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Assessing House price Effects on Unemployment dynamics

François Geerolf & Thomas Grjebine

Highlights

- Using property taxes as an instrument for house prices, we show the causal effect of house prices on unemployment dynamics across time and countries.
- A 10% appreciation in house prices yields to a 3.4% decrease in the unemployment rate.
- If house prices drive employment fluctuations in construction, they impact also total employment through their effects on labour demand.
- Housing booms impact specifically the tradable sector as they lead to real exchange rate appreciations that affect manufacturing activity.

Abstract

We investigate the causal effect of house price movements on unemployment dynamics. Using a dataset of 34 countries over the last 40 years, we show the large and significant impact of house prices on unemployment fluctuations using property taxes as an instrument for house prices. A 10% (instrumented) appreciation in house prices yields to a 3.4% decrease in the unemployment rate. These results are very robust to the inclusion of the variables commonly used to explain unemployment rate developments. If house prices directly impact employment in construction, job volatility in this sector resulting in large employment fluctuations, they impact also total employment through their effects on non-residential investment and consumption, two determinants of labour demand. Housing booms have a specific effect on employment in the tradable sector as they lead to real exchange rate appreciations that affect manufacturing activity.

Keywords

Unemployment, House Prices.

JEL

J60, E29, R32.

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RESEARCH AND EXPERTISE
ON THE WORLD ECONOMY

Assessing House price Effects on Unemployment dynamics[1]

François Geerolf* and Thomas Grjebine†

Introduction

Many commentators have noted a close link between house price busts and rising unemployment rates. In Spain, for example, there is a striking symmetrical evolution between house prices and unemployment over the last 30 years (Figure 1). Following the housing bust in 2007, the unemployment rate increased from 8.3% to 26% at the end of 2012. Unemployment had previously decreased from 24% to 8.3% during the housing boom period (1995-2007). The negative relationship between house prices and unemployment can however accommodate very different interpretations: house prices comove positively and unemployment negatively with the business cycle, so whatever drives the cycle could explain their comovement. Moreover, house prices could decline when unemployment goes up in the case of reduced consumption on all goods, and on housing services in particular. However, in this paper we investigate the opposite causal effect: the effects of house price movements on unemployment dynamics.

Following Geerolf and Grjebine (2013), we use property taxes as an instrument for house prices. Our identification strategy relies on the fact that property tax changes are driven by local politics rather than macroeconomics, so that they are orthogonal to macroeconomic factors which might otherwise determine the business cycle. We show that house prices have a causal effect on unemployment: a 10% (instrumented) increase in house prices yields to a 3.4% decrease in the unemployment rate. This is economically a very large effect[2]. It would for example account for one third of the unemployment rate decline in the US during the recent boom period (2003-2007), and for half of the unemployment rate decline in Spain during the period 1995-2007. To show the robustness of our instrumental strategy, we check through alternative methods whether our instrument introduces purely exogenous variations in house

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[2]The standard deviation of house prices is 9% in the whole sample, while that of unemployment is 1.3% of active population. Descriptive statistics are fully described in online appendix C.

Figure 1 – House prices and Unemployment in Spain

prices. We treat very carefully the business cycle dimension of house price fluctuations. Our data is a country-year dataset spanning 34 countries and the period 1970-2010.

We investigate which mechanisms are at the source of this causal relationship. Quite naturally, house prices have a strong effect on employment in the construction sector. House prices are indeed strongly correlated to the investment in housing sector, housing booms leading to hiring of construction workers. Jobs in construction are thus very dependent on the housing cycle. Employment in construction is also very volatile due to job insecurity in the sector. This implies that fluctuations of employment in construction have a large impact on unemployment dynamics[3]. In Spain, 1.7 million persons lost their job in the construction sector between 2007 and 2013, accounting for 52% of the total fall in employment in the period. But house price effects go well beyond the direct effect on employment in the construction sector. We decompose total employment into the different sectors of the economy to measure house price effects in non-housing sectors. We show that house prices have in particular a strong impact on employment in the non-tradable sector. We explain these results through the house price effects on non-residential investment and consumption, two determinants of labour demand[4]. Following a house price increase, non-residential investment rises through a relaxation of financial constraints for firms, and consumption increases through wealth effects. We finally find a specific effect of house prices on the tradable sector. If housing booms have a positive

[3]There is a debate in the literature about whether unemployment or employment-population ratio is a better indicator for measuring labour market dynamics. See Shimer (2005). We find useful to use both measures in this paper.

[4]Of course, investment and consumption could comove with unemployment following house price shocks. We try to identify investment and consumption specific effects on employment following house price shocks.

effect on total employment, they seem to affect negatively employment in the manufacturing sector. This could be explained by a mechanism reminiscent of a Dutch disease phenomenon. An increase in house prices tends indeed to lead to a real exchange rate appreciation that affects manufacturing activity.

Related literature. We will not review here the very vast literature on unemployment dynamics. In particular a large number of articles have sought the source of differences in labour market outcomes in differences in labour market institutions. Blanchard and Wolfers (2000) showed that the interaction between shocks and institutions is crucial to explaining unemployment patterns. Nickell et al. (2005) emphasized that broad movements in unemployment can be explained by shifts in labour market institutions. Bassanini and Duval (2006) looked at the existence of complementarities between labour market policies. The first contribution of this article is to show the strong explanatory power of house prices relative to labour market institutions to explain unemployment dynamics.

A limited number of papers has started to look at the issue empirically. Bover and Jimeno (2008) presented for example evidence regarding the relationship between house prices and relative employment in construction on a sample of nine OECD countries over the period 1980-2003. They showed that countries with more building possibilities tend to display larger elasticities of labour demand in the construction sector with respect to house prices than countries with fewer building possibilities. Byun (2010) tried to estimate the impact on employment of the recent housing bubble in the US. Using input-output tables, the bubble is estimated to have contributed somewhere between 1.2 million and 1.7 million jobs in 2005, accounting for 0.8 percent to 1.2 percent of total U.S. employment. Using our IV, we get a very close estimate of the house price impact on US employment in construction.

In this paper, we also investigate more fully the house price effects on unemployment. More importantly, we address the issue of causality between house prices and unemployment dynamics. We finally test different channels through which house prices could impact unemployment patterns. Note that if we study the macroeconomic consequences of house prices, we do not investigate specifically the effects of home-ownership rates on residential mobility. Following Oswald (1996) and more recently Blanchflower and Oswald (2013), a different strand of the literature has indeed looked at the role of home-ownership rates as a friction in the labour market[5].

[5] More theoretical papers have also address this question. Recently, Rupert and Wasmer (2012) presented a model where the interconnection between two frictional markets (housing and labour) can be used to understand differences in the functioning of labour markets. In this paper, we do not focus specifically on the effects of housing on residential mobility. In the robustness checks, we test the hypothesis that home-ownership

Outline. The rest of the paper is organized as follows. In Section 1, we develop our estimation strategy and we present our OLS results, controlling for the determinants which have been previously used in the literature. In Section 2, we present our instrumental variable approach. We treat very carefully the business cycle dimension of house price movements and we answer potential endogeneity issues. The main result is that a 10% (instrumented) increase in house prices leads to a 3.4% decrease in the unemployment rate. In Section 3, we try to understand the channels through which house prices impact unemployment. We decompose employment into the different sectors of the economy. If house prices have a strong impact on employment in construction, house price effects go beyond the construction sector. House prices impact also total employment through their effects on labour demand. In Section 4, we perform a simulation exercise to understand how far one can go towards explaining unemployment dynamics with changes in house prices. Finally, in the Appendices, we model the capitalization mechanism (A), we show descriptive statistics (B), and we present our robustness checks (C). We show in particular that our results are robust using VAR techniques.

1. Estimation methodology and OLS results

1.1. Data and estimation technique

Data. House price data are taken from Geerolf and Grjebine (2013). We use annual data for 34 countries for the period 1970-2010 [6]. To build this database, we notably used the property price statistics from the Bank for International Settlements which cover a large number of countries but only for a short period of time. We then completed this database with data from various national sources (central banks, national statistical agencies, etc.). Data for unemployment are taken from the OECD Labour Market statistics. Employment variables are built as a percentage of active population. In the robustness checks, we show also results with variables taken as percentage of working age population. Sectoral employment variables are in addition measured as a percentage of total employment. Other variables used in this article are described at the end of the paper, in Table C.1.

Stationarity problems and estimation technique. Due to data limitation on house prices, most of the economies we consider are advanced economies. House prices have an upward trend in the period we consider. Unemployment series contain also a unit root[7]. We detrend our data

could play as a friction in the labour market.

[6] Our sample comprises Australia, Austria, Belgium, Canada, China, Czech republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Indonesia, Ireland, Israel, Italy, Japan, Korea, Mexico, The Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, United Kingdom, the United States.

[7] Using augmented Dickey-Fuller, Phillips-Perron tests or panel-data unit root tests, we cannot reject the

by using a HP-filter with a smoothing parameter of 400 to remove the very low frequencies. We show in the robustness checks that our results are robust to several specifications of the HP parameter (Table C.2). Our results are also robust when taking first differences instead of a HP filter. Using augmented Dickey-Fuller and Phillips-Perron tests, we can then reject the hypothesis that our series contain a unit root. Moreover, after regressing unemployment on house prices, we can reject the null hypothesis that residuals contain a unit root at reasonable confidence intervals, for all series in which we have a sufficiently large sample (online appendix A). Since house prices and unemployment are serially correlated, we are careful to use robust estimation procedures to not overestimate the precision of our coefficients. In this paper, we only present standard errors which are robust to heteroscedasticity and autocorrelation (HAC). We use the Bartlett kernel-based (or nonparametric) estimator, also known as the Newey and West (1987) estimator. We use a bandwith of 2, which leads to the inclusion of autocovariances up to 1 lag. Our results are robust to different choices, for example inclusion of 2 lags[8].

1.2. OLS Results

The main specification of our paper is:

$$U_{it} = \alpha H_{it} + \beta X_{it} + \delta_i + \nu_t + u_{it}. \quad (1)$$

U_{it} and H_{it} are unemployment and house prices of country i in year t respectively. More precisely, U_{it} denotes the share of unemployment over active population. H_{it} denotes an index of real house prices (that is, deflated by the CPI), in base $1 = 2005$. X_{it} are controls for unemployment. δ_i and ν_t are country and year fixed-effects. Country-fixed effects are included in all the regressions of this article, and enable us to identify the effect of house prices on unemployment from the time-series dimension[9]. We also add year fixed-effects in the robustness checks.

hypothesis that our series are non-stationary. The high persistence in unemployment rates observed in the developed world since the first oil shock has led to a vivid debate over which paradigm can better explain the behavior of unemployment rates. The hysteresis hypothesis has been formulated in particular as a unit root or non-stationary process. Empirical evidence tends to support the hypothesis of hysteresis for the European Union economies and is mixed for the United States (Romero-Ávila and Usabiaga (2007), León-Ledesma (2002)). We show in the robustness checks that our results are also robust without filtering unemployment rate series (Tables C.5, C.6 and C.7).

[8] Automatic lag selection as in West (1994) is not available here since we use panel data. See Hayashi (2000) for more on GMM estimation with serial correlation.

[9] Country-fixed effect also control for the fact that house price indices may not be comparable across countries, so that we are only left with interpreting the difference from the country-mean.

Table 1 – House Prices and Unemployment. OLS regressions.

	(1)	(2)	(3)	(4)	(5)
	U	U	U	U	U
	(OLS)	(OLS)	(OLS)	(OLS)	(OLS)
House Prices	-7.734***	-7.247***	-5.006***		-4.517***
	(0.902)	(0.879)	(0.913)		(1.094)
GDP growth		-2.030***		-2.075***	-1.283*
		(0.488)		(0.741)	(0.680)
Min. vs. Av. wage				5.577	4.931
				(4.986)	(4.747)
LME				1.741	1.140
				(1.478)	(1.480)
Employment protection				0.0816	-0.479
				(0.651)	(0.651)
Tax Wedge				0.00761	0.000717
				(0.0338)	(0.0319)
Trade Union				0.212***	0.261***
				(0.0554)	(0.0578)
Replacement rate				7.924***	5.499**
				(2.706)	(2.532)
Observations	630	628	252	220	220
R^2	0.252	0.279	0.251	0.307	0.373

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. All series are detrended using a HP-filter. U denotes unemployment rate. LME denotes labour market expenditures.

The baseline regression yields the estimates displayed in Table 1. According to the simplest specification (column (1)), an increase in house prices of 10% is associated with a decrease of the unemployment rate of 0.8%. The correlation is very significant and the explanatory power of this regression is high: $R^2 = 25\%$ with house prices alone. Adding our house price variable to usual determinants of unemployment dynamics increases the R^2 by more than 7 percentage points (compare column (5) to column (4)).

In columns (4), (5), and (6) of Table 1, we follow the literature on unemployment to compare the explanatory power of house prices with other variables usually put forward in the literature (Blanchard and Wolfers (2000), Nickell et al. (2005), Bassanini and Duval (2006), Murtin and Robin (2013)). We add the following variables:

(i) *Employment protection.* It tends to increase long-term unemployment as employers are more reluctant to hire highly protected workers. In the short term, it can reduce unemployment as workers are fired less easily.

(ii) *Minimum versus average wage.* This is the minimum wage as a percentage of the median wage. High minimum wages tend to increase unemployment as they mean higher real labour costs but not necessarily higher productivity. But the literature does not find a significant effect of minimum wage on unemployment (Bassanini and Duval (2006)).

(iii) *Labour market expenditures.* We take the active measures in favour of the labour market. They include notably training, employment incentives or direct job creation. Effects of these measures can be complex as they may entail substitution effects or programmes that are likely to pay off only in the long-run (training programmes). This explains that macro studies tend not to find significant effects of these expenditures on unemployment.

(iv) *Tax wedge.* We define this variable as in Murtin and Robin (2013). It is the sum of the payroll, income, and consumption tax rates. Tax wedge is based on a full time worker with no children. The impact of this variable on unemployment depends on who shoulders the burden of taxes, and so on the relative bargaining power of the parties. If for example taxes cannot be shifted onto wages, then labour demand is likely to be negatively affected and so, employment is likely to be negatively affected as well. High tax wedges on labour largely may reflect high levels of public expenditure and the important role played by wage-based contributions in financing the transfer system.

(v) *Trade Union.* Higher levels of unionization can give rise to less competition in labour markets. In particular, Nickell and others (2001) find that greater unionization tends to increase real labour costs. de Serres and Murtin (2013) show that the degree of unionisation may either raise or lower unemployment cyclical volatility depending on whether unions push for higher real wages regardless of the unemployment level or seek to preserve current members' jobs.

(vi) *Replacement rate.* It captures the degree of generosity of the unemployment insurance system. More generous insurance systems may cause unemployment if they reduce the effectiveness of the search of jobs.

Interestingly, the six policy and institutional determinants of unemployment explain 30% of the variance (column (4)), almost as much as house prices alone (column (3)). Moreover, adding house prices to these institutional variables helps to explain 37% of the variance (column (5)). We control also by real GDP growth which is also endogenously affected by house prices (see section 3.3). We show in the robustness checks that these results are also robust without filtering our variables but by taking instead house prices in delta-log (Tables C.6 and C.7).

2. Instrumental approach

There are several issues with the OLS regression which prevent an interpretation of this correlation in a causal sense, from house prices to unemployment. The first issue is reverse causality: it could be argued that house prices can decrease when unemployment goes up because of reduced consumption on all goods[10], and on housing services in particular. Second, there is potentially an omitted variable problem, since many factors could drive both house price booms and unemployment patterns. For example, house prices could comove positively and unemployment negatively with the business cycle. Whatever drives the cycle could explain the comovement. Third, there is a clear problem of measurement errors in house prices.

To address these issues, we use an Instrumental Variable approach. Following Geerolf and Grjebine (2013), we use property taxes as an instrumental variable for house prices. Because of capitalization, unexpected increases in property taxes are immediately translated into a decrease of house prices (see the model in Appendix A). A very important element in the choice of this tax is that it is not endogenously affected by house prices. Indeed, property taxation essentially uses fiscal values (as opposed to market values) which are rarely revised to reflect market values. Concerning the construction of our instrument, it is not possible to use marginal rates as property taxes are highly multidimensional, nonlinear, with several brackets, and exemptions below a certain threshold. We therefore use the share of revenues brought about by property taxation in total taxation of a country. This enables to capture variations in property taxation that keep total tax receipts constant, since changes in total tax could impact the business cycle. We discuss the issue of exclusion restriction after presenting the IV results. Data on property taxes come from OECD Revenue Statistics. We use recurrent taxes on immovable property, a category that covers taxes levied regularly in respect of the use or ownership of immovable property[11].

2.1. IV results

We use Two stage least squares (2SLS), with exogenous variation of real-estate property taxation (T_{it}) as an instrumental variable for house prices in the first stage. We check in the

[10]For example, in the precautionary savings literature, capital market imperfections and the presence of uninsured idiosyncratic risk lead agents to save more than they would if there were no uncertainty (notably Carroll et al. (1992), and more recently Mody et al. (2012)).

[11]According to OECD Revenue Statistics, "these taxes are levied on land and building, in the form of a percentage of an assessed property value based on a national rental income, sales price, or capitalised yield; or in terms of other characteristics of real property, such as size, location, and so on, from which are derived a presumed rent or capital value. Such taxes are included whether they are levied on proprietors, tenants, or both. Unlike taxes on net wealth, debts are not taken into account in their assessment."

Table 2 – IV approach: first and second stage

	(1) House (IV: 1st st.)	(2) House (IV: 1st st.)	(3) House (IV: 1st st.)	(4) U (IV: 2nd st.)	(5) U (IV: 2nd st.)	(6) U (IV: 2nd st.)
House Prices				-33.89***	-34.78***	-37.14***
				(7.653)	(8.345)	(12.63)
Property tax	-3.545***	-3.307***	-3.505***			
	(1.067)	(1.030)	(1.037)			
GDP growth		0.0888**	0.140***		1.175	3.947
		(0.0352)	(0.0391)		(1.279)	(2.493)
Min. vs. Av. wage			-0.519			-20.36
			(0.318)			(12.94)
Tax wedge			-0.00169			-0.0391
			(0.00155)			(0.0731)
Trade Union			0.00785**			0.362***
			(0.00321)			(0.128)
Replacement rate			-0.144*			-4.069
			(0.0827)			(3.792)
Observations	634	633	299	634	633	299
Cragg-Donald				16.74	14.56	10.66

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. House Prices are an indice of house prices, normalized at 1 in 2005. U denotes the Unemployment rate. Country fixed effects included in the regressions. All series are HP-filtered.

first stage regression that this instrument is indeed related negatively to house prices (H_{it}), estimating the equation by least squares:

$$H_{it} = \gamma T_{it} + \delta X_{it} + \delta_i + \nu_t + v_{it}. \quad (2)$$

This regression leads to the estimates displayed in Table 2. The first-stage is strong and highly explanatory: the orders of magnitude of the change in house prices following an increase in property taxes are high: a 1% increase in the share of property taxation leads to a decrease in house prices of about 3.5% (column (1)). Our first stage in fact confirms a large literature on tax capitalization which documents that property taxes indeed have a negative effect on house prices. The debate on tax capitalization is old (see Oates (1969) for an early reference) but the most recent estimates suggest that this capitalization can be quite high. For example, Palmon and Smith (1998) finds a figure between 60% and 100%. Gravel et al. (2006) find a complete capitalization of local taxes. Gallagher et al. (2013) show that local property taxes are nearly fully capitalized into the prices of small homes. Housing market participants seem to rationally take into account increases in property taxes on the price they should pay for newly purchased homes.

Using the property tax as an instrument for house prices as a first stage gives the results for the second stage in Table 2. Looking at the column (4), we get that a 10% increase in house prices yields to a decrease of the unemployment rate of 3.4%. As stated in the introduction, this effect is large. It would for example account for one third of the unemployment rate decline in the US during the recent boom period (2003-2007), and for half of the unemployment rate decline in Spain during the period 1995-2007. The IV estimates are substantially greater than the OLS estimates; that is, OLS estimates appear to be biased downward significantly[12]. Comparing column (4) (2nd stage) in Table 2 with column (1) in Table 1, we interpret the increase in the coefficient with respect to OLS (in absolute value) by the fact that house prices are mismeasured and that OLS estimates are therefore biased towards 0. This suggests also that reverse causality is not at work in the data (higher unemployment does not generate lower house prices). The lower coefficient in the OLS case could also be explained by the use of housing as a precautionary saving asset in times of uncertainty. For example during the recent crisis in France, increase in the demand for housing could partly be due to an increase in uncertainty (correlated with higher unemployment rate).

2.2. Exclusion restriction.

Several arguments help to explain why our instrumental variable does not impact unemployment other than through house prices. Property tax changes must not result from an omitted third factor, like economic conditions. A major argument in favor of our instrument is that property taxes are usually set by local governments, and are not a tool used for macroeconomic policy. We check through alternative methods that our instrument introduces purely exogenous variations in house prices. We first show that variations of our instrument are not driven by changes in total taxes. We then answer potential endogeneity issues. We finally

[12]The result that the 2SLS coefficient is larger than the OLS coefficient is a "common empirical finding" (Hahn and Hausman (2005)). In this paper, we check that this is not due to weak identification. For our main specification (column (4) of Table 2), the Cragg-Donald Wald F statistic (Weak identification test) is about 17, so our instrument is not a weak instrument. Classical measurement error in an independent variable attenuates towards zero the OLS estimator. It does not affect the consistency of IV estimation (because the exclusion restriction holds), neither does it affect the consistency of OLS or IV estimators when the mismeasured variable is the endogenous variable. The fact that the IV estimator does not suffer from attenuation bias from classical measurement error, while the OLS estimator is attenuated, is an explanation for IV estimates usually being larger than their OLS counterparts, even when we expect omitted variable bias to go in the opposite direction. Such findings are common in the labour economics literature (Card (2001)).

propose a narrative approach for identification of property tax shocks.

Why choose Property Taxes as a % of Total Taxation? We use property taxes as a percentage of total taxation as our benchmark instrument for house prices. Property taxes being expressed in the OECD data as an amount in national currency, we therefore need a reference to which we can compare the amount of property taxes levied by the government across countries. Because we want to use unanticipated shocks to property taxes as our instrument for house prices, we do not want the increase of property taxes to reflect the general increase of total taxation in the country. Our instrument thus reflects the amount of property taxes levied by the government relative to the general level of taxation in the country. One could be worried that dividing by total taxes would introduce some spurious correlation between house prices and our instrument, leading us to an overestimation of the true link between house prices and property taxes in the first stage. However, we show three things to address this potential concern. First, we check that our results are not sensitive to the choice of this normalization rather than to using for example, the value of property taxes in national currency in a given year[13]. We call this other instrument "Property taxes (value)". Table 3 reports the IV results with this alternative measure of property taxes. Columns (1) and (2) show that using this alternative measure does not change significantly the point estimate of the estimated impact of house prices on unemployment[14]: a 10% increase in house prices leads to a 2.6% decrease in the unemployment rate (column (2)), against 3.4% in the baseline specification, column (4) of Table 2. Second, we show in column (4) that the inverse of total tax is not significantly correlated to GDP, and if anything it is positively correlated to GDP[15]. Third, we show in Table C.4, that smoothing our denominator does not alter the results in any way. In particular, we take an averaged value of total tax or we smooth total tax taking the trend component of a HP filter to remove business cycle frequencies. We verify also that

[13]To normalize this value, we divide it by the median of this value over the sample.

[14]In any case, we think that the alternative instrument is not as well suited to our analysis here, as we do not want to consider mechanic increases in Property Taxation resulting from the increase or the decrease of the overall tax shares as "shocks" to property taxes. Referring to the model developed in Appendix A, and in particular equation (H), it is unexpected shocks to property taxes that have an effect on house prices, not the expected ones which are already factored in prices. The mechanic increase of property taxes with the trend of general total taxation certainly is incorporated in prices well in advance of actual rises. In contrast, only when the government decides to shift the burden of taxes towards property taxation will we record a "shock" to property taxes. This is why in the following, we will work with property taxes as a percentage of total taxation, unless otherwise noted.

[15]The reason for this result is that $1/$Total Taxation barely moves over the cycle, and stays roughly equal to two. Because of the positive correlation between house prices and GDP, the denominator introduces some positive correlation between house prices and the instrument. This bias is not a problem because it tends to weaken the first stage, and hence go against our conclusions.

choosing other scaling variables for property taxes does not alter the results either.

Potential Endogeneity Issues. Our instrumental strategy requires that property tax changes be orthogonal to macroeconomic factors which might otherwise determine unemployment. We develop three arguments to answer potential endogeneity issues.

First, for our instrumental variable strategy to work, it must be that cadastral values are not revised too frequently, otherwise property taxes would mechanically rise when house prices increase (see equation (H) in the model in Appendix A). In that case, we would not be able to identify the negative relationship that property taxes have on house prices through capitalization. If property taxes are revised sometimes, then this introduces a positive correlation in the relationship between house prices and property taxes, which go towards weakening our first stage. Consistent with this weakening effect of the revision in property taxes on our estimation strategy, we show that in countries with no cadastral revision, the correlation between property taxes and house prices (column (6) of Table 3) is slightly stronger than using the full sample (column (1)), let alone using the sample with frequent revisions (column (9)). In particular, the explanatory power of the property tax is much higher in the case of no cadastral revision ($R^2 = 31\%$, column (6)) than in the case of frequent revisions ($R^2 = 12\%$, column (5)). We show also in column (5) of Table 3 that in countries that revise cadastral values relatively more infrequently (see online appendix B for details), property taxes are not at all correlated to GDP (this is true for both the instrument we use and property tax values). Property taxes are only very weakly correlated to GDP in the full sample: the explanatory power of GDP on property taxes is very low, lower than 2% (column (3)) (by comparison, the R^2 with income tax is very large, 45%).

A second argument in favor of our instrument is that the specialized literature on property taxes, especially that on the United States, points to the relative stability of property taxation over the cycle as an advantage of this form of taxation over others: see for example Lutz (2008) and Giertz (2006).[16] It is all the more remarkable that the United States are taken as having a relatively frequent revision of their property taxes compared to other countries (online appendix B).

As a third argument in favor our instrument, we show that controlling for GDP (through our variable of GDP growth) does not alter our results in any significant way (see Table 2). To further alleviate endogeneity problems, we also show that controlling by different measures of GDP like real GDP or relative income yields similar results (see Table C.3).

[16] Lutz (2008) writes: "The relative stability of the property tax over the course of the business cycle is often cited as one of the primary virtues of property taxation."

Table 3 – Examining exclusion restriction

	(1) House (1st st.)	(2) U (2nd st.)	(3) Property(v.) (OLS)	(4) 1/Total tax (OLS)	(5) Property(v.) (OLS)	(6) House (1st st.)	(7) U (2nd st.)	(8) Property(v.) (OLS)	(9) House (1st st.)	(10) U (2nd st.)
House Prices		-26.39***					-27.39***			-23.21*
		(7.566)					(9.249)			(12.38)
Property(v.)	-0.102***					-0.113***			-0.0785**	
	(0.0288)					(0.0377)			(0.0397)	
GDP	0.856***	9.802	0.347**	0.519	0.144	0.881***	10.59	0.842***	0.777***	7.715
	(0.0972)	(6.193)	(0.147)	(0.368)	(0.153)	(0.125)	(7.897)	(0.266)	(0.144)	(9.588)
Observations	736	588	736	736	421	421	312	315	315	276
Cragg-Donald (weak)		14.76					13.86			2.087
R^2	0.228		0.019	0.003	0.004	0.310		0.080	0.119	
Cadastral revision					No	No	No	Yes	Yes	Yes

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects are included. Series are HP filtered. "Cadastral revision" points to countries where cadastral values are reassessed at least every 2 years (see online appendix B for details). "Property(v)" is property tax value in national currency in a given year divided by the median of this value over the sample. "GDP " is the value of GDP in national currency in a given year divided by the median of this value over the sample.

2.3. A narrative approach: the example of France.

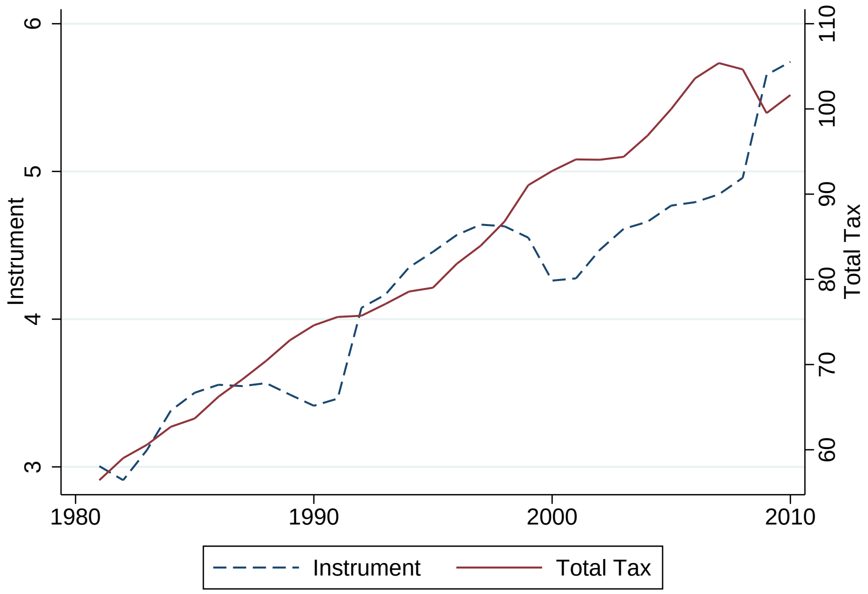
We take the example of France where it is possible to shed light on four different property tax shocks over the last thirty years (Figures 2 and 3). These shocks are consequences of decentralization policies, uncorrelated with unemployment dynamics or the business cycle. They can also be explained by the electoral cycle. The first shock was the result of the Defferre Laws in 1982-1983 that initiated the policy of decentralization in France. Prior to these laws, French municipalities and departments enjoyed very limited autonomy. The laws gave territorial collectivities in France separate defined responsibilities and resources. In particular, the 1983 laws dating from 7 January and 22 July defined the responsibilities of new bodies (the "Régions") and how they would be financed. If local authorities could set property tax rates since 1981, it was the need of increasing resources due to the new responsibilities of local collectivities that explained the rise of property taxes between 1982 and 1985. Property tax increases contributed to the gradual decrease of house prices and the increase in the unemployment rate.

Figure 2 – Instrument, house prices and unemployment in France

Source: OECD and authors' calculations. Series are not filtered.

A second shock was the halt to the decentralization reforms in 1985. That year marked the end of the first phase of decentralization. This started a period of moderation of local taxation. If local authorities enjoyed more autonomy thanks to the decentralization reforms, they became also responsible to the electors, in particular of their budget management. Several local elections took place during this period (for the "Départements" in 1985, for the "Régions" in 1986, for the municipalities in 1989). This was a major factor explaining the fiscal moderation.

Figure 3 – Instrument and total taxation in France



Source: OECD and authors' calculations. Series are not filtered. Total tax is measured in real terms.

During this period, new budgetary control rules were also put in place by local authorities and budgetary choices were rationalized. These efforts contributed to alleviating budgetary financing needs. The moderation of local taxation was an important factor in the increase of house prices and the decrease of the unemployment rate.

The third policy shock was the result of the law of 1990 which planned a major revision of cadastral values. To offset the cost of this reform for the State, this law contained an increase of collection and recovery costs that led to a significant increase of property taxes in 1991-1992[17]. The electoral cycle (post-election period) is another explanation of the increases in property taxes decided in 1990 (local elections were in 1989) (Guengant (1992)). Finally, increases in property taxes during this period can also be explained by a new decentralization reform: the ATR law of the 6th February 1992. Intercommunality really emerged in France with this law which created the "communautés de communes". The law was an immediate success with more than 1000 "communautés de communes" created during the first five years. Intercommunality was the main cause of the increase of property taxes between 1993 and 2006 (Charlot et al. (2008)). Decentralization reforms had permitted transfers of responsibilities to local authorities. Increasing responsibilities implied a need for increasing resources which explained the increase of property taxes during this period. The rise of property taxes contributed to the decrease of house prices and the rise of unemployment.

Finally, the fourth shock was the result of the tax exemptions of 1997 and the local elections

[17]Because of its political costs, the revision of cadastral values was abandoned in 1992.

of 1998. The increase of property taxes that had started in 1992 with the ATR law was temporary halted in 1997-1998. Several property tax exemptions were voted in 1996-1997 (property tax exemptions for developed property during 5 years in urban free zones with the Law of the 14th November 1996; property taxes for undeveloped property are removed for the "Régions" and "Départements" in 1996). In addition, local authorities started in 1997 a policy of tax moderation, notably because the parliament had secured the state grants to local governments with the Financial Stability Pact (integrated into the 1996 Finance Act). The local elections of 1998 (for the "Départements" and "Régions") contributed also to this tax moderation which was in important factor in the increase of house prices and the decline of unemployment.

3. Explaining the mechanisms

House prices have a causal effect on the unemployment rate. To understand this effect, we decompose employment into the different sectors of the economy. Quite naturally, house prices have a strong impact on employment in construction. House prices impact also total employment through their effects on non-residential investment and consumption, two determinants of labour demand.

3.1. House price effects on construction

House prices have a strong impact on employment in the construction sector. They are indeed highly correlated to investment in construction (see Table C.20), housing booms leading to hiring of construction workers. Employment in construction is also very volatile due to job insecurity in this sector. This implies that shocks on construction have a large impact on unemployment dynamics.

The magnitude of the direct effect. In average for our sample of 34 countries over the period 1970-2010, employment in the construction sector and in real estate activities represents around 8% of total employment[18] (7% for the construction sector only, with a standard deviation of 2%). It is Europe's largest industrial employer, accounting for about seven percent of total employment. In particular, employment in construction represented in 2005 around 6% of total employment in France or Germany, 7% in the United-Kingdom, 8% in the United States or 12% in Spain (Table B.1 in Appendix B). In addition, the production of other sectors of the economy may be used as inputs for construction. In table B.2 of Appendix B, we estimate the total share of employment devoted to housing in several countries. To do

[18] Estimations for non-filtered series.

so, we add employment in the construction sector (column (2)) and in real estate activities (column (3)). We calculate also thanks to OECD Input-Output tables an estimation of the number of employees devoted to housing in sectors that are used as inputs of construction and real estate activities (column (1)). The sum of these 3 columns gives us an estimation of the size of employment generated by housing sector activity. The housing sector represented 11.7% of total employment in the United States in 2005 (column (4)), 12% in the United Kingdom, 11.3% in France, almost 23% in Spain. It is interesting to notice the cases of Japan and Germany which had a housing boom in the nineties. If percentages in theses countries are still high (13.4% in Japan, around 10% in Germany), they are lower than in the mid-nineties (respectively 16.1% and 14.2%)[19].

A volatile sector. Not only the housing sector represents a significant share of total employment, but employment in this sector is also one of the most volatile in the economy. If employment in the construction sector represents in average in our sample 8% of total employment, it explains 56% of the variance of total employment[20] (Table C.8, column (2)). This volatility can be explained by job characteristics in the construction sector. Employment in the construction sector can be characterized by job insecurity, low wages and poor working conditions (ILO (2001)). The demand for labour in the construction industry tends to change from day to day. A large proportion of the construction workforce is employed on a casual and temporary basis to cope with variations in the contractor's workload and demand for different skills. Construction workers are often not protected by social insurance or trade union membership. Construction work also provides a traditional point of entry into the labour market for migrants (Wells (2012)). The practice of employing labour through subcontractors has also a profound effect upon occupational safety and it has undermined collective bargaining agreements. Amongst European countries, the trend to outsource has been most evident in the United Kingdom and in Spain (ILO (2001))[21]. Job volatility in construction helps to explain that house prices shocks on this sector have a high impact on employment dynamics (see subsection 3.2 for IV results on construction). After the 2007 housing bust, the number

[19] We calculate also in column (5) of Table B.2 the share of employment devoted to housing in sectors which use construction as an input. If employment in these sectors is not directly impacted by a construction boom, it is influenced by changes in house prices (rising input prices impact employment in output sectors). For instance, almost 8% of employment in Spain (in 2005) was in sectors which directly use housing as an input (in the sense of an input-output table).

[20] Employment in industry that represents 18% of total employment explains 44% of the variance (column (3)). Volatility is also high in retail services. Employment in retail service activities (hotels, restaurants, ..), that represents in average 24% of total employment, explains 56% of the variance (column (4)).

[21] In 1999, 62 per cent of Spain's 1.5 million construction workers held temporary contracts (compared with 33 per cent in the economy as a whole), ILO (2001).

of persons employed in construction in Spain was divided by three, 1.7 million persons lost their job in this sector (2007- 2013), accounting for 52% of the total fall in employment in the period. In the United States, 2.3 million jobs in construction disappeared between 2007 and 2012, accounting for 35% of the total fall in employment in the period.

3.2. House price effects go beyond impacts on construction

House price effects on unemployment dynamics go beyond the direct effect on the construction sector. Employment variations in construction explain 43% of the variations of total employment following house price fluctuations (Table 4). This implies that more than half of the variations comes from other sectors of the economy.

Decomposition of Employment. To measure the effects of house prices on the different sectors of the economy, we decompose employment into six sectors using ISIC Rev. 3 classification: (1) Agriculture, hunting and forestry, fishing ; (2) Industry, including energy ; (3) Construction ; (4) Wholesale and retail trade, repairs; hotels and restaurants; transport ; (5) Financial intermediation; real estate, renting and business activities ; (6) Other service activities. Each sectoral variable is measured as a percentage of active population.

Looking at OLS estimates between house prices and employment on these different sectors, we get that an increase of house prices of 10% is associated with an increase of total employment of 0.8% (column (1) of Table 4). If we decompose this effect, employment increases by 0.3% in the construction sector (column (4)), and by around 0.2% in industry (column (3)), in retail services (column (5)), and in financial and business activities (column (6)). These results are robust using the instrumental strategy (Table C.9 B). We discuss in next subsection (3.3) different explanations for the positive correlation between house prices and employment in industry and in retail services. Concerning financial activities, the result can probably be explained by the strong links between housing cycles and financial cycles (Claessens et al. (2012)), in particular with the strong dependency of financial products on the development in housing markets (see Table C.17 for the links between house prices and share prices).

Tradable and non-tradable sectors. To understand better the effects of house prices on the different sectors of the economy, we decompose the economy into tradable and non-tradable sectors. We define industry[22] as the tradable sector. For robustness, we show also the results restricting the tradable sector to manufacturing. To represent the non-tradable sector, we

[22] According to the International Standard Industry Classification (ISIC Rev.3), industry includes: mining and quarrying; manufacturing; and electricity, gas and water supply.

Table 4 – Employment Decomposition

	(1) Employ. total (OLS)	(2) Agri. (OLS)	(3) Ind. (OLS)	(4) Constru. (OLS)	(5) Retail. Serv. (OLS)	(6) Financial (OLS)	(7) Other Serv. (OLS)
House Prices	8.100***	-0.0881	1.617***	3.482***	1.573***	1.610***	-0.00704
	(1.110)	(0.200)	(0.439)	(0.389)	(0.574)	(0.258)	(0.371)
GDP growth	1.147**	-0.0869	0.998***	-0.0476	0.374	-0.0564	0.000886
	(0.531)	(0.128)	(0.270)	(0.181)	(0.246)	(0.137)	(0.202)
Observations	457	457	457	457	457	457	457
R^2	0.278	0.037	0.130	0.362	0.083	0.131	0.005

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. All series are HP-filtered. "Employ. total" denotes total employment. The six other columns represent the 6 sectors of ISIC Rev. 3 classification : Agri. denotes employment in agriculture; Ind. employment in industry; Constru. employment in construction; Retail Serv. employment in retail services; Financial employment in financial services; Other Serv. employment in other services. Employment variables are measured as a percentage of active population.

include market services[23] as in Freeman (2008). Note that we separate construction from the rest of the non-tradable sector. We control the classification of the tradable and non-tradable sectors by measuring the degree of trade openness in each sector[24]. Effects on tradable and non-tradable sectors tend to converge with the degree of trade openness.

Results on sectoral employment. Looking at OLS estimates, when house prices increase by 10%, employment increases by 0.2% of active population in the tradable sector and by 0.3% in the non-tradable sector (columns (2) and (3) of Table 5A). Looking at IV estimates, we get that a 10% increase in house prices leads to an increase of 2.2% of total employment (column (5)), 0.6% in the tradable sector (column (6)), 0.9% in the non-tradable sector (column (7)), 0.4% in construction (column (8)). The largest effect is thus on the non-tradable sector. This could come from house price effects on financial activities. It can also be explained by house price effects on the business cycle and on labour demand (see next subsection), particularly important in sectors very volatile in terms of employment (notably retail services, see Table C.8). Results on the construction sector are close to the estimates of Byun (2010) on the impact on employment of the recent housing boom in the US. Using input-output tables,

[23]According to the ISIC Rev.3, market services include: Wholesale and retail trade, repairs; hotels and restaurants; transport ; Financial intermediation; real estate, renting and business activities ; Other service activities. Note that we include real estate activities in the non-tradable sector as employment variations in real estate services only explain 3% of employment variations in the non-tradable sector following house price fluctuations.

[24]We use OECD STAN database that enables to measure exports and imports of each specific sector.

the bubble is estimated to have contributed somewhere between 1.2 million and 1.7 million jobs in 2005, accounting for 0.8 percent to 1.2 percent of total U.S. employment. These are the residential-construction-related jobs. During the period considered (2002-2005), our IV estimated impact of the house price boom on US employment in construction would be close to 1% of total employment (as house prices increased by 25%), a very close estimate to the one of Byun (2010).

Note that house price effects on the construction sector are even larger when we take into account the relative size of each sector. In elasticity terms, house price effects are much stronger in the construction sector than in the rest of the economy[25].

Asymmetric effects between booms and busts. Interestingly, house prices have asymmetric effects on employment during booms and busts[26]. In Table 5B, we show that the employment effect of house prices is much larger when house prices decrease (columns (1) to (4)) than during housing booms. For example, if house prices increase by 10%, total employment increases by 0.6%, while for a decline of house prices of the same magnitude, total employment decreases by 1.3% (column (1)). This asymmetric effect could be explained by the mismatches created by the labour reallocation following house price shocks. We can make the hypothesis that as housing busts tend to be more sudden than booms, labour reallocation effectively needs to be a lost faster during busts than booms, creating mismatch unemployment. Note also that this asymmetric effect could imply higher unemployment over the housing cycle, each housing cycle leading to a higher unemployment rate level. This could be linked to the hysteresis hypothesis. Such an effect would however depend on the structure of the housing cycle and on the duration of booms and busts. If the employment effect of house prices is larger when house prices decrease, the duration of housing busts is also shorter than booms[27]. These issues would require further investigation.

A specific effect in the tradable sector: a new Dutch Disease? Contrary to the other sectors of the economy, employment in the tradable sector does not increase during housing booms (column (2) of Table 5B). This result could be explained by a mechanism reminiscent of a "Dutch Disease" phenomenon[28]. House price booms lead indeed to rising economy-wide

[25] In table C.10, a 10% (instrumented) increase in house prices leads to an increase of 8% of employment in construction (4% in the tradable sector and 2% in the non-tradable sector).

[26] We measure booms as periods where house prices increase. Similarly, busts are defined as periods where house prices decrease.

[27] Bracke (2011) has calculated for OECD countries an average duration of housing cycle of 10 years with approximately 6 years of booms and 4 years of busts.

[28] The analogy between housing booms and the Dutch Disease phenomenon was suggested previously. But to our knowledge, no academic paper has investigated this issue before this work. Bover and Jimeno (2008) raised

Table 5 – House prices and Employment in tradable and non-tradable sectors

Table A	(1) E (OLS)	(2) E.T (OLS)	(3) E. NT (OLS)	(4) E. C (OLS)	(5) E. (IV)	(6) E. T (IV)	(7) E.NT (IV)	(8) E. C (IV)
House Prices	8.033***	1.617***	3.175***	3.482***	21.84***	6.109***	9.216***	4.015***
	(1.114)	(0.439)	(0.808)	(0.389)	(6.803)	(2.203)	(3.537)	(1.557)
GDP growth	1.234**	0.998***	0.318	-0.0476	-0.923	0.296	-0.625	-0.131
	(0.532)	(0.270)	(0.334)	(0.181)	(1.189)	(0.444)	(0.643)	(0.264)
Observations	457	457	457	457	457	457	457	457
R^2	0.277	0.130	0.131	0.362				
Cragg-Donald					17.02	17.02	17.02	17.02

Table B	(1) Employment (OLS)	(2) Employment T. (OLS)	(3) Employment NT (OLS)	(4) Employment C. (OLS)
House(boom)	5.941***	0.686	2.316***	3.039***
	(1.200)	(0.442)	(0.867)	(0.452)
House(bust)	12.52***	3.613***	5.018***	4.431***
	(1.656)	(0.729)	(1.203)	(0.555)
GDP growth	1.103**	0.939***	0.264	-0.0755
	(0.500)	(0.249)	(0.326)	(0.181)
Observations	457	457	457	457
R^2	0.310	0.169	0.150	0.374

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included. Series are HP-filtered. House denotes house prices. E. denotes total employment. E.T. denotes employment in the tradable sector; E. NT in the non-tradable sector; E. C employment in construction. Employment variables are constructed as a percentage of active population.

wages[29] and to real exchange rate appreciations that squeeze profits in the tradable sector (as prices are fixed at the world level) and affect manufacturing exports (Table C.15 and Table C.16). This could have adverse effects on employment in the tradable sector. We do not focus on sectoral labour reallocation in the core of the paper to concentrate on house price effects on unemployment dynamics. In the robustness checks, we show however that housing booms tend to lead to a reallocation of employment in favor of the construction sector (Table C.13). The share of employment in construction increases during booms while the share of employment in the tradable sector decreases[30].

3.3. Explaining house price effects on unemployment beyond construction

House prices do not only impact employment in the construction sector but also total employment. This could be explained by house price effects on labour demand. We investigate two channels to explain these effects: the investment channel and the consumption channel. Following a house price increase, non-residential investment tends to rise through a relaxation of financial constraints for firms, and consumption increases through wealth effects. If these wealth effects seem to impact labour demand, they do not have a negative effect on labour supply. Note however that if we can compute with our instrumental strategy house price effects on investment and consumption, we cannot precisely identify consumption and investment specific effects on employment following house price shocks.

The investment channel. The first channel we investigate is the investment channel. House prices could impact the business cycle and labour demand through their effects on investment. House prices have indeed a positive causal effect on investment (Table 6A). A rise of house prices of 10% leads to an increase of investment of 3.4% of GDP (column (4)). This effect can be explained both by a rise of construction (column (2)) and non-residential investment (column (3))[31]. The firm-financing channel could explain the rise of non-residential invest-

the hypothesis that housing booms could have effects close to a Dutch disease but they did not investigate further this suggestion. In a speech at the JRC inaugural conference in Princeton, on April 19, 2012, Professor Garicano presented stylized facts about what he called the "Spanish Variant of the Dutch Disease" due to the negative effects of the resource intensive construction growth.

[29] In a recent paper, Carluccio (2014) shows that house prices contributed to differences in wage evolutions between France and Germany during the period 1996-2012.

[30] We can make the assumption that house price booms raise profitability in construction and raise the demand for labour in construction at a given wage rate. This effect, which raises the wage rate (for a given real exchange rate) thus could cause labour to move out the manufacturing sector.

[31] Note that when looking at elasticity, i.e when we take into account the relative size of each part of investment, the effects of house prices on residential investment are much larger than the effects on non-residential investment (columns (5) and (6) of Table C.20).

Table 6 – Houses price effects on Investment and Consumption

Table A: Investment	(1) Inv. (OLS)	(2) Res. Inv. (OLS)	(3) NR. Inv. (OLS)	(4) Inv. (IV)	(5) Unempl. (OLS)	(6) Unempl. (OLS)
House Prices	11.95***	5.168***	6.826***	34.36***		
	(0.706)	(0.290)	(0.642)	(7.020)		
Invest.					-0.458***	
					(0.0228)	
Predicted Inv.						-0.208***
						(0.0165)
GDP growth	2.504***	0.571**	1.911***	0.782	-0.773*	-1.997***
	(0.544)	(0.224)	(0.495)	(0.980)	(0.428)	(0.483)
Observations	774	774	774	766	579	579
R^2	0.298	0.305	0.152		0.440	0.254

Table B: Consumption	(1) Cons. (OLS)	(2) Cons. (IV)	(3) Unempl. (OLS)	(4) Unempl. (OLS)	(5) E/WA (OLS)
House Prices	15.66***	37.42***			
	(0.829)	(7.245)			
Consumption			-0.368***		
			(0.0167)		
Predicted cons.				-0.169***	0.121***
				(0.0133)	(0.0160)
GDP growth	2.427***	1.225	-0.863**	-2.007***	0.790
	(0.620)	(0.975)	(0.392)	(0.459)	(0.579)
Observations	875	819	613	613	336
R^2	0.309		0.472	0.250	0.165

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included. Series are HP-filtered. Inv. denotes investment; Res. Inv. residential investment; NR Inv. non-residential investment; Unemp. the unemployment rate; Cons. consumption; Invest.(Pred.IV) is the instrumented predicted value of investment. "E/WA" is employment as a percentage of working age population.

ment following house price increases (Chaney et al. (2012)). The relaxation of borrowing constraints may indeed have caused increasing investment, together with an increased value of housing collateral (for its collateral services). Table C.21 in the robustness checks tends to confirm that the house price effect on non-residential investment goes through a relaxation of financing constraints for firms. Through investment, house prices could impact unemployment. Investment is indeed negatively correlated with unemployment (column (5)). The predictive value of investment following house price shocks is also negatively correlated to unemployment (column (6))[32]. We cannot exclude that unemployment comoves with investment following house price shocks.

The consumption channel. House prices could impact labour demand through a consumption channel. We show in Table 6B that house prices have a causal positive impact on consumption (column (2)). A 10% increase in house prices leads to an increase of consumption of 3.7% [33]. The much-commented "wealth effects" could explain house price effects on consumption (Case et al. (2013))[34]. In the robustness checks, we show that wealth effects seem indeed to be a feature of our data (Table C.23)[35]. Through this effect on consumption, house prices could impact aggregate labour demand and unemployment. Consumption is negatively correlated with unemployment (column (3) of Table 6B). The predictive value of consumption following house price shocks is also negatively correlated to unemployment[36]. As

[32]To try to identify investment effect on unemployment following house price shocks, we can use regression in column (2) of Table 6 to estimate the (instrumented) predicted value of investment. This predicted value of investments is negatively correlated with unemployment (column (6)). We can show that the predicted value of investment tend to granger cause unemployment (columns (5) and (6) of Table C.25). This could indicate a specific effect of investment on unemployment following a house price shock. Identifying properly house prices effects on labour demand channels would however require further investigation.

[33]In Table C.20, taking the variables in delta-log, we show that house price effects on consumption are higher during busts than during boom periods (column (1)). For a 10% increase in house prices, consumption increases by 1.1%. When house prices decrease by 10%, consumption decreases by 2.2%.

[34] Wealth effects through increases in housing prices are controversial. This is because they are usually seen as coming from an increase in the expected present value of dividends. In contrast, in a life-cycle model, increases in house prices lead to a transfer from young to old, who have a higher propensity to consume. Note also that another possible mechanism explaining house price effect on consumption is the consumer-financing channel. In Geerolf and Grjebine (2013), we show that the relaxation of consumer-financing constraints does not cause an increase in consumption in OECD countries.

[35]Note that concerning the effects of house prices on consumption, it is difficult to disentangle two different channels. New workers (or increase in wages) in the construction sector, thanks to the housing boom, could explain the increase in consumption. The increase in consumption could also be explained by traditional wealth effects. In Table C.22, we try to disentangle effects directly linked to construction (volume effect) and the more general effects of house price fluctuations (price effects).

[36]We can try to identify consumption effect on unemployment by using IV regression in column (2) of Table 6B

for investment, we cannot exclude that unemployment comoves with consumption following house price shocks. Note that housing wealth could also impact labour supply as consumers may partially spend housing wealth gains on both leisure and consumption. Leisure, like consumption, is typically thought of as a normal good so we might expect housing wealth gains decrease labour supply (Disney and Gathergood (2013)). This effect does not seem however to be a feature of our data. An (instrumented) increase of house prices of 10% leads to a 1.5% increase of employment as a percentage of working age population (column (1), Table C.14). House prices seem thus positively correlated with labour market participation. Similarly, we show in Table 6 that the (IV) predictive value of consumption is positively correlated with employment as a percentage of working age population (column (5)).

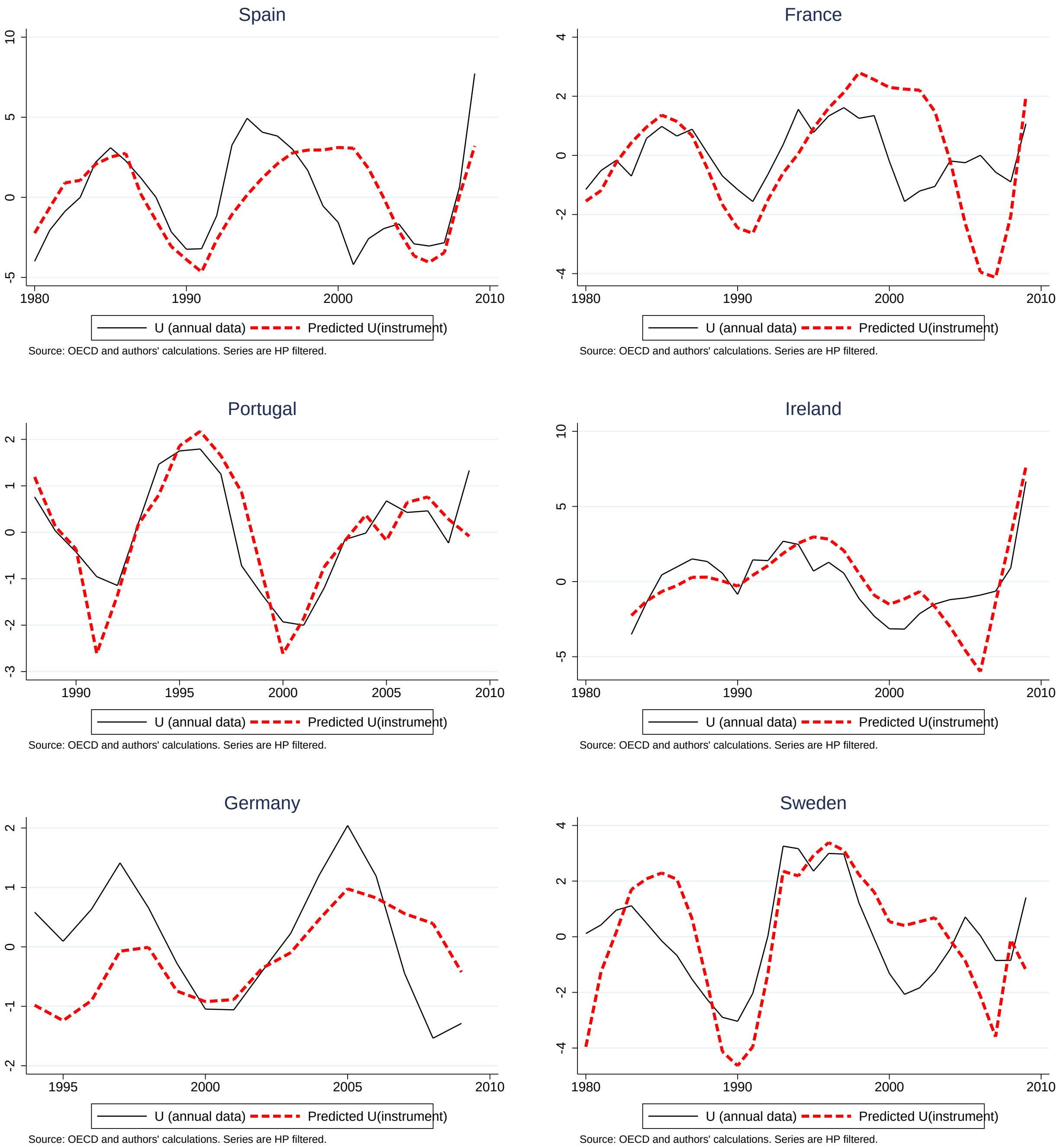
We finally compute house price effects on GDP, and on activity in the tradable and non-tradable sector. Because of their effects on investment and consumption, house prices could indeed impact total GDP. In Table C.24, we show that house prices seem to have a causal impact both on total GDP and on tradable and non-tradable activity. "Housing is the business cycle" according to Leamer (2007).

4. Simulating unemployment

Movements in house prices can be due to many factors -risk aversion, expectational shocks (bubbles), etc. Taking these movements as given, we can recover the unemployment patterns which would be generated by our very parsimonious IV model. To simulate unemployment patterns, we use IV equation in Table 2 (column (4)). The results of this simulation exercise are summarized in Figure 4. We show the results for six European countries (Spain, France, Germany, Ireland, Portugal and Sweden). Predicted patterns of unemployment match actual ones reasonably well.

to estimate the (instrumented) predicted value of consumption following house price shocks. This predicted value of consumption is negatively correlated with unemployment (column (4)). This predicted value of consumption tends to Granger cause unemployment (columns (3) and (4) of Table C.25).

Figure 4 – Simulated unemployment fluctuations and actual ones



Conclusion

In this paper, we establish that house prices have a large causal effect on unemployment dynamics. A 10% (instrumented) depreciation in house prices yields to a 3.4% increase in the unemployment rate. Our instrumental variable for house prices allows us to control for potential reverse causality or omitted variable problems. This result suggests that house prices are a major factor determining unemployment patterns. Results of the simulation exercise tend also to confirm that taking house price shocks as given enables to recover movements in the unemployment rate quite well.

We investigate empirically which mechanisms are at the source of this causal relationship. Quite naturally, house prices impact the construction sector with a large effect on employment, linked to the volatility in this sector. House prices impact also total employment through their effects on the business cycle. They could in particular affect labour demand through investment and consumption channels. House prices have finally asymmetric effects on employment during booms and busts. This should encourage more research on house price effects in the long run.

If housing booms have a positive effect on total employment, they however tend to affect negatively employment in the tradable sector. This could be linked to a Dutch Disease phenomenon: housing booms tend to lead to real exchange rate appreciations that affect manufacturing activity. More research would be needed to develop further house price effects on competitiveness and the theoretical linkages with a Dutch Disease.

Finally, future research could also investigate the mismatches created by the labour reallocation following house price shocks. We can make the hypothesis that as housing busts tend to be more sudden than booms, labour reallocation effectively needs to be a lot faster during busts than booms, creating mismatch unemployment.

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Appendix

A. The capitalization mechanism

In our instrumental strategy, we use exogenous variations of real-estate property taxation T_{it} as an instrumental variable for house prices in the first stage[37]. The price of housing is given by the iteration equation:

$$H_{it} = \frac{H_{it+1}}{1+r} + R_{it}(T_{it}) - T_{it}.$$

The price of housing is the actualized resale price of housing tomorrow $\frac{H_{it+1}}{1+r}$ plus the rental dividend $R_{it}(T_{it})$ (either housing services provided to the owner occupying his home, or rents paid by the renter), diminished by the tax on property $T_{it}(H_{i0})$ with T_{it} an increasing function, whose tax base H_{i0} was set at the beginning of the period 0, once and for all (as this is the case for the countries we consider). In the remaining, we drop the dependence in H_{i0}. Note that the introduction of a tax T_{it} may change rents charged by owners, if housing supply is not completely elastic. In effect, the real-estate tax reduces the number of homes constructed in equilibrium, as agents want to avoid the burden of the tax, and this increases the equilibrium rents $R_{it}(T_{it})$. More precisely, partial equilibrium tax incidence analysis tells us that if $Q^d_{i\tau}(R_{i\tau})$ denotes the demand for housing at time τ as a function of its price (rental price $R_{i\tau}$), and if $Q^s_{i\tau}(R_{i\tau})$ denotes the supply of housing, then denoting the respective demand elasticity and supply elasticity by

$$\epsilon_D = \frac{R_{i\tau}Q^{d'}}{Q} \quad \epsilon_S = \frac{R_{i\tau}Q^{s'}}{Q}$$

then, for small taxes, the net of tax rent is to the first order

$$R_{it}(T_{it}) - T_{it} = R_{it}(0) - \frac{\epsilon_S}{\epsilon_D + \epsilon_S} T_{it}$$

If housing supply is not completely inelastic that is $\epsilon_S \neq 0$, then the tax is not in the end borne by renters only, but also at least partly by proprietors. We indeed find in the data that our real estate tax has some negative effect on house prices, which means that renters do not bear all the tax. Iterating forward (and ruling out rational bubbles) yields:

$$H_{it} = \mathbb{E}_t \sum_{\tau=t}^{\infty} \frac{1}{(1+r)^\tau}(R_{i\tau}(T_{i\tau}) - T_{i\tau}) = \mathbb{E}_t \sum_{\tau=t}^{\infty} \frac{1}{(1+r)^\tau}\left(R_{i\tau}(0) - \frac{\epsilon_S}{\epsilon_D + \epsilon_S} T_{it}\right) \qquad \text{(H)}$$

For the last equality, we assume that the tax is set once and for all, and that changes are unexpected[38] :

$$\forall \tau \in \{t+1, t+2, ...\}, \mathbb{E}_t T_{i\tau} = T_{it}.$$

[37] The description of the capitalization mechanism is extracted from Geerolf and Grjebine (2013).

[38] For simplicity, we assume here a random walk for property taxes, but all that we need is that the process for tax changes is somewhat persistent to have an effect on house prices. In practice, we one can see that real world tax changes do have some persistence.

B. Tables: Descriptive statistics

Descriptive statistics are fully described in Online Appendix C.

Table B.1 – Share of each sector in total employment

	(1) Agriculture	(2) Industry	(3) Construction	(4) Retail Serv.	(5) Financial	(6) Other Serv.
France (2005)	3%	13%	6%	22%	17%	33%
Spain (2005)	5%	17%	12%	27%	11%	27%
United Kingdom(2005)	1.6%	11%	7%	28%	20%	32%
United States(2005)	15%	13%	8%	27%	17%	37%

Notes: Source: OECD. Authors' calculations. In percentage of total employment.

Table B.2 – Employment in Housing: an Input-Output table approach

	Year	(1) Inputs of construction	(2) Construction	(3) Real Estate	(4) Total	(5) Construction as input
France	1995	3.8%	6.2%	1.1%	11.1%	2.6%
	2005	4.2%	6.1%	1%	11.3%	3.3%
Germany	1995	4.8%	8.6%	0.8%	14.2%	4.7%
	2005	3.1%	5.6%	1.1%	9.8%	3.8%
Japan	1995	5.6%	10.5%	..	16.1%	2%
	2005	4.3%	9.1%	..	13.4%	1.8%
Spain	1995	6%	9.1%	0.6%	15.7%	4.3%
	2005	9.2%	12.5%	0.9%	22.6%	7.9%
United Kingdom	1995	3.2%	6.6%	0.9%	10.7%	3.8%
	2005	3.7%	7%	1.2%	11.9%	4.2%
United States	1995	3.2%	7.1%	..	10.3%	5.3%
	2005	3.9%	7.8%	..	11.7%	5%

Notes: Authors' calculations. Source: OECD Input Output table. "Inputs of construction" is an estimation of the number of employees devoted to housing in sectors that are used as inputs of construction and real estate activities. "Construction as input" is an estimation of the share of employment devoted to housing in sectors which use construction as an input. "Real estate" stands for real estate activities. Calculations are given in percentage of total employment. "Total" represents the share of employment devoted to housing (columns(1+2+3)).

C. Robustness checks

Granger causality. We check in this section that Granger causality tests confirm that house prices cause unemployment and not the other way around. Table C.1A shows that fitting simple VAR with 2 lags[39] confirm this result: a positive shock to house prices does cause a decrease of unemployment in the period after (columns (2)) while unemployment (a negative shock to unemployment) does not cause increases in house prices as can be seen in columns (1), (3). We show also in Table C.1B that Granger causality tests confirm that house prices cause GDP and not the other way round[40]. A positive shock to house prices does cause an increase of GDP in the period after (columns (1)) while GDP (a positive shock to GDP) does not cause increases in house prices as can be seen in columns (2). We have not pursued this empirical strategy in the core of the paper, even though it seems to yield the same conclusions qualitatively, because Granger causality is not strictly causality, and more importantly because the coefficients are impossible to interpret quantitatively.

Choice of HP filter parameter. Our results are robust to several specifications of the HP parameter. In Table C.2, we show that any HP-filter parameter in the range 10-1600 yields the same results with very good confidence intervals both for OLS results (A) and IV results (B). There is some disagreement in the literature as to which filter to use for frequencies different from quarterly data. We have used 400, as in Tomz and Wright (2007). Our results are robust to other lower proposed values of 6.25 (Ravn and Uhlig (1997)), 100 in Backus (1992) or higher, such as 1600 (the value commonly use for quarterly data). The choice of the parameter is not so important in our case as we are more interested in first moments than second moments for which the choice of the parameter is essential (Ravn and Uhlig (1997)). We use 400 as we both want to focus on medium term patterns of the data and to remove the trend of our data for our series to be non-stationary.

Controlling by different measures of GDP. Our results do not depend on the measure of GDP used. In most tables, we control with real GDP growth. But our results are robust to other measures. In Table C.3, we show that we could have controlled by relative income or real GDP without changing the results of our instrumental strategy.

Other scaling variables. In Table C.4, we show that using other scaling variables does not change our results. In particular, using as an instrumental variable the share of property taxation as a percentage of private consumption (column (1)) instead of using the share of

[39] To determine the number of lags, we use the Akaike Information Criterion (AIC) and the Schwarz' Bayesian Information Criterion (SIC/BIC/SBIC). For most countries, they indicate 2 lags.

[40] We show the instrumented effect of house prices on GDP in Table C.24.

this tax as a percentage of total taxes does not change the results. The results are also robust if we measure the property tax with other scaling variables, such as investment (column (2)) or GDP (column (3)). We show also that smoothing total tax does not alter the results. In particular, we smooth total tax using the trend component of a HP filter (column (4)). We use the parameter 6.25 that is recommended by Ravn and Uhlig (1997) to remove business cycle frequencies with yearly data. We smooth also total tax by taking an averaged value of total tax (column (5)).

No filter. In Table C.5, we show that our results are robust even without filtering the unemployment rate. Interestingly, house price effects on unemployment become higher. A 10% increase in house prices leads to a decrease of unemployment of 3.8% of active population (column (4)) against 3.4% in the baseline regression (column (4) in table 2). This higher effect could partly capture a hysteresis phenomenon. In Tables C.6 and C.7, we show that house price effects on unemployment we computed in Table 1 are robust even without any filter. We take instead house prices in delta-log. In Table C.6, we just measure the unemployment rate in log terms and house prices in delta log. In Table C.7, we then measure both the unemployment rate and house prices in delta-log. The effects of house prices on unemployment are very robust both for OLS and IV regressions, even controlling by the usual determinants of unemployment (columns (1) to (8)) as in Table 2. In Tables C.9, we show that results of Table 4 "Employment decomposition" are robust in delta-log, both for OLS (Table A) and for IV (Table B). In Tables C.10, we look at house price effects on employment in the tradable and non-tradable sectors. Results are robust in OLS and IV terms.

Booms and Busts: more. In Table C.12, we show that house price effects on employment and GDP are still higher during busts than during boom periods when taking the variables in delta-log. Effects on the unemployment rate (column (1) of Table C.12) are also higher than the effects on employment (column (2)). When house prices increase by 10%, unemployment decreases by 3.8% (column (1)) and employment increases by 0.4% (column (2)). Note that house prices are not correlated with employment in the tradable sector during boom periods (column (3)).

Year Fixed effects. We control that house price effects on employment are robust to the inclusion of year fixed-effects (Table C.11). In particular, an instrumented increase in house prices leads to an increase of employment in the tradable sector (column (5)), in the non-tradable sector (column (6)) and in construction (column (7)).

Other scaling variables : Total Employment and Working age population. In Table C.13, we use as denominator for sectoral employment variables total employment. Housing booms tend to lead to a reallocation of employment in favor of the construction sector. Indeed, the share of employment in construction increases during booms while the share of employment in the tradable sector decreases. House price effects on total employment are also robust when measuring employment variables as a percentage of working age population (Table C.14). A 10% (instrumented) increase in house prices leads to a rise of employment of 1.5% (column (1) of Table C.14B). Further research would however be necessary to interpret house price effects on inactive persons.

Share prices. Following Beaudry and Portier (2006), we use also share prices as a variable for capturing changes in agents expectations about future economic growth ("news shock"). These changes may drive business cycle fluctuations. In Table C.17A, we show that our results both in OLS and in IV (columns (3) and (5)) are very robust when we control by this variable. In Table C.17B, we show that house prices granger cause share prices.

Home-ownership: a friction in the labour market. Home-ownership could play as a friction in the labour market. Following Oswald (1996), we measure if home-ownership is a constraint for employment, notably because of reduced mobility. We build an interaction variable between house prices and the home-ownership ratio to capture this friction. To investigate this friction, we look also at unemployment dynamics (Table C.18). Panel data on unemployment dynamics are taken from Elsby et al. (2013). House prices have a significant and positive effect on job findings (column (1)). Interestingly, the effect of house prices on job findings becomes negative when looking at the interaction variable between house prices and home-ownership (column (2) of Table C.18): home-ownership seems a constraint in the process of finding a job. Concerning employment exits, house prices are negatively correlated to this variable (column (4)). Note that if home-ownership is not as friction for employment exits, employment protection tends to decrease employment exits (column (6)).

Beveridge Curve. In Table C.19, we show that job vacancy is indeed negatively correlated with unemployment (column (1)). If house prices are negatively correlated with unemployment (column (2)), they are positively correlated with job vacancy (column (3)). Mismatches induced by sectoral reallocation could lead to a shift in Beveridge Curve. This issue would require further investigation.

Dutch Disease. In Table C.15, we show that house prices lead to increases in real labour costs both in tradable and non-tradable sectors (columns (1) to (3)), and to real exchange rate appreciations (column (4)). They have a negative impact on exports (column (5)). Housing booms tend to reduce margins in the tradable sector as labour costs increase more than manufacturing prices (probably because these prices tend to be fixed at international levels)

(Table C.16).

The firm-financing channel. The firm-financing channel could explain the rise of non-residential investment following house price increases. Our data allows us to look into whether the relaxation of borrowing constraints might have caused increasing investment, together with an increased value of housing collateral (for its collateral services). In Table C.21 , we investigate whether house prices could impact investment through firm-financing mechanism. We use as a proxy for the potential tightness of credit constraints, the ratio of private credit to GDP. This is a standard mesure of financial development in the finance-and-growth literature (Aghion et al. (2010)). We construct an interaction variable between house prices and the ratio of private credit to GDP. The simultaneous of the two variables is significant for explaining investment and unemployment (columns (1) and (4) of Table C.21), which confirms that the effect goes through a relaxation of financing constraints for firms. It is interesting to notice that the interaction variable is almost not significant in the case of residential investment (column (2)). Since it is not construction firms who are the final investors in residential structures, it does not matter whether construction firms are financially constrained. Furthermore, this is consistent with the fact that houses are much less entrepreneur-specific investments, and that information asymmetries creating the need for collateral are quantitatively very low in housing investment.

Construction. In Table C.22, we compare the effects of house prices and the effects of construction volume variations. It is very difficult to disentangle price effects and volume effects as house prices are strongly correlated to construction (column (1)). In addition, we cannot use our instrument for construction. We show that the effects of house prices seem to be larger than the effects of construction (both for estimated coefficients and R^2). It is the case for consumption (columns (2) and (3)), for investment ((4) and (5)), for employment in the tradable sector ((6) and (7)), and for current account variations ((8) and (9)). This could indicate that price effects exist in addition to volume effects.

Testing wealth effects. In order to assess whether consumption rises with house prices because of wealth effects, we study the interaction between house prices and homeowneship rates. The higher is the homeownership rate, the less is the number of households which owns several housing units. Housing units occupied by renters are indeed owned by households which own more than one housing unit (in France in 2010, 96% of private renters occupied a housing unit owned by another household. In the US, individual investors owned 83% of all rental properties (US Census 2000)). These individual investors, richer in average than owners of single residential unit, have a lower marginal propensity to consume. In table C.23, we show that the correlation between house prices and consumption is higher in countries where the homeownership rate is higher. A 10% increase in house prices is associated with a 1.2% increase in consumption in low homeownership rate countries (column (1)), and a 2% increase in high homeownership rate countries (column (2)). IV regressions between house prices and consumption are only significant in the case of high homeownership rate countries (columns (5) and (6)). We also build an interaction variable between house prices and the homeownership rate, significant both for for OLS and IV regressions (columns (3) and (8)).

House prices and GDP. Because of their effects on investment and consumption, house prices could impact also GDP. In Table C.24, we show the effects of house prices on GDP. A 10% increase in house prices is associated with an increase of 1.9% of GDP (column (1)). Correlation is particularly large with the construction sector ($+10\%$ in house prices, $+6\%$ in construction (column (4)). Looking at IV estimates, a 10% increase in house prices leads to an increase of 4.3% of total GDP (column (5)), 4.5% in the tradable sector (column (6)), 3.1% in the non-tradable sector (column (7)) and 10% in construction (column (8)). Predicted value of GDP is negatively correlated with unemployment (column (9))[41].

Table C.1 – Granger causality: House Prices, Unemployment and GDP

	(1)	(2)	(3)	(4)		(1)	(2)
Table A	House	Unemploy.	House	Employ.	**Table B**	GDP	House Prices
House Prices (L1)	1.264***	-1,350**	1.263***	2,021**	GDP (L1)	0.891***	0.000104
	(0.0564)	(613.1)	(0.0572)	(836.0)		(0.0636)	(0.000403)
House Prices (L2)	-0.629***	1,385**	-0.629***	-1,793**	GDP (L2)	-0.414***	-0.000190
	(0.0578)	(612.1)	(0.0586)	(810.1)		(0.0571)	(0.000395)
Unemploy. (L1)	4.41e-06	1.087***			House (L1)	32.85***	1.260***
	(5.80e-06)	(0.145)				(5.717)	(0.0478)
Unemploy. (L2)	-2.27e-06	-0.728***			House (L2)	-18.64***	-0.620***
	(5.21e-06)	(0.183)				(5.676)	(0.0464)
Employ. (L1)			-1.91e-06	1.078***			
			(4.14e-06)	(0.110)			
Employ. (L2)			1.48e-06	-0.652***			
			(3.58e-06)	(0.139)			
Observations	523	523	523	523	Observations	719	719
R^2	0.714	0.562	0.714	0.566	R^2	0.526	0.729

Notes: HAC robust standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included. Series are HP-filtered.

[41]We estimate thanks to column (5) the instrumented value of GDP following house price shocks.

Table C.2 – Other HP filters

Table A: OLS	(1) U (OLS)	(2) U (OLS)	(3) U (OLS)	(4) U (OLS)	(5) U (OLS)
House Prices	-7.312***	-8.084***	-8.558***	-8.498***	-7.973***
	(0.785)	(0.792)	(0.773)	(0.790)	(0.802)
Observations	671	671	671	671	671
Smooth. parameter	1600	400	100	25	10

Table B: IV	(1) U (IV)	(2) U (IV)	(3) U (IV)	(4) U (IV)	(5) U (IV)
House Prices	-37.64***	-29.09***	-26.79***	-25.90***	-26.38***
	(12.30)	(6.563)	(5.239)	(4.686)	(4.887)
Observations	656	656	656	656	656
Smooth. parameter	1600	400	100	25	10

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included. U denotes the unemployment rate. Smooth. parameter is the HP smoothing parameter.

Table C.3 – Controlling by different measures of GDP

	(1) House (IV)	(2) House (IV)	(3) House (IV)	(4) U (IV)	(5) U (IV)	(6) U (IV)
Property tax	-3.069***	-3.190***	-3.345***			
	(0.901)	(0.947)	(1.008)			
Relative income	1.495***			10.92		
	(0.194)			(11.93)		
GDP		0.00359***			0.0817***	
		(0.000415)			(0.0287)	
GDP growth			0.0376**			2.728*
			(0.0183)			(1.421)
House				-27.49***	-29.02***	-30.37***
				(8.414)	(7.837)	(9.863)
Observations	688	616	615	507	507	506

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. Series are HP filtered.

Table C.4 – Other Scaling variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	House	House	House	House	House	U	U	U	U	U
	(1st st.)	(1st st.)	(1st st.)	(1st st.)	(1st st.)	(IV:Cons.)	(IV:Inv.)	(IV:GDP)	(IV:Tax sm.)	(IV:Tax m.)
Property/Cons.	-0.0454***									
	(0.0146)									
Property/Invest.		-0.0905***								
		(0.0198)								
Property/GDP			-0.0606***							
			(0.0137)							
Property/Tax sm.				-0.0399***						
				(0.0142)						
Property/Tax m.					-0.0286***					
					(0.0104)					
House						-3.102***	-2.777***	-3.085***	-2.641***	-4.318**
						(0.838)	(0.298)	(0.728)	(0.972)	(2.168)
Observations	824	822	836	803	767	578	578	575	578	563

Notes: The property tax variable is measured as a % of GDP, as a % of investment, as a % of consumption. "Tax smo." indicates that total tax is smoothed with the trend component of a HP filter. We use the parameter 6.25 that is commonly used to remove business cycle frequencies with yearly data (Ravn and Uhlig (1997)). "Tax m." is total tax mean, calculated as the moving average of Total tax with a 10-year period. *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. Series are taken in delta log (elasticity).

Table C.5 – House prices and Unemployment (IV) with Unemployment not HP filtered

	(1)	(2)	(3)	(4)	(5)	(6)
	House	House	House	U	U	U
	(IV: 1st st.)	(IV: 1st st.)	(IV: 1st st.)	(IV: 2nd st.)	(IV: 2nd st.)	(IV: 2nd st.)
Property tax	-3.384***	-3.154***	-3.455***			
	(0.787)	(0.766)	(0.887)			
House Prices				-37.89***	-38.95***	-41.39***
				(11.16)	(12.19)	(15.25)
GDP growth		0.0668**	0.112***		1.409	4.020
		(0.0293)	(0.0353)		(1.847)	(2.975)
Min. vs. Av. wage			-0.0436			-25.88*
			(0.164)			(14.32)
Tax wedge			-0.000584			0.0571
			(0.00115)			(0.0887)
Trade Union			0.00609**			0.322*
			(0.00267)			(0.167)
Replacement rate			-0.0419			12.89***
			(0.0612)			(4.844)
Observations	874	849	356	634	633	299
Cragg-Donald			.	16.74	14.56	10.59

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. U denotes the unemployment rate. Series are HP filtered, except the unemployment rate.

Table C.6 – OLS with House prices in delta-log and Unemployment in log. No HP filter.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	U	U	U	U	U	U	U
	(OLS)	(OLS)	(OLS)	(OLS)	(OLS)	(OLS)	(OLS)
House Prices	-0.743***	-0.554**	-0.814***	-0.826***	-0.832***	-0.872***	-0.880***
	(0.188)	(0.225)	(0.242)	(0.223)	(0.221)	(0.225)	(0.223)
GDP		-0.871***	-0.407***	-0.319**	-0.338***	-0.299**	-0.122
		(0.179)	(0.142)	(0.131)	(0.131)	(0.128)	(0.132)
Employment protection			-0.00377	-0.0726	-0.0455	0.00254	0.0146
			(0.0531)	(0.0524)	(0.0506)	(0.0508)	(0.0532)
Trade Union				0.0255***	0.0281***	0.0282***	0.0242***
				(0.00392)	(0.00403)	(0.00419)	(0.00372)
Tax Wedge					-0.0150*	-0.0143*	-0.0126
					(0.00822)	(0.00834)	(0.00824)
Replacement rate						0.0143	-0.175
						(0.364)	(0.428)
LME (active)							0.293***
							(0.0994)
Observations	657	547	428	427	415	395	384

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** $p<0.01$, ** $p<0.05$, * $p<0.1$. U denotes the unemployment rate (in log). House prices and GDP are taken in delta-log. Note that series are not HP filtered.

Table C.7 – House prices and Unemployment in delta-log. No HP filter

	(1)	(2)	(3)	(4)	(5)	(6)
	U	U	U	U	U	U
	(OLS)	(OLS)	(OLS)	(IV)	(IV)	(IV)
House Prices	-1.028***	-1.020***	-0.931***	-3.186***	-4.505**	-4.001**
	(0.111)	(0.110)	(0.130)	(0.692)	(1.843)	(1.644)
GDP		-0.263***	0.0291		0.421	0.443*
		(0.0881)	(0.0803)		(0.383)	(0.262)
Employment protection			0.0136			-0.0548
			(0.0218)			(0.0650)
Trade Union			0.00334**			0.00475
			(0.00164)			(0.00432)
Tax Wedge			0.00382			-0.000861
			(0.00322)			(0.00778)
Replacement rate			0.101			-0.365
			(0.164)			(0.524)
LME (active)			-0.0554			-0.0314
			(0.0441)			(0.0781)
Observations	639	530	376	609	515	372

Notes: HAC robust standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. U denotes the unemployment rate. Unemployment, House prices and GDP are taken in delta-log. Series are not HP filtered.

Table C.8 – Volatility of Employment

	(1) Employ. (OLS)	(2) Employ. (OLS)	(3) Employ. (OLS)	(4) Employ. (OLS)	(5) Employ. (OLS)	(6) Employ. (OLS)	(7) Employ (OLS)
E.Agriculture	0.00241						0.974***
	(0.218)						(0.0182)
E.Construction		1.936***					1.011***
		(0.0736)					(0.0113)
E.Industry			1.644***				0.979***
			(0.0798)				(0.00951)
E.Retail Services				1.949***			0.977***
				(0.0747)			(0.0116)
E. Financial					2.420***		1.001***
					(0.143)		(0.0171)
E. Other Services						0.138	0.981***
						(0.152)	(0.0131)
Observations	536	536	536	536	536	536	536
R^2	0.000	0.563	0.442	0.559	0.349	0.002	0.993

Notes: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Series are HP-filtered. "Employ." denotes total employment."E." represents employment in the 6 sectors of ISIC Rev. 3 classification.

Table C.9 – Employment Decomposition (Elasticity)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	U	E	Agri	Ind	Constru	Retail	Fin	Other
Table A: OLS	(OLS)	(OLS)	(OLS)	(OLS)	(OLS)	(OLS)	(OLS)	(OLS)
House	-1.020***	0.0661***	-0.0139	0.0674***	0.350***	0.0659***	0.113***	-0.00638
	(0.110)	(0.00908)	(0.0258)	(0.0184)	(0.0410)	(0.0146)	(0.0200)	(0.0113)
GDP	-0.263***	0.0184***	-0.00619	0.0570***	0.0864***	0.0193**	0.0187	-0.00494
	(0.0881)	(0.00634)	(0.0261)	(0.0150)	(0.0250)	(0.00835)	(0.0141)	(0.00877)
Observations	530	504	440	440	440	440	440	440
R^2	0.278	0.235	0.060	0.187	0.366	0.158	0.259	0.168

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	U	E	Agri	Ind	Constru	Retail	Fin	Other
Table B: IV	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)	(IV)
House	-4.505**	0.365***	0.134	0.538**	0.990***	0.337***	0.474***	0.116
	(1.843)	(0.141)	(0.173)	(0.210)	(0.314)	(0.120)	(0.182)	(0.119)
GDP	0.421	-0.0301	-0.0290	-0.0271	-0.0191	-0.0266	-0.0472	-0.0260
	(0.383)	(0.0257)	(0.0518)	(0.0403)	(0.0627)	(0.0250)	(0.0385)	(0.0223)
Observations	515	489	425	425	425	425	425	425

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. Series are taken in delta log (elasticity). E denotes total employment. Agri. denotes employment in agriculture; Ind. employment in industry; Constru. employment in construction; Retail employment in retail services; Fin employment in financial services; Other Serv. employment in other services. Employment variables are measured as a percentage of active population.

Table C.10 – House price effects on the tradable and non-tradable sectors (Elasticity)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employ	Employ T	Employ NT	Employ C	EmployT	Employ NT	Employ C
	(OLS)	(OLS)	(OLS)	(OLS)	(IV)	(IV)	(IV)
House Prices	0.0803***	0.101***	0.0547***	0.354***	0.415***	0.166***	0.766***
	(0.00898)	(0.0189)	(0.00768)	(0.0467)	(0.109)	(0.0498)	(0.168)
Observations	609	507	507	507	480	480	480
R^2	0.297	0.169	0.280	0.307			
Cragg-Donald					21.35	21.35	21.35

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included. Series are taken in delta log. House denotes house prices. Employ. denotes total employment. Employ T. denotes employment in the tradable sector; Employ. NT in the non-tradable sector; Employ. C employment in construction. Employment variables are constructed as a percentage of active population.

Table C.11 – Year fixed-effects (Elasticity)

	(1) Employ. (OLS)	(2) Employ. T (OLS)	(3) Employ. NT (OLS)	(4) Employ. C. (OLS)	(5) Employ. T (IV)	(6) Employ. NT (IV)	(7) Employ. C. (IV)
House Prices	0.0678***	0.0780***	0.0547***	0.318***	0.325***	0.160**	0.815***
	(0.00778)	(0.0168)	(0.00768)	(0.0454)	(0.125)	(0.0794)	(0.268)
Observations	609	507	507	507	480	480	480
R^2	0.536	0.454	0.280	0.413			

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country and Year fixed effects included. Series are taken in delta log.

Table C.12 – Booms and busts (Elasticity)

	(1) U (OLS)	(2) E (OLS)	(3) E.T (OLS)	(4) E.NT (OLS)	(5) E.C. (OLS)
House(boom)	-0.398**	0.0258**	-0.0189	0.0201*	0.245***
	(0.155)	(0.0115)	(0.0275)	(0.0111)	(0.0481)
House(bust)	-1.892***	0.122***	0.179***	0.0686***	0.486***
	(0.276)	(0.0223)	(0.0427)	(0.0211)	(0.0921)
GDP	-0.227***	0.0163***	0.0534***	0.00681	0.0819***
	(0.0789)	(0.00578)	(0.0140)	(0.00533)	(0.0237)
Observations	530	504	440	440	440
R^2	0.313	0.265	0.214	0.230	0.376

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. Series are taken in delta log. U. denotes the unemployment, E. is employment. T denotes the tradable sector; NT the non-tradable sector. C. construction.

Table C.13 – Employment reallocation during booms and busts

	(1) Employ. T (sh.) (OLS)	(2) Employ. NT (sh.) (OLS)	(3) Employ. C. (sh.) (OLS)
House(boom)	-0.0359**	-0.00716	0.232***
	(0.0179)	(0.00739)	(0.0358)
House(bust)	0.0545**	-0.0612***	0.346***
	(0.0250)	(0.0116)	(0.0589)
GDP	0.0332***	-0.00613*	0.0681***
	(0.00849)	(0.00334)	(0.0163)
Observations	503	503	503
R^2	0.179	0.293	0.389

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included. Series in delta log. Sectoral employment variables are measured as a share (sh.) of total employment.

Table C.14 – Other scaling variable: Employment in % of working age population

Table A: OLS	(1) E.(wa)	(2) Agri.(wa)	(3) Ind.(wa)	(4) Constru.(wa)	(5) Retail(wa)	(6) Fin.(wa)	(7) Other Serv.(wa)
House	4.837***	-0.216**	1.082***	1.958***	1.152***	0.827***	0.274
	(0.813)	(0.0920)	(0.239)	(0.274)	(0.284)	(0.217)	(0.211)
GDP	0.0257***	0.000421	0.00681***	0.00946***	0.00742***	0.00342*	-0.00395**
	(0.00720)	(0.000814)	(0.00211)	(0.00243)	(0.00251)	(0.00192)	(0.00186)
Observations	252	252	252	252	252	252	252
R^2	0.231	0.047	0.169	0.297	0.137	0.098	0.024

Table B: IV	(1) E.(/wa)	(2) Agri.(/wa)	(3) Ind.(/wa)	(4) Constru(/wa)	(5) Retail(/wa)	(6) Fin.(/wa)	(7) Other Serv.(/wa)
House	14.55***	0.703	5.178***	3.815***	4.529***	3.598***	-2.716**
	(4.193)	(0.448)	(1.448)	(1.229)	(1.461)	(1.148)	(1.164)
GDP	-0.00377	-0.00237	-0.00562	0.00383	-0.00283	-0.00498	0.00512
	(0.0153)	(0.00163)	(0.00528)	(0.00448)	(0.00532)	(0.00418)	(0.00424)
Observations	252	252	252	252	252	252	252

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included. Variables of employment are measured as a percentage of the working age population ("wa").

Table C.15 – Effects on manufacturing (IV).

	(1) LC (IV)	(2) LC(man) (IV)	(3) LC(NT) (IV)	(4) RER (IV)	(5) Exports(man) (IV)
House Prices	0.467***	0.632***	0.544***	0.511***	-0.429***
	(0.122)	(0.151)	(0.167)	(0.191)	(0.159)
Observations	549	553	509	678	684
Cragg-Donald	15.58	17.42	15.26	15.07	12.94

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. Series are taken in delta-log. "LC" means real labour costs. "Exports(man)" are calculated as a ratio over GDP(man).

Table C.16 – House prices and manufacturing margins.

	(1) Margin (OLS)	(2) Margin (IV)	(3) Margin (OLS)	(4) PPI (OLS)	(5) PPI (OLS)	(6) LC T (OLS)	(7) LC T (OLS)
House(boom)			-0.148***		3.197*		17.83***
			(0.0431)		(1.860)		(4.282)
House(bust)			-0.294***		7.122***		34.87***
			(0.0571)		(2.258)		(4.679)
House Prices	-0.217***	-1.496**		5.067***		25.95***	
	(0.0392)	(0.604)		(1.517)		(3.783)	
Observations	401	397	401	401	401	401	401
R^2	0.083		0.092	0.026	0.030	0.305	0.334

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. All series are HP-filtered. Series in nominal terms. Manufacturing margins ("Margin") are calculated as the ratio between producer price indexes (PPI) in the manufacturing sector and labour costs in the tradable sector ("LC T").

Table C.17 – Share Prices, House Prices and Unemployment

Table A	(1) U (OLS)	(2) U (OLS)	(3) U (OLS)	(4) Share (OLS)	(5) U (IV)	Table B	(1) Share (OLS)	(2) House (OLS)
House	-7.711***	-8.157***	-7.204***	80.80***	-40.49**	Share(L1)	0.896***	0.000107
	(0.601)	(0.638)	(0.644)	(11.80)	(16.50)		(0.0656)	(0.000136)
GDP		0.0120**	0.0120**		0.111**	Share(L2)	-0.500***	-0.000114
		(0.00593)	(0.00577)		(0.0511)		(0.0534)	(0.000129)
Share			-0.0118***		0.0183	House(L1)	25.61**	1.274***
			(0.00215)		(0.0158)		(11.88)	(0.0468)
						House(L2)	-49.21***	-0.627***
							(12.83)	(0.0457)
Obs.	525	525	525	525	525	Observations	688	688
R^2	0.245	0.251	0.291	0.090		R^2	0.526	0.743

Notes: HAC robust standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. Series are HP filtered. "Share" means share prices, "U" stands for the unemployment rate.

Table C.18 – Home-ownership: a friction in the labour market

	(1) Job Finding (OLS)	(2) Job Finding (OLS)	(3) Job Finding (OLS)	(4) Employ. Exit (OLS)	(5) Employ. Exit (OLS)	(6) Employ. Exit (OLS)
House Prices	0.148***	0.527***	0.576**	-0.00407***	-0.0110	-0.0120
	(0.0387)	(0.201)	(0.268)	(0.00155)	(0.0119)	(0.0140)
House*Homeowner		-0.00562**	-0.00734**		9.12e-05	0.000178
		(0.00280)	(0.00340)		(0.000166)	(0.000199)
House*Job protection			0.0341			-0.00261**
			(0.0309)			(0.00107)
GDP	-0.000630*	-0.000452	-0.000613*	4.68e-06	6.77e-06	1.84e-05
	(0.000329)	(0.000302)	(0.000324)	(1.53e-05)	(1.43e-05)	(1.46e-05)
Observations	360	311	242	360	311	242
R^2	0.052	0.067	0.101	0.037	0.065	0.102

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. All series are HP-filtered. Variables are defined in Table C.1.

Table C.19 – Beveridge Curve: Unemployment and Vacancy

	(1) Unemploy. (OLS)	(2) Unemploy. (OLS)	(3) Job Vacancy (OLS)
Job Vacancy	-3.504***		
	(0.298)		
House Prices		-6.932***	1.106***
		(0.745)	(0.118)
Observations	312	312	312
R^2	0.307	0.217	0.221

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. Series are HP filtered.

Table C.20 – House prices, Consumption and Investment (Elasticity)

	(1) Cons. (OLS)	(2) C. dura. (OLS)	(3) C. Hotels/Rest. (OLS)	(4) I (OLS)	(5) Res. I (OLS)	(6) NR. I (OLS)
House(boom)	0.115***	0.239***	0.128***	0.273***	0.461***	0.201**
	(0.0208)	(0.0870)	(0.0235)	(0.0687)	(0.0785)	(0.0845)
House(bust)	0.229***	0.861***	0.151***	0.694***	1.030***	0.581***
	(0.0369)	(0.165)	(0.0420)	(0.108)	(0.149)	(0.126)
GDP	0.0683***	0.230***	0.0602***	0.142***	0.142***	0.151***
	(0.0104)	(0.0499)	(0.0127)	(0.0279)	(0.0426)	(0.0369)
Observations	723	489	489	720	691	679
R^2	0.448	0.375	0.437	0.287	0.317	0.170

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. House Prices are an indice of house prices, normalized at 1 in 2005. Country fixed effects included in the regressions. Series are taken in delta log (Elasticity). Cons. denotes consumption; C. dura consumption of durable goods; C.Hotels/Rest. consumption in hotels and restaurants. I denotes investment ; Res. I is residential investment; NR. I non-residential investment.

Table C.21 – Houses prices and Investment: the firm-financing mechanism

	(1)	(2)	(3)	(4)
	Investment	Res. Inv.	NR. Inv.	Unemp.
	(OLS)	(OLS)	(OLS)	(OLS)
House Prices	7.542***	4.184***	3.458**	-4.517***
	(1.640)	(0.651)	(1.513)	(1.468)
House/PCGDP	528.1***	91.16*	393.2***	-326.1**
	(132.9)	(52.56)	(122.2)	(129.1)
1/PCGDP	10.71	-1.877	4.723	-19.27
	(10.86)	(4.316)	(10.03)	(12.65)
GDP	0.0180**	0.00406	0.0157*	0.0130**
	(0.00882)	(0.00358)	(0.00832)	(0.00636)
Observations	735	692	692	519
R^2	0.305	0.294	0.168	0.222

Notes: HAC robust standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included. Series are HP-filtered. Inv. denotes investment; Res. Inv. residential investment; NR Inv. non-residential investment. Unemp. denotes unemployment rate.

Table C.22 – House Prices and Construction

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dw.start.	Cons.	Cons.	Inv.	Inv.	E.T	E.T	CA	CA
House Prices	1.111***	0.542***		0.517***		0.101***		-2.544***	
	(0.157)	(0.0768)		(0.0494)		(0.0189)		(0.911)	
Dwell. tart.					0.179***		0.0467***		-0.232
			(0.0222)		(0.0213)		(0.0167)		(0.377)
Observations	381	608	238	780	363	507	227	291	114
R^2	0.236	0.279	0.121	0.233	0.208	0.169	0.172	0.046	0.019

Notes: OLS regressions. HAC robust standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. Series are HP filtered. Dw. start. denotes dwellings started. "Cons." denotes the consumption of durable goods. Inv. denotes investment.

Table C.23 – Wealth effects

	(1) Cons. (OLS)	(2) Cons. (OLS)	(3) Cons. (OLS)	(4) Cons. (IV)	(5) Cons. (IV)	(6) Cons. (IV)	(7) Cons. (IV)
House	12.71***	19.78***	-10.21	43.21***	14.91	55.48***	
	(1.884)	(1.877)	(8.165)	(9.699)	(13.18)	(12.13)	
House*Owner			0.407***				0.540***
			(0.128)				(0.124)
Owner. ratio			0.0216				0.0327
			(0.0179)				(0.0226)
GDP	6.04**	2.95	4.50***	-7.92*	5.04	-11.4**	-4.24
	(2.37)	(1.92)	(1.68)	(4.17)	(6.25)	(4.87)	(3.81)
Observations	334	427	626	738	334	404	613
R^2	0.402	0.398	0.430				
Cragg-Donald				16.30	2.541	22.54	17.18
Homeownership	Low	High			Low	High	

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country-fixed effects are included. "Cons." is real consumption (Index 2005 = 100). "Homeowner" is the homeownership ratio. The homeownership rate lies between 30 and 94. Series are HP filtered.

Table C.24 – House prices and GDP

	(1) GDP (OLS)	(2) GDP T (OLS)	(3) GDP NT (OLS)	(4) GDP C (OLS)	(5) GDP (IV)	(6) GDP T (IV)	(7) GDP NT (IV)	(8) GDP C (IV)	(9) Unemp (OLS)
House Prices	19.19***	15.15***	15.93***	61.80***	42.79***	44.96***	30.72***	106.8***	
	(1.880)	(2.579)	(1.614)	(5.282)	(7.601)	(16.77)	(5.681)	(17.18)	
GDP(Pred.IV)									-0.185***
									(0.0200)
Observations	820	820	820	820	751	751	751	751	568
R^2	0.280	0.064	0.277	0.375					0.282
Cragg-Donald					20.92	20.92	20.92	20.92	

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. Series are HP-filtered. GDP denotes total GDP; GDP T denotes GDP in the tradable sector; NT in the non-tradable sector; C in construction. GDP(Pred.IV) is the instrumented predicted value of GDP.

Table C.25 – Granger causality: Predicted GDP and U

	(1)	(2)	(3)	(4)	(5)	(6)
	GDP(predict.)	U	Cons.(predict.)	U	Inv.(predict.)	U
GDP(predict.)(L1)	1.265***	-0.362***				
	(0.0611)	(0.0645)				
GDP(predict.)(L2)	-0.655***	0.426***				
	(0.0649)	(0.0690)				
U(L1)	0.0361	1.133***	0.0967	1.132***	0.0954	1.132***
	(0.0336)	(0.0704)	(0.0919)	(0.0704)	(0.0906)	(0.0704)
U(L2)	-0.0709**	-0.545***	-0.189**	-0.545***	-0.186**	-0.545***
	(0.0337)	(0.0679)	(0.0920)	(0.0679)	(0.0907)	(0.0679)
Cons.(predict.)(L1)			1.267***	-0.132***		
			(0.0605)	(0.0231)		
Cons.(predict.)(L2)			-0.654***	0.155***		
			(0.0638)	(0.0247)		
Inv.(predict.)(L1)					1.267***	-0.134***
					(0.0605)	(0.0234)
Inv.(predict.)(L2)					-0.654***	0.157***
					(0.0638)	(0.0251)
Observations	500	500	506	506	506	506
R^2	0.706	0.696	0.707	0.696	0.709	0.696

Notes: HAC robust (Heteroscedasticity and AutoCorrelation robust) standard errors are in parentheses (we use Bartlett kernel-based filter with bandpass parameter 2). *** p<0.01, ** p<0.05, * p<0.1. Country fixed effects included in the regressions. All series are HP-filtered. "predict" denotes the instrumented predicted value of the variable. Cons. denotes consumption, Inv. denotes investment. U is the unemployment rate.

Table C.1 – Data Appendix: Variables

Variables	Abbreviation	Sources	Variable description
House Prices	House	Geerolf and Grjebine (2013)	Real house prices (base 1=2005)
Property Tax	Property Tax	OECD	Property tax (ratio of total taxation)
CPI	CPI	OECD	Consumer Prices, Index 2005=100
Employment	E.	OECD	Employed population(ETO)/Active population(PEANC), (%)
Employment Industry	E. Ind.	OECD	Employed persons industry(with energy)(ETOCE)/Active population, (%)
Employment Manufacturing	E.Manuf.	OECD	Employed persons manufacturing(ETOD)/Active population(PEANC), (%)
Employment Construction	E.Constru.	OECD	Employed persons Construction(ETOF)/Active population(PEANC), (%)
Employment X(share)	E.X(share)	OECD	Employed population in X/Employed population(ETO), (%)
Employment X(working age)	E.X(wa)	OECD	Employed population in X/Working age population, (%)
Unemployment	U	OECD	Unemployed population/Active population(PEANC), (%)
Active population	active population	OECD	Active population(PEANC), persons
Working age population	wa	OECD	Working age population, all persons
Real labour cost	LC	OECD	Real total labour cost (quantity series), Index 2005=100
Employment Exit	Employ. Exit	Elsby et al. (2013)	Rate of inflow to unemployment
Job finding	Job Finding	Elsby et al. (2013)	Rate of outflow from unemployment
Job vacancy rate	Vacancy	OECD	Job vacancies(total stock)/Active population(PEANC)
Employment protection	Job protection	OECD	Strictness of employment protection
Minimum versus average wage	Min. vs. Av. wage	OECD	Minimum relative to median wages of full-time workers
Labour market expenditures	LME	OECD	Public expenditure (active measures) as a percentage of GDP (EXPPCT)
Tax wedge	Tax wedge	OECD	Average tax wedge (%), Single person at 100% of average earnings, no child
Trade Union	Trade Union	OECD	Trade Union density
Replacement rate	Replacement rate	Van Vliet and Caminada (2012)	Net Unemployment Replacement Rate for an Average Production Worker, Single Person
Gross fixed capital Formation	Investment	OECD	Gross fixed capital Formation, total, ratio of GDP
Residential Investment	Res. Inv.	OECD	Gross fixed capital formation (housing), ratio of GDP
Household final consumption	Consumption	WDI	Household final consumption expenditure, etc. (ratio of GDP)
Consumption durable goods	Cons. dura.	OECD	Consumption of durable goods, Index 2005= 100, real terms
Share Prices	Share Prices	OECD	Share prices, Index 2005 = 100
Relative Income	Relative Income	WDI	Relative income is the the GDP per capita divided by the GDP per capita for the US
GDP	GDP	WDI	Real GDP, Index 2005=100
GDP growth	GDP growth	WDI	Real GDP growth
Domestic credit to private sector	PCGDP, Financial. Deep.	WDI	Domestic credit to private sector (ratio of GDP)