Homeownership externalities, Evidence from Rotterdam

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Abstract

Does homeownership benefit neighborhoods? We analyze three types of external effects of homeownership in neighborhoods: neighborhood safety, neighborhood satisfaction and percentage of citizens voting in local elections. We address endogeneity between ownership-rates and external effects using instrumental variables and examine non-linear effects. Using a detailed dataset of 75 neighborhoods in Rotterdam over an eight year time-span, we find consistent evidence that homeownership induces positive neighborhood externalities. Ownership-rates and external effects have no linear relationship but are subject to diminishing returns. Depending on the external effect under consideration these returns diminish once ownership-rates reached levels around 45-50 percent.

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1. Introduction

To own or not to own? That is the question that puzzled academics and dominated governmental housing policies of many Western countries during the last decades. One example is the passage of the Federal Home Loan Bank Act in 1932 in the U.S. intended to promote homeownership (Megbolugbe and Linneman, 1993). Also other countries adopted ownership stimulating policies such as tax-deductibility of mortgage interest and buyers subsidies in the Netherlands and Belgium.

These policies were developed and executed partly with the belief that homeowners provide – as DiPasquale and Glaeser (1999) call them - local amenities. Subsequent research by urban economists and sociological scientists produced evidence that owning a home benefits the performance of children at school (e.g. Jensen and Harris, 2008; Aaronson, 2000, Green and White, 1997), enhances local public involvement and social connections (Engelhart *et al.,* 2010; Kleinhans *et al.,* 2007; DiPasquale and Glaeser, 1999) and increases the stability of the neighborhood by reducing residential mobility and crime rates (Glaeser and Sacerdote, 2000; Rohe and Stewart, 1996).

However, the Chapter 11 filing of Lehman Brothers in September 2008 triggered the worldwide credit crunch with foreclosures reaching all-time heights due to households defaulting on their mortgages (Levy, 2009). The ownership-increasing nature of housing policies entails financial risks and it is reasonable to believe that part of these policies are subject to reassessment in the near future (Chase, 2010).

Moreover, evidence on external effects of homeownership is not conclusive. Dietz and Haurin (2003), Haurin, Dietz and Weinberg (2003) and Dietz (2002) provide a series of excellent review studies on the effects of neighborhood homeownership rates and methodological issues that arise. Haurin *et al.* (2003) states that "in general, empirical results obtained before 1990 are not reliable and should be re-estimated using up-to-date models". According to them, many empirical studies suffer omitted variable bias and do not sufficiently control for endogenous effects. Improperly controlling for endogeneity limits the extent to which any effects found can causally be attributed to homeownership. We add to this that most studies are also U.S.-based. The U.S. has historically seen relatively high homeownership rates (68 percent compared to 55 percent in Holland), and

different marginal income tax-rates and regulations with respect to education, social security provision and mortgage lending practices (e.g. mortgages in the U.S. are often non-recourse, while in Holland most of them are recourse). Some studies focused on the Dutch housing-market such as Kleinhans *et al.* (2007) who study restructured neighborhoods in Rotterdam and Van Beckhoven and Van Kempen (2003) who analyze restructured neighborhoods in Utrecht and Amsterdam. However, these studies only use relatively small samples.

We contribute to this literature by examining the U.S.-evidence in a European context paying in particular attention to the causal identification of the effect, using a unique dataset for 75 neighborhoods in Rotterdam over an eight year timeframe. This dataset allows us to use panel data models (Haurin *et al.,* 2003) which expands the number of possibilities to infer causality. Moreover, we empirically examine whether these relationships are non-linear and subject to diminishing returns, as suggested by Haurin *et al.,* 2003. Engelhardt *et al.* (2010) argue that if there are externalities to expanding homeownership rates, they should initially emerge when lower-income households become homeowners suggesting a non-linear relationship. Household-income and ownership-rates typically vary in the same direction, so the marginal impact of changes in ownership-rates on external effects is not equal for the whole range of neighborhoods.

We investigate the impact of homeownership rates using neighborhood safety, neighborhood satisfaction and the percentage of residents that votes in local elections (DiPasquale and Glaeser, 1999) as indicators for external effects. We find consistent evidence, using both OLS and IV estimates, for the non-linear impact of ownership rates on external effects with diminishing effects occurring when ownership-levels reach 45-50 percent. As far as the causality question is concerned: it runs in both directions. Our case-study showed that in a distressed neighborhood people are unwilling to buy a house unless they are incentivized to do so, implying that good neighborhoods attract homeowners. Following the moving in of gentrifying individuals, indicators of external effects show a profound increase.

We continue our paper with an overview of the existing literature. Section three discusses our dataset and provides background information on the Dutch housing market

and the four major cities including Rotterdam. The fourth section contains a case-study of a neighborhood where an ownership-increasing project is executed. In the fifth section we expand our analysis to the complete dataset. Section six concludes our paper with a brief discussion of our results and implications for housing policies.

2. Literature Review

There is an extensive stream of literature that examines the impact of homeownership on such things as local amenities, neighborhood stability, crime rates, public involvement and other externalities. Previous studies employed a broad variety of empirical strategies to examine their respective research questions such as instrumental variables, experimental designs (Engelhardt *et al.*, 2010; Ludwig *et al.*, 2001) and structural models (An *et al.*, 1993). We define external effects of ownership by neighborhood safety, neighborhood satisfaction (BRON) and residents participation in local elections (DiPasquale and Glaeser, 1999).

Sampson and Groves (1989) is an early empirical study showing that neighborhoods with low socioeconomic status and low social capital face increased crime- and delinquency rates. Indicators of socio-economic status of a neighborhood are level of education, income and length of tenure. Length of tenure is a measure for the residential mobility in a neighborhood, with the classical argument being that rental-dominated neighborhoods are more mobile than their owner-occupied-dominated counterparts. The longer an individual lives in a neighborhood, the higher the probability that he or she develops a social network/capital with other citizens in that neighborhood (see Kleinhans *et al.*, 2003; DiPasquale and Glaeser, 1999).

So homeownership and residential mobility are somehow related. Harkness and Newman (2002) show, that indeed the effects of homeownership are weaker when they add residential mobility (measured as the neighborhood turnover-rate) as a control to their model. Suggesting that part of the effects of homeownership can be attributed to a reduction in residential mobility. They control for both individual and neighborhood ownership levels and find that the latter one has virtually no effect. Also the size of the dwelling in which the individual lives is found to have an influence on the level of social capital. Glaeser and Sacerdote (2000) report that residents living in an apartment building

have increased social connections with their neighbors but reduced connections with the streets causing increased street crime in neighborhoods dominated by multi-family properties since less social-control is present.

Rosenthal (2008) points out that neighborhood economic status, measured as the income of the neighborhood relative to its MSA, is affected both through changes in the socio-economic composition of the neighborhood and deterioration of the housing stock, but that the first one is more persistent in the short run. Starting with the observation that houses occupied by low-income families where originally designed for higher-income families, he argues that neighborhood externalities emerge from individuals bringing social capital to the neighborhood such as high-educated workers and homeowners. Eventually, these people flee the area when the housing stock deteriorates, with lower-income households moving in lowering the socio-economic status of the neighborhood and preventing gentrifying individuals from moving in. The reduction in social capital leads to higher crime-rates, unemployment and a drop in average income.

Our second indicator for homeownership externalities is neighborhood satisfaction. Rohe and Stewart (1996), Austin and Babe (1990), Baba and Austin (1989) argue that homeownership has a positive effect on neighborhood satisfaction because it gives individuals a sense of pride and control over their own property. Rossi and Weber (1996) find that homeowners tend be higher in life satisfaction and self-esteem. Since homeowners face substantial costs of moving, it is reasonable to assume that they will engage in activities that generate positive outcomes for the neighborhood (such as involvement with organizations) which subsequently improves neighborhood satisfaction. Van Beckhoven and Van Kempen (2003) argue that the neighborhood plays a limited part in the lives of the resident, but their analysis is restricted to completely restructured neighborhoods, involving substantial movement of existing residents. These restructurings lead to a complete reshuffling of the socio-economic characteristics present in the neighborhood. Residents that are less residentially mobile (older people, families with children, lower-income) or that have a less widespread social network (lower-educated, unemployed) are more reliant on the neighborhood but in restructurings they might be forced to relocate, thereby not turning up anymore in the statistics. We do not

restrict our analysis to restructured neighborhoods but analyze a full cross-section capturing the full heterogeneity present.

The third indicator is local political involvement. Dietz and Haurin (2003) review some studies in this vein. There are several lines of reasoning why homeownership would alter voting behavior, since homeowners are less mobile and have a greater interest in the developments of their neighborhood and local affairs. Drier (1994) reports that the homeowners voting rate is 69 percent, clearly above the rate for renters being lower at 44 percent.

In the introduction it was mentioned that if changes in ownership rates create external effects in the neighborhood than this is likely to show up when low-income households become homeowners (Engelhardt *et al.,* 2010). Taking a policy perspective the question becomes whether distressed neighborhoods can be gentrified by increasing ownership-rates. There is not a single definition of a distressed neighborhood but based on McKinnish *et al* (2010), Rosenthal (2008) and Harkness and Newman (2002) crime-rates, household income, and welfare rates are good indicators of distress. Hilber (2005) and Rosenthal (2008) also argue that housing-density has an impact, since denser neighborhoods contain a larger amount of multi-family dwellings which are typically rented and therefore are subject to 'negative externalities'. Consequently, including these factors in the analysis provides a basis to assess whether (changes in) ownership-rates have a positive influence on observed external effects in that neighborhood.

However, past empirical studies haven been plagued by endogeneity and omitted variables, which comprises the reliability and significance of the results and their causal interpretation. This is the so-called *sorting* problem or endogenous neighborhood selection (Shlay, 2006; Dietz and Haurin, 2003), emerging when not all relevant background information that affects neighborhood choice of households is included in the model. Estimation of such a model suffers omitted variable bias producing invalid coefficients and standard errors, because the unobserved households' attributes might be correlated with the neighborhood characteristics. Causal statements about the influence of neighborhood characteristics on behavior become problematic since hypothesis testing is not valid (Dietz, 2002). The question whether neighborhood ownership rates causally

impact average neighborhood behavior (Manski, 1993) or that certain neighborhood characteristics attract home-owners remains unanswered.

Theoretical arguments put forward by Harkness and Newman (2002) provide some guidance. For example; moving a family to a low-ownership and/or distressed neighborhood might be beneficial for that neighborhood but not for the family, since they encounter low property-values, low neighborhood stability and low local amenity levels while they are restricted in their mobility. This is because gentrifying neighborhoods by raising ownership-levels is a long-term process. Moreover, households are apparently not willing to buy a house in a distressed neighborhood if there is no incentive to do so, such as a subsidy. Good neighborhoods apparently attract homeowners rather than the other way around absent incentives/policies. This is consistent with Hilber (2005) who finds that neighborhood externality risk – measured as the volatility in indicators such as littering and crime rates - does negatively impact the probability that a unit is owner-occupied. It also follows that (changes in) external effects lag (changes in) ownership.

There are some econometric strategies to deal with endogeneity, but none of them completely resolves it. A common approach used when time-series data is available, is using first differences or lagged effects to examine whether changes in ownership rates are related to changes in external effects. The major problem is identifying which changes in external effects are due to changes in ownership rates by incumbent citizens of the neighborhoods and which ones are due to changes in the sample e.g. due to movement of households. This is especially important from a housing policy perspective since major redevelopments projects (as is the case in Kleinhans *et al.*, 2007 and Van Beckhoven and Van Kempen, 2003) can drive low-income renters out of the neighborhood while attracting high-income owner-occupiers. McKinnish *et al.* (2010) analyzes these migration patterns and concludes that "neighborhood gentrification is associated with disproportionate immigration of [white] college graduates under 40 without children". Ideally, one would analyze the marginal resident moving in/out the neighborhood.

The second approach is instrumental variables. This involves the choice of an instrument that is related to the endogenous regressor e.g. homeownership rates and uncorrelated with the error term. The biggest challenge is to find a relevant and

convincing instrument that is uncorrelated with the error term (Dietz, 2002). Engelhardt *et al.* (2010) use a sophisticated approach to alleviate this concern by deriving their instrument based on a *randomly* assigned treatment status which can reasonably assumed to be uncorrelated with the error term.

So how should the unit of analysis "neighborhood" be defined? The issue is known as the modifiable areal unit in geography (Openshaw and Taylor, 1981). Dietz (2002) points out that no convincing evidence exists whether the size of a neighborhood is driving conclusions in current academic work. However, taking a too aggregate perspective on the 'ownership-external effects' question can complicate the interpretation of effects since one has to assume relative homogeneity within the unit of observation. Neighborhoods are ideally defined such that they are relatively homogenous with respect to policies (such as police attention, housing policies etc.). The first criterion is very hard to satisfy and therefore requires additional control variables, but the latter can be achieved – in Holland – using the definition that is employed by policy-makers.

In the next paragraph, we provide a brief discussion of Dutch housing markets and the city of Rotterdam. In the second part we explain our dataset and provide summary statistics.

3. Dutch housing markets and sample description

The G4 constitutes the four largest cities in Holland (Amsterdam, Rotterdam, The Hague and Utrecht) who are subject to a separate group of governmental policies commonly referred to as the 'grote steden beleid' (large city policy). Figure 1 shows the location of them in Holland and relatively to each other. Amsterdam and Rotterdam both have navigable rivers and a sea-port and The Hague houses the Dutch government and a number of embassies. All G4-cities are located within a 55 mile range of each other.

FIGURE 1/TABLE 1

Table 1 shows demographic and socio-economic statistics for all G4-cities and the Netherlands in general. Data are obtained from NICIS, a Dutch research institute that specifically focuses on city-level research. The percentage of (non-Western) immigrants

in all G4-cities is clearly above national average. Looking more specific into housing market statistics shows that Rotterdam has the second lowest ownership-rate and the highest percentage of social housing. Social housing in Holland is provided by housing associations subject to rent-control and other regulations. The ownership rate in Rotterdam in 2007 is around 30 percent less than half the national average and also substantially lower than The Hague and Utrecht. Rotterdam has the lowest average property value[b] and, after Amsterdam, the highest percentage of houses located in distressed neighborhoods (neighborhoods with socio-economic problems such as high rates of vandalism and poverty). Unemployment-rates are almost four times higher in Rotterdam than the Dutch average and exceed the rates of all other G4-cities and average income levels are the lowest of all G4 cities.

From the preceding discussion, it is evident that Rotterdam has a distinct profile in comparison to the other G4-cities. There are two reasons why Rotterdam's profile deviates so substantially from other Dutch cities. First, it got severely bombed during the Second World War. The bombardment destroyed 24.000 houses, leaving 80.000 citizens homeless. Rebuilding the city started during the War and the large expansion of the city's population in the 1950-60's lead to frenzied development of low-quality, multi-family dwellings in the Southern part of the city.

The second reason trend is the post-War growth in global trade leading to an expansion of the city's harbor and a huge need for workers in low-education jobs. People were attracted from foreign countries such as Morocco and Turkey. The extensive economic reliance of Rotterdam on the harbor lead to a relatively undiversified economy. Technological advances such as automation and containerization in the maritime industry lead to higher unemployment rates since less people are needed while high-educated individuals flee the area. This also explains why the average household income in Rotterdam is lower compared to other G4-cities.

Referring back to Engelhardt's (2010) discussion that external effects should initially emerge when low-income individuals become homeowners, learns that

[b] The values of all real estate is determined by the municipality using standards provided under the Dutch law on real estate (WOZ) and is used for property tax-purposes.

Rotterdam is a nice laboratory to examine external effects of ownership because both ownership-levels and income are low.

We created a panel dataset for the complete cross-section of neighborhoods in Rotterdam for the period 2000-2008. Data are obtained from the Rotterdam bureau of Census Statistics (COS), the department of Safety, the department of Education and Society (JOS) and the National bureau of Census Statistics (CBS). We observe neighborhood-averages, instead of household-level data. Fifteen neighborhoods were deleted from the analysis because they are located in industrial or harbor areas, leaving us with a sample of 75 neighborhoods in 13 sub municipalities[c] (see table A.1 Appendix 1). Yearly household income-data for 2007 is obtained from CBS since it was missing from the COS dataset. Our final sample consists of a cross-section of 75 neighborhoods observed over the time span 2001-2008. Descriptive statistics on a yearly basis are provided in table 2 (all data are percentages unless otherwise indicated). We distinguish between four blocks of characteristics in panel A through D.

TABLE 2

Panel A contains demographic statistics. The percentage of non-Western immigrants differs somewhat from table 1. This is due to the fact that population totals from the COS and NICIS dataset are not exactly equal. The percentage of retirees (residents age 65+) is slightly decreasing during the period of analysis.

Panel B shows our three indicators of external effects. Unfortunately no data for neighborhood satisfaction was recorded in 2001. Both satisfaction and safety are measured through surveys which are yearly administered among a representative sample of the neighborhood population. Neighborhood satisfaction is measured as the percentage of residents that is satisfied with the neighborhood. The safety index represents a score on a 1 to 10 scale with 1 being unsafe and 10 being very safe. The index is constructed from reported crime rates and from survey data. We observe a steady increase in both indicators over the period 2001-2007. Local elections for the city council were held in 2002 and 2006 and the percentage of residents that actually voted was slightly higher in 2006 than in 2002, while the dispersion was actually one third smaller.

[c] The city of Rotterdam is divided into thirteen sub-municipalities which all have their own council.

Income and labor market characteristics are provided in panel C. These variables control for socio-economic status of the neighborhood measuring the percentage residents that are on welfare, average household income and unemployment rates[d]. The general downward time-trend in welfare rates is in line with general government- and city policies to reduce reliance them. Household level income-data was unavailable in 2001 and is replaced with *individual*-level income observations from CBS. Naturally, one would expect controls for education to be presented here, but no consistent data on any measure of education was available for the complete sample-period. We computed (unreported) correlation coefficients between household income, school drop-out rates and average attained education level whenever available, and the correlation coefficients were in excess of 0,7. We are confident that the effects of education are largely absorbed by income.

The final panel (D) contains housing-market statistics. Homeownership rates are measured as the percentage of properties in the neighborhood that are available for owner-occupation. The ownership-rate is steadily increasing during the sample period, which is partially caused by housing corporations selling of stock to existing renters and prospective homeowners. This increase is also visible in the residential stability, measured as the percentage of residents that lives in the neighborhood for ten years or more. The value of rental and owner-occupier properties is rising as major restructuring and renovation of the housing stock in Rotterdam is taking place[e] and the housing stock is upgraded. The percentage of houses that is over-occupied, which happens when more people are living in the property than it was originally designed for, remains relatively stable. We include this variable in subsequent analysis as an indicator of local neighborhood distress.

Table 3 shows correlations between control variables and our external effects measures. Neighborhood satisfaction, neighborhood safety and voters in local elections are all highly correlated to each other. The ownership-rate correlates positively with all externality indicators as anticipated. Average yearly household income and property size

[d] This variable might be biased since not *all* unemployed people are included. However, one is obliged under the Dutch system providing social security to apply for a job when unemployed. So a high level of unemployment will be reflected in a high level of residents looking for a job as well.

[e] The bumps in 2001 and 2005 are caused by a change in the valuation criteria, and are equally affecting the neighborhoods in our sample.

correlate with our externality indicators according to expectation. The tenure length - measured here as the percentage of the population living in the neighborhood for ten years or longer - has a positive correlation with all indicators although for satisfaction and voting they are relatively small at 0,25. Unemployment, welfare and over-occupation rates show a negative relation with respect to external indicators consistent with prior studies (see Rohe and Stewart, 1996, p. 52).

TABLE 3

We now focus our attention to a case-study in Spangen.

4. The case of Spangen

The city-council of Rotterdam initiated a project in 2004 offering individuals to buy a house in Spangen with a substantial discount to the prevailing market price (the 'Wallis'-block). Participants were required to invest between 80.000 and 200.000 euro in their property and live there for a minimum of two years. In the early 2000's, the existing housing stock in Spangen was characterized by old and small two- and three room houses, many of them badly maintained and in need of substantial renovation[f]. Spangen also had a low socio-economic status with high crime-rates, drug dealing, high unemployment and poverty. The situation was so bad that Spangen was one of the first neighborhoods in Holland declared to be a 'no-go' area. The city tried to gentrify Spangen by diversifying the population and attracting high-income/educated individuals back to the neighborhood.

The instatement of the policy is an exogenous shock to the market and therefore we select two neighborhoods who did not experience such a shock to create an 'experimental set-up'. The two neighborhoods are Tussendijken and Oud-Mathenesse (see figure 2). We have two reasons for choosing these neighborhoods as controls: if there are any spill-over or *among*-neighborhoods effects (Dietz, 2002) than we might be

[f] This makes the project different from the one analyzed in Kleinhans *et al.* (2007) who analyzed completely restructured neighborhoods (Hoogvliet North-West and De Horsten). The core of the project in Spangen is renovation of the existing housing stock.

able to identify these. Second, these neighborhoods all belong to the same sub-municipality which provides more homogeneity in policies and actions.

The project is relatively small with only 96 dwellings included, while the total housing stock in Spangen was around 4300. This means that a two percent increase in homeownership can be directly related to the project. However, the change in ownership-rates is about four times as large. The disproportionate changes compared to the size of the project indicates 'second-round' effects, since no other ownership-increasing initiatives where initialized in the same period. It is consistent with the notion that gentrifying neighborhoods attract new homeowners after some initial base has emerged.

FIGURE2/TABLE 4

As table 4 shows, ownership rates in Spangen rose by a multiple since the start of the project, from a mere 6 percent in 2001 up to 21 percent in 2008, while the average ownership-rate in Rotterdam rose only 7 percent during the same period from 26 percent to 33 percent. The increase in homeownership rates is largest for Spangen, especially in 2004-05 and 2007-08. Oud-Mathenesse and Tussendijken faced a modest growth in ownership in the meantime.

The effects on neighborhood satisfaction are profound. Tussendijken and Oud-Mathenesse show a large increase in neighborhood satisfaction during 2004-05, while Spangen rose only five percent. There are three explanations: first, there seems to be a spillover-effect that precedes the inter-neighborhood effect. Second, if ownership causes external effects than changes in ownership-rates precede changes in these effects, ceteris paribus. Finally, the properties included in the project were in need of substantial renovation. Since these renovations take time offers an explanation why the increase in neighborhood satisfaction is lagging compared to the surrounding neighborhoods.

A similar picture emerges when changes in neighborhood safety are considered. Large increases in the safety-index are recorded for Tussendijken (+1,2) and Oud-Mathenesse (+0,9) since the start of the project (2004), while the improvement in Spangen is lagging one year behind. Taking into account the complete time-frame, Spangen shows almost a tripling in safety while the average safety in Rotterdam rose

only from 5.6 to 7.3. However, part of these effects need to be attributed to increased police-attention as the larger area was considered to be unsafe.

The bottom parts of table 4 offer some additional insights in the development of the area and the way the project affected the neighborhood. Average property values (both for rent and owner-occupier dwellings) increased in all neighborhoods while over-occupation, unemployment and welfare rates declined, with changes being largest for Spangen compared to the other two neighborhoods. Another remarkable number is the percentage of households that has an income in the lower 40 percent of the national income distribution. The number for Spangen declines as more high-income households move in, while both Tussendijken and Oud-Mathenesse show an increase in the number of low-income households. The city average, in the meantime, hovered around 45 percent. Given the scale of the project we wonder whether these effects are caused by migration patterns; with low socio-economic status households moving out of the neighborhood and high-status households moving in. We cannot completely rule out this explanation. However, our data show only a small increase in movers from other neighborhoods and outside the city into Spangen compared to the number of existing residents after the start of the project.

All in all, the project seems to have positive influences on Spangen's safety and satisfaction. Attributing these effects (entirely) to the fact that ownership-rates have increased is, given the size of the project, naïve. But the multiplier effect of the project, given that only 2 percent of the ownership increase can be directly attributed to the project, could be considered as an external effect as well.

The success of the project might be explained through an upgrade of the housing stock and the attraction of high-educated/high-income people to the neighborhood (McKinnish *et al.*, 2010). The findings are largely consistent with those of Kleinhans *et al.* (2007) though the induced migration patterns when neighborhoods are renovated are smaller compared to when they are restructured. One of the critical success factors of the project might be the requirement to stay at least for two years in the area, thereby reducing residential mobility and stabilizing the neighborhood.

In the next paragraph we examine the external effects for the complete spectrum of Rotterdam neighborhoods.

5. Multivariate analysis

As discussed before omitted variables and endogeneity bias impede the analysis of external effects of homeownership (Dietz, 2002 and Dietz and Haurin, 2003). First, we estimate a standard panel-fixed effects model[g], using neighborhood fixed-effects and neighborhood clustered standard errors (Petersen, 2009). Since only two observations for local elections are present (2002 and 2006) we run a cross-sectional regression model for this indicator because fixed-effects would result in overfitting. We test for non-stationarity and uncontrolled trends that might yield spurious results using the procedure outlined by Levin *et al.* 2002. Results in appendix A table 2 show that no unit root is present, except for welfare-rates. We estimate the following model for neighborhood *i* at time *t*:

$$\textit{Externality-indicator}_{it} = \beta \textit{ownocchousing}_{it} - \beta \textit{ownocchousing}_{it}^2 + \beta \textit{log(avghhincomeyr)}_{it} + \beta \textit{citzage65}_{it} + \beta \textit{tenure10plusyr}_{it} + \beta \textit{houseoveroccupied}_{it} + \beta \textit{house4plusroom}_{it} + \beta \textit{builtpreWar}_{it} + \beta \textit{built19451959}_{it} + \beta \textit{built1960now}_{it} + \beta \textit{unemploymentrate}_{it} + \beta \textit{welfarerate}_{it} + \beta \textit{og(addressdensity)}_{it} + \varepsilon_{it} \quad \text{with } \varepsilon_{it} \sim \text{IID}(0,\sigma^2)$$

TABLE 5

The results are contained in table 5 and largely according to expectations. Ownership and its squared term have both a significant impact on neighborhood satisfaction and safety[h], and evaluated together we find a non-linear impact. The squared ownership term shows a negative sign implying that there are diminishing returns to ownership rates. From a policy perspective this implies that after a certain ownership-level, external effects are a decreasing function of ownership. Control variables for income, over occupation, age of the housing stock and welfare rates turn out to be significant with expected sign. Unemployment rates, however, show a positive effect on neighborhood safety and satisfaction while we would expect a negative sign. Since

[g] The Hausman-test rejects the random-effects model ($\chi^2 = 271.67$, $df = 14$, $p = 0.000$) .

[h] The safety-index appeared to be truncated, so we ran a random-effects Tobit model to examine whether this would affect the outcomes. However, our results stay qualitatively and quantitatively similar.

welfare- and unemployment rates might be highly correlated, we re-estimated our models excluding one of them but this does not materially change the results. We examine whether residential mobility is the main driver of external effects (see discussion by Harkness and Newman, 2002) by excluding the tenure-measure from the equation. However, the coefficients for the ownership-rate stay similar in sign, magnitude and significance.

The results for participation in local elections are less profound. Neighborhood ownership-rates have a negative impact on the percentage that votes in local elections and the squared term is insignificant. This is counterintuitive, especially since most control variables have coefficients according to expectation. However, only a limited number of observations is available that might affect the results.

The results of OLS-estimation might be inconsistent if endogeneity or omitted variables bias is present so we proceed with an instrumental variables model where we treat the ownership-rates as an endogenous variable to external effects and instrument it by the size of the residential structure (the percentage of houses in a neighborhood that have more than 4 rooms). The underlying reasoning is that the size of a house is positively correlated with ownership, since larger houses tend to be owner-occupied (DiPasquale and Glaeser, 1999). The average rental house in Rotterdam has only three rooms and our (unreported) first stage results show indeed that this instrument is significantly positively affecting ownership-rates. The second criterion is that the instrument is uncorrelated to the error term. Rotterdam has neighborhoods e.g. Bergpolder with a substantial percentage smaller houses (less than three rooms) that score high on safety and satisfaction indicating that structure-size and external effects are uncorrelated.

TABLE 6

The regression results in table 6 stay largely similar. Ownership rates are still positively affecting external effects, but the coefficient decreased for satisfaction and increased for neighborhood safety. These differences might be explained by the fact that the squared term is dropped in this model, including it leads to an explosion of the

standard errors leading to many insignificant variables. The effect of over occupation, houses built pre-War and welfare stays negative and significant in the case where neighborhood safety is the dependent variable. Controlling for address density loses its significance in all models. Again the coefficients for unemployment stay positive but it loses significance in model 1 while its significance increases in the case of satisfaction. An explanation for this might be that neighborhood satisfaction has not a direct relationship with unemployment or people that are unemployed have more time to enjoy the local amenities of a neighborhood. The latter reasoning would also explain why the percentage of retirees (people aged 65 and above) has a positive sign, albeit not significant. In contrast with the OLS-results, we find that residential tenure has a significant impact on satisfaction but not on safety. The same robustness checks are performed as in the OLS-model and the results stay the same. We also test for over-identifying restrictions and in both cases the null-hypothesis is rejected implying that the model is just identified.

Model 3, explaining political activity, is estimated using a regular IV-model and ownership-rates show again a negative effect although it is not significant anymore. Residential mobility has a positive impact as do the unemployment rates. The latter might be explained by the fact that people 'vote for new opportunities' in elections.

If the first order derivative of the ownership effect in table 5 is taken and solved for zero, than the returns in external effects of ownership start to decrease when an ownership level around 45-50% is reached, which is consistent with the results we found in Spangen where ownership rates increased to 21 percent and the changes in external effects were positive.

FIGURE 3

As an additional illustration we plotted social index scores for 2008 and 2009 as a function of ownership rates in figure 3. The social index is constructed based on a wide variety of neighborhood aspects such as possibilities to participate, the quality of the living environment, schooling and the level of social bonding in the neighborhood. Unfortunately, the social-index started only recently to be administered limiting the

number of observations. Furthermore, not all control characteristics are available up to 2009. In the light of omitted variables, it is not very informative to perform a formal regression analysis on the data.

The general pattern in figure 3 reveals that the score on the social index is positively related to ownership-rates in the neighborhood. However, the variability significantly reduces after ownership-rates reach a level of about 50 percent, indicating that there is substantial more heterogeneity between neighborhoods that are rental-dominated. We cannot rule out measurement errors in the index either.

6. Conclusion

The last few decades considerable progress has been made in the examination of effects of homeownership on households, children and neighborhoods. There is still debate about the causal relationship between homeownership and externalities. As more and more time-series data over larger cross-sections become available, panel data econometrics can be used to examine the causality and magnitude of the effect.

We defined three indicators for external effects of ownership: neighborhood safety, satisfaction and percentage of residents that votes in local elections (DiPasquale and Glaeser, 1999). We compiled a unique dataset for 75 neighborhoods in Rotterdam over an eight year time-period to examine our research questions: is there a causal effect of homeownership on neighborhood externalities and is this a linear function of homeownership rates? Because endogeneity is an important and difficult issue to deal with we started with a case-study of Spangen. The results suggest that changes in ownership-rates become visible in externality indicators with a one year lag and homeowners apparently need to be incentivized to move to distressed neighborhoods. Moreover, a multiplier effect is present indicating that a relatively small project can result in major changes in the neighborhood.

The results of the multivariate analysis show that there is indeed an impact on satisfaction and safety from ownership even when after allowing it to be endogenous. An examination of the ownership-effects reveals that returns in external effects are diminishing when owernship-levels reach levels around 45-50 percent. These results are

in line with the results for Spangen and supporting the reasoning by Engelhardt *et al.* (2010) and Dietz and Haurin (2003).

In the light of current financial times where housing policies are subject to reconsideration and mortgage lending is more restrictive, we provide an up-to-date assessment of the external effects of ownership. There might be a role for stability increasing incentives for renters as well (see Chase, 2010). This area is understudied while renting involves less financial risks. Our findings are in line with most U.S. based studies. Institutional differences do not seem to drive external effects.

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Figure 1 Overview of Holland with the ‘big 4’, with a map of the Sub-municipalities of Rotterdam (source: Department of Safety, KEDG)

Figure 2 Map of the sub-municipality ‘Delfshaven’ where Spangen, Tussendijken and Oud-Mathenesse are located. Source: COS

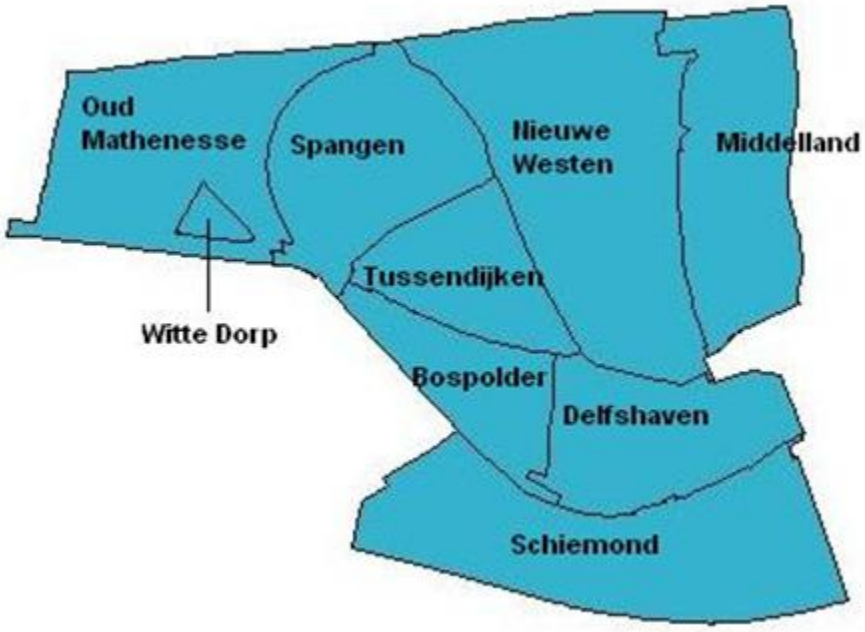
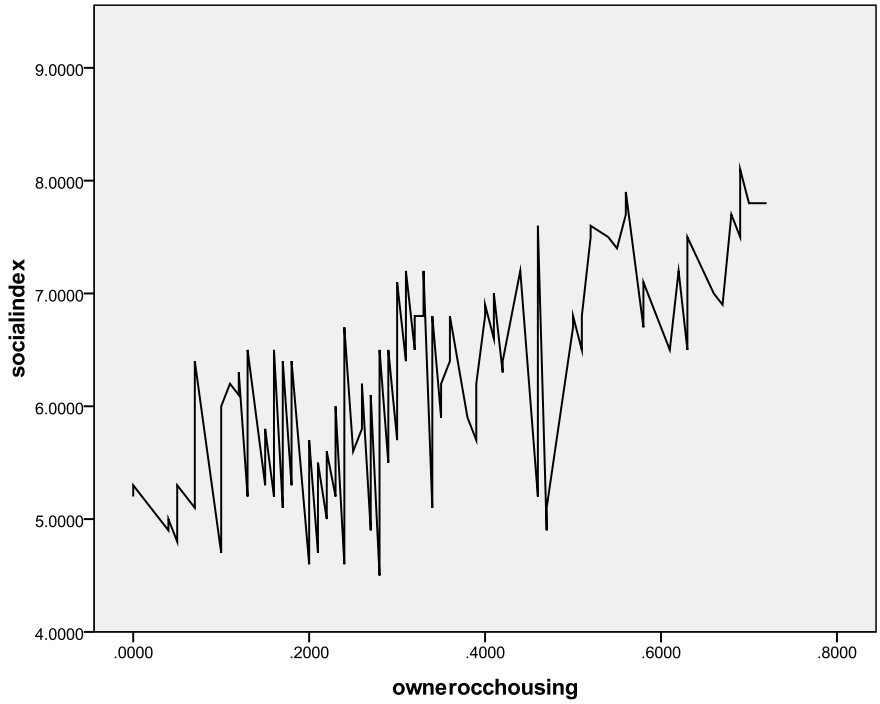


Figure 3: Social index as a function of ownershiprates. Source: COS

Social index and ownershiprates in 2008



Social index and ownershiprates in 2009

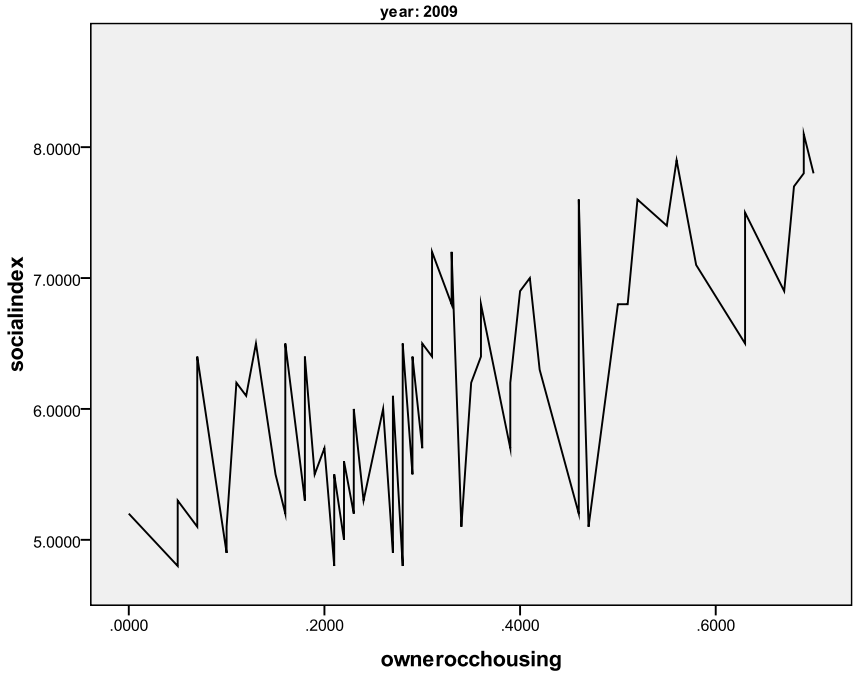


Table 1: Socio-economic statistics for the largest four Dutch cities and national averages. Data are for the year 2006-2007. Source: NICIS, CBS

City characteristics	**Rotterdam**	**Amsterdam**	**Den Haag**	**Utrecht**	**Netherlands**
Number of citizens	582,000	747,000	475,000	295,000	16,400,000
% non-Western immigrants	35.6	34.4	32.5	20.9	11.0
% owneroccupier homes	30.0	24.5	44.4	47.8	55.0
% social housing homes	51.7	51.7	34.8	38.1	30.0
% homes located in distressed neighborhoods	67.3	84.6	63.5	60.6	20.4
Average house-value (*K Euro)	144	204	172	194	226
Quality of living environment (1-10 scale)	7.5	7.9	7.8	7.6	8.4
% unemployed individuals age 15-24	21.2	14.3	11.5	11.8	5.7
% unemployed individuals age 15-64	11.1	6.6	6.4	4.3	3.2
% homes built 1960-2000	49.1	38.7	34.9	43.8	67.7
% homes built 1945-1959	12.8	9.5	15.6	10.6	10.5
% homes pre-War	33.7	48.6	41.9	35.8	16.6
Income/household (*K Euro/yr)	26.6	27.6	28.9	30.1	31.3
Income/citizen (*K Euro/yr)	12.5	13.9	13.4	13.3	13.3

Table 2: Descriptive statistics Rotterdam during period 2001-2008. Sources: COS, JOS, CBS

Panel A: Demographic characteristics		**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
% non-Western immigrants	Mean	27.0	29.0	29.0	30.0	31.0	31.0	32.0	32.0
	SD	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	Min	0.0	2.0	3.0	3.0	2.0	2.0	2.0	2.0
	Max	77.0	78.0	79.0	80.0	80.0	80.0	79.0	79.0
% residents age 0-14	Mean	15.9	15.9	15.9	15.8	15.7	15.6	15.3	15.2
	SD	6.2	6.2	6.0	6.0	5.9	5.6	5.8	5.5
	Min	0.0	0.0	0.5	0.0	0.0	0.0	0.0	2.5
	Max	27.4	27.3	26.7	26.9	28.5	27.2	28.0	30.0
% residents age 15-64	Mean	69.7	69.9	70.3	70.5	70.7	70.8	71.6	72.1
	SD	8.9	8.9	8.6	8.6	8.9	8.8	9.6	8.4
	Min	40.2	40.3	40.8	42.0	42.3	43.4	46.6	49.9
	Max	98.9	99.6	95.7	94.9	100.0	100.0	100.0	94.1
% residents age 65+	Mean	14.5	14.3	13.8	13.7	13.6	13.7	13.7	13.6
	SD	8.3	8.1	7.9	7.8	7.9	7.7	7.6	7.4
	Min	2.8	2.7	0.5	0.4	0.4	2.8	0.0	0.0
	Max	50.8	50.7	50.1	49.6	49.7	49.3	50.2	49.0
Panel B: External effects									
Safety index (score 1-10)	Mean	5.6	5.7	6.3	6.7	7.0	7.3	7.5	7.3
	SD	2.0	2.0	2.0	1.8	1.8	1.8	1.7	1.8
	Min	1.5	1.5	2.2	2.7	3.5	4.0	4.0	3.5
	Max	9.3	9.6	10.0	10.0	10.0	10.0	10.0	10.0
% residents satisfied with neighborhood	Mean		71.0	76.0	77.0	80.0	81.0	81.0	78.0
	SD		14.0	12.0	10.0	8.0	8.0	8.0	11.0
	Min		31.0	50.0	52.0	60.0	63.0	58.0	57.0
	Max		90.0	94.0	92.0	92.0	97.0	96.0	97.0
% voting in local elections	Mean		54.8%				57.8%		
	SD		9.1%				6.4%		
	Min		36.9%				40.8%		
	Max		78.3%				77.0%		
Panel C: Income and labor characteristics									
% residents on welfare	Mean	6.8	6.5	6.4	6.1	6.3	6.2	5.8	4.9
	SD	4.4	4.2	4.1	4.0	4.1	4.1	3.9	3.4
	Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Max	16.2	15.0	15.2	14.9	14.0	13.9	13.2	13.1
Avg. household income (*K Euro/yr)	Mean	15.8	25.3	25.7	25.6	26.7	27.9	28.3	
	SD	2.7	6.2	6.3	6.2	6.9	7.4	7.7	
	Min	11.8	18.1	18.2	18.6	19.6	20.4	20.5	
	Max	24.9	44.6	43.8	45.4	49.3	53.1	53.0	
% residents unemployed seeking job	Mean	5.1	5.6	6.5	8.6	7.5	7.5	6.4	6.0
	SD	2.9	3.1	3.5	4.4	3.7	4.3	3.7	3.6
	Min	0.9	1.1	1.2	1.9	1.8	1.0	1.1	1.0
	Max	12.0	11.3	12.9	16.4	14.7	18.7	15.9	16.2

Table 2 con'td

Panel D: Housing market characteristics		**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
% living at current address 10+yr	Mean	35.0%	35.5%	35.7%	36.3%	37.1%	37.6%	38.1%	38.4%
	SD	13.6%	13.9%	14.0%	14.1%	13.9%	13.0%	13.1%	12.7%
	Min	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.9%	0.9%
	Max	64.5%	68.4%	78.2%	86.4%	87.9%	67.4%	69.0%	72.2%
% owneroccupier homes	Mean	26.0	26.0	28.0	29.0	29.0	30.0	30.0	33.0
	SD	22.0	21.0	22.0	21.0	20.0	19.0	19.0	19.0
	Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Max	90.0	88.0	87.0	87.0	87.0	87.0	77.0	85.0
Avg. value owneroccc. homes (Euro)	Mean	127,462	130,590	130,709	127,338	197,460	196,003	211,757	228,427
	SD	94,036	93,988	92,830	66,334	99,691	98,064	108,665	137,590
	Min	0	41,899	46,322	37,248	81,194	81,073	68,642	82,017
	Max	748,737	748,737	748,737	387,353	628,522	586,538	684,154	1,034,308
Avg. value rental homes (Euro)	Mean	83,792	86,214	86,639	88,804	146,518	145,894	157,633	158,158
	SD	36,951	37,606	38,870	43,541	78,077	67,795	72,311	73,151
	Min	0	44,332	44,406	35,596	77,776	79,028	66,181	80,187
	Max	231,015	237,957	248,170	272,313	550,200	403,147	408,953	451,676
% homes with ≥4 rooms	Mean	45.8	46.0	46.2	46.2	46.5	46.7	46.9	46.9
	SD	19.0	19.2	18.5	18.3	18.3	17.7	17.5	17.2
	Min	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
	Max	93.0	93.0	93.0	94.0	94.0	94.0	89.0	85.0
% overoccupied homes	Mean	7.0	8.0	8.0	8.0	8.0	7.0	7.0	7.0
	SD	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0
	Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Max	25.0	22.0	21.0	22.0	22.0	22.0	22.0	24.0

Table 3 Correlation matrix between externality indicators neighborhood satisfaction and safety-index and various control variables during 2001-2008 for 75 neighborhoods .

Variables	**Satisfaction**	**Safety**	**Voting local election**
Satisfaction	1		0.7812
Safety	0.6993	1	0.6426
Voting local election			1
% owner-occupation	0.5808	0.5691	0.6126
Avg yearly hh income	0.6346	0.5515	0.7512
Tenure10plusyear	0.2165	0.4082	0.2735
House4plusroom	0.4911	0.6101	0.5703
Houseblt1945-59	0.0813	0.115	-0.0138
Umemployment	-0.6187	-0.419	-0.5269
Welfarerate	-0.6871	-0.5041	-0.7063
Overoccupation	-0.6260	-0.3674	-0.5655

Table 4: Socio-economic statistics for Spangen, Oud-Mathenesse and Tussendijken. The ownership increasing project in Spangen started in 2004. The year 2000 is omitted from the analysis because no externality indicators were available. Source: COS, JOS

Spangen	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
safetyindex	2.5	2.7	4.0	4.5	4.6	7.0	7.0	6.3
satisfiedwithneighb		31%	51%	62%	67%	78%	79%	63%
ownerocchousing	6%	6%	6%	7%	11%	13%	15%	21%
avgwozrentoo (*1000 Euro)	109.3	109.3	109.3	108.9	114.2	114.0	115.5	115.8
house4plusroom	39%	39%	39%	39%	40%	42%	42%	46%
houseoveroccupied	17%	17%	18%	17%	16%	15%	14%	13%
welfarerate	12%	12%	12%	12%	12%	11%	10%	7%
unemployedsearchingjob	10%	11%	13%	16%	13%	12%	8%	8%
standhhincomel40	55%	75%	75%	74%	72%	70%	65%	
avghhincomeyr (*1000 Euro)	2.55	2.95	2.98	2.99	3.06	3.12	3.14	
Oud-Mathenesse								
safetyindex	5.5	5.6	6.1	6.5	7.4	7.3	7.9	7.4
satisfiedwithneighb		77%	71%	75%	85%	79%	78%	73%
ownerocchousing	36%	37%	37%	38%	39%	40%	41%	46%
avgwozrentoo (*1000 Euro)	107.6	107.6	107.6	107.5	113.4	113.5	114.4	114.9
house4plusroom	29%	29%	29%	29%	29%	29%	29%	29%
houseoveroccupied	6%	7%	7%	7%	7%	7%	7%	7%
welfarerate	6%	5%	5%	5%	5%	5%	5%	4%
unemployedsearchingjob	4%	4%	5%	7%	6%	5%	4%	4%
standhhincomel40	43%	57%	56%	55%	59%	61%	55%	
avghhincomeyr (*1000 Euro)	26.6	30.1	30.1	30.2	30.2	30.6	30.4	
Tussendijken								
safetyindex	3.3	4.4	5	5.8	6.6	6	6.9	6.2
satisfiedwithneighb		47%	61%	64%	75%	74%	75%	70%
ownerocchousing	6%	6%	6%	7%	7%	7%	8%	10%
avgwozrentoo (*1000 Euro)	108.6	108.6	108.6	108.4	113.7	113.8	115.5	114.8
house4plusroom	38%	39%	39%	39%	39%	38%	40%	40%
houseoveroccupied	13%	15%	15%	15%	14%	12%	12%	11%
welfarerate	12%	11%	11%	11%	12%	12%	12%	9%
unemployedsearchingjob	10%	11%	12%	16%	13%	12%	10%	10%
standhhincomel40	58%	72%	72%	72%	71%	69%	70%	
avghhincomeyr (*1000 Euro)	25.6	29.2	29.2	29.3	30.2	30.4	30.2	

Table 5: OLS panel estimates using fixed effects and heteroskedasticy robust standard errors. Dependent variables are: model 1: safety, model 2: satisfaction. Model 3 is estimated using a crossectional-OLS model with robust standard errors

VARIABLES	(1) safetyindex	(2) satisfiedwithneighb	(3) voterslocalelection
ownerocchousing	7.502***	0.600**	-0.187*
	(2.729)	(0.228)	(0.111)
ownoccSQRT	-7.704**	-0.754**	0.200
	(3.520)	(0.308)	(0.131)
avghhincomeyrk	1.523***	0.239***	0.192***
	(0.210)	(0.0764)	(0.0327)
citz65_age	-6.100*	0.139	-0.133
	(3.590)	(0.257)	(0.153)
tenure10plusyr	1.853	0.201	0.181***
	(1.563)	(0.156)	(0.0489)
houseoveroccupied	-9.114*	-0.951***	-0.604***
	(4.841)	(0.306)	(0.162)
house4_room	2.818	0.240	-0.0110
	(2.180)	(0.324)	(0.0443)
builtprewar	-1.974**	-0.144*	0.846*
	(0.928)	(0.0794)	(0.507)
hsbuilt19451959	-3.981	-0.0135	0.825
	(4.079)	(0.394)	(0.512)
built1960now	3.782***	0.286**	0.817
	(1.302)	(0.143)	(0.511)
unemployedsearchingjob	3.339*	1.048***	0.878***
	(1.898)	(0.180)	(0.195)
welfarerate	-18.53*	-0.575*	-1.389***
	(10.20)	(0.291)	(0.409)
addressdensity	-0.370	0.0764***	0.0129
	(1.086)	(0.0256)	(0.00831)
Constant	3.545	-0.936***	-0.925*
	(8.654)	(0.333)	(0.544)
Observations	499	445	133
R-squared	0.538	0.391	0.701
Number of neighbcode	72	75	-

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 6: Results of panel IV-estimation using fixed effects. Ownershiprates are instrumented by the percentage of houses that provide more than 4 rooms. Model 3 is estimated using a regular IV-model, with the same instrument

	(1)	(2)	(3)
VARIABLES	**safetyindex**	**satisfiedwithneighb**	**voterslocalelection**
owneroccchousing	8.092***	0.409**	-0.0987
	-3.055	-0.208	(0.136)
avghhincomeyrk	1.421***	0.247***	0.206***
	-0.213	-0.0546	(0.0460)
citz65_age	-4.377	0.0317	-0.154
	-4.008	-0.288	(0.138)
tenure10plusyr	1.705	0.218**	0.188***
	-1.114	-0.102	(0.0589)
houseoveroccupied	-7.013*	-0.881***	-0.519***
	-4.025	-0.313	(0.173)
builtprewar	-2.150**	-0.185***	0.965*
	-0.835	-0.0715	(0.578)
hsbuilt19451959	-4.367	-0.0436	0.948
	-3.391	-0.311	(0.581)
built1960now	4.648***	0.408***	0.931
	-1.49	-0.142	(0.578)
unemployedsearchingjob	2.44	0.974***	0.826***
	-2.467	-0.208	(0.237)
welfarerate	-17.14***	-0.448	-1.472***
	-4.472	-0.372	(0.514)
addressdensity	-0.355	0.000559	0.0106
	-1.06	-0.0569	(0.00885)
Constant	3.359	-0.321	-1.071*
	-8.646	-0.492	(0.608)
Observations	499	445	133
Number of clusters	72	75	-

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Appendix 1

Table A.1: Sub-municipalities of Rotterdam and their neighborhoods. Excluded are neighborhoods that are not part of subsequent analysis. Source: COS

Sub-municipality	Neighborhood	Sub-municipality	Neighborhood
Charlois	Carnisse	Kralingen-Crooswijk	De Esch
	Heijplaat		KralingenOost
	OudCharlois		KralingenWest
	Pendrecht		KralingseBos
	Tarwewijk		NieuwCrooswijk
	Wielewaal		OudCrooswijk
	Zuiderpark		Rubroek
	Zuidplein		Struisenburg
	Zuidwijk	Noord	Agniesebuurt
Delfshaven	Bospolder		Bergpolder
	Delfshaven		Blijdorp
	Middelland		Blijdorpse Polder
	Nieuwe Westen		Liskwartier
	NieuwMathenesse		Oude Noorden
	OudMathenesse		Provenierswijk
	Schiemond	Overschie	Kleinpolder
	Spangen		Landzicht
	Tussendijken		NoordKethel
	Witte Dorp		Overschie
Feijenoord	Afrikaanderwijk		Schieveen
	Bloemhof		Spaanse Polder
	Feijenoord		Zestienhoven
	Hillesluis	Pernis	Pernis
	Katendrecht	Prins Alexander	Het Lage Land
	Kop van Zuid		Kralingseveer
	Kop van ZuidEntr		Nesselande
	Noordereiland		Ommoord
	Vreewijk		Oosterflank
Hillegersberg-Schiebroek	HillegersbergNoord		Prinsenland
	HillegersbergZuid		sGravenland
	Molenlaankwartier		Zevenkamp
	Schiebroek	Stadscentrum	C.S. Kwartier
	Terbregge		Cool
Hoek van Holland	Dorp		Dijkzigt
	Strand en Duin		Nieuwe Werk
Hoogvliet	HoogvlietNoord		Oude Westen
	HoogvlietZuid		Stadsdriehoek
IJsselmonde	Beverwaard		
	GrootIJsselmonde		
	Lombardijen		
	OudIJsselmonde		

Table A.2: Analysis of the presence of unit roots. Based on the procedure outlined by Levin, Lin and Chu (2002). The analysis is run including one and two year lags of the variable to allow for auto-correlation. The null-hypothesis is that at least one of the time-series in the panel contains a unit root. Reported are p-values, minuses indicate an unbalanced panel situation.

Variable	**lag: 1 yr**	**lag: 2 yr**
Safety index (score 1-10)	0.000	0.000
% residents satisfied with neighborhood	0.000	-
% owneroccupier homes	0.000	0.000
avg. household income (*K Euro/yr)	0.000	-
% non-Western immigrants	0.003	0.000
% residents age 65+	0.000	0.015
% living at current address 10+ yr	0.000	0.000
% residents unemployed seeking job	-	-
% residents on welfare	0.508	0.999
adress density (no./km2)	0.000	0.000
% homes with ≥4 rooms	0.000	0.000