BANK CREDIT AND THE HOUSING MARKET IN OECD COUNTRIES

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Abstract

Relevant economic literature frequently focuses on the impact of credit shocks on housing prices. The macroeconomic doctrine of the 'New Consensus Macroeconomics' completely ignores bank credit. The 'great recession', though, has highlighted the importance of bank credit. The purpose of this contribution is to re-visit this important macroeconomic variable. Consequently, we propose to endogenise the volume of bank credit by paying special attention to those variables that are related to the real estate market, which can be considered as key to the evolution of bank credit. Our theoretical hypothesis is tested by means of a sample of 9 OECD economies from 1970 to 2011. We apply the cointegration technique for the latter purpose, which permits the modelling of the long-run equilibrium relationship and the dynamics of the short run along with an error-correction term.

***Keywords**:* bank credit, collateral channel, housing market, OECD countries, empirical modelling.

JEL Classification: C22, R31.

1. Introduction

The events leading to the August 2007 financial crisis have shown that a private debt crisis can provoke a systemic banking crisis. This contribution proposes to examine the possibility of endogenous bank credit and consider the housing market as the main source of demand for credit in the private sector. In particular, our approach assumes that agents demand bank credit that they need to satisfy their economic activities. In this context, the final volume of credit is not a supply-led variable; it is rather a demand-determined variable in the sense that the banking sector provides credit in response to the demand for it. For the purposes of this contribution, we focus on the demand for credit, which emanates essentially from mortgages to acquire housing.

After endogenising bank credit to the domestic sector and discussing the main determinants of our theoretical framework, we proceed to investigate this proposition empirically. We employ for this purpose cointegration and error-correction techniques in a sample of 9 OECD economies over the period 1970 to 2011.

The remainder of this paper is structured as follows. In section 2 we put forward our theoretical framework. In section 3 we explain our approach and results of our empirical investigation: sub-section 3.1 presents the econometric technique, sub-section 3.2 discusses the data sources, and sub-section 3.3 reports the empirical results of the long-run equilibrium relationships and the short-run dynamics. Section 4 offers an overall discussion of the theoretical and empirical results. Finally, section 5 summarises and concludes.

2. Bank Credit

We begin with the traditional notion of the ‘dynamic monetized production economy’, which considers that any flow of production needs a previous flow of credit. In this sense businessmen determine the level of production, prices, dividends and salaries based on their expectations of future demand. The development of the production process requires credit, which is the element that drives and permits the evolution of the economy. The only role in this process, which has to be played by the banking sector, is to provide credit in response to businessmen’s demand. In this theoretical approach, the Central Bank influences the cost of credit through manipulating the interest rate under its control. The Central Bank also affects credit standards, which ensure the proper functioning of the economy, through generating the volume of reserves that commercial banks require in order to provide the credit that is demanded.

We develop our model by considering a close economy without public or foreign sectors where the following agents interact: households, firms, and the banking system. [1] We also adopt the following assumptions: (a) there are two factors of production; labour, which is remunerated by means of wages, and capital whose remuneration is the profits obtained from the production process; (b) firms develop productive activities in order to provide those goods and services as required; (c) firms are grouped into two categories: real estate firms, which include property developers, and non-real estate companies; the latter comprise of the rest of the firms in our model; (d) all the profits are saved; (e) households use their income to consume goods and services; (f) the acquisition of housing assets is the main investment decision undertaken by households, since it is normally financed by getting into debt and comprises of an important part of the income earned during households' working life; and (g) the Central Bank sets the short-term interest rate and the credit standards that the commercial banks have to face in order to provide the required credit.

We modify the original framework of the 'monetary production economy' by accounting for the housing market and the creation of related credit in order to show how those factors, which determine the equilibrium in the housing market, explain the evolution of credit in the private sector.[2] After the distribution of the income generated in the production process to remunerate households, a share of initial credits borrowed by firms comes back to the banking sector as deposits, which constitutes banking sector reserves. All the households use their current income to consume goods and services. Some of them decide to purchase a property, which means borrowing external resources from the banking sector in order to face its cost. The desire to invest in real estate assets, i.e. demand for housing, is mainly a function of housing prices, disposable income and the mortgages rate, since these elements determine the affordability of dwelling, which is defined as price-to-income ratio. As a result, households' demand for housing is summarised as in equation (1):

$$D_H = D_H(P_H, RDY, MR) \qquad (1)$$

$$\qquad\quad - \quad + \quad -$$

[1] The banking system includes the Central Bank and commercial banks.

[2] See Graziani (2003) for an explanation of the original 'monetary production economy' theory.

where the demand for housing, D_H, is a positive function of real disposable income, *RDY*, and a negative one with respect to housing prices, P_H, and the mortgage rate, *MR*. The sign below a variable indicates the partial derivate of D_H with respect to that variable.

To account fully for the dynamics in the housing market and include the role of house developers, i.e. firms, we hypothesise the supply for real estate assets as in equation (2):

$$S_H = S_H(P_H, RRI) \qquad (2)$$
$$\quad + \quad +$$

which shows how the supply of housing, S_H, is positively influenced by housing prices, P_H, and real residential investment, *RRI*.

Equations (1) and (2) can be set equal to each other at equilibrium, and solving the resulting equality, we obtain the quantity and the price of housing as shown in equation (3) and (4) respectively:

$$P_H = P_H(RDY, MR, RRI) \qquad (3)$$
$$\quad + \quad - \quad -$$

$$Q_H = Q_H(P_H, RDY, MR) \qquad (4)$$
$$\quad + \quad + \quad -$$

where the variables are as in equations (1) and (2).

Those households who decide to participate in the housing market are compelled to get into debt.[3] In this context, the commercial banks face households' demand for credit, select those borrowers who are credit-worthy and lend part of their reserves in the form of mortgages, which are required to purchase dwellings. As a result, the

[3]There is, of course, another group of households who invested in real estate assets in the past and have to employ a fraction of their income to repay their mortgages.

demand for credit, which is required to acquire those properties that households desire depends on the equilibrium in the housing market as displayed in equation (5):

$$D_C = D_C(P_H(\cdot), Q_H(\cdot)) \qquad (5)$$
$$\quad + \quad +$$

where the symbols have the same meaning as in previous equations, except D_C, which stands for credit demand.

Equation (6) is obtained by substituting equations (3) and (4) in equation (5), which provides an extended version of the credit demand equation:

$$D_C = D_C(P_H, RDY, RRI, MR) \qquad (6)$$
$$\quad + \quad + \quad + \quad -$$

where the variables are defined as in equation (3), (4) and (5).

The volume of bank credit, which is generated in this way is given by the interaction between a horizontal supply of credit, at a given level of interest rate, and the demand for credit, which satisfies the credit standards as determined by the central bank.[4] The supply of credit, which is included in the model, is defined as in equation (7):

$$S_C = S_C(MR) \qquad (7)$$

where *Sc* is the supply of credit, and *MR*, the mortgage rate.

At equilibrium, demand for and supply of credit are equal, which permits us to put equations (6) and (7) equal to each other and solve the resulting equality for bank credit, *BC*, at the steady state of our model; as in equation (8):

$$BC = BC(P_H, RDY, RRI, MR) \qquad (8)$$
$$\quad + \quad + \quad + \quad -$$

[4]The assumption of a horizontal supply of credit is the reflection of the notion of a horizontal supply of money (Kaldor, 1982, Moore, 1983). In the context of endogenous money, the central bank determines the rate of interest at which it provides the liquidity that is required by the credit-worthy demand. The stock of money-credit is driven by the demand for money and is out of the control of the banking institutions (see also Lavoie, 1984, for further analysis).

which displays how the volume of bank credit, *BC*, is positively related to housing prices, P_H, real disposable income per capita, *RDY*, and real residential investment, *RRI*. The volume of bank credit is also a negative function of the mortgage rate, *MR*. This shows how the volume of bank credit is explained by those variables, which define the affordability of the properties, i.e. housing prices, disposable income and the mortgage rate; and the flow of new real estate assets, which is measured by real residential investments.[5]

Our approach is different from the traditional one of the housing literature where the major role in the housing market is given to the supply of credit.[6] Our model, which is rooted in the Banking School doctrine, considers the supply of credit as a residual element, since credit is demand-driven and the supply of money-credit is horizontal at the level of the interest rate as determined by the Central Bank. As a result, the money-credit stock, i.e. the volume of bank credit, is determined by demand, which comes from the private sector, since commercial banks would provide all the volume of credit, which satisfies the credit standards as determined by the Central Bank.[7]

The first determinant of banking credit included in equation (8) is housing prices, P_H.[8] Its relevance is twofold: (a) housing prices are key in the determination of the affordability of dwelling; and (b) its evolution exerts important effects on the dynamics of the credit market and the housing market via the 'collateral' channel.[9] In particular, the 'collateral' channel captures how an increase in housing prices introduces relaxation of the conditions that a borrower has to face in order to obtain a mortgage. This is so since the 'protection' against a possible borrower's default, which is offered to the lender, is stronger due to the fact that the asset that is collateralised has a higher

[5]The model assumes that new properties are acquired by households who do not have a previous residential asset, which can be sold in order to finance the new purchase. Demand for credit has to account explicitly for residential investment since the final volume of bank credit is a proportion of the value of the flow of new dwellings, which are produced in response to the demand for housing.

[6] See Adelino et al. (2012) where empirical evidence is provided to support the assumption that easy access to credit fuels housing prices.

[7]See Daugherty (1942) for further details on the Banking School approach.

[8]See Goodhart (1995) and Hofman (2004) for empirical evidence of the positive impact of housing prices on credit.

[9]The 'collateral' channel is considered as a variant of the 'financial accelerator' introduced by Bernanke et al. (1999). According to this idea, under the presence of asymmetric information those economic agents who opt for borrowing resources, instead of using their own resources, in order to undertake their projects, have to face a prime. This moves procyclically due to two alternative factors: either procyclical movements in the value of those assets that can be used to secure the mortgage (Kiyotaki and Moore, 1997); or countercyclical changes in terms of the cost of information between external and internal source of finance (Bernanke and Gertler, 1989). The cost that investors have to pay for these resources depends on their net worth and exerts a procyclical impact on their capacity to obtain finance. Under these circumstances the credit market amplifies the fluctuations in production and other macroeconomic aggregates of the real economy (see also Bernanke, 2007).

value.[10] New households' indebtedness, which is secured on assets whose value is increasing, the real estate assets in this case, displays lower interest rates, and requires less additional guarantees and permits higher equity withdrawal. The increasing value of the homeowners' collateral during the pre-crisis period and the related 'wealth' effect, contribute to boost the demand for credit not merely via residential investment.[11] It also has a remarkable effect on other macroeconomic variables, which are a source of demand for credit too, i.e. consumption, as highlighted by Bridges et al. (2006), Arestis and Karakitsos (2008) and Case et al. (2011). We may also note that there is a loop between credit and housing prices. In particular the possibility of obtaining cheaper and higher volume of credit makes the ownership of dwelling more affordable and attractive, which increases the demand for housing. This increase in demand promotes housing price appreciation, since the supply of housing is fixed in the short run, which strengths the 'collateral' channel and fuels the loop credit-housing prices.[12] The inclusion of housing prices as a key determinant of credit demand is also justified following Iacoviello and Minetti (2008). The latter considers housing prices as the most informative element in terms of the evolution of housing demand in the short run, due to the nature of the housing market and the prevalence of price adjustments.

Our contribution also accounts for the positive impact of real disposable income, *RDY*, on the development of credit. Specifically, borrowers' income is used by the lenders to evaluate borrowers' risk of default, since in a context of imperfect information and uncertainty this is the basic indicator that commercial banks can utilize to approximate households' cash-flows.[13] This element influences the final risk premium that the borrowers have to face and also affects other conditions of the mortgage, as for example, its maturity, its volume or the requirement of additional assets to secure the operation. Regarding total income, Almeida et al. (2006) points to the so-called 'income (or affordability) constraint', i.e. households are finance-

[10]See Benito et al. (2006), Corrado (2007) and Aron et al. (2012) for further theoretical explanations and empirical analyses of the 'collateral' channel.

[11]Miller et al. (2011) and Campbell and Cocco (2007) distinguish between the effects of unpredictable and predictable variations in housing prices. The former influences the macroeconomy via the 'wealth' effect of households, while the latter proxies the 'collateral' channel. The influence of 'collateral' channel becomes stronger when households are financially constrained. Miller et al. (2011) found that the impact of the 'collateral' channel is stronger than 'wealth' effects in the US.

[12]Although the causality between credit and housing prices goes in both directions, the strongest effect is the one that emerges from housing prices to credit (Hofman, 2003; Goodhart et al., 2006).

[13]The effect of disposable income on credit is uncertain (Nobili and Zollino, 2012). Specifically, rising incomes induce individuals to go for higher indebtedness. Nevertheless, the demand for credit is not very sensitive to variations in income in those markets where the loan-to-value ratio is low (see also Almeida et al., 2006).

constrained in the sense that when they obtain a loan the annual total repayment of the mortgage has to be a proportion of their total yearly income.[14] In terms of our model, real disposable income is the main determinant of the demand for housing, and as a result, we expect a relevant role in the explanation of the demand for credit.[15]

The third determinant of the banking credit that our model considers is real residential investment, *RRI*, which approximates the flow of new constructions.[16] Our model assumes a positive and strong effect of residential investment on the demand for banking finance, since an increase in the volume of acquisitions of real estate assets drives up house prices in the short-run, which means that households have to face higher debts to purchase new properties. However, in the long-run increasing real residential investment means an increase in the supply of housing, which induces a decline in housing prices and makes the asset more affordable. This improvement of the affordability permits the entrance in the market of some households that were unable to purchase a property before. This increase in the demand for housing boosts the demand for credit, although the quantity that households have to borrow is lower than in the short-run; there are, actually, more purchasers willing to get into debt. After some period in which housing demand is growing, housing prices go up and a new cycle in the housing market emerges; in this evolution of banking, debt materialises.[17] Moreover, investment in housing assets has an indirect effect on credit demand, which reinforces the previous impact and is derived from an increase in the demand for housing. Residential investment has strong 'pulling' effects on the economy in terms of unemployment.[18] In this sense, an increase in the activity of the residential sector means creation of income, which is distributed to households and makes more affordable this kind of investment.

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[14]The impact on prices which emanates from changes in income is enlarged through fluctuations in the demand for credit (Stein, 1995; Almeida et al., 2006).

[15]Rising incomes reinforces the positive impact of housing prices on households' indebtedness, as has been demonstrated by Haurin and Rosenthal (2006) for the United States.

[16]The model assumes that the dynamics in the housing market are demand-led, although in the short run the supply of housing is given and all the pressures coming from the demand side have an impact on prices, and eventually on the value of the collateral.

[17]An alternative view of real residential investment considers that this variable is driven by the evolution of Tobin's q (Brainard and Tobin, 1977), which suggests that home builders develop their projects in those situations where the price of the asset is higher than their cost of production, i.e. the Tobin's q ratio is above unity. This theory can be reconciled with our perspective, under the assumption that extraordinary profitability, which emerges in the housing market due to an exogenous shock in incomes or monetary policy, fuels the demand for housing. See Girouard and Blöndal (2001) for more discussion of the Tobin's q ratio in the housing market.

[18]See Girouard and Blöndal (2001) and Iacoviello (2004) for a discussion of the role of this variable in an analysis of consumption, credit and the housing market.

Finally, our theoretical proposition accounts for the relationship between the mortgage rate, *MR*, and credit. The importance of this variable is multiple: (a) it is a proxy for the user cost of dwelling, which influences the demand for housing; (b) it accounts for the cost of external finance that households have to consider in order to purchase a dwelling, which also exerts an effect on the demand for credit; (c) it is also important in the supply side of the housing market, since some home builders have to borrow funds to develop their activities;[19] and (d) it is the main explanatory variable of the supply of credit. By considering the ratio of interest rate payments on consumer debt over nominal disposable income as an indicator of affordability, we can expect a slowdown of households' credit demand when the price of mortgages increases, since this means facing higher debt service burdens in those cases where disposable income is constant.[20] Moreover, rising mortgage rates provoke contractions in the demand for credit due to the fact that there is a fraction of the potential borrowers, which is not solvent under this condition.[21] The inclusion of this element could register possible credit crunch episodes; i.e. a sharp contraction of available credit could emerge if the Central Bank tightened strongly credit standards and pushed up interest rates in response to increasing risk of the borrowers' insolvency.[22]

3. Empirical Investigation

In this section the econometric technique, the dataset and our empirical results are presented.

3.1 Econometric Technique

We begin by assuming a linear specification of equation (3) and applying the standard cointegration technique (Engle and Granger, 1987). We deal with the estimation of the

[19] In this sense a high mortgage rate could crowd out some construction firms, which would have a negative impact on the supply of housing. As a result, acceleration of housing prices could take place, whose effects on credit can be interpreted as described in the text.

[20] See Aoki et al. (2002), Calza et al. (2007) and Corrado (2007) for a relevant discussion and empirical evidence on the positive effects of rising house prices on the access and the cost of credit. More specifically, the first study focuses on the US market, the second one considers some OECD countries and the third study concentrates on the UK.

[21] Under such a case, some households would have to opt to rent the dwelling services instead of acquiring the property of the asset, which in the long run means a final negative effect on house prices; this would induce a decline in the value of the collateral. This decline means a slowdown of credit demand, which reinforces the direct negative effect that emerges from an increase in interest rates.

[22] See Bernanke et al. (1991), Wolfson (1996) and Buera and Moll (2012) for further discussion and alternative views on the implications of a credit crunch.

relationship under examination as proposed by Hendry and Nielsen (2007). The first step is to estimate the long-run equilibrium relationship by means of Ordinary Least Squares (OLS). Then the existence of cointegration among the variables is tested by checking the stationarity of the residuals produced by the long-run relationship. We utilize the augmented Dickey-Fuller (Dickey and Fuller; 1979, 1981) and the Kwiatkowski-Phillips-Schmidt-Shin (Kwiatkowski et al., 1992) tests in our attempt to examine whether the residuals are integrated of zero degree. In the second step, we account for the short-run dynamics by estimating a model in differences, which also includes an error-correction term. The latter variable, which is built as the lagged-residuals term of the cointegrating long-run relationship, shows the percentage of disequilibria eliminated between the short-run and the long-run model in each period. The short-run relationships are estimated by applying the 'general to specific' modelling strategy (Hendry and Richard, 1983).[23]

The order of integration of our dataset is studied by means of several unit root/stationarity tests. We apply the augmented Dickey-Fuller (Dickey and Fuller; 1979, 1981), the GLS-based Dickey-Fuller (Nelson and Plosser, 1982) and the Phillips-Perron (Phillips and Perron, 1988) tests, whose null hypothesis is the existence of a unit root in the variable under consideration. The Kwiatkowski-Phillips-Schmidt-Shin (Kwiatkowski et al., 1992) test is also utilized to study the possible stationarity of the data, since under the presence of structural breaks the results of the unit root/stationarity tests could lead to the wrong order of integration. The use of cointegration methods in order to avoid the problem of spurious regressions can be justified to the extent our data are I(1), i.e. they present a unit root, as we try to verify empirically in what follows below, where the mentioned unit root/stationarity tests are utilized.

We also check for the existence of cointegration by means of the Johansen's (1988, 1991) maximum eigenvalue and trace tests for cointegration to assure the robustness of our results. Finally, the validity of the cointegrating relationships estimated by OLS is also tested by means of the R-squared, the DW statistic, the Akaike Information Criterion (AIC), the Schwartz Information Criterion (SIC) and the F-

[23] A general model is initially estimated, which includes several lags of the endogenous and the exogenous variables. Progressively, those statistically-insignificant variables are eliminated until the point when a parsimonious model with all its significant determinants is reached.

statistic.[24] We also report other diagnostic/statistics, which are utilized in the event of the short-run estimations: (a) the Breusch-Godfrey Serial Correlation LM (Breusch, 1979; Godfrey, 1978) test, which detects the existence of autocorrelation of first-, second- and third-order; (b) the White (White, 1980) test, with and without cross terms, which checks for homoscedasticity; and (c) the ARCH (Engle, 1988) test, which permits to test for the absence of ARCH effects of first- and second-order in the residuals.

We estimate a standard semi-log-linear model as shown in equation (9):

$$BC = \gamma_0 + \gamma_1 P_H + \gamma_2 RDY + \gamma_3 RRI - \gamma_4 MR \qquad (9)$$

where the meaning of variables is as explained above. All the variables are expressed in terms of logarithms except the mortgage rate.

3.2 Data

Our theoretical model is tested by means of samples for various countries, which includes annual observations from 1970 till 2011 for the following 9 OECD countries: Belgium, Finland, Italy, Japan, the Netherlands, New Zealand, Norway, Spain and the United States. The length of the period under consideration is determined by the availability of historical information in the sources consulted. The size of our sample is rich enough to study the relationship between the housing market and the bank credit in the private sector in countries with important differences in terms of development and structure of the financial sector and different role of the housing market.

The endogenous variable of our model, the volume of bank credit, is approximated by the *Domestic Credit to the Private Sector (as a Percentage of GDP)* time series, which are available on the *World Bank* databank.[25]

An important source of information is the *AMECO* databank, which is published by the European Commission's Directorate General for Economic and Financial

[24]The AIC and SIC are useful in selecting the model, which fits better to the features of the data under consideration when there are several specifications for the same relationship. In particular, the chosen model is the one, which exhibits the lowest values for both criteria (Gujarati, 1997).

[25]These series are available at:
http://data.worldbank.org/

Affairs.[26] The following statistics are obtained: (a) Gross Fixed Capital Formation by type of Goods at Current Prices (Dwelling); (b) Gross National Disposable Income per Head of Population; (c) Gross Domestic Product Price Deflator; and (d) Real Long-term Interest Rate. [27] The lack of homogeneous and reliable information for mortgages rates during the period under consideration forces us to use the long-term interest rate its proxy.

The *Bank of International Settlements (BIS)* is also consulted to obtain the Real House Prices Index, which is available for the period 1970-2011.[28]

E-Views 5.0 is the econometric package utilized to run the models and those tests, which are used for the purposes of our study.

3.3 Empirical Results

We check for the presence of unit roots in our data by applying several unit root/stationarity tests. We accept the null hypothesis of the presence of unit roots in the case of the augmented Dickey-Fuller (Dickey and Fuller; 1979, 1981), the Phillips-Perron (Phillips and Perron, 1988) and the GLS-based Dickey-Fuller (Nelson and Plosser, 1982) tests. These findings are supported by the rejection of the null hypothesis of stationarity in the case of the Kwiatkowski-Phillips-Schmidt-Shin test (Kwiatkowski et al., 1992). These results lead to the conclusion that our data are of first order integration, i.e. I(1).[29]

3.3.1 Long-run Equilibrium Relationships

The empirical relationships, which are modelled to analyse the long run are displayed in Table 1A.[30] The statistics applied to validate the econometric regressions are reported in

[26]This information is available at:
http://ec.europa.eu/economy_finance/db_indicators/ameco/index_en.htm

[27]The *OECD* databank is used to complete some missing information. We utilize *Gross fixed capital formation and housing* to replace the missing values in dwelling series for Norway, and the *Long-term interest rate* in the case of Norway and New Zealand.

[28]This data is available at:
http://www.bis.org/

[29]The results of all these unit root/stationarity tests are not displayed in the paper but are available from the authors upon request.

[30]The Johansen's (1988, 1991) test suggests cointegration at 5% significance level in all the countries except in Japan, where a cointegrating relationship is found at the 10% significance level. The results of this test are not reported but are available from the authors upon request.

Table 1B.[31] All the cointegrating relationships include an intercept which is negative and significant in all the cases.

TABLE 1A CREDIT LONG-RUN RELATIONSHIP (1970-2011).

Long-run relationship					
	Constant	L_RHP	L_RDY	L_RRI	MR
Belgium	-8.816358***		2.665025*** (0)		
Finland	-3.950581***	0.764384*** (0)			
Italy	-4.572499***			1.080865*** (0)	-3.291772*** (0)
Japan	-7.356197***	0.27513*** (0)	0.814936*** (0)		
Netherlands	-3.115259***			1.080747*** (0)	
New Zealand	-2.742257***			1.457735*** (0)	
Norway	-6.519227***		1.075322*** (0)		
Spain	-2.945305***	0.648469*** (0)			-1.617144** (0)
US	-5.557265***		1.712545*** (0)		

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

TABLE 1B CREDIT LONG-RUN RELATIONSHIP DIAGNOSTICS/STATISTICS I.

Diagnostic/Statistics Long-run Relationship					
	R-squared	DW	AIC	SIC	F-statistics
Belgium	0.920258	0.596177	-0.715964	-0.632375	450.0795 (0.0000)
Finland	0.523184	0.205051	-0.503058	-0.419469	42.79252 (0.0000)
Italy	0.745851	0.635862	-1.205774	-1.08039	55.75922 (0.0000)
Japan	0.921629	0.709889	-2.764604	-2.63922	223.4361 (0.0000)
Netherlands	0.843016	0.421676	-0.82782	-0.744231	209.4329 (0.0000)
New Zealand	0.734979	0.292691	1.309284	1.392873	108.158 (0.0000)
Norway	0.740873	0.208035	-0.517707	-0.430631	100.0691 (0.0000)
Spain	0.732446	0.214965	-0.470847	-0.345464	52.01382 (0.0000)
US	0.935325	0.55168	-2.308628	-2.225039	564.0178 (0.0000)

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

Table 1A reports the direct relationship between housing prices and the volume of bank credit. Specifically, the strength of the 'collateral' channel is remarkable in those countries, which suffer a devastating bubble in the housing market, as for example, Spain (0.648) and Finland (0.764). Interestingly enough, in 2008 housing prices in Spain were 24% above their fundamentals, while in Finland they were overvalued by 15%. These two countries showed then the strongest deviation between housing prices and their fundamentals in the Euro Area (El Mundo, 2010). The lowest

[31]The robustness of these models is checked by means of the OLS White-Heteroskedasticity Consistent technique (White, 1980), which corrects for the presence of heterokedasticity; and the Generalised Method of Moments (Arellano and Bover, 1995), which deals with autocorrelation of unknown forms and simultaneity problems. These estimations are not shown since their results in terms of significance and value of the coefficients are similar to those obtained by OLS reported in Table 1A.

incidence of housing prices on demand for credit emerges in the Japanese market (0.275).

Disposable income is the only variable, which drives demand for credit, in the case of Belgium (2.665), the United States (1.713) and Norway (1.075). It is also significant in Japan (0.815), although the effect is lower in comparison with the one, which is found in Belgium and the United States.

The flow of construction is relevant in the cases of New Zealand (1.458), the Netherlands (1.081) and Italy (1.081). In the first two markets, this variable, which comes in our model through the supply side of the housing market, is the only factor that determines the long-run equilibrium.[32]

Our study also points to a negative effect of the cost of external finance in the two Southern European economies that we consider, i.e. Italy and Spain. This last effect (-1.617) is around half of the size of the one found in the Italian economy (-3.292).

We discuss next the diagnostics/statistics applied in order to validate our models. In general terms, the adjustment of the models is high, since the R-squared is higher than 70% in all the econometric models except in Finland, where the model is able to explain just the 52% of the variation in bank credit. The second column reports the value of the Durbin Watson statistics, which are not close to 2 since there is autocorrelation.[33] We also report two information criteria (the AIC and the SIC). These statistics are useful to select the specification that fits better to the structure of the data when there are several alternatives to model the behaviour of the endogenous variable.[34] Table 1B shows the F-statistic where the rejection of the null hypothesis in all the cases is relevant, which enables us to conclude on the joint significance of the variables included in the models.

3.3.2 Short-run Dynamics

Table 2A displays the models, which are estimated to capture the dynamics of the model in the short run. Tables 2B and 2C report the results of the statistics/diagnostics, which were presented in section 3.1.

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[32]The strong impact in New Zealand is easily understood since in 2007 the housing market in this economy was stagnated and after then prices continue growing up again.

[33]According to the cointegration technique (Engle and Granger, 1987) the lack of autocorrelation has to be checked just in the error-correction model.

[34]Gujarati (1997) recommends choosing the model whose absolute values of the AIC and SIC are the lowest possible.

TABLE 2A CREDIT SHORT-RUN RELATIONSHIP (1970-2011).

Short-run Relationship							
	Constant	ΔL_RHP	ΔL_RDY	ΔL_RRI	ΔMR	ΔL_CREDIT	EL_CREDIT
Belgium	0.028389			0.267139* (3)			-0.265906**
Finland	0.008079	0.23186*** (2)				0.496211*** (1)	-0.073486*
Italy	0.002945					0.708952*** (1)	-0.138908*
Japan	0.002373					0.477998*** (1)	-0.350294***
Netherlands	0.036917***	0.172884** (0)					-0.103185**
New Zealand	0.034756***	0.210688*** (0)					-0.035089**
Norway	0.011056	0.312063** (1)				0.389465** (1)	-0.104594**
Spain	0.007648					0.707276*** (1)	-0.089730**
US	0.012611*		0.522043* (0)				-0.198502**

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

TABLE 2B CREDIT SHORT-RUN RELATIONSHIP DIAGNOSTICS/STATISTICS I.

Diagnostic/Statistics Short-run Relationship					
	R-squared	DW	AIC	SIC	F-statistics
Belgium	0.237075	2.033039	-1.457911	-1.327296	5.282674 (0.0101)
Finland	0.668652	2.322958	-3.648111	-3.475734	22.87036 (0.0000)
Italy	0.401239	2.111268	-3.360975	-3.233009	12.06208 (0.0001)
Japan	0.348626	2.082007	-3.767273	-3.639307	9.633914 (0.0004)
Netherlands	0.783877	1.985935	-3.643707	-3.474819	43.52391 (0.0000)
New Zealand	0.908671	1.603619	-3.263641	-3.094753	119.3928 (0.0000)
Norway	0.5112	1.956996	-3.148235	-2.970481	10.80689 (0.0000)
Spain	0.494425	1.717818	-3.304016	-3.176050	17.60305 (0.0000)
US	0.13882	2.417253	-3.476376	-3.349711	2.982144 (0.0630)

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

TABLE 2C CREDIT SHORT-RUN RELATIONSHIP DIAGNOSTICS/STATISTICS II.

Diagnostic/Statistics Short-run Relationship							
	LM (1)	LM (2)	LM (3)	White	White X	ARCH (1)	ARCH (2)
Belgium	0.025450 (0.874223)	0.048645 (0.952590)	0.099307 (0.959800)	1.991267 (0.119564)	1.781107 (0.145946)	0.001304 (0.971407)	0.003147 (0.996859)
Finland	1.74714 (0.195327)	0.871257 (0.428115)	0.809402 (0.498349)	0.485415 (0.814063)	0.335323 (0.955347)	0.014571 (0.904610)	0.12686 (0.881285)
Italy	1.707244 (0.199864)	1.300146 (0.285696)	1.07211 (0.374284)	0.226865 (0.921461)	0.192652 (0.963225)	0.051246 (0.822189)	0.083401 (0.920170)
Japan	1.82672 (0.185187)	1.526363 (0.231846)	1.395053 (0.261611)	1.186009 (0.334527)	1.087558 (0.385486)	0.752416 (0.391458)	0.619951 (0.543941)
Netherlands	0.363828 (0.550277)	0.53111 (0.592750)	0.514325 (0.675257)	0.323178 (0.895520)	0.28199 (0.941382)	1.672664 (0.203919)	1.116607 (0.338771)
New Zealand	1.45194 (0.236301)	1.783492 (0.183415)	1.160444 (0.339545)	1.860725 (0.127342)	1.618218 (0.173245)	0.035461 (0.851663)	0.200356 (0.819372)
Norway	0.02439 (0.876942)	0.609972 (0.550190)	0.394522 (0.757911)	0.385388 (0.882088)	0.386023 (0.930674)	0.044034 (0.835121)	0.048124 (0.953089)
Spain	0.016358 (0.898963)	0.146955 (0.863878)	0.335906 (0.961949)	0.378085 (0.822664)	0.307265 (0.905035)	6.470822 (0.015403)	0.474490 (0.626261)
US	3.320754 (0.076726)	1.843544 (0.173295)	1.367418 (0.269259)	1.819876 (0.147026)	2.212998 (0.075659)	2.187768 (0.147575)	2.056208 (0.143115)

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

The estimations of the dynamics in the short run reveal that the mortgage rate has no impact in this time horizon. This finding can be interpreted according to the Post Keynesian view, which assumes that the demand for credit is inelastic to fluctuations in the rate of interest (Lavoie, 1984).

The models estimated to capture the short-run effects include a constant, which is positive and significant in the cases of the Netherlands, New Zealand and the United States. Our estimations also include a lag of the endogenous variable, the bank credit. This element drives the evolution of credit in this time horizon in the credit markets of Spain, Italy and Japan. The strongest impact is found in Spain (0.707) and Italy (0.709). The coefficient, which emerges from the Japanese economy, is lower than in the markets just considered (0.478). In Finland this parameter is slightly superior (0.496). The lowest impact emerges in the Norwegian case (0.389).

Our empirical analysis indicates how rising housing prices exert a positive effect on credit in the half of the countries under consideration. Specifically, Finland (0.232) shares this element as the key explanatory factor of bank credit in the short and long run. The highest impact is found in Norway (0.312), while the lowest effect emerges in the Netherlands (0.173) and New Zealand (0.211).

Residential investment contributes to explaining the development of credit just in Belgium (0.267). This result conforms to our theoretical hypothesis, which assumes that the relationship between both variables is positive.

Our estimations also find positive effect of the disposable income variable only in the case of the United States (0.522). As in the long run, this variable is the factor that drives the evolution of bank lending in the United States economy.

The estimated models include an error-correction term which is negative and significant. In all the cases except in New Zealand (-0.035), Finland (-0.073) and Spain (-0.090), the percentage of adjustment is higher than 10%. The speed of adjustment is around 10% in Norway and the Netherlands. Slightly more dynamic is the Italian market where the error-correction term reduces to a 14% of the disparities every year. The highest values for this term appear in Japan and Belgium, where the model eliminates a 35% and 27% of the disequilibria in each period respectively. The United States also displays dynamic markets where the error-correction term is almost 20%.

In order to check the validity of our results we begin with the discussion of the R-squared. This value is very high in the case of New Zealand (91%) and the Netherlands (78%). In contrast, the United States model is able to explain only 14% of the fluctuations. The adjustment of the model is also high in Finland (66%), Norway (51%) and Spain (49%). Table 2B also reports the Durbin Watson statistic, whose values are around 2 in all the cases, except in Ireland and the United States where the values are close to 1.5 and 2.5 respectively. The AIC and the SIC, which are reported in

the third and fourth columns, show negative values. The models displayed in Table 2A were chosen according to both criteria, by selecting those with the lowest value for this statistic. The last column of this table presents the F-statistics, which conclude the joint significance of the variables included in these estimations.

We check the lack of autocorrelation of first-, second- and third-order by using the Breusch-Godfrey Serial Correlation LM test. In all the models we accept the null hypothesis of absence of autocorrelation. Table 2C also reports the values of the White test (without and with cross terms), which show homoscedasticity in the residuals of the models. The ARCH tests state the absence of ARCH effects of first- and second-order. In general terms, all the models satisfy the tests, which were applied at the 5% significance level.[35]

4. Overall Discussion of the Theoretical and Empirical Results

The econometric exercise, which is presented in the previous section, reinforces empirically our theoretical frame. The assumption of a monetary production economy, where money-credit is created by the commercial banks in response to the demand for credit, permits us to endogenise bank lending by considering households' investment in housing as the key element that induces households to get into debt.

Our analysis confirms the evolution of housing prices as the most important variable in the explanation of bank credit. This fact highlights the importance of the 'collateral' channel and the positive impact on demand for housing, which emanates from the 'wealth' effect that households experiment when there is an increase in the value of their assets. Incomes are also a relevant factor in the explanation of demand for housing and mortgages. Its influence is much more intense in the long run rather than in the short run, and it is particularly strong in the case of Belgium and the United States. These findings are perfectly understandable, since the demand for credit is driven by the activity in the housing market whose main determinants are those, which define the housing affordability.

Our estimations also capture the role of residential investment and mortgage rates, whose effects take place mainly in the long run. The cost of external finance, which approximates the user cost of dwelling, is an explanatory variable in Spain and Italy, where the impact is twice the one in the Spanish market. However, this variable

[35]In the case of Spain we relax the level of significance to 1% to accept the absence of ARCH effect of first order.

does not exert a persistent influence, which can be justified according to our theoretical framework, where the mortgage rate enters the model through the existence of a horizontal supply for credit. The flow of new residential assets, which are produced in response to demand for housing, is also included. In particular, residential investment, whose influence in the equilibrium of the housing market comes from the supply side of the market, exerts a positive effect on demand for credit since this investment requires strong external finance.

5. Summary and Conclusions

The aim of this contribution is to endogenize the development of bank credit following the notion of endogenous money-credit. We assume a dynamic monetized production economy where the main source of demand for credit emerges from households' desires to acquire housing. Our results conclude that bank credit is fuelled by housing prices, residential investment and disposable income. Changes in the mortgage rate affect the demand for credit negatively, since this means a significant change in the user cost of dwelling, which provokes a change in the demand for housing. The most important variables in the determination of demand for credit are those which determine the affordability of housing, i.e. prices and incomes.

In terms of economic policy, the most important tool that monetary authorities should utilize in order to avoid severe problems in the financial system is prudential policy. This is much more useful than actions via interest rates, since the role of the commercial banking sector is to provide the liquidity, which is required to develop economic activities. In this context, it is much more important for commercial banks to identify those households, which are credit-worthy rather than manipulate interest rates or focus on the compensations that they could obtain in case of households' default. Policymakers should also take into account the evolution of asset prices, since the conditions and the size of mortgage provision are related to the value of the asset, which is used to back the relevant loans.

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