

# “The determinants of mortgage interest rates: an empirical analysis of the euro area countries”

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## The determinants of mortgage interest rates: an empirical analysis of the euro area countries

### Abstract

Using the harmonized statistics of the Eurosystem, this paper focuses on the determinants of the fixed and variable mortgage interest rates applied to new transactions concluded by households resident in euro area countries in the period: 2003-2009. This is the first paper that analyzed the effects of the relationship banking and of the international financial crisis, started in 2007, on euro area mortgage interest rates.

On the basis of a random effect estimator, the econometric analyses show that among the various explanatory factors considered, the cost of funding, the level of guarantees given, the intensity of the bank-customer relationship, and the efficiency of the civil justice system have the most relevant influence on the interest rates determination. Bank competition does not appear to affect interest rates. There is no evidence that the financial crisis has generally led to the application of more stringent economic conditions to mortgages by the European banking industry. What does emerge is each country's very different reaction to the crisis.

**Keywords:** bank interest rates, bank lending, mortgages, retail market.

**JEL Classification:** E43, E44.

### Introduction

The development of the real estate market has been one of the few factors in the past decade that has sustained economic growth in the majority of European countries. The role of bank loans for house purchase has played a key function in the expansion of the real estate sector, and the supply of such kind of funds has become increasingly abundant. Europeans have progressively turned to this form of borrowing: while in 2003 the nominal average mortgage loan per euro area inhabitant was just over 8 thousand euro, in the past two years, said figure has surpassed 14 thousand euro, marking an increase of around 75%<sup>1</sup>. Between December 2002 and September 2009, the average compound annual growth rate of nominal mortgage outstanding in the euro area countries has generally been higher than 10%; only Portugal (8%), the Netherlands (4%), Belgium (3%), and Germany (0.6%) have registered lower growth rates.

As the use of mortgages increased, mass media, analysts and policymakers have paid greater attention to the economic conditions applied in this segment of the credit market. As all asset prices, house prices are interest rate-sensitive. An unanticipated decrease (increase) in short-term interest rate should be followed by an increase (decrease) in the house price due to the higher (lower) demand for ho-

meownership. Fluctuations in house prices have important economic implications (ECB, 2003a): (1) they affect investments in residential constructions; (2) through the so-called wealth effect, they affect the non-housing consumption expenditure<sup>2</sup>. Moreover, mortgage interest rate change has a direct impact on the household disposable income through the interest spending. Usually, a rise in the mortgage interest rate leads to a reduction of housing affordability level (Balchin and Rhoden, 2002). As a consequence, housing policies should remove all causes of growth in the level of mortgage interest rates to enlarge the owner occupation.

A number of empirical studies have debated whether there has been a process of convergence between the conditions applied to mortgage borrowers in the euro area. Affinito and Farabullini (2006), looking at a broad spectrum of interest rates applied to various bank products in the different markets of the euro area, find that differences among European countries can be explained by the domestic characteristics of each market, as well as by the specific features of different products. Sørensen and Lichtenberger (2007), analyzing the process of convergence of mortgage interest rates for the house purchase in the euro area, find that supply and demand factors only partially explain interest rates, while a fundamental role is played by institutional factors specific to each country. There can be a number of explanatory factors behind the differences between the various countries in the euro area: "standard economic theory suggests that the interest rate-setting behavior of banks can be influenced by a large

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<sup>1</sup> The percentage of households with a mortgage is very different in the various countries of the euro area (the referring year is brackets): Italy (2006) and Greece (2007), with 12% and 17% respectively, are the countries with the lowest number of households with loans to house purchase; Germany (2003), Spain (2005), France (2004) and Portugal (2006) instead show a percentage of between 25% and 30%, while in Ireland (2005) and the Netherlands (2007), this figure reaches between 35% and 40% (see ECB, 2009). Warnock and Warnock (2008) show that those countries with stronger legal rights for borrowers and lenders (through collateral and bankruptcy laws), deeper credit information systems, and a more stable macroeconomic environment have deeper housing finance systems.

<sup>2</sup> There are also implications on the household financial stability (Chiorazzo et al., 2009), and on the possible creation of housing bubbles (Dokko et al., 2009). In fact, interest rate policies affect, via its effect on money and credit, the probability of booms and busts in the housing market (Agnello and Schuknecht, 2009).

number of other factors, such as the degree of competition between banks, market contestability, competition from market-based financing and investment possibilities, perceived credit and interest rate risk, the cost of refinancing, the cost of switching banks, the existence of information asymmetries between MFIs and their customers and the strength of the bank customer relationship. Significant differences across countries in these factors may give rise to differences in national MFI interest rates, just as they may also explain differences within countries. Finally, some influence may also be expected from differences in the economic cycle” (ECB, 2006, p. 15)<sup>1</sup>.

The aim of this paper is to contribute to the literature on the topic, by providing empirical evidence on the macroeconomic, social, cultural, banking and financial determinants of mortgage interest rates in the countries of the euro area on the basis of a wider and a more up-to-date dataset (January 2003-September 2009) in comparison with the main reference literature on this topic. Moreover, the paper analyzes the effects of the relationship banking and of the international financial crisis, started in 2007, on euro area mortgage interest rates.

The results show that the cost of deposits, the level of the guarantees given, the intensity of the bank-customer relationship and the efficiency of the civil justice system are the factors that have the most relevant influence on interest rates. Bank competition does not appear to affect interest rates. Furthermore, the empirical analysis indicates that the financial crisis does not exert a general influence in terms of restriction of the criteria used to set interest rates; in any event, the reaction to the crisis ap-

pears to differ considerably between countries. In the light of my empirical results it is possible to provide a number of policy recommendations for European legislators able to improve the housing affordability.

The rest of the paper is structured as follows. Section 1 illustrates the data used in the study. Section 2 focuses on the empirical analysis, describing the model considered and presenting the main results. It also contains a simulation which enables us to evaluate, on the basis of the estimated model, what the theoretical interest rates would have been if the financial crisis not occurred. The final section concludes.

## 1. Data

When constructing the database, I seek to maximize the presence of information on the topic under analysis. In order to obtain directly comparable data, namely data based on the same accounting principles, I use the harmonized interest rates recorded by the Eurosystem (see ECB, 2003b) on a monthly basis starting from January 2003 (first data available) and up to September 2009<sup>2</sup>.

The countries analyzed in this study are all part of the euro area, including therein those that joined the system after the launch of the euro (15 countries).

The database employed has the characteristics of an unbalanced panel (i.e., I do not observe country data over the entire sample period).

The following sections provide details on the variables used in the empirical analyses, as shown in Table 1, which contains descriptions, sources and statistics<sup>3</sup>.

Table 1. Description of variables, sources and statistics

Variable	Description	Source	Latest data avail.	Average	St. dev.	Min	Max	Obs.
<i>Rent</i>	Annual rate of change of the rent price index (%)	Eurostat	Sept 2009	2.65	2.50	-16.50	12.30	972
<i>Bench</i>	10-year benchmark interest rate (%)	Thomson-Reuters	Sept 2009	4.04	0.43	3.04	5.69	891
<i>Comp</i>	Panzar-Rosse statistic on the level of bank competition	Casu and Girardone (2006)	2003	0.38	0.26	-0.07	0.92	891
<i>Density</i>	Number of branches per 10 thousand inhabitants	European Central Bank and Eurostat	2007	5.21	2.73	2.11	13.60	1,134
<i>Edu</i>	Percentage of inhabitants that on a yearly basis have obtained a qualification equivalent to a degree (%)	Eurostat	2008	0.72	0.25	0.36	1.43	1,053
<i>JusticeCost</i>	Cost of legal proceedings for credit collection (as a percentage of the credit claimed)	World Bank	2009	17.98	5.96	8.80	30.00	1,038
<i>Ltv</i>	Average loan-to-value ratio, equal to the ratio between the amount of the mortgage for house purchase and the value of the property (%)	London Economics (2005)	2003	72.14	10.65	55.00	95.00	1,134

<sup>1</sup> ECB (2006) draws attention to the fact that in addition to economic factors, statistical aspects and peculiarities as to the type of product offered to customers can also influence interest rates (see also Hurley, 2008).

<sup>2</sup> The time series considered includes one economic recession (Q2.2008-Q2.2009). Moreover, the period is long enough to include a full monetary cycle (contractionary monetary policy between December 2005 and July 2008 and expansionary monetary policy in the period of September 2008-April 2009).

<sup>3</sup> Some of the variables used have an annual frequency. In these cases, the value of said variable has been maintained constant for the 12 month reference period. Furthermore, when more recent information is not available for these variables, the latest data available is used to fill the gap. In Table 1, the latest data available is shown for each indicator used.

Table 1 (cont.). Description of variables, sources and statistics

Variable	Description	Source	Latest data avail.	Average	St. dev.	Min	Max	Obs.
<i>MortPerDiff</i>	First difference of the per capital mortgage amount for house purchase (in € billions)	European Central Bank	Sept 2009	83.8	183.3	-1,721.4	2,083.4	960
<i>Prod</i>	Annual rate of change of industrial production (%)	Eurostat	Sept 2009	-0.05	6.88	-25.00	24.60	882
<i>FixedR</i>	Interest rate fixed for at least 10 years on new mortgage transactions for house purchase (%)	Eurostat	Sept 2009	4.81	0.69	2.88	7.44	789
<i>VariableR</i>	Interest rate fixed for a maximum of one year on new mortgages for house purchase (%)	Eurostat	Sept 2009	4.29	0.94	1.99	7.25	1,097

Note: As regards variables for which more recent data was not available, the latest data available was used to fill the information gap.

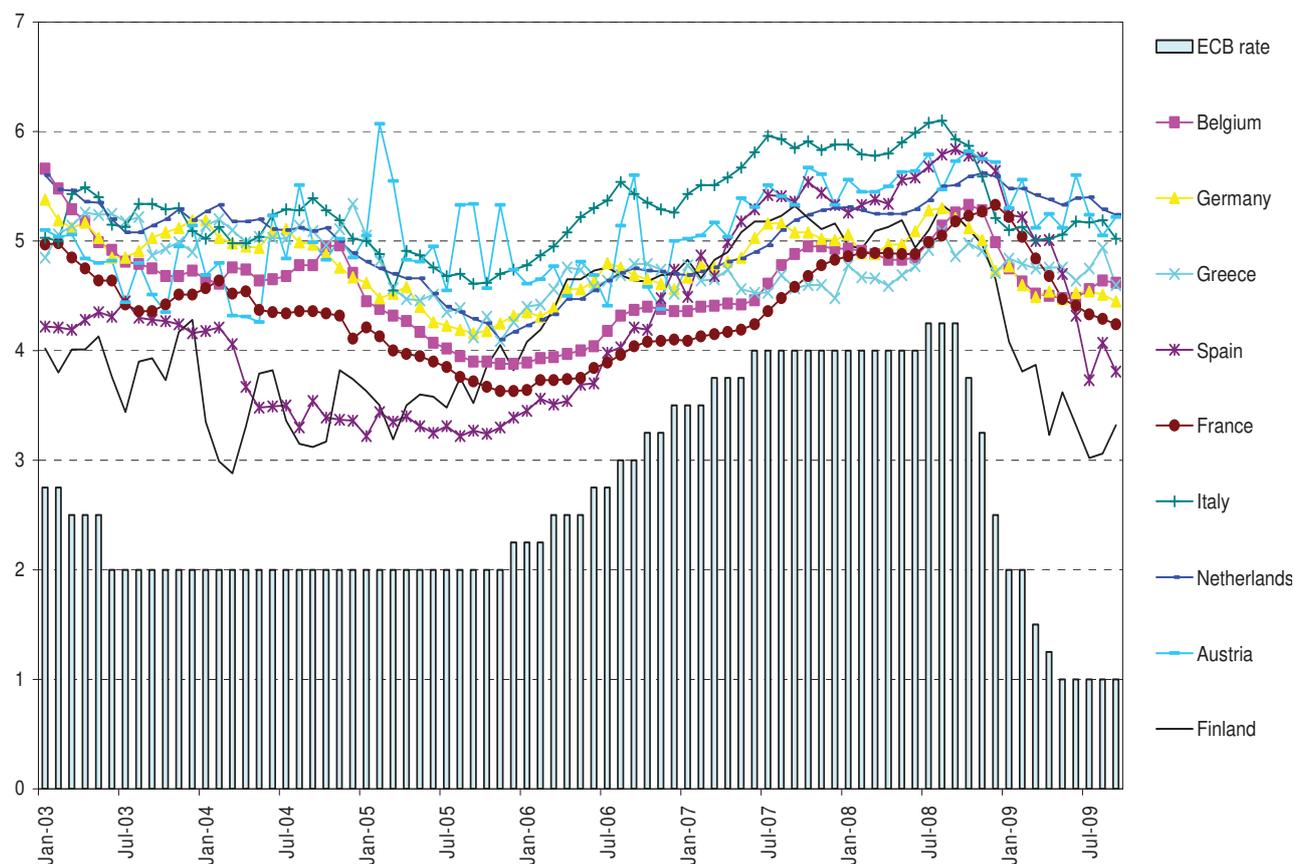
**1.1. Dependent variables: interest rates on loans for house purchase.** In order to acknowledge the specific nature of the market under analysis, I consider two different types of interest rate, both relating to the conditions of credit supply in force at the time the rates were recorded (rates on new business):

◆ the mortgage interest rate where the rate in question is fixed for a period exceeding 10

years. Fixed-rate mortgages are included in this category;

◆ the mortgage interest rate where the rate in question is fixed for a period of less than one year. Variable-rate mortgages are included in this category<sup>1,2</sup>.

Figures 1 and 2 show the monthly profiles of the above-mentioned interest rates.



Source: Own calculations on Eurostat data.

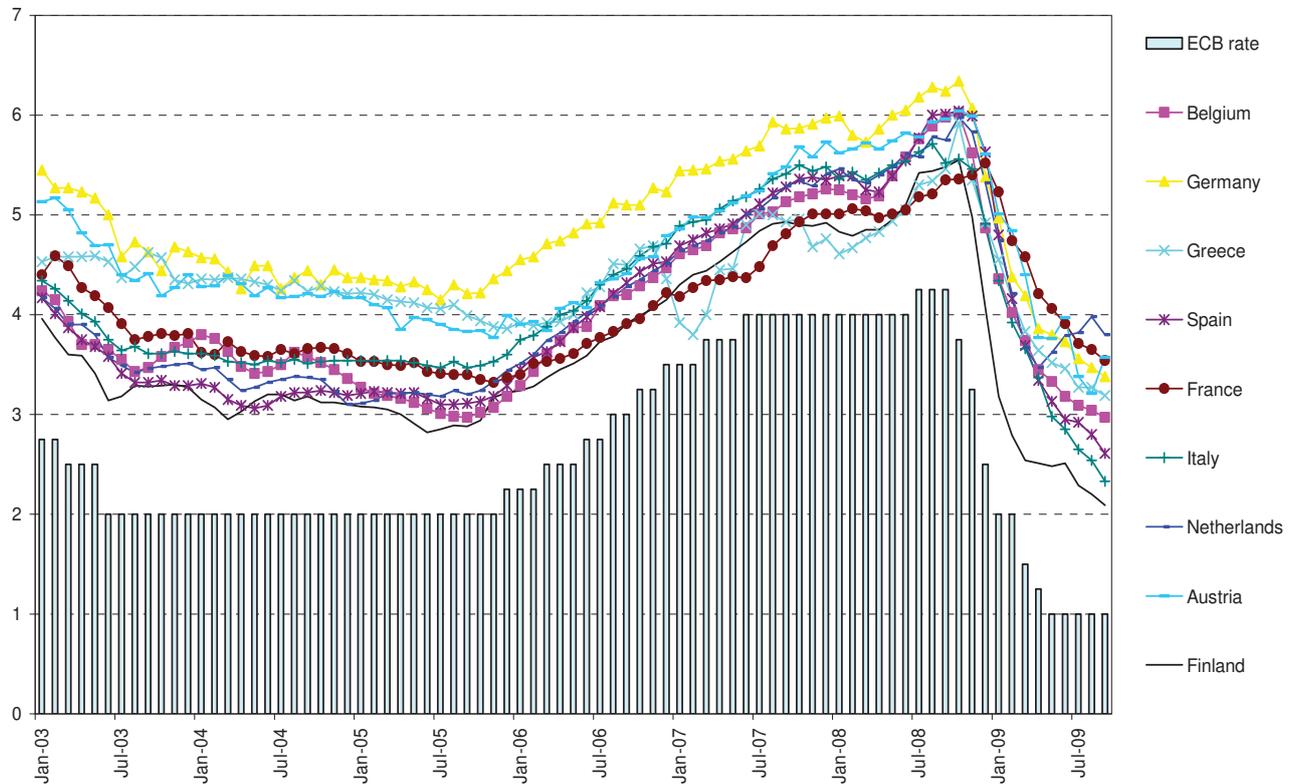
**Fig. 1. Interest rates on new business fixed-rate mortgages for house purchase**

<sup>1</sup> I do not consider mortgage with interest fixed over 1 and up to 5 years and over 5 and up to 10 years because, as showed by the ECB (2009), they have a limited diffusion in the euro area.

<sup>2</sup> As indicated by the ECB (2009), in the majority of euro area countries, variable-rate mortgages are the most common.

With regard to Figure 1, which illustrates the interest rate on fixed-rate mortgages (*FixedR*), it can be seen that up until the end of the period prior to the explosion of the financial crisis with the default of the Lehman Brothers, a process of convergence took place between the conditions applied in the various countries of the euro area. Following said event, however, the range of variability appears to increase.

By observing, for example, the simple difference between the maximum and minimum values of fixed rates, it can be seen that it fell from an average of around 1.8 percentage points in 2003 to 1.2 points in the twelve-month period prior to the Lehman default, but then rose to 1.5 points in the period between September 2008 and the same month of the following year.



Source: Own calculations on Eurostat data.

Fig. 2. Interest rates on new business variable-rate mortgages for house purchase

For the whole period considered (January 2003-September 2009), Table 2 shows that the countries with a higher average fixed interest rate, excluding those that joined the euro area at a later date for which the complete set of data is not available (Slovenia, Cyprus and Malta), are Italy and Austria, while the countries with the lowest

conditions are Finland and France. Also with reference to variable rates (*VariableR*), it can be seen that they follow the same pattern as that of fixed rates (see Figure 2). The countries that recorded the highest rates in this market sector are Germany and Austria, while the lowest average rates are in Finland and Luxembourg.

Table 2. Descriptive statistics per individual euro area country.  
Average of the period January 2003-September 2009

Variables	Austria	Belgium	Cyprus	Finland	France	Germany	Greece	Ireland	Italy
<i>Rent</i>	2.99	1.98	na	2.76	2.97	1.03	4.50	1.41	2.64
<i>Bench</i>	3.99	4.03	na	3.92	3.94	3.85	4.33	4.09	4.20
<i>Conc</i>	78.12	na	87.77	98.18	50.81	63.47	72.14	72.04	50.00
<i>Density</i>	5.22	4.38	12.42	3.09	5.34	5.15	3.26	2.41	5.46
<i>Edu</i>	0.41	0.84	0.51	0.78	1.00	0.47	0.51	1.37	0.64
<i>JusticeCost</i>	14.07	16.60	16.40	10.61	17.40	14.40	14.40	26.90	29.90
<i>Ltv</i>	75	75	na	65	80	70	60	65	55
<i>MortPerDiff</i>	54.4	17.4	na	93.4	70.2	7.1	50.6	200.9	30.2
<i>Prod</i>	2.84	0.06	na	0.51	-1.47	0.54	-0.58	2.56	-2.15
<i>FixedR</i>	5.09	4.60	na	4.18	4.39	4.79	4.78	na	5.30
<i>VariableR</i>	4.61	4.05	6.12	3.68	4.12	4.92	4.37	3.95	4.18

Table 2 (cont.). Descriptive statistics per individual euro area country.  
Average of the period January 2003-September 2009

Variables	Luxembourg	Malta	Netherlands	Portugal	Slovenia	Spain
<i>Rent</i>	2.28	na	2.45	2.62	Na	4.18
<i>Bench</i>	na	na	3.96	4.10	Na	4.00
<i>Comp</i>	0.59	na	0.31	0.52	Na	0.28
<i>Density</i>	5.21	na	2.25	5.39	3.53	9.84
<i>Edu</i>	na	na	0.68	0.71	0.80	0.66
<i>JusticeCost</i>	8.98	na	24.40	14.07	21.22	17.20
<i>Ltv</i>	75	90	95	75	65	65
<i>MortPerDiff</i>	246.4	na	65.8	50.6	Na	119.0
<i>Prod</i>	na	na	0.24	-1.47	Na	-1.67
<i>FixedR</i>	na	4.52	5.02	na	5.93	4.34
<i>VariableR</i>	3.88	4.35	4.12	3.98	5.41	4.03

Note: na – not available.

Figures 1 and 2 together show that, in all countries considered, the mortgage rate dynamics has exhibited three main stages: the first is the period of 2003-2005, when interest rates showed a downward trend. This first phase is followed by an upturn between 2006 and September 2008, which is then followed by an inversion of the latter trend. These said dynamics are significantly influenced by the changes in the stance of the ECB monetary policy<sup>1</sup>.

**1.2. Explanatory variables.** The set of variables considered capable of explaining the trend of mortgage interest rates includes macroeconomic indicators, indicators of the socioeconomic environment and banking-financial indicators; each of them will be described in detail in the following sections<sup>2</sup>.

<sup>1</sup> An increase (decrease) of interest policy rate determines an increase (decrease) in the banks' cost of borrowing, which generally produces an adjustment in all their interest rates, including mortgage rates, to pass this higher (lower) cost onto their customers. This mechanism consists in the so-called credit channel in the transmission of monetary policy (Bernanke and Gertler, 1995).

<sup>2</sup> I use the same source for each variable to maximize the comparability of statistics across countries and over time. Most of the data are taken from official sources (European Central Bank, Eurostat, Thomson-Reuters, World Bank) to guarantee an adequate level of data quality. Other sources are one empirical analysis (Casu and Girardone, 2006) and one survey (London Economics, 2005). Data from these sources should be considered more carefully due to the specific assumptions imposed by the authors to obtain their outcomes.

I consider as possible explanatory variables some other variables: the nominal GDP per capita; the GDP per capita at purchasing power parity; the days required to resolve credit disputes within the civil justice system; the index of the level of attention of national legislation to regulations aimed at improving access to credit; the percentage of the adult population whose credit information is held at public or private Credit Bureaus; the index of the level of depth of credit information; the 3-month Euribor rate; the 10-year Interest Rate Swap; ordinary customer bank deposits expressed as a percentage of the monetary financial institution's total assets; an index of the availability of non-traditional mortgages; the degree of bank efficiency in managing inputs; the degree of financial leverage, given by the relationship between total assets and capital and reserves of monetary financial institutions; the ratio between new issues of Mortgage Backed Securities and total new issues of mortgages for the house purchase recorded in 2003; the per capita mortgage amount for house purchase. However, I had to drop these variables due to their high cross-correlation.

**1.2.1. Macroeconomic variables.** The following macroeconomic explanatory variables are taken into consideration:

- ◆ the growth rate trend of the harmonized index of industrial production (*Prod*) on a monthly basis. This variable has been considered as a proxy for the monthly income trend<sup>3</sup>. Of the countries considered, Austria recorded the best performance in the period between January 2003 and September 2009 (an average growth rate of +2.8%), while Italy is at the tail end of the ranking (-2.2%);
- ◆ the growth rate trend of the harmonized price index of rent for housing (*Rent*) on a monthly basis. This variable is used as a proxy for the house price index. In fact, rent is one of the factors predominantly used in the literature as long-run determinants of house prices (see, e.g., Girouard et al., 2006)<sup>4</sup>. The expected impact on interest rates can work both ways: on the one hand, higher house prices reduce the risk premium through an increase in the value of the guarantees given; on the other hand, higher house prices could increase the demand for lending. Depending on the prevalence of one over the other, interest rates may rise or fall. In the period examined, Greece and Spain showed the highest increase in rent prices, while the most contained trend was recorded in Germany.

<sup>3</sup> The quality of this proxy is higher (lower) for the countries in which the industrial sector have a relevant (not relevant) incidence on the total value added.

<sup>4</sup> Some authors criticize the use of rent as an indicator of fundamental house price. In particular, Madsen (2011) argues that rents can only be used under the assumption that user cost of capital is expected to be constant and if the rental market is unregulated, or, if investors purchase rental property intended for later sale to owner occupied units with expectations of large capital gains. European harmonized data on house prices, at high frequency level, are not available to test the different impact of the use of housing rent against price.

1.2.2. *Variables of the socio-economic context.* With regard to variables related to the socio-economic environment, the following are considered:

- ◆ the number of inhabitants who, in a given reference year and with respect to the population as a whole, obtained a qualification corresponding to at least a degree (*Edu*). This variable is considered as a proxy for the level of financial literacy present in a specific country. Ireland and France are at the top of the ranking, while Austria and Germany are at the bottom;
- ◆ the cost incurred, expressed as a percentage of the credit claimed, to settle a credit dispute (*JusticeCost*) on an annual basis. This variable, extrapolated from the World Bank database *Doing Business*, shows the degree of inefficiency of the civil justice system, but in this case in terms of the costs needed to settle the dispute<sup>1</sup>. Italy is the lowest ranking country as almost one third of the credit claimed is lost due to delays and inefficiency. The country that succeeds in guaranteeing the least economic impact on creditors is Luxembourg, where only a 9% of the credit is lost during the process.

1.2.3. *Banking-financial variables.* With regard to banking-financial variables, the following are considered:

- ◆ the 10-year benchmark interest rate on government bonds (*Bench*), expressed as a monthly average of daily data. This variable is considered as a proxy for the average funding cost in financial markets of banks operating in a specific country. In fact, one of the main factors that impacts the funding costs of bank is the country risk which banks operating in a specific country are exposed to<sup>2</sup>. Of the countries considered, Germany has the lowest benchmark interest rate, while Greece has the highest rate, reflecting the different country risk behind said rates;
- ◆ the level of competitiveness of the banking market (*Comp*), expressed by the Panzar-Rosse statistics (or H-statistics) taken from Casu and Girardone (2006) and maintained constant for the entire period considered (Groop et al. (2007) use the same variable to assess the effect of competition on the pass-through phenomenon, namely the speed with which banks adjust interest income and interest expense rates as monetary

policies change)<sup>3</sup>. Table 2 shows that Finland has the highest degree of competition, while the Greek banking market has the lowest level;

- ◆ the density of bank branches in terms of inhabitants (*Density*) on an annual basis. This variable has been considered as a proxy for the level of relationship lending in a specific market, a factor that the economic literature has identified as a possible determinant of the level of bank interest rates (for a review of relationship banking see Boot, 2000). A higher density can be considered as an indicator of the willingness of the banking industry to be physically close to their customers in order to forge a personalized relationship with them (Bonaccorsi di Patti and Gobbi, 2001, use the same indicator as a proxy for relationship lending). This variable records the highest values in Cyprus, Spain and Italy and minimum values in Ireland and the Netherlands;
- ◆ the average loan-to-value ratio, given by the ratio between the average amount of mortgages given and the average value of the houses purchased (*Ltv*), taken from London Economics (2005) and held constant for the entire period considered. This variable expresses the level of coverage offered by the guarantee given by the borrower, therefore it is inversely correlated with the risk undertaken by the financial intermediary. Of the countries considered, the Netherlands has the highest average *Ltv* (95%), while Italy, with 55%, the lowest;
- ◆ the first difference of the per capita nominal mortgage amount for house purchase (*Mort-PerDiff*) on a monthly basis. This variable is considered as a proxy for the flow of per capita mortgages disbursed in order to have an indicator of the volumes of loans offered in a given month. On average, in the period considered, this proxy is around 83 euro per month per inhabitant, with a peak of 246 euro in Luxembourg and a minimum level of 7 euro in Germany<sup>4</sup>.

## 2. Empirical analysis

**2.1. Model.** The Monti-Klein model (Klein, 1971; Monti, 1972) and Ho and Saunders (1981) postulate the existence of a variety of factors determining banks' interest rate setting behavior, both on demand and supply side. As a consequence, my econometric specification includes a large number of different explanatory variables, which are also considered in the prevalent literature on the determinants of bank interest rates (see Groop et al., 2007, for a review):

<sup>1</sup> The World Bank specifies that *JusticeCost* "is assumed to be equivalent to 200% of income per capita. No bribes are recorded. Three types of costs are recorded: court costs, enforcement costs and average attorney fees" (see the section entitled Enforcing Contracts Methodology on [www.doingbusiness.org](http://www.doingbusiness.org)).

<sup>2</sup> The country risk incorporated in the benchmark rate can also be seen as a proxy of the average default risk of debtors in a specific country.

<sup>3</sup> Panzar and Rosse (1987) approach consists in evaluating the competitive behavior of market participants by measuring how the input prices are reflected in firms' equilibrium revenues.

<sup>4</sup> It should be noted that mortgage figures, in addition to new loans, also reflect the effect of periodical repayments of the principal and extraordinary repayments associated with total or partial advance extinction.

$$\begin{aligned}
 Int_{i,my} = & k + \mu_i + \beta_1 Bench_{i,my} + \beta_2 Prod_{i,my} + \\
 & + \beta_3 Rent_{i,my} + \beta_4 JusticeCost_{i,y} + \beta_5 Comp_i + \\
 & + \beta_6 Density_{i,y} + \beta_7 - Density_{i,y}^2 + \beta_8 Edu_{i,y} + \beta_9 Ltv_i + \\
 & + \beta_{10} MortPerDiff_{imy} + \beta_{11} Crisis_{my} + \varepsilon_{i,my}, \quad (1)
 \end{aligned}$$

where *Int* is one of the two interest rates applied to mortgages for house purchase taken into consideration (*FixedR* and *VariableR*) for country *i* in month *m*, in year *y*, *Crisis* is a dummy variable with a value of 1 starting from the outbreak of the international financial crisis in August 2007, *k* is a constant,  $\varepsilon$  is the regression error<sup>1</sup>.

Having included two time-invariant variables (*Comp* and *Ltv*) in equation (1), the estimator used is the random effect (from which it follows that  $\mu_i$  is a random variable with an average of zero and a standard deviation of  $\sigma_\mu$ ) as if I had used the fixed effect, the impact of these variables would have been absorbed by the fixed effect by country.

**2.2. Results.** Table 3 shows the results of the estimate of equation (1) with regard to fixed and variable interest rates.

Of the explanatory variables considered, *Bench* has a positive and significant impact on both types of the interest rates considered. The funding cost, reflected by the benchmark rate, is one of the main factors that influences the interest rate applied to mortgages for house purchase. The divergence of mortgage interest rates observed after the outbreak of the financial crisis (see Section 1.1) therefore appears to be at least partly linked to this factor. With the arrival of the crisis, the benchmark interest rates of various European countries, and others, fluctuated considerably as a result of the flight-to-quality of investors, which therefore led to government bonds with a lower perceived risk being favoured.

Table 3. Regression results (the results of the regression of (1) obtained using the random effect estimator)

Dependent variable	Fixed rate	Variable rate
<i>Bench</i>	0.582*** (0.187)	0.733*** (0.177)
<i>Prod</i>	0.014 (0.015)	0.032*** (0.012)
<i>Rent</i>	0.017 (0.021)	0.058 (0.041)
<i>JusticeCost</i>	0.040*** (0.003)	0.003 (0.010)
<i>Comp</i>	0.104	-0.323

<sup>1</sup> In August 2007 the subprime mortgage industry collapses, with considerable negative effects on international financial markets. In particular, after this event the euro area interbank market rates show an abnormal volatility (the coefficient of variation of Eonia, the euro area overnight interbank rate, in the period August 2007-December 2007 is around 8 times higher than the average variation observed in the four previous years).

	(0.076)	(0.229)
<i>Density</i>	0.202*** (0.041)	0.233* (0.129)
<i>Density</i> <sup>2</sup>	-0.017*** (0.003)	-0.018* (0.010)
<i>Edu</i>	-1.228*** (0.171)	-0.235 (0.349)
<i>Ltv</i>	0.010*** (0.002)	0.007* (0.004)
<i>MortPerDiff</i>	-0.001** (0.000)	-0.001** (0.000)
<i>Crisis</i>	0.374 (0.251)	0.244 (0.249)
Constant	1.184 (0.770)	0.189 (0.884)
R squared	0.527	0.277
Chi square	491***	359***
Cross-section	8	10
Observations	634	794

Notes: \*\*\*, \*\*, \* indicate statistical significance at 1%, 5% and 10%, respectively. Standard error adjusted for clustering shown in brackets.

The industrial production index (*Prod*), instead, appears to have a positive and significant influence only on the variable interest rate and not on the fixed interest rate. The stimulus deriving from credit demand therefore only appears to impact this segment of the mortgage market, while the interest rate on fixed-rate mortgages does not appear to be determined by a higher or lower demand for lending.

Civil justice costs have a positive and significant impact on the fixed interest rate (in this regard, Sørensen and Lichtenberger (2007) find a positive relation between the time of legal proceedings and mortgage interest rates, while ECB (2009) finds a weak relation between the length of solvency proceedings to enforce sale of real estate and mortgage spread<sup>2</sup>). This result shows how the inefficiency of the justice system impacts the cost of fixed-rate mortgages as the banks, when pricing this product, consider the costs they may incur if the borrower defaults.

The estimates show that the level of competition in the various banking markets does not have a significant impact on interest rates. However, this should not be interpreted as meaning that competition between European banks is not important to determine interest rates, but rather that some of the other determinants identified (primarily the funding cost and the justice system) actually prevent competitive products and conditions being offered in all segments. This interpretation is also sustained by the results of the survey conducted by ECB (2009) on a

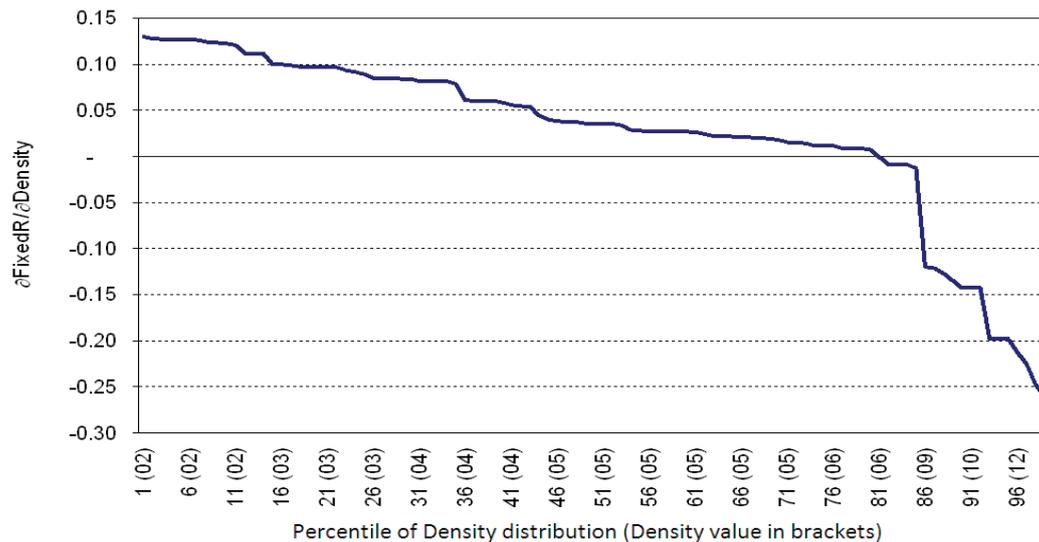
<sup>2</sup> One possible explanation for the not significant coefficient of *Justice-Cost* for the variable interest rate could be linked to the fact that this form of loan does not envisage the financial costs associated with covering interest rate risk, which on the other hand fixed-rate mortgages do envisage, financial costs that would be incurred also in the case of the default of the borrower and that therefore make banks particularly attentive to the possible effects of inefficiencies of the civil justice system.

representative sample of euro area banks. As a matter of fact, the credit institutions that responded to said survey reported that competition between banks in 2003-2007 mainly resulted in the relaxation of lending standards rather than in the reduction of spreads<sup>1</sup>.

With regard to the density of bank branches, the results show a negative and significant coefficient for both of the interest rates considered, as regards the squared variable, the coefficient is positive and still significant for the non-transformed *Density* variable. All in all, the relation between interest rates and the

density of bank branches takes a reversed “U” shape, i.e. interest rates rise as density increases up to a certain threshold, after which they start to fall. This result appears to indicate that relationship lending leads to benefits for borrowers due to the bank’s ability to create tailor-made products that reflect the economic financial characteristics of households in order to minimize the risk of default<sup>2</sup>.

This outcome could also explain why the Internet-based mortgages are not as widespread in the euro area as they are in the US and in the UK.



Note: The derivative is calculated on the basis of the estimated coefficients shown in Table 3.

**Fig. 3. Derivative of the interest rate of fixed-rate mortgages as a function of the density of branches per inhabitant**

However, these benefits can only be obtained when the investment in acquiring soft information is sufficiently high. More specifically, on the basis of the estimates made for both the types of interest rates considered, the threshold beyond which the acquisition of soft information enables the bank to apply better economic conditions to mortgage transactions lies around the third quartile of the *Density* distribution, i.e., around 6 bank branches per 10 thousand inhabitants (see Figure 3).

The proxy for the level of financial education has a negative and significant coefficient only in the case of fixed interest rates. This would appear to indicate that borrowers with a higher level of information are more aware of the different offer conditions

available on the market, for this type of loan, and are therefore able to choose the mortgages with the most reasonable/convenient rates.

The loan-to-value ratio, on the other hand, has a positive and significant impact for both of the interest rates considered (this result is in line with Sørensen and Lichtenberger (2007) and ECB (2009)). This outcome shows how the higher level of risk of a loan transaction, resulting from the lower value of the guarantee offered by the borrower with respect to the mortgage granted, is inevitably transferred to the interest rate applied.

The proxy for per capita nominal mortgage flows (*MortPerDiff*) is negative and significant for both interest rates considered. A greater flow (offer of loans) is associated with a reduction in the interest rate applied to mortgages. This appears to show how the economic conditions applied reflect the demand and supply on the basis of standard market practice.

Lastly, it should be noted how the coefficients on variables that tend to capture the possible impact of the financial crisis comes out positive but not statistically significant. This result would appear to indicate that the crisis, on average, has not pushed euro

<sup>1</sup> Sørensen and Lichtenberger (2007) also do not find a statistically significant outcome for the impact of competition on mortgage interest rates in euro area countries, while on the basis of the results of Gropp et al. (2007) bank competition only impacts the speed of implementation of changes in policy interest rates in the short term (known as the pass-through phenomenon) and not in the medium-long term.

<sup>2</sup> Hassink and van Leuvensteijn (2007), with reference to the German market, find that banks are more efficient in selecting borrowers as a result of their direct relationships with customers, compared to non-banking operators (insurance and pension funds), which instead have to entrust intermediaries. Consequently, the mortgage interest rates applied outside the banking market are subject to a higher level of dispersion.

area banks to change the criteria on the basis of which loans granting decisions are taken, with the consequent tightening of offer conditions. A more in-depth look at the impact of the financial crisis on interest rates is provided in the next section.

**2.3. Estimates of interest rates during the financial crisis started in 2007.** This section evaluates what the offer conditions applied by euro area banks would have been during the financial crisis started

in 2007 if the crisis itself not occurred. I perform counterfactual exercise on the basis of the estimates of equation (1) shown in Table 3. By comparing these estimates with the actual, observed values of the interest rates applied, I can see, for each country considered, what is the approach taken by the various banking industries in terms of criteria for granting loans for house purchase. Table 4 shows the estimates with reference to the two interest rates considered.

Table 4. Values observed and values estimated for interest rates in euro area countries

Reference period:	August 2007-September 2009			September 2008-September 2009		
	Average value recorded (a)	Average value estimated (b)	Difference (a-b)	Average value recorded (a)	Average value estimated (b)	Difference (a-b)
<b>Fixed rate</b>						
Austria	5.48	5.27	0.21	5.44	5.35	0.09
Finland	4.54	4.26	0.28	3.95	4.18	-0.23
France	4.82	4.54	0.28	4.81	4.49	0.32
Germany	4.86	4.74	0.12	4.69	4.58	0.11
Greece	4.74	5.21	-0.47	4.80	5.56	-0.77
Italy	5.58	5.46	0.13	5.27	5.49	-0.22
Netherlands	5.36	5.18	0.18	5.44	5.17	0.27
Spain	5.20	4.59	0.60	4.93	4.62	0.32
<b>Variable rate</b>						
Austria	5.19	4.59	0.60	4.66	4.46	0.20
Finland	4.13	3.79	0.34	3.28	3.45	-0.16
France	4.78	4.30	0.48	4.56	4.02	0.54
Germany	5.22	3.98	1.25	4.57	3.54	1.03
Greece	4.66	4.97	-0.30	4.37	5.21	-0.84
Ireland	4.37	4.26	0.12	3.63	3.99	-0.36
Italy	4.66	4.43	0.23	3.85	4.27	-0.41
Netherlands	4.94	4.27	0.67	4.46	4.05	0.41
Portugal	4.47	4.48	-0.01	3.67	4.46	-0.79
Spain	4.79	4.12	0.67	4.16	3.90	0.26

Note: The estimated values were obtained using the regression coefficients shown in Table 3.

With regard to the fixed rate, it can be seen that in the period between August 2007 and September 2009, in 7 countries out of 8, the interest rate applied is higher than that estimated by the model. The only exception is Greece where instead the rate actually applied is lower than that estimated. Looking at the peak phase of the crisis, namely that following the default of Lehman Brothers, it can be seen, on the other hand, that in addition to Greece, also Italy and Finland apply lower conditions than that of the theoretical model, showing therefore how during the most difficult phase of the crisis, the criteria for granting fixed-rate mortgages is relaxed by the banking industries in said countries, rather than tightened. Similar remarks can be made for variable interest rates.

On the basis of this evidence I conclude that mortgage interest rates reaction to financial crisis differs across country. In my interpretation this outcome could depend by the different policy interventions occurred in the European countries in

response to the financial crisis (e.g., in Italy the government has capped variable interest rate mortgage in 2009, while Spain temporarily deferred loan payments for unemployed. For a country comparison about the crisis measures in the housing market see IMF (2011)).

### Conclusions

This study empirically investigates on which macroeconomic, social, cultural, financial and banking factors influence the setting of interest rates on new mortgages for house purchase in the euro area countries.

The main data source for the analysis is the harmonized statistics recorded, on a monthly basis, by the Eurosystem, focusing on the two main types of interest rates: (1) fixed rate; and (2) variable rate. The period considered is that falling between January 2003 (the earliest figures available for harmonized statistics) and September 2009.

From the estimates of the database panel, it emerges that the funding cost, incurred by the banks belong-

ing to the various countries in the euro area and represented by the benchmark interest rate, is one of the main factors that explains the mortgage interest rate profile.

The nature of the relationship that the banking industry bank forges with its customers appears to be important in explaining the different mortgage interest rate profile. Mortgage interest rates tend to rise when a banking system tends to increase its propensity for a closer relationship with its customers – which allows a set of information (soft information) to be acquired that cannot be acquired through central databases, such as Credit Bureaus, and therefore allowing the creation of tailor-made mortgages – starting however from an insufficiently-developed relationship base. Beyond a specific threshold, that the estimates indicate to be fairly high, the close relationship with the customer, and the consequent exchange of soft information, leads to an improvement of the conditions applied on average to mortgage transactions.

The inefficiency of the civil justice system is important to explaining the level of fixed rates, but not of variable rates. More specifically, as the costs associated with the legal proceedings needed to settle credit claims rise, the economic conditions applied to fixed-rate mortgages for house purchase become more onerous. In fact, when pricing these mortgages, banks appear to discount the costs that they would incur if borrowers default.

Other factors that appear to be particularly important in explaining the different mortgage interest

rate profile are the ratio between the amount of the loan and the value of the house (loan-to-value ratio), the supply of loans, and the proxy for the level of financial education.

The results show that the level of competition in the various banking markets does not have a significant impact on interest rates. However, this should not be interpreted as meaning that competition between European banks is not important to determining interest rates, but rather that some of the other determinants identified actually prevent competitive products and conditions being offered in all segments.

Lastly, the results of the empirical analyses do not appear to be able to confirm that the international financial crisis started in 2007 generally had a direct impact on the criteria applied by the European banking industry to set the mortgage economic conditions. Estimating the mortgage interest rate that should have been applied, on the basis of the theoretical model used in this study, it emerges that in some countries, the criteria have become much more stringent, while in others they have been either more contained or even more accommodating. However, the time span considered is not long enough to include all the effects of the financial crisis, and in particular the sovereign debt turbulence showed in some peripheral euro area countries in 2010-2011. As a consequence, more robust evidence about the effect of financial crisis on the mortgage interest rates are left to future research.

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