{bLM}+N_{bLV}$$
$$= N_L[(w_{bL}\text{-}w_{aL})+(A_{bH}\text{-}A_{aH})+s]/2s - N_{LM}(p_b\text{-}p_a)/2s$$
$$N_{bH} = N_H\, [(w_{bH}\text{-}w_{aH})\text{-}(p_b\text{-}p_a)+(A_{bH}\text{-}A_{aH})+s]/2s$$

Fill in the expressions for relative wages and relative housing prices using equations (T3) and (T4). To arrange the notational burden define $Z_T=(X_{bT}\text{-}X_{aT})/h+(A_{bT}\text{-}A_{aT})+s+k_{aN}$, such that

$$N_{bH} = f_H\, Z_H\, N_H - f_H\, N_H(k_a+k_b)N_{bL} \qquad (T5)$$

$$N_{bL} = f_L\, Z_L N_L - f_L\, N_{LM}(k_a+k_b)N_bH - f_L N_{LV} k_a N \qquad (T6)$$

where $f_L = [2s+N_{LM}(k_a+k_b)]^{-1}$ and $f_H=[2s+N_H(k_a+k_b)]^{-1}$

Note that all parameters that occur on the right hand side of (T5) and (T6) are exogenously given. Next substitute the equations for the number of low-skilled workers in living in city *b* (equation (T6)) into equation (T5) to derive the equilibrium number of high-skilled workers in equation (T7). For completeness, the number of low-skilled workers in b is given in equation (T8).

$$N_{bH} = (z+N\text{-}N_H\text{-}N_{LV})\, N_H\, d[(X_{bH}\text{-}X_{aH})/h+(A_{bH}\text{-}A_{aH})]$$
$$\text{-}(N\text{-}N_H)\, N_H\, d[(X_{bL}\text{-}X_{aL})/h+(A_{bL}\text{-}A_{aL})] \qquad (T7)$$
$$+(z\text{-}N_{LV})\, N_H\, ds+zN_H dk_a N$$

with $d = [2s(z+N\text{-}N_{LV})]^{-1}$ and $z=2s/(k_a+k_b)$

$$N_{bL} = \text{-}(N\text{-}N_H\text{-}N_{LV})N_H\, d[(X_{bH}\text{-}X_{aH})/h+(A_{bH}\text{-}A_{aH})]$$
$$+(N\text{-}N_H)\, (z+N_H)\, d[(X_{bL}\text{-}X_{aL})/h+(A_{bL}\text{-}A_{aL})] \qquad (T8)$$
$$+[z(N\text{-}N_H)+N_H N_{LV}]ds+z(N\text{-}N_{H}\text{-}N_{LV})dk_a N$$

Equation (T7) shows that the number of high-skilled workers in city *b* depends positively on the relative local productivity of high-skilled workers and the valuation of relative local amenities by high skilled workers. Similarly, it depends negatively on relative productivity and valuation of relative amenities by low-skilled workers. Suppose that city *b* is the more attractive city to live in, such that for both skill types it holds that $(X_{bT}-X_{aT})/h+(A_{bT}-A_{aT})>0$. Then, the stock of housing vouchers distributed among low-skilled workers (N_{LV}) negatively influences the number of high-skilled workers in city *b*. Note that the results are identical to the ones presented in Moretti (2011) if there are no housing vouchers distributed to low-skilled workers ($N_{LV}=0$).

3. SOCIAL HOUSING AND SORTING OF HIGH-SKILLED WORKERS IN THE NETHERLANDS

Over the last three decades the average share of social housing in the Netherlands has decreased gradually from about 46 percent in 1981 to about 38 percent in 2006. The social housing stock is substantial compared to other European countries (Scanlon and Whitehead, 2007) and is most predominant in dense and old cities (see Figure D1).

Social housing is subject to rent control. The rents of social housing are based on the characteristics of the house, such as its size and the number of rooms. For each attribute of the house a number of points is assigned and the maximum rent that can be charged is based on the total number of points. If the total number of points assigned to the house is lower than a certain threshold, the house is considered social housing. If the total number of points assigned to the house exceeds this threshold, rent control is no longer applicable and the rent is determined by the market. It is important to realize that the city of residence is not an attribute for which points are assigned.[10] Hence, the maximum rent of social housing with similar attributes does not differ between cities with high and low housing prices.

In the Netherlands social housing is assigned to applicants based on waiting time. Sometimes preferential treatment is given to subgroups of applicants, such as the elderly, disabled or households with low incomes. Although housing agencies are free to allocate social housing according to those rules, they cannot force tenants to leave social housing once the entry-criteria no longer apply. Hence, tenants who enter

[10] This changed in 2011 when a modest markup was introduced for social housing in municipalities with tight housing market (the so-called scarcity areas').

social housing when their income is low cannot be forced to move once their income has increased. As a result, between 15 and 40 percent of the local social housing stock is rented out to households earning more than the modal wage (Van Daalen et al. 2012).

Although the average share of social housing has decreased only gradually over time, the average share of high-skilled workers in a city has increased strongly. Figure D.2 shows that the increase in percentage of high-skilled workers was especially strong in the west of the country. In 2006 high-skilled workers were concentrated in the west of the country. In contrast, the geographical distribution of high-skilled workers did not show a clear-cut geographical pattern in 1981.

In contrast to the hypothesis that social housing reduces the entrance of high-skilled workers, Table C.3 shows a positive correlation between the share of social housing and percentage of high-skilled workers at the cross-sectional level since the 1990s. This might have to do with the fact that the share of social housing is higher in more urban regions and these regions are also more likely to contain a university or university of applied sciences. Yet, in line with the hypothesis that social housing reduces the entry of high-skilled workers, the overall correlation between the share of high-skilled workers in a region and the share of social housing is found to be negative. This underlines the importance of using longitudinal panel data to study the relationship between skill composition and social housing within cities over time.

4. DATA

We have constructed longitudinal panel data for forty NUTS 3 regions in the Netherlands. This panel is based on seven nationally representative surveys on housing demand that have been conducted over the period 1981 – 2006.[11] Based on these surveys we constructed the share of workers who are high-skilled and the size of the social housing stock at the city level. All monetary variables have been converted to the price level in 2006 using national inflation figures. In all years a worker is considered high-skilled if he has obtained a degree from a university, including universities of applied sciences (in Dutch: has a *HBO* or *WO*-diploma). If

[11] We refer to the WBO or WoON surveys conducted in 1981, 1985, 1989, 1993, 1998, 2002, 2006. In each year about 69.000 people answered the survey.

not, the worker is considered low-skilled. Based on this variable the percentage of the population that is high-skilled is computed. Additionally, the survey contains information whether the landlord of the rental house is a social housing agency. This we use to construct our measure of social housing at the city level.

As data on individual house value is not available for the entire period, we use hedonic regression techniques to compute the local house price premium based on the expected selling price of homeowners. For each survey-year we regress the expected selling price on attributes of the house and city indicators.[12]

Finally, these data are merged with industry-specific information on regional labor productivity and jobs provided by TNO. We group this information into four industries, that are commercial services, industry, central government and all other industries.[13] For each industry we observe the number of (fulltime equivalent) jobs as well as total productivity. This allows us to compute the Gross Regional Product per worker at the industry level. Table C.1 provides summary statistics of these and other variables.

5. EMPIRICAL STRATEGY

Equation (1) is specified to investigate the effect of social housing on the share of the workforce that is high-skilled. The dependent variable is the percentage of the population that is high-skilled in city c at time t, denoted H_{ct}. The main independent variable is the share of housing that is rented out by housing agencies (which virtually equals the social housing stock) S_{ct}. As the share of high-skilled workers has increased over time and high-skilled workers might hold preferences for specific cities, we condition on a city-specific fixed effect α_c and fixed year indicators δ_t. As high-skilled workers with high-wages can afford to live in expensive cities, we also control for local house prices p_{ct}. Finally, as high-skilled workers might be working in specific industries, we condition on local labor market conditions using a matrix of explanatory variables $\mathbf{L_{ct}}$. By including indicators for the local labor market, we adjust

[12] We include as housing attributes variables indicating the number of rooms, the size of the living room, the size of the kitchen, the presence of a garden (or similar attribute), the bathroom facilities in the house. The baseline house is located in Zeeuws-Vlaanderen, has four rooms, a living room of 30-40 square meters, a kitchen of five to seven square meters, and contains a shower and a garden.
[13] The Dutch translation of these industries is \`banken en zakelijke dienstverlening', \`nijverheid', \`rijksoverheid' en \`overige bedrjjfstakken'.

for the clustering of high-skilled workers that is the result of labor market sorting. In the baseline specification $\mathbf{L}_{ct}$ contains the productivity per worker in each of the four industries. In a more elaborate specification $\mathbf{L}_{ct}$ is extended with the number of jobs per capita and the industry employment shares. Finally, ε_{ct} is an idiosyncratic error term.

$$H_{ct} = \alpha_c + \beta_1 S_{ct} + \beta_2 p_{ct} + \boldsymbol{\gamma L_{ct}} + \delta_t + \varepsilon_{ct} \quad (1)$$
$$c = 1,2,\ldots,40 \quad t = 1985, 1989, 1993, 1998, 2002, 2006$$

The presence of high-skilled workers might be positively correlated with the presence of consumer amenities. Note that time-invariant consumer amenities (such as the presence of a historic city center) are included in the city-specific fixed effect. However, time-variant consumer amenities are not controlled for and will end up in the error term. As a result, the coefficient on social housing will be biased upwards if consumer amenities have increased in cities where the reduction in social housing was lowest. To prevent this, the parameter on social housing is identified using variation in the social housing stock that is the result of changes in the local economy. If housing agencies decide to reduce their stock of social housing, they are motivated to sell social housing in those cities where demand for housing is high. Hence, as the number of jobs in the city increases, local demand for housing rises and the incentive to sell off social housing increases. We also assume that city politicians do not want the social housing stock to be too low. Increases in the number of jobs then will have a stronger negative effect on the social housing stock if the initial social housing stock is high. If such a relationship exists, we would expect a negative relationship between a city's share of social housing (from 1985 onwards) and the instrumental variable κ_{ct} defined as the product of the 1981 share of social housing (S_{c1981}) and the number of jobs per square kilometer (J_{ct}).

$$\kappa_{ct} = S_{c1981} J_{ct}$$

As left-wing politicians especially hold strong preferences for social housing, we also instrument the share of social housing using the vote share going to left-wing parties in municipal elections within the city boundaries.[14] Obviously, we can only use κ_{ct} to instrument the share of social housing if the location decisions of high-skilled workers do not depend on job density conditional on the specification in equation (1). We provide evidence that job density, as expressed by the number of jobs per capita, does not have a direct effect on the location decision of high-skilled workers conditional on the inclusion of local labor market characteristics.[15] This suggests that including these local labor market characteristics suffices to control for the sorting of high-skilled workers due to the state of the local economy and that therefore the number of jobs in the city can be included as part of the instrumental variable for social housing.

Local house prices are endogenous as well because they are positively correlated with changes in consumer amenities. If the share of the labor force that is high-skilled is positively correlated with location amenities, the effect of house prices would be biased upwards. Therefore we instrument local house prices with the log of houses per square kilometer in 1947 (housing density D_{1947}) multiplied with the share of employment provided by commercial services.[16] Because house construction costs are higher in already dense cities, this instrument is positively correlated with housing costs. We multiply housing density with the share of jobs provided by commercial services (s_{ct}^1) to acknowledge that high housing costs only reduce supply if there is increased demand for housing.

$$H_{1947} = D_{1947} s_{ct}^1$$

Finally, we hypothesize that the social housing stock in cities nearby might influence the share of workers that is high-skilled. If social housing reduces the presence of high-skilled workers, one would expect that high-skilled workers will settle in cities nearby. Thus the effect of social housing on the percentage of high-skilled workers

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[14] This latter instrumental variable improves identification, but is not necessary.

[15] Theoretically, we can include J_{ct} as an instrument in L_{ct} and still use κ_{ct} to instrument the share of social housing. Both J_{ct} and κ_{ct} are identified (conditional on including α_c) as $\tilde{\kappa}_{ct} = S_{c1981}\tilde{J}_{ct}$, where $\sim$ indicates a variable is within transformed. However, as J_{ct} and κ_{ct} are highly collinear, we include the number of jobs per capita.

16 There is no official statistic on the housing stock in 1947 for NUTS 3 regions, as the regions were created in 1971. The housing stock in 1947 for NUTS 3 regions has therefore been reconstructed based on the municipal housing stock in 1947 taking into account municipal amalgamations over the period 1947-1988. Appendix A lists the city (corop) and the housing stock in 1947.

might spill over to other cities. To derive consistent estimates, this cross-sectional dependence is explicitly modeled. We compute the so-called spatial lag of social housing ($W_{ct}S_{ct}$) by pre-multiplying the share of social housing (S_{ct}) with a spatial weight matrix W_{ct}.[17] Similarly, to consider the effect of labor market conditions in cities nearby, the spatial lag of labor market indicators ($W_{ct}\boldsymbol{L_{ct}}$) is included. Thus equation (2) is also estimated.

$$H_{ct} = \alpha_c + \beta_1 S_{ct} + \theta_1 W_{ct} S_{ct} + \beta_2 p_{ct} + \boldsymbol{\gamma L_{ct}} + \theta_2 W_{ct} \boldsymbol{L_{ct}} + \delta_t + \varepsilon_{ct} \quad (2)$$

$$c = 1,2,\dots,40 \quad t = 1985, 1989, 1993, 1998, 2002, 2006$$

It is important to realize that the estimated parameters on the spatially lagged variables do not necessarily equal the marginal effects. Therefore they are not sufficient to prove the existence of spatial spillovers (Elhorst, 2010; LeSage and Pace, 2009). Instead, we compute the average direct and indirect spillover effect as defined by equations (B.4) and (B.5) in Appendix B.

6. RESULTS

The model in equation (1) is estimated to test whether social housing influences the percentage of high-skilled workers. Table C.4 presents the main regression results where we have clustered standard errors on the city level. In columns one and two we present estimation results based on OLS. The estimates differ in the number of local labor market controls. In column one these results are limited to measures of local GRP, whereas in column two we augment the set of local labor market characteristics with the number of jobs per capita and employment shares of three of our four industries. Results are very similar and do not provide evidence that the share of high-skilled workers in a city is affected by the share of social housing using simple OLS. The parameter is negative, yet insignificant. We do find evidence in favor of a positive relationship between house prices and the share of high-skilled workers. The

17 *W* is a *N x N* matrix that has nonzero element w_{ij} if *j* is a neighbor of *i* and zero elements otherwise (including the main diagonal). Here adjacent regions are considered a neighbour (queen contiguity). *W* is row-normalized such that all elements on a row sum up to 1. See Kelejian and Prucha (1998, 1999) and Lee (2004). The specification of *W* influences the parameter estimates on the spatial lags and in empirical work different specifications of *W* are often tested. See (Harris et al., 2011) for a discussion on formulating *W*. However, according to LeSage and Pace (2010), the effect of the specification of *W* on the marginal effects of a (spatially lagged) variable is negligible.

number of jobs per capita and industry employment shares are insignificant at the five percent level (both individually and jointly). Hence, these variables do not seem to affect the location decision of high-skilled workers, once we adjust for house prices, city fixed effects, time indicators and local GRP.

In columns three and four we present estimation results where the share of social housing and housing prices are instrumented. Again, the results differ in the size of local labor market characteristics. Results in column three indicate that social housing negatively affects the share of the labor force that is high-skilled: a ten percentage points decrease in the social housing stock is found to increase the share of high-skilled workers by 1.8 percentage points. The effect of house prices on the share of the labor force that is high-skilled remains positive and significant: a ten thousand euro increase in house prices is found to increase the share of high-skilled workers by 0.76 percentage points. Hence a reduction of the social housing stock of ten percentage points has an equivalent effect on high-skilled workers as an increase in house prices of about 23,500 euro.[18]

The Kleibergen-Paap F-statistic indicated that our instrument set is relevant. Also, based on the Hansen J-statistic we fail to reject the null hypothesis that our instrument set is not overidentified. Panels B and C of Table C.4 show that our instruments are significant and enter the first stage regression with the expected sign.

In column four we condition on local GRP in all of the four sectors, the number of jobs per capita and the employment share in three industries (commercial services, industry and central government). Including this extended version of local labor market characteristics is important, as our instruments are only exogenous if the location decision of high-skilled workers is not driven by the employment share of commercial services or job density. We conclude that our results are robust to extending the set of local labor market controls, as parameters do not change significantly and the added labor market characteristics are insignificant at the five percent level (both individually and jointly). The negative effect of the share of social housing increases (in absolute terms) to -0.21, whereas the effect of house prices

[18] (-0.179*-10)/(0.762*10000)=23,490.

increases to 0.92. Thus a reduction of the social housing stock of ten percentage points has an equivalent effect on high-skilled workers as an increase in house prices of about 22,650 euro. Hence, the relative effect of social housing and house prices remains about the same, which adds to the stability of our results. Naturally, including these collinear variables weakens the relevance of our instruments. The Kleibergen-Paap F-statistic of 9.5 indicates that the instrument set is now on the edge of not being relevant. Hence, strictly speaking, our results should be interpreted with caution.

Although the Hanson J-statistic indicates that using two instruments for social housing does not lead to overidentification, we instrument social housing with only one instrument in columns one and two of Table C.5. This reveals that the vote shares going to left-wing parties is not a relevant instrument for the social housing stock. Results in column two show that results where we use only κ_{ct} are similar to the ones presented in Table C.4. We interpret column two as evidence that our results are not biased by the choice to include the share of votes in the instrument set (together with κ_{ct}), although we acknowledge that the gain in identification is limited.

The third column in Table C.5 shows the results where we have allowed the share of social housing to interact with an indicator for the relative size of the social housing stock in 1981. The share of social housing in 1981 is considered high if it exceeds the median value of percent, and is considered low otherwise. Results in column three indicate that the effect of social housing is driven by those cities with a high initial stock of social housing. A ten percentage point decrease of the share of social housing results in a 2.7 percent increase of the share of high-skilled workers , whereas no significant effect is found for cities with low initial values of social housing. This could suggest that social housing reduces the inflow of high-skilled workers more in cities where the social housing stock is large, although we stress that this conclusion is bold given the weak explanatory power of our instrument set.

Next, we consider the effect of social housing in nearby cities using distance cutoff thresholds at 40, 50, 75 and 100 kilometers. Panel A of Table C.6 shows the second stage estimation results, first stage results are presented in panels B to D. We do not find evidence that the stock of social housing in nearby cities influences the share of high-skilled workers in a city. All estimates are negative and insignificant. The parameters estimated for social housing and house prices are comparable to those presented in columns three and four in Table 3 as the estimates range from -0.26 to -0.32 for social housing and from 1.13 to almost 1.5 for house prices.

As the estimated parameters do not equal spatial spillovers, we present estimated spatial spillovers in Table C.7. Naturally, the direct effects are nearly identical to the estimated parameters. In contrast, the average indirect spillover effects are considerably smaller than the estimated parameters. However,
they are all insignificant and therefore it is concluded that social housing does not influence the percentage of high-skilled workers in neighboring cities.

7. CONCLUSION

Social housing generates misallocation costs (Glaeser and Luttmer, 2003) and reduces the geographical mobility of tenants (Munch et al., 2002), which prolongs unemployment spells (Svarer et al, 2005). We argue however, that social housing creates more externalities than these. Because social housing is allocated mainly to low-skilled workers by forces other than demand and supply, social housing distorts the location decision of both low-skilled *and* high-skilled workers. Especially, we envision that social housing reduces the access to housing in the cities of workers who cannot enter social housing, mainly middle and high-skilled workers. As a result, social housing might restrict a city's potential to realize economic benefits that are the result of skill-based sorting.[19] Furthermore, all workers in a city benefit from sorting

In this paper we use a longitudinal panel on 40 cities in the Netherlands to estimate the effect of the share of social housing on the percentage of the workforce that is high-skilled. We find evidence suggesting that social housing reduces the access of high-skilled workers to housing in the cities. A decrease of ten percentage points in the social housing stock increases the percentage of high-skilled workers by 1.8 percentage points. Based on our results we conclude that a ten percentage point decrease in the social housing stock has a similar effect on skill composition as an

[19] Note that it does not matter whether economic benefits are the result from the sorting of high-skilled workers only, or extreme-skill complementarity or top-skill complementarity (the latter two require three types of skills, see Eeckhout et al., 2013). Our point is that the location decision of all workers is affected by social housing.

increase of local house prices of about 23,500 euro. Our results are conditional on fixed region effects and fixed time effects, the local skill-premium, local house prices and local job density. Also, the estimation procedure allows for spatial dependence in the data, although this has been shown to be of minor importance.

The size of the effect of social housing on the percentage of workers that is high skilled seems to modest in economic terms. Several hypothesis can explain this small effect. First, it could be that social housing drives out middle-skilled workers, not high-skilled workers. For instance, if both high-skilled and middle-skilled workers cannot enter social housing, they have to compete for owner-occupied or private rental housing. Then, high-skilled workers could drive out middle-skilled workers. In this view, social housing would be responsible for hollowing-out the local skill distribution. Second, the explanation of the limited size of the effect of social housing on the presence of high-skilled workers might be institutional. Dutch entry regulations are based on income at the time of entry, and therefore cannot prevent high-skilled workers from remaining living in social housing once their income increases. Although this mechanism exists (Van Daalen et al., 2013), it is most likely too small to explain the limited effect of social housing on its own.

Previous literature has focused on the implications of social housing for residential mobility and the consequences for unemployment (Munch et al. 2002, Svarer et al., 2005). In addition to these effects at the individual level, we show that social housing reduces the potential for high-skilled workers to enter the city. Given the importance of skill-based sorting for agglomeration benefits, it follows that social housing generates externalities in the form of lowered productivity that affect all inhabitants in a city, including those workers who do not live in social housing.

Also, our paper sheds new light on the literature on skill-based sorting. Although we are silent on the nature of sorting that generates productivity externalities, we do show that sorting in the labor market is restricted by local housing market composition. Cities that inherited more social housing from the past can accommodate fewer high-skilled workers. As the effect is small, we expect that social housing mainly reduces the location decision of middle-skilled workers. Future research should establish whether this is the case. An interesting research question which we hope will be addressed in the near future is whether social housing affects the formation of agglomeration economies.

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REFERENCES

Brueckner, J. K., Thisse, J. F., & Zenou, Y. (1999). Why is central Paris rich and downtown Detroit poor?: An amenity-based theory. European Economic Review, 43(1): 91-107.

Ciccone, A. Hall, R.E. (1996),Productivity and the density of economic activity, American Economic Review, 86(1): 54-70.

Combes, P.-P., Duranton, G., and Gobillon, L. (2008). Spatial wage disparities: Sorting matters! Journal of Urban Economics, 63(2):723–742.

Coulson, E. N. and Fisher, L. M. (2009). Housing tenure and labor market impacts: The search goes on. Journal of Urban Economics, 65(3):252–264.

Dohmen, T. J. (2005) Housing, mobility and unemployment, Regional Science and Urban Economics, 35(1): 305-325.

Elhorst, J. (2010). Applied spatial econometrics: Raising the bar. Spatial Economic Analysis, 5(1):9–28.

Glaeser, E. L., Kolko, J., and Saiz, A. (2001). Consumer city. Journal of Economic Geography, 1(1):27–50.

Glaeser, E. L., and Luttmer, E.FP. (2003), The misallocation of housing under rent control, American Economic Review, 93(4):1027-1046

Glaeser, E.L., Gyourko, J. and Saks, R.E. (2006), Urban growth and housing supply, Journal of Economic Geography, 6(1):71-89.

Groot, S., Groot de, H. L., and Smit, M. J. (2014). Regional wage differences in the Netherlands: Micro evidence on agglomeration externalities. Journal of Regional Science,54(3):503–523.

Harris, R., Moffat, J., and Kravtsova, V. (2011). In search of 'W'. Spatial Economic Analysis, 6(3):249–270.

Havet, N. and Penot, A. (2010). Does homeownership harm labour market performances? A survey. MIMEO.

Kattenberg, M.A.C. and Hassink, W.H.J. (2015), Does social housing hinder the development of a high-skilled labor force?, TKI Discussion Paper.

Kelejian, H. H. and Prucha, I. R. (1998). A generalized spatial two-stage least squares procedure for estimating a spatial autoregressive model with autoregressive disturbances. The Journal of Real Estate Finance and Economics, 17(1):99–121.

Kelejian, H. H. and Prucha, I. R. (1999). A generalized moments estimator for the autoregressive parameter in a spatial model. International Economic Review, 40(2):pp. 509–533.

Lee, L.-F. (2004). Asymptotic distributions of quasi-maximum likelihood estimators for spatial autoregressive models. Econometrica, 72(6):1899–1925.

LeSage, J. and Pace, R. K. (2009). Introduction to Spatial Econometrics. Boca Raton, Taylor and Francis.

LeSage, J. P. and Pace, R. K. (2010). The biggest myth in spatial econometrics. Available at SSRN 1725503, pages 1–42.

Melo, P.C., Graham, D.J., and Noland, R.B. (2009). A meta-analysis of estimates of urban agglomeration externalities, Regional science and urban economics, 39(3): 332-342.

Moretti, E. (2004a). Human capital externalities in cities. In: Henderson, J.V., Thisse, J.-F. (Eds.), Handbook of Regional and Urban Economics, vol. 4(1): 2243-2291.

Moretti, E. (2004b). Estimating the social return to higher education: Evidence from longitudinal and repeated cross-sectional data. Journal of Econometrics, 121(1):175–212.

Moretti, E. (2011). Local labor markets. In Card, D. and Ashenfelter, O., editors, Handbook of Labor Economics, volume 4, part B, chapter 14, pages 1237–1313. Elsevier.

Munch, J.R., Rosholm, M. and Svarer, M. (2006). Are homeowners really more unemployed?, Economic Journal, Royal Economic Society, vol. 116(514): 991-1013.

Munch, J. R., Rosholm, M., and Svarer, M. (2008). Homeownership, job duration, and wages. Journal of Urban Economics, 63(1):130–145.

Munch, J. R. and Svarer, M. (2002). Rent control and tenancy duration. Journal of Urban Economics, 52(3):542–560.

Rosenthal, S. S., & Strange, W. C. (2004). CH 49 Evidence on the nature and sources of agglomeration economies. In Henderson, J.V. and Thisse, J.F. (eds), Handbook of Regional and Urban Economics, 4: 2119-2171.

Scanlon, K. and Whitehead, C. (2007). Social housing in Europe. LSE London.

Svarer, M., Rosholm, M. and Munch, J.R. (2005), Rent control and unemployment duration, Journal of Public Economics, 89(11): 2165-2181.

Van Daalen, G., Regeer, W., and Janssen-Jansen, S. (2012). Ruim een kwart van de huurders van corporatiewoningen verdient meer dan 33 duizend euro. CBS Webmagazine.
downloaded from

http://www.cbs.nl/nl-NL/menu/themas/bouwen-wonen/publicaties/artikelen/archief/2012/2012-3652-wm.htm visited at 04-11-2013.

Van Ewijk, C. and Van Leuvensteijn, M. (2009). Homeownership and the labour market in Europe. OUP Oxford.

APPENDIX A. HOUSING IN 1947

ID	City	housing stock 1947
1	Flevoland	1,281
2	Zuidwest-Drenthe	17,849
3	Midden-Noord-Brabant	47,239
4	Midden-Limburg	19,307
5	Groot-Amsterdam	251,037
6	Noord-Drenthe	18,807
7	Arnhem/Nijmegen	74,935
8	Zuid-Limburg	71,574
9	Zuidwest-Friesland	21,570
10	Zaanstreek	22,166
11	Oost-Groningen	31,692
12	Agglomeratie Leiden en Bollenstreek	42,581
13	Zeeuws-Vlaanderen	20,850
14	Overig Groningen	68,581
15	Zuidoost-Noord-Brabant	56,832
16	Noord-Limburg	22,674
17	Kop van Noord-Holland	39,633
18	Delfzijl en omgeving	9,223
19	Agglomeratie ’s-Gravenhage	146,151
20	Noordoost-Noord-Brabant	45,125
21	Groot-Rijnmond	233,872
22	West-Noord-Brabant	60,596
23	Overig Zeeland	40,179
24	Agglomeratie Haarlem	50,329
25	Achterhoek	44,773
26	Utrecht	120,352
27	Noord-Friesland	61,674
28	Noord-Overijssel	43,581
29	Zuidoost-Drenthe	17,356
30	Het Gooi en Vechtstreek	39,434
31	Zuidoost-Friesland	28,097
32	Veluwe	60,478
33	Twente	71,053
34	Zuidwest-Overijssel	16,989
35	Zuidwest-Gelderland	25,640
36	Zuidoost-Zuid-Holland	48,785
37	Delft en Westland	24,991
38	Oost-Zuid-Holland	33,109
39	Alkmaar en omgeving	22,176
40	IJmond	18,573

APPENDIX B. MEASUREMENT OF SPATIAL SPILLOVERS

Let y be a vector containing the dependent variable. y is explained by the matrix of independent variables X, a vector Wy containing the spatially lagged dependent and matrix WX containing the spatially lagged independent variables. ε is a vector containing an i.i.d. error term with expectation zero and constant variance. ρ, β and θ are scalars that have to be estimated. The reduced form becomes

$$y = \rho Wy + X\beta + WX\theta + \varepsilon$$

$$y = (I - \rho W)^{-1} X[\beta + W\theta] + (I - \rho W)^{-1}\varepsilon$$

From which it follows that the derivative of y towards any variable x_k in X is given by:[20]

$$\begin{pmatrix} \frac{\partial y_1}{\partial x_{k1}} & \frac{\partial y_1}{\partial x_{k2}} & \cdots & \frac{\partial y_1}{\partial x_{kN}} \\ \frac{\partial y_2}{\partial x_{k1}} & \frac{\partial y_2}{\partial x_{k2}} & \cdots & \frac{\partial y_2}{\partial x_{kN}} \\ \vdots & \vdots & \ddots & \vdots \\ \frac{\partial y_N}{\partial x_{k1}} & \frac{\partial y_N}{\partial x_{k2}} & \cdots & \frac{\partial y_N}{\partial x_{kN}} \end{pmatrix} =$$

$$(I - \rho W)^{-1} \begin{pmatrix} \beta_k & w_{1,2}\,\theta_k & \cdots & w_{1,40}\,\theta_k \\ w_{2,1}\,\theta_k & \beta_k & \cdots & w_{2,40}\,\theta_k \\ \vdots & \vdots & \ddots & \vdots \\ w_{40,1}\,\theta_k & w_{40,2}\,\theta_k & \cdots & \beta_k \end{pmatrix}$$

As direct and indirect effects are different for each spatial unit, LeSage and Pace (2009) suggest computing the average (in)direct effect and consider its distribution under the null of an (in)direct effect equal to zero. In matrix notation, the average direct and average indirect effect are given by:

$$\text{Average direct effect:} \quad \text{trace}[(I - \rho W)^{-1} I \beta]/N \qquad \text{(A1)}$$

$$\text{Average indirect effect:} \quad i_N{}' \; [(I - \rho W)^{-1}\, \theta\, W] i_N \frac{1}{N(N-1)} \qquad \text{(A2)}$$

where i_n is a N-dimensional vector of ones. The direct effect and indirect effect are divided by N and $N(N-1)$ as there are N regions with each $N-1$ potential neighbors.

Both the average direct and indirect effect are computed to test for the existence of

[20] Where $\frac{\partial y_a}{\partial x_{kb}}$ is the derivative of the y in region a to a shock to x_k in region b.

spatial spillovers in equation (15). One thousand realizations indexed $\mathrm{i} = 1, \dots, 1000$ of $\beta_{\mathrm{i}}, \theta_{\mathrm{i}}$ have been generated, where each realization $\beta_{\mathrm{i}}, \theta_{\mathrm{i}}$ has been drawn from an independent random normal distribution with mean $\widehat{\beta}, \widehat{\theta}$ and standard deviation $\widehat{se(\beta_{1}}), \widehat{se(\theta_{1}})$ respectively. This we use to compute one thousand randomly generated spatial spillovers according to equations 28 and 29. In addition, we compute and report the mean and the lower and upper bound of the 95 percent confidence interval.

APPENDIX C. TABLES AND FIGURES

Table C1. Summary statistics

variable	mean	sd	min	max
percentage of workers that is high-skilled	16.15	11.48	1.00	44.00
percentage of housing stock that is rent-controlled	43.35	7.29	24.50	65.60
local house prices (in 10,000)	10.58	3.39	4.78	25.63
local high-skill premium (w_c^H/w_c^L)	1.31	0.16	0.49	1.69
job density	184.11	201.61	12.02	1249.61
spatial lag perc. of housing stock that is rent-controlled	42.67	3.95	32.20	52.55
spatial lag jobs per km^2	177.36	87.69	27.18	481.11
log GDP per worker	10.77	0.34	10.01	11.82
local productivity share sector 1 (B_1)	1.49	0.55	0.65	3.67
local productivity share sector 2 (B_2)	0.10	0.08	0.00	0.30
local productivity share sector 3 (B_3)	1.87	0.35	0.76	2.75
local productivity share sector 4 (B_4)	0.23	0.23	0.00	1.39
local productivity share sector 5 (B_5)	3.29	0.93	1.03	5.66
local productivity share sector 6 (B_6)	1.66	0.43	0.73	3.28
local productivity share sector 7 (B_7)	1.50	0.45	0.82	3.23
local productivity share sector 8 (B_8)	0.63	0.23	0.23	1.63
surface	103815.43	70324.12	12818.00	342884.00
housing density in 1947	81.12	104.93	1.00	574.00
housing density in 1947 times log GDP per worker	873.63	1135.28	10.29	6499.92

Table C2. Share of high-skilled workers and social housing over time

	High-skilled workers		Social housing	
	mean	sd	mean	sd
1981	6.80	2.58	45.99	7.34
1985	6.58	2.90	47.21	6.83
1989	8.95	3.90	45.32	6.73
1993	7.47	4.29	43.87	6.29
1998	20.90	6.14	42.32	6.27
2002	30.32	5.39	40.10	6.81
2006	32.00	5.15	38.65	6.93

Table C3. Correlation high-skilled workers and rent controlled housing

	Correlation coefficients [a]
Overall	-0.26***
1981	-0.16
1985	-0.07
1989	0.15
1993	0.39**
1998	0.28*
2002	0.46***
2006	0.43***

[a] *Pairwise correlation coefficients are based on 280 observations for the overall correlation and on 40 observations per year. Significance level denoted with stars,* $* \, p < 0.1, \; ** \, p < 0.05, \; *** \, p < 0.01$

Table C4. Main results

Panel A: 2nd stage results	Dependent variable: Percentage high-skilled workers			
	(1)	(2)	(3)	(4)
Share social housing	-0.0498	-0.0359	-0.179**	-0.208**
	(0.0594)	*(0.0595)*	*(0.0832)*	*(0.0858)*
House price premium	0.577***	0.585***	0.762***	0.918***
	(0.167)	*(0.185)*	*(0.271)*	*(0.341)*
Observations	240	240	240	240
Method	OLS	OLS	IV	IV
Industry GRP (4)	YES	YES	YES	YES
Year indicators (6)	YES	YES	YES	YES
City indicators (39)	YES	YES	YES	YES
Jobs per cap. and employment shares (4)		YES		YES
Kleibergen-Paap F			18.24	9.496
Hansen J (p-value)			0.72	0.79

Standard errors clustered on the city level in parentheses
** p < 0.10, ** p < 0.05, *** p < 0.01*

Panel B: 1st stage results	Dependent variable: Share social housing	
Vote share left wing parties	0.210***	0.167***
	(0.0677)	*(0.0514)*
κ_{ct}	-0.202***	-0.173***
	(0.0530)	*(0.0428)*
H_{1947}	0.171***	0.352***
	(0.0353)	*(0.0646)*

Panel C: 1st stage results	Dependent variable: House price premium	
Vote share left wing parties	0.0824**	0.0854**
	(0.0333)	*(0.0343)*
κ_{ct}	0.0348	0.0572**
	(0.0250)	*(0.0234)*
H_{1947}	0.117***	0.196***
	(0.0132)	*(0.0376)*

Table C5. Results robustness analysis

Panel A: 2^{nd} stage results	Dependent variable: Percentage high-skilled workers		
	(1)	(2)	(3)
Share social housing	-0.554	-0.209**	
	(1.742)	*(0.0861)*	
Share social housing: high initial value			-0.267**
			(0.133)
Share social housing: low initial value			-0.428
			(0.342)
House price premium	1.877	0.963**	1.104***
	(4.801)	*(0.383)*	*(0.404)*
Observations	240	240	240
Method	IV	IV	IV
Industry GRP (4)	YES	YES	YES
Year indicators (6)	YES	YES	YES
City indicators (39)	YES	YES	YES
Jobs per cap. and employment shares (4)	YES	YES	YES
Kleibergen-Paap F	0.0754	9.165	3.204
Hansen J p-value			0.65

Standard errors clustered at the city level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C5. …continued

Panel B: 1st stage results	Dependent variable: Share social housing		
	(1)	(2)	(3)
Vote share left wing	0.220***		
	(0.0598)		
κ_{ct}		-0.217***	
		(0.0485)	
H_{1947}	0.439***	0.344***	
	(0.0682)	*(0.0717)*	

Panel C: 1st stage results	Dependent variable: Share social housing, high initial value		
	(1)	(2)	(3)
Vote share left wing			0.106*
			(0.0574)
κ_{ct}: high initial value			-0.261***
			(0.0640)
κ_{ct}: low initial value			0.233**
			(0.108)
H_{1947}			0.304***
			(0.0823)

Panel D: 1st stage results	Dependent variable: Share social housing, low initial value		
	(1)	(2)	(3)
Vote share left wing			0.0418
			(0.0372)
κ_{ct}: high initial value			0.0951**
			(0.0465)
κ_{ct}: low initial value			-0.288***
			(0.0882)
H_{1947}			0.0653
			(0.0421)

Panel E: 1st stage results	Dependent variable: House price premium		
	(1)	(2)	(3)
Vote share left wing	0.0676**		0.0750**
	(0.0319)		*(0.0360)*
κ_{ct}		0.0346	
		(0.0218)	
κ_{ct}: high initial value			0.0612**
			(0.0238)
κ_{ct}: low initial value			0.121**
			(0.0496)
H_{1947}	0.167***	0.192***	0.205***
	(0.0347)	*(0.0398)*	*(0.0362)*

Table C6. Results spatial LSDV

Panel A: 2nd stage results	Dependent variable: Percentage population that is high-skilled			
	(1)	(2)	(3)	(4)
Share social housing	-0.261***	-0.266***	-0.315***	-0.324***
	(0.0976)	*(0.0881)*	*(0.0944)*	*(0.105)*
Spatial lag share social housing	-0.140	-0.152	-0.310	-0.424
	(0.221)	*(0.182)*	*(0.250)*	*(0.268)*
House price premium	1.131***	1.143***	1.347***	1.467***
	(0.305)	*(0.293)*	*(0.342)*	*(0.357)*
Observations	240	240	240	240
Method	IV	IV	IV	IV
Industry GRP (4)	YES	YES	YES	YES
Year indicators (6)	YES	YES	YES	YES
City indicators (39)	YES	YES	YES	YES
Jobs per cap. and employment shares (4)	YES	YES	YES	YES
Kleibergen-Paap F	9.973	10.15	6.635	10.39
Hansen J (p-value)	0.98	0.99	0.99	0.94
Distance cutoff	40km	50km	75km	100km

Standard errors clustered on the city level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table C6. …continued

Panel B: 1st stage results	Dependent variable: Share social housing			
	(1)	(2)	(3)	(4)
Vote share left wing	0.111**	0.105**	0.0965*	0.0943*
	(0.0509)	*(0.0508)*	*(0.0506)*	*(0.0494)*
Spatial lag vote share left wing	0.171**	0.217***	0.253***	0.306***
	(0.0685)	*(0.0765)*	*(0.0935)*	*(0.102)*
κ_{ct}	-0.192***	-0.189***	-0.186***	-0.190***
	(0.0449)	*(0.0460)*	*(0.0429)*	*(0.0439)*
Spatial lag κ_{ct}	0.112	0.113	0.304**	0.440**
	(0.0839)	*(0.114)*	*(0.151)*	*(0.205)*
H_{1947}	0.353***	0.362***	0.342***	0.340***
	(0.0691)	*(0.0691)*	*(0.0696)*	*(0.0680)*

Panel C: 1st stage results	Dependent variable: Spatial lag share social housing			
	(1)	(2)	(3)	(4)
Vote share left wing	0.0984*	0.0817	0.0401	0.0437
	(0.0535)	*(0.0498)*	*(0.0364)*	*(0.0331)*
Spatial lag vote share left wing	0.160**	0.207***	0.331***	0.387***
	(0.0679)	*(0.0709)*	*(0.0723)*	*(0.0859)*
κ_{ct}	0.151***	0.136***	0.118***	0.0901***
	(0.0252)	*(0.0275)*	*(0.0213)*	*(0.0191)*
Spatial lag κ_{ct}	-0.0931	-0.129	0.0837	0.115
	(0.0941)	*(0.0931)*	*(0.118)*	*(0.163)*
H_{1947}	0.158***	0.155***	0.117***	0.105***
	(0.0470)	*(0.0470)*	*(0.0374)*	*(0.0342)*

Panel D: 1st stage results	Dependent variable: House price premium			
	(1)	(2)	(3)	(4)
κ_{ct}	0.0562**	0.0670***	0.0606***	0.0609***
	(0.0247)	*(0.0235)*	*(0.0215)*	*(0.0212)*
Spatial lag κ_{ct}	0.171***	0.204***	0.377***	0.580***
	(0.0359)	*(0.0442)*	*(0.0663)*	*(0.108)*
H_{1947}	0.191***	0.191***	0.173***	0.177***
	(0.0365)	*(0.0373)*	*(0.0336)*	*(0.0345)*
Vote share left wing	0.0702*	0.0659*	0.0548	0.0566*
	(0.0396)	*(0.0354)*	*(0.0334)*	*(0.0330)*
Spatial lag vote share left wing	0.0312	0.0285	0.0572	0.0215
	(0.0335)	*(0.0360)*	*(0.0406)*	*(0.0486)*

Table C7. Spatial spillovers of social housing

		mean (1)	CL lb (2)	CL ub (3)
	Direct effect	-0.2597	-0.4578	-0.0617
W40	Indirect effect	-0.0032	-0.0144	0.0080
	Combined effect	-0.2629	-0.4610	-0.0649
	Direct effect	-0.2643	-0.4432	-0.0855
W50	Indirect effect	-0.0036	-0.0127	0.0056
	Combined effect	-0.2679	-0.4467	-0.0891
	Direct effect	-0.3132	-0.5048	-0.1216
W75	Indirect effect	-0.0075	-0.0201	0.0051
	Combined effect	-0.3207	-0.5123	-0.1290
	Direct effect	-0.3220	-0.5346	-0.1094
W100	Indirect effect	-0.0104	-0.0240	0.0031
	Combined effect	-0.3324	-0.5451	-0.1198

Figure D1. Percentage of social housing in 1981 and 2006

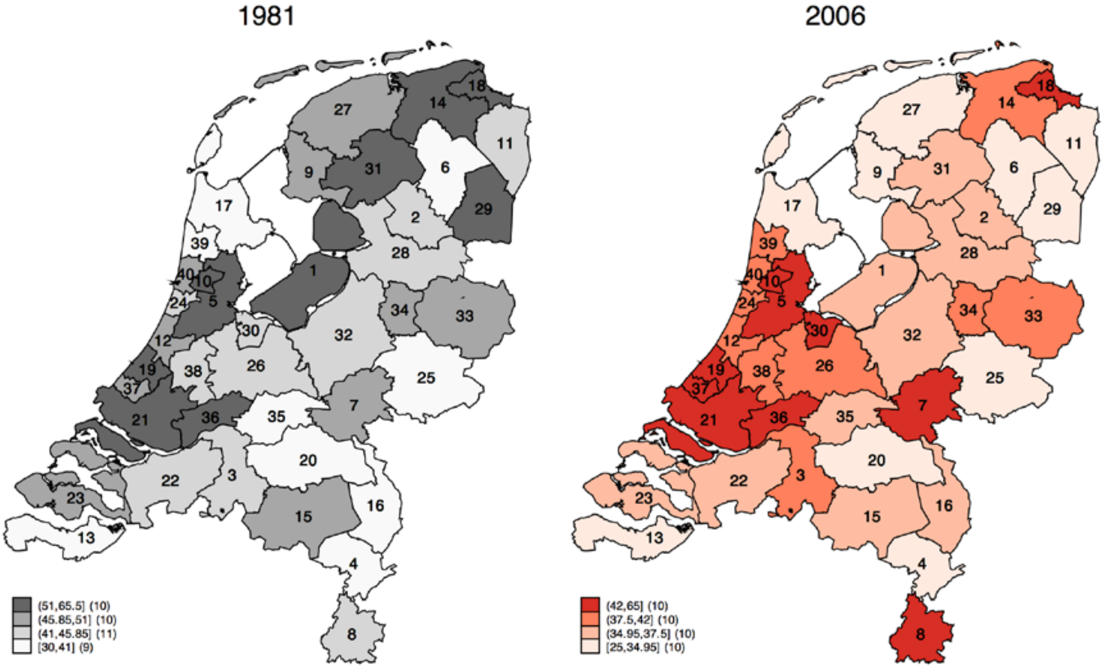

Figure D2. Percentage of high-skilled workers in 1981 and 2006