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ARTICLE

The mortgage rate channel of monetary policy transmission: A tale of two countries

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Abstract

We study the mortgage rate channel of monetary policy transmission under two different mortgage regimes by analyzing the United States with primarily long-term fixed-rate mortgages (FRMs) and Spain with mainly annually resetting adjustable-rate mortgages (ARMs). We find a robust transmission of mortgage rate changes to spending in both regimes, with marginal propensities to consume ranging between 0.58–0.67 in Spain and 0.27–0.52 in the United States. Under ARMs, transmission is stronger when rate changes are expected to persist, whereas under FRMs, the effect is larger when rate changes are expected to revert. We further document the important role of mortgage type in shaping the variation in transmission across mortgagors—while the mortgage rate effect is fairly homogeneous across diverse household characteristics under ARMs, it is more heterogeneous under FRMs and largest among potential refinancers.

Keywords: Consumption; intertemporal household choice; monetary policy transmission; adjustable-rate mortgages; fixed-rate mortgages

1. Introduction

In this paper, we study how mortgage institutions shape the transmission of monetary policy to household consumption through mortgage rate changes, with a special focus on the mortgage cash flow effect—that is, the change in consumption due to a change in mortgage payments. Specifically, we analyze the effect across two countries, Spain and the United States, with very different mortgage institutional settings. Indeed, most households in Spain hold adjustable-rate mortgages (ARMs) with automatic annual resets whether interest rates rise or fall. In comparison, the US mortgage market is dominated by fixed-rate mortgages (FRMs), where mortgagors must actively refinance to realize any savings from lower interest rates but do not face higher mortgage interest costs when rates rise. These different institutional frameworks could lead to meaningful differences in the impact of monetary policy on consumption between the two countries.

To estimate the impact of mortgage rate changes on expenditure growth, we use household-level expenditure survey data and exploit variation in mortgage rates during the period households remain in the survey. Given that mortgagors (homeowners with a current mortgage) in the United States must actively refinance to benefit from mortgage rate declines and FRMs offer relative protection against mortgage rate increases, one might expect more muted effects relative to Spain. We find a robust transmission of mortgage rate changes to consumption in both countries, but the transmission depends on the expected path of interest rate changes. Rate declines have larger effects in Spain when they are expected to persist, while they have larger effects in the United States

when they are expected to revert. We also go beyond the average response and document heterogeneity in the effects among mortgagors within and across countries. The consumption response to mortgage rate changes in Spain is quite homogeneous across mortgagor characteristics due to automatic resets, while the response is heterogeneous in the United States, with larger effects for households who potentially benefit the most from refinancing and can do so.

Overall, the documented patterns are consistent with the different mortgage instruments dominant in the two countries. However, we also find strong mortgage rate effects for nonmortgagors and build a model to better understand the various channels through which mortgage rate changes may affect household consumption. Since mortgage rates do not necessarily move in isolation with other interest rates, channels other than the mortgage cash flow effect are simultaneously at play. Our model is based on Slacalek et al. (2020), with a representative household that has net short-term and long-term debt. The household is subject to a standard intertemporal budget constraint, and its long-term debt (mortgage) follows a typical amortization structure. The model shows that the direct effect of mortgage rate changes on consumption can be decomposed into the sum of an intertemporal substitution (IES) effect, a cash flow effect due to the net interest exposure of the household's short-term positions (including nonhousing debt), and a cash flow effect due to the interest exposure of the household's long-term debt (mortgage). Thus, the model suggests that the estimated consumption impact for nonmortgagors could be driven by a combination of IES and nonmortgage cash flow effects.

Given the predictions of the model, we analyze the transmission of mortgage rate changes to household-level spending for all households together, as well as separately by household type, defined by net short-term nonmortgage debt and marginal propensities to consume (MPC). Specifically, following the approach of Cloyne et al. (2020), we estimate our baseline regressions for three different groups of households: outright homeowners, homeowners with a mortgage (mortgagors), and renters. We use data from the *Encuesta de Presupuestos Familiares–Base 2006* (EPCF–2006) for Spain and from the *Consumer Expenditure Survey* (CEX) for the United States. Our approach exploits the variation in the timing of households' interviews (households are exposed to different rate changes over the period in which they remain in the survey) to estimate the impact of (lagged) mortgage rate changes on expenditure growth. We simultaneously control for changes in other factors that could impact expenditure growth, including income growth and local and aggregate economic conditions. Although lagged mortgage rate changes are likely exogenous with respect to expenditure growth at the household level, we also compute instrumental variable (IV) estimates of the mortgage rate effect using shocks to the mortgage reference rates around monetary policy meetings as instruments. The advantages of this IV strategy are twofold. First, it helps identify the impact of monetary policy shocks operating through mortgage rate changes in each country. Second, it isolates changes in mortgage rates that are due to monetary policy surprises and not other factors.

When pooling all households together, we find that a one percentage point (p.p.) decrease in the mortgage rate leads to 1.74 (1.65) p.p. higher expenditure growth in Spain and 1.30 (2.56) p.p. higher expenditure growth in the United States under the OLS (IV) specification.[1] For the average mortgagor, for whom the mortgage cash flow channel likely dominates the other mortgage rate channels, these estimates translate into an MPC out of implied mortgage cash flows of 0.61 (0.58) in Spain and 0.27 (0.52) in the United States, respectively.[2] We also find a negative relationship between mortgage rate changes and expenditure growth for all three groups of households in each country (with renters in both countries the least sensitive). Our finding of a large and significant impact of mortgage rate changes on the expenditure growth of nonmortgagors highlights the relevance of mortgage rate channels of monetary policy transmission to consumption other than the mortgage cash flow effect.

To better understand the role of institutional differences in determining the transmission of monetary policy to consumption, we focus on mortgagors and investigate whether the effects of mortgage rate changes in the United States and in Spain are homogeneous, symmetric, and

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dependent on the expected path of interest rates. With automatic mortgage rate resets for most mortgagors in Spain, we expect similar effects across household types (other things equal). In contrast, the need to actively refinance an FRM to take advantage of lower rates in the United States implies that the effects are likely less homogeneous. Indeed, we find that the consumption response in Spain is quite homogeneous for mortgagors, irrespective of their age, education, income, house size, and other economic and demographic characteristics. In contrast, the consumption response to mortgage rate changes is somewhat more heterogeneous among mortgagors in the United States, with the greatest effects for those who have likely refinanced or have the most to gain from doing so. Regarding symmetry, automatic mortgage rate (and mortgage payment) resets should imply similar effects of rate increases and rate decreases for households in Spain. In contrast, mortgage rate increases should have less of an effect than rate decreases in the United States, as refinancing is potentially desirable only when rates decline. Although we offer suggestive evidence that this might be the case, our sample period is dominated by rate declines, which limits us from providing definitive evidence in this regard. Additionally, with automatic rate resets in Spain, we expect rate declines to have larger effects when they are expected to persist, whereas in the United States, mortgagors may be more inclined to refinance if they anticipate less favorable future refinancing opportunities. Indeed, we find that rate declines have larger effects in Spain when they are expected to persist, while they have a bigger impact in the United States when they are expected to revert.

Overall, our analysis points to a robust transmission of rate changes to expenditure growth under both ARMs and FRMs. This occurs through a mix of IES, mortgage cash flow effects, and nonmortgage cash flow effects. We further find that the mortgage market setting matters for the variation of the effect *across* mortgagors within a country and depends on the expected path of mortgage rates. While the effect of mortgage cash flow is automatic and homogeneous under ARMs, it is the result of active refinancing and more heterogeneous under FRMs. To our knowledge, we are the first to document such variation among mortgagors.

1.1 Choice of countries and related literature

Our choice to study the transmission of monetary policy to consumption in the United States and Spain is to a great extent dictated by data availability. However, there are three additional reasons behind this decision. First, Spain and the United States are at opposite ends of the spectrum in terms of mortgage institutional settings. Over 90% of mortgages in Spain were true ARMs during our sample period, while roughly 90% of mortgages in the United States were FRMs.[3] Second, within-country comparisons of interest rate effects across mortgage types are difficult. Although ARMs exist in the United States, they are much less common and typically have an extended initial fixed term (often 5, 7, or 10 years) before they reset. Thus, ARM mortgagors in the United States do not necessarily experience a rate reset soon after a policy rate change. FRMs exist in Spain, typically with a shorter duration than in the United States, but self-selection into a minority product is always a concern when interpreting results. Third, the divergent institutional settings of mortgages in the United States and Spain are primarily the result of differences in financial market development, namely loan securitization, thereby making the variation in mortgage types between countries exogenous to household choice.[4]

The comparison of effects between the United States and Spain is subject to some caveats.[5] It is possible that nonmortgage institutional differences between the two countries impact how mortgagors respond to mortgage rate changes, which makes it difficult to disentangle the role of mortgage institutional differences in driving the results. In addition, our analysis is focused on a sample period during which policy rates were mostly declining. We might reach different conclusions regarding the differences in average effects between the two countries during extended periods of interest rate increases. Despite these caveats, we make a novel contribution by showing

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how the mortgage setting matters for the variation of the effect based on the expected path of mortgage rates and *across* households within a country.

Our analysis relates to multiple strands of a growing literature on the transmission of monetary policy to consumption via changes in mortgage rates. First, we complement studies that directly analyze cash flow channels (mortgage and nonmortgage) of monetary policy transmission. La Cava et al. (2016) use household-level panel data from Australia to quantify a borrower channel (lower interest rates increase cash flow by reducing interest payments on net liabilities) and a lender channel (lower interest rates decrease cash flow by reducing interest receipts on net assets). They find that the borrower channel is stronger overall, so a rise in interest rates is contractionary. Flodén et al. (2021) use Swedish household data and find that borrower cash flow channels are strongest when households are highly indebted and have adjustable-rate loans. The main advantage of this paper relative to ours is that the authors have access to detailed household balance sheet information, both assets and liabilities, including loan balances and interest payments on loans (although they cannot tell whether a given loan is a mortgage or other type of debt). However, they lack direct data on household expenditures, which instead they must impute using balance sheet information. In contrast, we have very detailed household expenditure data but limited household balance sheet information and rely on homeownership and mortgage holding information to estimate the mortgage cash flow effect. Our analysis complements these two studies by analyzing this effect in two additional countries that lie at opposite ends of the spectrum in terms of their mortgage institutional settings.[6]

Second, we analyze how mortgage institutions and mortgage rate changes more generally impact consumption by comparing differently indebted households within the same country. Here, our study is closest to Cloyne et al. (2020), who compare the transmission of monetary policy in the United States versus the United Kingdom using housing tenure status as a proxy for household debt positions. However, our approach and analysis differ on many dimensions. While the empirical specification in Cloyne et al. (2020) is at the pseudo-housing tenure group level, our analysis is at the household-level. In addition, their paper's main focus is the potential heterogeneity across the pseudo-housing tenure groups in the response of income and expenditure to interest rate changes, while our goal is to identify the mortgage cash flow effect, which is a partial equilibrium effect (as we show in our model) and crucially requires controlling for income changes at the household level. Finally, the analysis in Cloyne et al. (2020) stops in 2007 to avoid the zero-lower-bound period, while our analysis covers 2007 to 2018. We therefore complement their work by exploring the mortgage cash flow channel during a period of low interest rates.

Third, we contribute to the existing literature that analyzes the causal effect of mortgage rate changes on expenditure. For example, Di Maggio et al. (2017) use the variation in the timing of automatic interest rate resets to identify the effect of mortgage rate changes on expenditure. Relative to this quasi-experimental design, we use an IV strategy, where we instrument for mortgage rate changes using surprises to the mortgage reference rate in a small window around monetary policy meetings following the high-frequency approach of Gürkaynak et al. (2005) and Cochrane and Piazzesi (2002). Our IV strategy contrasts with the existing literature that uses the monetary policy shocks directly as a regressor to analyze the transmission of monetary policy. We believe that by using the shocks as an instrument rather than a regressor and having the effects run through mortgage rates, we are primarily isolating the mortgage cash flow channel, thereby making the identification stronger.

Fourth, our empirical analysis complements and is motivated by the recent theoretical literature incorporating mortgages into general equilibrium models to analyze monetary policy transmission under ARMs versus FRMs. Rubio (2011) builds a New Keynesian DSGE model with variable- and fixed-rate mortgages and shows that the transmission of monetary policy shocks to consumption is stronger under a variable-rate mortgage regime. This is due to a combination of the cash flow effect (changes in interest payments), the wealth effect (changes in house prices, which feed into the collateral constraint), and the differential MPCs of borrowers versus savers.

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The model assumes that the variable rate moves one-for-one with the policy rate, while the fixed rate on existing debt is unaffected by the policy rate, as there is no refinancing option. Our analysis highlights that mortgage refinancing is an important direct channel of monetary policy transmission under FRMs. In addition, Garriga et al. (2017) incorporate mortgages into an incomplete asset market framework to highlight the differential effect of inflation on the real payments on outstanding debt under FRMs versus ARMs, and Garriga et al. (2021) construct a New Keynesian model with an additional long-term debt channel that operates via the mortgage market. In their model, the standard New Keynesian channel transmits mainly transitory monetary policy shocks, while the debt channel transmits persistent shocks. Wong (2021) builds a quantitative life cycle model with FRMs and the ability to refinance after paying a cost. She finds that the transmission of policy shocks to consumption is strongest for young homeowners who refinance. Other papers related to mortgage refinancing include Eichenbaum et al. (2022) who find that refinancing varies systematically with the pool of savings from such activity, making the effects of monetary policy state dependent. Similarly, Berger et al. (2021) show that the strength of the mortgage refinancing channel in the United States depends on the past history of interest rate changes—an effect that is best captured by the sufficient statistic $fracpos > 0$, which represents the fraction of outstanding loans with mortgage rates above the current market rate. Beraja et al. (2019), using loan-level data, provide empirical evidence that refinancing depends positively on home equity, which can vary over time. Although we do not focus on the state-dependent nature of monetary policy directly in our analysis, it is worth noting that monetary policy transmission under ARMs is likely less state dependent, as active refinancing is not needed to take advantage of mortgage rate declines. Importantly, we show that the response of consumption to mortgage rate changes in the United States is driven by households that likely can refinance and have the most to gain from doing so.

The remainder of the paper is organized as follows. Section 2 presents the model. Section 3 presents the data and empirical specifications for Spain and the United States and also discusses the institutional differences in the mortgage markets of the two countries. Section 4 presents the main findings, their discussion, and robustness checks. Section 5 concludes.

2. Model

We begin with a simple model that analytically decomposes the direct (partial equilibrium) channel of monetary policy transmission to consumption growth. The model is meant to show that mortgage rate changes affect consumption through various direct channels operating simultaneously, making it difficult to isolate the cash flow effect from the other channels.[7] Despite this challenge, we build the model to closely match our empirical specification (presented in the next section), so that we can use its insights to better understand our empirical findings. We do not use the model to propose a specific regression equation, but to more easily interpret our empirical results.

Our model closely follows Slacalek et al. (2020) with two main differences: we incorporate the typical amortization structure of debt and assume all debt and assets are real.[8] In this framework, households are infinitely lived, with intraperiod utility $u(c)$, where $u' > 0$ and $u'' < 0$. They hold long-term mortgages, short-term nonmortgage debt, and short-term assets in their portfolios. Let m denote the long-term mortgage amount, and b denote *net* short-term assets—that is, short-term assets net of interest-sensitive (nonmortgage) short-term debt. Mortgages follow a typical amortization structure, where p is the required payment amount, which depends on the mortgage interest rate r, the principal amount of the mortgage m, and the remaining duration of the mortgage contract $T - t$ (T is the initial term of the mortgage).

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Households maximize expected lifetime utility, discounting the future at rate $\frac{1}{\beta} - 1$, subject to an intertemporal budget constraint and the amortization structure of their mortgage. The recursive formulation of their optimization problem is as follows.[9]

$$V(b_t, y_t; r_t) = \max_{c_t, b_{t+1}} \left[u(c_t) + \beta V(b_{t+1}, y_{t+1}; \bar{r}) \right] \tag{1}$$

Subject to:

$$b_{t+1} = (1 + r_t) \times (b_t + y_t - c_t - p_t) \tag{2}$$

$$p_t = \frac{m_t r_t}{1 - (1 + r_t)^{-(T-t)}} \tag{3}$$

On the right side of the value function, we set $r_{t+1} = \bar{r}$ because we want to consider the effect of a one-time unexpected change in the real interest rate r_t, after which the rate returns to its steady state. Since the focus of our analysis is on the direct, partial equilibrium channels of monetary policy, we shut down the indirect general equilibrium channels by treating y_t as a constant throughout the model (we control for income growth at the household level in our empirical analysis).[10]

Online Appendix C contains full details of the model solution. Here, we briefly discuss the steps that yield the final decomposition of the direct effect of interest rate changes on consumption. The first-order condition of the household optimization problem yields the Euler equation:

$$u'(c_t) = \beta(1 + r_t) V'(b_{t+1}) \tag{4}$$

Totally differentiating the Euler equation, setting the general equilibrium effects to zero ($dy_t = 0$), and combining the resulting equation with equation (4) yields an expression linking the change in consumption (dc_t) to the change in the policy rate (dr_t):

$$\begin{aligned} dc_t \left[u''(c_t) + \beta(1 + r_t)^2 V''(b_{t+1}) \right] = \frac{u'(c_t)}{1 + r_t} dr_t &+ \beta(1 + r_t) V''(b_{t+1})(b_t + y_t - c_t - p_t) dr_t \\ &- \beta(1 + r_t)^2 V''(b_{t+1}) dp_t \end{aligned} \tag{5}$$

Next, defining the marginal propensity to consume out of income (MPC) $= \mu = \frac{\partial c_t}{\partial y_t}$, and using equation (3), we solve for dp_t in terms of dr_t.[11] Then, for small positive r, we can rewrite equation (5) in terms of μ as follows:

$$\frac{\frac{dc_t}{c_t}}{dr_t} = \underbrace{(1 - \mu) \frac{u'(c_t)}{u''(c_t) c_t}}_{\text{IES effect}} + \mu \left[\underbrace{(b_t + y - c_t - p_t)}_{\text{cash flow effect of net short-term position}} - \underbrace{\frac{\partial p_t}{\partial r_t}}_{\text{mortgage cash flow effect}} \right] \times \frac{1}{c_t} \tag{6}$$

Equation (6) shows that the direct effect of a change in the real interest rate on consumption growth can be decomposed into the sum of the IES effect and a (two-part) cash flow effect. The IES effect is a function of the household's risk aversion, summarized by $\frac{u'(c)}{u''(c)c}$, and is negative. Its strength depends inversely on the household's MPC: the higher the MPC, the lower the absolute value of the IES effect. The cash flow effect is made up of two parts. The first term is the effect of cash flow from a change in the interest rate due to the net interest rate exposure of the household's short-term asset-to-consumption position $\frac{b+y-c-p}{c}$. This effect is positive if the household is a net short-term saver and negative if it is a net short-term borrower. The second term is the effect of cash flow due to the impact of a change in interest rate on mortgage payments, $\frac{\partial p}{\partial r}$, which captures the net interest exposure due to its long-term balance sheet position (as a fraction of

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its consumption). This *mortgage cash flow effect* depends on the mortgage rate, the household's mortgage balance, and the remaining duration of the mortgage.[12] The strength of the total cash flow effect depends positively on the MPC—the higher the MPC, the larger the overall cash flow effect from a change in the interest rate.

Note that for a hand-to-mouth household, the MPC is 1. Therefore, the IES effect disappears, while the cash flow effect is the largest, *ceteris paribus*. Also, under an FRM, the r that appears in equation (3)—let's call it r^{FRM}—will typically be different from the policy rate r, except in the period of the FRM issuance. Therefore, $\frac{\partial p}{\partial r} = \frac{\partial p}{\partial r^{\text{FRM}}} \times \frac{\partial r^{\text{FRM}}}{\partial r}$. In the case of an FRM where the mortgagor does not refinance, $\frac{\partial r^{\text{FRM}}}{\partial r} = 0 \implies \frac{\partial p}{\partial r} = 0$. That is, for households with FRMs who do not refinance, the cash flow effect is determined only by the household's net short-term balance sheet position.

Related literature has shown that at least three other factors could be important in determining the direct effect of monetary policy changes on consumption growth: the degree of passthrough of the monetary policy rate to the mortgage rate, the degree of household attention to mortgage rate changes (in the case of fixed-rate mortgage holders), and the degree of persistence (or perceived persistence) of the mortgage rate change (see, for example, Berger et al. 2021). Our model assumes full passthrough of the monetary policy rate to the mortgage rate for ARMs and also for FRMs when they are refinanced, but in the empirical specification, we will use monetary policy shocks as an instrument for mortgage rate changes to arrive at a more realistic passthrough estimate. We also consider a fully mean-reverting interest rate shock (after one period), while Berger et al. (2021) study a small slow mean-reverting interest rate shock. When rates go down, FRM refinancers will save more on interest payments than ARM holders if rates revert to higher levels. A slowly mean-reverting shock will narrow this differential. In addition, the degree of attention of the borrower will certainly impact refinance rates, but predicting refinancing decisions is beyond the scope of this paper.

To reiterate, the mortgage cash flow effect that we seek to identify could, despite our best efforts, be conflated with other forces such as the IES effect, the attention to rate changes, the perceived persistence of the interest rate shock, nonmortgage cash flow effects, and even expectations channels.[13] We believe that our empirical strategy of comparing different types of households based on housing tenure and mortgage status will help address some of these identification challenges.

3. Data and empirical framework

3.1 Expenditure surveys

Spain: EPCF-2006 To study the relationship between mortgage rate changes and expenditure growth in Spain, we use a household-level dataset of annual spending conducted by the Spanish National Institute of Statistics (INE) called the *Encuesta de Presupuestos Familiares-Base 2006* (ECPF-2006).[14] Our analysis uses survey data from 2007 through 2018.[15] The main objective of the ECPF-2006 is to generate estimates of aggregate expenditure in Spain at the national and regional levels, as well as by certain household characteristics. The survey is a rotating panel of approximately 24,000 households, who are interviewed for two consecutive years. Each survey year is divided into 26 two-week periods, and households' interviews are uniformly distributed throughout the year. This interview schedule provides within-year variation for our analysis. The EPCF-2006 contains very detailed expenditure information, along with demographic information and basic household-level income data. The income measure is net of taxes and is imputed for a small fraction of households by the INE using reported income ranges.

United States: CEX For the United States, we use household-level public-use microdata from the CEX interview survey, which is a rotating panel of approximately 6,900 households per calendar quarter.[16] While earlier data are available, we employ data from 2007 through 2018 to coincide with the time period of the Spanish data. Households are interviewed every month and asked to

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report their expenditures over the previous three months. Each household is surveyed every three months for a maximum of four quarters before being dropped from the sample and replaced. Although a household is interviewed quarterly, its spending may not cover a traditional calendar quarter given the timing of the interviews. As a result, spending in the public-use microdata (FMLI files) is divided (evenly) between the current quarter (CQ) and the previous quarter (PQ). We combine these data to determine total spending corresponding to the three months prior to each household's interview month. We account for this interview and timing structure in our analysis and align the timing of non-CEX data, such as interest rates and monetary policy shocks, accordingly. We discuss this timing convention further in Section 3.4. Like the EPCF-2006, the CEX contains detailed data on expenditures along with demographic information and some after-tax income information. Although expenditure data are collected in each interview, income is only recorded in the first and last interviews. In recent survey years, these data are imputed, where necessary, by the BLS.[17]

Expenditure measures and data discussion Given the detailed expenditure data available in the EPCF-2006 and CEX, it is possible to construct several different measures of aggregate expenditures. We use total spending excluding housing-related expenses as the baseline consumption measure in our analysis.[18] We also consider spending on durables and spending on nondurables and services as part of our robustness checks. For income, we use households' reported after-tax income. All relevant (nominal) expenditure and income data are converted to real values using the Spanish regional CPI in the EPCF-2006 and the CPI for all urban consumers (CPI-U) in the CEX.

The main caveat of both of our datasets is the lack of wealth data or detailed mortgage information. The EPCF-2006 records whether households own their homes and whether they have mortgages, but not any wealth data or information on mortgage balances, mortgage types, or when mortgage rates reset. The CEX's main interview files contain data on households' quarterly mortgage interest payments but have no data on wealth, mortgage balances, or total monthly mortgage payments, or whether or when a household refinances. Despite these data caveats, the fact that new household interviews are staggered within a year and over time in both datasets, combined with the different institutional settings for mortgage contracts in Spain and the United States (as we discuss shortly), allows us to exploit the time-variation in interest rates and monetary policy shocks to conduct our analysis.

3.2 Mortgage rates and monetary policy shocks

For Spain, our mortgage rate data come from the official reference mortgage rate of the Bank of Spain.[19] For the United States, we use data on the 30-year fixed-rate mortgage rate from the Federal Home Loan Mortgage Corporation.

In part of our analysis, we instrument for actual mortgage rate changes using monetary policy shocks. For both countries, we identify these monetary policy shocks using asset price (rate/yield) changes in a daily window around monetary policy announcements. In Spain, the Euribor is used as the reference rate for a large number of mortgage contracts, and we focus on the three-month Euribor contract, which has the highest correlation with actual mortgage rate changes calculated using mortgage rate data from the Bank of Spain. Therefore, we measure the surprise component of the European Central Bank (ECB) monetary policy announcement as the difference between the rate on the three-month Euribor contract on the day of minus the day before the ECB General Council (GC) meeting. In the United States, movements in mortgage rates are most closely tied to the yields on long-dated Treasury securities, in particular, the 10-year US Treasury rate. Therefore, we measure the surprise component of the Federal Open Market Committee (FOMC) monetary policy announcement as the difference between the yield on the 10-year US government bond of constant maturity on the day of minus the day before the FOMC meeting. To interpret these rate surprises as monetary policy shocks, we multiply them by −100, so that a positive shock is

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expansionary while a negative shock is contractionary. See online Appendix B.2 for details on the approach that guides our choice of the asset for the construction of monetary policy shocks in each country.[20]

As robustness checks, we consider alternative monetary policy shocks. For Spain, we consider alternative shocks based on EONIA swaps and 10-year European government bonds. For the United States, we consider alternative shocks based on federal funds futures and 3-month Treasury bills.[21]

3.3 Institutional settings for mortgages

Homeownership in Spain was somewhat more prevalent than in the United States during our sample period, and relatively fewer households held mortgages on their main residence or another property. More than 90% of mortgages in Spain during our sample period were ARMs indexed to the Euribor or another official mortgage rate index. The most common ARM contract included yearly interest resets against the prevailing rate at the contract review date. Some banks charged a higher rate in the first year of the contract, and minimum rates (floor rates) were typically built in, sometimes in opaque ways.[22] Early repayment penalties were also common but limited by law (some lenders had lower penalties than others, and some had no early payment penalties at all). Starting in 2015, the Bank of Spain encouraged banks to offer more mixed-rate (with interest rates fixed for two, three, or more years) and fixed-rate (for the duration of the loan) mortgage contracts. Rates for FRMs in Spain are higher than those for ARMs and their terms are usually shorter (around 12 years) than in the United States. FRMs also face higher prepayment costs.[23] Despite the recommendations of the Bank of Spain, ARMs with yearly resets still constituted the majority of mortgages in Spain by the end of our sample period.

Importantly, during our sample period, it was prudent for Spanish consumers to repay their mortgages on time whenever possible due to stringent default and late-payment regulations and large spreads between mortgage rates and savings instruments. In particular, all mortgages were recourse mortgages, and interest rates on late payments at the time were extremely high—in many cases greater than 20%. The popular press is full of anecdotal evidence documenting widespread wage garnishing after houses were repossessed during and following the financial crisis, along with stories about the many individuals who lost their unmortgaged properties due to delinquent relatives whose loans they had guaranteed.[24] In addition, most households in Spain save using bank accounts, including certificates of deposit (CD), which paid relatively little during our sample period. Both direct and indirect participation in equity markets in Spain is low.[25]

To better understand how mortgage rate changes affected household finances in Spain, we use data from the INE's *Encuesta de Condiciones de Vida* (ECV), which contains some information on mortgage payments by households.[26] The survey has a cross-sectional and a longitudinal component (households remain in the sample for up to four years) that contain slightly different information about households, and the two components cannot be combined in the data available to us. We use data from both components to illustrate the evolution of mortgage payments in Spain over our sample period.

The cross-sectional data in the ECV have information on households' total monthly mortgage payments (principal plus interest). The top panel of Figure 1 shows the evolution of mortgage rates, monthly rental payments, and mean and median monthly mortgage payments during our sample period, which clearly decrease with the interest rate. In contrast, there is an overall negative correlation between rental payments and interest rates (a raw correlation of –0.35). The bottom panel of the figure shows the mortgage payment distributions in three different years when rates were declining, which are also consistent with payment reductions when rates were lower.

The longitudinal component of the ECV has information on mortgage interest payments starting in 2008, which is summarized in Table 1.[27] The first two columns show the reference mortgage rate from the Bank of Spain and its change. The third column reports average mortgage interest

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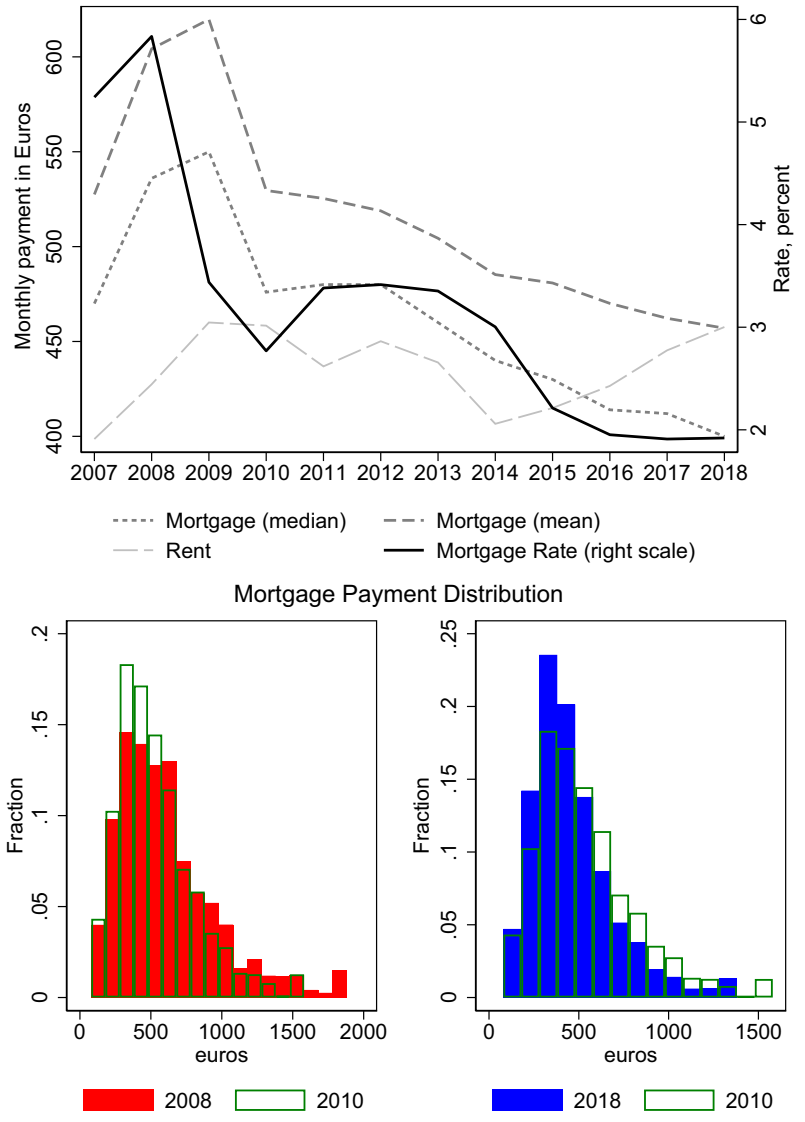

Figure 1. Mortgage and rental payments over time in Spain.
Source: Authors' calculations using the *Encuesta de Condiciones de Vida* (ECV) and data from the Bank of Spain on mortgage rates.

payments relative to income in the ECV, which clearly vary with changing interest rates. Mortgage interest payments, on average, represented 13.7% of household income in 2008 but only 4.6% in 2018. Column (4) shows that a large fraction of Spanish households experienced mortgage interest reductions each year, with a higher proportion benefiting during periods with large rate declines. As shown in columns (5) and (6), the absolute and relative-to-income magnitudes of savings from lower rates for those households with interest reductions were non-negligible, ranging from €670 a year (2.4% of household income) to €1,970 (6.8% of income) depending on the year. In general, the ECV data show that ARMs with frequent resets impact household cash flows as interest rates change.

The institutional details of mortgage markets in the United States are better known than those in Spain, but we briefly describe some of the main features. First, FRMs with long maturities dominate the United States mortgage market. According to the *National Mortgage Database*,

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Table 1. Mortgage interest rate payments over time in Spain

	(1)	(2)	(3)	(4)	(5)	(6)
				Households with Interest Declines		
Year	Mortgage Rate	Mortgage Rate Chg.	Interest Paid over Income	Fraction	Chg., Euros	Chg. rel. Inc.
2008	5.83	0.59	0.137	0.58	−1247	−0.044
2009	3.44	−2.40	0.102	0.78	−1970	−0.068
2010	2.77	−0.67	0.099	0.62	−1157	−0.044
2011	3.38	0.61	0.108	0.48	−1130	−0.044
2012	3.42	0.03	0.093	0.66	−1133	−0.045
2013	3.35	−0.06	0.083	0.69	−980	−0.038
2014	3.00	−0.35	0.084	0.64	−720	−0.030
2015	2.21	−0.79	0.069	0.71	−751	−0.030
2016	1.95	−0.26	0.057	0.66	−689	−0.028
2017	1.91	−0.04	0.046	0.60	−761	−0.028
2018	1.92	0.01	0.046	0.57	−670	−0.024

Notes: Data from the longitudinal component of the ECV. The sample includes households reporting mortgage payments in two consecutive years. The survey reports the annual amount of interest paid by households holding mortgages, but principal payments are not included. We do not know when a consumer moves or takes a new loan. Columns (1) and (2) report the mortgage reference rate published by the Bank of Spain and its change. Column (4) is the fraction of households with interest payment declines in a given year. Columns (3), (5), and (6) are averages across households in a given year. The last two columns report averages conditional on households having experienced an interest rate decline.

a nationally representative 5% sample of residential mortgages in the United States maintained by the FHFA, the share of ARMs in the United States during our period of analysis was just 5.3%. FRMs with 15-year maturity represented 19.5% of all mortgages during this period, while 75.2% of mortgages were FRMs with maturities over 20 years. The average maturity at the time of loan origination during this period was approximately 26 years, consistent with the 30-year FRM being the most common product.[28]

Second, many mortgages in the United States are guaranteed by the government (FHA-insured and VA-guaranteed loans account for about 24% of all loans from 2007 to 2018) or get sold to the government-sponsored enterprises (GSEs) Freddie Mac and Fannie Mae. The GSEs buy about half of the mortgage loans that lenders make (56.4% during our sample period), and when lenders sell their loans to the GSEs, they obtain capital to make additional loans. Because lenders want to sell their loans to the GSEs, they structure the mortgages according to the GSEs' underwriting standards, which became stricter following the 2008 financial crisis. This explains why the share of ARMs in the United States was much higher prior to the financial crisis (21.6% between 2000 and 2006). The difference in ARM shares pre- and post-2007 is consistent with a structural break in both the products offered to consumers by lenders and consumers' choices after the subprime crisis. Among other factors, ARMs had higher default rates during the financial crisis and have subsequently faced stricter underwriting standards. However, ARMs continue to be used, especially among higher income households and for larger loans, consistent with the idea that wealthier and more financially savvy mortgagors are the ones generally holding ARMs over our sample period.[29] It is also important to note that, unlike in Spain, most ARMs in the United States typically have an initial interest rate that is fixed for 5, 7, or 10 years before resetting, so on a relative basis they behave more like an FRM. Many of these loans are also refinanced before they reset.

In addition, most mortgages in the United States are securitized, especially GSE loans, which is not the case in Spain. Securitization removes the loans from banks' (and the GSEs') balance sheets and packages them into mortgage backed securities (MBS), which pool and transfer the interest rate and prepayment risks of the loans to a diverse set of investors. In comparison, there is no widespread use of (American-type) securitization in Spain, and most mortgage loans remain

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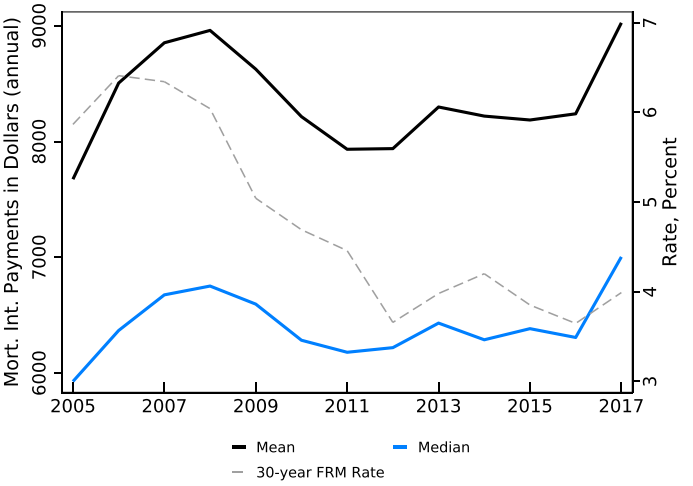

Figure 2. Mortgage interest payments over time in the United States.
Source: Authors' calculations using Consumer Expenditure Survey and data from the Federal Home Loan Mortgage Corporation on mortgage rates.

on banks' balance sheets.[30] As a result, Spanish banks probably want to ensure that the mortgage contracts they offer match the duration of their liabilities as much as possible. In addition, as shown by Krainer, 2010), the Federal Reserve began large-scale purchases of GSE's MBS in January 2009, adding significant secondary market demand for FRMs in the United States during our sample period. In sum, the reason mortgages look so different in the United States and Spain is due to important institutional differences between the two countries, especially differences in the prevalence of mortgage securitization. This is consistent with Fuster and Vickery (2015), who find that the share of FRMs is much lower when mortgages are difficult to securitize.

Finally, Figure 2 is the US counterpart to Figure 1 for Spain. Despite the market dominance of long-term FRMs, which require refinancing to realize the benefits of lower interest rates, mortgage interest payments in the United States decline as mortgage rates fall, similar to Spain.

3.4 Empirical specifications

Spain Taking advantage of the fact that the ECPF-2006 interviews each household i for two consecutive years, we estimate

$$\Delta \log C^i_{t,t-12} = \alpha_0 + \alpha_1 \Delta \log Y^i_{t,t-12} + \alpha_2 \Delta r_{t-6,t-18} + \mathbf{X^i_t}\Gamma + \text{FE} + \epsilon_{it}, \tag{7}$$

where $\Delta \log C^i_{t,t-12}$ is log consumption growth from the previous year, $\Delta \log Y^i_{t,t-12}$ is log income growth from the previous year, $\Delta r_{t-6,t-18}$ is the one-year change in the mortgage rate lagged six months relative to consumption, $\mathbf{X^i_t}$ is a matrix of household and regional/national controls that includes age, sex, education level, citizenship (Spanish or other), marital status, labor force status (employed, unemployed, or out of the labor force), and labor force status and marital status changes from the previous interview of the head of the household, number of household members, number of earners in the household, household size changes, the main source of household income (wages, self-employment, or other income), the presence of children, as well as the change in the regional unemployment rate and national real GDP growth.[31] FE denotes fixed effects that include year, CCAAs (regions), and interview weeks within a year (to account for seasonality). The regional unemployment rate and national real GDP growth are included to capture local and aggregate economic conditions that could impact spending behavior across households not fully captured by year fixed effects. In the regressions, standard errors are clustered at the two-week

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period × year level—the degree of variation of our regressor of interest, the change in mortgage rate. We restrict our analysis to households with heads 18 to 64 years old.

The mortgage rate change is lagged six months relative to the month of the household's final interview because we don't know exactly when households' mortgage rates reset. Even if all mortgage rates in the sample reset at $t-12$, consumers might not see their savings until a few billing cycles later. In addition, consumption might be slow to respond to rate changes if households opt to initially save to finance larger purchases a few months later. In the IV specifications, we aggregate monetary policy shocks in the last 12 months to create an instrument for the 12-month change in mortgage rates. We lag this instrument one additional month relative to the mortgage rate change to maximize the correlation with the actual rate change, but the results are similar if we do not. See online Appendix B.2 for more details on our choice of aggregation windows and the robustness of the results.

United States To match the time horizon in the Spanish data as best possible and to utilize the available income data in the CEX, we measure consumption (and income) growth between households' first and last interviews. This amounts to consumption and income growth over a nine-month period, which is slightly shorter than the one-year horizon in the Spanish data. Recall that households report their expenditure for the three months prior to each interview. For example, a household first interviewed in April 2017 reports expenditures for January to March 2017. The last interview for the same household (assuming that they do not exit the survey early) would be in January 2018 when they report spending for October to December 2017. We calculate the growth in quarterly expenditures during this nine-month period and follow the same procedure for other households based on when their first and last interviews occur. In addition, a household first interviewed in April 2017 reports its income covering the prior 12 months in April 2017 and then again in January 2018. We calculate the growth in income between these two reporting periods. Although the slightly overlapping 12-month time horizons are not ideal, we are limited by the available data and believe that it is important to control for income growth in our regressions.

Our main empirical specification for the United States is similar to that for Spain:

$$\Delta \log C^i_{t,t-9} = \alpha_0 + \alpha_1 \Delta \log Y^i_{t,t-9} + \alpha_2 \Delta r_{t-6,t-12} + \mathbf{X^i_t}\Gamma + \text{FE} + \epsilon_{it}, \tag{8}$$

where $\Delta \log C^i_{t,t-9}$ is log consumption growth between household i's first and last interviews, $\Delta \log Y^i_{t,t-9}$ is log income growth between household i's first and last interviews, and $\Delta r_{t-6,t-12}$ is the six-month change in the mortgage interest rate. The change in the mortgage rate is lagged six months relative to the month of a household's final interview.[32] In the IV specifications, we aggregate monetary policy shocks (measured with respect to the 10-year Treasury) over the final three months of the rate change period. Although we tried a number of different aggregation approaches, including the full six-month window over which the mortgage rate change is measured, we found that the rate changes were most highly correlated with shocks aggregated over this shorter window. The results using alternative aggregation windows are similar. See online Appendix B.2 for more details.

Returning to equation (8), $\mathbf{X^i_t}$ is a matrix of household-level controls including age and age squared (of the reference person), household size, number of earners in the household, and dummy variables for the level of education of the reference person (less than high school, high school, some college, college or more), whether there is a change in family size, and whether there is a change in the reference person's marital status over the estimation window.[33] FE denotes fixed effects that include year and state. The year fixed effects are based on the calendar year most closely aligned with the expenditure months reported in a household's final interview. State fixed effects capture differences across locations in the average level of unemployment and other unobserved, local, time-independent factors that might impact household income and spending. Standard errors are clustered at the month × year level. We restrict the sample to households with nonmissing housing tenancy information and where the reference person is between 18 and 64 years old.[34]

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Table 2. Consumption growth and mortgage rate changes in Spain

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All		Owners/Mortgage		Owners/No Mortg.		Renters	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Rate Chg.	−1.74***	−1.65***	−1.91***	−1.85***	−1.59***	−1.82***	−1.51	−0.40
	(0.39)	(0.48)	(0.64)	(0.67)	(0.51)	(0.65)	(0.97)	(1.20)
Household Income Growth	0.18***	0.18***	0.18***	0.18***	0.15***	0.15***	0.23***	0.23***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Cons. growth mean	−1.8	−1.8	−2.4	−2.4	−1.7	−1.7	−0.4	−0.4
Rate chg. mean	−0.2	−0.2	−0.2	−0.2	−0.1	−0.1	−0.2	−0.2
R-squared	0.05	0.04	0.05	0.03	0.05	0.04	0.08	0.05
Observations	69,516	69,516	30,479	30,479	27,720	27,720	11,311	11,311
F exc. instrument		550.4		548.5		573.3		481.4
Mortgage Rate Chg. MPC	0.61	0.58	0.67	0.65				

Notes: The LHS is log consumption growth excluding housing-related expenditures (mainly utilities, maintenance spending, and condo fees). The interest rate included in the regressions is the 12-month change in the reference rate for mortgages from the Bank of Spain, lagged six months relative to the date of the last household interview. Additional controls: region fixed effects, two-week period of the interview fixed effects, year fixed effects, household size, number of earners in the household, age, gender, education level, labor market status, nationality of the head, change in labor force status, change in household size, change in marital status, presence of children, an indicator for job loss, and the unemployment rate change and GDP growth (available only at a quarterly frequency). Standard errors (in parentheses) are clustered by two-week period × year, which is the level of variation of the mortgage rate. Sample: all households with heads 18 to 64 years old who are in the survey between 2007 and 2018. Instrument: Euribor three-month shock aggregated over a year, lagged to match the interest rate change plus one month.

Estimation We first estimate equations (7) and (8) using OLS. Although lagged changes in mortgage rates are likely non-endogenous for individual households, these changes might have been anticipated by households, which could bias our estimates of α_2 in both equations. To address this concern, we then estimate both equations using an IV approach, where we use monetary policy shocks as an instrument for mortgage rate changes. Our baseline regressions use nominal mortgage rate changes and include time fixed effects.[35] We also consider alternative specifications that exclude year fixed effects or include a linear time trend instead of year fixed effects as part of our robustness analysis.

4. Results

Tables 2 and 3 present estimates of equations (7) and (8) for Spain and the United States, respectively. When pooling households together (columns [1]), we find that a decrease in the mortgage rate of one p.p. is associated with 1.74 p.p. higher expenditure growth in Spain compared to 1.30 p.p. higher growth in the US. These estimated elasticities can be translated into MPC out of implied mortgage cash flows, with a resulting MPC of 0.61 for Spain and 0.27 for the United States. To calculate these MPCs we use data on loan-to-income ratios as well as average household spending and income in each country. In Spain, the average loan-to-income ratio among mortgagors is 2.48 (see Table 4 for details and source), while the average household income and spending are €29,014 and €25,380, respectively (see the online Appendix Table D.8). This implies that a one p.p. decrease in mortgage rates amounts to approximately €719.5 in additional income (29,014 × 2.48 × 0.01), assuming a one-for-one passthrough, while our OLS estimate for Spain implies €441.6 additional spending (1.74 × 25,380 × 0.01). Taken together, the MPC out of mortgage cash flows is 0.61 (441.6/719.5). We follow similar steps for the United States, where the average loan-to-income ratio among mortgagors is 1.93 (see Table 4), and the average household income and spending are $44,763 and $17,690, respectively (see online Appendix Table D.10). The equivalent estimated MPCs for the two countries based on the IV coefficients (columns [2]) are more similar: 0.58 for Spain and 0.52 for the United States.[36]

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Table 3. Consumption growth and mortgage rate changes in the United States

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All		Owners/Mortgage		Owners/No Mortg.		Renters	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Rate Chg.	−1.30**	−2.56**	−1.55*	−2.05	−2.70**	−4.33*	−0.02	−1.81
	(0.64)	(1.13)	(0.90)	(1.38)	(1.36)	(2.60)	(0.92)	(1.64)
Income Growth	0.12***	0.12***	0.13***	0.13***	0.12***	0.12***	0.11***	0.11***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Cons. growth mean	−2.9	−2.9	−2.3	−2.3	−3.2	−3.2	−3.6	−3.6
Rate chg. mean	−0.1	−0.1	−0.1	−0.1	−0.1	−0.1	−0.1	−0.1
R-squared	0.02	0.01	0.03	0.01	0.03	0.01	0.02	0.01
Observations	40,898	40,898	20,419	20,419	8,062	8,062	12,353	12,353
F exc. instrument		70.7		72.1		61.8		74.9
Mortgage Rate Chg. MPC	0.27	0.52	0.32	0.42				

Notes: The LHS is real log consumption growth excluding shelter-related expenses (rent, maintenance, utilities, etc.) and retirement benefit contributions. The interest rate included in the regressions is the six-month change in the 30-year fixed rate mortgage lagged six months relative to the end of a household's reported consumption period. Additional controls: age, household size, change in household size, change in marital status, number of earners in household, education, year fixed effects, and an indicator for missing household income growth. Standard errors (in parentheses) are clustered by month × year, which is the level of variation in the mortgage rate. Sample: all households with heads 18 to 64 years old who are in the survey between 2007 and 2018. Instrument: Shocks to the 10-year Treasury rate aggregated over the last three months of the rate change period.

Table 4. Mortgage to income ratios in Spain and the United States

	Min	Pct 25	Median	Mean	Pct 75	Max
Spain	0.01	0.90	1.98	2.48	3.55	7.19
United States	0.04	0.85	1.50	1.93	2.43	10.88

Notes: Outstanding primary residence mortgage debt relative to household income for households with such debt. Data for the United States come from the Survey of Consumer Finances from the Federal Reserve for 2007, 2010, 2013, and 2016. Data for Spain come from the *Encuesta Financiera de las Familias* (EFF) for 2008, 2011, 2014, and 2017. The EFF, conducted by the Bank of Spain, has a very similar design to the SCF.

Before delving deeper into the results, we want to stress that any differences in the estimated elasticities between the two countries do not appear to be driven by different-sized interest rate shocks. Specifically, in online Appendix B.3, we address the potential concern that generating a shock of a given size to the mortgage reference rate in the United States (the 10-year Treasury rate) could require a much larger movement in the policy rate than a shock of the same magnitude to the reference rate in Spain (the 3-month Euribor rate). Instead, our model suggests that differences in estimated elasticities between the two countries are likely driven by a combination of different IES (which depends on households' MPCs out of income) and cash flow effects. That said, we find a similar MPC out of income: 0.18 and 0.19 in Spain and the US, respectively.[37,38] Thus, any differences between average MPCs out of mortgage rate changes between countries could be driven by cash flow effects. It is also possible that the average mortgage rate effect we estimate masks important heterogeneity across household groups. To better understand these potential differences, we divide households by their housing tenure status in the analysis that follows.

4.1. Effects by housing tenure status

Columns (3)–(8) of Tables 2 and 3 report estimates of equations (7) and (8) for Spain and the United States, respectively, for three separate groups of households: homeowners with mortgages (mortgagors), outright homeowners (without mortgages), and renters/other.[39] We find a negative relationship between mortgage rate changes and expenditure growth for all types of households in both countries. However, the estimated effects are smaller and statistically insignificant for renters.

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In addition, in the United States, the IV estimate is imprecisely estimated for mortgagors, and, somewhat surprisingly, the estimated effect is larger (in absolute value) for outright homeowners relative to mortgagors (although the difference is not statistically significant). In comparison, in Spain, the estimated effect for outright homeowners is slightly smaller (in absolute value) than the estimated effect for mortgagors.

Significant effects for nonmortgagors confirm that channels of rate transmission other than the mortgage cash flow effect are at play. Interest rates on other loans and savings products, such as CDs that are widely used to save in Spain, move in tandem with mortgage rates (see online Appendix Figure D.9). In both countries, outright homeowners are likely net savers and should see their interest income increase (decline) when rates increase (decrease).[40] However, changes in interest rates also operate through the IES, as highlighted by the model. That is, outright homeowners might forego current expenditure when rates increase in order to consume more in the future, and *vice versa*. This latter effect seems to dominate for outright homeowners over our sample horizon, since we find a negative correlation between expenditure growth and mortgage rates for this group of consumers in both countries. Indeed, our model predicts that a lower MPC out of income increases the relative strength of the IES effect, and the estimated MPC out of income is lower for outright homeowners than for mortgagors (0.14 versus 0.19 in Spain, and 0.15 versus 0.27 in the United States).[41] The noticeably stronger estimated IES effect for outright owners in the United States compared to mortgagors could explain the larger estimated effect (in absolute value) for this group.

When focusing on mortgagors, we estimate a somewhat larger elasticity in Spain—a one p.p. decline in the mortgage rate is associated with a 1.91 p.p. increase in expenditure growth in Spain and a 1.55 p.p. higher growth in the United States. The IV estimates of the effects are larger (in absolute value) in the United States but statistically significant only for Spain.[42] The smaller effect (OLS) in the United States may capture the fact that mortgage rates do not reset automatically the way they do in Spain. Instead, consumers must actively refinance their loans to reap the benefits of rate changes, and refinancing is advantageous only when rates decline and gains are large enough to offset transaction costs. Although our sample is dominated by rate declines, the average effect still captures some periods of rate increases during which there would be limited cash flow gains among US fixed-rate mortgagors. In addition, the average effect in the United States may mask differences based on the expected path of mortgage rates as well as important heterogeneity across mortgagors from different socioeconomic, geographical (as it pertains to house price changes) and demographic backgrounds, which may impact their ability to refinance, especially early in our sample when the US economy was experiencing and then recovering from the housing market collapse. In other words, institutional differences between the two countries may shape the mortgage rate effect by influencing its homogeneity (across different mortgagor characteristics) and symmetry (between rate hikes and cuts) as well as its sensitivity to the expected persistence of rate changes. To investigate these possibilities further, we focus our analysis on mortgagors in the next three subsections.

4.2. Effects of rate changes across mortgagor characteristics

Given the need for active refinancing to benefit from rate declines in the United States compared to the automatic transmission under ARMs in Spain, we expect potential differences in transmission across types of mortgagors within the two countries. Table 5 shows how the mortgage rate effect varies for different types of mortgagors in Spain, as indicated by the column headings. In particular, we split mortgagors based on whether they are younger or older, more or less educated (above or below secondary education levels), have more or less income (above or below €2,000 per month), have large or small houses (above or below 100 square meters), do or don't experience sizable income declines from the previous year (20% or larger), have heads who work or don't

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Table 5. Consumption growth and mortgage rate changes (Spain). Splits of mortgage holders

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Younger than 45		High Education		High Income		Large House		Large Inc. Drop		Working		House-Price Apprec.	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Yes × Rate chg.	−2.30***	−2.14***	−1.69**	−1.57**	−1.71**	−1.88**	−2.38***	−2.18***	−2.23***	−2.62***	−1.90***	−1.86***	−2.05***	−2.09***
	(0.72)	(0.76)	(0.73)	(0.76)	(0.73)	(0.77)	(0.79)	(0.84)	(0.83)	(0.98)	(0.65)	(0.69)	(0.73)	(0.70)
No × Rate chg.	−1.40**	−1.45**	−2.04***	−2.03***	−2.05***	−1.82**	−1.68**	−1.69**	−1.82***	−1.66**	−1.95**	−1.77*	−1.79**	−1.56*
	(0.67)	(0.71)	(0.68)	(0.73)	(0.66)	(0.71)	(0.66)	(0.69)	(0.64)	(0.66)	(0.89)	(0.97)	(0.71)	(0.82)
Pct. Yes	0.56	0.56	0.43	0.43	0.39	0.39	0.33	0.33	0.19	0.19	0.86	0.86	0.39	0.39
p-value diff	0.11	0.27	0.56	0.49	0.53	0.92	0.28	0.47	0.52	0.21	0.95	0.92	0.71	0.48
R-squared	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.03
Observations	30,479	30,479	30,479	30,479	30,479	30,479	30,479	30,479	30,479	30,479	30,479	30,479	30,479	30,479
F exc. instrument		284		276		278		274		278		295		300

Notes: The LHS is log consumption growth excluding housing-related expenditures (mainly utilities, maintenance spending, and condo fees). The interest rate included in the regressions is the 12-month change in the reference rate for mortgages from the Bank of Spain, lagged six months relative to the date of the last household interview. All controls as in Table 2, not reported for brevity. Standard errors (in parentheses) are clustered by two-week period × year, which is the level of variation of the mortgage rate. Sample: all households with heads 18 to 64 years old who are in the survey between 2007 and 2018. Instrument: Euribor three-month shock aggregated over a year, lagged to match the interest rate change plus one month. 'Yes'/'No' indicates that the consumer is/is not in the group indicated by the column heading.

work (employed versus the rest), and whether they face house price appreciation versus depreciation (based on regional house price indices in the last two years). Additional controls are the same as in our previous regressions, but are not tabulated.

Overall, the interest rate effects are similar across the board for these mortgagors. The estimated coefficients are a bit larger for mortgagors who are younger, those who are in less advantaged groups (low education and low income), those with larger houses, those who experience large income declines, and in periods/areas with house price appreciation. Except for the house-price split, the larger coefficients are associated with consumers who are potentially more constrained. However, the differences are small and are not statistically significant. Regarding the house-price split, a lower (higher) mortgage rate is more strongly associated with higher (lower) expenditure growth when houses are appreciating. The coefficients are not statistically different in this case either, but a possible interpretation is that consumers might become more prudent in periods of home depreciation (which could, among other things, signal an ensuing economic downturn), choosing to put away some of their mortgage interest savings.

Table 6 shows how the effect of the mortgage rate varies for different types of mortgage holders in the US following a similar approach. Data differences do not allow us to have exactly the same splits as in Spain, and some of the classifications of homeowners are defined a bit differently. Those categories include: high education (households where the head has a college degree or higher), high income (households in the top quartile of the (real) after-tax income distribution), working (households where the head reports working at least 26 weeks in the previous year), and house price appreciation (whether price growth over the 5 years leading up to the consumption period is positive).[43] Information on house size is not available in the US data, but we consider an additional split between white and nonwhite mortgagors. The results show somewhat greater sensitivity to interest rate changes for younger households, high-income households, working households, white households, and households that experienced appreciation in home prices over the previous five years. These differences, though mostly not statistically significant at conventional levels, are broadly consistent with the active refinancing channel in response to mortgage rate changes in the United States. Indeed, younger mortgagors likely have more years left on their loans and potentially greater lifetime cash-flow savings from refinancing. In addition, working households are likely to have an easier time refinancing given typical underwriting standards and requirements (having a good history of recent earnings helps with obtaining a new loan). Moreover, high-income households could be more financially savvy, and greater home equity due to house price appreciation also facilitates refinancing (households may be more inclined to refinance when they can cash out equity from their homes than when they are underwater).

Previous literature has shown that, beyond demographic and socioeconomic factors, the response of spending to interest rate changes also depends on households' debt-to-income ratios. For example, Flodén et al. (2021) find that households with high levels of (total) debt to income in Sweden respond relatively more to changes in monetary policy than other households. We also consider this aspect of potential heterogeneity in the spending response to interest rate changes across the two countries. To begin, we consider the role of households' debt-to-income ratios in Spain. Although we do not have information on total household debt in our surveys, we impute mortgage payment-to-income ratios in the Spanish ECPF using data from the ECV.[44] Mortgage payment-to-income ratios can be seen as a proxy for debt relative to income (with less signal for households who obtained their mortgages further in the past).

The results in Table 7 show that neither the (imputed) mortgage payment-to-income ratio nor its interaction with the interest rate change are statistically significant (the estimated effects are also small in magnitude). This lack of differential effect could indicate that the mortgage payment-to-income ratio varies less in Spain than debt-to-income in Sweden, or that debt-to-income ratios are less important in a pure ARM setting.[45] It is also possible that our imputed variable is not a good proxy for households' debt-to-income ratios, but we are limited by the available data.

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Table 6. Consumption growth and mortgage rate changes (US). Splits of mortgage holders

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Younger than 45		High Education		High Income		Working		Large Inc. Drop		House-Price Appreciation		White	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Yes × Rate chg.	−3.24**	−5.34	−0.90	−2.46	−2.51	−5.61*	−2.04**	−1.95	−2.27	−4.83	−2.42**	−4.16**	−1.71*	−2.15
	(1.28)	(3.35)	(1.16)	(2.13)	(1.69)	(3.05)	(0.99)	(1.31)	(1.59)	(3.66)	(1.00)	(1.80)	(1.01)	(1.57)
No × Rate chg.	−0.22	0.64	−2.05*	−1.73	−1.23	−0.91	0.43	−2.46	−1.29	−1.07	0.71	5.01	−0.61	−1.50
	(1.28)	(2.37)	(1.22)	(2.16)	(0.97)	(1.87)	(2.10)	(5.09)	(1.06)	(1.73)	(1.82)	(4.05)	(2.44)	(6.02)
p-value diff	0.10	0.24	0.47	0.82	0.47	0.24	0.29	0.93	0.60	0.40	0.13	0.06	0.69	0.92
Percent Yes	43.7	43.7	43.0	43.0	25.0	25.0	80.7	80.7	24.9	24.9	64.6	64.6	85.2	85.2
R-squared	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01
Observations	20,419	20,419	20,419	20,419	20,419	20,419	20,419	20,419	20,419	20,419	20,419	20,419	20,419	20,419
F exc. instrument		11.2		12.5		9.1		9.6		9.5		9.1		9.6

Notes: The LHS is real log consumption growth excluding shelter-related expenses (rent, maintenance, utilities, etc.) and retirement benefit contributions. The interest rate included in the regressions is the six-month change in the 30-year fixed rate mortgage lagged six months relative to the end of a household's reported consumption period. All controls as in Table 3, not reported for brevity. Standard errors (in parentheses) are clustered by month × year, which is the level of variation in the mortgage rate. Sample: all mortgagors with heads 18 to 64 years old who are in the survey between 2007 and 2018. Instrument: Shocks to the 10-year Treasury rate aggregated over the last three months of the rate change period. 'Yes'/'No' indicates that the consumer is/is not in the group indicated by the column heading.

Table 7. Consumption growth, mortgage rate changes, and mortgage payments relative to income (Spain)

	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
Rate Change	−1.91***	−1.85***	−1.91***	−1.85***
	(0.64)	(0.67)	(0.64)	(0.67)
Mortgage/Income	0.20	0.20	0.23	0.22
	(0.39)	(0.39)	(0.40)	(0.40)
Rate Change × Mortgage/Income			0.15	0.09
			(0.33)	(0.36)
R-squared	0.05	0.03	0.05	0.03
Observations	30,478	30,478	30,478	30,478
F exc. instrument		548.6		274.3

Notes: The LHS is log consumption growth excluding housing-related expenditures (mainly utilities, maintenance spending, and condo fees). The interest rate included in the regressions is the 12-month change in the reference rate for mortgages from the Bank of Spain, lagged six months relative to the date of the last household interview. All controls as in Table 2, not reported for brevity. Standard errors (in parentheses) are clustered by two-week period × year, which is the level of variation of the mortgage rate. Sample: all households with heads 18 to 64 years old who are in the survey between 2007 and 2018. Instrument: Euribor three-month shock aggregated over a year, lagged to match the interest rate change plus one month. Mortgage/Income is imputed using information from the *Encuesta de Condiciones de Vida* (ECV).

As we document next, differential interest rate effects based on households' mortgage payments relative to income are important in the US.

Turning to the United States, we consider whether the consumption response to interest rate changes varies based on households' reported mortgage interest payments, which serve as a potential proxy for consumers who may have recently refinanced or who would likely benefit the most from doing so. (Unfortunately, the CEX does not contain a direct indicator of whether or not households refinance their mortgages, which would provide the most direct evidence of the role of the mortgage cash flow channel, so we must employ a proxy instead.) In particular, we group mortgagors according to the share of their income that is devoted to mortgage interest payments. Ideally, we would use a measure of total mortgage payments including principal as we did for Spain, but these data are not available in the CEX. However, interest payments tend to make up the majority of mortgage costs in the United States, especially early in the life of an amortized 30-year fixed-rate loan. We use the mortgage interest payment-to-income (Mpay) ratio as a proxy for the amount of a household's income (cash flow) that is tied up in housing costs. In particular, we divide households into three groups: those in the bottom quartile of the Mpay distribution, those in the middle two quartiles (25th to 75th percentile), and those in the top quartile. (We calculate Mpay as of the initial period in which we observe a household's spending.) In principle, nonhousing expenditures should be more sensitive to mortgage rate declines for households with more of their income devoted to mortgage-related interest costs, as long as they have the desire and ability to refinance.

We find that the spending response to mortgage rate changes is strongest for mortgagors in the middle part of the Mpay distribution, as shown in columns (5) and (6) of Table 8.[46] The results imply that a one p.p. decrease in the mortgage rate is associated with a 4.76 p.p. higher expenditure growth for middle-Mpay mortgagors. The corresponding IV estimate implies 8.52 p.p. higher expenditure growth. OLS and IV estimates for this middle Mpay group are greater than for all the mortgagors pooled together (columns [1] and [2]), with the estimated OLS effect being more than double and the IV estimate becoming significant. In contrast, the growth of household expenditure for those at the top and bottom of the MPay distribution exhibits little response to mortgage rate changes, a finding that is not necessarily surprising. Indeed, the cash flow benefits from refinancing are likely low for mortgagors with low Mpay ratios, while mortgagors with high Mpay ratios may have recently refinanced. Alternatively, they may have high debt relative

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Table 8. Consumption growth and mortgage-rate changes in the US splits based on mortgage-interest-payment-to-income ratios. Mortgage holders

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All w/ Mortgages		High MPay		Middle MPay		Low Mpay	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Rate Chg.	−1.55*	−2.05	0.94	1.96	−4.76***	−8.52***	2.51	6.45*
	(0.90)	(1.38)	(1.88)	(3.57)	(1.23)	(2.13)	(2.22)	(3.41)
R-squared	0.03	0.01	0.03	−0.00	0.03	0.01	0.03	0.01
Observations	20,419	20,419	5,103	5,103	10,210	10,210	5,104	5,104
F exc. instrument		72.1		78.1		70.5		66.2

Notes: The LHS is real log consumption growth excluding shelter-related expenses (rent, maintenance, utilities, etc.) and retirement benefit contributions. The interest rate included in the regressions is the six-month change in the 30-year fixed rate mortgage lagged six months relative to the end of a household's reported consumption period. All controls as in Table 3, not reported for brevity. Standard errors (in parentheses) are clustered by month × year, which is the level of variation in the mortgage rate. Sample: all households with heads 18 to 64 years old who are in the survey between 2007 and 2018. Instrument: Shocks to the 10-year Treasury rate aggregated over the last three months of the rate change period. Splits based on distribution of mortgage interest payment ratios for homeowners with mortgages as indicated by the column heading. High: top quartile; Middle: middle two quartiles; Low: bottom quartile.

to income or limited housing equity, leaving them more constrained in their ability to refinance. Overall, the results in Table 8 are consistent with refinancing driving the mortgage cash flow effect in the US.

4.3. Effects of rate increases versus rate declines

Next, we consider whether the effect of mortgage rate changes is symmetric among mortgagors in Spain and the US. In Spain, we only find significant effects for rate decreases (see the first two columns of Table 9). This is probably explained by the fact that rate decreases were more prevalent during our sample period (60% of the time) and that the rate increases that occurred tended to be relatively small. Importantly, the estimated coefficient for rate increases is still negative and the magnitudes of the estimated coefficients for rate increases and decreases are not statistically different. In the United States, a priori, one would expect mortgagors' expenditures to be impacted more by interest rate decreases than increases because payments from existing mortgages do not change when mortgage rates rise. However, as we have noted, active refinancing is also necessary for them to benefit from rate decreases. There are transaction costs associated with choosing to refinance one's mortgage when rates fall, but a large enough decline typically makes refinancing a cash-flow positive transaction for households with large remaining mortgage balances repayable over a longer horizon. Also, while higher interest rates are beneficial for all households with liquid savings, such gains likely have less impact on cash flows than gains from lower mortgage payments (conditional on refinancing), because mortgage contracts are long-term and refinancing provides benefits over many periods. The results in Table 10 examine the effect of rate increases compared to decreases for all mortgagors, as well as for mortgagors in the middle Mpay group. As expected, a decrease in rates has a somewhat greater effect on expenditure than an increase in rates (see columns [1] and [5]), although the coefficients are not statistically different from each other. In principle, we expected larger differences in the effects because rate increases do not necessarily impact mortgage payments for households with FRMs (except for new mortgage originations). However, as in Spain, the sample period is dominated by rate declines in the US, which could explain the result. In terms of IV results (columns [2] and [6]), the instrument is quite weak when trying to separate rate increases from rate decreases, and the coefficients are not precisely estimated.

When comparing the response of consumption to lower mortgage rates in the two countries, we find a stronger effect for middle-Mpay mortgagors in the United States than for the average mortgagor in Spain. For these respective groups, a one p.p. decline in the mortgage rate implies

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Table 9. Consumption growth and mortgage rate changes in Spain rate increases versus rate decreases and expected persistence. Mortgagors

	(1)	(2)	(3)	(4)
Increase × Rate Chg.	−2.50	−1.38		
	(2.03)	(2.92)		
Decrease × Rate Chg.	−1.73**	−1.99*		
	(0.85)	(1.12)		
Not Expected to Revert × Rate Chg.			−3.85***	−4.78**
			(1.41)	(2.04)
Expected to Revert × Rate chg.			−1.77***	−1.77***
			(0.65)	(0.68)
Increase	0.40	0.40		
Not Expected to Revert			0.22	0.22
p-diff	0.76	0.87	0.13	0.13
R-squared	0.05	0.03	0.05	0.03
Observations	30,479	30,479	30,479	30,479
F exc. instrument		44.5		23.2

Notes: The LHS is real log consumption growth excluding shelter-related expenses. All controls as in Table 2. Standard errors (in parentheses) are clustered at the level of variation in the mortgage rate. Sample: all mortgagors with heads 18 to 64 years old who are in the survey between 2007 and 2018.

a 1.73 (OLS) and 1.99 (IV) p.p. increase in consumption growth in Spain, while it implies a 3.34 (OLS) and 14.85 (IV) p.p. increase in consumption growth in the United States. The larger effect in the US could be due to the fact that mortgage cash-flow gains from active refinancing would typically last longer than from automatic ARM resets. We explore the role of expected interest rate change persistence on the spending response next.

4.4. The role of expected interest rate change persistence

An important distinction between an actively refinanced FRM and an automatic ARM reset is that the new rate from refinancing is locked-in (permanent), while a rate change (and any cash flow gains) for an ARM could be transitory. Therefore, mortgage rate effects on expenditure could be a function of how persistent the rate change is expected to be. To explore this, columns (3)–(4) of Table 9 for Spain and Table 10 for the United States explore whether expectations about the future evolution of interest rates—specifically whether they will continue to decrease (or increase) or "revert" to higher (lower) levels—affect the strength of the association between the mortgage rate change and expenditure growth.

Using data from Consensus Economics, which conducts surveys of professional forecasters for each country, we classify a rate change as "expected to revert" if the consensus forecast is for a rate increase following a period when actual interest rate declined or for a rate decrease after the actual interest rate increased.[47] Similarly, we classify a rate change as "not expected to revert" if rates are expected to continue to move in the same direction as the most recent actual interest rate change (or remain unchanged). We find that the effect of mortgage rate changes on consumption is somewhat stronger in Spain when the rate changes are not expected to revert. In the United States, the effect is larger and statistically significant when rate changes are expected to revert—both for all mortgagors and for those in the middle Mpay group, with the latter effects being larger and even more precisely estimated. These patterns are what we would generally expect given the institutional differences between the two countries. Spanish households should react more to rate changes if they expect them to have some persistence, while in the United States, mortgagors may be more inclined to refinance if they anticipate that refinancing might be less favorable in the

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Table 10. Consumption growth and mortgage rate changes in the united states rate increases versus rate decreases and expected persistence. Mortgagors

	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV	(7) OLS	(8) IV
	All Mortgagors				Middle Mpay Only			
Rate Chg. × Increase	−1.43	18.35			−2.96	24.02		
	(2.56)	(20.17)			(3.49)	(31.60)		
Rate Chg. × Decrease	−1.63	−11.02			−3.34*	−14.85		
	(1.31)	(11.69)			(1.80)	(17.78)		
Not Expected to Revert × Rate Chg.			0.26	−40.79			−0.97	−42.22
			(1.53)	(74.97)			(2.06)	(83.34)
Expected to Revert × Rate Chg.			−2.50**	−6.70			−4.25***	−7.26
			(1.08)	(11.28)			(1.56)	(11.38)
Increase	0.42	0.42			0.42	0.42		
Not Expected to Revert			42.5	42.5			42.3	42.3
p-value diff	0.95	0.35	0.11	0.60	0.93	0.43	0.18	0.63
R-squared	0.03	0.01	0.03	−0.02	0.03	0.00	0.03	−0.02
Observations	20,419	20,419	20,419	20,419	9,968	9,968	9,968	9,968
F exc. instrument		1.0		0.2		0.9		0.2

Notes: The LHS is real log consumption growth excluding shelter-related expenses. All controls as in Table 3. Standard errors (in parentheses) are clustered at the level of variation in the mortgage rate. Sample: all mortgagors with heads 18 to 64 years old who are in the survey between 2007 and 2018.

future. Overall, our results are consistent with what theory would predict, but the differences in estimates based on the expectations of rate movements are only statistically significant at the 13% level in Spain and at the 11 (18) percent level for all mortgagors (the middle Mpay group) in the United States.

4.5. Robustness

Tables 11 and 12 show that our results for both countries are generally robust to alternative specifications and controls. Our baseline specification (first panel) includes year fixed effects. The next two panels of the robustness tables show results for a specification without year fixed effects and a specification with a linear time trend instead of year fixed effects (second and third panels, respectively). The estimated coefficients for mortgagors in these two specifications are a bit smaller than with year fixed effects in Spain and a bit larger than the baseline in the United States, but the overall message remains the same. One notable difference is that, in these two alternative specifications, the coefficients for renters become significant in Spain. Indeed, renters tend to have nonhousing debt, and thus they may benefit (suffer) from reduced (increased) interest costs when rates decline (rise). Changes in rates impact their cash flows, leading them to adjust their consumption accordingly.[48] Our baseline specification with year fixed effects seems to purge some of these effects for renters better than the alternative specifications without a full set of year fixed effects.

The fourth and fifth panels of the Spanish table return to the baseline specification (including year fixed effects), but consider different horizon-lag combinations of the mortgage rate change: an 18-month change and a 12-month change, neither lagged relative to expenditure growth.[49] In both cases, the estimated coefficients are a bit smaller for mortgagors, and the IV estimates lose statistical significance for the 12-month no-lag case. Our reading of these results is that given that we do not know exactly when rates reset for mortgagors in Spain, the 6-month lag structure captures more resets and/or that consumption adjusts slowly to rate changes (and therefore, lagging the rate change relative to expenditure growth helps). Our baseline specification probably better captures potential slow expenditure adjustments to rate changes.

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Table 11. Consumption growth and mortgage rate changes (Spain) robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All		Owners/Mortgage		Owners/No Mortg.		Renters	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	Baseline, 12-month Change, 6-month Lag							
Rate Change	−1.74***	−1.65***	−1.91***	−1.85***	−1.59***	−1.82***	−1.51	−0.40
	(0.39)	(0.48)	(0.64)	(0.67)	(0.51)	(0.65)	(0.97)	(1.20)
	No Year Fixed Effects							
Rate Change	−1.47***	−1.50***	−1.46***	−1.45***	−1.43***	−1.67***	−1.49***	−1.09**
	(0.23)	(0.27)	(0.31)	(0.34)	(0.32)	(0.38)	(0.45)	(0.49)
	Linear Trend							
Rate Change	−1.38***	−1.41***	−1.37***	−1.35***	−1.31***	−1.55***	−1.47***	−1.06**
	(0.22)	(0.26)	(0.31)	(0.34)	(0.32)	(0.38)	(0.45)	(0.49)
	Alternative Rate, 18-month Change, No Lag							
Rate Change	−1.07***	−1.04**	−1.46***	−1.33*	−1.15**	−1.24*	0.42	0.37
	(0.40)	(0.50)	(0.55)	(0.68)	(0.49)	(0.64)	(1.27)	(1.33)
	Alternative Rate, 12-month Change, No Lag							
Rate Change	−1.03**	−0.73	−1.15**	−0.96	−1.70***	−1.37**	0.98	1.57
	(0.40)	(0.47)	(0.56)	(0.65)	(0.48)	(0.53)	(1.30)	(1.49)
	Durables							
Rate Change	−3.87***	−3.62***	−3.78**	−4.02**	−2.76*	−2.58	−7.21***	−5.00*
	(0.95)	(1.11)	(1.70)	(1.84)	(1.45)	(1.70)	(2.46)	(2.89)
	Nondurables and Services							
Rate Change	−1.27***	−1.14***	−1.15**	−0.96*	−1.57***	−1.65***	−0.66	−0.13
	(0.35)	(0.41)	(0.53)	(0.58)	(0.44)	(0.51)	(0.85)	(1.01)

Notes: The LHS is log consumption growth excluding housing-related expenditures (mainly utilities, maintenance spending, and condo fees). The rate included in the regressions is the 12-month change in the reference rate for mortgages from the Bank of Spain, lagged six months relative to the date of the last household interview unless indicated otherwise. All controls as in Table 2, not reported for brevity. Standard errors (in parentheses) are clustered by two-week period × year, which is the level of variation of the mortgage rate. Sample: all households with heads 18 to 64 years old who are in the survey between 2007 and 2018. Instrument: Euribor three-month shock aggregated over the same number of periods as the interest rate change, lagged to match the interest rate change plus one additional month. Alternative specifications as indicated by the panel heading in the table.

For the United States, we consider 6-month rate changes lagged three months relative to the end of the consumption period rather than our baseline measure, which is lagged six months, and a 9-month change in the mortgage rate in addition to the baseline 6-month change (see the fourth and fifth panels of Table 12). We consider these alternative rate-change horizons following the idea that households likely make the decision to refinance based on recent fluctuations in interest rates, but it takes time to complete the refinancing process and benefit from a cash flow perspective. We choose slightly shorter lags as a way of checking how quickly actual or expected cash flow changes impact spending behavior. In addition, households may choose to refinance based on rate changes over a longer period of time, and the 9-month change horizon allows us to consider this possibility in terms of the expenditure effect. The results with these alternative rate-change measures and horizons are broadly similar to our baseline findings for all households. This is especially the case for the longer rate-change horizon, the first 6 months of which cover the same period as our baseline measure and thus may be picking up those effects. Indeed, the 6-month rate change lagged only 3 months yields weaker and less precisely estimated effects for all households and homeowners with or without a mortgage, including the middle Mpay group that is more likely to want to refinance. This combined with the longer rate-change horizon (lagged less) results

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Table 12. Consumption growth and mortgage rate changes (US) robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	All		Owners/Mortgage		Middle Mpay		Owners/No Mortg.		Renters	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	Baseline, 6-month Rate Change, 6-month Lag									
Rate Chg.	−1.30**	−2.56**	−1.55*	−2.05	−4.76***	−8.52***	−2.70**	−4.33*	−0.02	−1.81
(0.64)	(1.13)	(0.90)	(1.38)	(1.23)	(2.13)	(1.36)	(2.60)	(0.92)	(1.64)	
	No Time Effects									
Rate Chg.	−2.24***	−2.50	−2.40**	−1.74	−5.53***	−8.12***	−3.08**	−4.03	−1.42	−2.21
(0.83)	(1.55)	(0.98)	(1.71)	(1.26)	(2.28)	(1.54)	(2.75)	(1.01)	(1.99)	
	Linear Trend									
Rate Chg.	−1.56**	−3.28**	−1.77*	−2.49	−4.75***	−8.77***	−2.34	−5.09*	−0.74	−2.82
(0.71)	(1.58)	(0.94)	(1.72)	(1.27)	(2.25)	(1.47)	(2.74)	(0.88)	(1.97)	
	Alternative Rate, 9-month Rate Change, 3-month Lag									
Rate Chg.	−1.45**	−3.53**	−1.31	−2.89	−2.46*	−10.37***	−1.40	−2.54	−1.87*	−5.91**;
(0.69)	(1.49)	(0.98)	(1.88)	(1.39)	(3.45)	(1.35)	(2.74)	(1.02)	(2.54)	
	Alternative Rate, 6-month Rate Change, 6-month Lag									
Rate Chg.	−0.99	−1.24	−0.47	−1.10	−0.72	−2.77	0.06	1.55	−2.92***	−4.38**
(0.63)	(1.13)	(0.88)	(1.65)	(1.43)	(3.12)	(1.37)	(2.76)	(1.03)	(2.00)	
	Nondurables and Services									
Rate Chg.	−0.72	−1.84**	−1.29*	−2.73**	−2.20***	−4.27***	0.35	−2.22	−0.50	0.25
(0.51)	(0.80)	(0.70)	(1.15)	(0.74)	(1.21)	(1.09)	(1.73)	(0.74)	(1.17)	
	Durables									
Rate Chg.	−7.52	−10.64	−8.86	−11.50	−17.79**	−29.73**	−13.35	−22.04	0.18	−0.01
(4.65)	(7.77)	(5.69)	(9.03)	(8.08)	(14.86)	(8.89)	(17.80)	(6.25)	(9.84)	

Notes: The LHS is real log consumption growth excluding shelter-related expenses (rent, maintenance, utilities, etc.) and retirement benefit contributions. Except where indicated, the interest rate included in the regressions is the six-month change in the nominal 30-year fixed rate mortgage lagged six months relative to the end of a household's reported consumption period. Each specification also includes all controls as in Table 3, not reported for brevity. Middle Mpay refers to mortgagors between the 25th and the 75th percentiles of the distribution of mortgage interest payments relative to income. Standard errors are clustered by month × year, which is the level of variation in the mortgage rate. Sample: all households with heads 18 to 64 years old who are in the survey between 2007 and 2018. Instrument: Shocks to the 10-year Treasury rate aggregated over the final 3 months of the rate change period. Alternative rate specifications as indicated by the panel heading in the table.

being closer to our baseline findings suggests that the rate change that matters for households' refinancing decision is the one they experience slightly before and into the early part of the period over which we observe their spending growth—a result consistent with the idea that it takes time to refinance and benefit from the cash flow gains.[50] It is also worth noting that the consumption effects of rate changes for renters are stronger and more precisely estimated in these alternative rate-change specifications. A possible explanation for this pattern is that renters save for future house purchases and their savings behavior responds to interest rate changes. Saving adjustments can occur quickly compared to the longer process required to refinance an existing home for cash flow gains, so more recent rate changes may be most salient for renters and hence more relevant for predicting changes in their consumption. Alternatively, renters might have relatively more short-term debt, the interest rate of which tends to move with longer-term rates.

Finally, we divide total nonhousing expenditures into its components—durables and nondurables/services—to check how the interest rate sensitivity varies across expenditure categories. In Spain, the estimated coefficients are lower for spending on nondurables/services and significantly larger for durable expenditures. The difference in the magnitude of the estimated coefficients for durables and nondurables/services is not surprising, as durables spending itself is

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interest-sensitive when financed through loans—which can also be seen in the significant effects for renters in Spain. In addition, the IES effect is likely to be greater for durable goods, as the service flow from durable purchases can be enjoyed for many years. There are qualitatively similar patterns for the expenditure components in the US, with the nondurables/services effects being smaller. The durables effects are quite large in the US, but they are only precisely estimated for mortgagors in the middle Mpay group. The estimated effects on durables for mortgagors in the middle Mpay group are significantly larger than those for Spanish households, likely pointing to the use of cash-out refinances to purchase durables. We also do not see any renter effect for durables in the US, unlike Spain. It is also worth highlighting that our findings for the US are particularly robust for mortgagors in the middle Mpay group—the ones who are most likely to respond to rate changes due to a potential desire and ability to refinance.

4.6. Further discussion

Our analysis points to a healthy transmission of mortgage rate changes to household consumption in both the United States and Spain between 2007 and 2018, a period dominated by interest rate declines. (Since we control for household income changes in our regressions, the effects that we document go beyond the general equilibrium effects of mortgage rate changes on income.) Our prior was that transmission would be more prominent in Spain because of the dominance of true ARMs in that country. Although we found this prior to be correct on average across all households, the details proved to be more complicated.

We have highlighted that mortgage rate changes affect household expenditure through multiple channels, not just the mortgage cash flow channel. The IES effect seems strong in both countries, as outright homeowners, who are likely net savers with low MPCs, increase their expenditure as rates decline (for outright homeowners, the mortgage cash flow effect is zero, and nonmortgage cash flows are likely lower as the interest earned on liquid savings also falls). Renters overall show less expenditure sensitivity to mortgage rate changes (especially rate changes occurring further in the past). On average, mortgagors in Spain exhibit a greater spending response to mortgage rate changes than mortgagors in the United States. However, mortgagors in the United States that are more likely to want and be able to refinance (middle Mpay) exhibit the largest response. The difference between the average response and the larger response of this group occurs because mortgage refinancing is necessary in the United States to take advantage of the lower interest rates—an undertaking that is not equally feasible across all mortgagors.

Another fact worth highlighting is the very different proportions of households in each category of housing tenure in the two countries. Our overall estimated interest rate effects are a weighted average of the effects for different groups, so even if mortgagors in Spain exhibited greater sensitivity to rate changes than mortgagors in the United States, the overall effect in Spain could be smaller depending on the behavior of other households. Mortgagors, outright owners, and renters represent 44, 40, and 16% of households in Spain in our sample. In the United States, the corresponding numbers are 50, 20, and 30%. In other words, within the 18-to-64 age group, homeownership is more prevalent in Spain (84% versus 70% in the United States), but homeowners in Spain are more likely to have fully paid off their balances and own their homes outright, which is not surprising given the steep penalties for late mortgage payments and default in Spain during our sample period.

Focusing on mortgagors, there are at least three reasons for the relatively larger response of likely refinancers in the United States relative to ARM holders in Spain. First, households in the United States that refinance might generally have higher MPCs out of cash flows, and if not, refinancing can potentially free up more cash than the (frequent) automatic rate resets in Spain. Second, refinancing locks in a new rate for the duration of the loan, while automatic resets might be perceived by Spanish households as transitory. Typically, the MPC out of transitory (resource) changes is lower than the MPC out of permanent changes, and we provided some evidence

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that expectations about future rates matter for the estimated elasticities of Spanish households.[51] Third, different risk aversion in the two countries could explain the observed patterns through a larger IES effect in the United States if mortgagors are less risk averse than in Spain. In contrast, outstanding mortgage debt relative to income is not radically different in the two countries, but, if anything, is slightly higher in Spain than in the United States (see Table 4). Thus, greater household mortgage debt relative to income in the United States is not a likely explanation for the somewhat larger cash flow effect for mortgagors that are potential refinancers in the United States.

In addition, we found that overall the mortgage cash flow effect is more similar across Spanish mortgagors than among United States mortgagors. So, while differences in the types of mortgages across the two countries might not matter much for the average effect of monetary policy, it might still matter in terms of how monetary policy (indirectly) impacts inequality. Importantly, mortgagors in the United States that benefit from lower interest rates are the ones with the ability and desire to refinance—households that overall are likely wealthier and more financially savvy. In fact, recent research by Agarwal et al. (2024) documents that homeowners in the top quintile of the income distribution were much more likely to refinance than homeowners in the bottom quintile during the pandemic. Similarly, Gerardi et al. (2021) find that nonwhite borrowers are much less likely to refinance than white borrowers. In general, refinancing incurs relatively high transaction costs, around $5,000 on average according to Freddie Mac[52]—an amount that may be prohibitive for less affluent borrowers even if the longer-term savings from refinancing outweigh the initial costs. In a mortgage market dominated by ARMs with frequent rate resets like in Spain, borrowers automatically benefit when rates decline without having to pay an upfront fixed cost, and the benefits of decreasing rates with expansionary monetary policy are spread more evenly across mortgagors. Also, monetary policy might be more powerful in slowing the economy in Spain than in the United States, given that mortgage rates can automatically reset higher on a yearly basis. Such frequent resets could also be destabilizing.[53] That said, FRMs can also create economic challenges, especially in an increasing rate environment where households might not move or sell their houses because their mortgage rate is low. This "lock-in" interest rate effect can limit job mobility that is beneficial to the overall economy (see Fonseca and Liu, 2024), or pose problems in the housing market. For example, older households might stay longer in their larger homes, making it challenging for younger ones to "trade-up" their housing. Indeed, more work is needed to compare ARMs and FRMs in a rising-rate environment, as our sample period is not well suited to estimate the sensitivity of expenditure to mortgage rate increases.

Finally, Figure 3 shows the implied partial equilibrium mortgage rate effects on household expenditure growth, during our sample period, for all households and for mortgagors in Spain and the United States. Although monetary policy (and therefore mortgage rates) take different paths in Europe and the United States over our sample period, the figure highlights that mortgage rate changes clearly affect household expenditure growth in both countries, with the effects in Spain more precisely estimated, likely because the effects across Spanish households, particularly mortgagors, are more widespread.

5. Conclusion

In this paper, we compare the transmission of monetary policy to consumption in two countries with very different mortgage market institutions—Spain and the United States. The Spanish mortgage market is made up mostly of true ARMs with annual rate resets, while the US market is dominated by long duration FRMs where homeowners' mortgage rate changes occur only if they actively refinance or move to a new home. The focus of our analysis is on the direct effect of monetary policy transmission, particularly the mortgage cash flow effect. We show that in Spain, due to the automatic resetting of mortgage rates, the mortgage cash flow effect is larger when rate changes are expected to persist, and it is homogeneous across households. In contrast, in the United States, the mortgage cash flow effect is larger for rate changes that are expected to revert (making it more

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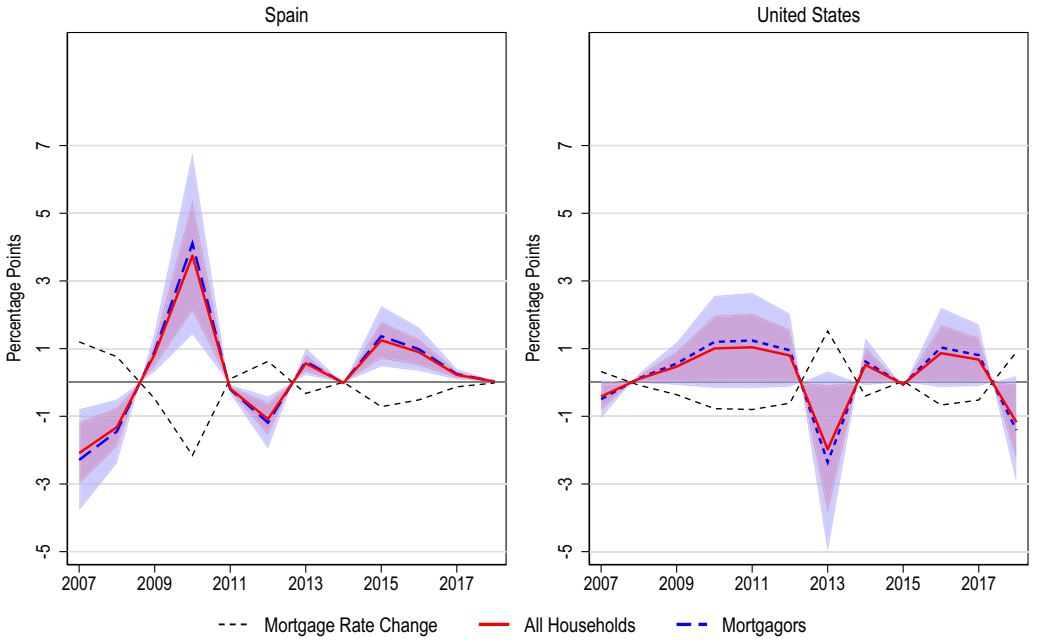

Figure 3. Mortgage rate effects on household consumption growth over time.
Source: Authors' calculations using OLS estimates in Table 2 for Spain and in Table 3 for the United States, along with actual mortgage rate changes during the period. US estimates are scaled up by a factor of 4/3 to account for the fact that US estimates refer to changes over a 9-month period instead of the 12 month horizon in Spain. Shaded areas represent 95% confidence intervals for each group.

attractive to refinance now rather than later), and it is heterogeneous among mortgagors, with the most likely refinancers showing the largest effects.

Our prior was that transmission of monetary policy to consumption via mortgage rate changes should be more noticeable in Spain because of the dominance of ARMs relative to the United States. We find that this is indeed the case for the average effect among all households. However, the average effect includes at least two other direct channels of monetary policy transmission to consumption beyond the mortgage cash flow effect: an IES effect and a nonmortgage cash flow effect, both of which are hard to disentangle from the mortgage cash flow effect due to the comovement of various interest rates in the economy. Although these channels are not the focus of our analysis, we find some evidence for these effects being operative in the data given the response of nonmortgagors' consumption to mortgage rate changes. Among mortgagors too, we find a somewhat larger effect in Spain than in the United States. However, when we focus on the group in the United States that is most likely able to refinance (those in the middle of the Mpay distribution), this is no longer the case. We further verify that the difference in the estimated effects between the two countries is not driven by different-sized policy shocks hitting the two countries but is instead likely explained by the fact that households in the United States can refinance to lock in a new lower rate for the duration of the loan when aggregate mortgage rates decline (as they did during most of our sample period), and refinancing is typically undertaken by those who have the most to gain from it. Indeed, in the United States, we find larger effects among households that are younger, working, white, or have experienced housing appreciation. In contrast, we find mostly homogeneous effects among mortgagors with different socioeconomic and demographic backgrounds in Spain.

In general, our results provide new evidence on the role of mortgage institutions in the transmission of monetary policy to consumption and, especially, on the mortgage cash flow effect.

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We show that the mortgage institutional setting matters for the average effect on consumption in a way that we would expect. In addition, the institutional setting has indirect consequences for inequality given the automatic transmission of rate changes under ARMs versus the selective transmission under FRMs based on who refinances.

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Notes

1 Note that we use the terms "consumption" and "expenditure" interchangeably, but we are aware of the conceptual difference, particularly for durable goods.

2 Based on the existing literature, it is not clear what one should expect about the relative effects across the two countries given the different mortgage rate regimes. On the one hand, the framework in Rubio (2011) suggests that the mortgage cash flow effect under ARMs should be at least as large as under FRMs. In contrast, Calza et al. (2013) document that the structure of housing finance affects the transmission of monetary policy with stronger effects on consumption in countries where the extraction of mortgage equity is common and mortgage contracts are variable rate. Mortgage equity extraction is more common in the United States than in Spain (see Haurin and Moulton, 2017), but variable rate contracts dominate in Spain.

3 The number for Spain is based on mortgage statistics produced by the INE. The United States numbers are based on calculations by Fuster and Vickery (2015), with more recent statistics reported by the St. Louis Fed.

4 For an overview and comparison of European and United States mortgage markets before the 2008 housing crisis, including securitization details, see Suárez & Vassallo (2004). In addition, Campbell (2013) discusses mortgage market design in the United States compared to other developed countries and annual European Mortgage Federation (EMF) Hypostat reports document developments in the housing and mortgage markets in Europe and beyond.

5 Ultimately, there is no perfect comparison of countries when evaluating how monetary policy transmits to consumption through interest rate changes under different mortgage regimes. An alternative approach could be to analyze Spain and another country within the Euro Area with predominantly FRMs, such as Germany. However, Germany lacks the spending data necessary to perform such an analysis, and while Germany has a much larger share of FRMs than Spain, it also has a relatively low homeownership rate, 41% as of 2007 compared to nearly 78% in Spain (see Figure 1 in Andrews & Sánchez, 2011). In addition, mortgage costs as a percentage of disposable income are more similar between the United States and Spain than between Germany and Spain (see Figure 3 in van Hoenselaar et al. 2021).

6 The mortgage market in Sweden lies somewhere in between. According to Flodén et al. (2021), Swedish households typically have a combination of FRMs and ARMs, rather than one or the other. Furthermore, 90% of new FRMs in Sweden have an initial duration of less than five years. As a result, one cannot easily compare the outcomes in Sweden directly with those in the United States or Spain. A within-country analysis of the mortgage cash flow effect under ARMs versus FRMs in Sweden would also be difficult because the amount of each type of mortgage is not known at the household level.

7 This identification challenge is not unique to our paper and is faced by most other papers in this literature.

8 We could alternatively consider nominal long-term debt, like in Slacalek et al. (2020), and then set the aggregate price level equal to a constant (zero inflation) because we are only interested in the direct (and not general equilibrium) effect of monetary policy on consumption. However, without inflation, the real interest rate will equal the nominal interest rate, and therefore we would be back in the purely real world that we consider.

9 For an FRM, p_t is constant over time, and equation (3) can also be written as $p_t = p_0 = \frac{m_0 r_0}{1-(1+r_0)^{-T}}$.

10 An alternative would be to treat y_t as a parameter, but the results would be identical under that alternative.

11 Note that since p_t is a function of r_t (m and T are parameters), the total derivative of p_t with respect to r_t is the same as the corresponding partial derivative. That is, $p_t = p(r_t) \implies dp_t = \frac{\partial p_t}{\partial r_t} dr_t \implies \frac{dp_t}{dr_t} = \frac{\partial p_t}{\partial r_t}$.

12 Note that if the change in the interest rate applies to next period's mortgage payments rather than current mortgage payments, as we have assumed, then the mortgage cash flow effect would be zero because the household would correspondingly adjust its position in the short-term bond market. Our assumption is in line with our data, where we find that mortgage payments vary with the mortgage rate in both Spain and the United States.

13 Ahn et al. (2024) study the degree of consumer attention to monetary policy shocks by considering the effect of these shocks on consumer expectations. They find that while homeowners adjust their expectations of inflation and labor market conditions in line with the intended effects of monetary policy, renters are less likely to do so. They argue that this result is due to homeowners being more attentive as they have more "skin in the game."

14 The data can be obtained from the INE.
15 While earlier ECPF data are available, the methodological differences between the EPCF-2006 and its predecessor, the ECPF-1997, are too large to extend our analysis to earlier years. In particular, the ECPF-1997 was quarterly and only interviewed 4,000 households. Moreover, expenditure data are inconsistent with households reporting on all expenditure categories in some quarters, but only on selected categories of goods and services in others.
16 The CEX data are collected by the Census Bureau for the Bureau of Labor Statistics (BLS). The primary purpose of the survey is to "revise the relative importance of goods and services in the market basket of the Consumer Price Index." See https://www.bls.gov/cex/ for more details on the design and objectives of the survey.
17 Prior to 2015, households in the CEX were interviewed five times (five quarters), which included a preliminary "bounding" interview that mainly collected background information on the household. During this period, income data were collected only in the second and fifth interviews. See online Appendix A for additional details on how we construct relevant data from the CEX for our analysis.
18 In the EPCF-2006, our measure of expenditure is constructed by subtracting expenditure on Group 4 items from total spending. Group 4 spending includes rental payments (actual and imputed for homeowners), utility payments, and maintenance expenditures related to housing. In the CEX, our measure of total expenditure excludes housing costs (actual or imputed rents and utilities), as well as contributions to retirement plans. Our results are similar if we do not exclude retirement contributions.
19 Specifically, we use the average rate on mortgage loans with a duration over 3 years offered by credit institutions for home purchases each month in Spain (series 7 on Table 19.1).
20 Asset price data for both countries are obtained from Bloomberg and Haver Analytics. The GC meeting dates are obtained from the website of the ECB, and the FOMC meeting dates come from the website of the Board of Governors of the Federal Reserve System.
21 See online Appendix B.1 for details on the construction of these shocks and additional details on our robustness analysis.
22 A 3% interest rate floor was very common during our sample period. Since 2019, interest rate floors have not been allowed beyond some minimum protections for lenders against negative rates.
23 Another product offered in the Spanish market is a fixed-repayment mortgage. This product is a variable interest loan that looks like an FRM in the sense that the borrower always pays the same amount each period irrespective of interest rate changes. The difference is that, if rates increase (decrease), the repayment period is extended (shortened).
24 See Fuentes et al. (2013) for a comparison of home repossessions in Spain and other European countries during the housing crisis.
25 Bank of Spain (2019) provides a report on the financial position of Spanish households.
26 The ECV interviews about 13,000 households each year. For more detailed information on this survey, visit the INE's website.
27 The longitudinal part of the ECV does not have information on mortgage principal payments.
28 See https://www.fhfa.gov/programs/nmdb for more details.
29 For more details, see a recent report by the St. Louis Fed available here.
30 Carbó-Valverde et al. (2012) discuss the growth in securitization that occurred in Spain before the housing crisis. This growth was accompanied by lower standards in new mortgage originations, but ARMs continued to be the dominant product, representing well above 90% of new originations until 2016. However, by the end of our sample, FRMs had quickly become more popular, constituting 39.2% of new originations according to INE.
31 Since households are interviewed at different times throughout the year, we assign to each household the month (for the mortgage rate) and the quarter (for the regional unemployment rate and national GDP, which are only available at the quarterly frequency) of their interview when calculating the growth rates or changes in these variables.
32 Returning to our previous example, if a household's first interview is in April 2017 and its last interview is in January 2018, then its consumption growth covers spending from October to December 2017 relative to spending from January to March 2017. Given this timing, the change in interest rates is measured between December 2016 and June 2017.
33 Unlike Spain, changes in state-level unemployment rates and quarterly real GDP growth rates (based on the households' interview date) were not significant after controlling for year fixed effects and are not included. Our estimates are very similar, however, when we include these controls (not shown).
34 For mortgagors we further limit the sample to those households with reported annual mortgage payment-to-income ratios less than 1.
35 In a previous working-paper version of this paper, where we presented baseline regressions *without* year fixed effects, we showed that our findings were similar using either real mortgage rate changes or controlling for inflation and changes in inflation expectations.
36 Using Swedish data, Flodén et al. (2021) report an MPC out of mortgage cash flows in the range of 0.19–0.5.
37 We compute the MPC out of income as follows. The average elasticity of expenditure with respect to income is 0.18 in Spain (see the coefficient of income growth in column (1) of Table 2), while the average expenditure-to-income ratio is 0.99 (see online Appendix Table D.7). Together, these numbers yield an MPC out of income of 0.18. We follow similar steps for the United States (see online Appendix Table D.9), where $0.12/0.63 = 0.19$.

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38 These estimated income MPCs are in line with existing studies. In particular, Fisher et al. (2020) and Dynan (2012) find an income elasticity of around 0.1 using United States household-level data. Most aggregate estimates of the MPC out of income range between 0.2 and 0.6—see Carroll et al. (2017) for a summary.
39 "Other" includes Spanish households living rent-free in properties that belong to their employers, relatives, or the government.
40 It is also possible that some outright homeowners in Spain may be co-signers of mortgage contracts for (younger) relatives. Although they would respond "no" to having a mortgage on their own properties, they might help to pay for their relatives' mortgages. In this case, the mortgage rate change might affect their spending directly, even though the property they live in is debt-free.
41 These MPCs are calculated by dividing each group's estimated elasticity by their corresponding consumption-to-income ratio.
42 These estimates translate into MPCs out of rates changes equal to 0.67 (OLS) and 0.65 (IV) in Spain and 0.32 (OLS) and 0.42 (IV) in the United States. We cannot calculate MPCs for households without mortgages or renters because they do not have mortgage debt, which is part of the MPC calculation.
43 We measure house price growth over 5 years prior to each household's consumption period as a proxy for the amount of equity mortgagors might have in their homes. Unfortunately, we do not know how long the respondents have been in their current residence, but mortgagors with more equity are more likely to refinance.
44 The ECV contains information on total mortgage payments (principal plus interest), and the ECPF and the ECV contain comparable information in many other dimensions because they are both conducted by the INE. Our imputation equation, with a 0.59 adjusted R-squared, includes imputed owners' rent (in both surveys homeowners are asked to provide an estimated market rental price for their properties) and income (both in log form) as well as dummies for the gender, education level, age group, marital status, and labor force status of the household head, as well as whether he/she is self-employed or a business owner, and his/her type of labor contract and nationality. We also control for household size along with year, region, population density group, and building type (e.g., single family home, townhouse, apartment building) effects.
45 The institutional setting is also quite different in the two countries: while Spanish households predominantly have only ARMs, Swedish households concurrently hold a mix of ARMs and FRMs.
46 This effect is driven by households that experience mortgage rate declines (not shown).
47 Expectations are based on the 3-month and 12-month ahead forecasts of the 3-month Euribor rate and the 10-year Treasury yield for Spain and United States, respectively.
48 For different lag structures of the interest rate, this pattern is also observed for renters in the United States; see the fourth and fifth panels of Table 12.
49 The instruments are adapted to each case accordingly in terms of the number of monetary policy shocks aggregated in each case (18 or 12 months). In both cases, the monetary policy shocks are lagged one month relative to the actual mortgage rate, as in the baseline specification.
50 Results lagging the 9-month rate change by 6 months rather than 3 months (not shown) are weaker than what are reported in the fourth panel of the table. This reinforces the idea that the rate changes close to the beginning of the expenditure period seem to matter the most for households' spending decisions.
51 Jappelli and Scognamiglio (2018) show that following a reduction in mortgage payments in Italy in 2008, the consumption of ARM holders increased relative to that of FRM holders. However, the implied MPC was not statistically different from zero, in part because the borrowers expected the income shock to be short-lived and interest rates to increase in the future.
52 For more details, see this WSJ article.
53 Spain's cabinet had to approve mortgage relief support for more than one million vulnerable households as the ECB started to increase interest rates to fight inflation. See this Reuters story (accessed on November 21, 2021) for more details.

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