The Spanish housing market: is it fundamentally broken?
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\textbf{ABSTRACT}
This paper aims to investigate the relationship between housing prices and their main fundamental determinants using the example of Spain and considering the possibility of structural breaks in the relationship. We find that the cointegrating coefficient estimates are quite unstable over 2001Q1–2017Q4 and need to be estimated for different subperiods. Specifically we find that the main long-run fundamentals explain the behaviour of equilibrium house prices well during the boom-bust period. However, only corporate profit, or capital income, seems to explain the evolution after the recovery from the recession.

\textbf{KEYWORDS}
House prices; capital income; wage income; DOLS; structural breaks; crisis

\textbf{JEL CLASSIFICATION}
E21; E51; R20

\section{Introduction}

The evolution of the Spanish housing market has attracted attention not only from policy makers but also within the academic literature on housing market booms, especially after the boom and bust episodes in the first decade of the 2000s. Research has confirmed the close relationship between the real estate market and the real economy (Crowe et al. 2013), highlighting the need to understand the drivers of house prices.

The sharp drop in house prices in 2008–2012 has been explained as a correction of the upswing in 1997–2007 (Cuerpo and Pontuch 2013). As prices have risen by 17\% since 2015, the question of the sustainability of house prices has emerged. There are several factors that affect the demand and supply of housing. Leung (2004) has grouped these factors under taxation, business cycles, collateral constraints and urban structure. Piazzesi and Schneider (2016) provide a theoretical model incorporating these determinants into a model for the asset portfolio choices of households. In this paper we focus on the factors that determine the long-run equilibrium of house prices, leaving short-term fluctuations aside. According to the literature, the main long-run determinants of house prices are disposable income, the lending interest rate for house purchase and the stock of dwellings; see the comprehensive overview of studies in Girouard et al. (2006) and Geng (2018).

After the 2009 recession, the affordability of housing for poor wage earners worsened in Spain (Pittini et al. 2017). At the same time, there was greater interest in investing in residential property from other parties in the market. According to the 2017 annual report of the association of property registers (Anuario 2017 del Colegio de Registradores in Spanish)\textsuperscript{1}, the percentage of dwellings purchased by legal entities increased from 2008 from 5.11\% to 12.55\%. The interest from companies or entrepreneurs is apparently driven by the opportunity to earn by renting property out. Additionally, it is not only companies but also capital owners more generally, meaning those earning capital income, that have become more interested in real estate investments (PwC 2018). This means it is possible that the main long-run fundamentals that determine housing prices in Spain have changed, and company profit or capital income is gaining importance in driving housing prices. This could potentially mean that the apparent rise in housing prices in Spain is not exclusively caused by the usual fundamental factors like wage income, which typically reflects the housing demand of wage earners. In 2018 the Spanish government announced a series of measures to avoid pressures from the price of housing. On 1 March 2019, the government of

\textsuperscript{1}http://www.registradores.org/wp-content/estadisticas/propiedad/eri/ERI_Anuario_2017.pdf, p. 60.
Pedro Sánchez passed a bill, a Royal Decree-Law, requiring the owners of uninhabited dwellings to pay higher taxes. Other measures include maximum ceilings for rental prices and longer contracts for renting homes. These all aimed to ration the investment in residential property for renting purposes.

In Figure 1 we display the evolution of the residential property price index in Spain in logs since 2001. There are three clear sub-periods: the first is the boom from the beginning of the sample until 2008, next is the bust from then until 2013, and then comes the recovery from 2013 until the end of the sample. Our hypothesis is that, given the big swings in house prices, the relationship between the main long-run determinants and housing prices may have changed during those periods. We particularly aim to compare the role of wage income and capital income in the evolution of housing prices.

The summary statistics of the quarterly inflation rates are shown in the Appendix. We see that the mean is very different across the three sub-periods. The first sub-period suffers from a significant increase in house prices, with average inflation of 2.5% per quarter, or about 10% per year. The second period is characterized by negative average inflation of 2.4% per quarter because of the Fisher disinflation effect. The last period, the recovery one, features a moderate increase in house prices of about 0.4% per quarter. Interestingly, the standard deviation is very similar in the three sub-periods.

The baseline we use in this paper is the fundamental long-run determinants, like many other papers discussed in Girouard et al. (2006) These determinants are compensation of employees as a proxy for wage income, the nominal lending interest rates for house purchase, and the supply of dwellings measured as the number of dwellings, or the stock. We add to the analysis operating surplus as a proxy for corporate profit or capital income. Although house prices are affected by several other factors, such as the credit supply, expectations and alternative investment choices, these factors are expected to affect prices in the short run while our focus is on the long-run determinants.

We estimate a broken type of equation using the Bai and Perron (1998, 2003a, 2003b) method, which we also back up with some preliminary analysis using the Johansen (1988, 1991) approach. With Bai and Perron’s method we can estimate models with changing coefficients, test for the optimal number of breaks and obtain the times of breaks endogenously. This analysis aims to expand on Cuestas (2017), who finds mild evidence of a cointegrating relationship between house prices and compensation of employees among other factors in 2001–2008, and Gimeno and Martínez-Carrascal (2010), who find that wages are mildly significant for explaining the long-run equilibrium of house prices.

Our results depict the interesting finding that since 2013 capital income or corporate profits seem to have been the only long-run driver of housing prices from among the main drivers affecting the equilibrium price, which underlines not only that capital income has gained explanatory power alongside wage income, but also that wages seem not to have mattered since the start of the recovery in 2013. The results imply that the rise in house prices since 2013 has been driven by demand from capital owners and not from wage earners.

In the remainder of the paper we present the results of the econometric analysis in section 2 and the conclusion in section 3.

II. Empirical analysis

In this section we analyse the long-run relationship between real house prices $hp$, and their fundamentals, which are the nominal lending interest rates
for house purchase $i$, compensation of employees $w$, operating surplus as a proxy for capital income $op$, and the number of dwellings $d$ for the period 2001–2017, using quarterly data. The data for compensation of employees and operating surplus were downloaded from Eurostat, the nominal variables were then deflated by the harmonized consumer price index, and the real variables thus obtained have been seasonally adjusted. For lending interest rates, we have used the data on lending for house purchases from the Statistical Data Warehouse of the European Central Bank. Finally, the data for the stock of dwellings, $d$, have been taken from the website of the Spanish Ministry of Development (Ministerio de Fomento in Spanish). All the data have been transformed into logs except the interest rates, which have been divided by 100.

Since all the variables are integrated of order one, our analysis relies on cointegration techniques. Hence we need to test whether there is any cointegration between $hp$, $w$, $op$, $i$ and $d$. In order to test for cointegration while incorporating the possibility of structural breaks, we apply the traditional Engle and Granger (1987) and Johansen Trace cointegration tests and the $\lambda$-maximum test, and also the Gregory and Hansen (1996) cointegration test with structural breaks, since it is well known that tests that do not take breaks into account may suffer from power problems in the presence of structural breaks. In Table 1 we display the Engle-Granger and Gregory-Hansen cointegration tests. Whereas the first version of the Engle-Granger test points to the non-rejection of the null of no cointegration, the $z$ and $z(t)$ tests reject the null. These results are backed up by the results from the Johansen tests displayed in Table 2, where it is found that at least one cointegrating vector exists. This implies that we have incorporated all the long-run fundamentals into the model.

In order to assess the presence of structural changes, we formally test for breaks in the parameters using the Bai and Perron (1998, 2003a, 2003b) method. This method allows us to test for the optimal number of breaks from a maximum and to find estimates of the coefficients for the different subsamples. Using the sequential method, and from a maximum of five breaks with trimming of 0.15 and significance of 0.05, we find that the optimal number of breaks from a model in the spirit of a dynamic ordinary least squares (DOLS) type equation is two, see Table 3, with the breaks occurring in 2005Q2 and 2013Q2. The test suggests that the effect of the fundamental variables on house prices changes over the sample period, as the determinants in the peak period and during the drop in house prices were similar, while the role of the fundamentals changed in the second period of rising house prices after 2013.

In Table 4 we display the DOLS estimates for the long-run coefficients for the broken equation with one lead and one lag of the first difference of the independent variables, which have been kept constant and are not reported in order to keep the table compact. The model does not suffer from autocorrelation, heteroskedasticity or normality issues. In addition the AR(1) parameter of the residuals is not

| Table 1. Single equation cointegration tests. |
|-----------------------------------------------|
| Engle-Granger $t$-test $-2.63$ | 0.77 |
| Engle-Granger $z$-test $-47.18$ | 0.00 |
| Gregory-Hansen $z(t)$-test $-6.37$ | $<0.10$ |

Note: The lag length has been chosen to suit the $t$-statistics.

| Table 2. Johansen cointegration tests. |
|----------------------------------------|
| $r$ | Eigenvalue | Trace Statistic | Prob. | $\lambda$-maximum Statistic | Prob. |
|-----|------------|-----------------|-------|---------------------------|-------|
| 0   | 0.45       | 95.44           | 0.00  | 38.44                     | 0.01  |
| 1   | 0.28       | 57.00           | 0.01  | 21.76                     | 0.23  |
| 2   | 0.27       | 35.24           | 0.01  | 20.46                     | 0.06  |
| 3   | 0.20       | 14.77           | 0.06  | 14.51                     | 0.05  |
| 4   | 0.00       | 0.27            | 0.60  | 0.27                      | 0.60  |

Note: The tests have been run for a model with an unrestricted constant and two lags.

| Table 3. Bai-Perron break tests. |
|----------------------------------|
| Break Test | F-statistic | Scaled F-statistic | Critical Value |
| 0 vs. 1 * | 172.64 | 863.19 | 18.23 |
| 1 vs. 2 * | 12.10 | 60.48 | 19.91 |
| 2 vs. 3 | 2.02 | 10.08 | 20.99 |

Note: * means rejection of the null. Critical values from Bai and Perron (2003b).

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4 The number of dwellings has been transformed from annual to quarterly observations assuming the same value in all quarters within the year.

5 The results of the unit root tests are available on request.

6 Juselius and McDonald (2004) and Juselius and Toro (2005) amongst others suggest that the addition of variables to a cointegrating relationship would not change that relationship, since the stochastic trends have already cancelled out.
significantly different from zero, which gives evidence of stationary residuals.\footnote{The results of the tests are available upon request.}

The results show that when the variables are significant, the estimated signs are as expected. In addition, all the variables are significant during the boom-bust period in 2005Q2-2013Q1, but the role of most regressors seems to fade out when house prices started to rise again after the recovery from the sovereign debt crisis. Most strikingly, the only variable among the fundamentals that seems to explain housing prices from 2013 onwards is operating surplus or capital income. This suggests that housing prices are mainly determined by the evolution of capital income.

Our results add an important explanation to the results obtained by Cuestas (2017) and Gimeno and Martínez-Carrascal (2010), since wages only seem to be relevant from 2005 until the beginning of the recovery in 2013, when the last upsurge in housing prices and the downward correction took place. Apparently the evolution of house prices was driven by the demand from wage earners, meaning from the general population. Similarly, the evolution of the stock of dwellings only affected housing prices in 2005–2013, which is the period when the largest changes in the supply of dwellings occurred. Operating surplus, which captures capital income, was an important driving force for house prices throughout the whole period under investigation 2001–2017, to the point that since 2013 it is apparently only the demand from companies or capital owners that has pushed up housing prices.

Finally, to complement our analysis we compare the equilibrium value obtained from the model using the coefficients from 2013Q2 with the actual values of housing prices. In Figure 2 we show the evolution of the two values in logs, showing that the housing price has tended to be overvalued in this period, with the gap widening in 2017. This implies that measures taken by policy makers to alleviate the pressure put on house prices are more than justified.

### III. Conclusion

In this paper we analyse the evolution of the impact of the long-run fundamental determinants of equilibrium housing prices, allowing for structural breaks. The initial hypothesis is that the relationship between wage income, lending interest rates, the supply of dwellings and capital income may have changed over time. When testing for this possibility we find that there are two major breaks, one in 2005Q2 and another in 2013Q2. It is also found that operating surplus, or capital income, seems to have had a major role in the evolution of housing prices since 2013 and that towards the end of the period, Spanish housing prices were overvalued. Further studies are needed to investigate the particular channels of demand for housing from capital owners in order to propose effective measures for alleviating the pressure on prices.

### Table 4. DOLS long run estimates, dependent variable \( p \).

| Period Until 2005Q1 | Coefficient | Std. Error | t-Statistic | Prob. |
|---------------------|-------------|------------|-------------|-------|
| \( \alpha_p \) | 2.43 | 0.68 | 3.58 | 0.00 |
| \( \omega_r \) | 0.29 | 0.76 | 0.38 | 0.70 |
| \( i_t \) | -5.87 | 0.99 | -5.94 | 0.00 |
| \( d_t \) | -0.17 | 0.55 | -0.31 | 0.76 |
| constant | -11.21 | 7.29 | -1.54 | 0.13 |

| 2005Q2 – 2013Q1 | Coefficient | Std. Error | t-Statistic | Prob. |
|-----------------|-------------|------------|-------------|-------|
| \( \alpha_p \) | 1.31 | 0.21 | 6.23 | 0.00 |
| \( \omega_r \) | 1.32 | 0.11 | 11.86 | 0.00 |
| \( i_t \) | -2.77 | 0.39 | -7.10 | 0.00 |
| \( d_t \) | -1.23 | 0.14 | -9.06 | 0.00 |
| constant | 7.26 | 2.33 | 3.12 | 0.00 |

| From 2013Q2 | Coefficient | Std. Error | t-Statistic | Prob. |
|-------------|-------------|------------|-------------|-------|
| \( \alpha_p \) | 1.15 | 0.27 | 4.27 | 0.00 |
| \( \omega_r \) | -0.31 | 0.58 | -0.53 | 0.60 |
| \( i_t \) | -2.67 | 3.44 | -0.78 | 0.44 |
| \( d_t \) | -1.59 | 3.14 | -0.51 | 0.61 |
| constant | 25.99 | 51.53 | 0.50 | 0.62 |

Note: Model estimates with non-breaking one lead and lag of the regressors in first differences. The estimated coefficients for leads and lags are not shown.
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References

Bai, J., and P. Perron. 1998. “Estimating and Testing Linear Models with Multiple Structural Changes.” *Econometrica* 66 (1): 47–78. doi:10.2307/2998540.

Bai, J., and P. Perron. 2003a. “Computation and Analysis of Multiple Structural Change Models.” *Journal of Applied Econometrics* 18 (1): 1–22. doi:10.1002/jae.659.

Bai, J., and P. Perron. 2003b. “Critical Values for Multiple Structural Change Tests.” *The Econometrics Journal* 6 (1): 72–78. doi:10.1111/1368-423X.00102.

Crowe, C., G. Dell’Ariccia, D. Igan, and P. Rabanal. 2013. “How to Deal with Real Estate Booms: Lessons from Country Experiences.” *Journal of Financial Stability* 9 (3): 300–319. doi:10.1016/j.jfs.2013.05.003.

Cuerpo, C., and P. Pontuch. 2013. “Spanish Housing Market: Adjustment and Implications.” *ECFIN Country Focus* 10: 8.

Cuestas, J. C. 2017. “House Prices and Capital Inflows in Spain during the Boom: Evidence from a Cointegrated VAR and a Structural Bayesian VAR.” *Journal of Housing Economics* 37: 22–28. doi:10.1016/j.jhe.2017.04.002.

Engle, R. F., and C. W. J. Granger. 1987. “Co-Integration and Error Correction: Representation, Estimation, and Testing.” *Econometrica* 55 (2): 251–276. doi:10.2307/1913236.

Geng, M. N. 2018. “Fundamental Drivers of House Prices in Advanced Economies.” *IMF Working paper WP/18/164*. doi:10.5089/9781484367629.001.

Gimeno, R., and C. Martínez-Carrascal. 2010. “The Relationship between House Prices and House Purchase Loans: The Spanish Case.” *Journal of Banking & Finance* 34 (8): 1849–1855. doi:10.1016/j.jbankfin.2009.12.011.

Girouard, N., M. Kennedy, P. Van Den Noord, and C. André. 2006. “Recent House Price Developments: The Role of Fundamentals.” *OECD Economics Department Working Papers*, No. 475. OECD Publishing. doi:10.1787/864035_447847.

Gregory, A. W., and B. E. Hansen. 1996. “Residual-based Tests for Cointegration in Models with Regime Shifts.” *Journal of Econometrics* 70 (1): 99–126. doi:10.1016/0304-4076(69)126. doi:10.1010/jimon.2005.01.002.

Johansen, S. 1988. “Statistical Analysis of Cointegration Vectors.” *Journal of Economic Dynamics and Control* 12 (2): 231–254. doi:10.1016/0165-1889(88)90041-3.

Johansen, S. 1991. “Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models.” *Econometrica* 59 (6): 1551–1580. doi:10.2307/2938278.

Juselius, K., and R. McDonald. 2004. “International Parity Relationships between the USA and Japan.” *Japan and the World Economy* 16: 17–34. doi:10.1016/S0922-1425(03)00003-3.

Juselius, K., and J. Toro. 2005. “Monetary Transmission Mechanisms in Spain: The Effect of Monetization, Financial Deregulation, and the EMS.” *Journal of International Money and Finance* 24: 509–531. doi:10.1016/j.jimonfin.2005.01.002.

Leung, C. 2004. “Macroeconomics and Housing: A Review of the Literature.” *Journal of Housing Economics* 37: 249–267. doi:10.1016/j.jhe.2004.09.002.

Piazzesi, M., and M. Schneider. 2016. “Housing and Macroeconomics.” In *Handbook of Macroeconomics* 2: 1547–1640. Elsevier.

Pittini, A., G. Koessler, J. Dijol, E. Lakatos, and L. Ghekiere. 2017. “The State of Housing in the EU.” A *Housing Europe Review: Brussels*. http://www.housingeurope.eu/file/614/download

PwC. 2018. *Emerging Trends in Real Estate. Creating an Impact*. London: A publication from PriceWaterhouseCoopers and the Urban Land Institute. www.pwc.com/etre2019europe

Appendix

| Table A1. Descriptive statistics for quarterly inflation rates for the housing price index in Spain. |
|--------|--------|----------------|----------------|
| Period | 2001-2007 | 2008-2012 | 2013-2017 |
| Mean | 0.025 | -0.024 | 0.004 |
| Median | 0.028 | -0.022 | 0.008 |
| Maximum | 0.052 | -0.003 | 0.023 |
| Minimum | -0.009 | -0.055 | -0.037 |
| Std. deviation | 0.014 | 0.016 | 0.014 |

Note: The quarterly inflation rates have been calculated as the difference between the log of the house price index and the previous period value.