Rent or Buy? The Role of Lifetime Experiences of Macroeconomic Shocks within and across Countries

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Abstract

There are vast differences in homeownership rates across countries. We show that the decision to buy versus rent is strongly affected by macroeconomic shocks that occurred in a country during a person's lifetime so far, specifically experiences of inflation and house prices. We show that experience-based expectation formation implies that households are more likely to own their home if, in their lives so far, they have experienced high house price increases or general inflation. Using household-level data from 13 countries in the European Central Bank's Household Finance and Consumption Survey (HFCS), we exploit differences in individual histories of inflation and house price experiences to identify their effect on homeownership rates. We find that a 1pp increase in experienced inflation predicts about a 7% increase in homeownership at the national level and a 25% increase in the odds of homeownership at the individual level, while a 1pp increase in experienced house price growth predicts a 4-9% increase in the odds of homeownership.

1 Introduction

Homeownership rates vary significantly across Europe. In Germany and Austria, less than half of households own their home, compared to about 80% in Spain and Cyprus and 90% in Slovakia. Figure 1 displays the wide range of homeownership rates across countries in the European Union and, for comparison, in the United States.[1] It is also striking that homeownership rates across U.S. states vary considerably less than across Europe: 43 of 50 states have homeownership rates between 65% and 75%.[2]

What explains these vast cross-country differences in household tenure decisions, i.e., the decision to rent versus buy the household's main residence? While prior research has shown that institutional differences, variation in housing supply, and population demographics play an important role (see, for example, Andersen (2011), Andrews and Caldera Sánchez (2011), Clark and Dieleman (1996), Doling (1973), Follain and Ling (1988), Haurin et al. (1996), Henderson and Ioannides (1987), Earley (2004), Ioannides (1987), Painter et al. (2001), and Souleles and Sinai (2005)), we point to the role of macroeconomic shocks that occurred in a country during the person's lifetime so far, specifically experiences of inflation and house prices. We argue that, in line with the emerging literature on experience effects, households overweight their own experiences of these macroeconomic outcomes when forming expectations and, as a result, are more likely to own their home when they experience high house price growth or high inflation in the future.

To illustrate the potential mechanism, consider Figure 2, which plots homeownership rates and experienced inflation and nominal house price growth (measured as a weighted average over the lifetime) in Italy, Luxembourg, and the Netherlands.[3] While much is left out of this simple diagram, the figure suggests that there might be a relationship between these macroeconomic experiences and homeownership. In countries where older generations happen to have experienced higher average inflation rates and higher house price growth over their lives so far than younger generations, homeownership rates follow the same trend - the older a person the more likely is she to own her home. In the Netherlands, instead, where household heads in their 30s happen to have experienced higher increases in house prices over their lives so far than older generations, the homeownership rate is highest among people in their 30s. Comparing just households in their 30s and in their 40s, we see a

[1] We return to a description of the data on European homeownership in more detail later in the paper.

[2] 2010 state homeownership rates from the U.S. Census Bureau.

[3] We return to a description of the data and calculation of experience measures in more detail later in the paper. In the main analysis, we distinguish between general inflation and house price growth in addition to inflation.

larger upward jump in the homeownership rate in Italy than in Luxembourg, and a decrease in the Netherlands. These differences mirror closely the similar trends in macroeconomic experiences among 30- and 40-year-olds; we observe steep slopes in experienced inflation and home price increases in Italy, flatter slopes in Luxembourg, and even flatter (or negative) slopes in the Netherlands.

The ability to predict household tenure choice, or the decision to rent or buy the household's main residence, is important for many reasons. Financially, it is often the largest decision a household makes. Children who grown up in owner-occupied homes have better cognitive and behavioral outcomes and achieve higher educational attainment (Haurin et al. (2002) and Green and White (1997)). Higher homeownership levels have been related to more investment in social capital, lower crime rates, and higher real estate prices (DiPasquale and Glaeser (1999), Sampson et al. (1997), Glaeser and Shapiro (2002)).[4]

In this paper, we ask whether there is a systematic relationship between experienced inflation and house price growth, on the one hand, and homeownership, on the other hand, both at the national and individual level. We develop a theoretical framework that links expectations about inflation and house prices to tenure decisions. If households put a higher weight on their own inflation experiences when forming expectations of the future, consistent with Malmendier and Nagel (2011, 2015), then differences in macroeconomic experiences can be used to predict household tenure choice. Using household microdata from 13 countries participating in the European Central Bank's Household Finance and Consumption Survey (HFCS), we provide evidence for correlations between these macroeconomic experiences and homeownership. At the national level, we find that a 1pp increase in average experienced inflation predicts about a 7pp increase in aggregate homeownership rate. We find that, on its own, a 1pp increase in average experienced real house price growth predicts a 4pp increase in homeownership rate (though only marginally significant). Focusing on individual tenure choice, we find that a 1 pp increase in experienced inflation corresponds to about a 25% increase in the odds of homeownership, while a 1pp increase in experienced real house price growth predicts a 4-9% increase in the odds of being a homeowner.

In our analyses, we measure macroeconomic experiences using historical data on inflation and house prices. While long time series of inflation data are available for most countries, the house price data extends only to 1975, allowing us to construct only partial noisy measures

[4]There may also be costs to high homeownership. Bracke et al. (2012) finds that purchasing a home decreases the likelihood of becoming an entrepreneur for several years following purchase. Blanchflower and Oswald (2013) find that high homeownership rates in the U.S. led to worse labor market outcomes due to decreased mobility, higher commuting times, and fewer new businesses.

of house price experiences. (We hope to expand these series in order to construct a satisfying measure of experienced real house price growth using the sources perused in the historical research of Bordo and Landon-Lane (2013) and Knoll et al. (2015). In this version of the draft, we will emphasize the results on experienced inflation rather than house prices due to the better availability of long-run historical inflation data.) We calculate measures of experienced price increases using a weighted lifetime average, with more recent experiences weighted higher than those in the distant past.

To provide intuition for how macroeconomic experiences may impact tenure choice, we develop a stylized model which demonstrates how experiencing high inflation and real house price growth can lead to a higher likelihood of being a homeowner. The intuition for house prices is straightforward: expecting real house prices to rise makes owning a home a more attractive investment. We demonstrate that experienced inflation impacts tenure choice through two channels: the desire to hedge against inflation and the attractiveness of a fixed-rate mortgage.

Real estate has classically been viewed as an inflation hedge, as can be represented by the classic Gordon growth model (1962). While the Gordon growth model is a good benchmark for a theoretical basis of whether real estate is an inflation hedge, it relies on the assumption that future rent growth and discount rate are constant and adjust one-for-one with inflation. In response to this critique, there is an extensive literature empirically testing whether real estate and real estate investment trusts (REITs) act as inflation hedges, with mixed results (see for example Anari and Kolari (2002), Brounen et al. (2012), Case and Wachter (2011), Fama and Schwert (1977), and Liu et al. (1997)).

Whether or not real estate is actually a good hedge against inflation, if households *believe* that real estate is an inflation hedge, households who have lived through high inflation may expect higher inflation in the future and therefore value the inflation-hedging advantages of investment in real estate. Similarly, if households *believe* that house prices will be high in the future, they may be more likely to purchase their home today.

Even if tenure choice is not influenced by inflation-hedging motivations, we use our theoretical framework to demonstrate that individuals who have experienced high inflation may be more likely to own their home if they can finance it with a fixed-rate mortgage. Individuals who expect higher inflation than the bank may want to own a home in order to be able to borrow money at what they expect will be a low real interest rate.

Our paper builds on several string of literature. The literature on experience effects shows that life experiences of macroeconomic events such as inflation and stock returns have

significant impacts on expectations and financial decisions. For example, Malmendier and Nagel (2011) find that stock and bond market experiences predict future investment decisions. Malmendier and Nagel (2015) show that experienced inflation can be used to predict individuals' inflation expectations and likelihood to borrow using fixed- versus variable-rate mortgages.

A recent paper by Ampudia and Ehrmann (2014) uses household data from the HFCS, the same dataset used in our analysis, to demonstrate that macroeconomic experiences influence the amount of risk households are willing to take. For example, they find that experiencing higher stock market returns increase households' self-reported tolerability of financial risk and stock market participation. The authors employ the same approach as used by Malmendier and Nagel (2011) to measure experiences and find that, relative to households in the U.S., European households tend to weight recent experiences more highly relative to past experiences. In addition to the weighted average summary of lifetime experiences, they also find that extreme market experiences have lasting effects on behavior. As further evidence for the persistence of extreme experience effects, Ehrmann and Tzamourani (2012) find that experiences of hyperinflation (inflation above 200%) have lasting effects on beliefs about the importance of price stability. Similarly, Giuliano and Spilimbergo find that recession experiences during one's youth have lasting impacts on beliefs about redistribution, confidence in the government, and attitudes on the importance of work versus luck.

After the housing crisis in the 2000s, a new vein of research has also examined whether preferences for homeownership in the U.S. have changed as a result of high foreclosure rates and steep declines in housing prices. Bracha and Jamison (2012), Drew and Herbert (2013), and Collins and Choi (2010) test the hypothesis that recession experiences influence housing preferences, but, perhaps surprisingly, find little evidence that such a relationship exists.

This paper also relates to the larger literature on determinants of tenure choice. These can broadly be classified as household characteristics (such as family structure, employment status, and wealth) and market factors (such as rent prices, tax benefits to homeowners, and structure of the credit market).

Household demographics that are important to homeownership decisions are typically age, marital status, presence of children, and employment status.[5] Household financial status measured by income, wealth, and access to mortgage debt are also key predictors of homeownership (Drew and Herbert (2013)). Tenure choice is also correlated with preferences

[5]See for example Andrews and Caldera Sánchez (2011), Bracha and Jamison (2012), Drew and Herbert (2013), and Collins and Choi (2010).

for type of home as some types of residences (i.e., single detached units) are more often available for sale than for rent (Andersen (2011)).

In addition to the household-level characteristics that determine tenure choice, many features of the housing market (such as prices and regulations) have been shown to influence aggregate homeownership rates. Looking across OECD member countries, Andrews and Caldera Sánchez (2011) cite policies such as tax relief on mortgage debt and rent regulations as drivers of aggregate homeownership rates. Focusing on the large differences in the homeownership rates across European countries, Earley (2004) finds that countries with high homeownership rates tend to be poorer, have lower levels of mortgage debt (and have been slower to develop financial markets), and have cultures or government policies that encourage children living at home for longer and/or purchasing their first home later. Earley also cites transaction costs, relative price of renting versus owning, and the supply of housing available for renting versus owning as potential drivers of differences in homeownership rates.

The rest of the paper proceeds as follows. Section 2 describes a theoretical framework demonstrating how inflation and house price expectations can influence tenure choice. Section 3 describes the data. Section 4 describes the analyses of the relationship between macroeconomic experiences and homeownership. Section 5 concludes.

2 Theoretical Framework

In this section, we develop a stylized model of household tenure choice, demonstrating how inflation and house price experiences can influence the decision to rent or buy a home. Real estate has classically been viewed as an inflation hedge, illustrated by the seminal Gordon growth model (1962). Our model builds on Gordon's theoretical setting and introduces the possibility of experience-based belief formation. We allow experiences of inflation to affect beliefs about future inflation, and experiences of house prices to affect beliefs about future house prices.

In our stylized model, experiencing real house price growth makes an individual more likely to think house prices will continue to rise and therefore makes purchasing a home seem like a more attractive investment.

The relationship between experienced inflation and homeownership is more nuanced in our model. Specifically, we demonstrate two channels through which experiencing high inflation, and thus expecting higher inflation in the future, can increase the likelihood of homeownership. First, there is an inflation-hedging motive, which increases with expected

inflation. Second, even if households can perfectly hedge against inflation using other assets, expecting high inflation makes owning a home with a fixed-rate mortgage more attractive.

2.1 Model Set-up

Households In this simple model, we consider an agent born at time t that lives for one period. When born, the agent observes current inflation, both in general and for house prices (i.e., price changes from $t-1$ to t). An experienced-based agent will use the inflation and change in house prices realized in t to form beliefs about the future, as described in more detail below.

The agent also observes the cost of renting a house, H_t, and of buying a house, M_t. The key decision we focus on in this model is the household's choice between buying and renting a home to live in from t to $t+1$. If the household decides to be a renter, it pays rent H_t at time t. If the household decides to buy a home, it must pay the current house price M_t at time t.

We assume that the agent has the option to finance the purchase with a fixed-rate mortgage of value $m_t \in [0, M_t]$. All mortgages last for one period and carry a fixed rate of r_t^{fix}. Hence, a household with a mortgage m_t raised at time t will need to pay back the mortgage with interest, $(1 + r_t^{fix})m_t$, at $t+1$. At $t+1$, the homeowner also sells the house at the new price M_{t+1}.

We allow the household to own at most one house. For simplicity, all houses in the economy are identical in quality, and therefore housing quality does not affect the choice to buy or rent.

The household is endowed with wealth w_t when born and consumes all of their wealth at $t+1$. Inflation in the price of consumption from t to $t+1$ is π_{t+1}, and is realized at $t+1$.

Households have log utility over consumption in $t+1$, or equivalently over real terminal wealth. For a household born at t,

$$U_t = u(c_{t+1}) = \log\left(\frac{w_{t+1}}{1+\pi_{t+1}}\right)$$

where w_{t+1} is nominal wealth at $t+1$.

Given initial wealth w_t, households make a housing decision to maximize expected real terminal wealth subject to a minimum housing constraint, which requires the household to either rent or own a house from t to $t+1$. We normalize the utility associated with living in a house to 0.

In addition to housing, there is a single alternative asset. Below we describe the model for two different assumptions about the return on the alternative asset. In the first version of the model, the alternative asset pays a known nominal interest rate, n_t. In this framework, housing is the only inflation hedge. In the second version of the model, we instead assume the alternative asset is inflation-protected and offers a known real return, r_t.

Households use only experienced inflation and house prices to form beliefs about the future. Households take rent and mortgage rates as exogenously given and do not use them to draw inferences about future inflation or house price growth.

Firms Risk-neutral firms in this economy offer fixed-rate mortgages. They can also buy houses and rent them to households. We assume that competition among firms forces firm returns on either investment to be equivalent to their returns from investing in the alternative asset.

Firms in this economy offer one-period fixed-rate mortgages. We define a "fixed-rate" mortgage as one in which the interest rate is fixed and known by all parties at the initialization of the loan. We denote the mortgage rate for a loan initialized at time t as r_t^{fix}.

For a household buying a house worth M_t at time t with a mortgage amount $m_t \leq M_t$, the m_t-dollar mortgage requires payment of the nominal interest $r_t^{fix} m_t$ and of the full (nominal) loan amount m_t at time $t+1$.

Alternatively, firms can decide to buy a house at time t, in which case it will rent the house to the agent for one period at rental price H_t, to be paid at time t. We assume the firm invests the rental income in the alternative asset. Like households, the firm can sell the house at the end of $t+1$ for the new house price M_{t+1}.

Differently from households, firms always form rational expectations about future price changes, i.e., are not subject to experience bias.

Housing Market We decompose the change in house prices in each period into (general) inflation, π, and a housing-specific component g. Letting M_t be the nominal house price at time t, the relationship between nominal house prices M_t and M_{t+1} is defined by

$$M_{t+1} = M_t(1 + \pi_{t+1} + g_{t+1})$$

where π_{t+1} is inflation between t and $t+1$ and g_{t+1} is the real house price growth, i.e., on top of inflation, during the same period.[6]

[6]Of course in general equilibrium, g would react to demand and supply. The simplification of having an

We consider a simple version of this framework where inflation is either high or low, denoted π^H and π^L, where π^H occurs with probability p_{π_H}. We assume $\pi_H, \pi_L \in (0, 1)$.

Real house price growth g_t varies independently from π_t and can also take on either a high or low value, denoted g_H and g_L. The probability of the high state occurring is p_{g_H}. We assume that $E_t[g_{t+1}] = 0$ and that $g_H \in (0, 1)$ and $g_L \in (-1, 0)$.

The assumption that $E_t[g_{t+1}] = 0$ means that real estate prices move, on average, with inflation. Housing in this model is therefore an imperfect inflation-hedge.

Beliefs Household beliefs about inflation and real house price growth are biased in the direction of their experience. Denoting household beliefs with $\hat{p}$, experience-biased households have beliefs $\hat{p}_{\pi_H} > p_{\pi_H}$ if a household born at t experienced high inflation at t and $\hat{p}_{\pi_H} < p_{\pi_H}$ if the household experienced low inflation. Similarly, $\hat{p}_{g_H} > p_{g_H}$ if the household experienced high g at time t and $\hat{p}_{g_H} < p_{g_H}$ if the household experienced low g. (This is a stylized way to capture the experience effect of inflation and real-estate prices, which we use for simplicity of exposition. In the empirical analysis, we allow all life-time experiences to affect the beliefs. We even allow other historical data to matter; the key feature is that lifetime experiences receive some extra weight.)

Firms in this economy have accurate beliefs about inflation and real house price growth.

2.2 Housing as the only inflation hedge

In this version of the model, the alternative asset pays a nominal rate n_t between t and $t+1$, known to households and firms at time t.

In this framework, we will show that households value the inflation-hedging aspect of homeownership. Homeownership becomes more attractive to households when beliefs about future inflation or house price growth are high. Under this set-up, firms offer a fixed-rate mortgage that is equivalent to the alternative asset and therefore households are indifferent between all forms of financing the purchase of a home.

Firm's Problem Risk-neutral firms act at time t to maximize real wealth in $t+1$. Firms set the mortgage interest rate and rent so that, in expectation, they are indifferent between owning a house and renting it to a household, offering fixed-rate mortgages to homeowners, and investing in the alternative asset.

exogenous process for home prices allows us to make our main points without complicating the model.

The firm sets mortgage rates so that they can earn at least the nominal rate n_t. Assuming competition drives profits to zero, the firm sets the fixed mortgage rate r_t^{fix} such that

$$\begin{aligned} & E_t\left[\frac{1+r_t^{fix}}{1+\pi_{t+1}}\right] = E_t\left[\frac{1+n_t}{1+\pi_{t+1}}\right] \\ \Leftrightarrow \quad & r_t^{fix} = n_t \end{aligned}$$

In addition to offering mortgages, the firm can also buy a house and rent it to a household for a one-period rental price H_t (we will refer to this as the "landlord" option). The firm sets rent assuming they invest any time t wealth not spent on housing at the nominal rate. Let $\tilde{R}_{t+1} = \frac{1+n_t}{1+\pi_{t+1}}$ be the gross real interest rate for the alternative asset. Assuming the firm has initial wealth W_t, the firm sets H_t such that

$$\begin{aligned} & E_t[W_{t+1}|\text{Landlord}] = E_t[W_{t+1}|\text{Invest all at } n_t] \\ \Leftrightarrow \quad & E_t\left[\frac{(W_t - M_t + H_t)(1+n_t) + M_t(1+\pi_{t+1}+g_{t+1})}{1+\pi_{t+1}}\right] = E_t\left[\frac{W_t(1+n_t)}{1+\pi_{t+1}}\right] \\ \Leftrightarrow \quad & H_t = \left(1 - E_t[\tilde{R}_{t+1}]^{-1}\right) M_t \end{aligned}$$

Household Problem Households choose to rent or buy by maximizing expected utility conditional on renting or buying with a fixed-rate mortgage of $m_t \in [0, M_t]$.

The household's expected utility from renting given equilibrium rental price H_t is

$$\begin{aligned} E_t\left[u(c_{t+1}|\text{renting})\right] &= \log\left((w_t - H_t)(1+n_t)\right) - E_t\left[\log(1+\pi_{t+1})\right] \\ &= \log\left(w_t(1+n_t) - \left(1 - E_t[\tilde{R}_{t+1}]^{-1}\right)(1+n_t)M_t\right) - E_t\left[\log(1+\pi_{t+1})\right] \end{aligned}$$

Given the fixed mortgage rate offered by firms, household expected utility conditional on buying a house is equivalent under all mortgage amounts $m_t \in [0, M_t]$ and is given by

$$\begin{aligned} E_t\left[u(c_{t+1}|\text{buying with fixed rate } m_t)\right] &= E_t\left[\log\left(\frac{M_{t+1} - m_t(1+r_t^{fix}) + (w_t - (M_t - m_t))(1+n_t)}{1+\pi_{t+1}}\right)\right] \\ &= E_t\left[\log\left(\frac{M_{t+1} + (w_t - M_t)(1+n_t)}{1+\pi_{t+1}}\right)\right] \\ &= E_t\left[u(c_{t+1}|\text{buying})\right] \end{aligned}$$

The household's expected utility conditional on buying a house can be re-written in terms

of the household's beliefs of the relative likelihood of the four possible states of the world.

$$\begin{aligned}
E_t\left[u(c_{t+1}|\text{buying})\right] &= E_t\left[\log\left(M_t(1+\pi_{t+1}+g_{t+1})+(w_t-M_t)(1+n_t)\right)\right] - E_t\left[\log(1+\pi_{t+1})\right] \\
&= \hat{p}_{\pi_H}\hat{p}_{g_H}\log\left(M_t(1+\pi_H+g_H)+(w_t-M_t)(1+n_t)\right) \\
&\quad + \hat{p}_{\pi_H}(1-\hat{p}_{g_H})\log\left(M_t(1+\pi_H+g_L)+(w_t-M_t)(1+n_t)\right) \\
&\quad + (1-\hat{p}_{\pi_H})\hat{p}_{g_H}\log\left(M_t(1+\pi_L+g_H)+(w_t-M_t)(1+n_t)\right) \\
&\quad + (1-\hat{p}_{\pi_H})(1-\hat{p}_{g_H})\log\left(M_t(1+\pi_L+g_L)+(w_t-M_t)(1+n_t)\right) \\
&\quad - E_t\left[\log(1+\pi_{t+1})\right]
\end{aligned}$$

Households decide to buy instead of rent if

$$E_t\left[u(c_{t+1}|\text{buying})\right] \geq E_t\left[u(c_{t+1}|\text{renting})\right]$$

Ignoring the normalization term $E_t\left[\log(1+\pi_{t+1})\right]$ which appears on both sides of this inequality, we see that the relative value of buying changes with experienced inflation and real house price growth, but the relative value of renting is constant with respect to beliefs.

Taking derivatives with respect to $\hat{p}_{g_H}$, we find that experiencing higher real house price growth raises the relative value of buying and makes a household more likely to buy instead of rent. Similarly, taking derivatives with respect to $\hat{p}_{\pi_H}$, we find that experiencing higher inflation increases the relative value of homeownership. When housing is the only available inflation-hedge, expecting higher inflation effectively increases the expected real return to homeownership relative to the non-inflation protected alternative asset.

2.3 Housing in a market with perfect inflation hedges

In the second version of the model, we assume that households and firms have access to a perfect inflation hedge. Specifically, that the alternative asset is inflation-protected and pays a *real* rate r_t between t and $t+1$, known to households and firms at time t.

The first model shows that beliefs about inflation can affect the desire to own a home through the inflation-hedge motive. However in the real world, households may have other (perhaps superior) inflation hedge investment opportunities.

In the environment with an asset that offers a known real return, household beliefs about inflation can still drive homeownership decisions, but only through the fixed-rate mortgage, which allows households to borrow at a rate they believe is advantageous.

Firm's Problem The firm sets the fixed nominal mortgage rate so that in expectation they earn the real rate r_t. The firm sets the fixed nominal mortgage rate r_t^{fix} such that

$$E_t\left[\frac{1+r_t^{fix}}{1+\pi_{t+1}}\right] = 1 + r_t$$

$$\Leftrightarrow \qquad r_t^{fix} = (1+r_t)\left(E_t\left[\frac{1}{1+\pi_{t+1}}\right]\right)^{-1} - 1$$

The firm sets rent assuming they invest any time t wealth not spent on housing at the real rate r_t.

$$E_t[W_{t+1}|\text{Landlord}] = E_t[W_{t+1}|\text{Invest all at } r_t]$$

$$\Leftrightarrow \qquad E_t\left[(W_t - M_t + H_t)(1+r_t) + \frac{M_t(1+\pi_{t+1}+g_{t+1})}{1+\pi_{t+1}}\right] = E_t\left[W_t(1+r_t)\right]$$

$$\Leftrightarrow \qquad H_t = \frac{r_t}{1+r_t}M_t$$

Household Problem Households choose to rent or buy by maximizing expected utility. The expected value of renting at the prevailing prices is

$$\begin{aligned} E_t\left[u(c_{t+1}|\text{renting})\right] &= E_t\left[\log\left((w_t - H_t)(1+r_t)\right)\right] \\ &= \log\left(w_t(1+r_t) - r_t M_t\right) \end{aligned}$$

When the alternate asset provides a known real rate, household beliefs about inflation (specifically deviations from the true expected inflation), drive preferences for fixed-rate mortgages and the expected utility of being a homeowner is no longer independent from the

financing decision.

$$
\begin{aligned}
E_t\left[u(c_{t+1}|\text{buying with } m_t)\right] &= E_t\left[\log\left(\frac{M_{t+1}}{1+\pi_{t+1}} - \frac{m_t(1+r_t^{fix})}{1+\pi_{t+1}} + (w_t - (M_t - m_t))(1+r_t)\right)\right] \\
&= \hat{p}_{\pi_H}\hat{p}_{g_H}\log\left(\left(\frac{g_H}{1+\pi_H}\right)M_t + \left((1+r_t) - \frac{1+r_t^{fix}}{1+\pi_H}\right)m_t + x_t\right) \\
&\quad + \hat{p}_{\pi_H}(1-\hat{p}_{g_H})\log\left(\left(\frac{g_L}{1+\pi_H}\right)M_t + \left((1+r_t) - \frac{1+r_t^{fix}}{1+\pi_H}\right)m_t + x_t\right) \\
&\quad + (1-\hat{p}_{\pi_H})\hat{p}_{g_H}\log\left(\left(\frac{g_H}{1+\pi_L}\right)M_t + \left((1+r_t) - \frac{1+r_t^{fix}}{1+\pi_L}\right)m_t + x_t\right) \\
&\quad + (1-\hat{p}_{\pi_H})(1-\hat{p}_{g_H})\log\left(\left(\frac{g_L}{1+\pi_L}\right)M_t + \left((1+r_t) - \frac{1+r_t^{fix}}{1+\pi_L}\right)m_t + x_t\right)
\end{aligned}
$$

where we define the value $x_t \equiv w_t(1+r_t) - r_t M_t$, which is known at time t.

To determine how experiences impact household buy versus rent decisions, we again recognize that the utility of renting is fixed with respect to beliefs and look at how the utility of buying varies with household beliefs. Taking the derivative of the utility of buying with respect to $\hat{p}_{g_H}$, we find again that the value of being a homeowner is increasing with household beliefs of g, as this directly increases the expected return on the investment. However, taking derivatives with respect to $\hat{p}_{\pi_H}$, we find that the effect of experienced inflation is ambiguous.

To gain some more intuition on this result, we consider the simpler case when household beliefs are fixed (i.e., the household believes that $t+1$ inflation and real house price growth will be exactly what they observed in t). We denote these certain household beliefs as $\hat{\pi}_{t+1}$ and $\hat{g}_{t+1}$. Then the condition for buying with mortgage m_t instead of renting can be rewritten as

$$
\begin{aligned}
&\log\left(\left(\frac{\hat{g}_{t+1}}{1+\hat{\pi}_{t+1}}\right)M_t + \left((1+r_t) - \frac{1+r_t^{fix}}{1+\hat{\pi}_{t+1}}\right)m_t + x_t\right) \geq \log(x_t) \\
\Leftrightarrow \quad &\frac{\hat{g}_{t+1}}{1+\hat{\pi}_{t+1}}M_t + \left((1+r_t) - \frac{1+r_t^{fix}}{1+\hat{\pi}_{t+1}}\right)m_t \geq 0
\end{aligned}
$$

If the household is buying outright (i.e., $m_t = 0$), then the household chooses to buy instead of rent whenever $\hat{g}_{t+1} > 0$ and beliefs about inflation do not affect the decision. This is because we have removed the inflation-hedge motive completely, and with no fixed-rate mortgage, inflation beliefs do not play a role.

Given r_t^{fix} set by the firm, the utility of buying a house will be increasing in the value of the mortgage, m_t, whenever

$$E_t\left[\frac{1}{1+\pi_{t+1}}\right] > \frac{1}{1+\hat{\pi}_{t+1}},$$

or approximately when $\hat{\pi}_{t+1} > E_t[\pi_{t+1}]$.

Therefore, even in a model with a perfect inflation hedge, household beliefs about inflation can affect willingness to buy versus rent a home through the mortgage channel. In this framework, households are more likely to buy if they believe inflation will be higher than the firm does, but only if they can finance with a fixed-rate mortgage. In the case with no inflation-hedging motive, households are motivated to buy in order to borrow "cheaply" from the firm.

3 Data

3.1 Household Finance and Consumption Survey Data

In this paper, we use household-level microdata from the Eurosystem Household Finance and Consumption Network's Survey (HFCS). Conducted by the European Central Bank (ECB) in 2008 to 2011, this survey collected information on households' finances and consumption from 15 countries. For reasons described below, we exclude Malta and Slovenia from all analyses, resulting in a total of 13 countries in our sample: Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Italy, Luxembourg, Netherlands, Portugal, Slovakia, and Spain.

The goal of the HFCS is to collect harmonized data across the euro area, with a sample that is representative at both the euro area aggregate and individual country level. The target population is all private households and their current members residing in the national territory. Each country conducts its own survey, working to integrate the HFCS questions and methodology into any preexisting surveys of household finances and consumption.

From the HFCS microdata for each country, we obtain the age, gender, marital status, highest education level, and employment status of the household head. We also observe whether the household head has any children.

In our analyses, we measure marital status with indicator variables for the following response: single/never married, married or consensual union on a legal basis, widowed, and divorced. Highest level of education attained by household head is measured in the HFCS using the International Standard Classification of Education (ISCED 1997), a seven category

system. The HFCS education level categories are: primary or below (No formal education or below ISCED 1 or ISCED 1), lower secondary (ISCED 2), upper secondary (ISCED 3 or ISCED 4), and tertiary (ISCED 5 or ISCED 6). For comparison to the United States education system the categories can be roughly mapped as primary or below is equivalent to primary school educated, lower secondary is middle school, upper secondary is high school, and tertiary level is college educated.

We represent employment status with indicator variables indicating whether the household head is employed, unemployed, retired, or not in the work force (not retired). The indicator for not in the work force (not retired) includes household heads who are students, on sick/maternity/other leave, permanently disabled, doing compulsory military service, fulfilling domestic tasks, and other not working for pay.

At the household level, we measure net wealth and total gross income. We convert all monetary values to 2010 Euros using country-specific inflation from 2010 to the time of the survey. Approximately 40% of the sample was surveyed in 2010. We test the robustness of our main analyses to using nominal wealth and income. In addition to adjusting for inflation between survey years, we also test the robustness of our analyses to adjusting wealth and income for purchasing power parities, using 2010 OCED purchasing power parities for actual individual consumption.

While few households are missing the family characteristic and employment variables in our analysis, we do have a substantial amount of missing wealth and income data (about half of the overall sample, including all French households). For these missing data points, the ECB provides multiple imputed data. Five copies of the data are provided in which missing values are imputed via stochastic imputation which estimates missing values conditional on observed variables. We use multiple imputation techniques (Rubin (2004)) to include the full imputed sample in our analyses.

In additional analyses, we use data on the household's current home equity, calculated as current value of the property minus current mortgages with household main residence as collateral. We also use the current value of the household main residence and value at the time of purchase to calculate a real gain from homeownership due to house price appreciation.

We focus on HFCS household heads aged 20-80 at the time the surveys were conducted in 2008-2011. We exclude Malta from all analyses as data on age of household head is unavailable. We also exclude Slovenia, which had over 1800% inflation in 1987. Slovenia and Malta make up only 2% of the total sample. In our main analyses, we include all households surveyed, regardless of where the household head was born as France, Spain,

and the Netherlands do not have information whether the household head is a native of the country. In countries with this indicator, almost 90% of household heads are natives. Our main results are robust to limiting analyses to natives only.[7]

We measure survey year at the individual level, using the year the interview was actually conducted if available, and otherwise the start year of the survey period for the country.

In our baseline analyses, we use household weights provided by the European Central Bank (ECB) that are representative of each country and the EU population (inverse probability of being sampled and non-response). We also use the ECB-provided replicate weights (bootstrap weights accounting for the sampling design) for use with the multiple imputation data.

Table 1 summarizes real estate participation (as measured in the HFCS data) in the 13 countries in our sample. We find a wide range of homeownership rates across countries in our sample. Less than half of households own their main residence in Austria and Germany while homeownership rates are above 80% in Spain and Slovakia.

In Table 2, we show summary statistics for the household characteristics used in our analyses. Our sample includes almost 57,000 households across 13 countries. The average household head is 51 years old. 56% of household heads are male and 41% have children. The average net wealth, in 2010 Euros, is about 200,000 and average household income is about 36,000. 55% of household heads are married, 23% are single, and the remaining household heads are widowed or divorced. 25% of household heads are educated at the tertiary ISCED-97 level (college in the U.S.) and 43% are educated at the upper secondary level (high school in the U.S.). The remaining 32% are educated at the lower secondary level or below. 56% of household heads were employed at the time of the survey, with 6% unemployed, and 27% retired.

3.2 Inflation Data

We obtain historical inflation data from Reinhart and Rogoff (2009), Global Financial Data, and the International Monetary Fund (IMF). Reinhart and Rogoff primarily use consumer price indices (CPI). In a discussion of the calculation of the CPI by the Bureau of Labor Statistics, Greenlees and McClelland (2008) point out that the CPI is meant to capture

[7]We do not find strong evidence that experience effects are weaker for non-natives. This is not surprising given that the ECB does not provide the country of origin so we cannot tell what experiences non-natives have had. In addition, most non-natives have lived in their current country for a substantial amount of time (an average of 23 years).

housing costs. Historically this has included house prices, while more recently the CPI is designed to target housing consumption rather than investment.

For Austria, Belgium, Germany, Finland, France, Greece, Italy, Netherlands, Portugal, and Spain, we use the Reinhart-Rogoff inflation data from 1925 through 2010. We use 2011 data from the IMF, to extend the series for countries that were surveyed in 2011.

The Reinhart-Rogoff data does not include Cyprus, Luxembourg, and Slovakia, and so we use historical inflation data from Global Financial Data. Unfortunately, inflation data from Global Financial Data does not extend as far back as the Reinhart-Rogoff series. In Cyprus, data begins in 1943 (affecting household heads aged 67 and up). In Slovakia, data begins in 1964 (affecting household heads over 46).

Belgium, Germany, Greece, and Luxembourg have gaps in the inflation series in the 1940s ranging from 1 to 7 years. Inflation was linearly imputed across missing data years.

In Figure 3, we plot annual inflation from 1925-2010 for European countries in the HFCS survey, dividing countries into quartiles by homeownership rate. Quartile 1 represents the countries with the highest real estate participation rates (averaging about 80% of households) while quartile 4 is the lowest (averaging about 50% of households). Figure 3 provides suggestive evidence of a correlation between variation in inflation experiences and homeownership; countries that have high homeownership rates also tend to have had higher historical inflation.

3.3 House Price Data

We obtain nominal house price indices from the Federal Reserve Bank of Dallas. The house price index is only available from 1975 onward. The house price index for each country was chosen by the Federal Reserve Bank of Dallas to be most consistent with the quarterly U.S. house price index for existing single-family houses produced by the Federal Housing Finance Agency. In each country, the index is seasonally adjusted and normalized to a base year of 2005. Using this data we cannot compare relative house prices across countries, and instead compare house price growth. Using the fourth quarter index values, we calculate annual house price growth within each country. We subtract our measure of annual inflation to calculate real house price growth (above inflation).

House price data from the Federal Reserve Bank of Dallas was unavailable for Austria, Cyprus, Greece, Portugal, and Slovakia. Therefore, all analyses with experienced real house price growth are limited to 8 of the 13 countries we use in the HFCS data.

3.4 Housing Market Data

We obtain country level measures of housing markets close to the time of the ECB survey, summarized in Table 3.

Prevalence of variable rate mortgages is a binary variable equal to 1 if variable rate mortgages were the prevailing type of interest rate. This measure is available for all countries in the sample except for Cyprus and was also obtained from Andrews et al. (2011).

Tenant protection provides a comparative measure of tenant-landlord regulations in the private rental market in 2009 from Andrews et al. (2011). This accounts for regulation such as requirements for evicting a tenant and deposit requirements. This measure does not include rent control. Tenant protection is unavailable for Cyprus.

Rent control, obtained from Andrews et al. (2011), is a composite indicator increasing in the extent of controls of rents. Measured in 2009, this variable captures the degree to which landlords and the tenants are free to negotiate rent levels. This measures accounts for any restrictions in rent setting, such as a cap on rent price increases or restrictions on types of costs that can be passed-through to tenants. Rent control is unavailable for Cyprus and Slovakia.

Tax benefits to homeowners was measured in 2009 and provides a comparative measure of tax relief on debt financing of homeownership from Andrews et al. (2011). In particular, this measures the extent to which mortgage interest payments are deductible from taxable income and the availability of tax credits for loans. The measure of tax relief to homeowners is unavailable for Cyprus and Slovakia.

Transaction costs measures the average cost associated with purchasing a home, including transfer taxes, real estate agent fees, notary fees, legal fees, and registration fees. This measure does not account for any tax breaks available to home buyers. This measure is available for all countries in the sample except for Cyprus and was obtained from Andrews et al. (2011).

We normalize all continuous comparative housing market measures to have a mean of 0 and variance of 1 across countries in our sample. We do not normalize the binary indicator of having primarily variable rate mortgages.

4 Empirical Analysis

We test the hypothesis that experienced inflation and house price growth predict investment in the real estate market through several sets of analyses. Calculating a measure of experi-

ence, we run an OLS regression of homeownership rates on average inflation and house price experience in each country. We then do the parallel analysis at the household-level, running Logit regressions while controlling for household characteristics that are typically found to influence tenure choice.

4.1 Measures of Experience

We use the same methodology for calculating experienced inflation and experienced real house prices growth. The methodology is described in detail below for experienced inflation, but is the same for experienced house price growth, replacing annual inflation with annual real percent increases in house price indices.

As a measure of experienced inflation, we calculate a weighted average of experienced annual inflation. The weighted average consists of annual inflation (measured in percent) from year of birth to the year before the survey. Consistent with the work of Malmendier and Nagel (2011), the most recent returns are given the highest weights with linearly decreasing weights back to a weight of zero in birth year.

Specifically, the experienced inflation for household i in year t is given by

$$\pi_{i,t} = \frac{\sum_{k=1}^{age_{i,t}-1} w_{i,t}(k)\pi_{t-k}}{\sum_{k=1}^{age_{i,t}-1} w_{i,t}(k)}$$

where the weights are given by

$$w_{i,t}(k) = \frac{age_{i,t} - k}{age_{i,t}}$$

When complete data is unavailable, we sum over all available years and rescale the denominator to be the sum of weights for available data years. For experienced inflation, this applies to older households in Cyprus and Slovakia. For experienced house price growth, almost all households have incomplete experience data, as the house price data begins in 1975. This approach maintains the feature that recent years will matter more for younger than older households. In our analyses, we focus on inflation experiences due to the lack of long-run historical data available for house price experiences.

Table 4 summarizes the measure of experienced inflation constructed for households in each country of our sample. The right set of columns summarizes actual inflation in each of these countries from 1925 to the survey year. For Cyprus and Slovakia, we summarize actual inflation for all available years.

Table 5 summarizes our calculated measure of experienced house price growth and actual

house price growth calculated for the countries in our sample. Experienced real house price growth in our sample is relatively low, with an average across countries of 1.4%. Germany has the lowest real house price growth, with house prices actually falling in the majority of years since 1975.

Figure 4 shows the distribution of experienced inflation and experienced real house price growth in the sample. There are 450 households in our sample with experienced inflation above 10%, almost all coming from Greece. German households have the lowest experienced house price growth, and the only country in which households have negative experienced house prices growth.

4.2 Country Analysis

In the first set of analyses, we treat each country as an observation, collapsing to country averages using the weights representative of the population.

Figure 5 shows this data graphically in a scatter plot of the countries in our analysis with experienced inflation or house price growth (in percentage points) measured on the x-axis and the percent of households living in owner-occupied housing on the y-axis. The lines are a linear fit of the data. In both plots we see an upward trend: countries with higher average experienced inflation and higher experienced house price growth have higher homeownership rates.

We formally test these relationships using OLS regressions where the dependent variable is the weighted percentage of households who own their household main residence, or the homeownership rate. The independent variables are the weighted average of household experienced inflation and house price growth.

Table 6 show the results of this analysis. In column 1, we find that a 1pp increase in country average experienced inflation corresponds to a 6pp higher homeownership rate. This increase is statistically significant. In column 2, we find that a 1pp increase in average experienced house price growth predicts a 4pp increase in homeownership, but is only significant at the 10% level. In column 3, we use both experience measures to predict homeownership, limiting our analysis to the 8 countries with house price data. In this model, we find that a 1pp increase in experienced inflation predicts an 8pp increase in homeownership, while the effect of experienced house price growth is statistically insignificant.

4.3 Household Analysis

In addition to using aggregate experiences to predict differences in homeownership rates across countries, we also test whether experiences predict an individual's likelihood to be a homeowner. In these analyses, we have variation in experiences across individuals in different countries and also within country (by age).

We run logit regressions on the household-level data. Our key dependent variable is a binary indicator of whether the household owns their primary residence, or household-level homeownership (Own HMR). The key independent variables are household experienced inflation and real house price growth, calculated using household head's age and country as described above.

In our main specifications, we control for household demographics that are likely to be related to homeownership: age, gender, having children, marital status, educational attainment, employment status, log net wealth, and log total gross income (measured in 2010 Euros). We use the HFCS multiple imputation data, which allows us to use the full sample despite missing net wealth and gross income for some households.[8] In all analyses, we use the HFCS household weights that are representative of each country and the EU population (inverse probability of being sampled and non-response). We also use the HFCS replicate weights (bootstrap weights accounting for the sampling design) in analyses with the multiple imputation data.

In Table 7 we report the odds ratios and standard errors for our main analyses. Analyzed separately, we find that a 1pp increase in experienced inflation predicts a 28% increase in the odds of being a homeowner while a 1pp increase in experienced real house price growth predicts a 9% increase in the odds of being a homeowner. In column 3, we use both experienced inflation and house price growth to predict homeownership and find that a 1pp increase in experienced inflation predicts a 22% higher likelihood of being a homeowner while a 1pp increase in experienced house price growth predicts a 4.5% increase.

Next, we describe the relationship between homeownership and the household demographic variables. We find that age has either a slightly negative or no effect on the likelihood of homeownership. Households headed by men are significantly less likely to be homeowners. We find that married and widowed household heads are significantly more likely to own a home than single household heads. Households with a household head in the lowest education group are the most likely to be homeowners. Having a child is a strong predictor of being a homeowner. Relative to being out of the work force, we find that employed, unemployed,

[8] As a robustness, we run our main analyses on the subsample with complete data (Appendix Table 1).

and retired household heads are more likely to be homeowners. We find that net wealth is a strong predictor of homeownership, but income is negatively correlated.

One of the predictions from the theory is that without an inflation hedge motivation and with no fixed-rate mortgages, inflation beliefs will not predict homeownership. For 12 of the countries in our sample, we have a measure of whether most mortgages in the country carry variable rates (PVR, obtained from Andrews et al. (2011)). If this reflects relative supply rather than demand of variable rate mortgages (compared to fixed-rate), we would predict that in countries with primarily variable rate mortgages, experienced inflation should have less predictive power.

In Table 8, we test this hypothesis. In Column 1, we find that experienced inflation predicts an increased likelihood of homeownership in general, but the effect is attenuated in countries with primarily variable rate mortgages. Controlling for experienced house price growth, we find the same qualitative results though lose statistical significance when we limit the analysis to the 8 countries with house price data. In both regressions, we estimate higher average homeownership rates in countries with primarily variable rate mortgages. There are many possible channels for this relationship, unfortunately we cannot distinguish between them. For example, it may be that the composition of mortgages affects access to financing and thus the homeownership rate. Alternatively, homeownership rates may influence the composition of mortgages in the country (e.g., marginal homeowners are more likely to have a variable rate mortgage).

4.4 Robustness

We test the robustness of our main analyses to a number of alternative specifications.

In Appendix Table 1, we test the sensitivity of our main estimates to the use of the multiple imputation data. Using only the non-imputed data, we limit the analysis to about 40% of the sample when we control for wealth and income (Columns 1 and 2).[9] Using this limited data, the coefficient on experienced inflation is attenuated in Column 1. In Column 2, we estimate a negative coefficient on experienced inflation and an even larger coefficient on experienced house price growth. To investigate the cause of this negative coefficient on experienced inflation, in Columns 3 and 4 we estimate the model on non-imputed data without including wealth and income controls. Expanding the sample by excluding wealth and income controls, we find that the estimated coefficients on experienced inflation and house price growth in Column 4 are much more similar to the benchmark estimates reported

[9]France is excluded from these analyses as none of the respondents have available wealth data.

in Table 7. This suggests the negative coefficient in Column 2 may be due to sample selection among those respondents who reported wealth and income.

We also test the robustness of our main results to inclusion of housing market factors that may influence household tenure choice. These include the measures of tenant protection, rent control, tax benefits to homeowners, and buyer transaction costs described in Section 3. Controlling for each of these measures, we find that a 1pp increase in experienced inflation predicts about a 20-30% increase in the odds of homeownership, statistically significant at the 1% level in all regressions. The estimated coefficient on experienced house price growth is less robust to including these house price measures, and loses statistical significance when we control for rent control and tax benefits to homeowners.

In a cross-country analysis, it is important to control for country-specific market factors that may impact household tenure choice. However, it is also important to note that the market factors may evolve endogenously with homeownership. For example, if Greek households have an innate preference for homeownership, households may be more likely to own their home and support regulations and politics that favor homeownership, such as increased tax benefits to ownership. Moreover, if macroeconomic experiences drive preferences for homeownership and homeowners support different policies than renters, we may expect experiences to drive policy. For example, in a quote from the German National Report on TENLAW: Tenancy Law and Housing Policy in Multi-level Europe, Cornelius and Rzeznik (2014) write, "since renting is the dominant housing choice in Germany, the political system is highly sensitive to tenants' rights, and perceived threats to the status quo typically receive prominent media attention and political responses."

We cannot include control variables for all potentially relevant market factors (due to data availability and theoretical reasons); however, all market factors in our analysis will be at the country level, since we have only one year of data for each country. As a catch-all measure for country effects, we add country dummy variables to our baseline regressions. The results are displayed in Appendix Table 3. The variation in experienced inflation at the country level is driven exclusively by age, and so we do not attempt to identify both age and experienced inflation effects in this analysis. Because we have only one year of data for each country and because age is excluded from this analysis, these results should be interpreted with caution. In these analyses, we find that a 1pp increase in experienced inflation predicts a 9% increase in the odds of homeownership. In column 2, we find that a 1pp increase in experienced house price growth predicts a 19% increase in the odds of being a homeowner, though this is statistically insignificant. When we include both experience measures (column

3), we estimate positive statistically significant coefficients for both experience measures.

In Appendix Table 4, we test the robustness of our analyses to including survey year fixed effects. We estimate magnitudes similar to those in the benchmark estimates though when we include both experience measures, the coefficient on house price growth is statistically insignificant.

In Appendix Table 5, we test the hypothesis that inflation volatility predicts individual homeownership. We calculate individual experienced inflation volatility as the variance of inflation over the lifetime. For these analyses we exclude households in Cyprus and Slovakia for whom we do not have complete lifetime inflation data. We find that inflation volatility does predict homeownership on its own, but that the effect is completely washed out when we also include our measure of the level of experienced inflation. This suggests that the level, rather than the variance, in experienced inflation predicts homeownership.

Our results are also robust to using nominal, rather than real log income and wealth and to adjusting real log income and wealth for purchasing power parity across countries, shown in Appendix Table 6. We also test two alternative measures of wealth discussed more in depth in Appendix A.

Finally, in Appendix Table 7, we test two alternative methods of controlling for experienced inflation. In Columns 1 and 2, we use an AR(1) model as described in Malmendier and Nagel (2015) to estimate households' inflation predictions from their lifetime experienced inflation. Rather than estimating the gain parameter in our sample, we use the parameter estimated in the U.S. sample of 3.044. This analysis excludes Cyprus and Slovakia as we have incomplete inflation data. We find that the predicted inflation measure (calculated from life experiences) significantly predicts likelihood of being a homeowner, though the relationship is small in magnitude.

Because some country-year observations have very high inflation, in Columns 3 and 4 of Appendix Table 7, we use an alternative experienced inflation measure that bounds the effect of experiencing an outlier inflation year. Specifically, we cap annual inflation at 10% prior to averaging inflation over an individual's life. Using this measure of experienced capped inflation, we estimate a large effect of experienced inflation; a 1pp increase in experienced "capped" inflation predicts a 40-50% increase in the odds of being a homeowner.

Our results are robust to including age fixed effects instead of a linear effect of age and to controlling for cohort (birth) year instead of age.

5 Conclusion

In this paper we present evidence that macroeconomic experiences are correlated with households' tenure choice. In particular, we hypothesize that households overweight their own experiences when developing expectations about inflation and house prices and that this heterogeneity in expectations can explain differences in the likelihood of being a homeowner. Consistent with this hypothesis, we find correlations between experienced inflation and real house price growth and homeownership.

The results of this paper tie into the literature on the long-run effects of macroeconomic events such as high inflation and economic crises.[10] In this paper we provide evidence for correlations between homeownership and experienced inflation and house prices. If these are causal relationships, monetary policy decisions and other policies affecting home prices today may have long-lasting impacts on homeownership rates in the future.

[10]See for example DeLong and Summers (2012), Giuliano and Spilimbergo, and Oreopoulos et al. (2012).

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A Appendix: Discussion of wealth controls

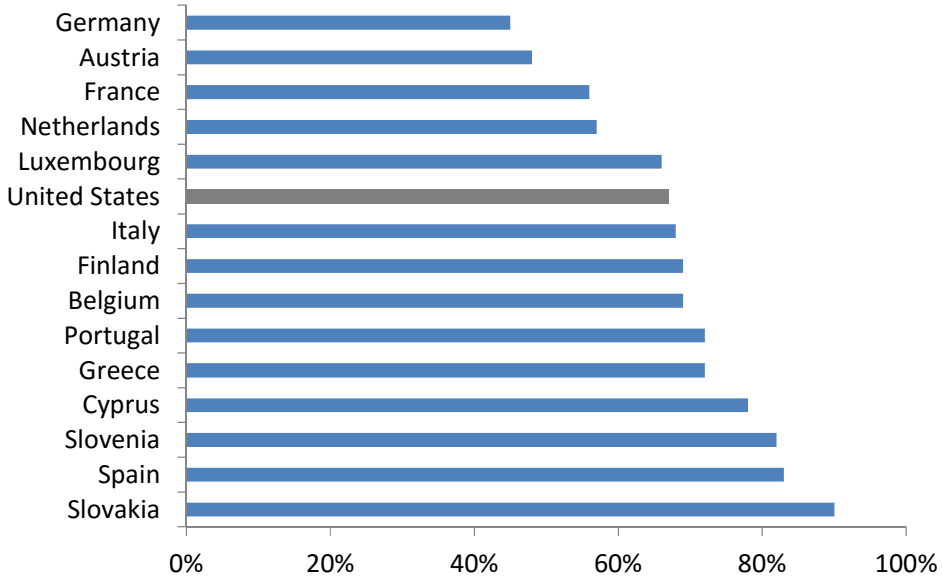
In our main analyses, we control for the log of total household net wealth at the time of the survey. One concern with including wealth as an independent variable is that wealth may be endogenous if owning a home acts as a means of forced savings or asset accumulation. Ideally, we would like to observe all household characteristics immediately before the decision to purchase or rent their home. In this idealized regression, we would not have an endogeneity problem as wealth would not be affected by tenure status.

In Columns 1 and 2 of Appendix Table 6 we try to address this endogeneity by removing home equity (current value of home minus outstanding debt) from net wealth. Experienced inflation and real house price growth continue to predict higher odds of homeownership, at statistically significant levels.

One concern with this analysis is that we are over correcting. With this definition of wealth, a household suffers a large drop in wealth immediately after purchasing a home, while we should really view those households as having the same wealth. As a way to try to improve upon the measure of wealth, we create an additional wealth variable which removes wealth accumulated from purchase date of a household's current home to the time of the survey associated with an increase in the price of the home. We can only calculate this measure for a subset of the data, so the sample size in Columns 3 and 4 is significantly smaller. Using this alternative definition of wealth, the effect of experienced inflation remains large and statistically significant; however, high experienced house price growth negatively predicts homeownership.

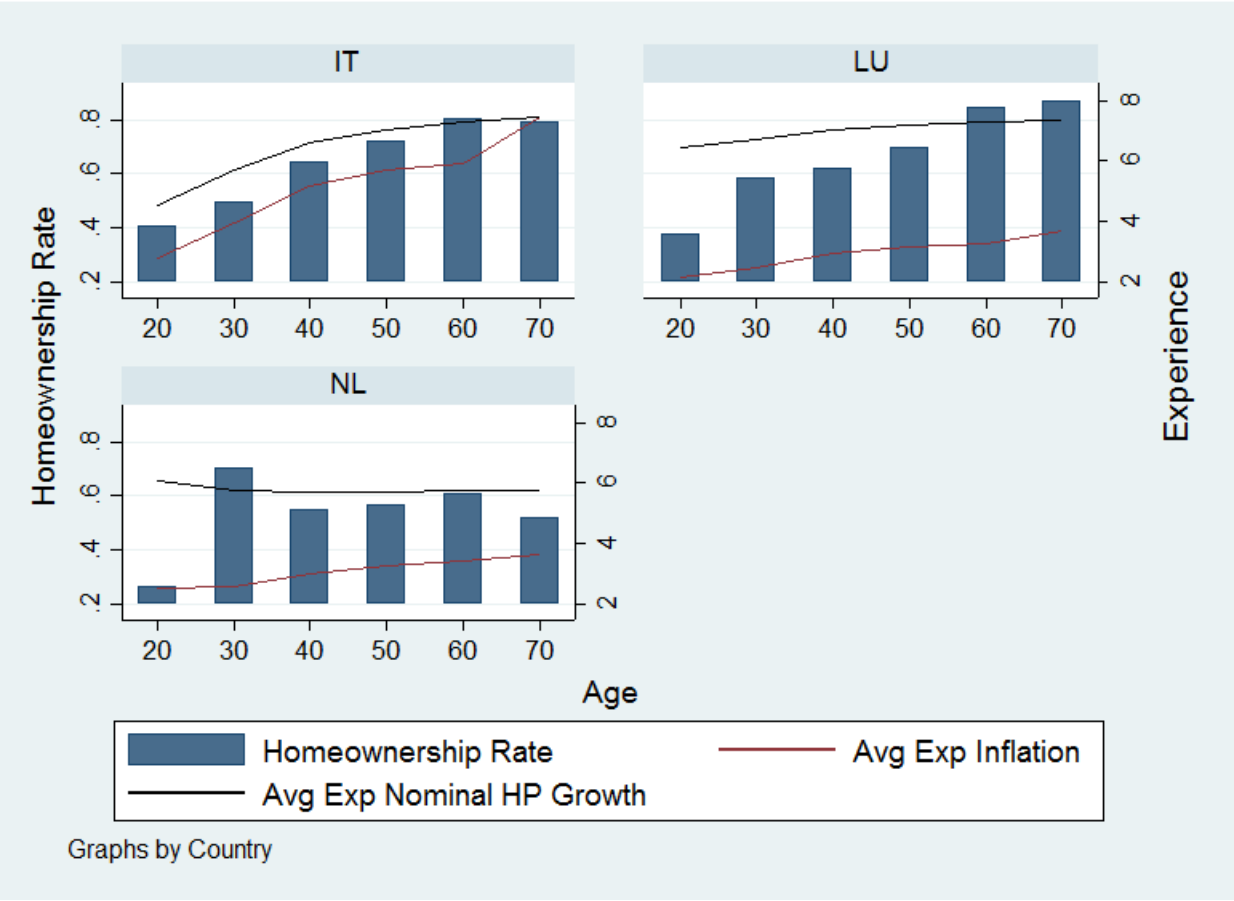
Measuring wealth net of the increase in home price is not ideal for several reasons. First, this is a noisy measure as we only observe the increase in price associated with the current home and not any previous owned property. Inertial effects in homeownership are likely to be problematic if the household currently owns, the may be more likely to have owned in the past. Another problem with this variable is that it does not account for additional investment into the home. If the value of the home increases because the homeowner invested in adding a second floor, we would subtracting more than just asset accumulation from being a homeowner. Another concern is that for homeowners, this measure does not represent their counterfactual had they not purchased their home. For example, if a household purchased their home 20 years ago, we subtract 20 years of price increases but presumably, the household would have invested their home equity elsewhere and would have received a return on their investment. For these reasons, we leave this as a robustness exercise.

Figure 1. Homeownership rates in Europe and the United States (2008-2011)



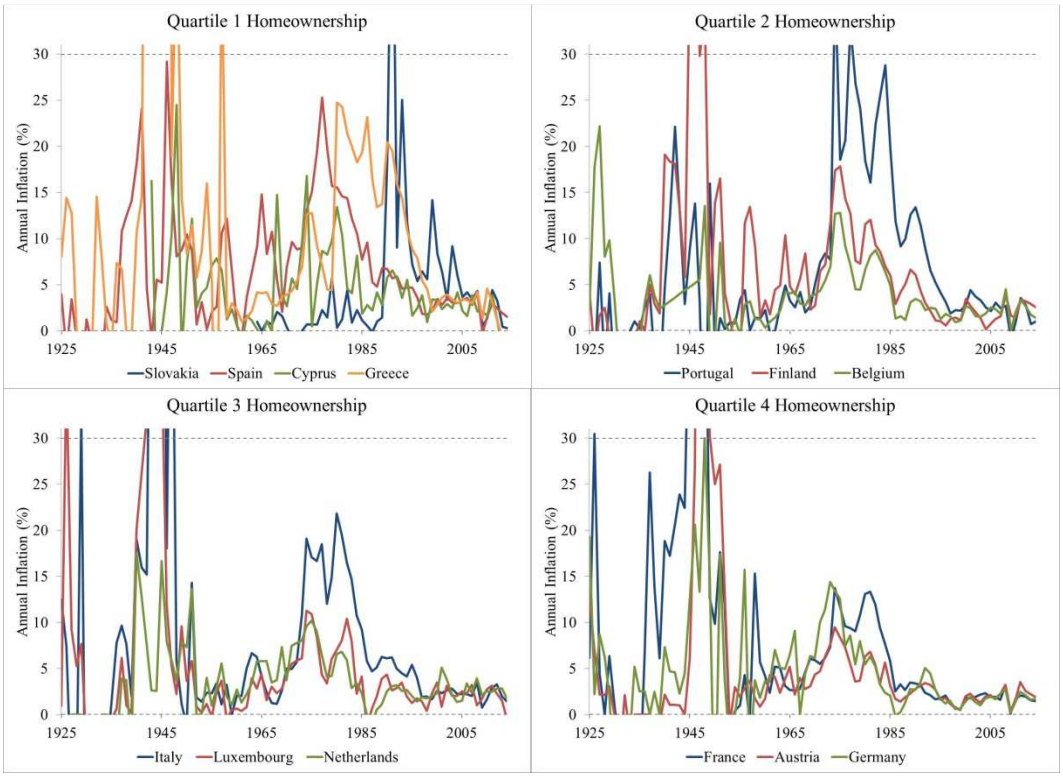
Source: ECB Household Finance and Consumption Survey and 2010 U.S. Census.

Figure 2. Homeownership and macroeconomic experiences in Italy, Luxembourg, and the Netherlands



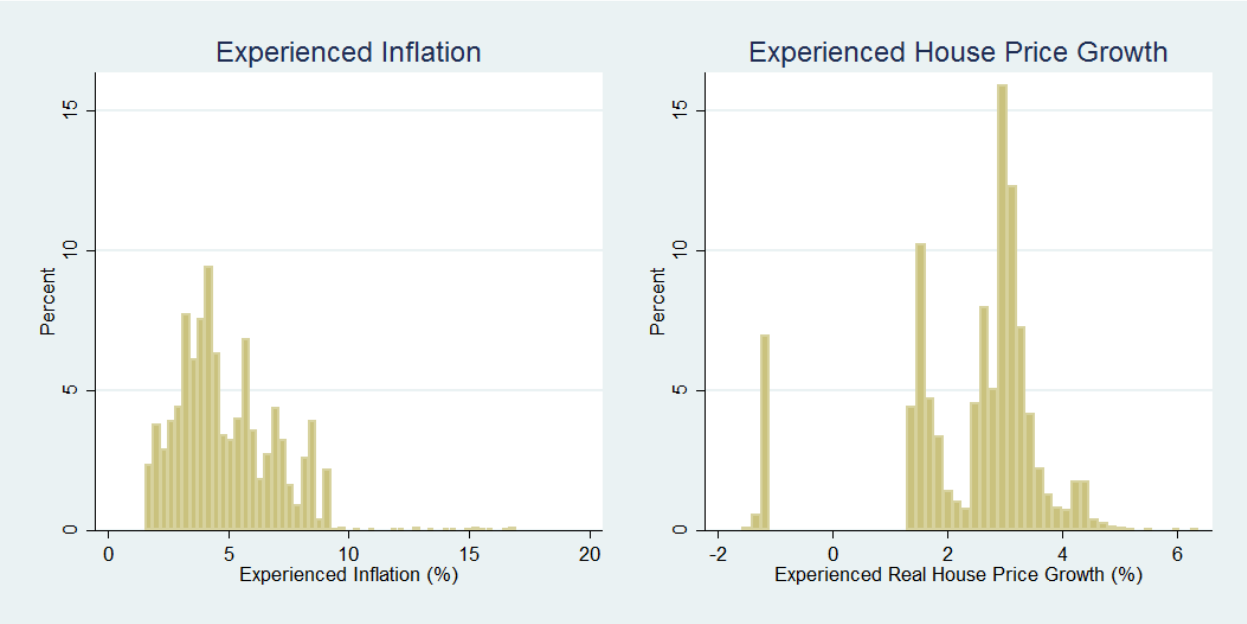
Note: Homeownership data from ECB Household Finance and Consumption Survey. Homeownership rate by age buckets plotted on the left x-axis with experienced inflation and nominal house price growth by age group plotted on the right x-axis.

Figure 3. Inflation rates, stratified by quartile of homeownership rate



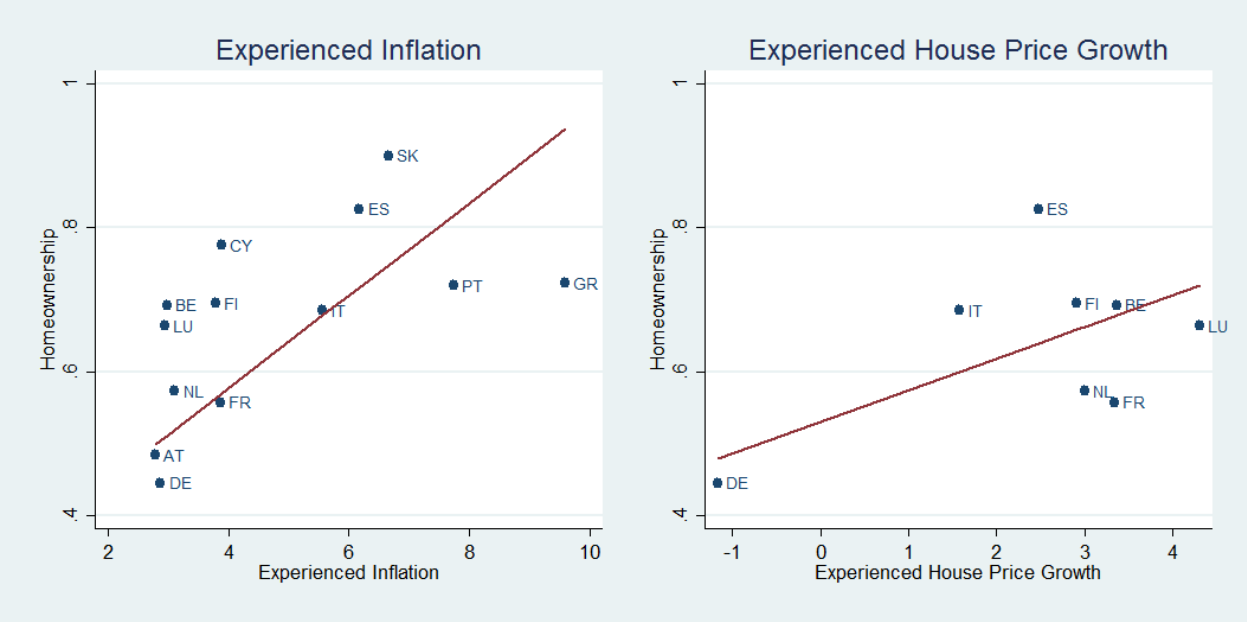
Note: Inflation data from Reinhart and Rogoff (2009) and Global Financial Data.
Inflation for chart capped above at 30% and below at 0%. Quartile 1 includes countries with the highest homeownership rates and quartile 4, the lowest.

Figure 4. Distribution of experienced inflation and real house price growth



Note: Histograms plot the distribution of experienced inflation and experienced real house price growth. House price analysis excludes Austria, Cyprus, Greece, Portugal, and Slovakia.

Figure 5. Homeownership rate by experienced inflation and real house price growth



Note: Scatter plot oh experience levels on the x-axis and homeownership rate on the y-axis. Red line shows weighted linear fit. House price analysis excludes Austria, Cyprus, Greece, Portugal, and Slovakia.

Table 1. Summary of real estate participation rates in HFCS countries

Country	Households in sample	Actual Population (M)	Year of Survey	Home-ownership Rate	Own other property (%)	Own any property (%)
Slovakia	2,056	5.4	2010	90%	15%	91%
Spain	5,717	46.6	2008	83%	37%	86%
Cyprus	1,202	1.1	2010	78%	54%	86%
Greece	2,860	11.2	2009	72%	38%	79%
Portugal	4,095	10.6	2010	72%	27%	76%
Finland	10,046	5.4	2010	69%	30%	72%
Belgium	2,164	10.9	2010	69%	16%	73%
Italy	7,243	59.3	2011	68%	26%	72%
Luxembourg	923	0.5	2010	66%	28%	74%
Netherlands	1,268	16.6	2010	57%	6%	58%
France	13,817	65.0	2009	56%	29%	62%
Austria	2,250	8.4	2010	48%	14%	53%
Germany	3,388	81.8	2010	45%	18%	49%

Note: Weighted averages are representative of the population. Table is sorted by the homeownership rate (the percent of households who own their main residence). Actual population in 2010 obtained from the World Bank. Year of survey is the start year of the survey period for that country.

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Table 2. Summary of HFCS household characteristics

Variable	Mean	Median	SD	N
Age	51	50	15.5	56,791
Male	0.56	1	0.50	56,791
Has child	0.41	0	0.49	56,791
Net wealth (2010 Euros)	206,576	100,100	492,144	31,669
Household gross income (2010 Euros)	36,407	28,419	37,302	48,244

Martial Status	Percent
Single/never married	23
Married or Consensual union on a legal basis	55
Widowed	10
Divorced	11

Education Level (ISCED-97 classification)	Percent
Primary or below	17
Lower secondary	15
Upper secondary	43
Tertiary	25

Employment Status	Percent
Employed	56
Unemployed	6
Retired	27
Other out of workforce	11

Note: HFCS sample summary statistics weighted to be representative of the population.

Table 3. Summary of housing market measures from Andrews et al. (2011)

Country	Households in sample	Home-ownership Rate	PVR	Tenant Protection	Rent Control	Tax Benefits
Slovakia	2,056	90%	1	-1.25		
Spain	5,717	83%	1	0.79	-0.65	0.03
Cyprus	1,202	78%				
Greece	2,860	72%	1	1.39	-0.43	0.93
Portugal	4,095	72%	1	1.07	-0.10	-0.70
Belgium	2,164	69%	1	-0.65	-1.53	0.91
Finland	10,046	69%	0	-1.05	-0.65	0.45
Italy	7,243	68%	0	0.15	-0.65	-0.86
Luxembourg	923	66%	1	-1.35	0.23	-0.78
Netherlands	1,268	57%	0	-0.95	1.88	2.06
France	13,817	56%	0	0.80	-0.10	-0.09
Austria	2,250	48%	0	0.91	0.45	-0.80
Germany	3,388	45%	0	0.13	1.55	-1.16

Note: Table is sorted by the homeownership rate (the percent of households who own their main residence). Household in sample and homeownership rate from HFCS sample. Housing market variables were obtained from Andrews et al. (2011). Prevalence of variable rate mortgages (PVR) is a binary variable equal to 1 if variable rate were the prevailing type of interest rate on mortgages. Tenant protection is a comparative measure of tenant-landlord regulations. Rent control is a composite indicator increasing in the extent of controls of rents. Tax benefits is a comparative measure of the tax relief on debt financing of homeownership. Transaction costs measures the average cost associated with purchasing a home, including transfer taxes, real estate agent fees, notary fees, legal fees, and registration fees. Tenant protection, rent control, and tax benefits are normalized to have a mean of 0 and variance of 1 across countries in our sample.

Table 4. Summary of experienced and actual annual inflation by country

	Experienced Inflation (%)				Actual Inflation (%)		
Country	**Mean**	**Median**	**SD**	**N**	**Mean**	**Median**	**SD**
AT	2.8	2.8	0.7	2,249	5.9	2.7	13.2
BE	3.0	3.2	0.5	2,164	3.7	2.9	4.3
CY	3.9	4.1	0.4	1,202	4.7	3.8	5.0
DE	2.9	3.0	0.7	3,388	4.2	3.5	7.2
ES	6.2	6.5	1.0	5,717	7.0	5.5	6.6
FI	3.8	4.1	1.2	10,046	6.6	4.0	9.8
FR	3.9	4.0	1.1	13,817	8.3	4.5	12.2
GR	9.6	9.1	2.5	2,860	26.8	7.0	87.3
IT	5.6	5.7	1.2	7,243	12.1	4.7	39.6
LU	2.9	3.0	0.4	922	5.5	2.8	9.7
NL	3.1	3.2	0.4	1,268	3.4	2.9	4.3
PT	7.7	8.3	1.3	4,095	6.5	3.3	9.5
SK	6.7	6.6	0.6	2,056	5.2	2.2	9.1
Total	4.4	3.9	2.0	57,027			

Note: Experienced inflation summary statistics are weighted to a representative population. Actual inflation is based on annual inflation from 1925 to the year prior to the survey year (Cyprus begins in 1943 and Slovakia begins in 1964).

Table 5. Summary of experienced and actual annual house price growth by country

	Experienced Real House Price Growth (%)				Actual Real House Price Growth (%)		
Country	**Mean**	**Median**	**SD**	**N**	**Mean**	**Median**	**SD**
BE	3.4	3.2	0.4	2,164	2.8	4.1	6.3
DE	-1.2	-1.2	0.1	3,388	-1.1	-0.9	1.9
ES	2.5	2.2	0.9	5,717	1.0	3.5	14.3
FI	2.9	2.8	0.4	10,046	2.3	3.3	8.6
FR	3.3	3.2	0.5	13,817	2.7	4.1	5.7
IT	1.6	1.5	0.1	7,243	1.4	1.0	8.7
LU	4.3	4.3	0.1	922	4.4	4.9	6.8
NL	3.0	2.9	0.2	1,268	3.0	3.6	9.6
Total	1.4	1.7	1.9	44,565			

Note: Experienced house price growth summary statistics are weighted to a representative population. Actual house price growth is based on annual house price growth above inflation from 1975 to the year before the survey year.

Table 6. Country Level OLS Regression of Homeownership on Experience

	(1) Homeownership	(2) Homeownership	(3) Homeownership
Experienced Inflation	0.064***		0.079***
	(0.020)		(0.020)
Experienced Real House Price Growth		0.044*	0.019
		(0.022)	(0.014)
Constant	0.319***	0.531***	0.239**
	(0.089)	(0.036)	(0.070)
Observations	13	8	8
R^2	0.652	0.395	0.869

Note: OLS regression coefficients with standard errors in parentheses. Data is the HFCS non-imputed data, using representative weights. Dependent variable is the weighted percent of household who own their main residence. House price analysis excludes Austria, Cyprus, Greece, Portugal, and Slovakia.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7. Logit of household-level homeownership on macroeconomic experiences

Dependent Var: Own HMR	(1)	(2)	(3)
Experienced Inflation	1.283***		1.220***
	(0.023)		(0.035)
Experienced Real House Price Growth		1.094***	1.045**
		(0.020)	(0.019)
Age	0.988***	1.004	0.992*
	(0.004)	(0.005)	(0.005)
Male	0.823***	0.795***	0.802***
	(0.059)	(0.064)	(0.065)
Married	1.698***	1.837***	1.773***
	(0.187)	(0.222)	(0.216)
Widow	1.653***	1.696***	1.683***
	(0.273)	(0.312)	(0.311)
Divorced	0.994	1.030	1.033
	(0.130)	(0.148)	(0.149)
Educ:2 (middle school)	0.691***	0.594***	0.653***
	(0.073)	(0.071)	(0.078)
Educ:3 (high school)	0.805**	0.638***	0.771**
	(0.083)	(0.075)	(0.095)
Educ:5 (college)	0.541***	0.425***	0.517***
	(0.063)	(0.055)	(0.069)
Has Child	1.312***	1.378***	1.285***
	(0.105)	(0.124)	(0.116)
Employed	1.341***	1.317**	1.287**
	(0.151)	(0.165)	(0.162)
Unemployed	1.714***	1.825***	1.769***
	(0.305)	(0.356)	(0.353)
Retired	1.562***	1.367**	1.467**
	(0.213)	(0.208)	(0.220)
Log real net wealth	5.007***	5.187***	5.041***
	(0.219)	(0.254)	(0.248)
Log real income	0.642***	0.661***	0.705***
	(0.045)	(0.050)	(0.054)
Imputed Data?	Yes	Yes	Yes
Observations	53,981-54,019	42,231-42,256	42,231-42,256
Countries	13	8	8

Note: Table reports exponentiated coefficients (odds ratios) from logit regressions with standard errors in parentheses. Data is the HFCS multiple imputation data, using representative and replicate weights. Dependent variable is an indicator for owning the household main residence (Own HMR). The reference groups for demographic variables are education level of primary or below according to the ISCED-97 categorizations, single/never married, and out of the work force (not retired). House price analysis excludes Austria, Cyprus, Greece, Portugal, and Slovakia. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8. Logit regression of household-level homeownership on interaction between experienced inflation and primarily variable rate mortgages

	(1) Own HMR	(2) Own HMR
Experienced Inflation	1.082***	1.052
	(0.030)	(0.032)
Experienced Inflation X PVR	0.909***	0.813***
	(0.030)	(0.049)
PVR	5.985***	9.893***
	(1.183)	(3.294)
Experienced Real House Price Growth		1.028
		(0.019)
Demographic Controls	Yes	Yes
Imputed Data?	Yes	Yes
Observations	52,853-52,889	42,231-42,256
Countries	12	8

Note: Table reports exponentiated coefficients (odds ratios) from logit regressions with standard errors in parentheses. Data is the HFCS multiple imputation data, using representative and replicate weights. PVR is an indicator for having primarily variable rate mortgages in the country. Dependent variable is an indicator for owning the household main residence (Own HMR). Demographic controls include household head age, gender, marital status, whether the household head has any children, education level, employment status, log net wealth, and log income. Table excludes Cyprus for missing PVR. House price analysis also excludes Austria, Greece, Portugal, and Slovakia.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table 1. Household-level logit regressions: non-imputed data

Dependent Var: Own HMR	(1)	(2)	(3)	(4)
Experienced Inflation	1.041***	0.756***	1.118***	1.306***
	(0.014)	(0.023)	(0.007)	(0.016)
Experienced Real House Price Growth		1.813***		1.190***
		(0.044)		(0.011)
Age	0.997	1.038***	1.045***	1.038***
	(0.002)	(0.004)	(0.001)	(0.002)
Male	0.812***	0.839***	1.105***	1.079***
	(0.038)	(0.047)	(0.024)	(0.027)
Married	1.153**	1.396***	2.118***	2.335***
	(0.075)	(0.107)	(0.060)	(0.076)
Widow	1.400***	1.413***	0.996	1.034
	(0.146)	(0.175)	(0.045)	(0.054)
Divorced	0.934	0.962	0.713***	0.733***
	(0.078)	(0.093)	(0.026)	(0.031)
Educ:2 (middle school)	0.699***	0.532***	1.616***	1.783***
	(0.056)	(0.053)	(0.056)	(0.072)
Educ:3 (high school)	0.735***	0.532***	2.050***	2.483***
	(0.058)	(0.056)	(0.063)	(0.091)
Educ:5 (college)	0.630***	0.441***	3.103***	3.610***
	(0.057)	(0.051)	(0.106)	(0.143)
Has Child	1.189***	1.309***	1.434***	1.320***
	(0.063)	(0.085)	(0.034)	(0.037)
Employed	1.226***	1.398***	1.323***	1.358***
	(0.090)	(0.119)	(0.045)	(0.054)
Unemployed	1.321**	1.396***	0.686***	0.647***
	(0.148)	(0.180)	(0.034)	(0.037)
Retired	1.297***	1.235**	0.900**	0.971
	(0.120)	(0.131)	(0.038)	(0.047)
Log real net wealth	4.404***	4.599***		
	(0.091)	(0.113)		
Log real income	0.760***	0.859***		
	(0.026)	(0.037)		
Imputed Data?	No	No	No	No
Observations	26,745	21,301	56,788	44,352
Countries	12	7	13	8
Pseudo R^2	0.524	0.555	0.124	0.144

Note: Table reports exponentiated coefficients (odds ratios) from logit regressions with standard errors in parentheses. Data is the HFCS non- imputed data, using representative weights. Dependent variable is an indicator for owning the household main residence (Own HMR). The reference groups for demographic variables are education level of primary or below according to the ISCED-97 categorizations, single/never married, and out of the work force (not retired). House price analyses excludes Austria, Cyprus, Greece, Portugal, and Slovakia. France excluded from all analyses with net wealth. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table 2. Household-level logit regressions: robustness to including housing market measures

Dependent Var: Own HMR	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Experienced Inflation	1.337***	1.258***	1.191***	1.155***	1.220***	1.289***	1.307***	1.205***
	(0.025)	(0.040)	(0.021)	(0.045)	(0.022)	(0.042)	(0.023)	(0.035)
Experienced Real House Price Growth		1.040**		1.023		0.955		1.102***
		(0.019)		(0.023)		(0.029)		(0.026)
Tenant Protection	0.710***	0.853***						
	(0.029)	(0.049)						
Rent Control			0.914***	0.904**				
			(0.029)	(0.045)				
Tax Benefits					1.134***	1.249***		
					(0.039)	(0.076)		
Buyer Trans Cost							0.768***	0.744***
							(0.025)	(0.043)
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Imputed Data?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	52,853-52,889	42,231-42,256	50,865-50,900	42,231-42,256	50,865-50,900	42,231-42,256	52,853-52,889	42,231-42,256
Countries	12	8	11	8	11	8	12	8

Note: Table reports exponentiated coefficients (odds ratios) from logit regressions with standard errors in parentheses. Data is the HFCS multiple imputation data, using representative and replicate weights. Dependent variable is an indicator for owning the household main residence (Own HMR). Demographic controls include household head age, gender, marital status, whether the household head has any children, education level, employment status, log net wealth, and log income. Housing market variables were obtained from Andrews et al. (2011). Tenant protection is a comparative measure of tenant-landlord regulations. Rent control is a composite indicator increasing in the extent of controls of rents. Tax benefits is a comparative measure of the tax relief on debt financing of homeownership. Transaction costs measures the average cost associated with purchasing a home. Housing market variables are normalized to have a mean of 0 and variance of 1 across countries in our sample. House price analysis excludes Austria, Cyprus, Greece, Portugal, and Slovakia.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table 3. Household-level logit regressions: robustness to including country fixed effects

	(1) Own HMR	(2) Own HMR	(3) Own HMR
Experienced Inflation	1.093**		1.186**
	(0.046)		(0.084)
Experienced Real House Price Growth		1.189	1.418**
		(0.132)	(0.194)
Demographic Controls	Yes (no age)	Yes (no age)	Yes (no age)
Country FE	Yes	Yes	Yes
Imputed Data?	Yes	Yes	Yes
Observations	53,981-54,019	42,231-42,256	42,231-42,256
Countries	13	8	8

Note: Table reports exponentiated coefficients (odds ratios) from logit regressions with standard errors in parentheses. Data is the HFCS multiple imputation data, using representative and replicate weights. Dependent variable is an indicator for owning the household main residence (Own HMR). Demographic controls include household head age, gender, marital status, whether the household head has any children, education level, employment status, log net wealth, and log income. House price analysis also excludes Austria, Cyprus, Greece, Portugal, and Slovakia.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table 4. Household-level logit regressions: robustness to including survey year fixed effects

	(1) Own HMR	(2) Own HMR	(3) Own HMR
Experienced Inflation	1.281***		1.268***
	(0.023)		(0.047)
Experienced Real House Price Growth		1.076***	1.009
		(0.025)	(0.027)
Demographic Controls	Yes	Yes	Yes
Survey Year FE	Yes	Yes	Yes
Imputed Data?	Yes	Yes	Yes
Observations	53,981-54,019	42,231-42,256	42,231-42,256
Countries	13	8	8

Note: Table reports exponentiated coefficients (odds ratios) from logit regressions with standard errors in parentheses. Data is the HFCS multiple imputation data, using representative and replicate weights. Dependent variable is an indicator for owning the household main residence (Own HMR). Demographic controls include household head age, gender, marital status, whether the household head has any children, education level, employment status, log net wealth, and log income. House price analysis also excludes Austria, Cyprus, Greece, Portugal, and Slovakia.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table 5. Household-level logit regressions: controlling for experienced inflation volatility

	(1) Own HMR	(2) Own HMR
Experienced Inflation Volatility	1.0002***	1.0000
	(0.0000)	(0.0000)
Experienced Inflation		1.2731***
		(0.0239)
Demographic Controls	Yes	Yes
Imputed Data?	Yes	Yes
Observations	53,080-53,118	53,080-53,118
Countries	13	13

Note: Table reports exponentiated coefficients (odds ratios) from logit regressions with standard errors in parentheses. Data is the HFCS multiple imputation data, using representative and replicate weights. Dependent variable is an indicator for owning the household main residence (Own HMR). Experienced inflation volatility is the variance of annual experienced inflation over the lifetime. Demographic controls include household head age, gender, marital status, whether the household head has any children, education level, employment status, log net wealth, and log income. Excludes households with incomplete inflation data in Cyprus and Slovakia.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table 6. Household-level logit regressions: alternative household wealth measures

	(1) Own HMR	(2) Own HMR	(3) Own HMR	(4) Own HMR	(5) Own HMR	(6) Own HMR	(7) Own HMR	(8) Own HMR
Experienced Inflation	1.498***	1.579***	1.518***	1.714***	1.289***	1.215***	1.233***	1.168***
	(0.019)	(0.033)	(0.025)	(0.042)	(0.023)	(0.034)	(0.021)	(0.033)
Experienced Real House Price Growth		1.091***		0.911***		1.054***		1.078***
		(0.012)		(0.014)		(0.019)		(0.020)
Log real net wealth minus home equity	1.404***	1.421***						
	(0.025)	(0.029)						
Log real net wealth minus house price appreciation			3.057***	3.079***				
			(0.108)	(0.129)				
Log nominal net wealth					5.011***	5.042***		
					(0.220)	(0.248)		
Log real net wealth (PPP-adjusted)							5.056***	5.037***
							(0.224)	(0.246)
Demographic Controls	Yes	Yes	Yes	Yes	Yes (nominal income)	Yes (nominal income)	Yes (PPP-adj income)	Yes (PPP-adj income)
Imputed Data?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	52,046-52,080	40,755-40,778	35,740-35,792	24,124-24,146	53,981-54,019	42,231-42,256	52,853-52,889	42,231-42,256
Countries	13	8	13	8	13	8	12	8

Note: Table reports exponentiated coefficients (odds ratios) from logit regressions with standard errors in parentheses. Data is the HFCS multiple imputation data, using representative and replicate weights. Dependent variable is an indicator for owning the household main residence (Own HMR). Demographic controls include household head age, gender, marital status, whether the household head has any children, education level, employment status, and log real income (unless otherwise noted). Column 1 only includes households with current home price. Column 2 only includes households who reported the purchase price of their home. House price analysis also excludes Austria, Cyprus, Greece, Portugal, and Slovakia. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table 7. Household-level logit regressions: alternative definitions of inflation experience

	(1) Own HMR	(2) Own HMR	(3) Own HMR	(4) Own HMR
Predicted Inflation (AR1 Model)	1.009***	1.007***		
	(0.002)	(0.002)		
Experienced Inflation (capping each year at 10%)			1.500***	1.398***
			(0.047)	(0.060)
Experienced Real House Price Growth		1.092***		1.025
		(0.020)		(0.019)
Demographic Controls	Yes	Yes	Yes	Yes
Imputed Data?	Yes	Yes	Yes	Yes
Observations	50,834-50,869	42,213-42,238	53,981-54,019	42,231-42,256
Countries	11	8	13	8

Note: Table reports exponentiated coefficients (odds ratios) from logit regressions with standard errors in parentheses. Data is the HFCS multiple imputation data, using representative and replicate weights. Dependent variable is an indicator for owning the household main residence (Own HMR). Predicted inflation is predicted from experienced inflation using an AR(1) model, not calculated for Slovakia or Cyprus. Experienced Inflation (capping each year at 10%) constructs a weighted average of capped inflation for each household. Demographic controls include household head age, gender, marital status, whether the household head has any children, education level, employment status, log net wealth, and log income. House price analysis also excludes Austria, Cyprus, Greece, Portugal, and Slovakia.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.