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Honing in on Housing

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Honing in on Housing[1]

Zoë Venter[2]

Abstract

Using a six variable SVAR model, we study the transmission mechanism of monetary policy to the housing market over the period between 1996:Q1 and 2019:Q4. The SVAR is repeated for two measures of fiscal policy namely, tax revenue and government spending as well as for three measures of the housing market namely, residential prices, the price-to-rent ratio and the price-to-income ratio. Our main results show that monetary policy shocks do not have an impact on residential prices however, when running our model using fiscal policy shocks instead of monetary policy shocks, the results become statistically significant. Further, our results show that the response of housing prices to fiscal policy shocks differs between Portugal and Spain. We conclude that the difference in the housing markets in these two countries can be attributed to the variation in the fiscal policy mandates adopted while the common monetary policy framework implemented by the ECB does not play a role.

JEL Classification: E44; E52; R21
Keywords: Monetary policy; Fiscal policy, House prices; Structural VAR

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1. Introduction

Spain and Portugal, two countries positioned on the southwestern tip of the European continent, are two countries that are often compared due to the similarity in language, culture and climate. Moreover, these two Iberian Peninsula countries are known for their reliance on tourism as well as their more recent encounters with soaring sovereign debt and the crises that supervened. Having both joined the Euro Area in 1999 and, as such, having adopted a single monetary policy framework, these two countries are often analysed conjointly in an economic setting. Although both countries experienced plummeting property prices in the aftermath of the global financial crisis (GFC) and both countries suffered at the hands of severe financial crises between 2010 and 2014, the reality is that the causes, courses and consequences of these crises have differed markedly.

In line with conventional wisdom in physics, what goes up must come down and the economic situation in Spain was no different: the crisis in Spain has been attributed to prospering property construction and investment, skyrocketing home prices and brutally bloated GDP growth rates. In contrast, a perky property market and unsustainable economic growth were not the root causes of the Portuguese crisis where instead, years of stagnated growth and declining investment festered the economy into austerity. The housing market is arguably a quintessential part of any economy as the both the credit channel and consumption are affected by movements in house prices. The property market may not have played a pivotal role in Portugal in the lead up to the crisis however, the recent Golden Visa framework combined with a scarce supply of housing has led to exorbitant prices which may indeed point towards a snowballing, speculative housing bubble. On the other side of the coin, Spanish house prices have yet to recover fully following the downturn.

Monetary policy in these two countries is homogenous and set by the European Central Bank (ECB) notwithstanding, the housing markets are somewhat disparate. Monetary policy shocks feed into the housing market in a number of ways: by affecting the price of mortgage credit, the price of housing, private consumption and residential investment as well as having a stimulating effect on the shadow banking system. As a consequence, and because of the parallels drawn between these two countries in the past as well as the expected economic consequences of the COVID pandemic, it is of interest to study and compare the impact of ECB monetary policy on the housing markets in these two countries.

We use a six variable SVAR model to study the transmission mechanism of monetary policy to the housing market over the period between 1996:Q1 and 2019:Q4. The SVAR is repeated for two measures of fiscal policy (as percentages of GDP) namely, tax revenue and

government spending as well as for three measures of the housing market namely, residential prices, the price-to-rent ratio and the price-to-income ratio. Our main results show that monetary policy shocks do not have an impact on residential prices however, when running our model using fiscal policy shocks instead of monetary policy shocks, the results become statistically significant. Further, our results show that the response of housing prices to fiscal policy shocks differs between Portugal and Spain.

The rest of the paper is as follows: Section 2 surveys existing literature; Section 3 discusses the methodology and the data used; Section 4 discusses the empirical results; and Section 5 concludes.

2. Literature Review

The transmission channel of monetary policy in the housing market is by no means a novel topic, in fact, Bernanke and Gertler (1995) introduce the credit channel and find that monetary policy has a strong impact on durable goods spending. The credit channel is also studied by Iacovielli and Minetti (2008) who find that this channel has become weaker following financial liberalisation in the 1990s. Further, they show that the relevance of the credit channel depends on the structural features of the credit system. Eickmeier and Hofmann (2012) aim to analyse the transmission of monetary policy through credit risk spreads and house prices. They find that shocks in monetary policy contributed to fuelling the late stage of the housing and credit boom leading up to the GFC.[3] Finally, the credit channel of monetary policy is studied by Musso et al. (2011) who find that the credit channel of monetary policy transmission is fundamental in Europe while, in the US, the housing channel plays a more important role.

Earlier literature also considers the transmission of monetary policy through asset prices. Afonso and Silva (2017) find that the economies are affected by ECB monetary policy through multiple channels namely: bank lending, balance sheets, exchange rates, asset prices and interest rates. Aoki et al. (2004) look at the relationship between house prices and both consumption and consumer durable expenditures. They find that this relationship has become weaker over time, they also find that house prices exhibit lower sensitivity to monetary policy shocks and finally, house prices play an important role in the transmission mechanism of monetary policy however, house prices are not a rudimentary source of shocks. McCarthy and Peach (2002) note that the impact of monetary policy shocks on mortgage credit supply has

[3] The larger contribution in the precrisis period is likely due to the increased size of monetary policy shocks in the lead up to the crisis.

become less severe in recent times following restructuring and increased competitiveness in both financial and housing markets. More recently, Christidou et al. (2018) find that the transmission of monetary policy to real house prices and housing investment differs across states in the US and that this response is less pronounced in states with tighter fiscal policy. This is particularly noteworthy when considering the EU where monetary policy is homogenous however, fiscal policy is left without hindrance.

Focusing on the Spanish and Portuguese case, Rodrigues and Lourenço (2015) study the house-price-to-rent ratio and price-to-income ratio progression using an Error Correction Model (ECM). They go further and perform an analysis of the potential speculative bubbles in these two countries and find that Spain has indeed experienced a speculative house price bubble in recent history. Jordà et al. (2015) account for exogenous variations in domestic monetary conditions. Based on Obstfeld and Taylor (2004), Jordà et al. (2015) note that pegged currency countries adopt the controlling country's monetary policy which introduces exogenous risks into the domestic economy. They find that an exogenous interest rate increase induces a devaluation of houses. This is particularly relevant for the cases of Portugal and Spain who are subject to exogenous risks caused by centralised monetary policy in the EU.

Vector Autoregressive (VAR) Models have been used frequently to study the relationship between monetary policy shocks and the housing market. Elbourne (2008) uses a structural VAR (SVAR)[4] model, based on that of Kim and Roubini (2000), to study the monetary policy transmission mechanism in the UK housing market. He finds that, following an interest rate shock, a $1/7^{th}$ of the decrease in consumption is explained by house prices. Fratantoni and Schuh (2003) implement a Heterogenous agent VAR (HAVAR) and find that housing investment lags monetary policy decisions by one period.[5] Finally, Carstensen et al. (2009)[6] use a Panel VAR (PVAR), the authors find that the housing market plays a more important role in the transmission of monetary policy in more developed mortgage markets.[7]

[4] Musso et al. (2011) note that there may be non-linear effects of housing booms and busts which may not be captured when using an SVAR.
[5] See Vargas-Silva (2008).
[6] Rahal (2016) uses a PVAR to show that unconventional policy shocks (central bank assets) affect both house prices and the cost of housing.
[7] See Milcheva and Sebastian (2016) and Calza et al. (2013). Milcheva and Sebastian (2010) find that when a structural break is included in the VAR analysis, the role of the housing market in monetary policy transmission has increased in roughly half of the cases.

3. Methodology and Data

3.1. Data

A balanced dataset covering the period between 1996:Q1 and 2019:Q4. The data used in the SVAR model uses a quarterly frequency, variables that are only available with an annual frequency are converted to a quarterly frequency using quadratic interpolation in EViews and variables that are available monthly are accumulated to a quarterly frequency in EViews. Data descriptions and sources are available in Appendix A (Table A.1).

The relevant variables are as follows:

- Consumption (FRED);
- GDP growth (FRED);
- Monetary policy proxied by the ECB short term interbank rate (FRED);
- Fiscal policy proxied by taxes (OECD) and government spending (FRED);
- Housing proxied by the real house price index (OECD and FRED), the price-to-income ratio (OECD and FRED) and the price-to-rent ratio (OECD and Eurostat);
- The growth in the level of housing credit (FRED).

The Schwarz Bayesian Information Criterion (SBIC) is appropriate when considering quarterly data with a sample size that is not necessarily greater than 120 observations[8] and in both the cases of Portugal and Spain, the SBIC suggests 1 lag.

Table 1 shows the results of tests for the stationarity of the all the time series. In the case of Portugal, GDP growth contains a unit root when considering both the Augmented Dickey-Fuller (ADF) test as well as the Kwiatkowski et al. (1992) (KPSS) test. Additionally, in the case of Spain, credit-to-GDP growth also contains a unit when considering both tests.

[8] See Ivanov and Kilian (2001).

Table 1

Portugal				
	ADF		KPSS	
	Test Statistic	5% Critical Value	Test Statistic	5% Critical Value
Monetary_Policy _Growth	-8.389994	-1.944248	0.24581	0.463
Private_Consumption_Growth	-3.611429	-1.944404	0.169407	0.463
Residential_Prices_Growth	-2.112904	-1.944445	0.289986	0.463
Price_to_Rent_Growth	-2.062323	-1.944445	0.240109	0.463
Price_to_Income_Growth	-2.397124	-1.944445	0.541309	0.463
Government_Consumption_Growth	-1.944404	-2.446039	0.04932	0.146
GDP_growth	-1.426861	-1.944404	0.560311	0.463
Tax_Revenue_Growth	-2.489253	-1.944619	0.058224	0.463
Credit_to_Private_Growth	-1.323182	-1.944445	0.095639	0.146
Spain				
	ADF		KPSS	
	Test Statistic	5% Critical Value	Test Statistic	5% Critical Value
Monetary_Policy _Growth	-8.389947	-1.944248	0.24452	0.463
Private_Consumption_Growth	-3.196853	-1.944404	0.185067	0.463
Residential_Prices_Growth	-1.489577	-1.944404	0.272873	0.463
Price_to_Rent_Growth	-2.628958	-1.94453	0.225475	0.463
Price_to_Income_Growth	-2.247687	-1.944286	0.18766	0.463
Government_Consumption_Growth	-2.228063	-1.944404	0.167055	0.463
GDP_growth	-1.01191	-1.944404	0.143118	0.146
Tax_Revenue_Growth	-1.803467	-1.944619	0.238838	0.463
Credit_to_Private_Growth	-1.156532	-1.944574	0.523787	0.463

The table shows the results of augmented Dickey–Fuller test for stationarity of each time series. The Kwiatkowski et al. (1992) test results are also shown.

3.2. Methodology

Grilli and Roubini (1996) note that "the structural VAR approach appears to be quite successful in explaining all the puzzles that plagued the recent literature on the effects of monetary policy in closed and open economies." Based on this as well as other existing literature, we choose to implement an SVAR model to analyse the impact of monetary policy on Portuguese and Spanish house prices. Following the implementation of an SVAR, we perform a boom test[9] to test whether a boom has occurred in these two housing markets. The Generalized Supremum value of the ADF test (GSADF) procedure implemented in EViews uses a right-tailed ADF Test to test for the null hypothesis of a unit root and the alternative

[9] Rodrigues and Lourenço (2015) implement a boom test based on Phillips, Wu, and Yu (2011) and Phillips, Shi, and Yu (2015). Otero and Baum (2020) present the community-contributed Stata command radf which tests for periods of explosive behaviour.

hypothesis of multiple periodically collapsing bubbles. Using this procedure, we are able to identify periods of explosiveness in housing prices. Finally, we implement an adjusted SVAR model to test if the response of housing prices to monetary policy differs in the potential boom period.

We estimate a six variable SVAR model of both the Portuguese and Spanish economies. The variables used in the model are as follows: consumption (proxied by final private consumption), GDP growth, monetary policy (proxied by the ECB short term interbank rate), fiscal policy (proxied by 1. taxes as a percentage of GDP and 2. government spending as a percentage of GDP), housing (proxied by 1. the real house price index, 2. price-to-income ratio and 3. price-to-rent ratio) and finally, the growth in the level of housing credit[10]. In an effort to understand both the model as well as the ordering of variables, it is useful to summarise the SVAR model.

The starting point of our model is to estimate the reduced form VAR (p) model:

$$X_t = \phi_0 + \sum_{l=1}^{p} \Phi_l X_{t-l} + \varepsilon_t \quad (1)$$

where X_t is a (K x 1) vector of endogenous variables, ϕ_0 is a (K x 1) vector of intercepts, Φ_l are (K x K) coefficient matrices and $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t}, \dots, \varepsilon_{Kt})'$ is an unobservable error term representing the reduced form innovations.

Further,

$$\phi_0 = {B_0}^{-1} c \,, \quad (2)$$

$$\phi_l = {B_0}^{-1} B_l \,, \quad (3)$$

$$\varepsilon_t = {B_0}^{-1} U_t. \quad (4)$$

U_t represents the structural innovations and is a multivariate white noise process with variance/covariance matrix D where D is a (KxK) matrix, B_i is the structural lag polynomial at lag i and is a (KxK) matrix, c contains K elements where K is the number of variables with i = 0, …, p. Finally, B_0 is the structural lag polynomial at lag zero.

When B_0 is invertible, the reduced form VAR(p) in equation (1) is equivalent to an SVAR (p) model:

$$B_0 X_t = c + B_1 X_{t-1} + B_2 X_{t-2} + \dots + B_p X_{t-p} + U_t \quad (5)$$

[10] Jordà et al. (2015) note that mortgage lending constitutes roughly 60% of bank lending, to avoid short time series, we use credit to the private sector as our measure of mortgage lending. The value used to measure housing credit in our dataset is thus 60% of the value of credit to private non-financial institutions. Although this may not match the exact value of housing credit, we crosscheck the ratios of mortgage lending to total household credit (available from Pordata and INE) and find that this ratio has a value of roughly 60%. Using mortgage lending data would limit our sample to a period of roughly 40 quarters which would result in inaccurate conclusions.

Finally, the SVAR allows us to decompose the error terms into mutually orthogonal shocks as the error terms are not correlated (Schenck, 2016). The Cholesky decomposition (6) is used to construct the impulse responses to the structural form shocks following that B_0 is lower triangular:

$$\begin{pmatrix} u_{cons} \\ u_{gdp} \\ u_{monetary} \\ u_{fiscal} \\ u_{housing} \\ u_{credit} \end{pmatrix} = \begin{pmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 \\ b_{21} & b_{22} & 0 & 0 & 0 & 0 \\ b_{31} & b_{32} & b_{33} & 0 & 0 & 0 \\ b_{41} & b_{42} & b_{43} & b_{44} & 0 & 0 \\ b_{51} & b_{52} & b_{53} & b_{54} & b_{55} & 0 \\ b_{61} & b_{62} & b_{63} & b_{64} & b_{65} & b_{66} \end{pmatrix} * \begin{pmatrix} \varepsilon_{cons} \\ \varepsilon_{gdp} \\ \varepsilon_{monetary} \\ \varepsilon_{fiscal} \\ \varepsilon_{housing} \\ \varepsilon_{credit} \end{pmatrix} \begin{matrix} consumption\ innovation \\ gdp\ innovation \\ monetary\ policy\ innovation \\ fiscal\ policy\ innovation \\ housing\ innovation \\ credit\ innovation \end{matrix} \quad (6)$$

The SVAR is repeated for two measures of fiscal policy namely, tax revenue and government spending. Additionally, for each measure of fiscal policy, the SVAR is once again repeated for three measures of housing namely, the real house price index, the price-to-income ratio and the price-to-rent ratio. This results in six SVAR analyses for verification purposes.

The order of variables in the Cholesky decomposition is chosen based on the relationship between the relevant variables previously discussed and studied in earlier literature. The OECD (2012) notes that household final consumption represents roughly 60% of GDP, we therefore assume that consumption has a contemporaneous effect on GDP. Chirinko et al. (2004) find that both consumption and GDP are affected by house price shocks with a lag. As house prices decrease, we expect mortgage defaults to increase and the level of home loans to decrease thus, the ordering of our model assumes housing prices affect the level of home loans in the same period[11] however, the level of home loans would only affect housing prices in the next period. Further, in line with Elbourne and de Haan (2004), we assume that monetary policy does not affect GDP contemporaneously.[12] We assume, in line with Haug et al. (2013), that unlike monetary policy, fiscal policy decisions take time to implement after they are announced and therefore, monetary policy affects fiscal policy contemporaneously but the feedback from fiscal policy to monetary policy is assumed to only occur with a lag. Lastly, in line with Elbourne (2008), monetary policy is assumed to have a contemporaneous effect on housing prices.[13] The fiscal policy measure included is used to proxy the impact of fiscal policy on the housing market, we consider both measures (government consumption and tax revenue) from the side of the government and hence, total government consumption and total tax revenues are used.

[11] See Gerlach and Peng (2005), Fitzpatrick and McQuinn (2004) and Gimeno and Martínez-Carrascal (2006).
[12] See Gerlach and Smets (2005), Ramaswamy and Sloek (1997) and Philipsen and Wuyts (1999).
[13] See Aoki et al. (2004) and Giuliodori (2005).

4. Results

Table 2 provides a summary of the impulse response functions to a shock in monetary policy. The results are not statistically significant in any of the cases, we do however find that house prices consistently have a negative reaction to positive shocks in monetary policy. Price-to-rent ratios also have a negative reaction in both the case of Portugal and Spain while the price-to-income ratio increases in the SVAR that includes government consumption as the fiscal policy measure.

Table 2 – Summary of responses of variables to a monetary policy shock

Summary of Responses of variables to a monetary policy shock								
Variables								
Short Run Response								
	Portugal	Spain		Portugal	Spain		Portugal	Spain
Private Consumption	-	-	Private Consumption	-	-	Private Consumption	-	-
GDP Growth	+	-	GDP Growth	+	+	GDP Growth	+	+
Tax Revenue	-	+	Tax Revenue	-	+	Tax Revenue	-	+
Residential Prices	-	-	Price to Rent	-	-	Price to Income	-	-
Credit to Private	-	-	Credit to Private	-	-	Credit to Private	-	-
Long Run Response								
	Portugal	Spain		Portugal	Spain		Portugal	Spain
Private Consumption	-	-	Private Consumption	-	-	Private Consumption	-	-
GDP Growth	+	-	GDP Growth	+	0	GDP Growth	+	+
Tax Revenue	-	+	Tax Revenue	-	+	Tax Revenue	-	0
Residential Prices	-	-	Price to Rent	-	-	Price to Income	+	-
Credit to Private	-	-	Credit to Private	-	-	Credit to Private	-	-
Short Run Response								
	Portugal	Spain		Portugal	Spain		Portugal	Spain
Private Consumption	-	-	Private Consumption	-	-	Private Consumption	-	-
GDP Growth	+	-	GDP Growth	+	-	GDP Growth	+	+
Government Consumption	-	-	Government Consumption	-	-	Government Consumption	-	-
Residential Prices	-	-	Price to Rent	-	-	Price to Income	+	-
Credit to Private	-	-	Credit to Private	-	-	Credit to Private	-	-
Long Run Response								
	Portugal	Spain		Portugal	Spain		Portugal	Spain
Private Consumption	-	-	Private Consumption	-	-	Private Consumption	-	-
GDP Growth	+	-	GDP Growth	+	-	GDP Growth	+	+
Government Consumption	-	-	Government Consumption	-	-	Government Consumption	-	-
Residential Prices	-	-	Price to Rent	-	-	Price to Income	+	-
Credit to Private	-	-	Credit to Private	-	-	Credit to Private	-	-

−, Negative response; +, positive response *Statistically signifcant response at 5% level

Figure 1 shows the relevant GSADF test results for house prices in Portugal while figure 2 shows the relevant GSADF test results for house prices in Spain. As can be seen in figure 1, Portugal has experienced three periods of explosive behaviour while figure 2 shows that Spain has also experienced three. The three periods of explosive behaviour identified in Portugal are: 1999Q1-1999Q3, 2008Q1-2008Q3 and 2013Q3-2014Q2 while the three periods in Spain are: 2002Q2-2003Q1, 2008Q1-2009Q4 and 2011Q4-2012Q4.

Figure 1

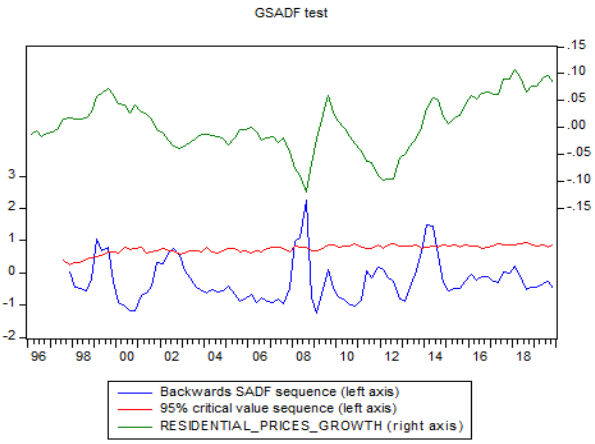

Figure 2

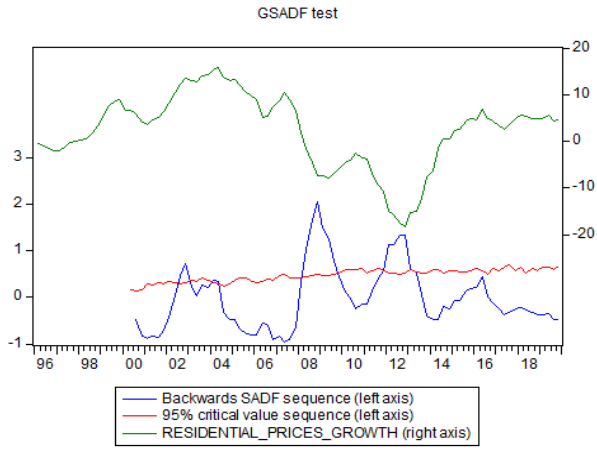

Table 3 provides a summary of the impulse response functions to a shock in fiscal policy. The impact of a shock in fiscal policy on residential prices is statistically significant in the majority of cases. In Portugal, a positive shock in taxation results in a decrease in residential prices, the price-to-rent ratio and the price-to-income ratio while a positive government consumption shock results in an increase in these fundamentals. In Spain, both shocks in taxation as well as shocks in government consumption result in a decrease in residential prices, the price-to-rent ratio and the price-to-income ratio.

Table 3 - Summary of responses of variables to a monetary policy shock

Summary of Responses of variables to a taxation shock								
Variables								
Short Run Response								
	Portugal	Spain		Portugal	Spain		Portugal	Spain
Private Consumption	+	+	Private Consumption	+	+	Private Consumption	+	+
GDP Growth	-	+*	GDP Growth	-	+*	GDP Growth	-	+
Monetary Policy	-	+	Monetary Policy	-	+	Monetary Policy	-	+
Residential Prices	-*	+*	Price to Rent	-	+*	Price to Income	-	+*
Credit to Private	-	-	Credit to Private	-	-	Credit to Private	+	-
Long Run Response								
	Portugal	Spain		Portugal	Spain		Portugal	Spain
Private Consumption	+	+	Private Consumption	+	+	Private Consumption	+	+
GDP Growth	-	+*	GDP Growth	-	+*	GDP Growth	-	+
Monetary Policy	-	+	Monetary Policy	-	+	Monetary Policy	-	+
Residential Prices	-*	+*	Price to Rent	-	+*	Price to Income	-	+*
Credit to Private	-	-	Credit to Private	-	-	Credit to Private	+	-
Summary of Responses of variables to a government spending shock								
Short Run Response								
	Portugal	Spain		Portugal	Spain		Portugal	Spain
Private Consumption	-	+	Private Consumption	-	+	Private Consumption	-	+
GDP Growth	+*	-*	GDP Growth	+*	-*	GDP Growth	+*	-*
Monetary Policy	+	-	Monetary Policy	+	-	Monetary Policy	+	-
Residential Prices	+*	-*	Price to Rent	+*	-*	Price to Income	+*	-
Credit to Private	-	-	Credit to Private	-	-	Credit to Private	-	-
Long Run Response								
	Portugal	Spain		Portugal	Spain		Portugal	Spain
Private Consumption	-	+	Private Consumption	-	+	Private Consumption	-	+
GDP Growth	+*	-*	GDP Growth	+*	-*	GDP Growth	+*	-*
Monetary Policy	+	-	Monetary Policy	+	-	Monetary Policy	+	-
Residential Prices	+*	-*	Price to Rent	+*	-*	Price to Income	+*	-*
Credit to Private	-	-	Credit to Private	-	-	Credit to Private	-	-

–, Negative response; +, positive response *Statistically signifcant response at 5% level

5. Conclusion

Fiscal policy, by its nature, cannot be outsourced to an unelected, independent agency which and instead is determined independently by the democratically elected governments in both Portugal and Spain. In contrast, monetary policy in these two countries is established and governed by a central mandate set by the ECB. Monetary policy has long been thought to be at the centre of housing market movements however, given the variations in the Spanish and Portuguese housing markets over time, we are forced to rethink our view of the transmission of monetary policy to house prices.

We use an SVAR model and impulse response functions to study the impact, if any, of monetary policy shocks on the housing market where the housing market is represented by housing prices, the price-to-rent ratio and the price-to-income ratio. The price-to-rent ratio serves as a proxy for the profitability of housing, the price-to-income ratio serves as a proxy for the affordability of housing and finally, the housing price index is used to track changes in the price of housing. Monetary policy is represented by the interbank rate set by the ECB while fiscal policy is represented by both taxation and government spending.

Parallels regarding culture, geography and language are often drawn between Spain and Portugal. Economically speaking, these two countries are often considered to be like two peas in a pod having both joined the Euro Area in 1999 and having both suffered at the hands of sovereign debt crises in the aftermath of the GFC. Our results show that the housing markets in these two countries differ significantly even though the effect of monetary policy is insignificant in both cases. Our main results show that monetary policy shocks have no effect on residential prices, price-to-rent ratios or price-to-income ratios however, when running our model using fiscal policy shocks instead of monetary policy shocks, the results become statistically significant.

When fiscal policy shocks (both taxation-based as well as government spending based) are introduced, the Spanish housing market reacts differently to the Portuguese housing market. Positive fiscal policy shocks result in a decline in residential prices, the price-to-rent ratio and the price-to-income ratio in Spain while in Portugal, positive shocks in taxation result in a decrease in housing prices and positive shocks in government spending have the opposite effect. In both countries, higher taxation therefore constitutes lower housing prices however, these two countries differ in their response to government spending. In the face of higher government spending, house prices rise in Portugal while in Spain, they decline. We conclude that the difference in the housing markets in these two countries can be

attributed can be attributed to the variation in the fiscal policy mandates adopted while the common monetary policy framework implemented by the ECB does not play a role.

Appendix A

Table A.1. Data Sources and Definitions

Data Source and Definitions					
Variable	**Country**	**Code**	**Source**	**Frequency**	**Description**
Monetary_Policy _Growth	Portugal	IR3TIB01EZQ156N	FRED	Quarterly	Author's own calculations based on 3-Month or 90-day Rates and Yields: Interbank Rates for the Euro Area, Percent, Quarterly, Not Seasonally Adjusted.
	Spain	IR3TIB01EZQ156N	FRED	Quarterly	Author's own calculations based on 3-Month or 90-day Rates and Yields: Interbank Rates for the Euro Area, Percent, Quarterly, Not Seasonally Adjusted.
Residential_Prices_Growth	Portugal	HOUSECOST:IDX2015	OECD	Quarterly	Author's own calculations based on OECD real house price index.
	Spain	QESR628BIS	FRED	Quarterly	Author's own calculations based Real Residential Property Prices for Spain, Index 2010=100, Quarterly, Not Seasonally Adjusted.
Price_to_Rent_Growth	Portugal		OECD	Quarterly	Author's own calculations. The price to rent ratio is determined as the nominal house price index divided by the rental price index (Eurostat monthly data).
	Spain		OECD	Quarterly	Author's own calculations. The price to rent ratio is determined as the nominal house price index divided by the rental price index (Eurostat monthly data).
Price_to_Income_Growth	Portugal		OECD	Quarterly	Author's own calculations. The price to income ratio is determined as the nominal house price index divided by the nominal disposable income (Real disposable income available from Eurostat multiplied by the GDP deflator available from FRED)
	Spain		OECD	Quarterly	Author's own calculations. The price to income ratio is determined as the nominal house price index divided by the nominal disposable income (Real disposable income available from Eurostat multiplied by the GDP deflator available from FRED)
Government_Consumption_Growth (as% of GDP)	Portugal	PRTGFCEQDSMEI	FRED	Quarterly	Author's own calculations based on Government Final Consumption Expenditure in Portugal, Euros, Quarterly, Seasonally Adjusted. Adjusted to percentage of GDP.
	Spain	ESPGFCEQDSMEI	FRED	Quarterly	Author's own calculations based on Government Final Consumption Expenditure in Spain, Euros, Quarterly, Seasonally Adjusted. Adjusted to percentage of GDP.
Private_Consumption_Growth (as% of GDP)	Portugal	PRTPFCEQDSMEI	FRED	Quarterly	Author's own calculations based on Private Final Consumption Expenditure in Portugal, Euros, Quarterly, Seasonally Adjusted. Adjusted to percentage of GDP.

	Spain	ESPPFCEQDSMEI	FRED	Quarterly	Author's own calculations based on Private Final Consumption Expenditure in Spain, Euros, Quarterly, Seasonally Adjusted. Adjusted to percentage of GDP.
GDP_growth	Portugal	CPMNACSCAB1GQPT	FRED	Quarterly	Author's own calculations based on gross Domestic Product for Portugal, Millions of Euros, Quarterly, Seasonally Adjusted.
	Spain	CPMNACSCAB1GQES	FRED	Quarterly	Author's own calculations based on gross Domestic Product for Spain, Millions of Euros, Quarterly, Seasonally Adjusted.
Tax_Revenue_Growth (as% of GDP)	Portugal		OECD	Annual	Author's own calculations based on total tax revenue, Millions of Euros. Adjusted to percentage of GDP.
	Spain		OECD	Annual	Author's own calculations based on total tax revenue, Millions of Euros. Adjusted to percentage of GDP.
Credit_to_Private_Growth (as% of GDP)	Portugal	CRDQPTAPABIS	FRED	Quarterly	Author's own calculations based on 60% of the total Credit to Private Non-Financial Sector, Adjusted for Breaks, for Portugal, Billions of Euros, Quarterly, Not Seasonally Adjusted.
	Spain	QESPAMUSDA	FRED	Quarterly	Author's own calculations based on 60% of the total Credit to Private Non-Financial Sector, Adjusted for Breaks, for Spain, Billions of Euros, Quarterly, Not Seasonally Adjusted.

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