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INTERACTION BETWEEN CREDIT LENDING AND HOUSE PRICES IN THE EUROPEAN UNION: AN ASSESSMENT OF SOVEREIGN DEBT CRISIS COUNTRIES

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Abstract

The existing literature indicates developments in either the housing markets or the credit markets can influence the whole financial sector or even the economy due to the close relationship between both markets. With an increasing dependency on the domestic financial markets to international financial markets caused by an increasing financial liberalisation degree, this relationship has strengthened significantly in many countries. This study aims at examining the interaction between credit lending and house prices for the Eurozone and the sovereign debt crisis countries of the EU (the GIIPS) at the cross-country and country levels, respectively. To do this, the vector autoregressibe (VAR) approach is followed. The findings show credit lending, not house prices are decisive in the interaction between credit and house prices for all samples.

Keywords*: Credit Lending, House Prices, the Sovereign Debt Crisis Countries*

Avrupa Birliği'nde Kredi Arzı ve Konut Fiyatları Arasındaki Etkileşim: Devlet Borç Krizi Ülkelerine İlişkin Bir Değerlendirme

Öz

Mevcut literatür, konut ya da kredi piyasaları arasındaki yakın ilişki nedeniyle, bu piyasaların herhangi birinde ortaya çıkan gelişmeler tüm finansal sektörü, hatta ekonomiyi de etkileyebileceğini göstermektedir. Üstelik artan finansal

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serbestleşmeyle, yurt içi finansal piyasaların uluslararası finansal piyasalara artan bağımlılığı pek çok ülkede konut ve kredi piyasaları arasındaki ilişkiyi önemli ölçüde güçlenmiştir. Bu çalışmanın amacı, vektör otoregresif (VAR) modeli kullanarak, hem Avro Bölgesi hem de AB'nin devlet borç krizine giren ülkelerinde (GIIPS), konut fiyatları ile açılan kredi arasındaki etkileşimin incelenmesidir. Analiz sonuçları, tüm örneklemlerde kredi arzının, kredi ve konut fiyatları arasındaki ilişkide belirleyici olduğunu göstermektedir.

***Anahtar Kelimeler**: Açılan Kredi, Konut Fiyatları, Devlet Borç Krizi Ülkeleri*

Introduction

It is observed that the relationship between credit markets and housing markets is important at the macro level and micro level in many economies, especially in last two decades. Theory asserts there is a bi-directional causality between both covariates. One of the main reasons is the importance of the housing sector because of its contribution to the economy (e.g. the economic growth and employment) and social order (social peace, mental health, happiness, trust). Another reason is the highest share of household expenditure relating to the house itself. For example, a ratio of 24.2% on average for European Union (EU) households as of the end of 2017, which equates to 13.1% of total GDP of the EU.[1] In addition, housing is the greatest financial commitment for most of households and most of them need to borrow from the credit markets to obtain it as a consumption good and/or an investment good.

The share of mortgage debt in household debts is evidence of the importance of housing finance in many countries. The study of Cerutti showed show that the share of mortgage debt in household debts consists of 70% of total household debt in 120 developed and developing countries; and in only six of these countries is it lower than 40%. It is also the biggest single item from the lenders' point of view.[2] For example, in the EU, the share of housing credit in total credit accounts to range from 60% to 85% among EU countries.[3] Thus, the significance of the housing sector is what earns credit markets their exalted position in so many countries and causes credit and housing markets to be closely linked. As such, in many economies, it needs

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1 Eurostat, 2018, https://ec.europa.eu/eurostat/data/database (11.08.2019).

2 Eugenio Cerutti et al. "Housing finance and real-estate booms: A cross-country perspective, *Journal of Housing Economics*, 38(2017), 1–13.

3 EBA, *EBA Consumer Trends Report 2017,* https://eba.europa.eu/documents/10180/1720738/Consumer+Trends+Report+2017.pdf (16 June 2018).

regular monitoring of housing and credit markets indicators in the interest of economic stability, and an accompanying diligence regarding macroeconomic indicators. For example, in the Macroeconomic Imbalances Procedure Scoreboard of the EU, which is considered for the surveillance of the external and internal aspects of macroeconomic imbalances, two of the headline indicators relate to both markets: changes in house price and the share of private sector credit in GDP.[4]

Over the last two decades, the importance of the relationship between the housing and credit markets has increased significantly, with an increasing dependency on the domestic financial markets with international financial markets caused by an increasing financial liberalisation degree and the diversification[5] of funding sources in mortgage markets. In addition, the effects of this relationship on the financial sector and hence on the economy have been stronger than before. This case has been proved by the US subprime mortgage crisis, and the sovereign debt crises in the Eurozone.

The aforementioned information makes a compelling case for studying the relationship between both two markets. Admittedly, there is a vast amount of literature on the relationship of credit lending with house price.[6] A

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[4] They are year-on-year changes in house prices relative to a Eurostat consumption deflator, with a threshold of 6% and private sector credit flow in % of GDP with a threshold of 14% (see EC, Scoreboard for the surveillance of macroeconomic imbalances, Occasional Paper No.92, February, 2012, Brussels.

[5] With regard to housing credit, developed mortgage markets since the 1990s have seen an increase in capital-market-based funding relative to deposit-account funding. This evinces a steady shift from an 'originate-to-hold' model to an 'originate-to-distribute' one. In the first model, banks originate credits and keep them on their balance sheet until maturity. In the second model, credits are transferred to other entities (e.g. special-purpose vehicles) by the banks for the purpose of structured finance transactions, asset securitisation, etc. Thus, such debts are taken off the banks' balance sheets. They can therefore create additional funds and also isolate any risk deriving from their debt. This process contributes to an increase in non-bank financial intermediaries. See. Sarai Criado ve Andrian Van Rixtel, *Structured Finance and The Financial Turmoil of 2007-2008: An Introductory Overview*, Banco de Espana, Documentos Ocasionales No. 0808, 2008, http://www.bdc.es/informes/be/ocasional/do0808e.pdf (03.12.2017); FCIC, *Securitization and Mortgage Crisis,* April 7, 2010(a), http://www.fcic.gov/reports/pdfs/2010-0407-Preliminary_Staff_Report_-_Securitization_and_the_Mortgage_Crisis.pdf (20.05.2018); FCIC, *Shadow Banking and Financial Crisis,* May 4 2010(b) http://c0182732.cdn1.cloudfiles.rackspacecloud.com/2010-0505-Shadow-Banking.pdf(20.05.2018).

[6] Stefan Gerlach ve Wenshegn Peng, "Bank lending and property prices in Hong Kong", *Journal of Banking &Finance*, 29(2005), 461–481; Elias Oikarinen, "Interaction between housing prices and household borrowing: The Finnish case", *Journal of Banking & Finance*, 33, No.4 (2009), 747–756; Christoph Basten ve Catherina Koch, "The causal effect of house prices on mortgage demand and mortgage supply: Evidence from

common point of previous studies is that there is the interaction between credit and house prices over the long term, but even where a similar model specification is used, the direction of the causality differs from one country to the next. Some studies support the theory that there is a two-way causality between credit and house prices[7] whereas others have concluded that there is a one-way causality. [8] Again, in some cases, the long-term causality is stronger from house prices to credit,[9] in some this relationship seems to be the reverse[10] and for others the direction of this relationship is unclear, albeit that these studies note that it has a strong effect.[11] However, the literature review shows that there are very few studies exploring the relationship of credit with house price in the Eurozone**.** In fact, we found only two studies-those of both Greiber and Setzer[12] and Ryczkowski[13]. Additionally, there is no study on this relationship at the individual country level in GIIPS countries of the Eurozone and comparing them with each other. The similarity between these countries is that they were the main actors in triggering and spreading the sovereign debt crisis in the EU, which was the first crisis in the EU since the Eurozone was established. This has led to them being labelled as the sovereign debt crisis countries (or the crisis countries) of the EU.

When the sovereign debt crisis started to spread, the GIIPS in 2010 was responsible 1/3 of the total production in Eurozone.[14] Before the crisis hit, these countries also shared numerous similar economic problems, such as a high increase in current account deficits, in labour costs, in public debt, and gradually decreasing debt payment capacity and so on. They also figured higher than the EU average with respect to such indicators.[15] In addition,

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Switzerland", *Journal of Housing Economics,* Cilt.30, 2015, s.1-22; Peter Öhman ve Darush Yazdanfar, "Bank lending and housing prices in Sweden", *International Journal of Housing Markets and Analysis*, 11, No.3(2018), 498-519.

7 Fitzpatrick and McQuinn, House Prices, 86; Gimeno and Martinez-Carrascal, The relationship, 1854; Öhman and Yazdanfar, Bank lending, 451.

8 Brissimis ve Vlassopoulos, The Interaction between,161; Hofmann, The Determinants, 234; Gerlach and Peng, Bank, 465.

9 See. Hofmann, Determinants, 244; Brissimis ve Vlassopoluos, Interaction, 165; Che et al., Property, 1665.

10 Liang and Cao, Property prices,73; Oikarinen, Interaction between, 568.

11 Addae-Dapaah ve Anh, Housing, 1513-1524.

12 Claus Greiber ve Ralph Setzer, "Money and housing – evidence for the euro area and the US", Deutsche Bundesbank Discussion Paper Series 1: Economic Studies No 12/2007.

13 Maciej Ryczkowski, "Money, credit, house prices and quantitative easing–the wavelet perspective from 1970 to 2016", *Journal of Business Economics and Management,* 20, No.3 (2019), 546–572.

14 Eurostat, 2018, https://ec.europa.eu/eurostat/data/database (11.08.2019).

15 Aahoka Mody ve Damiano Sandri, "The Eurozone crisis: how banks and sovereigns came to be joined at the hip", *Economic Policy,* 27, No.70 (2012), 199-230; Charles Wyplosz,

similar developments occurred simultaneously in both the credit and housing markets in the GIIPS countries.[16] For example, all these countries have rapid increases in credit lending between 2000 and 2007 (see Figure 1).

In the same period, the share of private sector lending in GDP was 175.46% in Greece, 182.7% in Ireland, 103.65% in Italy and 163.51% in Spain and it was higher that the Eurozone average.[17] Again, high increases in house prices were observed in all, except for Portugal as exhibited in Figure 1. During the same period, the average house price increased in these countries were higher than those in the Eurozone (about 40%).[18] An increase in real housing prices was about 50 % in Greece and Italy, 60% in Ireland, and 95% in Spain.[19]

Thus, the aim of our study is two-fold.

- To examine the interaction between credit lending and house prices for the Eurozone and the GIIPS countries.

- To investigate the effect on this interaction of a common monetary policy within the GIIPS countries individually.

Eurozone Crisis. About Public Debt, not Competitiveness, The Graduate Institute for International Relations and Economic Development, 27August, 2012.

[16] See. Paul Hilbers et al., House Price Developments in Europe: A Comparison IMF Working paper No.211, October,2018; Ambroigo Cesa-Bianchi, Andrea Ferrero and Alessandro Rebucci, "International Credit Supply Shocks", Journal of International Economics, 112(2018), 219-237; Jorge Buzaglo, "The Eurozone crisis: Looking through the financial fog with Keynesian glasses", *Real World Economics Review,* 54(2011), 77-82; Mody and Damiano, Eurozone, 210; Ryczkowski, Money, 552.

[17] BIS (2018), https://www.bis.org/statistics/totcredit/credpriv_doc.pdf (13.01.2018).

[18] EMF*, Hypostat 2010,* November, Brussels, 2011.

[19] OECD, 2018.

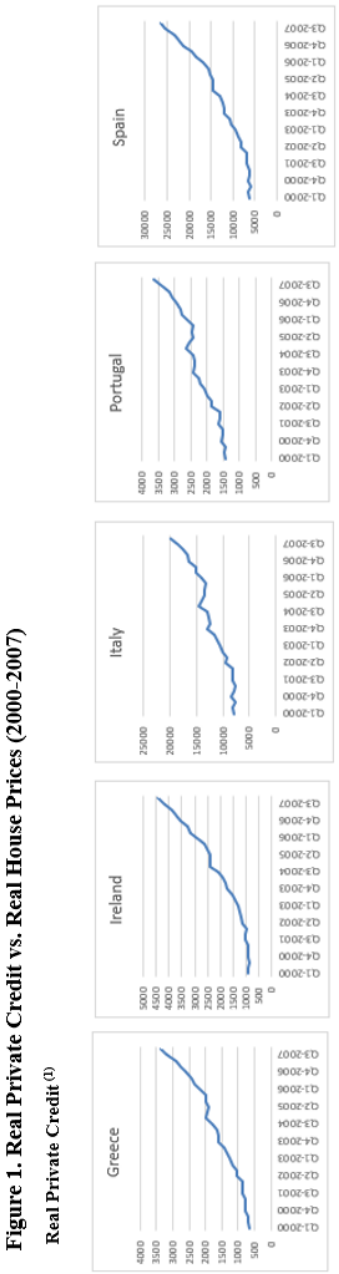
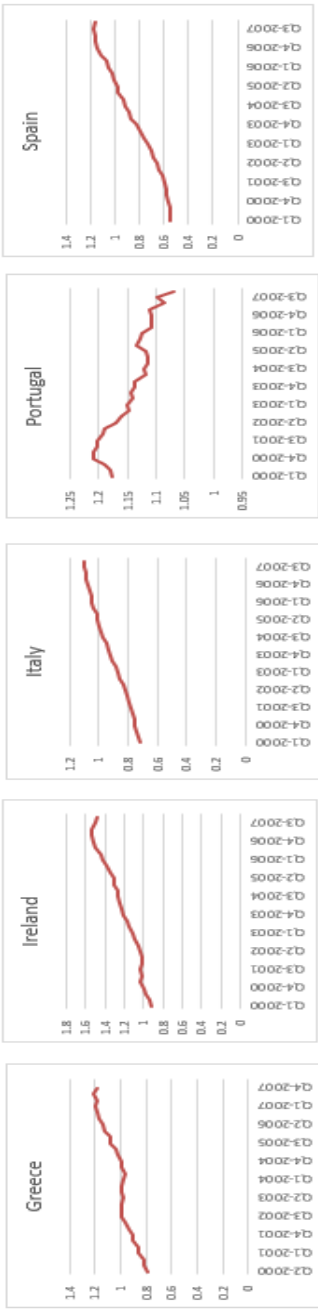


Figure 1. Real Private Credit vs. Real House Prices (2000-2007)



Source: BIS, 2018; OECD, 2018.
(1) Real outstanding private credit (billions of US dollar)
(2) Real house price index (2010=100)

In order to achieve our aims, two hypotheses will be tested.

$H_{1:}$ There is a two-way relationship between credit lending and house prices.

$H_{2:}$ The credit lending- house prices interaction differs at the country level although they may be governed by the same monetary policy.

In this study focused on the Eurozone and the GIIPS countries, the relationship in question is estimated by employing a vector autoregressive (VAR) model. The findings of the empirical analysis indicate there is one way relationship between credit lending and house prices for all samples and that its direction is from house prices to credit.

The contribution of the study to the literature is that it examines the interaction of credit lending with house prices at cross country and country levels in the Eurozone and reveal the direction and the size of this interaction. By so doing, the study addresses the effect of the common monetary policy on this relationhip in members of the Eurozone individually and compares them with each other. It also reveals the importance of the direction of casuality between credit and house prices and may thereby aid in prompting governments of the Eurozone members to implement more efficient micro and macro policies in their respective economies.

The paper is structured as follows: Section 1 provides a contextual background in the Eurozone and the GIIPS. In Sections 2 and 3 the literature review and theoretical framework are set out respectively. Section 4 covers the methodology and data description while Section 5 presents the empirical analysis and discusses the main findings. Section 6 includes the robustness check of these findings. Lastly, Section 7 sets out the main conclusions of the study.

I. The Eurozone and GIIPS Countries

The Eurozone is an economic and monetary union area of the EU, which is the example of the most advanced economic integration in the world. It was established in 1999. To join the Eurozone, the EU members need to meet certain criteria.[20] All these criteria are intended to increase

[20] These criteria are divided into three groups: legal criteria, convergence criteria and other criteria The legal criterion aims to provide the compatibility between the national legislation of each Member State other economic indicators, which also have a bearing on economic integration, but fall outside the convergence criteria. They include, the level of integration

economic convergence among member economies and promote the sustainability of macroeconomic stability in the Eurozone.[21]

The main characteristics of the Eurozone are the use of a single currency (euro), the existence of a single monetary authority (the European Central Bank - ECB) and the implementation of a single monetary policy as well as of a single exchange rate policy. The sole responsibility for these common policies lies with the ECB. The primary objective of the ECB, which operates entirely independently, is to ensure and maintain price stability in the Eurozone; its secondary objective is to implement monetary policy in line with the objectives of the European Union Treaty (e.g. full employment, economic and social progress, etc.). Thus, the countries in the Eurozone cannot implement their own monetary and exchange rate policies. They must relinquish their national currency and use the common currency. [22]

Today, not all members of the EU (27) are a part of the Eurozone because some are yet to fulfil the required criteria (e.g. Bulgaria and Hungary) or choose to remain outside (e.g. Denmark and Sweden). On its establishment in 1999 the Eurozone was a collaboration of 11 EU member states; today it comprises 19 states.[23] As at the end of 2017, the Eurozone realized approximately 72% of the total EU production.[24]

The GIIPS group comprises five countries, which are the members of the Eurozone, Greece, Ireland, Italy, Portugal and Spain. These countries were called as crisis countries of the EU, which faced sovereign debt crisis. This crisis has led to the questioning of the future of the economic and monetary area (the Eurozone), which is considered one of the biggest political and economic successes of the EU. Table 1 shows that as of the end of 2017, GIIPS economies have a share of 31.9% in the Eurozone with a production volume of 4.03 trillion dollars.[25] Especially Italy and Spain are the third and fourth-largest economies of the Eurozone and realize more than 80% of the total GIIPS production.

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of product and financial markets, developments in the balance of payments, developments in labour unit costs and other price statistics. These are considered within the scope of 'other' criteria. For more information, see ECB, *Convergence Report*, (Frankfurt: 2016).

[21] ECB, *Convergence Report*, (Frankfurt: 2016).

[22] ECB, *Monetary Policy of the ECB,* (Frankfurt: 2011).

[23] The Eurozone countries consist of 19 countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain.

[24] See World Bank, 2018, https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database (20.07.2018).

[25] In 2010, when the sovereign debt crisis began to spread, GIIPS was 34.2% in the production of the Eurozone (World Bank, 2018).

Table 1. Main Macroeconomic Indicators (as of the end of 2017)

Economic Indicators	Greece	Ireland	Italy	Portugal	Spain	Eurozone (19)
Population	10,768,413	4,784,313	60,589,445	10,309,573	46,528,028	340,511,142
GDP (PPP, 1000 000 USD dollar)	203.09	334.84	1956.96	220.8	1309.31	4024.995
Real economic growth rate (%)	1.5	8.1	1.7	2.8	3.0	2.5
Per capita GDP, (USD dollar)	29,089	78,128	41,785	33,086	39,576	45,742
Unemployment rate (%)	21.5	6.7	11.2	9.0	17.2	9.1
Inflation (HICP, %)	1.1	0.3	1.3	1.6	2.0	1.5
Long term interest rates (%) (*)	5.98	0.8	2.1	3.1	1.6	0.9
Current account balance /GDP (%)	-1.9	0.5	2.6	1.3	2.7	3.5
Government deficit-surplus /GDP (%)	0.7	-0.3	-2.4	-3.0	-3.0	-1.0
General government gross debt/GDP (%)	176.2	67.7	98.6	134.1	126.1	87.8

(*) 10-year central government bonds.

Source: Eurostat, 2018; the World Bank, 2018.

Although there are differences between the GIIPS economies in terms of the magnitude of economic problems (e.g. high current account deficits and high unemployment rate), which they faced, the trend and results of the developments in these countries before the sovereign debt crisis are alike to a large extent. In the period prior to the sovereign debt crisis, the current account deficits of all GIIPS were expanding at rates that exceeds the Eurozone average. In 2008, Greece (-15.1%), Portugal (-11.8%) and Spain (-8.9%) were the countries with the highest current account deficit / GDP ratio, respectively. In the same period, wages that increased above productivity in all these countries had a profound effect on increasing total demand while simultaneously increasing labour costs. The natural consequence of this impact has been the rise in inflation in all the GIIPS countries and thus remaining above the Eurozone average[26] in the pre-sovereign debt crisis period.

Similarly, the GIIPS countries are also among the leading net capital importer countries of both the world and Eurozone in the pre-sovereign debt crisis period. Foreign capital inflows into these countries increased regularly during this period. According to the IMF, the share of GIIPS countries, especially Spain, Italy and Greece, increased more than three times in 2009

[26] Ireland, whose inflation level increased 2.5 times the Eurozone average in 2000, was the country with the fastest price increases. Although this year followed a downward trend until 2006, it always remained above the Eurozone average, except for 2005 (Eurostat, 2018).

compared to 2002 and reached 8.2%, 6.4% and 3.7% respectively. However, with the crisis, foreign capital inflows decreased rapidly, and they faced a "sudden stop".[27]

In all the GIIPS countries, public debt had an upward trend before the crisis and the public debt/ GDP ratio remained well above the reference value of the Eurozone.[28] As of the end of 2008, Greece had the highest public debt / GDP ratio among the GIIPS. It was followed by Italy, Portugal, Ireland and Spain, respectively. In addition, the external debt stock of GIIPS has increased, especially since the mid-2000s. In fact, the external debt of not only the GIIPS but also of the Eurozone increased significantly during this period.[29] However, the growth rate of the GIIPS external debt stock was above the Eurozone average,[30] and during this period, the share of the GIIPS' total net external debt in GDP grew nearly eight times.[31]

Likewise, among the GIIPS economies is the downward trend of real interest rates above the Eurozone average. Since this situation increased the affordability of the households, it paved the way for the households to demand more goods and services, especially durable goods (e.g. housing), by receiving more credit. Along with the increasing demand for housing, housing credit demand increased. Total outstanding mortgage debt in all the GIIPS grew in 2008, above the Eurozone average (83%) when compared to the year 2000. Among these countries, the country where the mortgage debt increased the most was Greece (589%), and the least increase was observed in Portugal (107%). Greece is followed by Ireland, Spain and Italy,

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[27] IMF, *Global Stability Report*, March,2003; IMF, *Global Stability Report*, April,2010.

[28] The reference value of the government debt criteria that an EU member country must meet in order to participate in the monetary union area is based on the assumption that the share of public debt in GDP should not exceed 60% (see ECB, *Convergence, 11)*.

[29] Gross external debt is the amount of an economy's actual current liabilities that require payment of principal and interest to non-residents in the future. These liabilities include loans, deposits and commercial loans and advance payments, as well as debt securities such as bonds, promissory notes, money market instruments. Debt securities can be issued by government, banks and private companies in different terms (Jorge Dis Dias, "The External Debts Statistics of Euro Area", Final Version 12 October, paper presented in IFC Conference on Initiatives to address data Gaps Revealed by the Financial Crisis, 25-26 August 2010, http://www.bis.org/ifc/events/5ifcconf/dias.pdf (01.12.2017).

[30] As of the end of 2009, Italy ($ 2.33 trillion), Spain ($ 2.31 trillion) and Ireland ($ 2.31 trillion) had close debt stock in terms of external debt stock, but the gap between these countries in the following years grew bigger. By 2012, the external debt of Italy ($ 2.7 trillion) and Spain ($ 2.5 trillion) (IMF, 2009).

[31] As of the end of 2009, while the Eurozone average was 12.6%, Spain's net foreign debt / GDP ratio increased to 87.2%, Portugal's 85.1% and Greece's 84.6%. In fact, during this period, most of the Eurozone countries were in net debtor position, albeit at a lower level than the GIIPS countries (Dis Diaz, External, 24).

respectively.[32] However, the result of increasing housing demand, which could not be met by housing supply simultaneously has been rapidly increasing housing prices, except for Portugal. The increase in real housing prices was mostly in Spain (95%) and Ireland (60%).[33]

Similarly, the GIIPS economies have faced decreasing external debt payment capacity in the period before the sovereign debt crisis. The findings of the empirical studies show that the upper threshold is in the range of 2 to 3, and the debt crisis in many countries also occurs when this threshold is exceeded. As of 2009, even Italy, which has the lowest external debt/total export ratio among the GIIPS countries, is three times above this threshold.[34]

Another similar trend seen in GIIPS economies is increased budget deficits. However, despite showing similar trends, there are significant differences between the GIIPS in terms of their budget positions in the pre-crisis period. Unlike other crisis countries, Ireland was a country that had a budget surplus for many years but since 2008, its budget deficit increased the fastest among the GIIPS countries and the other countries in the Eurozone. The share of Ireland's budget deficit in GDP before the crisis, broke a record (-30.9%). On the other hand, Greece, Portugal and Italy are countries that have had a budget deficit far above the average of the Eurozone since they joined the Eurozone. Spain, on the other hand, is a country that generally had a budget surplus before the crisis. However, in 2008, its budget deficit was at the record level of -4.5%, which its highest level in the last 20 years.

The natural consequence of these developments before the crisis is the increased vulnerability in the GIIPS economies and their increasingly weakening competitive power in the international market. According to the World Economic Forum (WEF)'s report, while Italy and Greece are the most competing GIIPS countries, Spain, Portugal and Ireland (respectively) follow these countries.[35]

Although some economic problems continue, as at the end of 2017, there has been a significant improvement in all the GIIPS economies as displayed in Table 1. Among GIIPS countries, Ireland is the country with the highest economic growth, highest per capita income, lowest inflation and unemployment rates, government debt and budget deficit in 2017. The opposite is true for Greece. It is observed that the GIIPS countries, except Ireland, still have similar economic problems (e.g. high public debt, high unemployment, high budget deficit above the Eurozone average) even though their economic outlook have improved.

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[32] EMF*, Hypostat 2017,* November, Brussels, 2018.
[33] OECD (2018), https://stats.oecd.org/
[34] Buzaglo, Eurozone,79.
[35] Klaus Schwab, *The Global Competitiveness Report 2006-2017 (2017).*

II. Theoretical Framework

When assessing the interaction between credit lending and house prices, it is critical that housing be viewed as both an investment and consumption good. Theory asserts there is a bi-directional causality between both covariates, but the monetarist approach can also be used to explain this interaction. Within this approach there are two sub-groups: the financial accelerator mechanism approach and the mechanisms of optimal portfolio. It has also been observed that the life-cycle approach of household consumption has be drawn on to investigate the interaction between credit lending and house prices.

From the monetarist perspective, it is evident that monetary policy impacts the supply of credit. This view also contends that monetary expansion increases credit lending by affecting interest rates. However, the financial accelerator approach addresses the ways in which credit channels affect decisions at the household level by using the bank lending and balance sheet channels.[36] Both channels have an indirect influence on decisions made by households and firms as they affect their financial stature and uptake of investment opportunities. In a general sense, one may expect that when the supply of credit increases then households may prefer to purchase durable goods such as housing, while firms may prefer to purchase, plant. machinery, equipments and other types of inventory that will boost productivity.

It is noteworthy that although the balance sheet and bank lending channels both fall within the monetarist view, they operate differently. In this regard, the balance sheet channel influences the decisions of households and firms by making adjustments to interest rates along with their net worth and/ or liquidity of assets profile. On the other hand, the bank lending channel gives attention to how a country's monetary affects the credit lending of banks, which in turn may increase or decrease housing demand and house prices since housing demand generally outstrips housing supply in the short run but catches up with demand in the long run.[37]

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[36] Ben S. Bernanke ve Mark Gertler, "Agency costs, collateral and business fluctuations", *American Economic Review*, 79(1989), 14-31; Anıl Kashyap et al, Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance, *The American Economic Review*, 83(1), March, 78-98; Michael Bordo et al., "Economic policy uncertainty and the credit channel: Aggregate and bank level US evidence over several decades", *Journal of Financial Stability*, 26(2016), October, 90-106.

[37] Matteo Iacoviello, "House Prices, Borrowing Constraints, and Monetary Policy in the Business Cycle", *American Economic Review*, 95, No.3 (2005), 739–64.

In the event that monetary policy increases housing demand, then with higher housing prices, we can expect to see a large number of households and firms investing in the real estate housing markets. With higher prices comes higher values of the collateral persons will be burrowing against. As a result, the burrowing capacity of firms and households will increase, the value of houses will also increase and the spending levels among firms and households will increase.

As explained previously, another approach that has been used to evaluate the interaction between credit lending and house prices is the life cycle model of household consumption. This model is underpinned by the view that the credit lending-house prices relationship is directly influenced by the wealth and collateral effects created by the effect of increasing house prices on credit demand and supply. Accordingly, the authors of studies which utilized this approach contend there is a positive relationship between house prices and household expenditures and debts. They also assert that households strategize and plan their consumption and investment decisions at each phase of their development.[38]

Studies that have drawn on the lifecycle approach also demonstrate the cyclical nature of the interaction between credit lending and house prices. In this regard, when house prices increase, there is a positive effect on the burrowing capacities of household. Banks are more willing to provide mortgages to households when the value of their collateral is high. In such a case, banks will lend more capital and in turn the debt and spending levels of households increase.[39]

In a similar vein, Greiber and Setzer[40] along with Goodhart and Hofmann[41] assert that when house prices increase a welfare and collateral effect occurs. This they claim is due to the fact that economic actors will re-assess their investment decisions when prices are high and this re-assessment process will bring about a collateral and welfare effect, which will make

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[38] Meen, Geoff. *Modelling Spatial Housing Markets: Theory, Analysis and Policy*, (New York.: Springer Business Media, 2001); Angus Deaton, " Franco Modigliani and the Life Cycle Theory of Consumption", *BNL Quarterly Review*, 58(2005), 91-107; John Muellbauer ve Antony Murphy, "Housing, Credit and Consumer Expenditure", *Proceedings - Economic Policy Symposium* - Jackson Hole, Federal Reserve Bank of Kansas City, 2007, 267-334.

[39] Atif R. Mian and Amir Sufi, "House Price Gains and U.S. Household Spending from 2002 to 2006", NBER Working Paper No. 20152, May 2014.

[40] Claus Greiber and Ralph Setzer, "Money and housing – evidence for the euro area and the US", Deutsche Bundesbank Discussion Paper Series 1: Economic Studies No 12/2007.

[41] Charles Goodhart and Boris Hofmann House prices, money, credit, and the macroeconomy, *Oxford Review of Economic Policy*, 24(2008).

credit more affordable to the market. In light of this, both studies concluded that the interaction between credit lending and house prices is two-fold as house price adjustments can positively or negatively affect house values or monetary expansion can reduce interest rates which will increase the demand and supply of credit, which increases house prices.

In summary, both the monetarist and lifecycle approaches conclude there is a mutual causality between credit lending and house prices and that there is mutual interaction between both variables. However, their point of departure relates to the origin of the relationship.

III. Methodology and Data Description

This study examines the dynamic interaction between credit lending and house prices in the Eurozone and GIIPS countries over the period 1999q1–2017q3, by using quarterly data. Our sample includes 11 countries of the Eurozone,[42] which became members the EU prior to 2004. The GIIPS group consists of five countries of the Eurozone, which faced the sovereign debt crisis between 2010 and 2012, soon after the 2007-2008 global financial crisis. The GIIPS countries are Greece, Ireland, Italy, Portugal and Spain.

The analysis, at both the cross-country and individual-country levels, is based on certain assumptions, namely: there is a two-way causality between credit and house prices in the Eurozone and the GIIPS countries**;** these countries have the same direction of the relationship between credit and house prices as they are members of the Eurozone with a common monetary policy. Thus, this study makes it possible to discover whether there are differences in terms of the size and direction of the relationship between credit lending and house prices between individual countries with the same monetary policy in the Eurozone.

In order to achieve our aim, the vector autoregressive (VAR) approach is used. The VAR model is a powerful tool in terms of revealing dependencies between sectors and markets links in an economy to capture the structural time variation in the dissemination of impacts of the shocks or the connections between regions or countries in today's increasingly globalised world.[43] In VAR modelling, the equation for each endogenous

[42] They are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, and Spain.

[43] See. Chris Brooks, *Introductory Econometrics for Finance,* second edition (New York: Cambridge University Press, 2008); Fabio Canova, *Methods for Applied Macroeconomic Research*, (New Jersey: Princeton University Press, 2011).

variable is derived from its lagged value, the lagged values of the other endogenous variables, and possibly some other control variables.

For this study, we have followed the approach of Abrigo and Love in constructing our panel VAR model. The empirical analysis comprises two stages. In the first stage, we estimate the VAR model for the Eurozone at the cross country leve, while in the second stage, we estimate the VAR model for the GIIPS countries at the individual country level. Our panel VAR model with panel-specific fixed effects consists of a two equations system in which credit and house prices are specified as endogenous variables.

Model specification

In this study, our VAR model consists of a credit and house price equation that each have two control variables.

The first equation (Equation 1) is the credit equation, which includes gross domestic product (*gdp*) and short term interest rates (*sint*) as control variables. These variables were selected as a result of the standard credit model used in studies such as Bernanke and Gertler[44] and Hofmann. The standard credit model indicates that credit lending is a direct function of financing cost and economic activity (GDP). Studies such as Helbling[45] *et al*. (and Gertler and Kiyotaki[46] suggest, there is a strong positive relationship between credit lending and economic activity because the latter determines the uptake of investments and consumption levels. As such, we can expect to see a positive relationship between credit lending and GDP. We can also expect to see an inverse relationship between credit lending and financing cost (i.e. short term interest rate) because with higher short term interest rates, the cost of credit increases and as such there should be a falling off in the demand for credit.

Our second equation (Equation 2) is the house price equation. Our control variables in this equation were selected based on the frequently referred to supply-demand approach that can be seen in studies such as Oikarinen[47] and Bahmani-Oskooee and Ghodsi.[48] In constructing this

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[44] Bernanke ve Gertler, Agency,1989, 213.

[45] Thomas Helbling, "Do credit shocks matter? A global perspective", *European Economic Review,* 55 (2011), 340-353.

[46] Mark Gertler and Nobuhiro Kiyotaki, "Banking, Liquidity, and Bank Runs in an Infinite Horizon Economy", *American Economic Review*, 105(2015), 2011-2143.

[47] Oikarinen, Interaction, 451.

[48] Mohsen Bahmani-Oskooee ve Seyed Ghodsi, "Asymmetric Causality between Unemployment Rate and House Prices in Each State of the U.S.A", *International Real Estate Review,* 12, No.1 (2018), 71-92.

equation w adopted the assumption that in the long run supply side factors have a negligible effect on house prices.[49] The selected control variables for this equation are income (*gdp*) and term spread (*dfint*).

In light of the aforementioned, the two equations that were used to test the multifaceted relationship between credit and house prices are as follows:

$$credit_t = \beta_0 + \beta_1 credit_{t-p} + \beta_2 hprice_{t-p} + \beta_3 contol\ variables_t + U_1 \quad (1)$$

$$hprice_t = \beta_0 + \beta_1 hprice_{t-p} + \beta_2 credit_{t-p} + \beta_3 control\ variables_t + U_2 \quad (2)$$

i = 1, 2, 3, N; t= 1, 2, 3…T

Where *credi*t is the quarterly private credit lending to households and companies in country *i* at time *t* and *hprice* is the quarterly house prices in country *i* at time t; *p* is the lag length and U_1 and U_2 are the error terms.

All variables were entered in the model as first- differenced of real terms where, with the exception of interest rates, the natural logs of all covariates were used. We anticipate that the analysis will reveal there is a positive relationship between credit lending and house prices. We are also of the view that both variables will have a positive relationship with GDP and share an inverse relationship with short term interest rates and term spread.

Data Description

The data sample consists of the 11 countries in the Eurozone. Six variables have been collected for each country over the period 1999q1 to 2017 q3. These variables are: credit lending house price, economic activity, consumer price index, term spread and short-term interest rates. With the exception of the credit lending variable, all data were obtained from the Organization for Economic Cooperation and Development (OECD). The data for the credit variable was obtained from the Bank for International Settlements (BIS). Appendix 1 sets out the definitions and sources of the dataset.

It is noteworthy that to avoid the multicollinearity problem, the credit lending to GDP ratio is used as a proxy for the credit variable. The consumer price index (2010 = 100) was used to transform all covariates from nominal to real values. All covariates with the exception of short term interest rates and term spread variables were transformed into logarithmic form. In

[49] Meen, Modelling, 236-238; Oikarinen, Interaction, 751; Basten and Koch,Causal, 1-22.

relation to economic activity, quarterly GDP (current prices in US dollars) is used as a proxy for total output, which is used to represent economic activity in our model. Therefore, GDP was used to represent economic activity and total income because there is limited data on household income in the long run.

IV. Empirical Analysis and Main Findings

This section presents the results of the empirical analysis. Before the VAR model is estimated, we first conducted stationarity tests for all variables and then, the VAR structure is identified. To ensure that the variables are stable, the Augmented Dickey-Fuller statistic test is applied. As illustrated in Table 2, the results of the unit root tests show that all variables in levels are non-stationary at both cross-country and individual country level. Therefore, all variables are as first differenced in our VAR model.

Table 2. Unit Root Tests (Augmented Dickey-Fuller (ADF) Test)

	Credit		House Prices		Economic Activity		Short-term Interest rates		Term Spread	
	Level	First difference	Level	First difference	Level	First difference	Level	First difference	Level	First difference
Eurozone	0.20336	-9.7354***	2.1279	-60.7701***	0.53454	-22.3721***	-0.1929	-11.2731***	-4.0318	-16.0088***
Greece	-0.1704	-4.3196***	-0.0802	-1.6187*	0.2108	-4.8397***	1.1047	-3.4362***	-2.283141	-4.797629 ***
Ireland	0.2635	-3.6369***	-0.2045	0.3605*	1.1544	-4.5252***	1.1047	-3.1564***	-1.887331	-0.068486***
Italy	-0.1318	-5.0052***	-3.2935	0.2591**	-0.0701	-5.2382***	1.1047	-3.1564***	-1.960304	-0.073640***
Portugal	-4.8997	-4.8997***	-.4517*	1.9622**	0.0184	-5.0233 ***	1.1047	-3.1564***	1.985104	-0.052083***
Spain	-4.2464	-4.2464***	-.4517	-0.4871*	0.0184	-5.0233 ***	1.1047	-3.1564***	-1.970476	-0.067607**

Note that: The table presents Augmented Dickey-Fuller (ADF) test statistics for the null hypothesis of a unit root. In ADF, probabilities for Fisher tests are asymptotic normality. (***) indicates that null hypothesis is rejected at the statistical significance levels of 5 and 10 percent respectively.

For identifying the structure of the VAR model, the lag length needs to be selected. Determining an appropriate lag is of critical importance. For this, one approach is to use of information criteria.

In this study, considering the quarterly frequency, to select the number of lag orders, up to five lags are tested for validity and the lag length is decided according to the lowest value of the Bayesian information criterion (BIC) (or Schwarz information criterion) which is based on the estimated standard errors.[50] The results show that the first order should be selected for all samples (Table 3 and Table 4).

Table 3. Lag order Selection for the Eurozone

Eurozone						
LAG	CD	J	J pvalue	MBIC	MAIC	MQIC
1	0.3756601	237.5695	3.30E-13	-423.6346	37.56949	-140.209
2	0.5904205	173.0438	3.06E-08	-327.3288	23.04381	-110.2901
3	0.6906436	106.112	6.45E-06	-224.4901	6.111974	-82.77726
4	0.7499692	81.13025	7.58E-08	-84.17077	31.13025	-13.31437

Note that: *CD*: over-all coefficient determination; *J statistic*: statistics of over identifying restrictions in the model (i.e. the Sargan–Hansen test*); J pvalue*: p-values for Hansen`s J statistics; *MBIC:* Bayesian information criteria (or Schwarz information criterion); *MAIC*: Akaike information criteria; *MQIC*: Hannan-Quinn information criteria.

[50] Brooks, Introductory, 321.

Table 4. Lag order Selection for the GIIPS Countries

Greece								
LAG	LL	LR	df	p	FPE	AIC	HQIC	BIC
0	633.997				1.40E-13	-18.2608	-18.2694	-18.1313
1	680.216	53.242	16	0.000	5.70E-14	-19.1367	-18.8798	-18.4891
2	706.837	109.9376	16	0.000	4.20E-14	-19.4445	-18.9821	-18.2789
3	714.59	15.506	16	0.488	5.50E-14	-19.2055	-18.5375	-17.5218
4	724.104	19.028	16	0.267	6.70E-14	-19.0175	-18.144	-16.8158
5	740.723	33.238	16	0.007	6.90E-14	-19.0354	-17.9564	-16.3157
Ireland								
LAG	LL	LR	df	p	FPE	AIC	HQIC	BIC
0	665.368				5.60E-14	-19.1701	-19.1187	-19.0406
1	718.361	105.99	16	0.000	1.90E-14	-20.2423	-19.9854	-19.5948
2	730.117	23.513	16	0.101	2.20E-14	-20.1193	-19.6569	-18.9537
3	742.263	24.292	16	0.083	2.40E-14	-20.0076	-19.3397	-18.324
4	755.872	27.217	16	0.039	2.70E-14	-19.9383	-19.0648	-17.7366
5	762.211	12.679	16	0.696	3.70E-14	-19.6583	-18.5793	-16.9385
Italy								
LAG	LL	LR	df	p	FPE	AIC	HQIC	BIC
0	848.841				2.70E-16	-24.4881	-24.4368	-24.3586
1	949.936	202.19	16	0.000	2.30E-17	-26.9547	-26.6977	-26.3071
2	975.008	50.144	16	0.000	1.80E-17	-27.2176	-26.7552	-26.052
3	985.13	20.245	16	0.209	2.10E-17	-27.0473	-26.3798	-25.3636
4	1003.18	36.099	16	0.003	2.10E-17	-27.1067	-26.2332	-24.9049
5	1008.76	11.169	16	0.799	2.90E-17	-26.8048	-25.7257	-24.085
Portugal								
LAG	LL	LR	df	p	FPE	AIC	HQIC	BIC
0	801.395				1.10E-15	-23.1129	-23.0615	-22.9834
1	839.988	77.186	16	0.000	5.60E-16	-23.7678	-23.5108	-23.12
2	856.856	33.737	16	0.006	5.50E-16	-23.7929	-23.3305	-22.6273
3	867.444	21.177	16	0.172	6.50E-16	-23.6361	-22.9681	-21.9524
4	881.259	27.629	16	0.035	7.10E-16	-23.5727	-22.6992	-21.371
5	892.994	23.47	16	0.102	8.30E-16	-23.4491	-22.3701	-20.7293
Spain								
LAG	LL	LR	df	p	FPE	AIC	HQIC	BIC
0	764.718				3.10E-15	-22.0498	-21.9984	-21.9203
1	850.391	171.35	16	0.000	4.10E-16	-23.7745	-23.5174	-23.1267
2	875.461	50.14	16	0.000	3.20E-16	-24.0322	-23.5698	-22.8666
3	887.654	24.387	16	0.081	3.60E-16	-24.2219	-23.5539	-22.5382
4	906.285	37.261	16	0.002	3.40E-16	-24.2981	-23.4246	-22.0964
5	919.049	25.527	16	0.061	3.90E-16	-24.2049	-23.1253	-21.4845

Note that: The number of observations is 69 for each of the countries. *LL*: Likelihood; *LR*: Likelihood ratio; *df:* degree of freedom; *p:* p-value; *FPE*: Final prediction error; *AIC*: Akaike information criteria; *HQIC*: Hannan-Quinn information criteria; BIC*:* Bayesian information criteria (or Schwarz information criterion).

A. Results

Table 5 presents the estimation results of VAR model for the Eurozone and each of the countries in the GIIPS group by considering the first order for all the samples.

The first phase of the analysis is focused on the interaction between credit lending and house prices for the Eurozone, the estimation results confirm the hypothesis being tested and assert a dynamic relationship between credit and house prices. The signs of the estimated coefficients of the endogenous variables (*dlnrcredit and dlnrhprice*) indicate there is a positive relationship between credit and house price variables. The results show that changes in house prices have caused credit to change in the same direction. The same can be seen in the relationship between both endogenous variables. The results of the cross-country analysis also show that the effect of house prices on a change in credit lending is stronger than the effect of credit lending on a change in house prices. Similarly, the signs of estimated coefficients of the exogenous variables (i.e. economic activity, total income, short-term interest rates and term spread) are as expected. The economic activity and total income affect credit and house prices in the same direction and a change in interest rates adversely affects both endogenous variables. In addition, the findings for the Eurozone show that housing demand, and hence house prices is the most sensitive to a change in interest rates. This may be taken as an indication that affordability of credit is a more important factor than income in households' borrowing decisions.

In the second phase of the analysis, the relationship between credit lending and house prices is examined for each of the GIIPS countries in the Eurozone. That is, this relationship is explored for Greece, Ireland, Italy, Portugal and Spain. To achieve this, we re-estimated the VAR model at the country level, by using the first order lag for each of the individual countries.

The individual country findings are similar to those of the Eurozone and show that there is a dynamic relationship between credit and house prices, but with different magnitudes. Again, the effect of house prices on a change in credit lending is stronger than the effect of credit lending on a change in house prices or all individual countries in the lag order one, but with different strengths. Among the GIIPS countries, the effect of house prices on a change in credit lending is strongest in Spain and weakest in Ireland. Conversely, the strongest impact of a change in credit on house prices is in Greece while the weakest is in Italy.[51]

[51] In fact, in the real world, all variables of the VAR model, could be regarded as endogenous. Indeed, the empirical study of Goodhart and Hofmann (2008) on this issue confirm the results. As a matter of fact, when we estimate the VAR model for each of individual countries without any assumption based on the fact that there are control

Table 5. Estimation Results

	Eurozone		Greece		Ireland		Italy		Portugal		Spain	
	credit	hprice	credit	hprice	credit	hprice	credit	hprice	credit	hprice	credit	hprice
$dlnrealhp_{t-1}$	.0869**	-.3978***	.2523***	.6009***	.0807*	.7690***	.1849**	.9696***	.3769**	.6105***	.4777***	.8769***
	(0.043)	(0.000)	(0.000)	(0.000)	(0.090)	(0.000)	(0.098)	(0.000)	(0.022)	(0.000)	(0.000)	(0.000)
$dlncredit_{t-1}$	-.0226*	.0117	.1103***	.0600**	.4987***	.0145*	-.0083	0.013	.1198***	.0383	.0568g*	.0217*
	(0.063)	(0.232)	(0.003)	(0.048)	(0.000)	(0.093)	(0.716)	(0.125)	(0.002)	(0.109)	-0.099	(0.096)
dlnrealgdp	.9807***	.0214**	.9669***	.0245	1.040***	.1042**	1.0020***	.0047	1.0124***	.0188	.9959***	.04563*
	(0.000)	(0.038)	(0.000)	(0.365)	(0.000)	(0.07)	(0.000)	(0.672)	(0.000)	(0.398)	(0.000)	(0.065)
drealsint	-.1094	-.4435	-.3843	-.9702**	-1.3769	-.4239	-.1324	-.6429**	-.9118	-.0993	-.4386*	-.6359
	(0.861)	(0.363)	(0.110)	(0.012)	(0.102)	(0.799)	(0.137)	(0.014)	(0.154)	(0.800)	(0.077)	(0.255)
drdfint	-.1757	-.3651	-.3041	-.1553	-.9645	-.4501	-.1438	-.4068	-.4179	-.0568	-1.3735**	-.3659
	(0.675)	(0.298)	(0.250)	(0.194)	(0.89)	(0.641)	(0.613)	(0.106)	(0.426)	(0.855)	(0.05)	(0.391)

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. The variables are transformed in logarithms except for short term interest rates and term spread. Also, all variables with their first difference at real terms. The lag order is one for all samples. *dlnrlhprice*: house prices, *dlncredit*: private credit, *dlnrgdp*: economic activity (and total income), *drsint*: short- term interest rates; *drdfint*: term spread.

variables, the results themselves confirm this (see Appendix 3.8). In this case, all variables are treated as endogenous and that each variable's equation has its own lagged value, the lagged values of the other model variables, and an error term. As the focus of this study is to examine the relationship between credit supply and house prices, we estimate the panel VAR model by assuming that all other variables are exogenous except for house prices and credit variables.

From these results, it can be suggested that the common monetary policy determined by the ECB can produce different outputs for each of the GIIPS countries of the Eurozone with respect to the strength of the relationship of credit lending with house price.

In practice, the VAR model estimates are evaluated together with other tools of the VAR approach.[52]Thus, after estimating our model, Granger causality tests and impulse response functions were performed.

Granger causality test

An examination of causality in the VAR model helps with identifying whether an endogenous variable in the model has a statistically significant effect on the future values of each of the other endogenous variables in the system.[53] The causality test results show whether a change in one of our endogenous variables gives rise to a change in the other. In addition, they point out whether one of the endogenous variables has a unidirectional, a bidirectional or no interaction with other endogenous variable.

The Granger causality test results for the Eurozone and the GIIPS countries are displayed in Table 6. The results for the Eurozone show that it has a one-way interaction between credit lending and house prices in one lagged quarter. However, the results do not confirm our first hypothesis for the Eurozone, which suggests there is a two-way interaction between credit lending and house prices. In addition, **t**he direction of the causality is from house prices to credit.

The findings of the Granger causality test, which was applied separately to the GIIPS countries are similar to those of the Eurozone. As in the case of the Eurozone, these results do not also support the first hypothesis for the five countries because the causality test results show that there is a one-way causality between credit and house prices, except for Greece, which has a two-way causality.

[52] Brooks, Introductory; Canova and Ciccarelli, Methods.

[53] Jeffrey Woodridge, I*ntroductory Econometrics: A Modern Approach,* Sixth Edition, (Cengage Learning, the USA, 2016); Brooks, Introductory.

Table 6. The Results of Granger Causality Test

		Credit Equation		Housing Price Equation		Causality and direction	
		dlnrhprice	All	dlnrcreditt	All		
Eurozone	Lag order: 1	4.284**	4.284**	1.426	1.426	One way	HP → CRE
Greece	Lag order: 1	3.920**	3.920**	3.669***	3.669***	Two way	HP ↔ CRE (1)
Ireland	Lag order: 7	4.107 **	4.1077**	0.201	0.201	One way	HP → CRE
Italy	Lag order: 1	2.730*	2.730*	1.352	1.352	One way	HP → CRE
Portugal	Lag order: 1	5.278**	5.278**	1.980	1.980	One way	HP → CRE
Spain	Lag order: 1	13.115***	13.115***	8.580	8.580	One way	HP → CRE

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively.

HP: housing price; CRE: private credit.

(1) The effect of housing prices on credit is stronger than that of credit on housing prices.

The direction of the causality is from house prices to credit in Ireland, Italy, Portugal and Spain. In Greece with two way causality, the direction of causality from house prices to credit is also stronger than that from credit lending to house prices. Thus, the country level results do not confirm the first hypothesis except for Greece.

In addition, among the GIIPS countries, the strength of the causality changes from a country to another. Spain has a stronger causality than the others while the weakest causality is in Italy. The same exists relating to the length of time of interaction. The interaction between credit and house prices can be observed in all countries in the same period, except for Ireland While the causality starts in the seventh lagged quarter in Ireland, in the other GIIPS countries, it starts in in first lagged quarter As a result, the results also confirm the second hypothesis. From these results, one suggestion is that the common monetary policy determined by the ECB can produce different outputs for each of the GIIPS with respect to the relationship between credit and house price.

Another suggestion that may emerge in light of the aforementioned findings is that the housing markets, not the credit markets, are decisive in credit lending - house prices relationship in all the GIIPS countries, even when causality is bi-directional. In this case, contrary to expectations, a single monetary policy alone may not have a strong impact on the causal relationship between credit lending and house prices in the Eurozone at cross country and country levels. As such, while governing the relationship of credit lending with house price is important, an integral part of the governance system has to be that consideration is given to both credit policies and housing market policies together by the ECB.[54] This is because although the ECB is the only authority with the responsibility to govern the Eurozone credit markets by determining monetary policy, the housing markets of each country are governed by national policies. This highlights the need for close coordination between the ECB and national authorities in order to simultaneously achieve the objectives of stability in both credit and housing markets in the Eurozone.

As a result, the causality test results indicate that despite a common monetary policy, not only do the magnitude and direction of this interaction vary from country to country in the Eurozone, but so does the length of time of the interaction as is the case with Ireland.

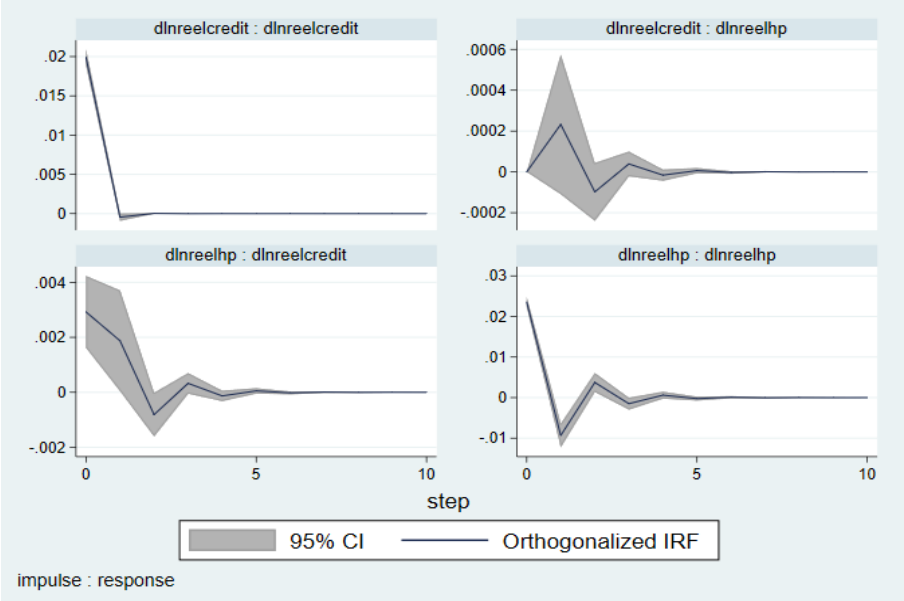
[54] Housing polices include investment in social housing, rent controls, and support for alternative types of rental housing (such as co-ops).

Impulse responses function

Impulse response functions are used to track impulses of system shocks to responses of system variables. In the impulse response function, a unit of shock is applied for each endogenous variable in each equation, and its effect on the VAR system is observed within a certain time period.[55] In order to observe the effects of impulses of shocks vis-à-vis the responses of the endogenous variables (i.e. credit and house prices) in our VAR model, first a unit of shock is applied to the model by taking the Eurozone, then each country in the GIIPS group.

Figure 2 and Figure 3 display the impulses and responses of endogenous variables for the Eurozone and each of the GIIPS countries in a 95% confidence band. Looking at the Eurozone, when one standard deviation shock on credit is applied, the effect of the shock on house prices is significantly positive for one step and then insignificant (Figure 2). When a unit of shock on house prices is applied, the effect of the shock on credit lending is significantly negative.

Figure 2. Impulse Response Functions for the Eurozone

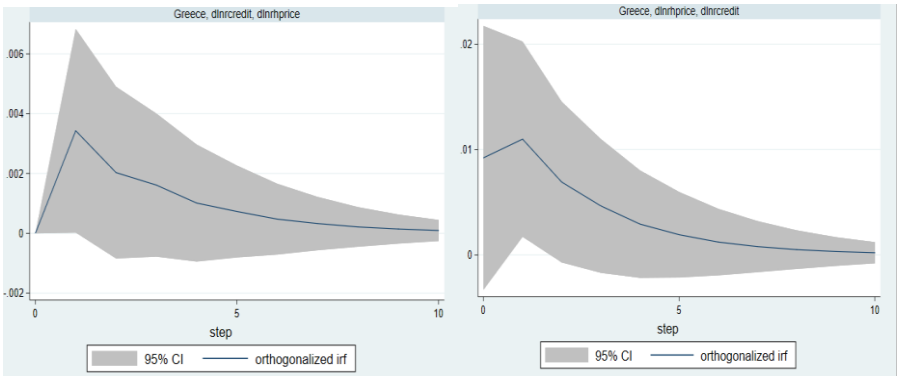


Note that: *dlnrcredit:* credit/GDP and *dlnrhprice*

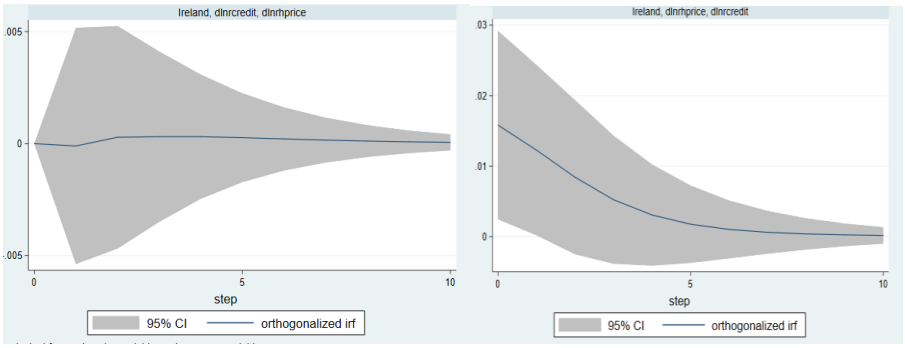
[55] Brooks, Introductory; Woodridge, Introductory.

Figure 3. Impulse Response Functions for the GIIPS Countries (I)

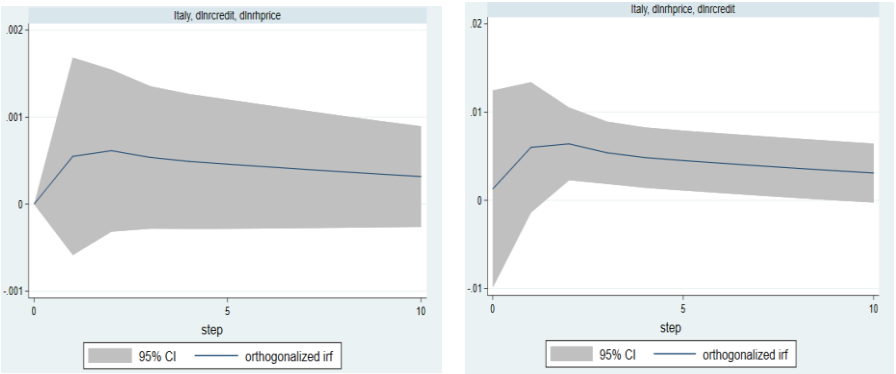
Greece



Ireland



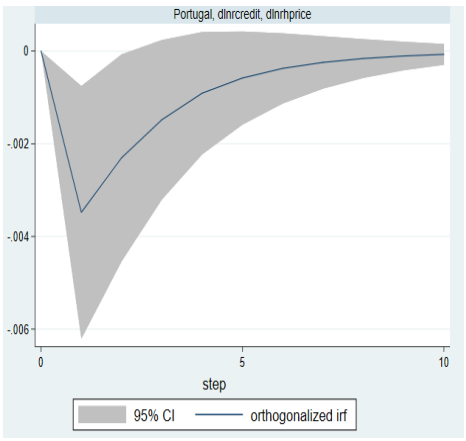
Italy

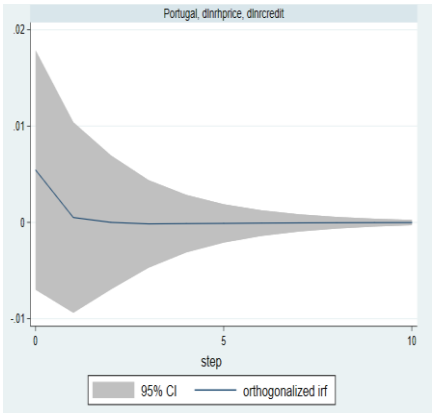


Note that: *dlnrcredit:* credit /GDP and *dlnrhprice*: house price

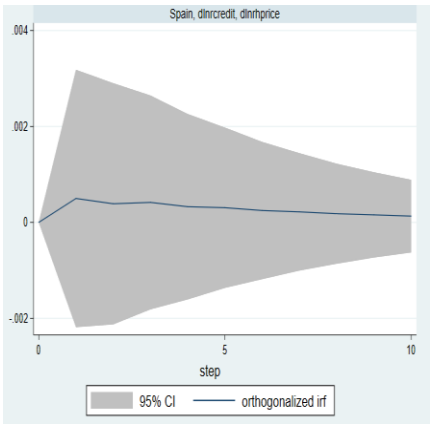
Figure 3. Impulse Response Functions for the GIIPS Countries (II)

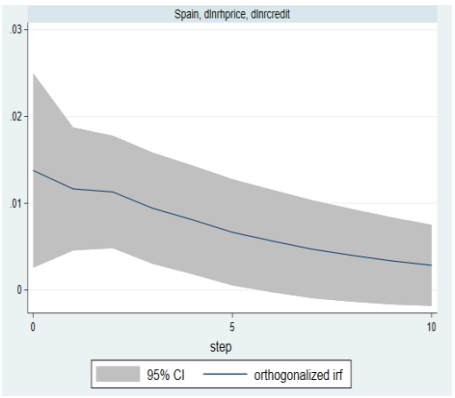
Portugal





Spain





Note that: *dlnrcredit:* private credit /GDP and *dlnrhprice*: house price.

In Greece, when a positive shock on credit lending to house price occurs, the response of house prices is significant for two steps, in which prices increase; thereafter it is insignificant (see Figure 3). In Portugal, the effect of one-unit shock to credit lending is similar to Greece but in Portugal, the response is significantly negative and occurs in a shorter time.

On the other hand, for the remaining GIIPS the impacts of a positive shock on house prices to credit lending are not significant. In applying a

positive shock to house prices, the response of credit is almost similar in three of the GIIPS countries (Greece, Italy and Portugal) but not significant (see Figure 2 and 3). In Ireland, the impact of this shock is significant for the first step and then disappears, while in Spain this effect continues for longer (about five periods) than in Ireland until it disappears.

In summary, these findings are in line with previous studies, which show the existence of the relationship between credit and house prices in the long term for the Eurozone, Greece, Ireland, Italy, and Spain[56] as well as the existence of the causality between both variables.[57] In addition, our results relating to the direction of the causality largely confirm the results of previous studies covering these countries individually. However, both cross-country and country specific results are not largely consistent with the theory except for Greece**.** That is, there is no two-way causality between credit and house prices for all samples.

The results of the empirical analysis at the cross-country and country levels also confirm the second hypothesis, but not the first hypothesis of the study. That is, the causality between credit lending and house prices exists in the Eurozone and each of the GIIPS, but its direction is not two way, except for Greece and also that this relationship looks different in the GIIPS countries in the Eurozone. Despite a common monetary policy, not only do the magnitude of the causality relationship can vary from country to country, but so does the length of time of the causality. One possible explanation for this result can be that there is heterogeneity in the monetary policy transmission on house prices. This result is consistent with previous studies on the effect of monetary policy on housing markets in the EU.[58] In this case, it can be argued that besides the monetary policy, the relationship between credit and house prices is affected by other factors, such as economic structure, the level of financial development, the sensitivity of the economy to external developments, the institutional environment, and macroeconomic environment etc.

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[56] Based on the literature review, it is observed that there is no study on examining this relationship for Portugal.

[57] For example; Greiber and Setzer, Money, 7-8; Fitzpatrick and McQuinn, House, 82–103; Brissimis and Vlassopoulos, Interaction, 146–164; Gimeno and Martínez-Carrascal, Relationship, 1844-1855; Nobili and Zolina, Structural, 73–87.

[58] Bing Zhu et al. "Housing market stability, mortgage market structure, and monetary policy: Evidence from the euro area", *Journal of Housing Economics*, 37(2017), 1–21; Alessandro Calza et al., "Credit in the euro area: An empirical investigation using aggregate data", *Quarterly Review of Economics and Finance*, 46(2006), 211-226.

B. Other Factors

In this section, we examine whether there is a difference between GIIPS countries, with respect to the institutional environment, financial development and macroeconomic environment, which are among the factors predicted to affect the relationship between credit lending and house price.

Institutional environment, which is the organization of society, can result in different directions of causality and strengths of the relationship between house price and credit lending in GIIPS countries. This is because institutions determine rules of the game in an economy and thus affect the allocation of resources.[59] According to North, institutions are formal institutions (rules, laws), informal institutions (habits and customs) and their enforcement.[60] The generally accepted definition is that institutions embody the norms, regulations and laws that establish the rules of the game. Previous empirical studies show that institutions create differences among countries by influencing the structure and functioning of markets in the economy (e.g. credit markets and housing markets) and their development.[61] Due to this, institutional environment can be one of the important factors in understanding the differences among the countries relating to the relationship between credit lending and house prices.

Another reason why the relationship between credit and house prices is different between the GIIPS countries may be their different levels of development amidst their financial markets. The financial sector is an integral part of the economy as a provider of financial services to the public sector and private sector (i.e. households and companies). Investment is vital for economic development and productivity growth, and capital needs to be easily accessible. Therefore, economies require sophisticated financial markets that can make capital available. A developed financial sector is one

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[59] Douglas.C. North, *Institutions, Institutional Change and Economic Performance*, (New York: Cambridge University Press**,** 1990); Dani Rodrik, Getting Institutions Right, (2004), https://drodrik.scholar.harvard.edu/publications/getting-institutions-right (11.08.2016); Daron Acemoğlu et al., "Institutions as the Fundamental Cause of Long-Run Growth", *Handbook of Economic Growth,* eds. Philippe Aghion and Steven N. Durlauf, Vol.1-B, (Amsterdan: North-Holland Publishing Co., 2005), 386-472.

[60] Douglas.C. North, "Economic Performance Through Time", *The American Review,* 84(3), (1994), 359-368.

[61] Rafel La Porta et al., Law and Finance", *Journal of Political Economy*, 106 (6) (1998), 1113-1155; Michael Ball, Colin Lizieri ve Bryan MacGregor, E*conomics of Commercial Real Estate Markets, (*Abingdon on Thames: Routledge, 1998), 22-32; Raj Aggarwal ve John W. Goodell, "Markets and institutions in financial intermediation: National characteristics as determinants", *Journal of Banking & Finance*, 33 (2009), 1770–1780; Gaganis, National culture, 19–41.

with the lowest risk, minimum transaction costs, normal profit opportunities, and access for all market participants in the credit markets to full information – and thus essentially well-functioning. In such markets, no market participant (e.g. financial intermediaries, lenders, investors and borrowers) has a privileged position in estimating market prices since there are no data that could provide any additional advantage.[62] The lack of these characteristics can affect the financial sector, such as the functioning of the credit markets (e.g. availability of financial services, ease of access to loans, credit affordability, the nature of financial activities), and thus the magnitude of the relationship between credit lending and house prices.

On the other hand, another factor that can make a difference in this relationship can be the macroeconomic environment. In general, the macroeconomic environment encompasses the trends in production, expenditures, employment, inflation and implemented economic policies in a country. A stable macroeconomic environment contributes to the growth of the economy and increasing the living standards of the society. Even if the financial markets of the countries have a similar structure and development level, the existence of macroeconomic stability may affect the expectations of the market participants (households, financial intermediaries, investors) and thus, their decisions (e.g. amount of credit lending, housing demand), and may create different results from country to country. If there is no stability in the economy, the relationship of credit with house price can be influenced significantly because financial markets and market participants cannot operate efficiently.

In order to see whether there is a difference between the economies in the GIIPS group in terms of institutional environment, financial development and macroeconomic environment, the sub-indices[63] produced by World Economic Forum (WEF) are to be taken into account. They are Institutions, Financial Market Development and Macroeconomic Environment sub-indices. They cover the different dimensions of the economy.

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[62] Frederic S. Mishkin ve Stanley G. Eakins, *Financial Markets and Institutions,* Eight Edition, (London, Pearson Education Ltd., 2016), 221-229; James Tobin, "On the Efficiency of the Financial System", *Lloyds Bank Review,* 153(1984), 1-15.

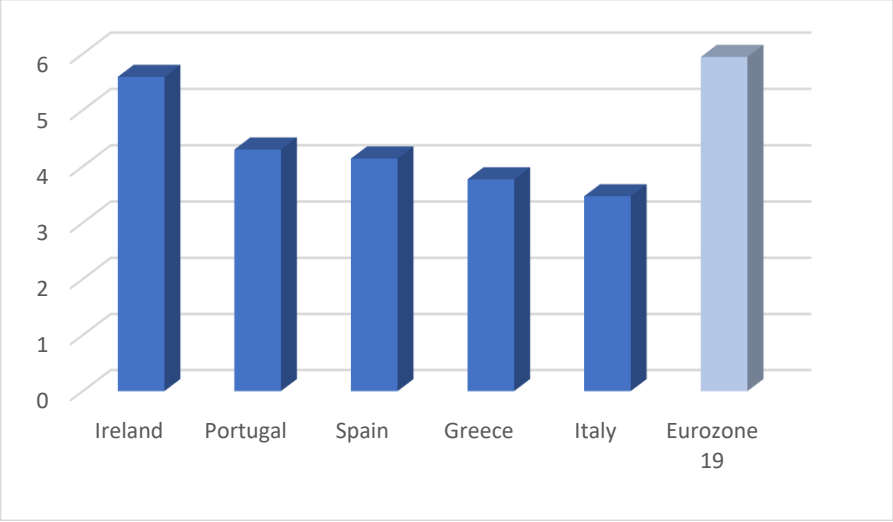
[63] They are the sub-indices of Global Competitiveness Index developed to measure the competitiveness of the countries. The Global Competitiveness Index, which is developed by the WEF for 138 countries is a benchmark for the drivers of long-term competitiveness. It is counted by considering 12 features of a country (e.g. institutions, financial system, infrastructure, macroeconomic stability, health, skills, labour market; ICT adoption) For more information see Schwab, Klaus (ed.), *The Global Competitiveness Report 2006-2017*, (World Economic Forum, Geneva, 2017), 8-11.

In these indices, countries are given *one* to *seven* points. *One* indicates the country in the weakest position within the index. For *seven,* the opposite is true. In other words, the country score approaching *seven* means that its economy has a more developed financial sector than those of others, a better functioning corporate environment and a more stable macroeconomic environment.

The WEF's Institutions Index includes both the formal institutional characteristics of countries (e.g. property rights, judicial independence, burden of government regulation, strength of investor protection and efficiency of legal framework in challenging regulations) and the behaviour and as well as the efficiency of participants both in the private and public sectors, such as transparency of government policymaking, ethical behavior of firms, efficacy of corporate boards, and favoritism in decisions of government officials.[64]

The positions of GIIPS countries in the index in terms of their institutional environment are given in Figure 4. The Institutions Index scores indicate that there are significant differences between these countries, and all are below the Eurozone (19) average.

Figure 4. The Institutional Environment (2017)



Source: Schwab, 2017.

[64] Schwab, Global, 127.

Among GIIPS countries, Ireland is the country with the best position, with 5.59 points, as displayed in Figure 4. That is, Ireland has better institutional environment than the others; for example, it has an institutional environment with a more effective legal system (e.g. more judicial independence), more transparent policymaking of government), and institutional environment with better market protection policy of market participants as well as more transparent. The positions of the GIIPS support the findings of previous studies on the institutional environment in the Eurozone.[65]

The Financial Market Development Index is calculated considering the eight features of the financial sector.[66] Thus, the financial services' ability to meet the needs, and its affordability, the configuration of the financial sector and the soundness of financial intermediaries, etc. of the countries are evaluated within the context of the effectiveness and development of financial markets.

Figure 5, which shows the GIIPS countries positions in the Financial Market Development Index and the Eurozone average, indicates that the situation is similar to the findings on the Institutional Index scores as their Financial Market Development scores are all below the Eurozone average. Again, Ireland has the highest score among the GIIPS countries. That is, the financial sector of Ireland is able to provide more effective financial services for the private sector, and also market participants can access loans that are easier and the terms of payment are more appropriate and thus being able to protect their rights.

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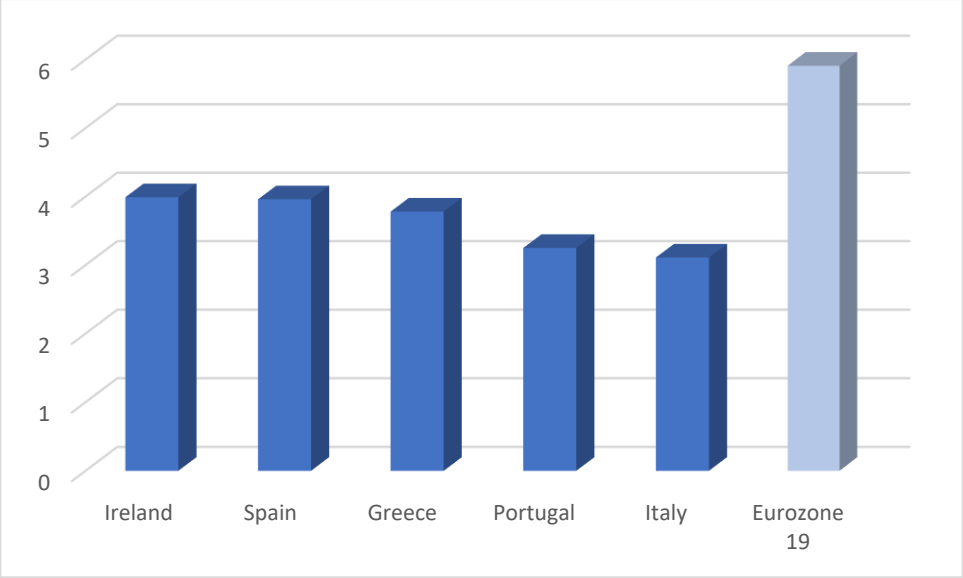
65 Francesco Drudi et al. "The interplay of economic reforms and monetary policy: The case of the euro area", *Journal of Common Market Studies*, 50(2012), 881–898; Duré, Alain et al., "The ECB's Experience of Monetary Policy in a Financially Fragmented Euro Area*", Comparative Economic Studies,* 56(2014), 396-423.

66 These features are affordability of financial services, accessibility of loans, soundness of banks, financial services meeting business needs, financing through local equity market, venture capabiliyregulation of securities exchanges and legal right index. See. Schwab, Global.

Figure 5. Financial Development (2017)



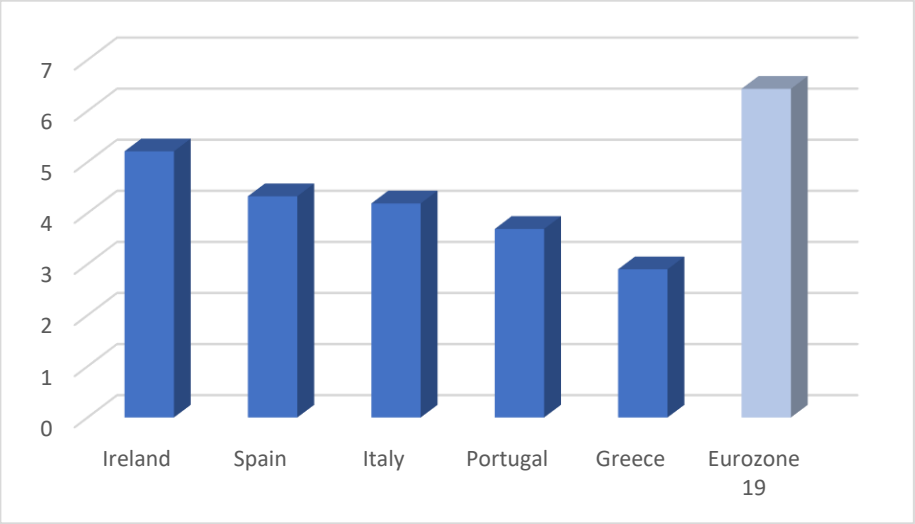
Source: Schwab, 2017.

When the Institutions and Financial Market Development indices scores of the GIIPS are evaluated together, they coincide with the results of La Porta *et al*. The findings of La Porta *et al*. show that origin of the legal system (e.g. French or Scandinavian or German origin civil law or Common Law) affects the financial sector's performance and its development as well as the financial sector of countries with French Law origin civil law is less developed than the financial sector of countries with Common Law or Scandinavian origin civil law or German origin civil law. Their findings are consistent with the positions of GIIPS countries in both indices. Both the scores of the Institutions and Financial Market Development indices indicate that among the GIIPS countries, Ireland with Common Law has better functioning institutional environment than the four GIIPS with French Law origin civil law. The same exists for the financial development. In addition, the index scores show that the law system of countries can be the same, but the enforcement of legal system may be different as seen in Portugal, Spain and Italy.[67]

[67] La Porta et al., Law, 1113-1114.

Another index of the WEF is the Macroeconomic Environment Index. It gives an idea about the positions of countries in terms of economic stability.[68] Economic stability, as in other sectors of the economy, is expected to influence developments in credit and housing markets (e.g. decisions of both financial intermediaries and potential home buyers, the country's credit rating, its access to international funds and its borrowing cost, etc.), and therefore the relationship between credit lending and housing prices. The Macroeconomic Environment Index shows that all the GIIPS countries have different positions (Figure 6).

Figure 6. Macroeconomic Environment (2017)



Source: Schwab, 2017.

In addition, compared to the Eurozone (19) average, all five countries are below the Eurozone average, even if there is a change in their rank in the index. In the Macroeconomic Environment Index, the GIIPS countries also have largely similar position to the other indices. Again, Ireland with 5.20 points, which has the highest rank, has a better macroeconomic environment than others, even it falls below the Eurozone average. Indeed, this result is also confirmed the main macroeconomic indicators exhibited in Table 1. On average, unemployment levels, public debt and/or budget deficits are higher

[68] While counting this index, the WEF consider five features of the economy: government budget balance, government dept, inflation, gross national savings and credit rating of the country (See. Scwab, Global).

for the GIIPS economies when compared to the Eurozone. In this case, it can be argued that, on average, they have lower competitiveness than the Eurozone in the international markets. Indeed, the Global Competitiveness Index confirms this. The same also exists in terms of their credit ratings which is lower than the Eurozone average. In a low credit rating country, domestic financial intermediaries, for example, in international markets, will have higher borrowing costs and hence result in higher lending costs in domestic markets. This case was experienced by the GIIPS countries which started the sovereign debt crisis.[69]

In summary, all three WEF indices show that there are differences between the GIIPS countries of the Eurozone in terms of institutional environment, macroeconomic environment and financial sector development. Their index scores are also below the Eurozone average. This case proves that besides monetary policy, other factors, such as the existence of macroeconomic stability, the level of financial development and institutional characteristics can contribute to the emergence of differences in both the magnitude and direction of the relationship between credit lending and housing prices. Moreover, following these findings one suggestion can be that despite the economic integration progress amongst the Eurozone countries, as observed in the example of the GIIPS, the Eurozone members largely retain national characteristics in the housing and credit markets. This result is also consistent with those of previous studies on the EU housing and/or mortgage markets.[70]

V. Robustness Check

As is the case with any quantitative study that relies on the use of econometric models, robustness checks have to be conducted. To this end,

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[69] See. Joshua Aizanman et al., "What is the Risk of European Sovereign Debt Defaults? Fiscal Space, CDS spreads and market pricing of risk", *Journal of International Money and Finance*, 34, April (2013), 37-59; Dominic O'kane, "The Link between Eurozone Sovereign Debt and CDS Prices", EDH EDHEC Risk Institute, January, 2012; Mody and Damiano, Eurozone, 199-230.

[70] For more information see. Wyman, Mercer O., *Financial Integration of European Mortgage Markets,* European Mortgage Federation, (Brussels: EMF, 2003); Dübel, Hans-Joachim, "The Commission's White Paper on Mortgage Markets: Inching towards consensus…but missing the big picture*", ECRI Commentary*, 2008, No.4/1. February,1-7; Martins, Francisco V. et al. EU Housing Markets: The Role of Institutional Factors, Working Papers in Real Estate & Planning 04/15, Reading University, 2015; CEC, White paper on the integration of EU mortgage credit markets, SEC(2007) 1683} {SEC(2007) 1684.

we developed a strategy for checking the robustness of our model by estimating a simultaneous equations model by using the three-stage least squares (3SLS) technique.

It is important to note that whilst VAR and simultaneous equations models are suitable alternatives for each other there are differences between them with respect to the determination and separation of variables, the distribution of lags, autocorrelation and the factors affecting each covariate in a model.

As was the case with our panel VAR model, our simultaneous equations model covers two equations: a credit and a house price equation where both equations consisted of the same variables. With the exception of short-term interest rates and term spread, all covariates were in their natural log forms. In addition, all variables were entered in both models with their first differences in real terms.[71]

Table 7 sets out the results of our robustness check and reveals that our results coincide with the results of our panel VAR models.

[71] Kalok Chan ve Y.Peter Chung, Vector autoregression or simultaneous equations model? The intraday relationship between index arbitrage and market volatility", *Journal of Banking & Finance,* 19 (1995), 173-179; Brooks, Introductory Econometrics.

Table 7. Robustness Check

	Eurozone		Greece		Ireland		Italy		Portugal		Spain	
	credit	**hprice**	**credit**	**hprice**	**credit**	**hprice**	**credit**	**hprice**	**credit**	**hprice**	**credit**	**hprice**
$dlnrealhp_{t-1}$	.1765***		.2942***		.2593*	.	.4017***	.	.1325*		.4703***	
	(0.000)		(0.000)		(0.088)		(0.001)		(0.097)		(0.000)	
$dlncredit_{t-1}$		.0335***		.1181***		.1013*		.0693***		.0603*		.1656***
		(0.004)		(0.003)		(0.063)		(0.005)		(0.059)		(0.000)
dlnrealgdp	.9834***	.0585***	.9811***	.0571	1.002***	.1601**	.9816***	.0477*	1.017***	.1278***	.9782***	.1418***
	(0.000)	(0.000)	(0.000)	(0.164)	(0.000)	(0.027)	(0.000)	(0.061)	(0.000)	(0.001)	(0.000)	(0.003)
drealsint	-.0449		-.2651		-.4601		-.1849		-.3952		-.5109	
	(0.795)		(0.477)		(0.735)		(0.595)		(0.438)		(0.336)	
drdfint		-.2175***		- .0678		-.7731		-.1443		-.1939		-.2925
		(0.000)		(0.635)		(0.143)		(0.615)		(0.433)		(0.000)

Note that: p-values are provided in parentheses. (***), (**) and (*) indicate statistical significance at the levels of 1, 5 and 10 percent respectively. The variables are transformed in logarithms except for short term interest rates and term spread. Also, all variables with their first difference at real terms. The lag order is one for all samples. *dlnrlhprice*: house prices, *dlncredit*: private credit, *dlnrgdp*: economic activity (and total income); *drsint*: short- term interest rates; *drdfint*: term spread.

Conclusion

This study sought to explore the interaction between credit lending and house prices at both the cross-country and individual country levels in the Eurozone and the GIIPS countries by using VAR modeling.

A common point of the results at both cross-country and individual country level is the existence of the causality between credit and house prices during the period between 1990q1- 2017q3 as well as its direction. Another result is that there is a one-way causality for the Eurozone and the GIIPS countries, except for Greece, which has a two-way causality. These findings are consistent with those of previous studies on this relationship,[72]not with theory for all, that suggests that there is a mutual relationship between credit and house prices.

Yet, the individual country results for the GIIPS show that the size of the relationship changes from country to country in the Eurozone with the single monetary policy, and that although the timing of the interaction is similar to most of them, it doesn't exist for all. In this case, one suggestion can be that besides monetary policy, other factors (e.g. institutional features, macroeconomic stability) may play a role in the differences observed between the GIIPS countries. In fact, the positions of the GIIPS countries in the WEF indices -the Institutions, Financial Market Development and Macroeconomic Environment indices- support this result and show that all countries have different index scores in terms of institutional environment, macroeconomic environment, and financial sector development.

Furthermore, these results can be taken as an indication that the integration of both credit and/or housing markets has not been fully realised in the Eurozone as yet, which is the economic and monetary union area of the EU. These findings also align with those of previous studies on the integration of housing markets as well as of and mortgage markets of the EU. [73]

The findings of the study have important policy implications at the individual country level and cross-country level. First, further consideration on the direction of causality may contribute to more efficient policies on credit and housing markets in the Eurozone and its member countries, where credit markets and housing markets are governed by a common monetary policy and national policies respectively, thereby implying the need for

[72] See. Greiber and Setzer, Money, 3-5; Nobili and Zolina, Structural, 73-87; Ryczkowski, Money, 546-572.

[73] See. Wyman, Financial, *12-18*; CEC, White, 19-21; Martins et al., Role, 54-58.

strong coordination between the ECB and national authorities. Second, in order to successfully govern the relationship between credit lending and house price, policy makers should be aware of differences between the member states with respect to their macroeconomic environment, financial development, institutional environment.

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Appendix 1. Data List

CODE	VARIABLES	DATA DECRIPTION AND SOURCE
cip	Consumer price index (2010=100) (%)	Definition: Consumer price index (CPI) is defined as the change in the prices of a basket of goods and services that are typically purchased by specific groups of households. Source: OECD, 2018.
credit	Private Credit/ GDP (%)	Definition: It shows that total bank lending to private sector is divided by the GDP. Total credit is in terms of billions of US dollar. It covers total *credit to* the non-financial sectors (households and non-financial corporations excluding general government lent by deposit money banks and other financial institutions Source: BIS, 2018.
dfint	Term spread (%)	Definition: Term spread is also called interest rate spread. It measures the difference between long term and short term interest rates. It is calculated by author. Source: Author's calculations.
gdp	Economic activity and total income (as of current billions of the US dollar)	Definition: Gross domestic product (GDP) is total of all the final goods and services produced as monetary value within the borders of a country in a specific period. GDP shows the size of economic activity as well as of total income earned in an economy in a specific period. Source: BIS, 2018.
hprice	Nominal house price index (%) (2010=100)	Definition: House price index measures the price changes of residential housing. Source: OECD,2018.
lint	Long- term interest rates (%)7	Definition: Nominal long-term interest rates are long term government bond yields and are calculated as monthly averages (non-seasonally adjusted data). They refer to central government bond yields on the secondary market, gross of tax, with a residual maturity of around 10 years. Source: OECD,2018.
sint	Short-term interest rates (%)	Definition: *Short-term interest rates are* rates on money markets for different maturities (overnight, 1–12 months. Source: OECD, 2018.