Philip Arestis

University of Cambridge,
UK

University of the Basque Country,
Spain

✉ pa267@cam.ac.uk

Ana Rosa González

Cambridge Econometrics,
UK

✉ ar.gonzm@gmail.com

Paper by invitation

The Housing Market-Bank Credit Relationship: Some Thoughts on Its Causality

Summary: The dominance of the orthodox paradigm over the last decades prior to the "great recession" left no room for the notion of "endogenous money" in the development of economic theory. However, this alternative direction of the causality of demand for money-credit and economic activity has been present in the heterodox economic thought since the 1930s and should be reconsidered in the current situation. In this context, the numerous episodes of housing bubbles, which have been taking place since 2007, create the perfect "environment" to explore the notion of "dynamic monetized production economy". Our theoretical framework is estimated econometrically by using a sample of 6 developed economies which spans from 1970 to 2011. The non-stationary "nature" of our data recommends the use of cointegration techniques (Søren Johansen 1995) in order to estimate our models.

Key words: Bank credit, Collateral channel, Financial wealth, Housing market, Cointegration.

JEL: C22, R31.

In the last decade, one notion has become extremely popular in housing economics, i.e. the "collateral" channel. After the collapse of the housing market that led to the "great recession" a great deal of research has explored how abundant credit contributes to fuel rising housing prices. However, the causality between housing prices and credit has been overlooked by the vast majority of the housing literature. The theoretical essence of this controversy finds its roots in the large discussion regarding the endogenous nature of money.

The development of the housing literature along these lines is related to the debate of the endogeneity of the credit-money. This premise, which has been rejected by the orthodox economic thought, should be reconsidered. In this context, our proposal elaborates a theoretical framework which explains credit demand as a function of demand for housing assets. In doing so, this contribution re-visits the notion of "dynamic monetized production economy" initially proposed by Augusto Graziani (2003).

In the second part of our analysis our theoretical proposition is tested by means of a multivariate cointegration technique (Johansen 1995). In doing so, a sample of 6 developed countries which spans from 1970 to 2011 is employed. Particularly, the following economies are studied: Australia, Denmark, France, Germany, Ireland and the United Kingdom.

The remainder of this contribution is structured as follows. Section 1 examines the notion of the "collateral" channel. Section 2 presents our testable hypothesis. In Section 3 the econometric technique, which is employed, is discussed. Section 4 summarizes the data sources and presents our sample. Section 5 presents and discusses our empirical results. Finally, some conclusions, along with a summary, are provided in Section 6.

1. Literature Review: The "Collateral" Channel

The majority of the existing body of research on housing issues is based on the premise that demand for housing can be driven by supply of credit (John V. Duca, John Muellbauer, and Anthony Murphy 2013; Manuel Adelino, Antoinette Schoar, and Felipe Severino 2012 also deal with this aspect where empirical evidence is provided to support the assumption that easy access to credit fuels housing prices). In this context, there is a basic concept, which has been discussed deeply and it is fundamental for our purpose, i.e. the "collateral" channel. Prior to the explanation of this notion in the next section, a review of its theoretical roots, i.e. the "financial accelerator" or "credit multiplier", is required.

The existence of the "financial accelerator" (Ben S. Bernanke and Mark L. Gertler 1989; Bernanke, Gertler, and Simon Gilchrist 1996, 1999) is supported by three main arguments: (a) internal finance is always more affordable than external finance, independently of the value of the collateral, which backs the loan; this is due to lenders' agency costs; (b) agents' risk premium is negatively related to their net wealth, i.e. internal funds (liquid assets) and collateral (illiquid assets); and (c) a decline in agents' net wealth induces a hike in the risk premium, which provokes a rise in the volume of external funds that borrowers require and finally slows down borrowers' spending and production (Bernanke, Gertler, and Gilchrist 1996; Nobuhiro Kiyotaki and John Moore 1997). Specifically, Bernanke, Gertler, and Gilchrist (1996) focus on the empirical evidence in which small variations, for example, oil price fluctuations or changes in monetary policy, provoke an important effect on aggregate economic activity. Bernanke, Gertler, and Gilchrist (op. cit.) define the "financial accelerator" as the amplification of real or monetary shocks in the economy due to variations in credit conditions. This notion suggests that variations in credit-market conditions enhance and extend the impact, which emanates from monetary or real shocks. In this context any kind of negative shock, which curb the economic expansion, hardens financial conditions and complicates the entrance of agents in the credit market while agents' credit necessities are increasing. As a result, there is a slowdown of spending, which accelerates the downturn of the economy. Bernanke, Gertler, and Gilchrist (1996) also coin the term "flight to quality", which refers to a situation where agents have to deal with higher agency cost and as a result the volume of credit that they can receive is lower. This kind of problems is peculiar in a recessionary stage of the economy.

The "financial accelerator" approach is along the same lines that other contributions, for example, Stewart C. Myers (1984) and Steven M. Fazzari, Glenn R. Hubbard, and Bruce C. Petersen (1988), which suggest firms get into intermediate debt instead of financing by external equity when they are obliged to do it. Although

it is true that companies consider internal resources as the cheapest and preferred alternatives to finance their activities.

2. Demand for Bank Credit

The theoretical framework, which is elaborated for the purpose of this contribution is rooted in the "dynamic monetized production economy", which is modified in order to provide an explanation of evolution of demand for mortgages.

To begin with the "dynamic monetized production economy", which is due to Graziani (2003), is presented. Graziani (op. cit.) describes the monetary "circuit" as a process in five steps. Graziani (2003) suggests that the development of the "circulation" approach relies on three pillars: (i) the French School, where Jacques Le Bourva (1962) and Alain Parguez (1979) are the most important contributors; (ii) the Anglo-Saxon view, which was developed by John M. Keynes (1930) and Joan Robinson (1956); and (iii) Paolo Sylos Labini (1948), who defends the idea that the money stock is endogenously created in order to satisfy firms' demand for credit.

Sylos Labini's (1948) approach was conflicting with the dominant orthodox Italian thought of the time. First, banks grant credit to firms, this is the so called "initial finance", which permit them to initiate the production process. Before starting the mentioned process firms hire their workers. As a result, firms demand the volume of credit that they need to pay the wage bill. Once the wages are paid, final or intermediate goods are produced. There is equivalence between the wage bill and the cost of the goods, which are produced. In this step, banks and firms negotiate the volume of credit and its cost, i.e. the interest rate. In the second step, wage earners decide to utilize their income for several purposes: consumption, bank deposits or acquisition of securities. Thirdly, consumer goods are purchased by wage earners. Investment goods are exchanged among firms. The acquisition of consumer goods and securities permits money to flow back to the companies, which use it to repay their initial debts. Money is destroyed when debts are paid, i.e. the circuit is closed. Then, money creation takes place when the banking sector grants new loans to the companies. Firms can also use the resources that they obtain from the sales of their production and the issue of their securities to start the new production process instead of repaying their debts, which mean a renewal of their credits. However, if wage earners do not spend all their income, firms are not able to repay completely their debts and there is a fraction of the initial money, which is not destroyed. In that case, the financing of a new production cycle means an increase in the total money stock. Finally, the payment of the interests of the loans has to be discussed. Particularly, firms can only face the payment of the interests by selling a part of their production, or issuing securities for the banks. If the public sector is introduced in this scheme, its deficit could give the resources that firms need to pay the interest of the loan. However, this deficit means public debt towards the central bank since the public sector cannot obtain the resources that it needs to repay the deficit issued when it transferred the financial resources that firms needed.

Graziani (2003) also highlights some discrepancies between the first generation of Post Keynesian scholars and the circuit theorists, since for the former group there is no room for the supply of money. Particularly, they downgrade this element

due to the fact that they assume that money supply is perfectly elastic. Moreover, they also consider that in those cases where the central bank limits the amount of loans which can be provided by commercial banks, potential borrowers will find another source of liquidity; for instance, credit granted by single individuals. As a result, the relationship between banks and companies is ignored. However, the second generation of Post Keynesian authors and the circuit theorists explore in detail the interaction between both sectors.

This theoretical framework can be modified and adapted to the particular case of the housing market by assuming that all the flows of real estate assets, which are produced in the economy in response to households' housing demand require previous creation of credit. In other words, there will be no activity in the housing market if there is no issuance of those mortgages, which are necessary to materialize the purchase of real estate assets.

As in other markets, the demand function of an asset will be driven by its price, *P*, and some other determinants. As advanced in the previous section, housing literature points to the importance of the "collateral" channel, which is related to predictable variations in the value of real estate assets and impacts current consumption (Norm Miller, Liang Peng, and Michael A. Sklarz 2011). These fluctuations have played a fundamental role in the dynamics of the housing market and the emergence of the "great recession". Specifically, Kosuke Aoki, James Proudman, and Gertjan W. Vlieghe (2001) hypothesize that an increase in the value of those assets, which back credit, reduce agency costs. This means a relaxation of the requirements that borrowers have to satisfy and a lower risk prime. In particular, this mechanism can be described as follows. Increasing dwelling prices means a rise in the volume of resources that home buyers have to borrow, which fuels demand for credit. At the same time, this increase in housing prices means higher households' wealth, which enhances their mortgage equity withdrawal and reduces the risk that lenders have to assume. This mechanism is self-reinforcing, since more abundant and cheaper credit favours demand for housing and hikes in real estate prices. For instance, Roberto Cardarelli et al. (2009) provide empirical evidence, which supports the "collateral" channel. Particularly, Cardarelli et al. (op. cit.) reach the following conclusions: (1) the effect of housing demand shocks on consumption is stronger than the influence of housing supply shocks; (2) the more developed the mortgage market is the stronger the impact of housing demand shocks on consumption; and (3) the role played by housing demand shocks has gained importance through time, which was favoured by the process of financial deregulation in the 1970s. Specifically, housing demand shocks explain a 10-15% of the fluctuations, which occur in GDP and consumption, while housing supply shocks explain just a 5-7%. This discussion permits us to include housing prices as a driver of the demand for bank credit as in Equation (1):

$$C = C(P) \atop +$$

(1)

where the volume of bank credit, *C*, is positively related to housing prices, *P*. The sign below a variable indicates the partial derivative of the dependent variable with respect to that variable. Francisco Carballo-Cruz (2011) is an important contribution

in this respect since it deals with the evolution of the banking sector and the housing market in the particular case of Spain.

The demand for credit has been related to equilibrium in the housing market. However, further determinants of this equilibrium should be included in our proposed credit relationship, for example, real disposable income *per capita*, *Y*, which is a proxy of home buyers' cash flows and is also a key element in the determination of housing affordability. In particular, our testable hypothesis points to some co-movement between real disposable income and the volume of mortgages. The justification for this relationship is the fact that in a context characterized by the presence of moral hazard problems and "principal-agent" conflicts, commercial banks need to define some kind of eligibility criteria to constraint potential demand for credit just to those borrowers which are credit-worthy. Bernanke, Gertler, and Gilchrist (1996) also coin the term "flight to quality", which refers to a situation where agents have to deal with higher agency cost and as a result the volume of credit that they can receive is lower. This kind of problems is peculiar in a recessionary stage of the economy. Moreover, Bernanke, Gertler, and Gilchrist (1999) point to the existence of a positive risk premium as a natural phenomenon in a banking system characterized by the presence of "agency" problems.

Moreover, real disposable income should be included since it is the local fundamental of the housing market which better reflects the economic situation. Dimitri B. Papadimitriou, Greg Hannsgen, and Gennaro Zezza (2007) highlight the role of expectations regarding the availability of credit and expected incomes, which are a common driver of housing prices and some macroeconomic aggregates, for example, households' consumption. In terms of our proposed framework, we modify Equation (1) as follows:

$$C = C(P, Y)$$
$$+ \quad +$$

(2)

where all the variables have the same meaning as in Equation (1), with the exemption of *Y*, which accounts for real disposable income.

In addition to that, the equilibrium in the housing market, as in any other market, is defined by a price and a quantity of equilibrium. In the particular case of the housing market, the quantity variable is proxied by real residential investment. This aggregate measures the flow of new dwelling assets, which are produced in a given period in order to meet effective demand. We may note that the real residential investment exerts a different influence through time. More precisely, an increase in real residential investment today means rising supply of housing assets in the long run, which will produce a slowdown of housing prices. As a result, there is more home buyers that are willing to get into debt to buy new properties, which are now less expensive than in the past. In this situation, although the amount of funds that a given household needs to borrow is lower than in previous periods, we can expect a positive effect of real residential investment in demand for credit since there are more potential homebuyers who enter in the housing market. This example of the so-called "fallacy of composition" highlights how there is a negative relationship between credit and real residential investment on an individual basis, which turns into a positive

effect at the aggregate level. However, in the short run there is just one positive and unique effect. An increase of real residential investment moves prices and quantities of equilibrium in the same direction. As a result, we can expect that rising investment in housing assets will increase the volume of mortgages in both levels, i.e. aggregate and individual. In terms of our model, we can modify Equation (2) to account for the positive impact of real residential investment on the demand for credit:

$$C = C(P, Y, I)$$
$$+ \ + \ +$$

(3)

where all the symbols have the same meaning as in previous equations, and I is real residential investment.

Furthermore, the interest rates of loans for housing should be included in Equation (3). Our model assumes that commercial banks are willing to provide all those financial resources, which are demanded by households. However, not all the demand for credit, which is faced by commercial banks will be satisfied. This is in view of the existence of prudential policy measures, which are implemented by the monetary authorities. In particular, central banks should define some standards that potential borrowers must satisfy if they want to get into debt. In addition to that monetary authorities could also influence the evolution of credit by manipulating the basic interest rate, which influences the mortgage rate; i.e. rising interest rates will crowd-out some potential borrowers from the credit market since they cannot afford the cost of bank finance at these new conditions. Mortgages rates are also relevant in terms of our model since they capture institutional factors of the banking system. This is so since the prevalence of fixed or variable interest rates in the mortgages contracts could "inflate" the length and the strength of those expansionary and recessionary stages of the cycle of the housing market. Margarita Rubio (2009) provides empirical evidence of the divergences across countries in the context of the EMU in terms of credit market. Rubio (op.cit.) highlights the fact that the kind of mortgages which are more abundant are an important factor in the transmission of those shocks, which take place in the housing market. To make the point, in those countries where the collapse of the housing market had more deep consequences, for example, Spain and the United Kingdom are characterized by the prevalence of variable mortgages rates.

In the context of rising stock prices some households will sell their portfolios in order to materialize their capital gains, which imply additional resources to finance the purchase of dwellings. This also permits the entrance in the market of other home buyers who prefer renting the properties instead of acquiring them prior to this increase in their net wealth. In particular interest rates permit the entrance of a larger share of potential home buyers during the boom. However, variable interest rates are also a "catalyst" of the collapse of the market. This is so since those households who obtained this kind of mortgages will experience a rapid increase of their monthly repayments in a context of increasing systemic risk. We may also note that in the empirical part of our study this variable is proxied by the long-run interest rate since there is no consistent time series for the economies and the period under consideration. In order to account for the rate of interest on loans for housing, the Equation presented in (3) is modified to produce Equation (4):

$$C = C(P, Y, I, R)$$
$$+\ +\ +\ -$$

(4)

where all the variables are as in Equation (3), except for R, which stands for the mortgage rate.

Finally, the evolution of share prices, S, is also included to account for households' financial wealth. Fluctuations in stock prices affect individuals' financial position by modifying the value of their portfolios, and as a result, a change in households' net wealth takes place. This variation influences their demand for consumption goods and housing assets. In this context there will be more households willing to get into debt in order to finance the acquisitions of new properties. In the context of rising stock prices some households will sell their portfolios in order to materialize their capital gains, which imply additional resources to finance the purchase of dwellings. This also permits the entrance in the market of other home buyers who prefer renting the properties instead of acquiring them prior to this increase in their net wealth. Variations in stock prices also affect indirectly credit standards; for example, an external shock, which pushes up stock prices is understood by the banking system as an improvement of the financial position and the solvency of their potential borrowers. In this context, an increase in households' capacity to get into debt will take place. This fluctuation of stock prices also provokes an increase in the value of the "collateral" that they own and induces the relaxation of the requirements to obtain a loan and slows down the cost of banking finance since this kind of loans is less risky (see also, Muellbauer and Gavin Cameron 2000; John Baude 2005). Dimitrios Gounopoulos et al. (2012) consider the inclusion of the stock index as a proxy for activity in the financial system. Moreover, Andrea Nobili and Francesco Zollino (2012) suggest an uncertain effect of financial wealth on the demand for credit, since those households who are richer will have to accept lower mortgages. However, we can expect that the effect, which will prevail, is a positive one since those households who are richer will acquire the most expensive properties and maybe several of them. Luca Casolaro and Leonardo Gambacorta (2005) suggest a positive relationship between the volume of credit to finance dwelling acquisitions and the evolution of the stock market in the long run, since there is an increase in the value of households' wealth and their possibilities of indebtedness at the aggregate level. They also point to a negative relationship between both variables in the short run, based on the possibility that households can consider these two assets, i.e. shares and dwellings, as alternative elements to include in their portfolios. Finally, our testable hypothesis is captured by Equation (5):

$$C = C(P, Y, I, R, S)$$
$$+\ +\ +\ -\ +$$

(5)

where the variables are as in Equation (4), except for S, which stands for share prices.

3. Relevant Econometric Technique

All the estimations are conducted by applying cointegration, since some preliminary tests clearly show the presence of unit roots in the data. More specifically, the fol-

lowing unit root/stationarity tests are applied: the augmented Dickey-Fuller (David A. Dickey and Wayne A. Fuller 1979, 1981) tests, the Phillips-Perron (Peter C. B. Phillips and Pierre Perron 1988) test, the GLS-based Dickey-Fuller (Charles R. Nelson and Charles Plosser 1982) test, and the Kwiatkowski-Phillips-Schmidt-Shin (Denis Kwiatkowski et al. 1992) test. All of them confirm that our data are integrated of first-order. The results of these unit root/stationarity test are available from the authors upon request.

This is so in order to deal with the lack of stationarity of the data, avoid spurious regressions and model the cointegrating relationships and their short-run dynamics along with an error-correction term. Following Richard Harris and Robert Sollis (2003) two or more series are cointegrated if there is a long-run equilibrium relationship between them, although the series could include a stochastic trend. Harris and Sollis (2003) recommend to start the estimation procedure by applying a multivariate vector autoregression (VAR) approach, e.g. Johansen (1995), given that this technique does not require to make any kind of assumptions about the potential endogeneity of the variable involved and the number of existing cointegrating relationships.

More specifically, the Vector Error-Correction Model (VECM) developed by Johansen (1995) is applied. The potential existence of several cointegrating relationships, the large number of variables that are included in the model, and the presence of endogeneity among them, which is recognised by the economic literature in some of the cases (for example, real residential investment affects credit, although, at the same time the availability of credit could be a driver of real residential investment), compels us to utilize a technique that deals with these specific problems, namely endogeneity and reverse causality. However, Johansen's (1995) approach could lead to the identification of cointegrating relationships, which are meaningless from an economic point of view. This is so since those results, which are obtained by means of Johansen (1995), require detailed review and analysis, i.e. economic explanation and identification, in order to evaluate their economic meaning. For the purpose of this contribution, we regress the VECM proposed in Equation (6), and we just report those relationships, which can be interpreted from a theoretical point of view as in Equation (6):

$$\Delta C = \beta_0 + \sum_{i=1}^{n} \varphi_{11} \Delta C_{H\,t-i} + \sum_{i=1}^{n} \varphi_{12} \Delta \prod_{t-i} + \alpha_0 E_{t-1} + \mu_t \qquad (6)$$

where C means bank credit; Π is a vector, which includes the following variables: real hosuing prices, P, real disposable income, Y, real residential investment, I, mortgage rate, R; and the share prices index, S. Equation (6) also includes an error-correction term, E, and μ is a random error term. β_0, α_0, φ_{11} and φ_{12} are the estimated coefficients of the VECMs.

The validity of our results is tested by means of a set diagnostic/statistics. More specifically, we report the R-squared (R-sq), the Breusch-Godfrey Serial Correlation LM (Leslie G. Godfrey 1978; Trevor S. Breusch 1979) statistic, the Akaike Information Criterion (AIC), the Schwartz Bayesian Information Criterion (SBIC) and the Hannan-Quinn Information Criterion (HQIC).

4. Data

The theoretical framework elaborated in Section 2 is tested econometrically in this part of this contribution. In doing so, our theoretical proposition is tested for the following economies: Australia, Denmark, France, Germany, Ireland and the United Kingdom. The annual times series under consideration cover the period 1970-2011. The length of the time series under analysis is determined by the time coverage of the Real House Prices Index, which is available.

Our sample collects annual data from 4 different data sources: (a) the annual macro-economic database of the European Commission's Directorate General for Economic and Financial Affairs (AMECO); (b) the Bank for International Settlements (BIS); (c) the World Bank; and (d) the Organisation for Economic Co-operation and Development (OECD). Table 1 displays the data provider of those time series which compound our sample.

Table 1 Data Sources

Data provider	Source	Time series
World Bank	http://data.worldbank.org/	Domestic credit to the private sector (% GDP)
BIS	http://www.bis.org/	Real house prices index
OECD	http://stats.oecd.org/	Share prices
AMECO	http://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm	Gross fixed capital formation by type of goods at current prices (dwelling)
		Gross national disposable income per head of population
		Gross domestic product price deflator
		Real long-term interest rate

Source: Authors.

We also may note that the collected data present some missing observations, which were filled in by using data published by the relevant national statistics agencies, for example, INE in the case of Spain.

E-Views 5.0 and STATA 11.0 are the econometric packages employed to estimate the models and conduct those test which are relevant in the validation of the results.

5. Empirical Findings

5.1 Cointegrating Relationships

The results of the Johansen's cointegration test (Johansen 1988, 1991) are shown in Table 2. The results presented in the first column indicate the existence of a cointegrating relationship in the event of all the credit markets, which are under consideration. The values of the log-likelihood function that are used when analyzing the possibility of restricting a VAR(n) to another VAR(n-1) are reported in the second column. Table 2 also shows the eigenvalues and the trace statistics (third and fourth column respectively), which are calculated to perform this cointegration test. The last column presents the critical values at the 5% significance level for the trace statistics. These tests confirm that there is some co-movement between the variables under

consideration in the long run. Then we proceed to estimate the VECMs, which also provide the corresponding cointegrating equations in their normalized form. The choice of the lag length which is considered to estimate the VECMs which are presented in the next section is taken based on the values of the Akaike Information Criterion (AIC), the Hannan-Quinn Information Criterion (HQIC) and the Schwartz Bayesian Information Criterion (SBIC).

Table 2 Johansen Test for Cointegration

Johansen tests for cointegration					
	Maximum rank	LL	Eigenvalue	Trace statistic	5% critical value
Australia	1	175.9751	0.4610	29.1564	29.68
Denmark	1	119.5154	0.1980	0.4402	3.76
France	1	82.7594	0.3768	1.0552	3.76
Germany	1	267.7555	0.4368	21.1630	24.31
Ireland	1	123.4114	0.4206	9.2687	12.53
UK	1	141.5160	0.5176	19.4983	25.32

Source: Authors' calculations.

Table 3 presents the estimated cointegrating relationships, which permit us to model the equilibrium in the long run.

Table 3 Long-Run Relationships

Long-run relationship - normalized parameters						
	Intercept	L_C	L_P	L_Y	L_I	R	L_S
Australia	3.055748	1				3.164169***	-0.6558728***
Denmark	5.00166	1					-1.232096***
France	0.3348008	1					-0.0708784*
Germany	3.410084	1		-0.2516388***	-0.5572366***		
Ireland	6.883062	1	-1.579172***				
UK	4.066192	1			-0.7301613**		-0.4434546***

Note: *, ** and *** indicate statistical significance and rejection of the null at the 10%, 5% and 1% significance levels, respectively. Numbers in parentheses, in the case of the variables, show the lag(s) of the relevant variable.

Source: Authors' calculations.

Our estimations find a positive impact of real housing prices in the case of Ireland (1.579). This finding emphasizes the importance of the "collateral" channel and the makes evident the link which exist between demand for credit and demand for housing assets. Moreover, those cointegrating relationships which are reported in Table 3 also suggest a positive effect of real residential investment on credit in the case of Germany (0.557) and the United Kingdom (0.730). In addition to that, our proxy of households' cash flows, i.e. real disposable income, is also an important determinant of demand for credit in the German economy (0.251). This elasticity is

positive as suggested by our theoretical framework. Furthermore, Table 3 reports a negative and strong semi-elasticity of the mortgage rate in the case of Australia (-3.641).

Finally, the analysis undertaken for the purpose of this contribution highlights a positive correlation between households' financial wealth and bank credit. Specifically, our results suggest a significant relationship between these elements in the case of the United Kingdom (0.443), Denmark (1.232) and Australia (0.656). This effect is also significant in France (0.071), although its influence is not as strong as in the other three countries mentioned above. Our results show that financial wealth is the only explanatory variable of demand for credit in the case of France. This positive correlation is also pointed out by Baude (2005).

All the estimated elasticities and semi-elasticities have the expected and sign. These empirical results support our theoretical framework.

5.2 Vector Error-Correction Models

Those Vector Error-Correction Models (VECMs), which have been estimated to model credit dynamics in the short run are shown in Table 4a. The validity of all these estimations is checked by means of a set of tests which are displayed in Table 4b and 4c.

The relationships which are presented in Table 4a highlight the impact of disposable income in the evolution of demand for credit in the short run in the case of France (3.826).

All the error-correction models, which were estimated for the purpose of this contribution include an intercept, which is significant in all the cases expect in France and Denmark. To model the evolution of bank credit in the short run, lagged terms of this variable were included in the corresponding equations. The lowest effect of the variable is found in the case of the UK economy (0.251). On the other hand, the evolution of credit demand in the recent past is an important driver of this variable in the German market (0.282).

Table 4a Vector Error-Correction Models (VECMs)

Short-run relationship

	Intercept	ΔL_P	ΔL_Y	ΔL_I	ΔR	ΔL_S	ΔL_C	EL_C
Australia	0.03681***					0.101686* (0)		-0.16672**
Denmark	-0.042421	0.934740* (4)				0.516881** (3)		-0.135968*
France	-0.083716		3.826020* (2)			0.403566** (0)		-0.672137***
Germany	0.009118**						0.281519*** (3)	-0.266409***
Ireland	0.039529***	0.425212* (0)						-0.176393**
UK	0.041742***						0.250604* (1)	-0.314173***

Note: *, ** and *** indicate statistical significance and rejection of the null at the 10%, 5% and 1% significance levels, respectively. Numbers in parentheses, in the case of the variables, show the lag(s) of the relevant variable.

Source: Authors' calculations.

Table 4b VECMs Diagnostics/Statistics I

Diagnostic/statistics short-run relationship

	R-squared	DW	AIC	SIC	F-statistics
Australia	0.168886	1.686311	-3.032552	-2.904586	3.657666 (0.0358)
Denmark	0.217897	2.04737	-0.085906	0.090041	2.971775 (0.0464)
France	0.494769	1.874427	-0.254457	-0.082079	11.09863 (0.0000)
Germany	0.405973	1.706129	-4.710435	-4.57982	11.61824 (0.0001)
Ireland	0.218467	1.461980	-1.959976	-1.83331	5.171433 (0.0105)
UK	0.306918	1.929656	-1.860157	-1.733491	7.970952 (0.0014)

Note: In the last column numbers in parentheses indicates the p-value of each test.

Source: Authors' calculations.

Table 4c VECMs Diagnostics/Statistics II

Diagnostic/statistics short-run relationship

	LM (1)	LM (2)	White	White X	ARCH (1)	ARCH (2)
Australia	0.96507 (0.3327)	0.905703 (0.4138)	0.288993 (0.7507)	0.934718 (0.4714)	0.285363 (0.5965)	0.189091 (0.8286)
Denmark	0.037303 (0.8481)	0.169029 (0.8453)	1.901627 (0.1144)	10.24028 (0.0000)	0.001186 (0.9727)	0.048930 (0.9523)
France	0.377841 (0.5430)	1.108106 (0.3425)	1.320915 (0.2775)	1.957940 (0.0841)	0.869321 (0.3575)	0.545956 (0.5844)
Germany	0.051095 (0.8226)	0.875939 (0.4262)	0.451841 (0.6402)	1.651531 (0.1759)	0.003499 (0.9532)	0.123984 (0.8838)
Ireland	2.752436 (0.1058)	1.453673 (0.2475)	0.144622 (0.8655)	0.156618 (0.9765)	0.161931 (0.6897)	0.068304 (0.9341)
UK	0.098689 (0.7553)	1.291132 (0.2881)	0.160529 (0.8523)	0.477446 (0.7904)	0.014482 (0.9049)	0.022091 (0.9782)

Note: Numbers in parentheses indicates the p-value of each test.

Source: Authors' calculations.

Our econometric analysis confirms the existence of a positive effect, which emanates from housing prices, i.e. "collateral" channel, in the case of Denmark (0.935) and Ireland (0.425).

Moreover, the level of activity of the housing market, which is proxied by real residential investment, does not play a significant role in the dynamics of the credit market. This lack of impact in the short run is a reflection of the fact that in this time horizon the demand side elements of this market are the most important drivers of demand for housing since housing supply is given.

The parameters estimated in the case of the VECMs highlight the lack of impact of the rate of interest of the loans for housing in the short run. This phenomenon is along the lines of Post Keynesianism, which points to an inelastic relationship between demand for credit and the interest rate (Philip Arestis 1988).

The results displayed in Table 4a also show the positive influence of the stock market, i.e. household's financial wealth in the demand for credit. The role played by

this variable is particularly important in Denmark (0.517); although it is also remarkable in France (0.404) and Australia (0.102).

The error-correction term, which is included in all the models displayed in Table 4a is negative as expected. Around a 14% of the disequilibria between the short-run model and the long-run equilibrium relationship is eliminated yearly in the case of the Danish market. The highest value for this term appears in France (67%). The speed of adjustment is also high in the case of Germany and the United Kingdom (27 and 31% respectively). The Irish and Australian markets are slightly less dynamics, as suggested by their error-correction terms which are around 18%.

The error-correction models that have been presented in this section are able to explain between a 17-50 % of the fluctuations in the volume of bank credit in the short run, as indicated by the R-squared. The Durbin Watson statistic is around 2 in the majority of the estimated models. However, it is slightly lower for the Irish models (1.5). Table 4b also reports the AIC and the SIC of the selected models, which were selected on the basis of the lowest values for these statistics. All those variables which were included in these models are jointly significant as confirmed by the value of the F-statistics. Moreover, we apply the Breusch-Godfrey Serial Correlation LM test in order to check the lack of autocorrelation of first- and second-order. Additionally, the ARCH test and the White test (without and with cross terms) are also employed. All these tests confirm the lack of autocorrelation and ARCH effects of first- and second order, and the homocedasticity of the residuals at the 5% significance level. The White test with cross terms rejects the null hypothesis of homocedasticity in the case of Denmark. Although the results of this version of the test without cross terms suggest the lack of heteroskedasticity of the model.

Finally, some general ideas can be highlighted in view of the empirical results, which were presented in this section. To begin with, our theoretical framework that captures the essence of Graziani's (2003) writings suggests the endogeneity of bank credit. This premise, which is confirmed empirically, highlights how bank credit is led by the evolution of the demand for housing. In this context, a relevant influence of housing prices on bank credit is expected. This hypothesis has been confirmed by our results. This positive relationship also makes evident the so-called "collateral" channel. Additionally, a relevant impact of real residential investment, which brings into the model the supply side of the housing market, is also expected.

An important impact which emanates from the households' wealth is also present in view of the positive effect of share prices on bank credit. This is so since an increase in the value of households' financial assets boosts demand. In addition to that, we could also expect an important effect of income which is one of the main determinants of housing affordability and also an important indicator of the capacity of repayment of a mortgage by a given household.

Furthermore, our results also account for the impact of investment in real estate assets and the cost of external finance, i.e. mortgage rate. In terms of the latter variable, its lack of impact in the short run suggests that manipulation of the interest rate is not the most important instruments that policy makers can utilize. This finding confirms the validity of the Post Keynesian view of the relationship between interest rates and credit.

6. Summary and Conclusions

The objective of this contribution is to develop a theoretical framework that confirms the endogenous nature of the bank credit to the private sector. For this particular purpose, demand for credit is related to demand for housing.

Our analysis permits us to provide some policy recommendations in view of the significance of those variables, which are included in our testable hypothesis. Specifically, in terms of those actions that monetary authorities could implement in order to contribute to the prevention of the collapse of the housing market, and the subsequent increase of the systemic risk of the economy, this contribution suggests that interest rates should be settled as low and stable as possible, since the banking sector has to provide the liquidity, which is required to permit the functioning of the sphere of production without creating distortions. At first sight, this policy recommendation could be controversial. However, monetary authorities may develop more important tasks in terms of prudential policy in order to guarantee the solvency of the banking sector.

The role that monetary authorities have to play is really important since credit markets are far from being "perfect" and borrowers are not "rational agents". In the context of asymmetric information, the conflict principal-agent gains relevance and there is an important necessity to reduce bankers' incentives to take unnecessary risks in their attempt to increase banks' profits. More precisely, just the value of those assets, which are collateralized, is not enough to guarantee the "health" and stability of the financial system. This has been demonstrated extensively during the last episodes of housing bubbles, where the prices of these assets were overvalued and far from their fundamentals. The key issue is not the compensation that the lender could obtain in case of default; it is when the value of the asset is not its real one and could fluctuate sharply after the burst of the bubble. In this context, the fundamental task has to be identifying those borrowers that are credit-worthy, in order to close the "gap" between potential and solvent demand for credit in the context of asymmetric information. Finally, we also note that the financial system in general and the banking sector in particular really require better regulation. This is so since there is no sense in having a huge "package" of rules and mechanisms of supervision that are not applied in practice and eventually can end in the well-known situation of some banks with high property exposure (The Economist 2012).

References

Adelino, Manuel, Antoinette Schoar, and Felipe Severino. 2012. "Credit Supply and House Prices: Evidence from Mortgage Market Segmentation." National Bureau of Economic Research Working Paper 17832.

Aoki, Kosuke, James Proudman, and Gertjan W. Vlieghe. 2001. "A Financial Accelerator Model of the U.K. Household Sector." Unpublished.

Arestis, Philip. 1988. "The Credit Segment of a UK Post Keynesian Model." *Journal of Post Keynesian Economics*, 10(2): 250-269.

Baude, John. 2005. "The Impact of Stock Market Shocks on Credit in France since the Mid-1990s." Banque de France: Financial Stability Review 7.

Bernanke, Ben S., and Mark L. Gertler. 1989. "Agency Cost, Net Worth, and Business Fluctuations." *American Economic Review*, 79(1): 14-31.

Bernanke, Ben S., Mark L. Gertler, and Simon Gilchrist. 1996. "The Financial Accelerator and the Flight to Quality." *Review of Economics and Statistics*, 78(1): 1-15.

Bernanke, Ben S., Mark L. Gertler, and Simon Gilchrist. 1999. "The Financial Accelerator in a Quantitative Business Cycle Framework." In *Handbook of Macroeconomics*, ed. John B. Taylor and Michael Woodford, 1341-1393. Amsterdam: North-Holland.

Breusch, Trevor S. 1979. "Testing for Autocorrelation in Dynamic Linear Models." *Australian Economic Papers*, 17(31): 334-355.

Carballo-Cruz, Francisco. 2011. "Causes and Consequences of the Spanish Economic Crisis: Why the Recovery Is Taken so Long?" *Panoeconomicus*, 58(3): 309-328.

Cardarelli, Roberto, Tomasso Monacelli, Alessandro Rebucci, and Luca Sala. 2009. "Housing Finance, Housing Shocks, and the Business Cycle: Evidence from OECD Countries." http://www.iadb.org/res/files/Housing_09.pdf.

Casolaro, Luca, and Leonardo Gambacorta. 2005. "Un Modello Econometrico per il Credito Bancario alle Famiglie in Italia." *Moneta e Credito*, 58(229): 29-56.

Dickey, David A., and Wayne A. Fuller. 1979. "Distribution of the Estimator for Autoregressive Time Series with a Unit Root." *Journal of the American Statistical Association*, 74(366): 427-431.

Dickey, David A., and Wayne A. Fuller. 1981. "Likelihood Ratio Statistics for Autoregresssive Time Series with a Unit Root." *Econometrica*, 49(4): 1057-1072.

Duca, John V., John Muellbauer, and Anthony Murphy. 2013. "Shifting Credit Standards and the Boom and Bust in U.S. House Prices: Time Series Evidence from the Past Three Decades." Spatial Economics Research Centre Discussion Paper 0076.

Fazzari, Steven M., Gleen R. Hubbard, and Bruce C. Petersen. 1988. "Financing Constraints and Corporate Investment." *Brookings Paper on Economic Activity*, 1: 141-195.

Godfrey, Leslie G. 1978. "Testing against General Autoregressive and Moving Average Error Models when the Regressors Include Lagged Dependent Variables." *Econometrica*, 46(6): 1293-1302.

Gounopoulos, Dimitrios, Andreas G. Merikas, Anna A. Merika, and Anna Triantafyllou. 2012. "Explaining House Price Changes in Greece." *Applied Financial Economics*, 22(7): 549-561.

Graziani, Augusto. 2003. *The Monetary Theory of Production*. Cambridge: Cambridge University Press.

Harris, Richard, and Robert Sollis. 2003. *Applied Time Series Modelling and Forecasting*. Chichester: John Wiley & Sons.

Johansen, Søren. 1988. "Statistical Analysis of Cointegrating Vectors." *Journal of Economic Dynamics and Control*, 12(2-3): 231-254.

Johansen, Søren. 1991. "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models." *Econometrica*, 59(6): 1551-1580.

Johansen, Søren. 1995. *Likelihood-Based Inference in Cointegrated Vector Autoregressive Models*. Oxford: Oxford University Press.

Keynes, John M. 1930. *A Treatise on Money*. London: MacMillan.

Kiyotaki, Nobuhiro, and John Moore. 1997. "Credit Cycles." *Journal of Political Economy*, 105(2): 211-248.

Kwiatkowski, Denis, Peter C. B. Phillips, Peter Schmidt, and Yongcheol Shin. 1992. "Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root: How Sure Are We that Economic Time Series Have a Unit Root?" *Journal of Econometrics*, 54(1-3): 159-178.

Le Bourva, Jacques. 1962. "Création de la Monnaie et Multiplicateur du Crédit." *Revue Économique*, 13(1): 29-56.

Miller, Norm, Liang Peng, and Michael A. Sklarz. 2011. "House Prices and Economic Growth." *Journal of Real Estate Finance and Economics*, 42(2): 522-541.

Muellbauer, John, and Cameron Gavin. 2000. "Equity Markets and the UK Housing Market." *Housing Outlook.* November 13.

Myers, Stewart C. 1984. "The Capital Structure Puzzle." *Journal of Finance*, 39(3): 575-592.

Nelson, Charles R., and Charles Plosser. 1982. "Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications." *Journal of Monetary Economics*, 10(2): 139-162.

Nobili, Andrea, and Francesco Zollino. 2012. "A Structural Model for the Housing and Credit Market in Italy." Banca d'Italia Working Paper 887.

Papadimitriou, Dimitri B., Greg Hannsgen, and Gennaro Zezza. 2007. "The Effects of a Declining Housing Market on the U.S. Economy." Levy Economics Institute Working Paper 506.

Parguez, Alain. 1979. *Monnaie et Macroéconomie*. Paris: Economica.

Phillips, Peter C. B., and Pierre Perron. 1988. "Testing for a Unit Root in Time Series Regression." *Biometrika*, 75(2): 335-346.

Robinson, Joan. 1956. *The Accumulation of Capital*. London: Palgrave Macmillan.

Rubio, Margarita. 2009. "Housing Market Heterogeneity in a Monetary Union." Bank of Spain Working Paper 0916.

Sylos Labini, Paolo. 1948. *Saggio dell'interesse e Reddito Sociale.* Rome: Accademia Nazionale dei Lincei.

The Economist. 2012. "Spain's Banking System - Teetering," June 2.