Winners and Losers of House Price Booms and Busts*

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Abstract

Fluctuations in house price 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 life-time consumption and 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 which we estimate using an IV strategy. Men work more in response to higher house prices, 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 costs

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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 the house price boom and bust of the 2000s in Spain. 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 most families, over 80%, live in an owner-occupied house. 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 borrowing needed to buy the same house with the same net wealth. These differences in borrowing generate different consumption commitments. In turn, these lead to differences in income net of the commitments across households who differ only in their time of purchase. We foucs on two issues arising from these differing mortgage commitments. First, the impact on 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.[1] Second, households may respond to smooth the effects of these housing commitments by changing non-housing consumption or by changing labour supply.[2]

For our analysis we use data from the Family Financial Survey (2002-2017) conducted

[1]Because our focus is on the impact of the price at the time of purchase we ignore renters.

[2]Several papers analyze labor supply as an insurance device against labor market risk, 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 response (added worker effect).

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.

Those who purchased at the peak of house prices have higher incomes subsequently than those who purchased outside the peak, but their income net of house costs and their consumption was lower. This finding however raises the question of whether these individuals had higher wages or worked longer hours. Inequality in household income adjusted for housing is larger than in actual income, partly due to the variation in housing circumstances within income bands. 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. 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.

The closest related paper to us is Dustmann, Fitzenberger, and Zimmermann (2018) exploring the effect of housing cost on inequality in disposable income net of housing expenditure. 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.[3] However, in the presence of house price fluctu-

[3]Dustmann, Fitzenberger, and Zimmermann (2018) define housing expenditure for renters as the basic rent (including utilities) and energy costs, and housing expenditure for owner-occupiers as mortgage interest

ations it is important to go further and show the extent to which the variation in house prices over the cycle is an important source of differences both in living standards and in inequality across households with similar levels of life-time income. Related to this, Kiyotaki, Michealides, and Nikolov (2011) find that house price fluctuations cause a large redistribution between net buyers and net sellers of houses. More recently, 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 decumulation of wealth over the life-cycle.[4] Finally, Lavean 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 on young Americans' choices related to home ownership, household formation, and fertility. They show that younger individuals who did buy a home in MSAs with above-average house price increase between 2001 and 2006 accumulated substantially higher housing debt per unit of housing, relative to young buyers in MSAs with a below-average house price increase.

The decision to buy itself is affected by house prices and there is a sizable literature on the difficulties of getting onto the housing ladder (Ortalo-Magne and Rady (1999), and more recently, Carozzi (2019)). Nonetheless, in Spain, house purchasing has remained very high, 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: 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, 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.[5]

Our paper is also related to recent papers that have documented the existence of important heterogeneity in prices of even very homogeneous goods, recent examples are Kaplan et al. (2019). As argued by Attanasio and Pistaferri (2016) the extent to which differences in

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]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 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.

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.[6]

Finally, our paper contributes to the literature on inequality in income and wealth for Spain. Anghel et al. (2018) and Pijoan-Mas and Sanchez-Marcos (2010) explore the evolution of inequality in Spain along different time periods. These papers document moderate levels of inequality in Spain compared to other developed countries. In a recent paper Toledano (2020) studies how business cycle dynamics shape the wealth distribution through asset price changes and saving responses.

We proceed in section 2 to describe the data. In section 3, we show how the time of purchase generates winners and losers over the business cycle. 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 4 shows the implications of house prices for subsequent labour supply of men and women. Section 5 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 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.[7]

We restrict the sample to homeowner couples in which the head was born between 1960 and 1979. We also require the age of purchase to be between 25 and 45. As a result of these restrictions our sample is made of 4,519 observations. In section 3 we further restrict the sample to those who bought after 1994, a total of 3,662 observations. Finally, for the analysis of labor supply in section 4, we restrict the sample to those who bought in 2001

[6]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).

[7]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.

or after, which gives 2008 observations. The reason to make this restriction is that we use regional house prices as an instrument for the price of purchase and these are only available starting in 2001.

Table 1 provides descriptive statistics of interest in our sample, by the year of house purchase. In the first column we document the median house price (in 2014 euros) paid by households depending on the year of purchase. For this table, we focus on the years 1995 to 2010 where we have above 50 observations per year. The median price paid in 2008 is about twice the median price paid in 1998. In the second column we report median (monthly) household income across waves depending on the year of purchase. Median price of purchase of those who bought in 1998 was about 36 times median monthly household income, whereas it was about 56 times monthly household income in 2008. In the third column we report an increase in the number of years to repay the mortgage and a decrease in the interest rate of mortgage over time is shown in the fourth column. Finally, average size of the dwellings is quite stable.

Table 1: Statistics by Year of Purchase

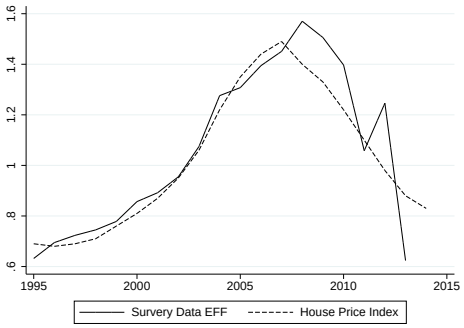
	Median Price at Purchase	Median HHold Income	Mortgage Duration	Mortgage Interest Rate(%)	Squared Metres
1995	90160	2961	18	4.4	102
1996	93757	3052	19	4.2	102
1997	105748	3495	20	4.1	107
1998	103674	2686	20	3.7	114
1999	114072	2857	22	4.2	102
2000	119481	3166	23	3.8	113
2001	127410	2968	23	3.2	114
2002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

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

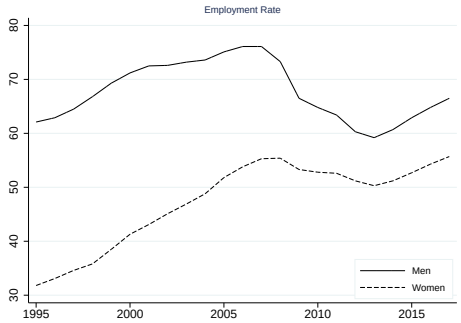
The first graph in Figure 1 shows the time path of aggregate house prices. The second and third graphs provide the aggregate context for these movements in house prices and mortgage debt by showing how employment for men and women changed over this time period and how consumption changed. These raw descriptive 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.

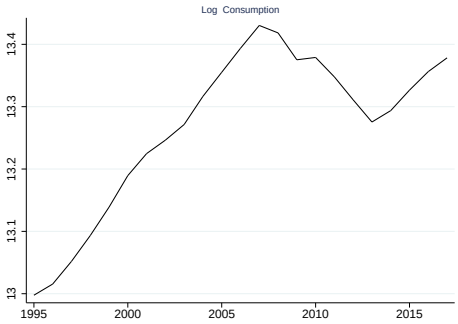
Figure 1: Time Paths of House Prices, Employment and Consumption



(a) House Price Index



(b) Employment



(c) Consumption

Source: Aggregate households' consumption is from National Account and employment rates are from the Labor Force Survey. House Price Index is from TINSA.

3 Winners and Losers due to 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.

3.1 Adjusting for Mortgage Costs

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, 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 an 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_t is consumption, A_t is end-of-period net wealth, Y_t is household income and r_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 depends on the interest rate and on repayments of capital. These repayments depend implicitly on the duration of the mortgage, N and on the repayment schedule. To decompose the effect of the purchase price on subsequent mortgage commitments, we define three hypothetical mortgage payments.

If the interest rate is fixed over the duration of the mortgage at r, the duration of the mortgage is equal to N and the purchase price is p, then we can calculate a hypothetical constant mortgage payment from the time of purchase, m:

$$m = pr\frac{(1+r)^N}{(1+r)^N - 1} \tag{4}$$

The values of the interest rate, price and duration 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 focus on the impact of differences in the price of purchase and the interest rate available at the time of purchase. 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:

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

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 when individuals who bought at price p_i with a common interest rate:

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

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 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.[8]

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

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

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

[8]The assumption is that different segments of the housing markets move in parallel across regions and across types of house.

$\hat{p}$.

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):

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

We rearranage equation (9) to show this decomposition:

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

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

We define *adjusted household income* as household income after subtracting off the difference in mortgage costs 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

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

Note that this measure of adjusted income does not adjust for actual mortgage payments. Instead, the adjustment is to allow for the aggregate state of the house market. We show below how this adjustment changes income for households that have bought at different times.

3.2 Household Income and Consumption by Time of Purchase

We compare gross household income and *adjusted household income* (as defined in the previous section) for two groups of households.[9] First group is made of households who bought at the peak of the housing boom, the second group is made of all other households in our sample. 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 (from 2005 to 2010).

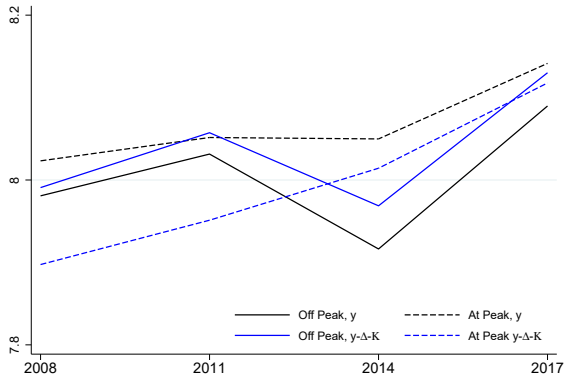
Figure 2 shows the evolution of the log of gross household income and the log of *adjusted household income*, by removing Δ_i and κ_i, from 2008 to 2017. [10] First, the solid lines show

[9]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.

[10]We only report the comparison from the survey data in 2008 since there are no households in the 2005

that 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 richer households were more likely to buy at the peak or alternatively because those buying at the peak then had to work harder. We distinguish between these selection and behavioural explanations in section 4 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



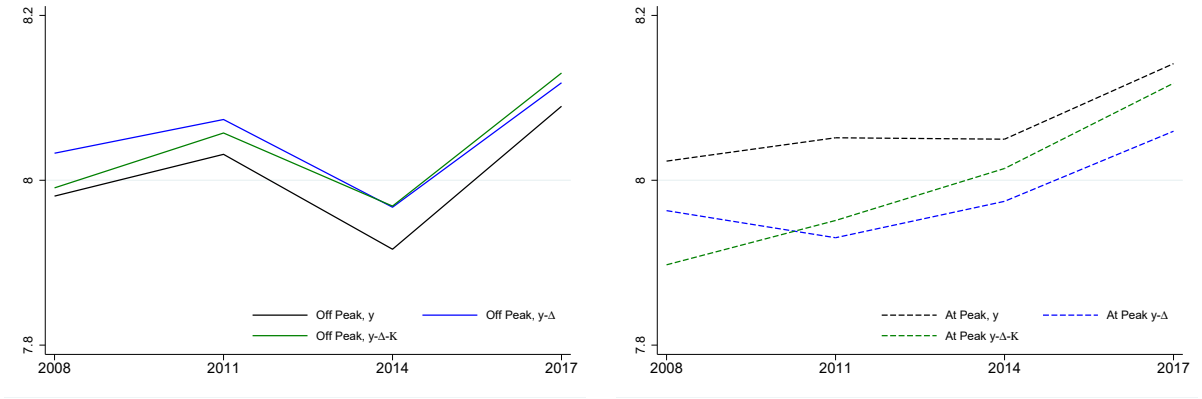
Notes: The adjustments Δ and κ account for the difference in mortgage costs due to differences in house price due to the year of purchase and due to differences in the interest rate, as in equation (11). The year on the x-axis is the interview year, while the year of purchase affects individual values of Δ and κ 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.

Differences in other household characteristics between those who buy at the peak and those who buy off-peak mean that our exercise does not provide causal estimates of the effect of buying at the peak as compared to buying off peak. Instead it shows the impact of Δ_i and κ_i on household income for different households.

survey who could have bought at the peak.

Figure 3: Median Income



(a) Off Peak

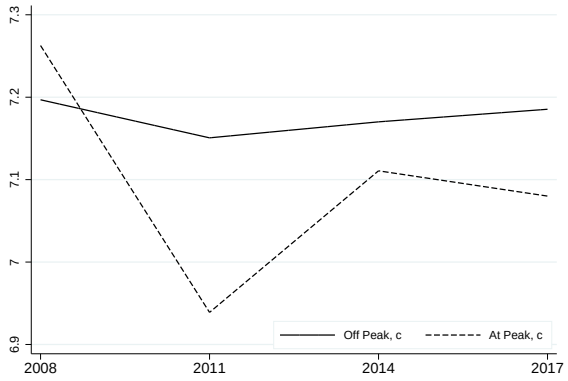
(b) At Peak

Notes: The adjustment Δ is the difference in mortgage costs due to differences in the price at the timing of purchase and the adjustment is the difference in mortgage costs 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 and κ used to construct individual adjusted income.

To complement this evidence on income, the right hand graph in Figure 4 shows evidence on how consumption excluding housing costs depends on the time of purchase. Consumption is nondurables, durables and utilities, but excludes mortgage payments. In other words, the housing costs that are netted off consumption include all mortgage costs, rather than just the Δ and κ adjustments. Except in 2008, households who bought at the peak report consumption around 10% lower than those who bought off peak.

Table 2 reports the regression results corresponding to Figures 2, 3 and 4, but conditioning on additional characteristics, in particular age, occupation and number of children. Income is 7% higher for those that bought at the peak (column 1) but after adjusting for the cost of house purchase, income is almost 5% lower (column 4). This swing is caused by the difference in the adjustment, Δ, partially attenuated by κ. Column 2 shows that the size of the Δ adjustment for those who bought at the peak is greater in absolute terms for households in higher terciles. The marginal effect of purchasing at the peak relative to off-peak by income tercile increases from 275 euros in the first tercile to 493 in the third tercile. However, the value of Δ relative to income of those who bought at the peak is 18% in the first tercile, but only 8% in the third (in 2014). Cyclical movements in house prices have regressive impacts on spending power. In column 3 we report the same regression for κ. The coefficient of buying at the peak on κ is negative and significant only for those in the second and third terciles. This arises because these households benefit from lower interest rates at the time of purchase. Finally, column 6 reports the regression of consumption: net-consumption is

Figure 4: Consumption



Notes: Consumption includes utility payments but is otherwise net of all housing costs. These housing costs include all mortgage, rather than just the Δ adjustment.

8% lower for those who buy at the peak, and the proportional reduction is greater for those in the lower tercile. This effect reverses for the highest tercile where consumption for those who bought at the peak is higher than consumption of those within the tercile who bought outside the peak. This suggests selection into the timing of purchase that we return to in section 4 below.

Table 2: Income, Adjusted Income and Consumption

	$\log y$	Δ	κ	$\log(y-\Delta)$	$\log y^{adj}$	$\log c$
At Peak	0.0727***	274.8***	-4.059	-0.0645***	-0.0469**	-0.0845**
	(0.0232)	(9.273)	(9.587)	(0.0234)	(0.0237)	(0.0339)
Age	0.00299	-6.981***	4.231***	0.00433**	0.00375*	0.00454**
	(0.00206)	(0.499)	(0.517)	(0.00208)	(0.00211)	(0.00182)
Number of Children	0.0460***	-1.614	-5.232*	0.0447***	0.0451***	0.0974***
	(0.0107)	(2.590)	(2.682)	(0.0108)	(0.0109)	(0.00945)
Household Inc Terc 2		-21.59***	-0.347			0.308***
		(6.837)	(7.070)			(0.0250)
Household Inc Terc 3		-59.85***	-13.35*			0.464***
		(7.152)	(7.404)			(0.0261)
At Peak× Hhold Inc Tercile 2		81.06***	-50.75***			-0.0118
		(12.59)	(13.02)			(0.0459)
At Peak× Hhold Inc Tercile 3		217.5***	-93.93***			0.159***
		(12.74)	(13.18)			(0.0465)
Constant	8.335***	112.4***	-35.39*	8.341***	8.328***	6.858***
	(0.0829)	(20.55)	(21.30)	(0.0839)	(0.0849)	(0.0750)
Observations	3637	3637	3611	3637	3610	3637
Adjusted R^2	0.174	0.656	0.344	0.176	0.173	0.226

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

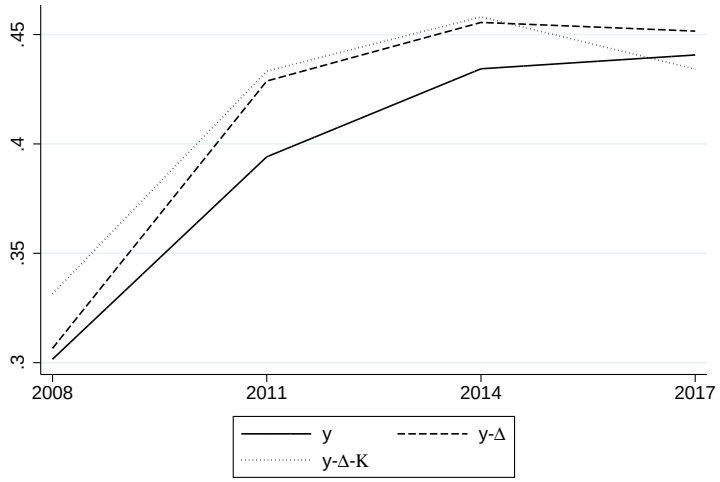
3.3 Adjusted Income Inequality

We turn now to assess whether adjusting for differences in housing costs due to the timing of purchase affects inequality across households. In Figure 5 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. Inequality in $(y - \Delta)$ is greater than inequality in income, y, and the increase in adjusted income inequality during the recession 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. However, this arises for two reasons: first, while Δ increases by income tercile, Δ as a fraction of income falls. In 2014, Δ for those who buy at the peak as a fraction of mean income within a tercile falls from 18% in the first tercile, to 12% in the second and to 8% in the third. Second, part of the extra inequality in

adjusted income arises because households with the same income now have different *adjusted income*, increasing variability. Inequality in $(y - \Delta - \kappa)$ is larger that inequality of $(y - \Delta)$. 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 of similar magnitude to the adjustment Δ and κ) and increases inequality by about 4%. 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.

Figure 5: Variance of Log Household's Income



Notes: The adjustment Δ is the difference in mortgage costs due to differences in the timing of purchase and the adjustment κ is the difference in mortgage costs 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 and κ used to construct individual adjusted income.

4 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 of the price of purchase on the employment of men and women, and on

their hours of work.

4.1 Empirical Approach

Our estimating equation for the effect on employment is given by:

$$E_{i,t} = \alpha \log P_i + \beta X_{i,t} + \gamma G_{r,t} + \delta_c + \eta_r + u_{i,t} \tag{12}$$

where i is the household. r is the region, t time and c is the individual's cohort. $E_{i,t}$ is individual employment status at time t, P_i is the price of purchase, $X_{i,t}$ is a set of individual controls including: education, age dummies, cohort dummies, number of children, spouse's employment, spouse's monthly earnings in the current year and spouse's annual earnings in the previous period. $G_{r,t}$ is a set of time-varying regional characteristics such as the regional unemployment rate. δ_c and η_r are cohort and region dummies.

The main issue with addressing the effect of the house price at the time of purchase is that the house price that was paid may be endogenous. In particular, the willingness and ability to pay for a particular house may depend on expectations about current and future income and labour supply. We therefore 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.[11]

4.2 Results

Table 3 reports OLS and IV estimates of the effects of house price at purchase and other variables on employment, separately for men and for women. Columns (1) and (3) report OLS estimates that a 10% increase in the price of purchase is associated with 0.4 percentage point higher employment rate of men and women. Columns (2) and (4) report IV estimates which are larger for men than the OLS, and smaller for women compared to the OLS. In terms of the controls, employment is positively correlated with education both for men and women, while and the number of children has a negative effect on females employment rate, but a non-significant on males.

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. The difference between the IV and OLS arises

[11]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.

from two contrasting effects. First, the price of purchase may be endogenous to future labor supply because 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. At the same time, those whose earnings grew more during the boom, were more likely to buy a house, but were also more likely to lose their job after the boom. This was particularly likely for young men workers working in the construction industry. In this case the OLS estimates of the effect of the price of purchase on the labor supply would be smaller than the IV estimate. This is what we observe in the case of men. Table 6 in the Appendix shows that these results are robust to excluding potentially endogenous variables such as spouse's earnings and employment status.

As a robustness exercise, in Table 7 in the Appendix we estimate the same IV regression as in Table 3 but with the regressor of interest being the ratio of Δ_i to m_2, instead of the price of purchase. This ratio represents the house price paid relative to the average price over the period, which may be negative number. The estimated impact on the labor supply of men is the same as in our benchmark regression and, again, not significant in the case of women.

In addition to the employment effects in Table 3, we explore in Tables 4 and 5 the further impacts of the price at the time of purchase on individual earnings, on hours worked, on wages, and on household income. The tables report IV estimates as in Table 3.

For men, the greater purchase price leads to greater earnings. This is driven by the effect on the extensive margin shown in Table 3. We find no effect on hours worked or on the wage rate. Higher earnings and higher household income reflect the greater number of men working with the higher purchase price. The lack of an association between the house price and the wage rate implies the greater employment by men is not driven by differences in wages for those who bought at the peak. For women, as with the lack of an impact on women's employment, we do not find an effect on earnings, nor on hours of work or wages. Household income is higher, but this is explained by the extra income from their spouses.

5 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.

Table 3: Time of Purchase and Employment

	Men		Women	
	OLS	IV	OLS	IV
Log Price Purchase	0.0365***	0.110***	0.0403**	-0.00532
	(0.0139)	(0.0336)	(0.0197)	(0.0479)
Unemployment	0.00198*	0.00183*	0.00291*	0.00288*
	(0.00111)	(0.00110)	(0.00164)	(0.00161)
Age 35-44	-0.0350*	-0.0448**	0.0663**	0.0708**
	(0.0194)	(0.0196)	(0.0278)	(0.0277)
Age 45-59	-0.130***	-0.137***	-0.0177	-0.0105
	(0.0314)	(0.0313)	(0.0492)	(0.0489)
Cohort 1960-1964			-0.239*	-0.221*
			(0.132)	(0.131)
Cohort 1965-1969	-0.0176	-0.0148	-0.194	-0.174
	(0.0264)	(0.0262)	(0.130)	(0.130)
Cohort 1970-1974	-0.0414	-0.0295	-0.105	-0.0878
	(0.0291)	(0.0292)	(0.132)	(0.131)
Cohort 1975-1979	-0.0365	-0.0282	-0.137	-0.123
	(0.0316)	(0.0315)	(0.134)	(0.133)
Cohort 1980-			-0.129	-0.107
			(0.137)	(0.137)
Number of Children	-0.00219	-0.00605	-0.0347***	-0.0333***
	(0.00784)	(0.00794)	(0.0110)	(0.0109)
Secondary Edu	0.0289*	0.0143	0.120***	0.123***
	(0.0175)	(0.0184)	(0.0262)	(0.0260)
Tertiary Edu	0.112***	0.0812***	0.196***	0.207***
	(0.0201)	(0.0238)	(0.0294)	(0.0308)
Spouse's Emp	0.0673***	0.0674***	0.0939***	0.0947***
	(0.0193)	(0.0191)	(0.0346)	(0.0341)
Spouse's Monthtly Earn	-0.00734	-0.00675	-0.00162	-0.00176
	(0.00927)	(0.00919)	(0.00901)	(0.00887)
Spouse's Annual Earn	-0.00410	-0.00887*	-0.00283	0.00121
	(0.00476)	(0.00513)	(0.00628)	(0.00730)
Constant	0.532***	-0.322	0.361	0.872
	(0.178)	(0.399)	(0.276)	(0.560)
Observations	1951	1951	1949	1949
Adjusted R^2	0.058	0.045	0.119	0.117
F stat		23.61		22.91

Note: Standard errors in parentheses. Given our sample restrictions, there are no observations of men in the early 1960s cohort and in the 1980s cohort. Year and occupation dummies are included. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 4: Price at Purchase and Earnings, Wages and Hours for Men

	Earnings	Hours	Wage	Household Income
Log Price Purchase	0.186***	-0.0465	0.0399	0.140***
	(0.0668)	(0.0302)	(0.0531)	(0.0537)
Unemployment	0.00419*	-0.00125	0.00721***	0.00493***
	(0.00224)	(0.000941)	(0.00165)	(0.00176)
Age 35-44	-0.00236	-0.0511***	0.152***	0.0138
	(0.0392)	(0.0168)	(0.0286)	(0.0314)
Age 45-59	-0.207***	-0.0639**	0.128***	-0.129***
	(0.0624)	(0.0268)	(0.0468)	(0.0499)
Cohort 1965-1969	-0.148***	0.0146	-0.0106	-0.140***
	(0.0529)	(0.0227)	(0.0416)	(0.0419)
Cohort 1970-1974	-0.254***	-0.0560**	-0.0507	-0.325***
	(0.0581)	(0.0248)	(0.0447)	(0.0467)
Cohort 1975-1979	-0.343***	-0.0442*	-0.0514	-0.371***
	(0.0629)	(0.0267)	(0.0475)	(0.0502)
Number of Children	0.0707***	0.0165**	0.0367***	0.0483***
	(0.0157)	(0.00686)	(0.0119)	(0.0127)
Secondary Edu	0.111***	-0.0188	0.169***	0.169***
	(0.0374)	(0.0162)	(0.0283)	(0.0293)
Tertiary Edu	0.393***	0.0261	0.429***	0.316***
	(0.0482)	(0.0214)	(0.0371)	(0.0380)
Spouse's Emp	0.00187	0.0357**	-0.175***	0.110***
	(0.0384)	(0.0165)	(0.0299)	(0.0305)
Spouse's Monthly Earn	0.0420**	-0.00730	0.137***	0.0880***
	(0.0179)	(0.00786)	(0.0205)	(0.0147)
Spouse's Annual Earn	0.0380***	0.00442	0.00101	0.124***
	(0.00995)	(0.00424)	(0.0141)	(0.00818)
Constant	5.171***	4.285***	1.481**	6.082***
	(0.788)	(0.355)	(0.625)	(0.637)
Observations	1821	1749	1350	1951
Adjusted R^2	0.249	0.056	0.380	0.474

Note: Standard errors in parentheses. Earnings are total annual earnings in the year before the interview and hours are total weekly hours. * $p < .1$, ** $p < .05$, *** $p < .01$

Table 5: Price at Purchase and Earnings, Wages and Hours for Women

	Earnings	Hours	Wage	Household Income
Log Price Purchase	0.0446	0.0146	-0.00247	0.0885*
	(0.0971)	(0.0460)	(0.0514)	(0.0514)
Unemployment	-0.00114	-0.00437***	0.00290*	0.00248
	(0.00327)	(0.00154)	(0.00172)	(0.00173)
Age 35-44	0.0330	0.0640**	0.0793***	-0.0347
	(0.0555)	(0.0265)	(0.0291)	(0.0297)
Age 45-59	0.150	0.0822*	0.232***	0.00526
	(0.102)	(0.0493)	(0.0558)	(0.0525)
Cohort 1960-1964	0.308	0.137	0.0675	0.0247
	(0.271)	(0.128)	(0.145)	(0.140)
Cohort 1965-1969	0.131	0.184	0.0391	-0.0616
	(0.270)	(0.128)	(0.146)	(0.139)
Cohort 1970-1974	0.183	0.129	0.0973	-0.0934
	(0.274)	(0.129)	(0.148)	(0.141)
Cohort 1975-1979	-0.00306	0.127	0.111	-0.230
	(0.277)	(0.130)	(0.149)	(0.143)
Cohort 1980-	0.108	0.214	0.167	-0.221
	(0.287)	(0.136)	(0.155)	(0.147)
Number of Children	-0.0713***	-0.0594***	0.0115	-0.0134
	(0.0237)	(0.0114)	(0.0127)	(0.0117)
Secondary Edu	0.416***	0.0999***	0.168***	0.195***
	(0.0572)	(0.0279)	(0.0310)	(0.0278)
Tertiary Edu	0.928***	0.141***	0.532***	0.366***
	(0.0654)	(0.0319)	(0.0349)	(0.0330)
Spouse's Emp	0.00326	-0.0759**	-0.0425	0.0999***
	(0.0723)	(0.0358)	(0.0401)	(0.0366)
Spouse's Monthtly Earn	-0.0592***	-0.00330	0.0309***	-0.0100
	(0.0193)	(0.00858)	(0.0108)	(0.00951)
Spouse's Annual Earn	0.0727***	0.0128*	0.0333***	0.168***
	(0.0167)	(0.00710)	(0.00792)	(0.00783)
Constant	5.399***	3.163***	1.641***	6.510***
	(1.103)	(0.524)	(0.589)	(0.601)
Observations	1455	1404	1227	1949
Adjusted R^2	0.294	0.124	0.384	0.534

Note: Standard errors in parentheses. Earnings are total annual earnings in the year before the interview and hours are total weekly hours. * $p < .1$, ** $p < .05$, *** $p < .01$

We find that those who bought at the peak of the market had higher gross income. However, adjusting for the extra expense of buying at the peak of the market meant they were on average worse off. In particular, they had lower adjusted income and lower consumption after mortgage payments. The adjustment was 18% of mean income in the bottom tercile, but fell to 8% in the top tercile. We find that there is an increase in inequality once we adjust income for these extra 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 use an IV approach to 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 due to the increase in supply of labour. This mitigates the effect of the consumption commitment on the disposable income of households. By contrast for women, our IV estimates of the effect of the house price are insignificantly different from zero. This is despite the OLS showing a positive correlation: in other words, 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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6 Appendix

In this Appendix we report several robustness exercises. First in Table 6 we show the results of the IV specification of Table 3, but omitting variables that are potentially endogenous, such as spouse's earnings and employment status. As shown, our results are robust to this.

Second, in Table 7 we estimate the same IV regression as in Table 3 but with the regressor of interest being the ratio of Δ_i to m_2, instead of the price of purchase. This ratio represents the house price paid relative to the average price over the period, which may be negative number. The estimated impact on the labor supply of men is the same as in our benchmark regression and, again, not significant in the case of women.

Table 6: Time of Purchase and Employment, IV-Exogenous Regresors

	Men	Women
Log Price Purchase	0.101***	0.0134
	(0.0335)	(0.0445)
Unemployment	0.00194*	0.00309*
	(0.00110)	(0.00161)
Age 35-44	-0.0403**	0.0665**
	(0.0196)	(0.0277)
Age 45-59	-0.133***	-0.0230
	(0.0313)	(0.0483)
Cohort 1960-1964		-0.220*
		(0.130)
Cohort 1965-1969	-0.0114	-0.178
	(0.0262)	(0.129)
Cohort 1970-1974	-0.0225	-0.0913
	(0.0293)	(0.130)
Cohort 1975-1979	-0.0207	-0.126
	(0.0315)	(0.132)
Cohort 1980-		-0.116
		(0.136)
Number of Children	-0.00612	-0.0347***
	(0.00786)	(0.0110)
Secondary Edu	0.0214	0.131***
	(0.0185)	(0.0260)
Tertiary Edu	0.0792***	0.210***
	(0.0246)	(0.0320)
Constant	-0.192	0.744
	(0.401)	(0.532)
Observations	1951	1949
Adjusted R^2	0.042	0.116
F stat	22.73	24.04

Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 7: Time of Purchase and Employment

	Men	Women
$\frac{\Delta}{m_2}$	0.111***	0.0115
	(0.0347)	(0.0493)
Unemployment	0.00204*	0.00288*
	(0.00109)	(0.00161)
Age 35-44	-0.0378**	0.0696**
	(0.0191)	(0.0274)
Age 45-59	-0.141***	-0.0124
	(0.0312)	(0.0485)
Cohort 1960-1964		-0.224*
		(0.130)
Cohort 1965-1969	-0.0274	-0.179
	(0.0261)	(0.128)
Cohort 1970-1974	-0.0546*	-0.0923
	(0.0286)	(0.130)
Cohort 1975-1979	-0.0590*	-0.127
	(0.0315)	(0.133)
Cohort 1980-		-0.114
		(0.136)
Number of Children	-0.00117	-0.0336***
	(0.00768)	(0.0108)
Secondary Edu	0.0351**	0.123***
	(0.0170)	(0.0258)
Tertiary Edu	0.127***	0.206***
	(0.0189)	(0.0286)
Spouse's Emp	0.0656***	0.0940***
	(0.0190)	(0.0342)
Spouse's Monthtly Earn	-0.00648	-0.00172
	(0.00911)	(0.00887)
Spouse's Annual Earn	-0.00170	0.000686
	(0.00460)	(0.00594)
Constant	0.968***	0.815***
	(0.0734)	(0.164)
Observations	1951	1949
Adjusted R^2	0.060	0.117
F stat		

Note: Standard errors in parentheses. Given our sample restrictions, there are no observations of men in the early 1960s cohort and in the 1980s cohort. * $p < .1$, ** $p < .05$, *** $p < .01$