

Housing Bubbles and Support for Incumbents

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Abstract

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1 Introduction

The state of the economy - one's own or that of the nation - has long been considered among the most important predictors of support for incumbent politicians. This is generally considered desirable because it provides a shorthand for evaluating the performance of incumbent politicians and punish and reward them accordingly (Ashworth, 2012; Healy and Malhotra, 2013). While a simple idea at heart, the specifics of retrospective voting remain debated. In this paper, we focus on what we believe to be an understudied economic influence: local housing markets.

Housing markets saw a global boom followed by a bust in the period around the great recession. This had severe economic implications for well-being of both individual households and the overall state of the economy. Pairing the economic importance of the housing market with the fact that national housing and monetary policy to a considerable extent influenced the severity of the market crash makes housing markets a particularly useful mean for voters to evaluate the incumbent government by. Furthermore, housing markets are not a monolithic national phenomenon, but vary substantially across geographical contexts, thereby providing voters with relevant local information by which to assess incumbents.

In this paper, we assess the relationship between changes in the local housing market and support for the incumbent government using uniquely detailed and comprehensive data on housing sales at the local level. We do this using two complementary empirical approaches. First, we link detailed registry data on local housing prices to election results at the precinct level across five national elections, allowing us to study whether within-district differences in property values are related to changes in support for governing parties. Second, to test the hypothesized causal mechanism that voters make inferences about government based on the state of their local housing market, we zoom in on individual voters' local contexts. Specifically, we link a two-period panel survey to precise measures of how individuals' neighborhoods –measured at very low levels of aggregation– were affected by changes in house prices.

We find the hypothesized positive relationship between local housing prices and

support for governing parties at both the precinct-level and in the individual-level data. Specifically, a 50 pct. year-on-year increase in local housing prices, equivalent to the sharpest price increases during the housing boom, is associated with a 3 to 5 percentage points increase in the support for governing parties. In subsequent analyses, we probe the suggested role of local housing markets further by testing a number of observable implication arising from this conjecture.

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2 Relation to existing literature

We are not the first to investigate, whether voters might draw inferences about policy outcomes from local economic conditions. A number of studies have examined the extent to which voters draw inferences about national economic conditions from local economic conditions (Books and Prysby, 1999; Reeves and Gimpel, 2012; Anderson and Roy, 2011; Ansolabehere et al., 2014; Bisgaard et al., 2016), and a number of studies have examined the extent to which voters draw inferences about whether to support incumbent politicians (Hansford and Gomez, 2015; Eisenberg and Ketcham, 2004; Kim et al., 2003; Healy and Lenz, 2014a). The results from these studies are somewhat mixed, but on balance they find that voters do make inferences based on local economic conditions; asserting that the national economy declining or that incumbent politicians are doing a bad job when local economic conditions are declining.

Our study distinguishes itself from these previous efforts by focusing specifically on the role of local housing markets, not just individual home ownership and the personal economic asset it constitutes, in shaping support for incumbents. Theoretically, we thus highlight how housing markets – in addition to concerns over personal finances already established in the literature – shape voting by providing locally derivable information about incumbent politicians' capacity to manage the economy.

In doing so, our study ties into several neighboring literatures. First, a recently emerged strand of research in political economy highlighting the influence of home ownership – in itself or as part of a portfolio of economic assets – on redistribution and

social policy preference as well as voting (Ansell, 2014; Nadeau et al., 2010; Stubager et al., 2013). Second, by conceptualizing housing bubbles as the result of government policy, our study also relates to the policy feedback literature (?), which emphasizes how policies shape mass political behavior by providing incentives and conveying information to citizens.

At the methodological level, we contribute to the existing literature by exploiting uniquely detailed and comprehensive data on housing market transactions available in Danish public registries. Specifically, we can link highly detailed register data on local housing prices to both precinct-level panel data on national election outcomes as well as individual-level panel survey data. This data ameliorates three immanent methodological challenges confronting the broader class of studies scrutinizing local influences on political attitudes and behavior.

First, using extremely precise and highly local measures of house prices enables us to address the common problem of confounding of local context with local media market—a very different mechanism—typically arising in previous studies focusing on local economic conditions in highly aggregate geographical contexts (due to limited data availability) (Bisgaard et al., 2016).

Second, the panel set-up of data enables us to rule out time-invariant structural differences between local contexts as explanations of any observed relationship between local house prices and support for incumbents by using only within-precinct/individual variation in local housing prices (by means of fixed effects). This is particularly important given the strong urban-rural gradient in local property values, which would very likely confound any observed cross-sectional relationship with support for the sitting government.

Third, measures of local economic conditions are often based on samples which, while large enough to estimate precise national economic conditions, typically suffer from insufficient precision when estimating conditions at lower geographical levels (Healy and Lenz, 2014a).

While some previous studies do some of these methodological challenges, our study

is to the best of our knowledge the first to address all of these shortcomings at once.

3 Empirical setting: a policy-driven boom and bust

The setting of our study is Denmark in the years surrounding the onset of the Great Recession. The precinct-level data (cf. Section 4) covers the election years of 2005, 2007, 2011, and 2015, whereas the individual-level data (cf. Section 5) covers panel survey responses from 2004, 2008, and 2011. Denmark is a useful empirical case for studying the consequences of housing bubbles, since the boom and bust of the Danish real-estate market were very dramatic, even by international standards. Figure 1 shows the trajectory of Denmark's housing bubble compared with other international cases.

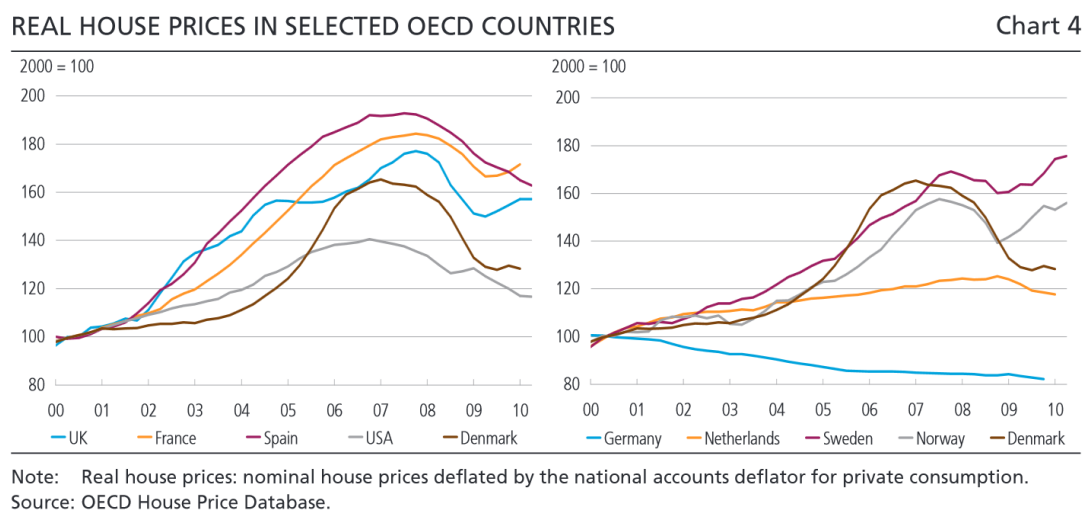


Figure 1: Trends in real house prices in Denmark and selected OECD countries, 2000-2010 (2000 level = 100). Taken from Dam et al. (2011, p. 50)

As shown in Figure 1, although many economies experienced large increases in real house prices, Denmark's housing bubble was exceptionally volatile, characterized by a late, rapid increase quickly succeeded by a crash. The bulk of Denmark's housing boom and bust occurred in just four years, from 2005 to 2009. In contrast, the housing bubble in the United States (shown in the light gray line in the left panel of Figure 1), though far bigger in absolute terms, was relatively protracted in comparison. As a consequence, local housing markets in Denmark saw year-to-year changes in housing prices that were, even by the standards of a globally economically volatile period, unusually large. This

provides us with ample variation in the independent variable of interest.

Notably, Denmark's housing bubble was not merely a product of changes in the international business cycle. In fact, a majority of the housing bubble is typically attributed to national government policy. In 2002, the newly elected conservative government implemented a nominal freeze on property taxes, in effect cutting the real tax rate on property over time. The year after, the government introduced new loan types including deferred-amortisation loans which allowed homeowners to take out larger mortgage loans. In a study estimating the contribution of these domestic policies to the housing bubble, Dam et al. (2011, p. 62) conclude that "two thirds of the additional cyclical fluctuations that accompanied the housing bubble can be attributed to the deferred-amortisation loans and the nominal tax freeze".

The role of national government policy in driving the housing bubble is important, since it means voters have a reason to view house prices changes as a relevant informational source when evaluating government performance. The government's role in exacerbating the housing bubble was a politically salient issue in the aftermath of the Great Recession, so voters are likely to be aware of this link. However, although the policies exacerbating the housing bubble were implemented by the conservative government, which held office from 2001 to 2011, our argument does not cover only evaluations of the conservative government. If that were the case, evaluations of the government would be observationally indistinguishable from voters becoming more ideologically conservative, a plausible consequence of increases in housing wealth. In Section 5.3, we exploit the change in incumbency in 2011-2015 to show that housing price changes affect support for the incumbent government per se, not merely support for a conservative government.

4 Precinct-level evidence

We begin our exploration of the relationship between the state of local housing markets and incumbent support by looking at precinct-level election returns in Danish Parlia-

mentary elections between 2005 and 2015. In particular, we match electoral support for parties in government in these precincts with change in the price of all house sales sold in and around the precincts, examining the extent to which local housing prices and local electoral support for government parties go hand in hand.

4.1 Data sources and indicators

The key dependent variable in our study is *percent of votes cast for government parties* in each voting precinct. Each voting precinct corresponds to a single polling place and is this the smallest unit at which voting returns can be observed in Danish Elections. We measure this for all precincts in four elections: 2005, 2007, 2011 and 2015. A number of precincts are redistricted between each election. This is problematic, as we want to use the precincts as part of a panel data set. There are two ways to deal with this. We can drop precincts, as their geographical boundaries get altered. This would mean dropping roughly 15 pct. of the data on the dependent variable. The other option is to fix the precincts geographical boundaries at one reference election (i.e. 2015), and then recalculate vote returns in any changed precincts, so they match up with precincts in the reference election. Since there are a lot of minor changes in geographical boundaries from election to election, but only a few major changes, we opt for the latter, which allows us to keep these slightly altered districts in the analysis.¹

The key independent variable is *change in local housing prices*. We obtain housing price data from The Danish Mortgage Banks' Federation (*Realkreditforeningen*), which publishes quarterly data on the average price per square meter of all sales at the zip code level.² For each election, we calculate change in housing prices as the percentage change in the price of houses sold in the quarter of the election compared to the same quarter one year before.

Zip codes are a substantively interesting level of aggregation when it comes to the price of housing, as it is the level at which house prices are most often reported in

¹For details of how returns from the redistricted precincts are calculated, see Søren Risbjerg Thomsen's research note at bit.ly/20501Pi. We use 2015 as a reference elections

²Available at statistik.realkreditforeningen.dk.

Denmark (cf. the fact they are published by The Danish Mortgage Banks' Federation). However, since the dependent variable is measured at the precinct level, merging these observations is not trivial. The easiest solution would be to extract the zip code of the address of each polling place and link the polling place to housing prices in that zip code. Unfortunately, full addresses are not available for all polling places. Instead, we use a three-stage approach to linking polling places to zip codes. First, we extract the street address and higher-level voting district of each polling place and add 'Denmark' at the end of the string (the full resulting string is of the format 'Streetname X, City, Denmark'). Second, we pass this string to the Google Maps API, which geocodes the string and returns latitude-longitude coordinates.³ Third and last, we pass these coordinates to the Danish Addresses Web API (DAWA), a public service provided by the Danish Geodata Agency.⁴ The DAWA returns the zip code for each address, allowing us to link the two sources of data. It is important to note that statistically speaking, precincts are therefore nested inside zip codes; we take this into account by clustering the standard errors on the precinct-level in our analysis.

We examine changes in prices rather than price levels. This is in part because previous economic voting literature, to the extent that it has looked at prices, have also focused on changes (i.e. inflation) rather than levels (cf. Kramer, 1971), and in part because it seems likely that changes in housing prices will be more salient for voters than levels. As such, changes in housing price will mean either very short or very long turnaround time, as sellers and buyers try to adjust to the new prices, leaving visible traces of these changes in the voters immediate context – such as the amount of for sale signs, and the speed at which old neighbors are exchanged for new ones.

In addition to the main independent variable, we measure both the unemployment rate and median income at the zip-code level. We also measure the population density ($\log(inhabitants/km^2)$) of the municipality in which the precinct is located. These are all population based measures calculated from national registers provided by Statistics Denmark.

³Available at developers.google.com/maps/documentation/geocoding/intro.

⁴Available at dawa.aws.dk.

4.2 Estimating the average effect of housing prices

In table 1 we report estimates from a set of linear regression of electoral support for governing parties using changes in local housing prices as the primary independent variable. For all models we use robust standard errors clustered at the precinct-level. In the first column we present a simple linear regression between electoral support and changes in housing prices. In the second column we add year fixed effects. In column 3 we add precinct fixed effects, giving us a difference-in-difference model. In column 4 we include the unemployment rate and median income as controls for the trend of the state of the economy in the precinct.

Table 1: Estimated effects of house prices on electoral support for governing parties.

	(1)	(2)	(3)	(4)
Δ housing price	0.104** (0.008)	0.048** (0.007)	0.053** (0.008)	0.030** (0.007)
Unemployment rate				-1.898** (0.221)
Log(Median income)				-0.891** (0.064)
Year FE		✓	✓	✓
Precinct FE			✓	✓
Observations	4193	4193	4193	4173
RMSE	8.403	6.748	5.713	5.321
Standard errors in parentheses				
* $p < 0.05$, ** $p < 0.01$				

As can be seen from table 1, there is a statistically significant and positive effect of changes in housing prices, indicating that a larger fraction of the electorate casts their vote for governing parties in precincts where housing prices are increasing. In the most demanding specification the effect is 0.03, the implication being that if the price of housing sold in a precinct's zip-code in the last quarter before the election is twice that of the housing sold in the same quarter the year before, electoral support for governing parties in this precinct will increase with roughly 3 percentage points.

Unsurprisingly, the effect is larger in the models which use fewer controls – the effect size drops from 0.1 to 0.05 when introducing the economic controls, and drops an additional 0.02 when introducing the time and precinct fixed effects. This seems to

suggest that using a difference-in-difference approach and detailed information about other aspects of the local economy is, in fact, important when identifying the effect of local housing prices on incumbent support.

Table 2: Assessing the Robustness of the Precinct-level Evidence

	(1)	(2)	(3)	(4)
Δ housing price (2 years)	0.129** (0.007)	0.035** (0.007)	0.040** (0.008)	0.021** (0.007)
Δ housing price (FD controls)	0.104** (0.008)	0.048** (0.007)	0.053** (0.008)	0.058** (0.008)
Δ housing price (FD DV)	0.037** (0.004)	0.006 (0.004)	0.020** (0.004)	0.019** (0.004)
Δ housing price (negative)	-0.081*** (0.022)	-0.054** (0.018)	-0.074*** (0.020)	-0.032 (0.019)
Δ housing price (positive)	0.116*** (0.012)	0.045*** (0.010)	0.043*** (0.012)	0.029* (0.011)
Year FE		✓	✓	✓
Precinct FE			✓	✓
Economic Controls				✓
Standard errors in parentheses				
* $p < 0.05$, ** $p < 0.01$				

How robust are these results? In table 2 we try to reanalyze the models above in different ways, to get a more complete picture of the statistical evidence for (or against) the importance of local housing markets for incumbent support.

We begin by looking at whether the chosen time period, i.e. year-over-year changes, is important. To do so we reestimate the models from table 1 using the change in housing prices over two years rather than one. The results are fairly similar using this measure of more long run changes in housing prices, however, the estimated effects tend to be smaller than what we found above. This fits nicely with previous work showing that voters are, by and large, myopic when it comes to relating economic indicators to incumbent support (Healy and Malhotra, 2009; Healy and Lenz, 2014b).

As mentioned above, we use changes in house prices rather than levels. However, in our models we control for the level of income and the level of unemployment. One could imagine, that this means that we fail to capture something important about how

the economic status of the precinct is changing, which could, in turn, be driving our results. To examine whether this is the case, we re-estimate the different models using first-differenced (FD) controls. As can be seen in the fourth row of table 2, this does not change the results substantially, if anything, with the estimated effects of local housing prices roughly doubling in size. We also estimated a set complete change models, using an FD dependent variable as well. The estimates from these models are reported in the fifth row of the table. The estimated effect size of housing prices in the completely differenced model is somewhat smaller than what was identified in table 1, but it remains statistically significant.

As a final robustness test we split the housing price variable in two, creating one variable which measures the size of positive changes, which is zero if there is a negative change, and one variable which measures the size of negative changes, which is zero if there is a positive change. This makes it possible to study the effect of increases and decreases in housing prices separately. We report the result of these analyses in the two last rows of table 2. Interestingly, the effect of negative changes and positive changes do not seem to differ - they are roughly 0.03. This is both important and somewhat surprising. Important, because it suggests that incumbent politicians are not only rewarded for the boom or punished for the bust. Instead, voters seem to first reward governing politicians when house prices are on the rise, and then punish them when they fall. Somewhat surprising, because much previous research have found that voters respond more strongly to negative economic conditions (e.g. Bloom and Price, 1975; Headrick and Lanoue, 1991; Soroka, 2014).

Taken together, these analyses suggest that there was a robust, positive effect of local housing prices on support for governing parties.

4.3 Placebo test

Next, we look at whether governing parties were already getting more popular in places where house prices would eventually increase and getting less popular in places where house prices would eventually decrease. To do this we estimate the same model as

before, using support for the governing party at the last election as the dependent variable – the lag of the dependent variable. As can be seen from the second row of table 2 there is an significant effect of housing prices in the less restrictive models, however, in the final model the estimated effect of housing prices is 0.005, less than a sixth of the estimate in the corresponding model in table 1, and statistically insignificant. This is important, because a key assumption underlying the difference-in-difference design is that prior trends in the dependent variable is uncorrelated with the independent variable (i.e. the parallel trends assumption), and this analysis shows that there was no such correlation.

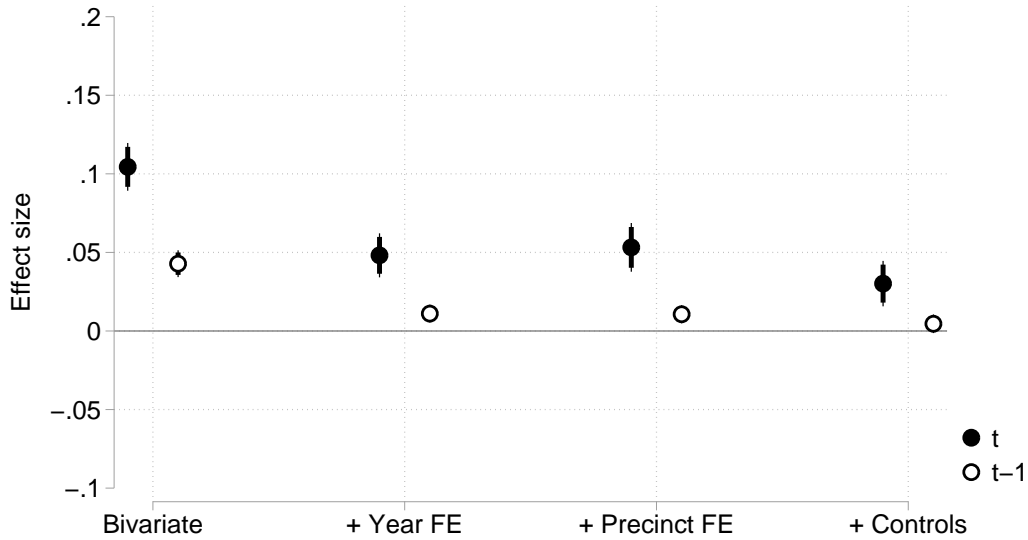


Figure 2: Effects of Housing Prices on support for governing party at the present election (t) and the last election (t-1) with 90 and 95 pct. Confidence Intervals

5 Individual-level evidence

We continue our study of how local housing markets shape incumbent support by tracking a representative sample of Danish citizens in a two wave panel survey collected between 2002 and 2011. We link the survey respondents to the prices of houses sold in their residential context using the national Danish registers. The registers contain very detailed information about all individuals legally residing in Denmark, including the

exact geographical location of their residence, the price of any real estate they sell, and a range of other socio-demographic characteristics (Thygesen et al., 2011). This makes it possible to calculate the distance between the individuals in the survey and all other individuals in Denmark and, in turn, the distance to any individuals who are selling their home.

While it is always desirable to try and replicate findings using a different methodology and a different set of data, linking individual level data to these detailed registers has some advantages over the precinct-level data used above. The flexibility and detail of the Danish registers makes it possible to look at multiple levels of aggregation – not just official levels of aggregation, such as zip codes. This makes it possible to eliminate concerns related to the modifiable area unit problem (MAUP), in that we can rule out that the findings are tied to a specific way of geographically aggregating housing prices. We can also link house prices to individual level variables such as attitudes or home ownership, and use these variables to rule out alternative explanations and explore individual-level moderators of the housing price effects.

5.1 Data sources and indicators

Our independent variable is once again year-over-year changes in housing prices in the residential context of the respondent. We measure the change by comparing the price of housing sold in the quarter prior to the data collection and the price of housing sold in the same quarter a year earlier. Unlike for the precinct-level data we do not have data on prices per square meter. This makes our change measure more sensitive to random variation in the types of houses put up for sale in the two time periods we compare. As such, some of the changes from year to year might be due to the fact that larger houses were put up for sale in one year. To take this, as well as other structural differences in the type of houses put up for sale, into account we divide the sales price of each unit of housing by its public valuation, before calculating the year-over-year change.⁵

⁵The Danish government makes a conservative estimate of the price of all houses in Denmark every two years which is used to calculate property taxes. The public evaluation was constant across the time periods we use to estimate house price changes.

We estimate the changes in housing prices within each survey respondents residential context, measuring this context in three different ways. First, and similar to what we did for the precinct-level data, we use the respondents zip-code, comparing houses sold within the same zip code a year apart. Second, we look at the prices of the 20 or 40 units of housing sold closest to the respondents own home, comparing the prices of houses sold in the immediate proximity of the respondent to that of houses sold one year earlier. Third, we look at the price of houses sold within a fixed radius of 1000 or 1500 meters of the respondent. These latter ways of defining the respondents residential contexts have the benefit of being centered on the respondent, alleviating the problem that the context of a respondent living far from the centroid of one zip-code might be better represented by an adjoining zip-code. Note also that these latter two types of residential context differ in important ways – whereas the first method takes number of sales as fixed, but varies the geographical dispersion of these sales, the second method holds geographical dispersion fixed, but varies the number of sales. Since it is not obvious which of the three ways of measuring the states local housing market is preferable, we will use them all in the analysis below.

To get at support for governing parties at the individual level we utilize a two-wave panel survey, constructed by re-interviewing respondents who had participated in the Danish Version of the European Social Survey (ESS); a nationally representative survey conducted regularly in most European countries. All in all 1,745 people were re-interviewed in the winter of 2011-12, with some of these having been interviewed for the first time in 2007-8, some in 2003-4 and some in 2001-2 – corresponding to rounds five, three and one of the ESS.

The respondents in the ESS in Denmark are randomly sampled from the national civil registry, and therefore the civil registration numbers were retained by the data collection agency. This made it possible to identify the respondents for a second interview, and made it possible to link the respondents to the national registers. From the survey, we use the following question: “What party did you vote for at the last parliamentary election?” Respondents were presented with all the parties which ran in the previous election. For

the analyses we create a dummy variable indicating whether the respondent voted for a party in government.

In addition to these central variables, we also use a number of supporting variables in the analysis for statistical control, interactive analyses and placebo tests. From the registers we include unemployment and income both for the individual respondent and in the respondents immediate context, we include whether the respondent owns his or her own home, and how long a period expired between the day the respondent was surveyed and the day the respondent relocated (i.e. moved). From the survey, we include an item on the respondents ideological orientation, measured on a ten point scale going from 'Left' to 'Right', and rescaled to go between zero and one.

5.2 Average effect

In table 3 we report estimates from a set of linear probability models (LPM), setting the probability of voting for for a party in government as a function of changes in local housing prices. We estimate the models using a linear regression with fixed effects for the respondent, and fixed effect for which of the four different survey rounds the respondent is participating (ESS round 1, 3, 5 or the re-interview). All models include controls for the average income and unemployment rate in the respondents context, as well as indicators of the respondent's own income and whether someone in the household is unemployed. As such, we end up with a difference-in-difference model which controls for trends in the economic situation – however, unlike for the precinct level data we can now control for trends in both the individuals personal economy and for the economy of the larger context. We use robust standard errors, clustered at the individual level.

All models include the same set of variables, but they differ in how the contextual variables are operationalized. In column one we present a model where housing price change is calculated based on the 20 closest sales (cf. above), and the other contextual variables – average income and unemployment rate – is measured within a 500 meter radius of the respondent. In column two we use the 40 closest houses, but leaves the

remaining variables operationalized as in column one. In column three and four we operationalize all contextual variables, sales, unemployment rate and average income, as 1000 and 1500 meter radii around the respondent. Finally, in column five, we examine sales at the level of zip-codes, but the other contextual variables are calculated based on people within a 1500 meter radii around the respondent.

Table 3: Linear Regression of Voting for Governing party

	20 Closest	40 Closest	1000 metres	1500 metres	Zip code
Δ housing prices	0.035 (0.036)	0.056 (0.044)	0.064 (0.052)	0.114* (0.051)	0.063 (0.056)
Unemployment rate	0.052 (0.290)	0.056 (0.289)	-0.439 (0.627)	0.755 (0.575)	0.796+ (0.422)
Average income	-0.004 (0.003)	-0.004 (0.003)	-0.005 (0.007)	-0.005 (0.007)	-0.006 (0.006)
Personal income	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.000)
Unemployed (household)	-0.032 (0.035)	-0.033 (0.035)	-0.066 (0.043)	-0.048 (0.040)	-0.034 (0.036)
Round FE	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes
Observations	3479	3479	2790	2992	3384

Standard errors in parentheses

+ $p < 0.1$, * $p < 0.05$

The estimated effect sizes across these different models is consistently positive, although the size of the effect varies somewhat, going from 0.04 in column one to 0.11 in column 4. The effect is only statistical in one of the five specification – the one which focus on the 1500 meter context.

Figure 3 examines differences between the two...

5.3 Self-interest, ideology and inference

Ideology, Self Interest or Inference

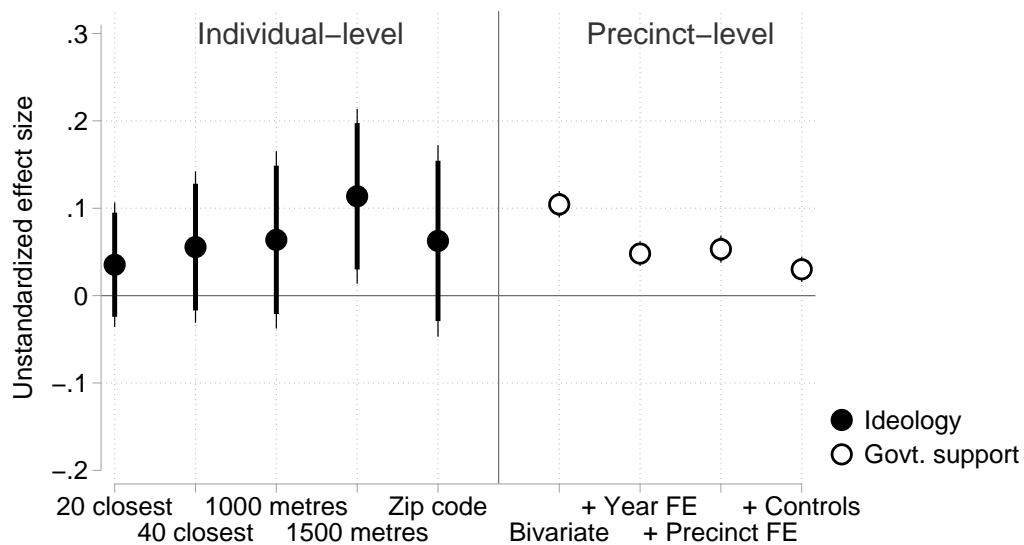


Figure 3: Effects of Housing Prices across levels of analysis with 90 and 95 pct. Confidence Intervals

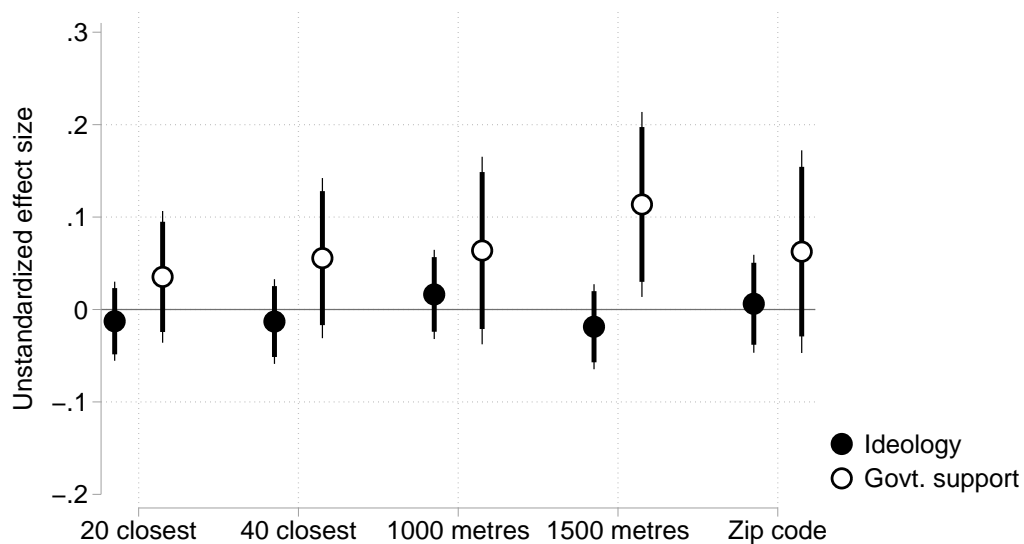


Figure 4: Effects of Housing Prices on Ideological Orientation and Support for Governing Parties with 90 and 95 pct. Confidence Intervals

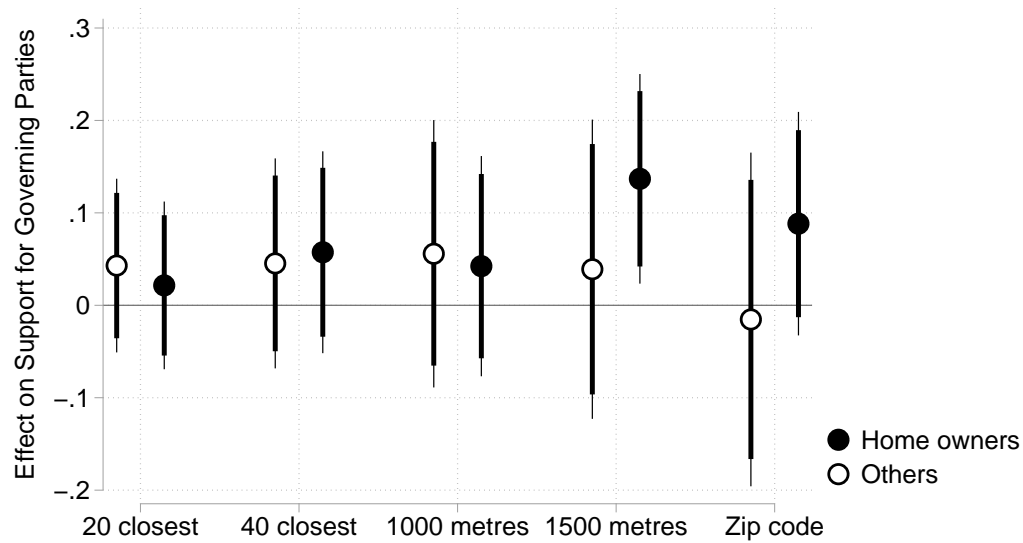


Figure 5: Effects of Housing Prices for those who own their home and those who do not with 90 and 95 pct. Confidence Intervals

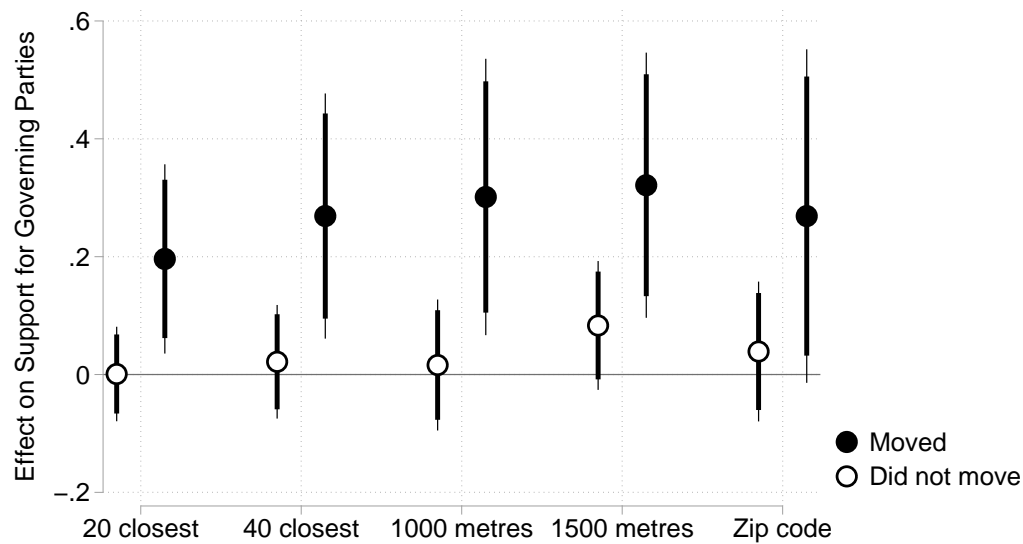


Figure 6: Effects of Housing Prices for those who had just or were going to move soon and those who did not with 90 and 95 pct. Confidence Intervals

6 Conclusion

What implications do these findings have? First, politicians should care about housing prices and the policies that influence them. More generally, these findings suggest that it might be interesting to look more at housing prices as a driver of political behavior.

Second of all, studying housing prices allows us to understand how local economic conditions shape electoral support for governing politicians. Something which is interesting in light of the fact that most studies of the electoral effects of the economy have focused on the national economy or, to a lesser extent, personal economic conditions (Healy and Malhotra, 2013, 290). To the extent that we find that voters do hold politicians accountable for the state of economy in their local community, this means that reelection minded politicians cannot simply be attentive to the economy as a whole, but have to worry about the geographic distribution of economic grievances (cf. Ferejohn, 1986, 11).

To the extent that we find that voters do hold politicians accountable for the state of economy in their local community, this means that reelection minded politicians cannot simply be attentive to the economy as a whole, but have to worry about the geographic distribution of economic grievances (cf. Ferejohn, 1986, 11).

Though the data used in this study is a clear improvement compared to those in earlier studies, its major shortcoming is that the data is nonetheless observational. In the absence of fully or quasi-experimental variation in housing prices, we cannot be sure that the estimated effects are not confounded by unobserved heterogeneity. This concern remains even though we apply highly stringent tests to the effect estimate. Hence, a promising avenue for future research is to identify settings with plausibly exogenous variation.

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Supplementary materials

S1:Descriptive statistics

Table of descriptive statistics

S2: Common trends in precinct-level data

In table 4 we look at whether housing prices can predict changes in support for governing parties in the last period.

Table 4: Estimated effects of house prices on electoral support for governing parties at t-1.

	(1)	(2)	(3)	(4)
Δ housing price (lag DV)	0.043** (0.004)	0.011** (0.003)	0.011** (0.003)	0.005 (0.003)
Precinct FE			✓	✓
Year FE		✓	✓	✓
Observations	3061	3061	3061	3051
RMSE	4.314	1.856	1.471	1.447

Standard errors in parentheses

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

S3: Alternative estimation in individual-level data

In table 5 we estimate a conditional logit model on the panel data. We find similar effects as in linear model above.

Table 5: Conditional Logit Model of Voting for Governing party

	10 Closest	20 Closest	40 Closest	500 metres	1000 metres	1500 metres
Δ housing prices	0.687 (0.431)	0.631 (0.559)	1.015 (0.766)	0.557 (0.627)	0.752 (0.871)	0.837 (0.962)
Unemployment rate	-1.950 (3.126)	-2.044 (3.142)	-2.109 (3.068)	-9.478 (6.613)	2.381 (6.747)	15.116 ⁺ (7.775)
Average income	-0.040 (0.040)	-0.035 (0.039)	-0.036 (0.039)	-0.046 (0.071)	-0.055 (0.059)	-0.081 (0.075)
Personal income	-0.001 (0.004)	-0.001 (0.004)	-0.001 (0.004)	-0.009 (0.017)	-0.002 (0.004)	-0.003 (0.005)
Years of Education	0.042 (0.171)	0.030 (0.170)	0.017 (0.171)	0.128 (0.206)	0.023 (0.210)	0.027 (0.218)
Round FE	Yes	Yes	Yes	Yes	Yes	Yes
Voter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	562	562	562	420	504	528

Standard errors in parentheses

⁺ $p < 0.1$, * $p < 0.05$

S3: Heterogeneous effects in precinct-level data

Tables 6 and 7 examines the heterogeneity of the effects in the precinct level data.

Table 6: Estimated effects of house prices on electoral support for governing parties across positive and negative changes.

	(1)	(2)	(3)	(4)
Δ housing price (negative)	-0.082*** (0.022)	-0.054** (0.018)	-0.073*** (0.020)	-0.030 (0.019)
Δ housing price (positive)	0.115*** (0.012)	0.045*** (0.010)	0.044*** (0.012)	0.030** (0.011)
Precinct FE			✓	✓
Year FE		✓	✓	✓
Test of no difference (p)	0.27	0.71	0.28	0.99
Observations	4193	4193	4193	4173
RMSE	8.41	6.75	5.71	5.32

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Estimated effects of house prices on electoral support for governing parties across volatility.

	(1)	(2)	(3)	(4)
Δ housing price	-0.01 (0.03)	-0.20** (0.02)	-0.18** (0.02)	-0.17** (0.03)
Log(density)	-5.49** (0.37)	-2.69** (0.41)	0.00 (.)	0.00 (.)
Δ housing price \times Log(density)	0.05** (0.01)	0.12** (0.01)	0.10** (0.01)	0.10** (0.01)
Precinct FE			✓	✓
Year FE				✓
Observations	4191	4171	4171	4171
RMSE	8.43	6.81	5.50	5.40

Standard errors in parentheses

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

S4: Heterogeneous treatment effects in individual-level data

Tables 8 and 9 examines the heterogeneity of the effects in the individual level data.

Table 8: Linear Regression of Voting for Governing party

	10 Closest	20 Closest	40 Closest	500 metres	1000 metres	1500 metres
Δ housing prices (positive)	-0.020 (0.062)	-0.037 (0.072)	0.034 (0.083)	-0.053 (0.095)	-0.005 (0.088)	-0.021 (0.089)
Δ housing prices (negative)	0.070 ⁺ (0.041)	0.071 (0.065)	0.137 ⁺ (0.075)	0.063 (0.074)	0.101 (0.063)	0.129 ⁺ (0.075)
Unemployment rate	0.040 (0.291)	0.050 (0.291)	0.044 (0.292)	-0.527 (0.462)	0.035 (0.495)	0.847 ⁺ (0.490)
Average income	-0.004 (0.003)	-0.004 (0.003)	-0.004 (0.003)	-0.004 (0.004)	-0.006 (0.006)	-0.006 (0.006)
Personal income	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.001* (0.000)	-0.000 (0.001)	-0.000 (0.000)
Unemployed (household)	-0.032 (0.035)	-0.031 (0.035)	-0.031 (0.035)	-0.081 ⁺ (0.041)	-0.050 (0.038)	-0.041 (0.037)
Round FE	Yes	Yes	Yes	Yes	Yes	Yes
Voter FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3473	3473	3473	2846	3173	3313

Standard errors in parentheses

⁺ $p < 0.1$, * $p < 0.05$

Table 9: Linear Regression of Voting for Governing party

	10 Closest	20 Closest	40 Closest	500 metres	1000 metres	1500 metres
Δ housing prices	-0.007 (0.078)	-0.084 (0.107)	-0.166 (0.137)	0.014 (0.173)	-0.127 (0.157)	
Log(No. of ppl in context)	-0.010 (0.010)	-0.010 (0.010)	-0.010 (0.010)	0.006 (0.020)	-0.001 (0.015)	
Δ housing prices \times Log(No. of ppl in context)	0.008 (0.010)	0.021 (0.014)	0.031 ⁺ (0.019)	0.006 (0.023)	0.024 (0.019)	
Unemployment rate	0.098 (0.297)	0.102 (0.295)	0.114 (0.293)	-0.580 (0.484)	0.035 (0.557)	
Average income	-0.004 (0.003)	-0.004 (0.003)	-0.004 (0.003)	-0.004 (0.004)	-0.007 (0.006)	
Personal income	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.001* (0.000)	-0.000 (0.001)	
Unemployed (household)	-0.034 (0.035)	-0.034 (0.035)	-0.034 (0.035)	-0.081 ⁺ (0.042)	-0.050 (0.038)	
Round FE	Yes	Yes	Yes	Yes	Yes	
Voter FE	Yes	Yes	Yes	Yes	Yes	
Observations	3473	3473	3473	2846	3173	

Standard errors in parentheses

⁺ $p < 0.1$, * $p < 0.05$