The Cost to Households of House Price Booms and Busts*

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Abstract

Fluctuations in house prices generate substantial heterogeneity in the price of purchase of similar dwellings depending on the time of purchase. These differences in the price of purchase have large effects on income-net-of-housing-costs. We document these effects using the large house price fluctuations during the recent housing boom-bust in Spain. Households can mitigate these impacts through changing labor supply. Men work more subsequent to paying higher house prices at purchase, whereas the correlation of house prices and labor supply for women is driven by selection: households where women work more, buy more expensive houses.

JEL Classification: D31, E32, J22

Keywords: house price fluctuations, labor supply, life-cycle, mortgage payments

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1 Introduction

Households devote much of their lifetime income to the purchase of their residential home and for most families, when to buy their main home is not a decision with much room for manoeuvre. However, the price they pay depends very much on the time of purchase and the point in the business cycle when they enter the housing market. This heterogeneity in the price of purchase can potentially have lasting effects, driving inequality in disposable income and changing labour supply decisions. The aim of this paper is to show the long run effects of the timing of house purchase. Our focus is on the implications of the price paid at the time of purchase, rather than how households react to subsequent house price shocks.

We study the impact of fluctuations in house prices in Spain over a twenty year period, from 1995 to 2017, on several variables of interest observed between 2002 and 2017. We focus in Spain for at least two reasons. First, almost 90% of the real assets of families consist of real estate (Banco de España 2017) and over 80% of families live in an owner-occupied house.[1] Second, during the last two decades, house prices in Spain have undergone tremendous fluctuations. During the years of the last expansion (1998-2007), house prices in Spain have generally doubled. After Spain entered the EU, an enormous amount of funds coming from a large and competitive banking sector fuelled housing demand and consumption (Jimeno and Santos (2014)). By bursting the bubble, during the ensuing crisis, the price fell considerably to an average devaluation of about 40% and much worse in some places.

The impact of the boom and bust on any particular household depends on when that household entered the housing market. In particular, the house price at the time of purchase changes the amount of lifetime income to buy the same house and generate different consumption commitments over the life-cycle. In turn, these lead to differences in income net of the commitments across households who differ only in their time of purchase. We focus on two issues arising from these differing consumption commitments. First, these commitments affect inequality of income net-of-housing costs: whether netting-off the additional costs of purchase in a housing boom increases or decreases inequality may depend on who is purchasing at different points in the business cycle. Cohorts of individuals who are exposed to large fluctuations in house prices at early ages may be expected to have greater inequality in income net of housing expenditures. Second, the overall impact on inequality will depend on how households respond, and in particular whether they change non-housing consumption or labour supply. Our analysis here relates to the literature exploring labor supply as an insurance device against labor market risk.[2]

[1] Between 2002 and 2011 the fraction of owners is around 82%, it is 80% in 2014 and 76% in 2017.

[2] See for instance Low (2005) and Pijoan-Mas (2006) for the individual's intensive margin response to an adverse wage shock, and Attanasio, Low, and Sanchez-Marcos (2005), Ortigueira and Siassi (2013) and Blundell, Pistaferri, and Saporta-Ekstein (2016) for the second earner intensive and/or extensive margin

For our analysis we use data from the Family Financial Survey (2002-2017) conducted by the Banco de España. We construct a measure of the additional housing cost associated with buying at the peak of the market, rather than at other times. We compute a house price index and calculate the price that would have been paid at the average over the period. In other words, the deflated price reflects the additional cost for the same house, rather than the additional costs that may arise due to the type of house purchased differing over the cycle. We use this measure to calculate the counter-factual mortgage payment and consider the difference between this payment and the payment implied by the actual price paid. We subtract this difference from household income to obtain a measure of income adjusted for the extra cost associated with the time of purchase. To the best of our knowledge, we are the first to quantify differences in households' disposable income that arise due to fluctuations in the purchase price of homes caused by aggregate cycles in prices.

Those who purchased at the peak of house prices have similar incomes subsequently than those who purchased outside the peak, but their income net of house costs was 10% lower. Inequality in household income adjusted for housing is larger than in actual income, partly due to the variation in housing circumstances within income bands. To give a sense of the size of the impact on inequality, the magnitude is similar to removing public transfers during a boom. Further, inequality in adjusted income increased faster over 2008 to 2017 than inequality in actual income.

We find that greater labour supply itself is part of the response of households to paying higher house prices at the time of purchase. We show the impact on labour supply for men and women of having paid higher prices for their homes. Clearly the house price that an individual pays is an endogenous choice depending on expectations about current and future earnings and so we instrument the actual price that was paid for the house with the regional house price at the time of purchase. Our findings on the impact of house prices on employment differ for men and women. For men, purchasing when prices are higher leads to greater employment. Further, the OLS estimate is an underestimate of the effect of house prices because those who bought in the boom were also more likely to lose their jobs after the boom and the collapse of the construction industry. For women, the OLS estimate shows a positive correlation between the house price and employment, but this disappears when we instrument the house price. In other words, those who anticipate working in the future choose to pay a higher price than the local average, rather than the higher price inducing greater employment. We estimate that at the bottom tercile of the income distribution the mitigation effect of labor supply is 30% of the extra cost of buying at the peak, and 52% at the top income tercile.

There is a growing empirical literature measuring the impact of changes in asset prices

response (added worker effect).

on wealth inequality. Kuhn, Schularick, and Steins (2020) show the importance of portfolio composition and the evolution of equity and house prices to account for wealth dynamics in the US. In Europe, Adam and Tzamourani (2016) show that richer households benefit more from equity price increases, but that house prices are more important at the median of the wealth distribution. For the case of Spain, Toledano (2022) studies how business cycle dynamics shape the wealth distribution through asset price changes and saving responses. However, the point we make in this paper is that heterogeneity in the price of purchase due to the cycle is an important source of differences both in living standards and in inequality across households with similar levels of life-time income and similar levels of wealth at a point in time. The importance of housing costs for disposable income net of housing expenditure is shown in Dustmann, Fitzenberger, and Zimmermann (2021). They find that the increase in income inequality in Germany since the mid-1990s is exacerbated by changes in housing expenditures, partly driven by the decline in the relative costs of home ownership versus renting. However, they do not consider differences in housing costs arising from differences in the price paid at the time of purchase.[3,4]

The decision to buy itself is likely to be affected by house prices. Laeven and Popov (2017) exploit regional variations in house price fluctuations in the United States during the early to mid-2000s to study the impact of the housing boom. They show that younger individuals who bought a home in MSAs with above-average house prices accumulate substantially higher housing debt.[5] Another potential reason for individuals to refrain from buying at the peak of a housing boom is that, as reported by Kuchler, Piazzezi, and Stroebel (2022), housing market expectations are strongly influenced by recently observed house price changes, by personally or locally observed house price changes and by house price changes observed in a person's social network. In Spain, however, house purchasing has remained very high despite the aggregate price increases, particularly at the point of household formation. Our analysis therefore explores the heterogeneity and decisions of home-owners.

Our question of how the purchase price subsequently impacts households is related to a small literature on how households' labor supply responds to house price movements:

[3]Dustmann, Fitzenberger, and Zimmermann (2021) define housing expenditure for renters as the basic rent (including utilities) and energy costs, and housing expenditure for owner-occupiers as mortgage interest payment, energy costs and maintenance and operation costs. They argue that repayment of mortgage capital constitutes an accumulation of net wealth and then is part of savings rather than consumption.

[4]In a macro model, Kiyotaki, Michealides, and Nikolov (2011) find that house price fluctuations cause a large redistribution between net buyers and net sellers of houses. Similarly, Glover et al. (2020) show that large fluctuations in earnings and asset prices in the US during the Great Recession have different consequences on welfare across generations because of the typical patterns of accumulation and deacumulation of wealth over the life-cycle. According to their analysis, the Great Recession implied modest average welfare losses for households in the 20-29 age group, but very large welfare losses of around 10% of lifetime consumption for households aged 60 and older.

[5]There is a sizable literature on the difficulties of getting onto the housing ladder (Ortalo-Magne and Rady (1999), and more recently, Carozzi (2019)).

Daminato and Pistaferri (2020) show the importance of family labor supply in understanding how households respond to shocks to financial and housing markets. Disney and Gathergood (2017) show that house price movements lead to changes in labour supply for home owners, with young married women increasing labour supply in response to a house price fall. By contrast, Bottazzi, Trucchi, and Wakefield (2019) show that in Italy, the effects of changes in financial wealth on labour supply are very small.[6]

Finally, our paper is also related to recent papers that have documented the existence of important heterogeneity in prices of even very homogeneous goods, see for instance Kaplan et al. (2019). As argued by Attanasio and Pistaferri (2016) the extent to which differences in prices actually paid affect the dynamics of consumption inequality is an open question. In this paper we focus on the heterogeneity in the price that households pay for dwellings of similar characteristics due to large house price fluctuations over time.[7]

We proceed in section 2 to describe the data and macroeconomic background and in section 3 we describe in detail characteristics of house buyers over the cycle. In Section 4, we show how the time of purchase generates generates differences in the housing costs. We adjust income to allow for differences in the price at the time purchase and show the adjusted income and inequality in adjusted income. Section 5 shows the implications of house prices for subsequent labour supply of men and women. We also provide a quantitative assessment of the mitigation effect of the labor supply response on the disposable income. Section 6 concludes.

2 Data and Background

We use for our analysis the Spanish Survey of Household Finance conducted by the Banco de España which provides detailed information on the income, assets, debt and spending of Spanish households for around 6,000 households. This is a triennial survey available from 2002 to 2017. The period we consider encompasses the housing market boom-bust of the Spanish economy. The survey contains information of wealth holdings, debt and consumption, as well as individual information about personal characteristics, earnings, labor status and other labor market characteristics. Importantly, retrospective information on the year of residential house purchase and the price paid is provided for each household. We use

[6]There is a much wider literature on expenditure responses to house price changes: Mian, Rao, and Sufi (2013) and Berger and Vavra (2015) show that consumption responds substantially to changes in house values, and Crossley, Levell, and Low (2020) show that this response is more in housing investment rather than consumption.

[7]Of course, there may be certain frictions in the housing market generating house prices dispersion at a particular time period, this is something that has been studied, among others is Rincón-Zapatero, Jerez Garcia-Vaquero, and Diaz Rodriguez (2020).

sample weights so that the statistics we provide are representative of the population in each wave. This is very important because the survey overrepresents rich households.[8]

We restrict the sample to homeowner couples in which the head was born between 1960 and 1979. The fraction of renters in our sample fluctuates a small amount across waves. The average is 14% renters, 80% homeowners, with the remainder in other forms of housing. We require the age of purchase to be between 25 and 45 to focus on households at similar life-stages. We further restrict the sample to those who bought after 1994, a total of 3,639. Finally, when regional house prices are needed for the analysis we restrict the sample to those who bought in 2001 or after, when the data is available. This leaves us with 1,987 observations. In the regression analysis, depending on the specification we may have fewer observations since some variables are not available for all households. This is for example the case for the loan-to-value ratio at the time of purchase which is only available for those with outstanding debt.

The first graph in Figure 1 shows the time path of aggregate house prices.[9] The second graph report annual house price growth for each region over time. The figure highlights the heterogeneity across regions, but also the common movement in house price growth. The third and fourth graphs provide the aggregate context for these movements in house prices by showing how employment for men and women changed over this time period and how consumption changed. These raw descriptive numbers show sizeable movements over time in averages but can mask substantial heterogeneity across households. In particular, we cannot see how much heterogeneity there is in outcomes across households due to differences in house prices at the time of purchase. In what follows, we use micro data to analyse this heterogeneity.

There are two aspects of the Spanish institutional setup to note. First, in Spain, foreclosure and eviction do not terminate the debt. This means that even after losing their homes, individuals still owe the remainder of the mortgage and mortgage debt is specifically excluded from the bankruptcy laws.[10] From 2012, the law changed (Real Decreto-ley 6/2012) to be somewhat more lenient towards defaulting households, but only for those in poverty. In particular, mortgagors for whom mortgage payments exceed 50% of net household income, have the right to be offered a restructuring plan for the mortgage debt by the bank or even a reduction of the debt.[11] Second, as in many countries, mortgage payments are deductible

[8]In the second part of our analysis we pool the different waves of the survey and we normalize cross-sectional weights to one before pooling to avoid weighting differently individuals that belong to waves with different number of households.

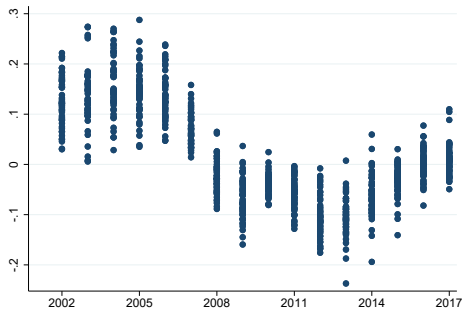
[9]The evolution of house prices of purchase reported in the survey mimics the evolution according to the house price index. After 2010 the smaller number of observation in the survey causes some discrepancies.

[10]See the article in The New York Times, In Spain, Homes Are Taken but Debt Stays, https://www.nytimes.com/2010/10/28/world/europe/28spain.html.

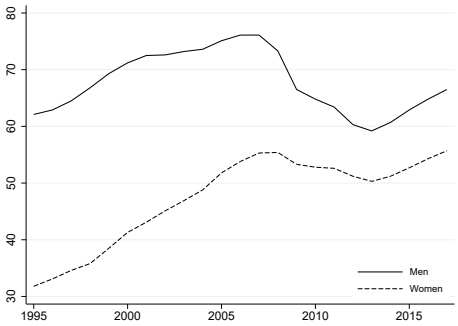
[11]Further, if the restructuring plan is not viable, the mortgagor may handover their residence as a means

Figure 1: Time Paths of House Prices, Employment and Consumption

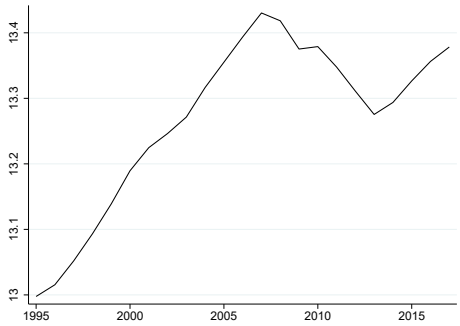
(a) House Price Index



(b) Regional House Price Growth



(c) Employment



(d) Log Consumption

Source: Aggregate households' consumption is from National Account and employment rates are from the Labor Force Survey. House Price Index is from the Valuation Agency of Real State Properties TINSA.

from income taxes (up to a maximum) for properties bought before the end of 2013.

3 House Buyers Across the Cycle

In this section we report the characteristics of households who bought at different times of the business cycle. We define the peak as years in which house prices were at least 20% higher than the average price over the period 1995 to 2017. The peak years were from 2005 to 2010.[12]

In Table 1 we summarize several variables for households who bought at the peak and off-peak. Household income and wealth, consumption and the age of the oldest child are measured at the time of interview. The other variables are from the time of purchase. In

of definitively discharging the debt. Moreover, the debtor is allowed to stay in the residence as a tenant for two years, paying rent, thus avoiding foreclosure.

[12]In the Appendix, Table 8, we provide detailed descriptive statistics of interest in our sample by the year of house purchase.

Table 1: Household Characteristics for Purchases Off-Peak vs At the Peak

	Off Peak	At the Peak
Price At Purchase	132,275	217,640
Square Metres	110	110
Year Built	1987	1991
Age of Household's Head	41	41
Age Oldest	11	9
Mortgage Duration	23	28
Interest Rate (%)	3.7	2.5
Household Income	3,738	3,950
Financial Wealth	34,277	37,873
Household Consumption	1,603	1,592
Total Gross Wealth	288,974	304,646
Total Net Wealth	247,886	171,557
Observations	2,576	1,063

Note: 2014 euros. Income is monthly income. Statistics are mean values.

the first row, we document the mean house price at paid by households. Differences across households who bought at different points of the cycle are clear in terms of the price they paid, in spite of the average size being the same regardless of the time of purchase and the year in which the houses were built not differing much. The mean price paid at the peak is 64% higher than the mean price paid off-peak. Credit conditions (interest rate and duration of their mortgages) also differ across the cycle, but there is little difference in terms of age of household head and age of the oldest child at the time of purchase. Household income at the time of the interview is similar across the two groups of households. As a result, mean price of purchase of those who bought off-peak was about 35 times mean monthly household income at interview, whereas it was about 55 times monthly household income for the rest. Finally, although financial assets and total gross wealth at the time of the interview is similar for both groups, total net wealth is about 31% lower in the case of households who bought at the peak reflecting the greater mortgage debt.

In Table 2 we report the distribution of the price of purchase and the reported value of the house at the time of the interview for households who bought off peak (left panel) and at the peak (right panel). First, the increase in prices during the peak is of similar size all across the distribution of prices at purchase. Second, the value of the house at the time of the interview is similar regardless of the time of purchases. This shows that the houses that were bought at the peak do not differ much from the houses that were bought off peak. Further, those who bought at the peak have similar housing wealth to those who bought off peak,

Table 2: Percentiles of Price of Purchase and Current Value Distribution

	Off Peak		At the Peak	
	Price of Purchase	Current Value	Price of Purchase	Current Value
10th	58,059	81,137	86,545	81,888
25th	83,300	120,202	137,340	119,000
50th	115,275	180,000	197,290	167,860
75th	161,552	247,500	252,424	220,000
90th	226,943	327,551	331,759	327,000

Note: 2014 euros.

despite paying a substantially higher price. This suggests that consumption commitments differ substantially depending on the time of purchase.

In response to an increase in house prices, households may delay the time of purchase. However, demographic needs often mean there is limited margin to adjust. Although the rental market is an alternative to home purchase, changes in the fraction of renters are small over the period of analysis among couples in which the head was born between 1960 and 1979.

4 Differences in Housing Costs by the Time of Purchase

In this section we propose a decomposition of the household's budget constraint to separate out differences in consumption commitments to housing due to buying at different times over the business cycle. Owning the same house but paying more for it means that once the mortgage is paid off, the household that paid more for it will have spent more of their resources on interest payments and in total on debt repayment. This is the key difference caused by purchasing at different points in the business cycle.

The differences in costs caused by the time of purchase generates winners and losers. We first show how income after the adjustment differs for those who bought cheaply compared to those who bought at the peak of the market. Similarly, we show how consumption differs. Finally, we show the evolution of inequality of income netting off the adjustment.

4.1 Adjusting for Mortgage Payments

Households purchase their homes at different points in time and can choose different schemes to finance the price of purchase. Some households may accumulate a large down-payment before purchasing or others may choose to finance most of the price with a mortgage and the time horizon to repay may also differ. As a result, adjusting household income with actual mortgage payments does not provide an appropriate measure of the housing cost faced by households. For this reason we build a counterfactual annualized housing cost based on the price of purchase reported by households.

To fix ideas, we start from the household's budget constraint of a homeowner and assume there are no changes in house size overtime and that the only asset being purchased is housing:

$$C_{i,t} + A_{i,t} = Y_{i,t} + (1 + r_{i,t})\, A_{i,t-1} \tag{1}$$

where i indicates the household, $C_{i,t}$ is consumption, $A_{i,t}$ is end-of-period net wealth, $Y_{i,t}$ is household income and $r_{i,t}$ is the return on net wealth held going into period t.

Equation (1) can be rewritten as

$$C_{i,t} = Y_{i,t} + r_{i,t} A_{i,t-1} - (A_{i,t} - A_{i,t-1}). \tag{2}$$

Since there is only one asset in this simple example, we define the mortgage payment to be,

$$m_{i,t} = r_{i,t} A_{i,t-1} - (A_{i,t} - A_{i,t-1}) \tag{3}$$

The mortgage payment, $m_{i,t}$ depends on the interest rate and on repayments of capital. These repayments depend implicitly on the duration of the mortgage, N, and on the re-payment schedule. To decompose the effect of the purchase price on subsequent mortgage commitments, we define three hypothetical mortgage payments.

If a household has a loan-to-value ratio of L_i at the time of purchase, then total borrowing equals $L_i p_i$. If the interest rate of household i is fixed over the duration of the mortgage at r_i and the duration of the mortgage is equal to N_i, then we can calculate a hypothetical constant mortgage payment from the time of purchase.

$$m_i \;=\; L_i p_i r_i \frac{(1 + r_i)^{N_i}}{(1 + r_i)^{N_i} - 1} = L_i p_i \nu_i \tag{4}$$

The values of the interest rate, loan-to-value ratio, house price and duration of loan differ across households depending on the size and other characteristics of the house and depending

on the year of purchase. These differences yield different hypothetical payments. We hold constant the duration of the mortgage because we are considering the annualised cost of the house purchase. Allowing the duration to differ would artificially lower the annualised cost for those who have chosen a long duration and artificially increase the cost for those choosing a short duration. We therefore define $m_{0,i}$ as follows:

$$m_{0,i} = L_i p_i r_i \frac{(1+r_i)^N}{(1+r_i)^N - 1} = L_i p_i \nu\left(r_i, N\right) \tag{5}$$

where $\nu\left(r_i, N\right)$ is the hypothetical proportion of the price paid each period by household i.

We define the value $m_{1,i}$ as the mortgage payment for individuals who borrowed at a common interest rate:

$$m_{1,i} = L_i p_i r \frac{(1+r)^N}{(1+r)^N - 1} = L_i p_i \bar{\nu} \tag{6}$$

where $\bar{\nu}$ is the hypothetical proportion if there is a common interest rate and mortgage term: $\bar{\nu} = \nu\left(\bar{r}, \bar{N}\right)$.

Finally, we adjust for business cycle variation in borrowing due to variation in the house price. We set $\bar{p}$ as the average price paid over the time period and $\bar{p_\tau}$ as the average price paid for those who bought in year τ. We define the price that a household would have paid in the absence of house price fluctuations, $\hat{p}_i$, as follows:

$$\hat{p}_i = p_i \frac{\bar{p}}{\bar{p_\tau}} \tag{7}$$

This price is equivalent to the average price of a particular house over the time period we consider, and so nets out the effect of the particular year of purchase. The assumption is that different segments of the housing markets move in parallel across regions and across types of house. Table 2 shows that the percentage change in house prices is similar across the house price distribution. Figure 1 shows that regional house price growth moves together.

We use this adjusted price to determine the mortgage commitment associated with a particular purchase if there was no cyclical variation:

$$m_{2,i} = L_i \hat{p}_i \bar{\nu}\left(\bar{r}, \bar{N}\right) \tag{8}$$

The difference between $m_{0,i}$ and $m_{2,i}$ is the difference in mortgage payments caused by the difference induced by the timing of purchase. There are two components to this difference: first, the mortgage conditions are adjusted so conditions are common across individuals, i.e. imposing $\bar{\nu}$. Second, purchase prices are adjusted to remove the cyclical effect, i.e. imposing $\hat{p}_i$.

We use the definitions of $m_{1,i}$ and $m_{2,i}$ to decompose $m_{0,i}$. We add and subtract terms

from equation (5):

$$m_{0,i} = L_i p_i \nu\left(r_i, N_i\right) + \underbrace{L_i \hat{p}_i \bar{\nu}}_{m_{2,i}} - L_i \hat{p}_i \bar{\nu} + \underbrace{L_i p_i \bar{\nu}}_{m_{1,i}} - L_i p_i \bar{\nu} \tag{9}$$

We rearranage equation (9) to show this decomposition:

$$(m_{0,i} - m_{2,i}) = \underbrace{(m_{1,i} - m_{2,i})}_{\Delta_i} + \underbrace{(m_{0,i} - m_{1,i})}_{\kappa_i} \tag{10}$$

The left-hand side is the total effect of adjusting prices and equalising mortgage conditions. The first term on the right hand side, labelled Δ_i, is the effect of adjusting prices, holding mortgage conditions constant.

$$\Delta_i = L_i \bar{\nu}(p_i - \hat{p}_i)$$

This term, Δ_i, may vary across households due to differences in size or other characteristics of the house. The term, κ_i, is the effect of adjusting mortgage conditions (e.g. the interest rate) but without adjusting prices.

We define *adjusted household income* as household income after subtracting off the difference in mortgage payments due to differences in house price related to the timing of purchase, Δ_i, and the differences due to the different interest rate on the mortgage, κ_i.[13]

$$y_i^{adj} = y_i - \Delta_i - \kappa_i \tag{11}$$

$$\Delta_i = L_i p_i \bar{\nu}(1 - \frac{\bar{p}}{\bar{p_\tau}}) \tag{12}$$

$$\kappa_i = L_i p_i (\nu_i - \bar{\nu}) \tag{13}$$

Our aim is to show the impact on household disposable income due to differences in the price paid for the house that arose due to the timing of purchase. We make two alternative assumptions on the loan-to-value ratio to obtain measures of adjusted income. First, we assume the loan-to-value ratio is equal to one; second, we use the loan-to-value ratio at the time of purchase. The first assumption has the advantage of capturing the full opportunity cost of the purchase. However, some households that bought at the peak had also sold their previous

[13] If there were no repayments of the mortgage, then the annual payment for a given mortgage would be the interest payment alone. In other words, $\nu_i = r$, and Δ becomes:

$$\Delta_i^r = L_i r(p_i - \hat{p}_i)$$

.

house at the peak before purchase. This means that they would have benefited somewhat from the house price growth. To assess this caveat, we would ideally have information on prior house sales. In the absence of this information, we use the actual loan-to-value ratio at the time of purchase. The size of the loan-to-value ratio (and the implied downpayment into the new house) is an imperfect measure of how much the household has benefited from selling at the peak because net wealth will also increase because of direct saving.

Neither measure of adjusted income is based on realised mortgage payments. Instead, the adjustments are to allow for the aggregate state of the house and credit markets. We show below how this adjustment changes income for households that have bought at different times.

To understand how these differences in housing costs may impact households, take two households that paid very different prices at purchase for identical houses. The houses will be worth the same price at any period observed after (the later) purchase. This means that the two households will be observed to have the same gross housing wealth and the same change in gross housing wealth in each period. However, their net wealth positions will differ depending on their borrowing at purchase and indirectly on whether they had housing to sell before purchase. Our focus is on the impact of differences in the initial purchase price which partly captures a wealth effect and partly a difference in the cost of finance. This level effect is distinct from the subsequent impacts of changes in gross wealth (and of net wealth).

4.2 Household Adjusted Income by Time of Purchase

We compare gross household income and *adjusted household income* (as defined in the previous section) for two groups of households.[14] The first group comprises households who bought at the peak of the housing boom, the second group comprises all other households in our sample.

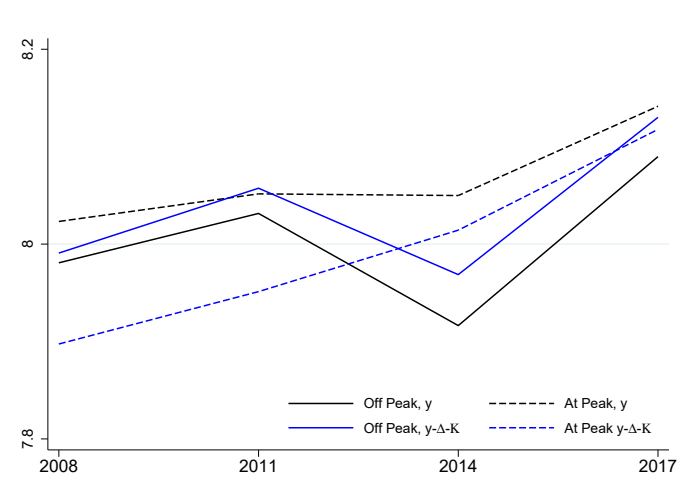
Figure 2 shows the evolution of the log of gross household income and the log of *adjusted household income*, by removing Δ_i and κ_i, from 2008 to 2017, assuming $L_i = 1$.[15] First, a comparison of the black dashed line with the black solid line shows that median household income of those who bought at the peak is above household income of those who bought off the peak in all years. This may be because of selection into who buys at the peak. In regressions reported in Table 3, we show that once we control for observables there is no residual difference in income. Further, those buying at the peak may then have had to work

[14]We assume $N = 25$ and set $r = 0.03$ in order to compute $m_{1,i}$ and $m_{2,i}$. We use the reported current interest rate paid on the mortgage to compute $m_{0,i}$. If a household does not report the interest rate, we input the average interest reported by households that bought in the same year of purchase.

[15]We only report the comparison from the survey data in 2008 since there are no households in the 2005 survey who could have bought at the peak.

harder, which we return to in section 5 below. Second, *adjusted household income* of those who bought at the peak falls below *adjusted household income* of those who bought off the peak, except in 2014. This reversal of the order before and after the adjustment reflects the large differences in housing costs by time of purchase.

Figure 2: Median Income



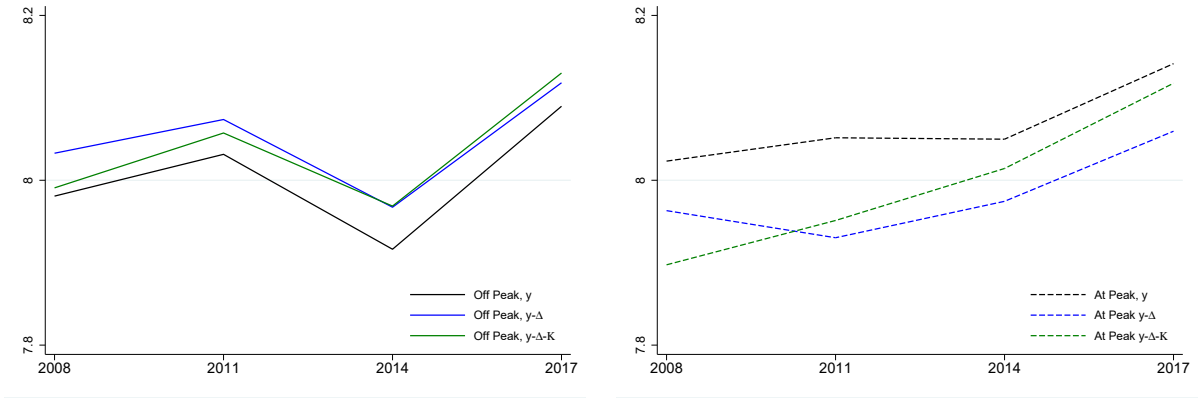
Notes: We use the adjustments Δ_i and κ_i assuming $L_i = 1$ to account for the difference in mortgage payments due to differences in house price arising from the year of purchase and differences in the interest rate, as in equation (11). The year on the x-axis is the interview year, while the year of purchase affects individual values of Δ_i and κ_i used to construct individual adjusted income.

In Figure 3 we decompose the effect of the two components that adjust income by time of purchase. In left-hand graph of Figure 3 we show the evolution of the median of the log of gross household income, the log of household income subtracting only Δ_i, and the log of household income subtracting both Δ_i and κ_i for those who bought off peak. The same variables are shown in the right-hand graph for those who bought at the peak. Differences in the interest rate attenuate the cost of paying a higher house price at the peak because interest rates were lower at the peak.

Table 3 reports the regression results corresponding to Figures 2 and 3 under the assumption that $L_i = 1$. For these regressions, we define the peak of the market at the region level.[16] Further, we condition on additional characteristics, in particular age, education, number of children, age of oldest child, house tenure and year the house was built. There are no significant differences in the current income between those who bought at the peak and those who bought off peak (column 1) but after adjusting for the cost of house purchase, income

[16]In Table 10, we define the peak using national house prices rather than regional. This increases the number of observations but does not alter the results.

Figure 3: Median Income



(a) Off Peak

(b) At Peak

Notes: The adjustment Δ_i is the difference in mortgage payments due to differences in the price at the timing of purchase, and the adjustment κ_i is the difference in mortgage payments due to differences in the interest rate at the timing of purchase, assuming $L_i = 1$. See Equation (11). The year on the x-axis is the interview year, while the year of purchase affects individual values of Δ_i and κ_i used to construct individual adjusted income.

is 10% lower (column 5). This is caused by the difference in the adjustment, Δ_i, partially attenuated by κ_i. Column 2 shows that, for those who bought at the peak, Δ_i is greater in absolute terms for richer households, but the percentage differences are small. In column 3 we report the same regression for κ_i. The attenuation effect of interest rates is heterogeneous across the income distribution with households at the bottom of the distribution not benefiting from lower interest rates.

In the Appendix, in Table 9 we present the same regressions for the case in which we compute Δ_i and κ_i based on the loan-to-value ratio at the time of purchase. The information on loan-to-value at the time of purchase, t_0, is however, only available for those households who have some outstanding mortgage at time t. This results in about 15% of households being dropped when we include the loan-to-value, and these households are clearly not a random sample. Nonetheless, the regression results are very similar.

4.3 Adjusted Income Inequality

We turn now to assess whether adjusting for differences in housing costs due to the timing of purchase affects inequality across households. In Figure 4 we report the variance of log income and the variance of log adjusted income, first by subtracting Δ_i and then by additionally subtracting κ_i, assuming $L_i = 1$. Inequality in $(y - \Delta_i)$ is greater than inequality in income, y, and the increase in adjusted income inequality during the recession

Table 3: Income and Adjusted Income, Peak at Year-Province Level, $L_i = 1$

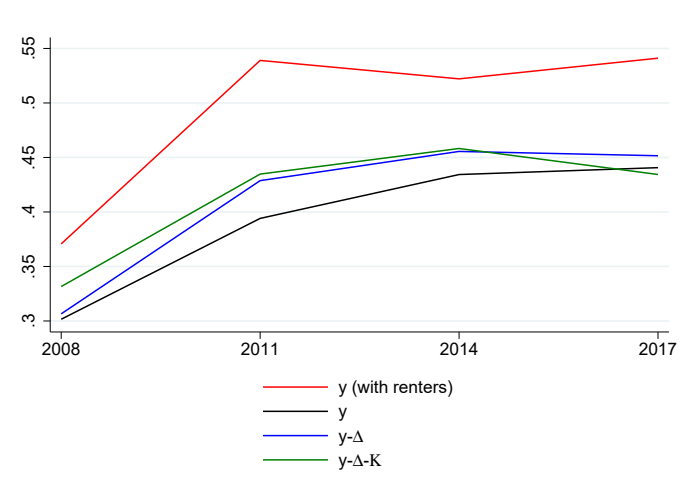
	$\log y$	Δ	κ	$\log(y - \Delta)$	$\log(y - \Delta - \kappa)$
At Peak	0.0144	256.4***	8.939	-0.0993***	-0.0904**
	(0.0353)	(15.21)	(14.93)	(0.0374)	(0.0372)
Age	0.0176***	2.324	2.434	0.0166***	0.0170***
	(0.00418)	(1.530)	(1.993)	(0.00428)	(0.00421)
Secondary Edu	0.340***	9.694	-6.294	0.352***	0.341***
	(0.0382)	(10.94)	(9.904)	(0.0393)	(0.0386)
Tertiary Edu	0.983***	53.82***	-63.39***	1.001***	0.997***
	(0.0449)	(18.94)	(20.29)	(0.0462)	(0.0449)
Number of Children	0.0999***	40.33***	-20.98	0.0980***	0.106***
	(0.0276)	(11.09)	(13.73)	(0.0269)	(0.0263)
Tenure	-0.0182***	-12.45***	5.620**	-0.0130**	-0.0129**
	(0.00580)	(3.681)	(2.423)	(0.00575)	(0.00583)
Year Built	0.000607	-0.197	-0.200	0.000476	0.000653
	(0.000800)	(0.323)	(0.392)	(0.000805)	(0.000820)
Age Oldest	-0.000562	-1.508	1.074	0.000121	-0.000930
	(0.00355)	(1.465)	(1.557)	(0.00363)	(0.00364)
Income Tercile 2		11.48	-6.195		
		(12.09)	(11.54)		
Income Tercile 3		-56.20***	-37.68**		
		(17.26)	(16.80)		
At Peak × Tercile 2		41.10*	-23.35		
		(21.15)	(23.92)		
At Peak × Tercile3		323.4***	-78.89**		
		(33.21)	(35.98)		
Constant	5.728***	85.61	505.1	6.058***	5.654***
	(1.594)	(649.9)	(830.9)	(1.602)	(1.632)
Observations	1685	1685	1667	1685	1666
Adjusted R^2	0.319	0.421	0.196	0.312	0.322

Note: Standard errors in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$. Year dummies are included as controls.

is greater than in actual income. At first glance, it is surprising that *adjusted income* is more unequal than income because richer households spend more on housing. Part of the extra inequality in *adjusted income* arises because households with the same income now have different *adjusted income*, increasing variability. Inequality in $(y - \Delta_i - \kappa_i)$ is larger that inequality of $(y - \Delta_i)$. This is because the households who benefited most from the lower interest rates during the peak are those further up the income distribution.

To benchmark the impact of the timing of house purchase on inequality, we compare to the impact of government transfers in reducing inequality. The average impact of removing transfers during a boom is to increase inequality by about 4%, which is of similar magnitude to the adjustment of Δ_i and κ_i.[17] However, the increase caused by removing transfers is greater in recessions, averaging about 20%. The response of household's labor supply to the price of purchase may of course attenuate the impact of the adjustment on inequality, as discussed below.[18]

Figure 4: Variance of Log Household's Income



Notes: The adjustment Δ_i is the difference in mortgage payments due to differences in the timing of purchase and the adjustment κ_i is the difference in mortgage payments due to differences in the interest rate at the timing of purchase. See equation (11). The year on the x-axis is the interview year, while the year of purchase affects individual values of Δ_i and κ_i used to construct individual adjusted income.

[17] In our sample in 2005 standard deviation of log of household total income minus public transfers is 4% higher than standard deviation of log of household total income.

[18] The rise in inequality that we highlight is for homeowners. The increase in the variance of log income across the whole population was from 0.37 in 2008 to 0.54 in 2017, which compares to an increase from 0.3 to 0.44 for homeowners.

5 Labour Supply Responses to the Price of Purchase

The price of a house at the time of purchase affects households ongoing consumption commitments. These in turn affect the income available for other consumption, as shown in Figure 2 above. A key question is how households respond to these consumption commitments, and in particular whether labour supply adjusts. Our aim in this section is to estimate the impact that differences in mortgage payments due to differences in the price at the timing of purchase has on the subsequent employment of men and women. Our focus is on the impact of different consumption commitments created at the time of purchase on subsequent labor supply decisions. This is in contrast to Disney and Gathergood (2017) who analyse the contemporaneous response of labour supply to house price variation.

5.1 Empirical Approach

We are interested in the impact of changes in the cost of housing at the time of purchase on subsequent labour supply. We use two approaches to address this. First, we estimate the effect of differences in mortgage payments depending on when the house was bought. In Section 4 we decomposed the impact of costs into Δ and κ, reflecting price differences and interest rate differences respectively. We focus on price differences because these are larger, as reported in Table 3. Second, we estimate directly the effect of the house price at the time of purchase.

The first specification uses the ratio of Δ_i to the average mortgage over the period, $m_{2,i}$. Using Equation (9) and (7), we can write:

$$\frac{\Delta_i}{m_{2,i}} = \frac{m_{1,i}}{m_{2,i}} - 1 = \frac{p_i}{\hat{p}_i} - 1 = \frac{\bar{p}_\tau}{\bar{p}} - 1$$

In other words, the definition of $\frac{\Delta_i}{m_{2,i}}$ is independent of the individual house price, p_i and of the loan-to-value ratio, L_i. We specify the ratio $\frac{\bar{p}_\tau}{\bar{p}}$ to be region specific.

The variable $\frac{\Delta_i}{m_{2,i}}$ is the regressor of interest in:

$$E_{i,t} = \alpha \frac{\Delta_i}{m_{2,i}} + \beta X_{i,t} + \gamma G_{r,t} + \zeta L_{i,t_0} + \delta_c + \eta_r + u_{i,t} \tag{14}$$

where i is the household, r is the region, t time and c is the individual's cohort. $E_{i,t}$ is a $\{0,1\}$ variable denoting individual employment status at time t. $X_{i,t}$ is a set of contemporaneous and fixed individual controls including: education, age dummies, number of children. $G_{r,t}$ is a set of time-varying regional characteristics such as the regional unemployment rate at time t and at the time of purchase. δ_c and η_r are cohort and region dummies.

Purchasing a house at the peak of the market will mean different things for different households depending on whether they have simultaneously sold a house. Those who have also sold at the peak will purchase the new house with larger net wealth and so either a larger downpayment or by purchasing a larger house. We do not observe whether households sold a house at the same time as the purchase or observe direct information on net wealth holdings at the time of purchase. However, we use the information on the loan-to-value at the time of purchase, L_{i,t_0}, as an additional control in Equation (14) to capture individual differences in net wealth at the time of purchase: the cost of a greater price at purchase will be lower for those with a lower loan-to-value ratio. As we noted before, information on the initial loan-to-value is only available for those households who have some outstanding mortgage at time t and so 15% of households are dropped.

The second specification uses the log of the house price at the time of purchase:

$$E_{i,t} = \alpha \log P_{i,t_0} + \beta X_{i,t} + \gamma G_{r,t} + \zeta L_{i,t_0} + \delta_c + \eta_r + u_{i,t} \tag{15}$$

where P_{i,t_0} is the price individual i paid at the (earlier) time of purchase, t_0. The issue is that the house price that was paid may be endogenous because the willingness and ability to pay for a particular house may depend on expectations about current and future income and labour supply. Households may choose to work harder at the time of purchase in order to afford the purchase; or households may be more likely to purchase if holding a more secure job.[19] Both selection effects are potentially associated with subsequent increases in wages and employment. The issue is whether these effects are stronger for those households that purchase at the peak of the market. However, credit was more available at the peak and so there was less need to change labour supply to meet downpayment or other restrictions on borrowing. The greater availability of credit suggests less of a selection effect of those purchasing in the peak.[20]

For this specification, we use a set of instruments for the household's price of purchase. In particular, we consider the year of purchase and the average price at the time of purchase either in the municipality (which is available only for cities that are the capitals of provinces) or in the province.[21] This is alongside including province dummies. This means that our instrument is essentially within province variation over year of purchase. Our instrument is closely related to the instrument used by Disney and Gathergood (2017) who exploit variation of regional house prices relative to average in the UK.

[19] See Barceló and Villanueva (2018).

[20] There is also a selection issue if individuals choose which region to buy partly because of the price in that region.

[21] These prices are provided by TINSA, a valuation agency of real state properties that uses information from each valuation done by the agency in each mortgage application. We have monthly information on prices at the aforementioned geographical levels starting in 2001.

Both empirical strategies have to address the potential challenge of an omitted variable issue caused by opportunities for work differing across regions over time. This is a potential problem because we would expect that house prices at time t_0 are positively correlated with opportunities for work in subsequent periods and this could impact our estimates. In our regression analysis, we control for the regional unemployment rate to proxy for work opportunities to mitigate this bias.

5.2 Results: Labour Supply

Empirical Specification 1 Table 4 reports the effect on employment at time t of $\frac{\Delta_i}{m_{2,i}}$, the proportional difference in mortgage payments depending on the time of purchase. Columns (1) and (2) report the results for men, with and without including the loan-to-value ratio. The average value of $\frac{\Delta_i}{m_{2,i}}$ is 0.2. If this ratio increases by 0.1, men's employment is 1.1 percentage points higher. The coefficient is barely affected by the inclusion of the LTV at purchase, which is itself insignificant. Columns (3) and (4) report the results for women. Differences in mortgage payments at the time of purchase are not significant predictors of women's employment. However, the loan-to-value ratio is associated with greater subsequent labour supply of women.

In terms of the controls, employment is positively correlated with education both for men and women, while employment is negatively correlated with the number of children for women, and not significant for men. The province level unemployment rate is negatively correlated with the individual being employed in the case of men, but not for women. Broader economic conditions at the time of purchase, captured by unemployment rate at that time, are not significant predictors of subsequent employment.

Empirical Specification 2 Tables 5 and 6 reports OLS and IV estimates of the effects of house price at purchase and other variables on employment, separately for men and for women.

For men, the price of purchase is not significant once the LTV is included. However, the restriction to households with an outstanding mortgage is not random. Using the whole sample, a 10% increase in the price of purchase is associated with 0.4 percentage point higher employment rate of men in the OLS. Our IV estimate of the effect of the house price at purchase being 10% higher is that employment is about 1 percentage point higher for men.

For women, the estimate of the effect is insignificantly different from zero in the IV, but significant in the OLS indicating the importance of endogeneity of the purchase price for women. Further, the loan-to-value ratio at purchase has a positive, significant effect on

Table 4: Time of Purchase and Employment, Δ At Year-Province Level

	Men		Women	
$\frac{\Delta}{m_2}$	0.111**	0.124***	0.0651	0.0682
	(0.0504)	(0.0474)	(0.0697)	(0.0658)
Unemp	-0.588***	-0.639***	0.166	-0.0494
	(0.219)	(0.207)	(0.299)	(0.305)
Unemp At Purchase	0.160	0.164	0.289	0.0111
	(0.243)	(0.235)	(0.423)	(0.428)
Age 35-44	0.0381	0.0273	0.0773*	0.0914**
	(0.0320)	(0.0302)	(0.0442)	(0.0434)
Age 45-59	-0.00981	-0.0241	0.0361	0.0237
	(0.0474)	(0.0440)	(0.0671)	(0.0634)
Number of Children	-0.00779	-0.00218	-0.0467***	-0.0342**
	(0.0116)	(0.0112)	(0.0161)	(0.0158)
Secondary Edu	0.0467*	0.0457*	0.173***	0.140***
	(0.0255)	(0.0251)	(0.0407)	(0.0393)
Tertiary Edu	0.120***	0.129***	0.209***	0.213***
	(0.0246)	(0.0231)	(0.0401)	(0.0376)
Loan To Value At Purchase	-0.00334		0.0707**	
	(0.0217)		(0.0338)	
Constant	0.953***	0.977***	0.704***	0.791***
	(0.0626)	(0.0541)	(0.204)	(0.175)
Observations	1695	1989	1694	1987
Adjusted R^2	0.061	0.074	0.110	0.105

Note: Δ is defined using province level price variation over time. "Unemployment" is the time varying, province level unemployment rate, included in addition to province fixed effects and cohort dummies. The sample in columns (1) and (3) is smaller than in columns (2) and (4) because Loan-to-value ratios at purchase are only available for households with outstanding mortgages at period t. Standard errors in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

women's employment.

The difference between the IV and OLS arises because the price of purchase may be endogenous to future labor supply if those who expect to work in the future are more likely to buy expensive houses, and this would upward bias the OLS estimates. This seems to be what happens in the case of women. For men, the OLS estimate is lower than the IV estimate. This means that the men who bought at the peak were less likely to be working subsequently regardless of whether or not they had bought the house. This would be the case for workers in the construction industry (see Bonhomme and Hospido (2017)). This difference in the impact of house prices on men and women is consistent with the first specification looking at the impact of differences in mortgage payments.

Overall. Our analysis highlights the complex way in which labor supply choices and housing interact. Households purchase more expensive houses because they anticipate greater labor supply, but labor supply will respond to the house price at the time of purchase in order to smooth the impact on disposable income.[22] This conclusion is consistent across our two specifications.

In addition to these impacts on the extensive participation margin, we explore the impact on hours worked and on consumption of Δ and Log Price Purchase. We find no effect on hours worked. This is likely to reflect both a lack of an intensive margin response and the fact that some of the individuals who respond at the extensive margin, work less hours. For consumption, we do not find significant effects of buying at the peak.[23]

Restricting Mobility There is a source of selection bias due to the fact that house price are not exogenous for individuals who change their province of residence. In order to address this concern we undertake the same analysis with a restricted sample of households who at the time of the interview live in the same province where they were born (see Disney and Gathergood (2017)). We present the results in Tables 11 and 12 in Appendix B. Interestingly, the quantitative results hold for this restricted sample of households under both specifications for men and women.

5.3 Mitigation Effect of the Labor Supply Response

Our main results show how employment changes with housing costs. A natural question is to what extent these changes in employment help to mitigate the extra cost associated with buying at the peak of the market.

[22]Focusing on *current* house prices, Disney and Gathergood (2017) found that labor supply responses to the current house price were stronger for female owners.

[23]Results are available upon request.

Table 5: Time of Purchase and Employment, Men

	Restricted Sample		Full Sample	
	OLS	IV	OLS	IV
Log Price Purchase	0.0405	0.0734	0.0450**	0.110**
	(0.0261)	(0.0498)	(0.0207)	(0.0448)
Unemp	-0.576***	-0.594***	-0.628***	-0.664***
	(0.214)	(0.219)	(0.203)	(0.208)
Unemp At Purchase	-0.0300	-0.0125	-0.0304	0.0196
	(0.213)	(0.215)	(0.214)	(0.216)
Age 35-44	0.0429	0.0408	0.0307	0.0241
	(0.0322)	(0.0313)	(0.0305)	(0.0301)
Age 45-59	0.00394	0.00248	-0.0119	-0.0180
	(0.0476)	(0.0466)	(0.0442)	(0.0435)
Number of Children	-0.00931	-0.0111	-0.00385	-0.00755
	(0.0119)	(0.0115)	(0.0113)	(0.0112)
Secondary Edu	0.0404	0.0353	0.0360	0.0223
	(0.0262)	(0.0278)	(0.0260)	(0.0285)
Tertiary Edu	0.108***	0.0960***	0.110***	0.0796**
	(0.0268)	(0.0325)	(0.0259)	(0.0328)
Loan To Value At Purchase	0.0116	0.0255		
	(0.0218)	(0.0284)		
Constant	0.460	0.0574	0.444*	-0.321
	(0.318)	(0.608)	(0.242)	(0.519)
Observations	1695	1695	1989	1989
Adjusted R^2	0.059	0.056	0.073	0.062
F stat		18.12		15.11

Note: "Unemployment" is the time varying, province level unemployment rate, included in addition to province fixed effects. Cohort dummies are included. The sample in columns (1) and (2) is smaller than in columns (3) and (4) because Loan-to-value ratios at purchase are only available for households with outstanding mortgages at period t. Standard errors in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 6: Time of Purchase and Employment, Women

	Restricted Sample		Full Sample	
	OLS	IV	OLS	IV
Log Price Purchase	0.0723**	0.0518	0.0518**	0.0426
	(0.0313)	(0.0633)	(0.0238)	(0.0557)
Unemp	0.160	0.168	-0.0505	-0.0458
	(0.295)	(0.292)	(0.299)	(0.298)
Unemp At Purchase	0.200	0.190	-0.0745	-0.0814
	(0.395)	(0.391)	(0.400)	(0.401)
Age 35-44	0.0765*	0.0776*	0.0900**	0.0908**
	(0.0432)	(0.0428)	(0.0429)	(0.0426)
Age 45-59	0.0374	0.0388	0.0236	0.0247
	(0.0656)	(0.0648)	(0.0629)	(0.0622)
Number of Children	-0.0508***	-0.0495***	-0.0370**	-0.0364**
	(0.0164)	(0.0159)	(0.0161)	(0.0157)
Secondary Edu	0.163***	0.165***	0.131***	0.132***
	(0.0413)	(0.0406)	(0.0399)	(0.0396)
Tertiary Edu	0.186***	0.193***	0.193***	0.196***
	(0.0425)	(0.0441)	(0.0396)	(0.0426)
Loan To Value At Purchase	0.101***	0.0918**		
	(0.0363)	(0.0440)	(0.0363)	(0.0440)
Constant	-0.174	0.0733	0.191	0.297
	(0.419)	(0.793)	(0.317)	(0.665)
Observations	1694	1694	1987	1987
Adjusted R^2	0.114	0.114	0.108	0.108
F stat		17.97		15.83

Note: "Unemployment" is the time varying, province level unemployment rate, included in addition to province fixed effects. Cohort dummies are included. The sample in columns (1) and (2) is smaller than in columns (3) and (4) because Loan-to-value ratios at purchase are only available for households with outstanding mortgages at period t. Standard errors in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

The first stage in showing the mitigation effects is to calculate the impact on earnings. In table 7 we report separately the impact of Δ and the Log Price Purchase on earnings for men and for women. Column (1) and (2) show the estimates for men and columns (3) and (4) for women. The specification in which we use the log price at the time of purchase we report the IV estimates. Both for men and for women, the greater purchase price leads to greater earnings, but the coefficient is only marginally significant in the case of men when we use the log price directly. A positive effect on earnings may be driven by the effect on the extensive margin shown in Table 5. The difficulty with this earnings regression is we know from Tables 4, 5 and 6 that the composition of workers has changed, and individuals who respond to higher prices at purchase by participating more, may be less productive, counteracting the positive direct effect on earnings.

Using our estimates of the average impact of the price at the time of purchase on husband's earnings we can assess the extent to which labor supply helps to mitigate the effect of buying at the peak, instead of buying at the average price over the period of analysis. To do so, for each household buying at the peak we compute the additional monthly earnings and the fraction that those earnings represent of the Δ for that household (Δ measures the effect of adjusting prices holding mortgage conditions constant).[24] The distribution of the mitigation achieved has a median of 42%, and ranges from 18% at the 10th percentile to 85% at the 90th percentile. We calculate this fraction for different income terciles to show how well different households can mitigate the shocks. For the first tercile, the median fraction of Δ covered by the extra earnings is 30%. This rises to 41% for the middle tercile and 52% for the top tercile.

6 Conclusion

There are large differences in housing costs depending on the time of house purchase. This was particularly striking in Spain in the 2000s, when house prices more than doubled within a decade before crashing back. We use the Spanish Survey of Household Finance from 2002 to 2017 to show first, the impact of these house price movements on income adjusted for the extra expense associated with the time of house purchase, and second, on labour supply decisions.

We find that those who bought at the peak of the market had similar gross income than those who bought off peak. However, adjusting for the extra expense of buying at the peak of the market meant they had lower adjusted income after allowing for consumption commitments. There is an increase in inequality once we adjust income for these extra

[24]We restrict the analysis to households in which husband's earnings are positive, 94% of our sample of households who bought at the peak.

Table 7: Log Earnings

	Men		Women	
$\frac{\Delta}{m_2}$	0.129		0.0727	
	(0.111)		(0.138)	
Log Price At Purchase		0.167*		0.164
		(0.0895)		(0.105)
Unemp	-1.166***	-1.237***	-0.455	-0.455
	(0.407)	(0.393)	(0.540)	(0.528)
Unemp at Purchase	-0.298	-0.394	1.029	0.998
	(0.630)	(0.583)	(0.824)	(0.762)
Age 35-44	0.100	0.0915	0.0275	0.0199
	(0.0680)	(0.0649)	(0.0961)	(0.0942)
Age 45-59	-0.0222	-0.0236	0.128	0.105
	(0.106)	(0.103)	(0.136)	(0.134)
Number of Children	0.0781***	0.0708***	-0.0477	-0.0603
	(0.0220)	(0.0217)	(0.0387)	(0.0380)
Secondary Edu	0.154***	0.116**	0.441***	0.412***
	(0.0485)	(0.0512)	(0.0821)	(0.0815)
Tertiary Edu	0.559***	0.481***	0.985***	0.922***
	(0.0530)	(0.0712)	(0.0796)	(0.0861)
Constant	7.479***	5.524***	5.915***	4.073***
	(0.150)	(1.057)	(0.515)	(1.302)
Observations	1857	1857	1479	1479
Adjusted R^2	0.192	0.23	0.278	0.290
F stat		14.23		15.27

Note:Δ is defined using province level price variation over time. "Unemployment" is the time varying, province level unemployment rate, included in addition to province fixed effects and cohort dummies. Standard errors in parentheses. We include cohort dummies. * $p < .1$, ** $p < .05$, *** $p < .01$

housing expense due to the time of purchase. The negative implications of buying at house price peaks may be offset by mortgage tax deductions, although the generous deductions in Spain may themselves have helped generate the large price fluctuations, which we are treating as exogenous.

We show that the higher price at purchase led to increases in employment for men at the extensive margin: a doubling of house prices leads to an 11 percentage point increase in employment. This mitigates the effect of the consumption commitment on the disposable income of households. The mitigation effect is 30% at the bottom tercile of the income distribution and 52% for the top tercile. By contrast for women, the effect of the house price are insignificantly different from zero because of selection: women who expect to work more in the future purchase more expensive houses.

We have not addressed the source of the increase in house prices, which was associated with relaxed credit conditions and low interest rates. Nonetheless, our conclusion is that the time of house price purchase had significant impacts on spending power, on inequality and on men's employment. This increase in men's employment among those facing high prices will have mitigated the impact of the house prices on incomes and income inequality.

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Appendix A More Descriptive Statistics

In this Appendix we provide additional descriptive statistics to complement information in Section 2. Table 8 shows median price, mortgage duration and interest rate and square meters at the time of purchase and median household income at the time of the interview by year of purchase.[25] In the last column we report the number of observations.

Table 8: Statistics by Year of Purchase

	Median Price at Purchase	Median HHold Income	Mortgage Duration	Mortgage Interest Rate(%)	Square Metres	Number Observations
1995	90160	2961	18	4.4	102	180
1996	93757	3052	19	4.2	102	192
1997	105748	3495	20	4.1	107	292
1998	103674	2686	20	3.7	114	352
1999	114072	2857	22	4.2	102	288
2000	119481	3166	23	3.8	113	348
2001	127410	2968	23	3.2	114	269
2002	126933	3044	24	3.4	111	270
2003	153600	3324	26	2.8	114	282
2004	173600	2794	26	2.7	108	252
2005	194727	2893	28	2.8	103	242
2006	208800	3210	29	2.7	113	209
2007	203743	3263	30	2.3	111	137
2008	209633	3683	26	1.9	124	71
2009	196200	4039	29	1.7	109	83
2010	181900	3910	31	1.4	114	69

Note: 2014 euros. Income is monthly income. The year is the year of purchase of the house.

[25] We exclude years of purchase in which the number of observations is below 50.

Appendix B Robustness Analysis

In this Appendix we report the results of several robustness exercises that we discussed previously in the main text.

First, in Table 9 we replicate the analysis in Table 3 using the actual loan-to-value ratio at the time of purchase. The main results are robust to this alternative assumption: the size of the coefficient of buying at the peak on the adjusted income is of similar size to our baseline definition of the peak.

Second in Table 10 we define the peak using national house prices rather than regional. This increases the number of observations but does not alter the results.

Finally, in Tables 11 and 12 we restrict the sample to households in which at the time of the interview the husband lives in the same province where he was born. The main result of our analysis holds for this restricted sample.

Table 9: Income and Adjusted Income, Peak at Year-Province Level, L_i

	$\log y$	Δ	κ	$\log(y-\Delta)$	$\log(y-\Delta-\kappa)$
Peak	0.0144	183.3***	4.432	-0.0927**	-0.0976***
	(0.0353)	(10.34)	(11.46)	(0.0364)	(0.0375)
Age	0.0176***	0.854	1.412	0.0159***	0.0154***
	(0.00418)	(0.968)	(1.153)	(0.00455)	(0.00459)
Secondary Edu	0.340***	-2.079	-5.768	0.322***	0.324***
	(0.0382)	(6.923)	(7.685)	(0.0394)	(0.0408)
Tertiary Edu	0.983***	13.57	-46.32***	0.948***	0.958***
	(0.0449)	(10.81)	(11.84)	(0.0471)	(0.0489)
Number of Children	0.0999***	15.59**	-14.54*	0.0921***	0.0936***
	(0.0276)	(7.675)	(8.045)	(0.0288)	(0.0286)
Tenure	-0.0182***	-6.472***	1.903	-0.0179***	-0.0163**
	(0.00580)	(2.306)	(1.544)	(0.00615)	(0.00635)
Year Built	0.000607	-0.349*	-0.171	0.000627	0.000583
	(0.000800)	(0.208)	(0.227)	(0.000878)	(0.000915)
Age Oldest	-0.000562	-2.093**	1.681*	-0.00268	-0.00374
	(0.00355)	(0.901)	(1.009)	(0.00379)	(0.00380)
Income Tercile 2		9.244	-5.954		
		(7.858)	(8.431)		
Income Tercile 3		-27.78***	-37.00***		
		(10.06)	(10.84)		
At Peak× Tercile 2		14.42	-3.729		
		(14.62)	(17.91)		
At Peak× Tercile 3		160.8***	-45.75**		
		(20.71)	(22.20)		
Constant	5.728***	546.1	412.2	5.755***	5.840***
	(1.594)	(420.0)	(469.1)	(1.743)	(1.823)
Observations	1685	1432	1414	1432	1414
Adjusted R^2	0.319	0.455	0.329	0.316	0.313

Note: Standard errors in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$. Year dummies are included as controls.

Table 10: Income and Adjusted Income, Peak at Year-National Level, $L_i = 1$

	$\log y$	Δ	κ	$\log(y - \Delta)$	$\log(y - \Delta - \kappa)$
At Peak	-0.0102	162.7***	18.79	-0.110**	-0.0979**
	(0.0444)	(12.91)	(14.79)	(0.0461)	(0.0469)
Age	0.0143***	-3.178***	1.011	0.0146***	0.0152***
	(0.00449)	(0.803)	(1.353)	(0.00450)	(0.00454)
Secondary Edu	0.307***	-17.78***	5.279	0.317***	0.314***
	(0.0327)	(6.170)	(11.30)	(0.0334)	(0.0343)
Tertiary Edu	0.715***	-15.79*	-14.02	0.727***	0.734***
	(0.0436)	(9.063)	(11.37)	(0.0436)	(0.0438)
Number of Children	0.0721***	-0.255	-10.26**	0.0699***	0.0743***
	(0.0230)	(4.553)	(4.859)	(0.0229)	(0.0231)
tenure	-0.00358	-22.02***	4.039***	0.00373	0.00306
	(0.00519)	(1.446)	(1.395)	(0.00520)	(0.00538)
Year Built	0.000682	-0.317**	-0.201	0.000743	0.000898
	(0.000798)	(0.159)	(0.196)	(0.000803)	(0.000836)
Age Oldest	-0.00661**	0.673	2.471**	-0.00680**	-0.00808**
	(0.00331)	(0.587)	(1.066)	(0.00332)	(0.00341)
Income Tercile 2		-28.72***	-1.686		
		(6.106)	(12.83)		
Income Tercile 3		-68.44***	-11.07		
		(8.398)	(12.76)		
At Peak× Tercile 2		89.13***	-48.66**		
		(14.71)	(19.60)		
At Peak × Tercile3		227.8***	-96.43***		
		(19.84)	(24.83)		
Constant	5.878***	679.6**	470.5	5.770***	5.407***
	(1.566)	(315.0)	(382.0)	(1.580)	(1.648)
Observations	3124	3124	3103	3124	3102
Adjusted R^2	0.204	0.715	0.347	0.210	0.211

Note: Standard errors in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$. Year dummies are included as controls.

Table 11: Time of Purchase and Employment, Δ At Year-Province Level, Residence At Birth Place

	Men		Women	
$\frac{\Delta}{m_2}$	0.137**	0.142**	0.00932	0.0120
	(0.0623)	(0.0602)	(0.0894)	(0.0829)
Unemp	-0.802***	-0.778***	0.133	-0.225
	(0.244)	(0.231)	(0.362)	(0.363)
Unemp At Purchase	0.393	0.240	-0.108	-0.175
	(0.300)	(0.288)	(0.570)	(0.527)
Age 35-44	0.0660	0.0502	0.0907	0.127**
	(0.0420)	(0.0390)	(0.0579)	(0.0555)
Age 45-59	0.0297	0.0146	0.0419	0.0625
	(0.0583)	(0.0534)	(0.0900)	(0.0816)
Number of Children	-0.0220	-0.0167	-0.0468**	-0.0402**
	(0.0141)	(0.0138)	(0.0206)	(0.0199)
Secondary Edu	0.0245	0.0341	0.131**	0.112**
	(0.0329)	(0.0317)	(0.0546)	(0.0510)
Tertiary Edu	0.0797***	0.102***	0.164***	0.168***
	(0.0284)	(0.0261)	(0.0544)	(0.0493)
Loan To Value At Purchase	0.0231		0.101**	
	(0.0325)		(0.0420)	
Constant	0.885***	0.960***	0.693***	0.899***
	(0.112)	(0.0888)	(0.258)	(0.177)
Observations	1009	1210	1009	1210
Adjusted R^2	0.060	0.077	0.092	0.090

Note: Δ is defined using province level price variation over time. "Unemployment" is the time varying, province level unemployment rate, included in addition to province fixed effects and cohort dummies. The sample in columns (1) and (3) is smaller than in columns (2) and (4) because Loan-to-value ratios at purchase are only available for households with outstanding mortgages at period t. Standard errors in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 12: Time of Purchase and Employment, Δ At Year-Province Level, Residence At Birth Place

	Restricted Sample		Full Sample	
Log Price At Purchase	0.114	0.112*	0.0482	0.0520
	(0.0698)	(0.0590)	(0.0867)	(0.0663)
Unemp	-0.843***	-0.778***	0.115	-0.238
	(0.251)	(0.233)	(0.349)	(0.356)
Unemp At Purchase	0.171	0.0494	-0.120	-0.174
	(0.264)	(0.259)	(0.513)	(0.487)
Age 35-44	0.0658	0.0411	0.0889	0.121**
	(0.0422)	(0.0403)	(0.0546)	(0.0539)
Age 45-59	0.0503	0.0195	0.0423	0.0558
	(0.0586)	(0.0523)	(0.0850)	(0.0793)
Number of Children	-0.0283*	-0.0224	-0.0499**	-0.0435**
	(0.0146)	(0.0144)	(0.0209)	(0.0200)
Secondary Edu	0.00528	0.0105	0.127**	0.103**
	(0.0370)	(0.0361)	(0.0535)	(0.0511)
Tertiary Edu	0.0492	0.0604	0.149**	0.148***
	(0.0398)	(0.0378)	(0.0606)	(0.0564)
Loan To Value At Purchase	0.0708*		0.122**	
	(0.0425)		(0.0563)	
Constant	-0.496	-0.346	0.110	0.310
	(0.852)	(0.683)	(1.086)	(0.771)
Observations	1009	1210	1009	1210
Adjusted R^2	0.037	0.053	0.096	0.089

Note:"Unemployment" is the time varying, province level unemployment rate, included in addition to province fixed effects. Cohort dummies are included. The sample in columns (1) and (2) is smaller than in columns (3) and (4) because Loan-to-value ratios at purchase are only available for households with outstanding mortgages at period t. Standard errors in parentheses. * $p < .1$, ** $p < .05$, *** $p < .01$