INTEREST RATE DISPERSION IN DEPOSIT AND LOAN MARKETS

2005

Alfredo Martín, Jesús Saurina
and Vicente Salas

Documentos de Trabajo
N.º 0506

BANCO DE **ESPAÑA**

INTEREST RATE DISPERSION IN DEPOSIT AND LOAN MARKETS (*)

Alfredo Martín and Jesús Saurina (**)

BANCO DE ESPAÑA

Vicente Salas

UNIVERSIDAD DE ZARAGOZA AND BANCO DE ESPAÑA

(*) This paper is the sole responsibility of its authors and the views represented here do not necessarily reflect those of the Banco de España. We thank participants at a CEMFI seminar for their helpful comments and suggestions, in particular, those of Rafael Repullo. Julio Segura and an anonymous referee also helped with their comments to improve the paper. We thank participants at the 25th SUERF Colloquium and XII Foro de Finanzas for their useful suggestions. Any errors that remain are, however, entirely the authors' own.

(**) Address for correspondence: Jesús Saurina, C/ Alcalá, 48, 28014 Madrid, Spain. Tlf.: + 34 91 338 5080; email: jsaurina@bde.es.

Documentos de Trabajo. N.º 0506
2005

ISSN: 0213-2710 (print)
ISSN: 1579-8666 (on line)
Depósito legal:
Imprenta del Banco de España

Abstract

This paper investigates the existence and determinants of interest rates dispersion in loans and deposits of Spanish banks. A unique feature of the research is that it covers a whole industry (thirty products and two hundred banks) from 1989 to 2003. We find that: i) interest rates dispersion is a persistent phenomena in loans and deposits markets; ii) the differences across products in the observed dispersion can be explained as a function of variables that affect the private net benefits of consumers' investment in information including search costs (frequency and volume of transactions); iii) interest rate dispersion is more sensible to product specific inflation than to changes in the interest rate of the economy; iv) regulation of standards of transparency by the Spanish Central Bank has been effective in reducing interest rate dispersion.

JEL: D83, G18
Key words: price dispersion, search costs, information differentiation, inflation, transparency regulation

1 Introduction

When information is costly to produce markets may be affected by information differentiation, which in turn gives place to market power by selling firms in otherwise homogeneous products and perfectly competitive markets. This is the main contribution of Stigler's (1961) and Rothschild's (1973) path breaking papers in the economics of price formation in markets where buyers engage in costly search to locate more favorable trade opportunities. Information differentiation helps to explain the empirical regularity of price dispersion, the fact that consumers' perfect substitute products sell at different prices in a persistent way. Indeed, a variety of models have formally shown that price dispersion can be an equilibrium solution in markets where information is not freely available. Other theoretical research has related costly search and information differentiation with the welfare loss attributed to price inflation.

This paper studies the dispersion in monthly quoted annual interest rates by Spanish banks from 1988 to 2003. The study covers fifteen asset products and fifteen liability products offered by over 200 banks, practically the population of retail banks in Spain in the period of study. The research interests are to evaluate the magnitude of price dispersion in the retail banking industry and to find out if such dispersion varies across products in ways that are consistent with theoretical predictions from equilibrium search models that contemplate repeated purchases. Care is taken to evaluate price dispersion free from price differences across banks due to product differentiation as banks can differentiate their offers to make products less substitutes from the products of their competitors. Finally, the paper is policy oriented since it tests if public regulation of banks' interest rate transparency by the Spanish Central Bank has been effective or not to reduce price dispersion, and it investigates if price dispersion is affected by the development and use of new technologies such as Internet.

We find that interest rates dispersion exists in Spanish retail banking and the dispersion is persistent over time. The dynamics of interest rates changes over time are consistent with (randomized) pricing strategies by banks in order to make more difficult for the consumers to learn about which banks offer better conditions for their loans or deposits. Interest rate dispersion increases with product specific inflation, but much less with changes in the interbank interest rate. Dispersion is higher in loans and deposits of higher maturity and in loans and deposit with lower balances. Higher maturity and larger volume of balances are also associated with higher mark ups of interest rates over the interbank interest rate. Regulation by the Spanish Central Bank aimed to increase transparency has contributed to lower interest rate dispersion. Interest rates dispersion increases with the introduction of the Euro but there is evidence that the dispersion has decreased during the late years of the period coinciding with the diffusion of Internet banking. These findings are consistent with the hypothesis that interest rate formation in retail banking takes place under conditions of information differentiation due to consumers search costs.

Empirical research in price dispersion is still very limited, especially if one compares it with the amount of research about other determinants of market power, such as collusion and product differentiation. A first distinct feature of our paper is that the empirical analysis is quite comprehensive since it covers a whole industry of a country for a long period of time. This contrasts with Sorensen (2000) who studies prescription drugs price dispersion in pharmacies of two towns in a given moment of time; with Dahlby and West (1986), who study the determinants of price dispersion in a regional market for one automobile insurance product during five years data; with Van Hoomissen (1988), who focuses mostly on the relation between inflation and price dispersion, and with Lach (2002) who focuses on the

pricing strategies of stores to sustain price dispersion but not in the explanation of observed price dispersion. Neither Sorensen nor Dahlby and West control for price inflation in their tests of the determinants of price dispersion and this may bias their results if inflation is correlated with some of the explanatory variables used in their analysis, for example the level of prices of drugs of different frequency of purchase. Van Hoomissen, on the other hand, does not model other product attributes different from product specific inflation and the model ignores the stock of information at the beginning of the period (i.e. lagged dispersion). Lach only reports pricing strategies that attempt to keep price dispersion over time, but does not model price dispersion itself.

Second, banking products are a good laboratory to study price dispersion. Financial products offered by banks in the form of loans and deposits have different maturity, which implies different frequencies in the transactions between banks and consumers, higher for short term loans/deposits and lower for long term ones. The frequency of the transaction is one of the key variables identified in the literature to determine differences in search activity by consumers [Benabou (1993), Fishman and Rob (1995), Sorensen (2000)], so our database is particularly suitable to investigate price dispersion. Moreover, we can also test if the average volume of the transaction in each product affects dispersion given that higher volume implies higher benefits of search.

Third, the time dimension of the data allows us to test some of the predictions about the transaction costs created by inflation and to evaluate whether pricing strategies by banks are consistent with the mixed strategies prescribed in the literature to assure the persistence of price dispersion over time [Diamond (1971), Varian (1980) and Lach (2002)]. The transaction costs of inflation originate price dispersion when there are costs of adjusting nominal prices (menu costs) as in Sheshinski and Weiss (1977) and Benabou (1992); by the fact that unanticipated inflation increases dispersion by reducing the information content of observed prices [Benabou and Gertner (1993)]; due to the increment in the depreciation rate on the stock of information [Van Hoomissen (1988)]; and because an increase in the rate of inflation raises the variance of producers costs [Fishman and Rob (1995)].

A distinct feature of the retail baking industry is that short-term marginal cost of loans and short-term marginal revenues from the deposits are closely tied to the interbank interest rate. The paper investigates if interbank interest rate inflation, common to all banks, is the relevant measure of inflation to explain price dispersion across banking products or, on the contrary, the monetary shock of changes in the interbank rate over time are not transmitted evenly across banks so that the inflation measure that distorts price formation is a product specific one.

The rest of the paper is organized as follows. Section 2 presents the basic model and the main hypothesis about the determinants of price dispersion and market power. Section 3 presents a description of the Spanish banking sector and of the loans and deposits used in the research as well as the data on interest rate available for the analysis. Section 4 contains the results of the estimation of the empirical models. Finally, Section 5 discusses the results and summarizes the conclusions and main findings of the paper.

2 The basic theory

The theoretical framework is based on the assumption that price formation in each of the products, banks' loans and deposits, results from monopolistic competition among the banks operating in the market. Banks can have market power because of product differentiation and because of information differentiation in product markets that are segmented by the type of service, mainly loans and deposit. Since the price data refer to monthly interest rates on new transactions made during the respective month, it will be assumed that banks make decisions taking operating costs as a fixed cost. Under this assumption, prices of loans and deposits are determined by the bank applying a mark up to the money market interest rate *r*. We assume that most of the differences across banks in terms of costs and product differentiation are stable over time. There may also exist heterogeneity across buyers of banking services in terms of differences in search costs, believes about the price distribution or repetitiveness of purchases over time.

From the profit maximizing solution of a bank that faces an inelastic demand function for loans or an inelastic supply function of deposits, the price charged by bank *j* for product *i* in month *t* will be equal to[1],

$$p_{ijt} = k\,(i, j, t) \cdot r_t \tag{1}$$

where *k(i,j,t)* is the profit maximizing mark up as a function of characteristics of the bank, the product, the information and search activity of the consumers and the time period and r_t is the interbank interest rate. A relevant distinction to be made is between loans and deposits. Banks charge interest rates for loans and pay interests to deposits. When there is an interbank market, interest rate r_t is, at the same time, the marginal revenue that can be earned from the deposits, and the marginal cost (opportunity cost) of the money lent to a safe borrower. The mark up in loans will therefore be greater than one and the mark up in deposits will be less than one.

The variable *k(i,j,t)* depends on the elasticity of demand, *ED,* for loans, and on the elasticity of supply, *ES,* for deposits, in the following way, where sub-index *L* means loans and sub-index *D* means deposits, and the elasticity *ED* is expressed in absolute terms:

$$k_L(i,j,t) = \frac{ED(i,j,t)}{ED(i,j,t) - 1}$$

$$k_D(i,j,t) = \frac{ES(i,j,t)}{ES(i,j,t) + 1} \tag{2}$$

Therefore market power, *k(i,j,t)* different from 1, comes from inelastic supply and demand functions for the products of the respective banks[2]. Product differentiation and/or information differentiation lower the effective substitution between banks in each of the product markets and make supply and demand for the products of each bank price inelastic.

Interest rates differences across banks for product *I* in period *t* will be affected by product differentiation decisions of the banks and by information differentiation that will result from the limits in the incentives to search by the consumers. We shall focus on the later. In markets with homogeneous products, a bank will be able to pay a lower interest for the deposits if there is a positive probability that a depositor that approaches the bank has not been offered a higher interest for the same deposit in another bank, and the consumer

1. For general models of the banking firm see Freixas and Rochet (1997).

2. An interior profit maximizing solution in the loans market requires that the elasticity of demand be greater than 1 in absolute value at the profit maximizing interest rate, so that the mark up in this market is greater than 1 (interest in loans higher than interbank interest rate).

accepts the offer by the bank instead of incurring in the cost of searching for another offer. If search activity increases because search costs decrease or because the consumer has more benefits from the search, then price dispersion and price level are likely to decrease (the interest on deposits would, of course, increase with more search, although the predictions for price dispersion are the same as for the loan products).

For a given search cost per unit of activity, the benefits and incentives to do more search activity will increase with the frequency of purchases [Benabou (1993) and Fishman and Rob (1995)]. The reason is that the benefits of finding a bank that charges lower interest for loans, for example, are realized each time a new loan is made and the total expected benefit of search will increase with the number of repeated purchases. Frequency of purchase, on the other hand, can also be regarded as "a measure of the number of times the information gained from a price search can be used before that information expires" [Sorensen (2000), page 836]. Since the search activity has a cost independent of the amount of the transaction but the total benefits of lowering interest rates on loans or of getting more interest from the deposits will increase with the amount of the loan or deposit, search activity should be higher in banking products with larger average volume per transaction. Therefore, other things equal*, price dispersion will be lower for banking products with more frequent transactions over time and for products with higher volume per transaction.*

Besides cross section sources of price dispersion as those mentioned above, price dispersion is also affected by the evolution of the level of prices over time. The models that study these relationships are grouped into menu cost models, as Benabou (1992), signal extraction models, Benabou and Gertner (1993), and information investment models [Van Hoomissen (1988)]. In banking products menu costs can be expected to be very low but inflation (deflation) changes the distribution of interest rates from period to period and therefore when there is inflation, investing in information will have lower return for the consumer. Thus, for the same frequency of purchase, consumers will find optimal to be less informed when prices change at a higher rate.

As Van Hoomissen (1988) indicates, consumers determine the optimal stock of information to hold about prices and places to shop as well as the optimal flow on new information (investment through search activities), as a function of the costs of search, of the equation that transforms search into valuable information, and the rate at which the stock of information depreciates. Since depreciation increases with inflation of the product, consumers will hold less information and therefore *price dispersion will be higher when the rate of change in the level of prices is also higher.*

The cost and benefits of search and the returns from investing in information can change over time due to technological innovations, for example new distribution channels as Internet, due to new commercial policies by banks, for example the use of advertisement on prices to attract consumers, or due to new regulatory rules about transparency on prices and other product attributes. An across the board reduction in search costs because sellers advertise the prices of the products and consumers can easily observe and compare them when doing their shopping, will lower price dispersion and the level of prices. For a similar reason, a change in regulation in interest rate transparency that forces banks to publicize the terms of their loans of deposits, or forces them to use standardized prices (such as the annual equivalent rate of interest of the loan or deposit) for loans and deposits, will lower dispersion for a given search activity of the consumers. Therefore we expect that *regulatory reforms that increase interest rates transparency will lower interest rates dispersion in loans and deposits.*

But there are other circumstances in which the costs of search vary across buyers and then the predictions about the effect in price dispersion of technologies that close the gap in search costs, are less straightforward. In these cases the final effect on price

dispersion of the diffusion of price search technologies, such as Internet, becomes an empirical question[3].

A distinctive feature of banking markets is the existence of an interbank market where banks can borrow and lend at a given interest rate. The interbank interest rate becomes the short-term marginal cost of lending for a bank, assuming no risk premium, and the marginal revenue from the deposits. The interbank interest rate and its variations over time is public information that consumers of banking products can know at negligible costs. One relevant question to be asked is whether interbank inflation is or is not a sufficient statistic for product specific inflation in all the bank products or, to the contrary, banks choose randomized strategies in deciding the interest rates of their products which lowers the link between interbank interest inflation and product specific inflation. In this respect Varian (1980) argues that, in order to assure persistent price dispersion, firms will use mixed strategies to fix prices, otherwise buyers could learn the true distribution of prices after repeated search and dispersion could not be sustained.

Each bank offers multiple products, loans and deposits, but little is known about the theoretical and empirical implications for price dispersion of the existence of multi product firms. McAfee (1995) gives conditions under which multi product equilibrium price dispersion satisfies the property that "the marginal distribution of any one good's price is the same as if it were determined in a single good environment" (page 93). We will assume that this property holds in our price data. But the characteristics of the market can still vary across products. For example, relationship lending [Boot (2000)] may make the demand of loans from a particular bank fairly price inelastic, while mortgages are likely to be more standardized products and each bank faces a price elastic demand for this product. Reinganum (1979) provides conditions under which price dispersion will be lower in markets with more elastic demand and, according to them, price dispersion should be lower in more standardized products such as mortgages, than in less standardized ones such consumers' and business' loans.

3. Stahl (1989) presents a model of competition with search costs in which some of the consumers in the market pay a search cost for each price offer they get, and others have no search costs. In the equilibrium solution, an increase in the proportion of consumers with zero search costs first increases the dispersion in prices and later reduces it, if the initial proportion of informed consumers is rather low. Brown and Goolsbee (2002) test the predictions of Stahl in the life insurance industry assuming that the proportion of consumers with zero search costs corresponds to buyers that use Internet as a searching device.

3 The Spanish banking sector, definition of the variables and preliminary evidence on interest rate dispersion

3.1 Developments in the Spanish banking sector and regulation on transparency

The Spanish banking industry was heavily regulated at the beginning of the seventies. From 1974 onwards, restrictions on price (interest rates and fees), quantities (compulsory investment coefficients) and capacity (geographical expansion through new branches) were progressively lifted. The deregulation process was long, with some steps backwards from time to time, but eventually it led to a banking system where institutions could set freely the interest rate of all of their banking products as well as open branches nationwide[4]. For the purpose of the present paper we shall focus on the changes in the Spanish banking sector that may have more consequences for information differentiation and dispersion in interest rates: liberalization of interest rates, transparency regulation and competitive behavior by banks.

Liberalization of interest rates has occurred through a lengthy period. During the period under study, 1988 to 2003, banks have been free to set interest rates on loans and deposits. In 1989 the ban for savings banks opening branches outside their regions of origin was removed and since then new competitors have entered local and regional markets. This has occurred at the same time that intense merger activity has reduced substantially the number of banks. The third quarter of 1989 a large nationwide bank started a very aggressive advertising campaign in order to attract depositors for sight accounts. The level and nature of competition has been also affected by the development of the money and investment funds market, mainly after tax changes in 1991, and by the fact that Spain joined the Euro area so that, since 1999, interbank interest rates have been at historical low values, with real rates close to zero or even negative. Technological advances have allowed the development of other channels to reach customers. In particular, since the year 2000 some very active telephone and Internet banks have put in place aggressive price strategies to gain market share in deposits markets.

Apart from the liberalization measures, Banco de España, the banking regulator and supervisor, put a lot of attention and detailed requirements for banking transparency and consumer protection, in particular, regarding interest rates. After the complete liberalization of interest rates in 1987, Banco de España increased transparency requirements regarding interest rates. Banco de España Rule 15/1987 explained how interest rates had to be calculated (i.e. in terms of yield rate) in order to make comparisons of rates across banks homogeneous. Rule 11/1988 and Rule 15/1988 provided even more detailed guidance in order to calculate the yield rate and, the latter one enhanced the obligation to publish quite visibly and permanently information on some interest rates (i.e. those of loans to prime customers and overdrafts) as well as advising to provide information on some other loan rates. Apart from that, Banco de España started to collect information from every bank about interest rates for several types of products with various maturity breakdowns[5], both from the asset and the liability side.

Rule 8/1990 increased significantly information to customers and transparency. In every bank branch it was made compulsory to have a clearly visible permanent panel in order to keep customers informed of interest rates applied by the bank (extending the previous coverage to other loans and deposits) as well as other information (to mention that there is a

4. A thorough analysis of the Spanish banking deregulation process, chronology and its consequences in terms of efficiency and solvency can be seen in Salas and Saurina (2003).
5. This database is the one we use in the paper. See below for a thorough discussion of its content.

booklet offering more information on product characteristics, tariffs, valuation procedures, etc., as well as the Laws that protect banking customer interests).

Finally, Rule 5/1994 defined the official reference rates for mortgages at variable interest rates. In order to improve transparency and consumer protection Banco de España provides, since that rule, public information on several interest rate references that should be used preferably for banks in their mortgages at variable rates (i.e. mortgage interest rates are set as the reference plus some basis points). Those references, in particular, one of them based on Euribor (or Mibor before European Monetary Union) have become the benchmark for the mortgages market and more than 90% of all new mortgages granted at variable rates (the bulk of mortgage operations in Spain) are based on them.

As the liberalization process advanced, the Banco de España has enhanced banking transparency and information release by making compulsory to disclose some interest rate in each bank branch, providing references and detailed instructions in order to make interest rates comparable and creating and supporting rate benchmarks and, finally, by publishing some of those interest rates. One of the interest of the paper is to find out if banking regulation has indeed contributed to reduce search costs among bank customers through improved comparability and transparency[6].

3.2 Sample of banks and banking products

As mentioned before, Banco de España Rule 15/1988 started to ask for detailed information on interest rates set by banks (i.e. commercial and savings banks) in all their *new* operations. It is very important to realize that the information is based on new operations undertaken (i.e. new loans granted or new deposits received) instead of being information on average interest rates, some of them set years ago. The interest rate reported by the bank for a given product is the weighted average of the interest rate charged in the operations made in that product during the corresponding month. Thus, we have information on marginal interest rates for around 200 banks during 172 months and 30 different banking products.

For each bank, information is available on the annual interest rates quoted monthly to several loan products: discounting of receivables, credit line facilities, uncollateralized personal loans, mortgages and loans at variable interest rates. Except for mortgages in which almost all of the loans are long term (maturity of three years or more), the rest of the loans are broken down in periods of different maturity: up till 3 months, between 3 months and 1 year, between 1 and 3 years and more than 3 years. On the liability side, banks declare interest rates paid on current accounts (sight deposits that include check facilities), savings accounts[7] (sight deposits that do not incorporate any check facility), term deposits, repo-type deposits (i.e. a deposit backed by the bank with a government security) and, finally, other deposits (i.e. zero-coupon-type products), with a five maturity break down: up till 3 months, from 3 to 6 months, from 6 to 12 months, from 1 to 2 years and more than 2 years.

The information requirement covers both commercial and savings banks. Therefore, we almost have the whole population of Spanish banks[8]. We have set a minimum market share (in national terms) of 1 over 10,000 in terms of total assets, in order to eliminate inactive banks that introduce a lot of noise in the data (i.e. many blanks in the data) but allowing us to include very small local banks that, although not being important players at national level, they have a more relevant role on some province markets. Moreover, mostly all the branches of

6. Nakane and Koyama (2003) find preliminary evidence of the role played by dissemination of information on interest rates by Banco do Brazil in order to decrease their dispersion.
7. Current and savings accounts with no remuneration, or with very close to zero remuneration, are excluded.
8. We do not have information on interest rates posted by credit cooperatives which, in any case, represent less than the 5% of total deposits.

foreign banks have been excluded (but not subsidiaries of foreign banks) in order to concentrate the analysis on retail markets (in both loans and deposits)[9].

Apart form that, given the existence of missing values (as a result of no new operations in the month) we performed further filtering of the data base. In particular, for each product and bank, we only have taken into account data from years in which there is information of interest rates for at least eight months, so as to get rid of banks that have few or no operations in a given product during a year.

For each product and maturity, up to a total of thirty different banking products, a dummy variable is defined. *RECEIVABLE*, takes the value of 1 if it is a receivables operation and zero otherwise; the variable is further broken down in three maturity periods, less than 3 months, between 3 and 12 months and more than 12 months (up to 3 years). *CREDITLINE*, takes the value of 1 if the loan is a credit line and zero otherwise; the maturity here goes as follows: less than 3 months, from 3 months to 1 year, from 1 to 3 years and more than 3 years. *PERSONAL*, takes the value of 1 if it is a personal loan and 0 otherwise; the same maturity breakdown as *CREDITLINE*. *MORTGAGE*, 1 if it is a mortgage loan with a more than 3 year maturity (given the characteristics of this product, used mainly by households to finance the acquisition of their houses, it is clearly a long term product, being the amounts lend to shorter periods almost negligible) and 0 otherwise. *VARIABLE* takes the value of 1 if the loan has a variable interest rate and 0 otherwise; variable interest rates are revised in one, three or more than three months[10].

Regarding liability-side products, *CURRENT* takes 1 if it is a sight current account with check facilities, 0 otherwise. *SAVINGS* take 1 if it is a sight account without check facilities and 0 otherwise. For the purpose of the paper it is assumed that the relevant transaction is to open or close a current or saving account, not the frequency with which the balance of the account is used to make payments or withdraw cash. The time interval between opening and closure is, in general, large and therefore current and saving accounts are considered products of low frequency of transaction (i.e. they are included among the products of long maturity). *DEPOSITS* takes the value of 1 if the product is a term deposit and 0 otherwise; the maturity breakdown is less than 3 moths, between 3 and 6 months, between 6 months and 1 year, between 1 and 2 years and more than 2 years. *CTA* will be equal to 1 if it is a "repo" operation and 0 otherwise, with maturity of less than 3 months, between 3 and 6 months, between 6 months and 1 year and between 1 and 2 years. Finally, *DISCLIABILITY* takes 1 if the product is a zero-coupon type emission by the bank and 0 otherwise; maturity breakdown is the same as *CTA*.

For the purpose of the paper it is important to identify the potential incentives for price search by consumers, borrowers and depositors, in each of the selected products. As indicated in the former Section, these incentives will depend, on a given moment of time, on the frequency and amount of the transactions so that, more frequency and higher volume will imply more search activity and less price dispersion. The general assumption is that short maturity implies higher frequency of the transaction and therefore the empirical prediction is that a positive association is expected between maturity and price dispersion within each product and in the overall. To facilitate comparisons, bank products will be grouped into three categories, *LOW, MEDIUM* and *HIGH* maturity depending upon their respective maturity class. The variable *LOW* will take the value of 1 for all products that have maturity of less than 3 months and 0 otherwise; *MEDIUM* will take the value of 1 for products on the liability side with maturity between 3 months and 2 years, and for loan products

9. Branches of foreign banks have also a very small market share, in particular in deposits, mortgages and loans to SMEs, the bulk of banking activities in Spain. However, a foreign branch that has been the last years a very active player in the Spanish deposit market through Internet and telephone banking has been included.
10. It is important to recall that variable interest rate mortgages are excluded from this group of loans because they are included in MORTGAGE.

between 3 months and 3 years, and 0 otherwise; *HIGH* takes the value of 1 for products with maturity above 2 (deposits) and 3 years (loans), and 0 otherwise.

Products are grouped into large or small volume of transaction taking into account regulatory experience and partial information available on average balances for each of them[11]. The variable *LARGE* will take the value of 1 for the products *CREDIT LINE*, *MORTGAGE*, $VARIABLE_{more3months}$, *DEPOSITS*, *CTA* and *DISCLIABILITY*, and 0 otherwise. The variable *SMALL* takes the value of 1 for the rest of the product categories and 0 otherwise. The grouping of banking products according to maturity and volume of the transaction is summarized in Table 1.

The structural changes in the Spanish banking sector will be incorporated to the empirical model through time dummy variables. Since those rules and developments are permanent, we construct dummy variables equal to 0 until the month the change happens and equal to 1 from that month onwards. Therefore, *REG90* is a dummy variable that takes the value of 1 from October 1990 onwards and 0 otherwise (i.e. Rule 8/1990 came into effect on October 1990). Note that *REG90* takes 1 for almost all the period studied and, therefore, is close to a general constant term. Changes made by Rule 5/1994 came into effect in August 1994 and, given that they focused on mortgages, *REG94* takes the value of 1 for mortgages from August 1994 till the end of the period and 0 otherwise. We test the possible "Euro" effect in price dispersion through the explanatory variable *EURO*, a dummy variable that takes 1 since January 1999 and 0 before. Finally, to account for the possible effect of Internet banking in search activity and price dispersion we define the variable *TECH* that takes the value of 1 for each month after January 2000 and 0 otherwise. The variable is introduced into the model allowing for different effects in the loan and in the deposit products (*DEPOSITSTECH* takes the value of 1 if the time period is beyond January 2000 and the bank product is a deposit product, and 0 otherwise).

3.3 Measures of price dispersion and inflation

Observed prices of banking services can differ across banks due to product differentiation and due to information differentiation. If banks fix their interest rates according to a formula like (1) then a measure of price dispersion such as the standard deviation of prices across banks for product *i* in *t* will be equal to the standard deviation of mark up times the interbank rate r_t. If r_t increases or decreases over time we would observe changes in price dispersion over time even if the dispersion of mark ups (i.e. differentiation) remains unchanged. To avoid this undesirable effect, price dispersion will be evaluated from the log of the respective interest rate,

$$\ln p_{ijt} = \ln k_{ijt} + \ln r_t \qquad (3)$$

Both, the product and the information differentiation will still affect the dispersion in the log of the price across banks. The former can be associated to policies and management practices put in place by each bank to make more attractive its products to the consumer (convenient branches, friendly attendants, better general consumer service, persuasive advertising, corporate image and so on) and, therefore, they will be bank specific and relatively stable over time. If our interest were price dispersion due to information differentiation, it would be necessary to obtain measures of price dispersion free of possible effects of product differentiation. As in Van Hoomissen (1988), this paper will examine the time behavior of interest rate dispersion by looking at the dispersion of interest rates

11. The average size of sight deposits is around 5,000 euros whereas that of term deposits is five times larger. Average size of credit lines is between ten and twenty times larger than other loan type products to firms (i.e. receivables). Mortgages are around 100,000 euros.

movements over time. The assumption is that price dispersion due to information differentiation will lead to dispersion in price changes.

Define $D_{ijt} = ln\left(\frac{p_{ijt}}{p_{ijt-1}}\right)$ as the relative rate of change in the interest of product *i* charged by bank *j* in period *t* with respect to *t-1*. And $D_{it} = \frac{\sum_j D_{ijt}}{J_t}$, where J_t is the number of banks in period *t,* as the average across banks of the rates of change for product i in period t. The interbank relative interest rate variability for product i in month t is the standard deviation of banks interest rates movements around the average relative change in the interest rate of product i in period t:

$$V_{it} = \sqrt{\frac{\sum_j \left(D_{ijt} - \overline{D}_{it}\right)^2}{J_t}} \qquad (4)$$

As indicated in Section 2, one of the possible sources of price dispersion is inflation. Our analysis considers product specific inflation and general inflation. The former is measured by the absolute value of D_{it} and the later by the absolute value of the rate of change in the interbank interest rate $DIB_t = ln\ (r_t/r_{t-1})$.

Table 2 contains a summary of the variables used in the analysis and their respective definitions, while Table 3 contains a summary of the descriptive statistics for the dependent dispersion variable, V_{it}, and for the product specific inflation variables D_{it} in absolute terms.

3.4 Preliminary evidence on interest rate dispersion

Table 4 presents information about the evolution in the level of interest rates on loans and deposits in Spain in four periods of time between 1988 and 2003, together with the evolution of the interbank interest rate also in the same periods. In 1988-1991 the interbank interest rate was 14.07%, in average during the period, and goes down to 3.83% during 2000-2003. The average interest rates across banks and products follow a similar pattern both in the assets (from 16.8% to 6.43%) and in the liabilities side (from 9.64% to 3.15%).

The table confirms that there is dispersion in interest rates across banks and the dispersion differs across products. For example in the period 2000-2003 the average standard deviation of interest rates across banks for the 15 loan products is 1.54, with a maximum of 3.71 and a minimum of 0.47. For deposits the standard deviation is lower, 0.63, with a range between 0.96 and 0.25. The average dispersion remains rather stable over time for loans and decreases for deposits, but the coefficient of variation, standard deviation of interest rates across banks divided by average interest rate also across banks, in average for the loans and for the deposits products, does not decrease over time for either type of products.

The comparison of the numbers in Table 4 is affected by differences in mark up across banks, by changes in the mark up over time and by the evolution of the interbank interest rate over time. Table 5, on the other hand, presents similar evidence but now the variable is not the interest rate but the mark up, p_{ijt}/r_t, for loans and r_t/p_{ijt} for deposits, so that the two mark ups can be directly comparable. The average mark up for the thirty products and for all the banks goes from 1.47 in 1988-1991, to 1.70 in the period 2000-2003. The average mark up has increased over time especially for loan products (from 1.2 to 1.71), while it remains rather stable for deposits (from 1.74 to 1.68). The average mark up tends to increase with maturity of the products and decrease with the volume of the transaction.

The dispersion in mark up is positive and persistent over time, as the values of the standard deviation of the mark up across banks indicate. In the period 1988-1991 the

average for all thirty products of this standard deviation is 0.283 and in 2000-2003 goes up to 0,624. The average standard deviation is different loans and deposits but their respective average coefficients of variation tend to converge over time. Overall, the pattern of standard deviations across maturity and volume follows the pattern of average mark up (dispersion increases with maturity and decreases with volume), which would be preliminary evidence consistent with the theory that links price dispersion with search activities and information differentiation.

3.5 Pricing Strategies

The persistence over time of price dispersion in homogeneous products can only occur if sellers follow mixed strategies to fix prices [Varian (1980) and Lach (2002)]. Otherwise, if some sellers always sell at the highest price and others at the lowest one, buyers would finally learn who the low price-selling firms are and they would only buy from them. Thus, to confirm that banks do indeed follow some randomizing process to fix interest rates is prior to further analysis of the determinants of dispersion.

Figure 1 shows the distribution of all banks in the sample according to their respective frequency of being classified as banks that for product *i* and month *t* have the highest, the middle or the lowest change in their interest rate (for a maximum of 30 products times 171 months). The pure randomized pricing strategy would imply that the area of the three regions of Figure 1 is equal. With few exceptions, most often banks tend to be classified a similar number of times in each category so, again, the preliminary evidence is in favor of pricing behavior that tends to take advantage of search costs and information differentiation of the consumers.

The second prediction from the use of mixed strategies by sellers is that the position of the bank in the ranking of interest rate changes in a given time period, will vary over time. To confirm this prediction Table 6 shows the mean, the maximum and the minimum of the standard deviation of the positions in the rankings of interest rate variations of the 20 largest banks of the sample during all the months considered in the analysis. The standard deviations are relatively high for all banks, evidence that is consistent with the hypothesis that banks randomize their interest rate decisions[12].

12. If ranks were randomly distributed, according to their uniform distribution, they should have a standard deviation of $\frac{(n_t - 1)}{\sqrt{12}}$, where n_t is the number of entities taken into account in month *t*. If n = 20 then the random dispersion would be 5.48.

4 Empirical models of price dispersion

From the theoretical hypothesis and the definition of the variables presented above, the empirical model on the determinants of interest rate dispersion is formulated as follows:

$$V_{it} = \alpha V_{it-1} + \sum \left(\beta_i PRODUCT_i\right) + \delta_1 \left|D_{it}\right| + \delta_2 D_{it}^2 + \gamma_1 REG90 + \\ + \gamma_2 REG94 + \lambda_1 TECH + \lambda_2 DEPOSIT\,TECH + \theta\, EURO + \mu T + \varepsilon_{it} \quad (5)$$

The lagged dependent variable is included as explanatory variable to account for possible persistence effects in the evolution of dispersion. From the investment information model the lagged dispersion will also be a proxy of the stock of information at the beginning of the period. Product specific inflation D_{it} is included in linear and squared form to account for non-linear effects of inflation on price dispersion. Inflation is measured in absolute values since the theoretical models (signal extraction and investment in information) predict that the effects on dispersion are symmetric in inflation and deflation periods. The time trend variable *T* is an additional control variable that will capture possible trends in the dispersion variable over time.

The results from the estimation of the model are presented in Table 7. The first column corresponds to the estimation of the model with time dummy variables in substitution of the regulatory, technological change and euro dummy variables. The second column includes the later variables and excludes the time dummies. The estimated coefficients of the explanatory variables lagged dispersion, product specific inflation and bank products dummies are very similar in the two estimations. The two R^2 are also very close. Therefore, the *REG, EURO, TECH, DEPOSITTECH* and *T* variables capture rather well the time dynamics of the dispersion variable after controlling for the persistence, inflation and product dummy variables. Overall, the results obtained show that dispersion of interest rates across banks has persistent effects, the coefficient of V_{it-1} is statistically significant, and it increases with the rate of product specific inflation, since the coefficients of D_{it} and D_{it}^2 are both positive, but only the former is statistically significant[13].

The coefficients of *REG90* and *REG94* are both negative and statistically significant, which indicates that the transparency regulations, in general, *REG90*, and specific for mortgages, *REG94*, contributed to lower price dispersion. The introduction of the Euro increases the interest rates dispersion across banks, the coefficient of *EURO* is positive and statistically significant, while the new distribution and price search technologies with Internet seem to decrease interest rate dispersion more intensively in the deposits products (coefficients of *TECH* and *DEPOSITTECH* negative and significant). Finally, the time trend has a positive and significant coefficient a result that points towards an increase in interest rate dispersion over time, even after controlling for all the rest of the variables of the model.

The estimated values of the coefficients of the product dummies β_i give the average dispersion for each product after we control for the rest of the variables of the model. The highest estimated coefficient is 5.39 for *RECEIVABLE 1 to 3 years* and the lowest 1.125 for *RECEIVABLE less than 3 months.* For this loan product dispersion increases with maturity but this is not the case for *CREDITLINE* and for *PERSONAL* which are also the products with higher and more even dispersion across maturities. The coefficient of *MORTGAGE*, on the other hand, is the lowest among products of long maturity, a result that can be explained by

13. We re-estimated the model taking into account the hypothesis of i) potential endogeneity and ii) autocorrelation in the error term The results obtained were almost equal to the ones obtained with *OLS*. To test the hypothesis of i) endogeneity, we have used instrumental variables (lags of D_{it}). ii) On the other hand, we have performed tests of autocorrelation: Only 6 out of the 30 time series were likely to present autocorrelation. Then, we have estimated a model with a specific coefficient for the lagged dependent variable for each of those products. As a result, the errors did not show any significant autocorrelation.

the fact that this is a standard product (high price elasticity of demand) with high volume per transaction.

To test for statistical differences among the price dispersion of products of different maturity and different volume per transaction, the thirty products are classified in low medium and high maturity and in large and small volumes per transaction. Sub-index i (of product type) is first decomposed in two, *q* and *m*, where *q* refers to one of the ten product categories and *m* takes three values one for each maturity, *LOW, MEDIUM* and *HIGH,* as defined above. The basic model (column 2 of Table 7) is estimated again with the additional constraint that all products within each class of maturity have the same coefficient,

$$\omega_{1m} = \omega_{2m} = \ldots = \omega_{qm=\ldots} = \omega_{10m} = \omega_m \text{, for } m = \textit{LOW, MEDIUM} \text{ and } \textit{HIGH} \qquad (6)$$

The exercise is repeated grouping the products according to the volume per transaction in *LARGE* and *SMALL,* also defined above. The restriction imposed in the model is now,

$$\phi_{1v} = \phi_{2v} = \ldots = \phi_{qv} = \ldots = \phi_{10v} = \phi_v \text{, for } v = \textit{LARGE} \text{ and } \textit{SMALL} \qquad (7)$$

The estimated coefficients ω_n and ϕ_v are presented in the first column of Table 8 expressed in their long-term values. The results confirm that price dispersion increases with maturity of the banking products and is also higher for products with low volume per transaction than for products with high volume per transaction. *LOW* maturity products (less than 3 months) have in average 5.76 percentage points (pp) of dispersion in their rates of change of interests over time, almost 1 pp less than products with *MEDIUM* maturity (between 3 months and 2/3 years), with average dispersion of 6.73%. Finally, *HIGH* maturity products (more than 2/3 years) have on average a 8.64% almost 2 pp more dispersion than products of *MEDIUM* maturity. All these differences are statistically significant at the 1% level of significance or less as indicated by the values of 0 for the p statistics in the corresponding column of the table. Moreover, the null hypothesis that $\omega_1 = \omega_2 = \omega_3$, that is, all products of different maturity have the same average dispersion, is rejected also at *p* values close to zero[14].

Finally, the groups of products with *LARGE* volume per transaction show 1.2 percentage points less dispersion than the *SMALL* volume ones, a difference also statistically significant at *p* values close to zero[15].

The coefficients in the OLS estimation of equation (5) presented in Table 8 are obtained under the restriction that the model is the same across products except for the product dummy variables that vary depending upon maturity and volume. A robustness test of the previous results compares the average dispersion across maturity and amount of the transaction allowing for differences in the coefficients of the variables V_{it}, D_{it} and D_{it}^2 for each product and maturity. To do so, equation (5) is estimated under a *SUR* specification, where the coefficients of the explanatory variables, lagged dispersion and product specific inflation, are allowed to be different for each product and maturity. The model is estimated twice, once with restriction (6) and the other with restriction (7). The values of the estimated coefficients of variable ω_n and ω_v are presented in the second block of columns of Table 8. The estimated coefficients follow the same pattern and show similar values than those obtained under *OLS* and common lagged persistence and inflation effects.

14. F (2,5063) = 139,15, *p* value equal to 0.

15. The result of the test $\phi_{LARGE} = \phi_{SMALL}$ gives an statistic F(1, 5063) = 102,5 so the null hypothesis is again clearly rejected.

4.1 Price dispersion and mark up

The evidence of price dispersion points towards information differentiation in the banking markets. This differentiation is one of the potential sources of market power for the firms in the market. Therefore, one important corollary from the results above is that the same sources of differences in the costs and benefits of consumers search across products that determine more or less price dispersion, will also determine differences in their respective mark up. The dependent variable is now $ln(p_{it}/r_t) = ln(k_{it})$ for the case of loans and $ln(r_t/p_{it}) = - ln(k_{it})$ for the case of deposits, where p_{it} is the average interest across banks of the product i in period t. The explanatory variables are the same as in equation (5) but substituting lagged average mark up in the place of lagged dispersion.

The hypothesis are that the coefficients of the variable $PRODUCT_i$ will vary across maturity and volume in the same way as the coefficients of the same variables do when the dependent variable is V_{it}, price dispersion. In other words, high maturity (low frequency of transaction) and low volume that imply, both, more information differentiation, will be associated with higher mark up. Second, we also expect the same signs as in Table 7 for the coefficients of the regulatory, euro, technology and time trend dummy variable. The model is estimated under the same variations that were used to obtain the values of the coefficients in the first part of Table 8 referred to price dispersion; that is, with restrictions defined in equations (6) and (7), and two specifications, *OLS* and *SUR* estimations.

The second part of Table 8 presents a summary of the results from the estimations. The mark up increases with maturity and is lower for products that involve large transactions than for those of small transactions. The differences in the estimated coefficients are statistically significant at 1% levels or less except in the case of the difference between low and medium maturity. The coefficients of the rest of the variables have in most of the cases the same sign and similar levels of statistical significance than the coefficients presented in Table 7, which reinforces the robustness of the results obtained using dispersion as dependent variable[16].

The search models predict that price dispersion and profit margins will move together in response to changes in the parameters that describe the search environment. The same could be expected for our measure of mark up and the rate of change in interest rates: if the distribution of changes in the interest rates of the banking products are affected by consumer search, a positive correlation could be expected between the residuals of the regression of dispersion and the residuals of the regression on mark ups. The reason is that the effects of unobserved characteristics of the products and of the banks that may shift the costs of search but have not been taken into account in the regression, should have the same sign.

Computing the simple correlation between the residuals of the two models we obtain a value of 0.07, statistically different from 0 at the 1% level. Since this correlation is affected by the time variation of the variables of the model, we regress the residuals of the basic model of dispersion and the residuals of the mark up model controlling form time dummies. The estimated regression coefficient between the two variables is 0.06, statistically significant at the 1% level, and the correlation coefficient of the regression is 0.28. Therefore the null hypothesis that the residuals of the two regressions are independent is clearly rejected.

Overall, the behavior of the mark up confirms the conclusions obtained from the basic model of price dispersion and we can conclude that the empirical evidence on interest

16. The estimated model for the common variables, in the *SUR* estimation, is as follows, with coefficients in long term values:

$ln(k_{it})$=-0,09REG90 – 0,05REG94 + 0,06 EURO + 0,03TECH – 0,27 DEPOSITTECH + 0,001T
(-3,6) (-1.4) (1,8) (0,5) (-4,2) (6,0)

t values in brackets.

rate formation in loan and deposit products is affected by factors that create conditions for information differentiation due to search costs by borrowers and depositors.

4.2 General and product-specific inflation

The interbank interest rate is a common benchmark for the interest rates of all the banking products. This section will present evidence on whether changes in the interbank rate over time are sufficient statistics for the rate of inflation of each of the products considered in the analysis or, alternatively, the most relevant measure of inflation is still product specific. To do so, an additional variable, the absolute value of the change in the interbank interest rate in month *t* with respect to *t-1* (DIB_{it}) is introduced into de model of dispersion [equation (5)].

Table 9 presents the results. The first estimation includes both general and product specific inflation as explanatory variables while the second introduces only general inflation. The estimated coefficient of the variable DIB_{it} is negative and has lower absolute value than the corresponding coefficient for the variable of product specific inflation. The negative sign of the common inflation variable suggests that dispersion may be affected by relative inflation of product *i* with respect to interbank interest rate inflation. When the product specific inflation variables are excluded from the regression, the coefficient of the common inflation variable is significant with a positive sign but the coefficient of the variable is very low and the goodness of fit of the model is reduced. Common inflation has a positive effect in price dispersion, but it is not a sufficient statistics for the evaluation of the effect of inflation in the dispersion of interest rates. Interbank interest rate can help consumers to predict the evolution of interest rates of particular banks in a limited way so, banks seem to be effective in maintaining persistent price dispersion over time.

5 Discussion and conclusion

This paper presents empirical evidence in favour of the hypothesis that information differentiation is an important variable to explain price formation in the markets of financial products supplied by banks, both in the asset side (loans) and in the liability side (deposits). The evidence is obtained taking care to isolate information differentiation from product differentiation due to bank specific variables that are relatively stable over time (consumer service, convenience, credit risk policies, ownership, etc). The paper also provides preliminary evidence that the significant decline in the interest rates over time across banks during the period 1988-2003 may be highly determined by the evolution of the interbank interest rate, while the competitive conditions show no trend at all. Neither the observed evolution in mark up nor the positive trend in interest rate dispersion suggest that competition has significantly increased in banking markets during the period of study.

According to the results of the paper, information differentiation is observed in the form of persistent dispersion across banks in the interest rates of each one of the thirty financial products considered in the analysis. Such differentiation is also observed in the distribution of average mark up across products, that follows a similar pattern as price dispersion. Evidence is also provided consistent with the prediction that in order to sustain price dispersion over time, banks will randomize their pricing strategies so making difficult for the buyers to find banks that offer systematically worst or systematically better conditions.

Secondly, price dispersion and average mark up vary across products in a consistent way with the predictions from the theory of search according to which one way consumers have to obtain information about product prices is to search for products of lower price, taking into account that search is costly and therefore the amount of search will be endogenously determined from the marginal benefits and costs of search. The paper confirms this result by the fact that the financial products which show less persistent dispersion and lower average mark up are also those with lower maturity (more frequency of shopping) and higher volume of balances, precisely the variables that the literature associates with higher benefits of search.

Third, product specific inflation increases price dispersion in a significant and proportional way. One percentage point increase in inflation increases dispersion in 0.25 percentage points in the short term and 0.40 percentage points in the long term, according to Table 7. This result provides support to the theories that relate price dispersion and inflation, as higher inflation means higher depreciation of the existing stock of information hold by the consumers in the market. They also confirm that inflation can produce important frictions and inefficiencies in the functioning of markets and that lower volatility in the market interest rate can produce additional benefits to those of lower level interest rates, in terms of more efficient markets of financial products supplied by banks.

Our forth important result is that past regulatory initiatives aimed at increasing transparency in interest rates in order to reduce search costs, seem to have been effective in reaching that objective. This would confirm that private incentives of banks and consumers to produce information might result in a stock of information about ranking and distribution of interest rates, inferior to the socially optimal stock. Since the level of persistent price dispersion is still relatively high, the results of the paper recommend further regulatory initiatives in this direction. The introduction of new technologies that allow for new distribution channels for the banking products and especially for lower search costs, seem to contribute to lower interest rate dispersion and, therefore, they may be a source of more competition in these markets. However, the effect of Internet in reducing dispersion in interest rates differs

across products being more effective in deposit products, presumably more homogeneous, than in loan products.

The results of the paper point out that the markets of financial products supplied by banks are far from being homogeneous. Moreover, common inflation across products measured in terms of absolute variation in the interbank interest rate is clearly insufficient to capture the effect of inflation in price dispersion across products. To properly explain such dispersion the relevant variable is inflation specific to each loan or deposit product, which points out to segmentation and heterogeneous competitive conditions across banking products even though interbank interest rate sets a parallel time trend evolution for most of them.

The evolution of mark ups and dispersion of relative prices over time differs across products, even after taking into account the effects from possible sources of information differentiation. Although these conclusions would require further and more thorough analysis, it appears that current and saving accounts may not be quite sensitive to interest rates since they are the deposits products that show the highest level of price dispersion. Consumers may search before deciding in which bank to open the accounts, satisfy liquidity needs and, maybe, obtain better interest but, after the choice of a bank is made, search stops. Second, the loans' markets appear highly segmented in mortgage loans, personal loans and business credit. Interest rate dispersion in mortgages is lower than in the rest of the loans. The differences may be attributed, at least partly, to the effects of relational lending and the benefits of investing in information about the attributes and behaviour of the borrowers by the lenders to overcome problems of adverse selection and moral hazard. Some form of price dispersion in credit markets may result from investments in information by the banks that encourage long term relations and reduce credit rationing. If this was the case, interest rates dispersion in bank loans markets may respond to particular features that are not present in other products and markets.

References

AXELL, B. (1977). "Search Market Equilibrium", *Scandinavian Journal of Economics,* 79, N.º 1, pp. 20-40.

BANCO DE ESPAÑA (2003). *Financial Stability Report,* November.

BENABOU, R. (1988). "Search, Price Setting and Inflation", *Review of Economic Studies,* 55 (3), pp. 353-76.

— (1992). "Inflation and Efficiency in Search Markets", *Review of Economic Studies,* 59, pp. 299-329.

— (1993). "Search Market Equilibrium, Bilateral Heterogeneity, and Repeat Purchases", *Econometrica,* 51, pp. 955-69.

BENABOU, R., and R. GERTNER (1993). "Search with Learning from Prices: Does Increased Uncertainty Lead to Higher Mark ups?", *Review of Economic Studies,* 60, pp. 69-94.

BOOT, A. W. (2000). "Relationship Banking: What Do We Know ?", *Journal of Financial Intermediation,* 9, pp. 7-25.

BROWN, J., and A. GOOLBEE (2002). "Does Internet make Markets more Competitive? Evidence from the Life Insurance Industry", *The Journal of Political Economy,* 110, pp. 481-507.

BURDETT, K., and K. L. JUDD. (1983). "Equilibrium Price Dispersion", *Econometrica 51,* pp. 955-970.

BUTTERS, G. R. (1977). "Price Distributions of Sales and Advertising Prices", *Review of Economic Studies,* 44, pp. 465-491.

CARLSON, J. A., and R. P. MCAFEE (1983). "Discrete Equilibrium Price Dispersion", *The Journal of Political Economy,* 91, pp. 480-493.

CARLSON, J. A., and D. R. PESCATRICE (1980). "Persistent Price Distributions", *Journal of Economics and Business,* 33, pp. 21-27.

DAHLBY, B. and D. S. WEST (1986). "Price Dispersion in an Automobile Insurance Market", *The Journal of Political Economy,* 94, pp. 418-438.

DIAMOND, P. (1971). "A Model of Price Adjustment", *Journal of Economic Theory,* 3, pp. 158-168.

DOMBER0GER, S. (1987). "Relative Price Variability and Inflation: A Desegregated Analysis", *The Journal of Political Economy,* 95, pp. 547-566.

FISHMAN, A., and R. ROB (1995). "The Durability of Information, Market Efficiency and the Size of Firms", *International Economic Review,* 36, pp. 19-36.

FREIXAS, X., and J. C. ROCHET (1997). *Microeconomics of Banking,* The MIT Press, Cambridge, MA.

JANSSEN, M., and E. RASMUSEN (2002). "Bertrand Competition under Uncertainty", *The Journal of Industrial Economics,* 50.

LACH, S. (2002). "Existence and Persistence of Price Dispersion: An Empirical Analysis", *The Review of Economics and Statistics,* August, pp. 433-444.

LACH, S., and D. TSIDDON (1992). "The Behavior of Prices and Inflation: An Empirical Analysis of Disaggregated Price Data", *The Journal of Political Economy,* 100, pp. 349-389.

MCAFEE, P. (1995). "Multiproduct Equilibrium Price Dispersion", *Journal of Economic Theory,* 67, pp. 83-105.

NAKANE, M. I. and M. S. KOYAMA (2003). *Search Costs and the Dispersion of Loan Interest Rates in Brazil,* mimeo, Banco Central do Brasil.

PRATT, J., D. WISE and R. ZECKHAUSER (1979). "Price Differences in Almost Competitive Markets", *Quarterly Journal of Economics,* 93, pp. 189-211.

REINGANUM, J. F. (1979). "A Simple Model of Equilibrium Price Dispersion", *The Journal of Political Economy,* 87, pp. 851-58.

REINSDORF, M. (1994). "New Evidence on the Relation between Inflation and Price Dispersion", *American Economic Review,* 84 (3), pp. 720-31.

ROTHSCHILD, M. (1973). "Models of Market Organization with Imperfect Information: A Survey", *The Journal of Political Economy,* 81, pp. 1283-1308.

SALAS, V. and J. SAURINA (2003). "Deregulation, Market Power and Risk Behaviour in Spanish Banks", *European Economic Review,* 47, pp. 1061-1075.

SALOP, S., and J. STIGLITZ (1977). "Bargains and Ripoffs: A Model of Monopolistically Competitive Price Dispersion", *The Review of Economic Studies,* 44, pp. 493-510.

— (1982). "The Theory of Sales: A Simple Model of Equilibrium Price Dispersion with Identical Agents", *American Economic Review,* pp. 1121-1130.

SHESHINSKI, E. and Y. WEISS (1977). "Inflation and Costs of Price Adjustment", *Review of Economic Studies,* pp. 287-303.

SORENSEN, A. T. (2000) "Equilibrium Price Dispersion in Retail Markets for Prescription Drugs", *The Journal of Political Economy,* 108, pp. 833-850.

STAHL, D. (1989). "Oligopolistic Pricing with Sequential Consumer Search", *American Economic Review,* 79, pp. 700-712.

STIGLER, G. J. (1961). "The Economics of Information", *The Journal of Political Economy,* 69, pp. 213-225.

VAN HOOMISSEN, T. (1988). "Price Dispersion and Inflation: Evidence from Israel", *The Journal of Political Economy,* 96, pp. 1303-1314.

VARIAN, H. (1980). "A Model of Sales", *American Economic Review,* 70, pp. 651-659.

TABLE 1.-Grouping of products by Maturity and Volume.

SMALL VOLUME			LARGE VOLUME		
LOW MATURITY	**MEDIUM MATURITY**	**HIGH MATURITY**	**LOW MATURITY**	**MEDIUM MATURITY**	**HIGH MATURITY**
$RECEIVABLE_{less3months}$	$RECEIVABLE_{3months-1year}$	$PERSONAL_{more3years}$	$CREDITLINE_{less3months}$	$CREDITLINE_{3months-1year}$	$CREDITLINE_{more3years}$
$PERSONAL_{less3months}$	$RECEIVABLE_{1year-3years}$	CURRENT	$DEPOSITS_{less3months}$	$CREDITLINE_{1year-3years}$	$MORTGAGE_{more3years}$
$VARIABLE_{less1month}$	$PERSONAL_{3months-1year}$	SAVING	$DISCLIABILITY_{less3months}$	$VARIABLE_{more3months}$	$DEPOSITS_{more2years}$
$VARIABLE_{1month-3months}$	$PERSONAL_{1year-3years}$		$CTA_{less3months}$	$DEPOSITS_{3months-6months}$	
				$DEPOSITS_{6months-1year}$	
				$DEPOSITS_{1year-2years}$	
				$DISCLIABILITY_{3months-6months}$	
				$DISCLIABILITY_{6months-1year}$	
				$DISCLIABILITY_{1year-2years}$	
				$CTA_{3months-6months}$	
				$CTA_{6months-1year}$	
				$CTA_{1year-2years}$	

TABLE 2.- Description of the variables.

Variable	Definition	Computation
$PRODUCT_i$	Dummy variable that takes the value of 1 for product i and 0 otherwise.	
V_{it}	Price dispersion of product *i* in month *t*.	Standard deviation across banks (*j*) of $\ln (p_{ijt} / p_{ijt-1})$, where p_{ijt} is the annual interest rate applied by bank *j* in product *i* for period t.
D_{it}	Inflation rate of product *i* in month *t*.	Absolute value of average values of $\ln(p_{ijt} / p_{ijt-1})$ across banks (*j*).
DIB_t	Inflation rate of the interbank interest rate in month *t*.	Average absolute value of $\ln(r_t / r_{t-1})$; where *r* is the monthly interbank interest rate.
REG 90	Regulatory variable that accounts for obligation of bank to publish interest rates in the branches.	Takes the value of 1 from 10/1990 (when the regulation is issued) to 03/2003 and 0 otherwise.
REG 94	Regulatory variable that accounts for the impact of publication of reference interest rates for mortgages at variable rates.	Takes the value of 1 from 08/1994 onwards if the product *i* is a mortgage and 0 otherwise.
EURO	Dummy variable that accounts for the impact of the introduction of the Euro.	Takes the value of 1 from 01/1999 onwards and 0 otherwise.
TECH	Variable that captures the development of Internet as a distribution channel.	Takes the value of 1 from 01/2000 onwards and 0 otherwise.
DEPOSITTECH	Variable that captures a possible different effect of Internet as distribution channel for deposit products.	Takes the value of 1 from 01/2000 onwards if the product *i* is a liability for the bank.
LOW	Variable that identifies products with short maturity (up to 3 months).	It takes the value of 1 when the product has a maturity up to 3 months and 0 otherwise.
MEDIUM	Variable that identifies products with medium maturity (from 3 months to 2 and 3 years in liability and asset products, respectively.	It takes the value of 1 when the product has a maturity greater than 3 months and smaller than 2/3 years and 0 otherwise.
HIGH	Variable that identifies products with high maturity (more than 2 years in asset products 3 years in liability products).	It takes the value of 1 when the product has a maturity greater than 2/3 years and 0 otherwise.
SMALL	Variable that identifies products with low volume per transaction.	It takes the value of 1 when the product has a low volume and zero otherwise.
LARGE	Variable that identifies products with large volume per transaction.	It takes the value of 1 when the product has a large volume and zero otherwise.

TABLE 3.- Banking product sample statistics.

	V_{it} (in percentage)				D_{it} (in percentage)				Number observ.
Product	Mean	Std.Deviation	Min	Max	Mean	Std.Deviation	Min	Max	
$RECEIVABLE_{less3months}$	5.294	1.840	2.362	15.412	1.416	1.151	0.015	4.683	19010
$RECEIVABLE_{3months-1year}$	5.486	1.742	2.857	18.418	1.416	1.182	0.006	6.196	18310
$RECEIVABLE_{1year-3years}$	16.213	4.668	7.238	34.160	2.127	1.923	0.001	9.185	13126
$CREDITLINE_{less3months}$	15.935	6.579	5.750	40.140	2.322	1.860	0.053	8.516	11982
$CREDITLINE_{3months-1year}$	12.613	4.500	5.125	24.592	1.950	1.525	0.015	7.216	17389
$CREDITLINE_{1year-3years}$	9.947	2.988	4.368	16.694	1.746	1.421	0.002	7.372	18832
$CREDITLINE_{more3years}$	14.033	6.289	5.862	63.393	2.057	1.773	0.016	9.547	9888
$PERSONAL_{less3months}$	15.477	5.208	6.346	30.635	2.110	1.822	0.055	9.673	16280
$PERSONAL_{3months-1year}$	14.191	4.500	6.546	28.558	1.833	1.424	0.053	10.032	18844
$PERSONAL_{1year-3years}$	10.841	4.135	4.438	21.101	1.833	1.404	0.009	7.053	19050
$PERSONAL_{more3years}$	9.135	2.322	4.224	15.528	1.940	1.586	0.023	8.547	18616
$MORTGAGE_{more3years}$	5.349	1.547	1.893	11.079	1.657	1.205	0.028	6.511	17654
$VARIABLE_{less1month}$	7.180	3.851	1.282	19.919	2.577	2.306	0.009	11.679	8805
$VARIABLE_{1month-3months}$	7.354	3.291	2.060	16.642	2.349	1.974	0.013	10.127	12001
$VARIABLE_{more3months}$	7.778	2.382	3.141	14.360	1.865	1.525	0.003	8.821	16291
CURRENT	15.101	5.750	7.417	37.192	2.115	1.892	0.052	11.122	21611
SAVINGS	14.899	7.079	3.762	49.245	2.004	2.021	0.007	14.815	18118
$DEPOSITS_{less3months}$	6.584	2.725	2.427	13.604	2.222	2.229	0.001	10.416	14907
$DEPOSITS_{3months-6months}$	7.692	3.436	3.295	19.653	2.291	2.261	0.001	10.716	18740
$DEPOSITS_{6months-1year}$	7.703	3.201	2.598	17.844	2.321	2.131	0.020	10.111	18836
$DEPOSITS_{1year-2years}$	8.785	5.678	3.502	50.564	2.535	2.351	0.021	11.532	18481
$DEPOSITS_{more2years}$	13.615	5.273	5.335	33.282	2.640	2.441	0.007	12.437	13750
$DISCLIABILITY_{less3months}$	5.911	3.060	1.035	14.855	2.536	2.380	0.003	12.275	2886
$DISCLIABILITY_{3months-6months}$	5.874	2.788	1.452	18.753	2.438	2.397	0.002	10.824	3160
$DISCLIABILITY_{6months-1year}$	7.449	3.648	2.220	20.324	2.880	2.719	0.004	13.667	3063
$DISCLIABILITY_{1year-2years}$	6.982	3.091	1.399	16.882	3.120	2.528	0.067	13.012	3271
$CTA_{less3months}$	6.457	4.157	1.673	19.344	2.918	3.047	0.031	21.158	18487
$CTA_{3months-6months}$	11.291	5.536	3.593	27.159	3.032	2.432	0.053	12.247	16368
$CTA_{6months-1year}$	11.888	5.942	3.276	27.793	3.227	2.668	0.006	16.083	14811
$CTA_{1year-2years}$	10.636	5.863	1.498	33.631	3.143	2.854	0.004	14.895	5522

TABLE 4.- Evolution over time of average and dispersion of interest rates across banks for loan and deposit products.(%).

	Time Period 1988-1991			Time Period 1992-1995			Time Period 1996-1999			Time Period 2000-2003		
	Banks average	Standard Deviation	Coeff. of Variation	Banks average	Standard Deviation	Coeff. of Variation	Banks average	Standard Deviation	Coeff. of Variation	Banks average	Standard Deviation	Coeff. of Variation
Interbank interest rate	14.07			10.51			5.05			3.83		
Loan products												
Products´ average	16.80	1.70	0.10	13.94	1.89	0.13	7.83	1.85	0.23	6.43	1.54	0.23
Maximum	19.90	2.77	0.16	16.88	3.70	0.25	9.66	3.77	0.42	8.19	3.71	0.47
Minimum	15.40	0.86	0.06	11.67	0.93	0.08	6.13	0.61	0.09	4.99	0.47	0.09
Average Short Term	16.17	1.60	0.10	13.22	2.01	0.15	7.44	2.31	0.31	6.21	1.77	0.29
Average Medium Term	17.40	1.77	0.10	14.63	1.98	0.14	8.24	1.80	0.22	6.64	1.51	0.23
Average Long Term	16.46	1.71	0.10	13.52	1.48	0.11	7.50	1.17	0.16	6.34	1.20	0.19
Average Low Volume	17.20	1.81	0.11	14.36	2.06	0.14	8.13	2.05	0.25	6.62	1.67	0.25
Average High Volume	16.20	1.54	0.09	13.30	1.64	0.12	7.38	1.54	0.21	6.16	1.34	0.22
Deposit products												
Products´ average	9.64	1.58	0.19	8.52	1.04	0.14	4.08	0.63	0.18	3.15	0.63	0.24
Maximum	11.43	2.66	0.61	9.94	1.98	0.52	4.89	1.12	0.60	3.73	0.96	0.86
Minimum	3.82	0.71	0.06	3.80	0.74	0.08	1.87	0.33	0.07	1.12	0.25	0.07
Average Short Term	11.17	1.66	0.15	9.36	0.87	0.09	4.47	0.51	0.11	3.38	0.51	0.15
Average Medium Term	9.99	1.44	0.14	9.04	0.89	0.10	4.30	0.54	0.13	3.39	0.59	0.17
Average Long Term	7.09	1.89	0.27	6.14	1.66	0.27	3.03	1.01	0.33	2.20	0.86	0.39
Average Low Volume	6.05	2.11	0.35	5.10	1.80	0.35	2.38	1.03	0.43	1.55	0.91	0.58
Average High Volume	10.19	1.49	0.15	9.05	0.93	0.10	4.34	0.57	0.13	3.39	0.59	0.17
Number of observations		106291			125436			115956			80406	

TABLE 5- Evolution over time of average and dispersion of mark up across banks for loan and deposit products.

	Time Period 1988-1991			Time Period 1992-1995			Time Period 1996-1999			Time Period 2000-2003		
	Banks average	Standard Deviation	Coeff. of Variation	Banks average	Standard Deviation	Coeff. of Variation	Banks average	Standard Deviation	Coeff. of Variation	Banks average	Standard Deviation	Coeff. of Variation
Products´ average	1.468	0.283	0.158	1.367	0.253	0.162	1.548	0.419	0.237	1.698	0.624	0.290
Maximum	4.972	2.302	0.463	3.590	1.833	0.511	4.203	2.798	0.666	7.394	6.697	0.906
Minimum	1.095	0.062	0.056	1.062	0.094	0.083	1.044	0.100	0.094	1.031	0.077	0.075
Average Loans	1.197	0.122	0.100	1.356	0.194	0.140	1.640	0.414	0.250	1.713	0.420	0.233
Average Deposits	1.739	0.444	0.216	1.378	0.312	0.183	1.456	0.423	0.223	1.683	0.828	0.347
Average Short Term	1.212	0.178	0.147	1.225	0.176	0.144	1.408	0.400	0.284	1.482	0.431	0.291
Average Medium Term	1.403	0.221	0.158	1.287	0.193	0.150	1.438	0.291	0.202	1.445	0.371	0.257
Average Long Term	1.983	0.587	0.296	1.770	0.516	0.291	2.027	0.784	0.387	2.661	1.557	0.585
Average Low Volume	1.621	0.363	0.224	1.631	0.387	0.237	1.953	0.694	0.355	2.325	1.074	0.462
Average High Volume	1.380	0.236	0.171	1.214	0.175	0.144	1.313	0.259	0.197	1.335	0.363	0.272
Number of observations		106291			125436			115956			80406	

FIGURE 1: Frequency of high, medium and low interest rate changes for banks.

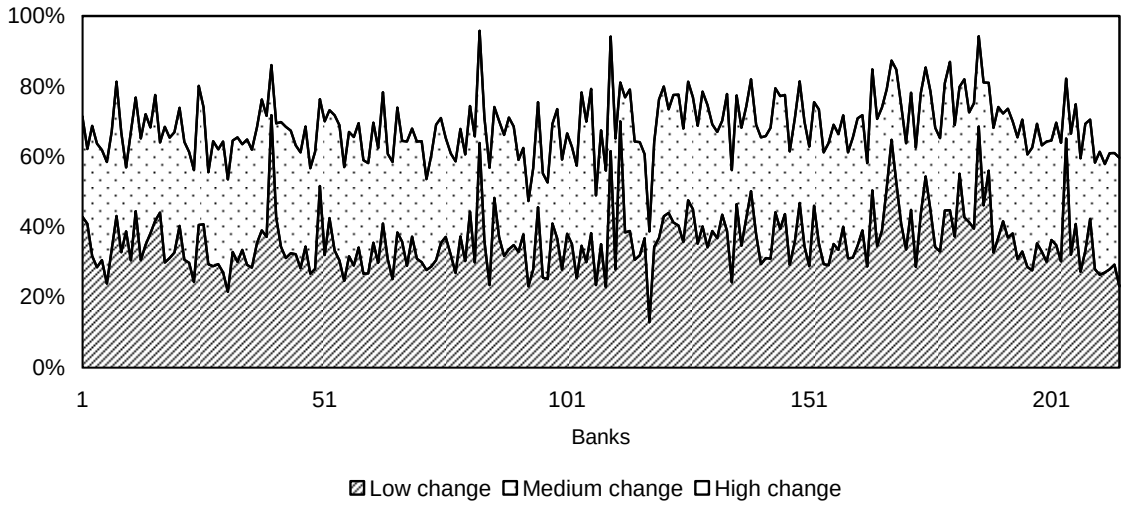

TABLE 6.- Standard deviation of banks. (%).

	Mean	Maximum	Minimum	Number observations
$RECEIVABLE_{less3months}$	4.326	5.803	3.339	2625
$RECEIVABLE_{3months-1year}$	4.379	6.191	2.788	2634
$RECEIVABLE_{1year-3years}$	4.003	4.944	2.580	2453
$CREDITLINE_{less3months}$	3.280	4.461	2.342	2026
$CREDITLINE_{3months-1year}$	3.835	4.776	2.539	2379
$CREDITLINE_{1year-3years}$	4.212	5.837	3.448	2590
$CREDITLINE_{more3years}$	3.720	4.674	2.049	2010
$PERSONAL_{less3months}$	3.757	4.484	1.629	2288
$PERSONAL_{3months-1year}$	4.536	5.722	3.664	2722
$PERSONAL_{1year-3years}$	4.479	5.378	3.096	2806
$PERSONAL_{more3years}$	4.444	5.849	2.916	2818
$MORTGAGE_{more3years}$	4.433	5.283	2.806	2721
$VARIABLE_{less1month}$	2.648	3.286	2.151	1785
$VARIABLE_{1month-3months}$	3.230	3.821	2.094	2028
$VARIABLE_{more3months}$	4.326	5.631	3.177	2720
CURRENT	4.471	6.436	3.291	2806
SAVING	3.573	4.593	1.303	2636
$DEPOSITS_{less3months}$	3.511	4.131	1.812	2183
$DEPOSITS_{3months-6months}$	4.312	5.815	0.669	2781
$DEPOSITS_{6months-1year}$	4.534	5.798	3.441	2794
$DEPOSITS_{1year-2years}$	4.627	5.651	3.794	2806
$DEPOSITS_{more2years}$	4.157	6.185	0.793	2698
$DISCLIABILITY_{less3months}$	1.537	2.065	1.112	2183
$DISCLIABILITY_{3months-6months}$	1.520	1.931	0.934	947
$DISCLIABILITY_{6months-1year}$	1.551	1.941	0.934	802
$DISCLIABILITY_{1year-2years}$	2.227	3.084	1.569	966
$CTA_{less3months}$	4.721	6.101	3.713	2806
$CTA_{3months-6months}$	4.484	5.350	2.493	2709
$CTA_{6months-1year}$	4.328	5.442	2.875	2672
$CTA_{1year-2years}$	2.857	4.749	1.357	1283

TABLE 7: Estimates of the empirical model.

Dependent Variable: V_{it} (in percentage)

	Time-Dummy Variables		Regulatory Variables	
	COEFFICIENT	**STAND. ERROR**	**COEFFICIENT**	**STAND. ERROR**
V_{it-1}	0.608***	(0.011)	0.595***	(0.035)
D_{it}	0.291***	(0.050)	0.249***	(0.063)
D_{it}^2	0.007	(0.005)	0.012	(0.008)
$RECEIVABLE_{less3months}$	1.172**	(0.561)	1.125***	(0.189)
$RECEIVABLE_{3months-1year}$	1.245***	(0.561)	1.201***	(0.186)
$RECEIVABLE_{1year-3years}$	5.285***	(0.583)	5.390***	(0.529)
$CREDITLINE_{less3months}$	5.127***	(0.582)	5.232***	(0.530)
$CREDITLINE_{3months-1year}$	3.933***	(0.573)	3.993***	(0.396)
$CREDITLINE_{1year-3years}$	2.903***	(0.568)	2.924***	(0.306)
$CREDITLINE_{more3years}$	4.437***	(0.577)	4.514***	(0.434)
$PERSONAL_{less3months}$	4.977***	(0.581)	5.074***	(0.510)
$PERSONAL_{3months-1year}$	4.572***	(0.577)	4.654***	(0.461)
$PERSONAL_{1year-3years}$	3.257***	(0.569)	3.293***	(0.342)
$PERSONAL_{more3years}$	2.520***	(0.566)	2.532***	(0.282)
$MORTGAGE_{more3years}$	1.112**	(0.562)	2.153***	(0.287)
$VARIABLE_{less1month}$	1.554***	(0.564)	1.530***	(0.257)
$VARIABLE_{1month-3months}$	1.702***	(0.564)	1.687***	(0.238)
$VARIABLE_{more3months}$	2.024***	(0.564)	2.016***	(0.241)
CURRENT	2.930***	(0.569)	3.163***	(0.367)
SAVINGS	4.037***	(0.575)	4.304***	(0.557)
$DEPOSITS_{less3months}$	1.415**	(0.562)	1.588***	(0.241)
$DEPOSITS_{3months-6months}$	1.820***	(0.564)	2.008***	(0.280)
$DEPOSITS_{6months-1year}$	1.181***	(0.564)	2.006***	(0.275)
$DEPOSITS_{1year-2years}$	2.188***	(0.566)	2.392***	(0.378)
$DEPOSITS_{more2years}$	4.055***	(0.576)	4.325***	(0.496)
$DISCLIABILITY_{less3months}$	1.053**	(0.562)	1.215***	(0.267)
$DISCLIABILITY_{3months-6months}$	1.035**	(0.562)	1.196***	(0.261)
$DISCLIABILITY_{6months-1year}$	1.535***	(0.564)	1.713***	(0.312)
$DISCLIABILITY_{1year-2years}$	1.272**	(0.564)	1.451***	(0.293)
$CTA_{less3months}$	1.070**	(0.563)	1.222***	(0.288)
$CTA_{3months-6months}$	2.909***	(0.571)	3.151***	(0.412)
$CTA_{6months-1year}$	3.125***	(0.572)	3.369***	(0.435)
$CTA_{1year-2years}$	2.613***	(0.570)	2.833***	(0.456)
REG90			-0.454***	(0.169)
REG94			-1.766***	(0.290)
EURO			0.902***	(0.260)
TECH			-0.405*	(0.249)
DEPOSITTECH			-0.901***	(0.222)
TREND			0.009***	(0.002)
R^2	0,938		0.933	
Number observations	5100		5100	

Note: OLS regression with Huber-White robust estimates of standard errors.
Time-Dummy Variables Especification has been estimated with monthly time dummies.
Standard errors in parenthesis.
(*)=Significant at 10% (**)= Significant at 5% (***)=Significant at 1%.

TABLE 8: Estimations with Maturity and Volume Variables

	Dispersion. Dependent variable: V_{it}				**Markup.** Dependent variable: **ln** K_{it}			
	OLS estimation		**SUR estimation**		**OLS estimation**		**SUR estimation**	
	Coefficients(1)	p values(2)	Coefficients(1)	p values(2)	Coefficients(1)	p values(2)	Coefficients(1)	p values(2)
MATURITY								
LOW (ω_1)	5.763***	0.000	6.116***	0.004	0.160***	0.331	0.207***	0.150
MEDIUM (ω_2)	6.730***	-	7.122***	-	0.190***	-	0.235***	-
HIGH (ω_3)	8.637***	0.000	8.682***	0.000	0.453***	0.000	0.421***	0.000
VOLUME								
SMALL (ν_1)	7.694***	0.000	8.219***	0.000	0.422***	0.000	0.378***	0.000
LARGE (ν_2)	6.452***	-	6.626***	-	0.126***	-	0.205***	-
Number observations	5100				5130			

(1) Coefficients significantly different from zero at 10% (*), 5%(**), 1%(***).

(2) P values: Significant level at which the null hypothesis $\omega_1=\omega_2$, $\omega_2=\omega_3$, $\nu_1=\nu_2$.

Note: OLS regression with Huber-White robust estimates of standard errors and Seemingly Unrelated Regressions estimations.

Explanatory variables in all especifications: Lagged-dependent variable, D_{it}, D^2_{it} and regulatory variables.

The coefficients have been calculated in their long term value: $Coefficient\ L/T_i = \frac{Coefficient_i}{1-\alpha_i}$

TABLE 9: Product and interbank interest rate inflation.

Dependent Variable: V_{it} (in percentage)

	Product and interbank inflation		Interbank inflation	
	COEFFICIENT	**STAND. ERROR**	**COEFFICIENT**	**STAND. ERROR**
V_{it-1}	0.594***	(0.035)	0.619***	(0.036)
D_{it}	0.384***	(0.037)		
DIB_{it}	-0.040***	(0.014)	0.033***	(0.012)
$RECEIVABLE_{less3months}$	1.103***	(0.188)	0.971***	(0.194)
$RECEIVABLE_{3months-1year}$	1.180***	(0.185)	1.042***	(0.192)
$RECEIVABLE_{1year-3years}$	5.348***	(0.533)	5.210***	(0.557)
$CREDITLINE_{less3months}$	5.172***	(0.534)	5.113***	(0.557)
$CREDITLINE_{3months-1year}$	3.943***	(0.399)	3.832***	(0.415)
$CREDITLINE_{1year-3years}$	2.886***	(0.308)	2.761***	(0.320)
$CREDITLINE_{more3years}$	4.467***	(0.434)	4.360***	(0.449)
$PERSONAL_{less3months}$	5.027***	(0.513)	4.901***	(0.536)
$PERSONAL_{3months-1year}$	4.613***	(0.464)	4.411***	(0.484)
$PERSONAL_{1year-3years}$	3.248***	(0.345)	3.131***	(0.356)
$PERSONAL_{more3years}$	2.481***	(0.284)	2.452***	(0.296)
$MORTGAGE_{more3years}$	2.133***	(0.289)	2.100***	(0.296)
$VARIABLE_{less1month}$	1.465***	(0.259)	1.731***	(0.263)
$VARIABLE_{1month-3months}$	1.620***	(0.239)	1.788***	(0.245)
$VARIABLE_{more3months}$	1.969***	(0.242)	1.940***	(0.251)
CURRENT	3.113***	(0.369)	3.101***	(0.388)
SAVINGS	4.273***	(0.559)	4.145***	(0.584)
$DEPOSITS_{less3months}$	1.542***	(0.243)	1.672***	(0.250)
$DEPOSITS_{3months-6months}$	1.960***	(0.284)	2.090***	(0.294)
$DEPOSITS_{6months-1year}$	1.949***	(0.278)	2.087***	(0.288)
$DEPOSITS_{1year-2years}$	2.334***	(0.377)	2.526***	(0.395)
$DEPOSITS_{more2years}$	4.269***	(0.500)	4.385***	(0.521)
$DISCLIABILITY_{less3months}$	1.154***	(0.268)	1.424***	(0.281)
$DISCLIABILITY_{3months-6month}$	1.143***	(0.263)	1.374***	(0.265)
$DISCLIABILITY_{6months-1year}$	1.654***	(0.317)	2.015***	(0.332)
$DISCLIABILITY_{1year-2years}$	1.365***	(0.298)	1.828***	(0.309)
$CTA_{less3months}$	1.184***	(0.285)	1.584***	(0.288)
$CTA_{3months-6months}$	3.069***	(0.417)	3.388***	(0.430)
$CTA_{6months-1year}$	3.293***	(0.442)	3.665***	(0.458)
$CTA_{1year-2years}$	2.773***	(0.456)	3.151***	(0.472)
REG90	-0.447***	(0.169)	-0.414**	(0.176)
REG94	-1.806***	(0.291)	-1.819***	(0.291)
EURO	0.903***	(0.258)	1.067***	(0.259)
TECH	-0.459*	(0.246)	-0.744***	(0.245)
DEPOSITTECH	-0.897***	(0.222)	-0.832***	(0.229)
TREND	0.010***	(0.002)	0.013***	(0.002)
R^2	0.933		0.929	
Number Observations	5100		5100	

Note: OLS regression with Huber-White robust estimates of standard errors.
Standard errors in parenthesis.
(*)=Significant at 10% (**)= Significant at 5% (***)=Significant at 1%.

BANCO DE ESPAÑA PUBLICATIONS

WORKING PAPERS[1]

0301 JAVIER ANDRÉS, EVA ORTEGA AND JAVIER VALLÉS: Market structure and inflation differentials in the European Monetary Union.
0302 JORDI GALÍ, MARK GERTLER AND J. DAVID LÓPEZ-SALIDO: The euro area inefficiency gap.
0303 ANDREW BENITO: The incidence and persistence of dividend omissions by Spanish firms.
0304 JUAN AYUSO AND FERNANDO RESTOY: House prices and rents: an equilibrium asset pricing approach.
0305 EVA ORTEGA: Persistent inflation differentials in Europe.
0306 PEDRO PABLO ÁLVAREZ LOIS: Capacity utilization and monetary policy.
0307 JORGE MARTÍNEZ PAGÉS AND LUIS ÁNGEL MAZA: Analysis of house prices in Spain. (The Spanish original of this publication has the same number).
0308 CLAUDIO MICHELACCI AND DAVID LÓPEZ-SALIDO: Technology shocks and job flows.
0309 ENRIQUE ALBEROLA: Misalignment, liabilities dollarization and exchange rate adjustment in Latin America.
0310 ANDREW BENITO: The capital structure decisions of firms: is there a pecking order?
0311 FRANCISCO DE CASTRO: The macroeconomic effects of fiscal policy in Spain.
0312 ANDREW BENITO AND IGNACIO HERNANDO: Labour demand, flexible contracts and financial factors: new evidence from Spain.
0313 GABRIEL PÉREZ QUIRÓS AND HUGO RODRÍGUEZ MENDIZÁBAL: The daily market for funds in Europe: what has changed with the EMU?
0314 JAVIER ANDRÉS AND RAFAEL DOMÉNECH: Automatic stabilizers, fiscal rules and macroeconomic stability
0315 ALICIA GARCÍA HERRERO AND PEDRO DEL RÍO: Financial stability and the design of monetary policy.
0316 JUAN CARLOS BERGANZA, ROBERTO CHANG AND ALICIA GARCÍA HERRERO: Balance sheet effects and the country risk premium: an empirical investigation.
0317 ANTONIO DÍEZ DE LOS RÍOS AND ALICIA GARCÍA HERRERO: Contagion and portfolio shift in emerging countries' sovereign bonds.
0318 RAFAEL GÓMEZ AND PABLO HERNÁNDEZ DE COS: Demographic maturity and economic performance: the effect of demographic transitions on per capita GDP growth.
0319 IGNACIO HERNANDO AND CARMEN MARTÍNEZ-CARRASCAL: The impact of financial variables on firms' real decisions: evidence from Spanish firm-level data.
0320 JORDI GALÍ, J. DAVID LÓPEZ-SALIDO AND JAVIER VALLÉS: Rule-of-thumb consumers and the design of interest rate rules.
0321 JORDI GALÍ, J. DAVID LÓPEZ-SALIDO AND JAVIER VALLÉS: Understanding the effects of government spending on consumption.
0322 ANA BUISÁN AND JUAN CARLOS CABALLERO: Análisis comparado de la demanda de exportación de manufacturas en los países de la UEM.
0401 ROBERTO BLANCO, SIMON BRENNAN AND IAN W. MARSH: An empirical analysis of the dynamic relationship between investment grade bonds and credit default swaps.
0402 ENRIQUE ALBEROLA AND LUIS MOLINA: What does really discipline fiscal policy in emerging markets? The role and dynamics of exchange rate regimes.
0403 PABLO BURRIEL-LLOMBART: An economic analysis of education externalities in the matching process of UK regions (1992-1999).
0404 FABIO CANOVA, MATTEO CICCARELLI AND EVA ORTEGA: Similarities and convergence in G-7 cycles.
0405 ENRIQUE ALBEROLA, HUMBERTO LÓPEZ AND LUIS SERVÉN: Tango with the gringo: the hard peg and real misalignment in Argentina.
0406 ANA BUISÁN, JUAN CARLOS CABALLERO AND NOELIA JIMÉNEZ: Determinación de las exportaciones de manufacturas en los países de la UEM a partir de un modelo de oferta-demanda.
0407 VÍTOR GASPAR, GABRIEL PÉREZ QUIRÓS AND HUGO RODRÍGUEZ MENDIZÁBAL: Interest rate determination in the interbank market.
0408 MÁXIMO CAMACHO, GABRIEL PÉREZ-QUIRÓS AND LORENA SAIZ: Are European business cycles close enough to be just one?

---

1. Previously published Working Papers are listed in the Banco de España publications calalogue.

0409 JAVIER ANDRÉS, J. DAVID LÓPEZ-SALIDO AND EDWARD NELSON: Tobin's imperfect assets substitution in optimizing general equilibrium.

0410 A. BUISÁN, J. C. CABALLERO, J. M. CAMPA AND N. JIMÉNEZ: La importancia de la histéresis en las exportaciones de manufacturas de los países de la UEM.

0411 ANDREW BENITO, FRANCISCO JAVIER DELGADO AND JORGE MARTÍNEZ PAGÉS: A synthetic indicator of financial pressure for Spanish firms.

0412 JAVIER DELGADO, IGNACIO HERNANDO AND MARÍA J. NIETO: Do European primarily Internet banks show scale and experience efficiencies?

0413 ÁNGEL ESTRADA, JOSÉ LUIS FERNÁNDEZ, ESTHER MORAL AND ANA V. REGIL: A quarterly macroeconometric model of the Spanish economy.

0414 GABRIEL JIMÉNEZ AND JESÚS SAURINA: Collateral, type of lender and relationship banking as determinants of credit risk.

0415 MIGUEL CASARES: On monetary policy rules for the euro area.

0416 MARTA MANRIQUE SIMÓN AND JOSÉ MANUEL MARQUÉS SEVILLANO: An empirical approximation of the natural rate of interest and potential growth. (The Spanish original of this publication has the same number).

0417 REGINA KAISER AND AGUSTÍN MARAVALL: Combining filter design with model-based filtering (with an application to business-cycle estimation).

0418 JÉRÔME HENRY, PABLO HERNÁNDEZ DE COS AND SANDRO MOMIGLIANO: The short-term impact of government budgets on prices: evidence from macroeconometric models.

0419 PILAR BENGOECHEA AND GABRIEL PÉREZ-QUIRÓS: A useful tool to identify recessions in the euro area.

0420 GABRIEL JIMÉNEZ, VICENTE SALAS AND JESÚS SAURINA: Determinants of collateral.

0421 CARMEN MARTÍNEZ-CARRASCAL AND ANA DEL RÍO: Household borrowing and consumption in Spain: A VECM approach.

0422 LUIS J. ÁLVAREZ AND IGNACIO HERNANDO: Price setting behaviour in Spain: Stylised facts using consumer price micro data.

0423 JUAN CARLOS BERGANZA AND ALICIA GARCÍA-HERRERO: What makes balance sheet effects detrimental for the country risk premium?

0501 ÓSCAR J. ARCE: The fiscal theory of the price level: a narrow theory for non-fiat money.

0502 ROBERT-PAUL BERBEN, ALBERTO LOCARNO, JULIAN MORGAN AND JAVIER VALLÉS: Cross-country differences in monetary policy transmission.

0503 ÁNGEL ESTRADA AND J. DAVID LÓPEZ-SALIDO: Sectoral mark-up dynamics in Spain.

0504 FRANCISCO ALONSO, ROBERTO BLANCO AND GONZALO RUBIO: Testing the forecasting performance of Ibex 35 option-implied risk-neutral densities.

0505 ALICIA GARCÍA-HERRERO AND ÁLVARO ORTIZ: The role of global risk aversion in explaining Latin American sovereign spreads.

0506 ALFREDO MARTÍN, JESÚS SAURINA AND VICENTE SALAS: Interest rate dispersion in deposit and loan markets.

BANCO DE ESPAÑA

Unidad de Publicaciones
Alcalá, 522; 28027 Madrid
Telephone +34 91 338 6363. Fax +34 91 338 6488
e-mail: Publicaciones@bde.es
www.bde.es