SEARCH COST AND PRICE DISPERSION IN VERTICALLY RELATED MARKETS: THE CASE OF BANK LOANS AND DEPOSITS

2008

Alfredo Martín-Oliver, Vicente Salas-Fumás
and Jesús Saurina

Documentos de Trabajo
N.º 0825

BANCO DE **ESPAÑA**
Eurosistema

SEARCH COST AND PRICE DISPERSION IN VERTICALLY RELATED MARKETS: THE CASE OF BANK LOANS AND DEPOSITS

SEARCH COST AND PRICE DISPERSION IN VERTICALLY RELATED MARKETS: THE CASE OF BANK LOANS AND DEPOSITS (*)

Alfredo Martín-Oliver (**)

BANCO DE ESPAÑA

Vicente Salas-Fumás

UNIVERSIDAD DE ZARAGOZA

Jesús Saurina

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. This paper has been accepted for publication in the *Review of Industrial Organization.* We thank Lawrence White, the Journal Editor, and two anonymous referees for their very helpful suggestions that contributed significantly to improve the paper. We also benefited from the comments of A. Almazán, S. Titman and the participants at the EARIE 2006 Conference in Amsterdam. All the remaining errors are our exclusive responsibility.

(**) Address for correspondence: Alfredo Martín-Oliver; C/ Alcalá 48, 28014 Madrid, Spain. Tlf: + 34 91 338 6178; e-mail: alfredo.martin@bde.es.

Documentos de Trabajo. N.º 0825
2008

ISSN: 0213-2710 (print)
ISSN: 1579-8666 (on line)
Depósito legal:
Unidad de Publicaciones, Banco de España

Abstract

Using data on marginal interest rates of loan and deposit products by Spanish banks, we find that the level of interest rates on loans (deposits) across geographic markets decrease (increase) with the number of banks in each market, and that the level of interest rates on loans increases with the level of interest rates of deposits. We also find that the dispersion of interest rates of both loans and deposits increase with the number of banks. This evidence is interpreted as evidence of customer's search costs in retail banking, consistent with predictions from the Carlson and McAfee (1983) model of market competition with search costs.

Keywords: Interest rate dispersion, market structure, search costs.

JEL: D83, G21.

1 Introduction

The number of firms in a market is a key variable for competition analysis and policy. The realistic observation that it is costly for buyers to discover the lowest selling price in a market (search costs) widens the theoretical predictions on the relationship between market structure and level and dispersion of equilibrium prices, complicating market analysis and policy formulation[1]. In this vein, under search costs, some models predict a positive association between the number of sellers and the average equilibrium selling prices [Rosenthal (1980); Varian (1980)], whereas others predict a negative one [Carlson and McAfee (1983)]. In addition, predictions on the relationship between price dispersion and the number of sellers differ depending on the assumptions about search activity, the distribution of search costs across buyers, and the heterogeneity of producers: Carlson and McAfee (1983), Varian (1980), Barron, Taylor, and Umbeck (2004) predict a positive association; whereas Baye and Morgan (2001) and Baye, Morgan, and Scholten (2004) predict a negative one, and Janssen and Moraga-González (2004) predict that the relationship depends on the endogenously determined intensity of consumer search.

Empirical research has provided general support for the hypothesis that costly information acquisition by buyers breaks the law of one price[2]. However, papers that test alternative theoretical predictions about market structure and the values of the moments of the equilibrium distribution of prices are scarce and non coincident. For example, the same evidence of a negative association between number of sellers and level and dispersion of market prices leads to a rejection of the hypothesis that search models explain the empirical evidence in Barron, Taylor, and Umbeck (2004) and to an acceptance of it in Dahlby and West (1986) and in Baye, Morgan, and Scholten (2004). The development of Internet-based electronic markets provides new opportunities for empirical research on price dispersion, but differences in empirical findings continue[3].

In this paper we use a large proprietary database to study interest rate levels and dispersion in twenty-two loan and deposit products offered by Spanish banks in fifty different geographic markets over the 1989 to 2003 period. Therefore, we have data for a whole industry in a country over a long period. The main research question is to examine the effect of market structure variables (i.e., number of banks in a province) on the average level and dispersion of interest rates in each bank product market. The null hypotheses, drawn from the Carlson and McAfee (1983) model of competition in retail markets with search costs, are confronted with alternative ones drawn from other models of price dispersion. The fact that banks collect deposits and grant loans justifies the extension of the Carlson and McAfee model to vertically related product markets, as is the case with bank deposit products and loan products.

---

1. Stigler (1961) opened the research path on how imperfect buyers' information can cause price dispersion in markets with homogeneous products. Further theoretical work has been devoted to refine Stigler's predictions and to provide formal conditions under which price dispersion may be an equilibrium solution in non-differentiated product markets [Rothschild (1973); Rosenthal (1980); Varian (1980); Burdett and Judd (1983); Carlson and McAfee (1983); Stahl (1989); Anderson and Renault (1999); Baye and Morgan (2001); and Anderson and de Palma (2004)]. Carlson and McAfee, for brick and mortar retail markets, and Baye and Morgan, for Internet based electronic markets, specifically address the question of how market structure affects the moments of the equilibrium distribution of prices. Janssen and Moraga-González (2004) extend Stahl's model and show that the number of firms has an undetermined effect on price level and dispersion.

2. Existing evidence in support of search costs, as an explanation for observed price dispersion, comes from papers that link price dispersion to product-specific inflation [Stigler and Kindhal (1970); Van Hoomissen (1988); Reinsdorf (1994)], to differences in search costs and search activity across markets [Pratt, Wise and Zeckhauser (1979); Dahlby and West (1986); Hayes and Ross (1998); Brown and Goolsbee (2002); Barron, Taylor and Umbeck (2004)], and to the frequency of repeated purchases of products [Sorensen (2000)]. Other papers that provide evidence consistent with search costs are Hortacçu and Syverson (2004) and Hong and Shum (2006). The role of exchange rates and product differentiation to explain price dispersion is analyzed in Goldberg and Verboven (2001).

3. Ellison and Ellison (2005) show the discrepancies found in studies that use Internet-based commerce data.

Our database is a panel of interest rates charged by banks for new loans granted during the quarter and of interest rates paid in new deposit transactions, also during the respective quarter. This database has important advantages: First, interest rates are the prices of transactions that took place, not just posted prices for which we do not know whether actual transactions take place or not. One important limitation of using posted prices, as is the case in most of the research on price dispersion on Internet selling sites, is that the researcher does not know whether there are transactions or not at prices that are different from the lowest one [Baye, Morgan and Scholten (2004)]. Moreover, we have data on new transactions (i.e., we have marginal interest rates), not on average prices. Finally, we use advanced econometric techniques to control for the endogeneity of the explanatory variable (number of banks in the market), a clear improvement with respect to Barron, Taylor, and Umbeck (2004), who treat the number of sellers as exogenous.

We find that interest rate dispersion is economically relevant in the Spanish banking system and it persists over time. Overall, the level of interest rates in loans (deposits) decreases (increases) with the number of banks in the market, in line with Barron, Taylor, and Umbeck (2004) and with Baye, Morgan, and Scholten (2004). However, interest rate dispersion increases with the number of banks, a result that departs from existing empirical findings, but is consistent with the theoretical model based on Carlson and McAfee (1983). We also find that the level and dispersion of interest rates in loan product markets increase, respectively, with the level and dispersion of deposit interest rates. This result contradicts the assumption that loan and deposit markets are separated by the interbank market and supports models of the banking firm, such as Berlin and Mester (1999), where banks create a stable deposit base to implement relational lending practices.

Carlson and McAfee's model of sequential search, uniformly distributed search costs, heterogeneous producers, and Cournot-type competition is hard to adapt to Internet markets where the search cost of the lowest offered price tends to zero, at least in clearinghouse markets as those described by Baye, Morgan, and Scholten (2004). The more realistic assumption in Internet markets is that buyers either search and buy from the lowest price producer or do not search at all because they are loyal to particular sellers. Since our evidence contradicts predictions from Internet-adapted search models, the conclusion is that price formation follows different patterns in Internet markets than in brick and mortar markets.

Section 2 presents the preliminary analysis of price differences in Spanish retail banking. Section 3 presents the theoretical predictions of the determinants of interest rate dispersion. In section 4 we present the explanatory variables and the empirical models used to test the theoretical predictions. Section 5 contains the results of the empirical analysis. Finally, in section 6 we summarize the main results of the paper.

2 Data on interest rate level and dispersion

The database consists of interest rates charged or paid by almost all Spanish banks in all lending and deposit operations. The vast majority of loans granted by Spanish banks are grouped into four different product classes: Receivables, Credit Line, Personal, and Mortgages. The first two are mainly loans to firms, and the last two are loans to households. Except for Mortgages, which are all long term, the rest of the loans have different maturities (i.e. from less than 3 months to more than 3 years). Bank deposits are also classified into four main product classes: Current Accounts, Savings Accounts, Deposits, and Repo operations. Current and Savings accounts are liquid assets for depositors, while Repo operations and Deposits have maturities that range from less than three months to more than two years. Taking into account product class and maturity, the total number of products is 22: 12 loan products and 10 deposit products[4]. The database contains information on up to 215 banks[5]. At the end of each month, banks report to the Banco de España the average interest rate (weighted by the volume of the operation) of all transactions closed during the past thirty days in each of the 22 product types. Monthly data are in turn averaged into quarterly values (from 1989 to 2003), which are the raw numbers for interest rates that we use in this paper.

We identify fifty different geographic markets one for each of the Spanish provinces (the lowest possible level of geographic desegregation permitted by the data). For each product and province, we only consider banks that have a significant presence in the province (at least, three branches) and have a relevant volume of business in that loan/deposit market (at least, eight months per year selling the product). National banks operate in many provinces and have an average market share of around 34% across provinces. We do not know the price charged by a national bank in a given province. In the empirical analysis reported in this paper we assume that national banks charge the same interest rate nationwide (since national banks advertise interest rates of products such as mortgages or deposits nationwide). We perform robustness analysis of the results excluding national banks from the data to see if the results are sensitive to this assumption on the pricing policy by these banks. Therefore, our interest rate variable is r_{ijmt} , the interest rate charged or paid by bank j (j=1 to 215) in product I (i=1 to 22) in province m (m=1 to 50) during quarter t (t=1 to 58).

Table 1 shows yearly averages of daily interbank interest rates for each year from 1989 to 2003, and average level and dispersion measures of interest rates for selected loan products (Credit Line and Mortgages) and deposit products (Current Accounts and Deposits)[6]. The interbank interest rate was around 15% at the end of the eighties and is only 2.75% in 2003. The greatest decline took place in 1993 and 1994 when the rate went from 12.25% to 7.81%. From 1998 onwards no clear trend is detected in interbank interest rates. Loan and deposit interest rates follow the decreasing trend of interbank interest rates during the period. The table documents that dispersion in interest rates is a persistent phenomenon in Spanish retail banking. Moreover, the

---

4. For loans: Receivables (less than 3 months; 3 months to 1 year; 1 to 3 years), Credit Line (less than 3 months; 3 months to 1 year; 1 to 3 years; more than 3 years), Personal (less than 3 months; 3 months to 1 year; 1 to 3 years; more than 3 years) and Mortgages (always more than 3 years). For deposits: Current Accounts, Savings Accounts, Deposits (less than 3 months; 3 to 6 months; 6 months to 1 year; 1 to 2 years; more than 2 years), and Repo operations (less than 3 months; 3 to 6 months; 6 months to 1 year). A complete description of the database can be found in Martín-Oliver, Salas and Saurina (2007).

5. We only consider banks that are active in retail banking. Licensed banks with no activity in retail banking (i.e., wholesale banks), as well as foreign banks involved exclusively in investment banking, are excluded. We focus on commercial and savings banks, with a 95% market share. A more detailed analysis of the Spanish banking market can be found in Caminal, Gual and Vives (1993) and in Salas and Saurina (2003).

6. The daily quoted interbank interest rate is taken as the basic interest rate of the economy. It is highly correlated with other reference interest rates.

coefficients of variation shown in Table 1 (that go from 0.06 in Mortgages in 1992 to 0.40 in Current Accounts in 2003) are in line with those reported by Dahlby and West (1986) on automobile insurance premiums (from 0.07 to 0.18), by Sorensen (2000) on prices of drogue products (average value of 0.22), and with the 0.10 of CD and book prices across e-retailers [Ellison and Ellison (2005)].

To understand better the factors that may be behind the variations observed in interest rates of loans and deposits in the Spanish banking industry, we perform an analysis of variance (ANOVA) with the pooled data of interest rates of loans and deposits. The original interest rates are expressed in log differences with respect to the log of the interbank rate *(ln* r_{ijmt} *– ln* r_t for loans *ln* r_t *– ln* r_{ijmt} for deposits, where r_t stands for the interbank interest rate at *t),* so that differences in interest rates are expressed in relative terms.

$$\begin{aligned} \ln r_{ijmt} - \ln r_t &= a_o + a_i + a_j + a_m + a_t + \varepsilon_{ijmt} \qquad \textit{for loans} \\ \ln r_t - \ln r_{ijmt} &= a_o + a_i + a_j + a_m + a_t + \varepsilon_{ijmt} \qquad \textit{for deposits} \end{aligned} \tag{1}$$

The sources of variability in interest rates considered are: time, product class, bank, and province. Table 2 summarizes the results of the variance decomposition analysis[7]. In both loans and deposits, the fixed effects of time, bank, product, and province explain up to two thirds of the variability observed in interest rates relative to the interbank rate in Spain, although the contribution of each source of variability is different in loans and in deposits. For the loan products, the main source of relative variability in the interest rates is due to Time effects (46% of the explained variation). Next, the Bank specific effects account for close to 27% of the relative variability observed in interest rates. Product class contributes to relative variability in interest rates by 12% of the explained variation. Finally, there is 1.8% of relative variability in interest rates of loans explained by Province effects. In the case of deposits, the main source of relative variability is the Product class, as 87% of the explained variance is attributed to this factor, followed by Bank (7.4%), Time (4.3%) and Province (1.05%).

7. The measure of contribution to the explained variance for each explanatory variable is calculated as the decrease in the sum of squares of the model if the respective explanatory variable is removed from the model (the so-called partial sum of squares), divided by the sum of squares of the model. That is, $\frac{\Delta SS_{model}}{SS_{model}} = \frac{\Delta SS_{model} / SS_{total}}{SS_{model} / SS_{total}} = \frac{\Delta R^2}{R^2}$. The addition of the marginal contributions to the explained reported in the Table is not 100% because they are obtained keeping all the other explanatory variables in the regression (with replacement).

3 Models of price dispersion and hypotheses

Models of the banking firm differ on whether they assume that loan and deposit markets are separated by the interbank market or that the two markets are integrated [Freixas and Rochet (1997)]. The hypothesis of integration has been put forward mainly in studies about the credit channel [Kishan and Opiela (2000), Kashyap and Stein (2000)] or relational banking [Berger and Udell (1992), Berlin and Mester (1999)]. We assume that all bank customers do some search and face a positive cost for discovering the more attractive offer in the market. We also assume the same search model for loan than for deposit products, since there are no a priori reasons to assign a diffrent degree of search activity in the two product markets.

3.1 Basic model

The model of retail banking with search costs is adapted from Carlson and McAfee (1983). Customers use a sequential reservation price strategy in their search and have the correct perception about the price distribution. Firms differ in their costs of supplying the product. The distribution of the search costs across consumers in a given market m (province in our case) is uniform under the interval [0, T_m]. If the density of buyers in the interval is $1/s_m$, then the total size of the market will be T_m/s_m. Carlson and McAfee (1983) show that, with buyers' randomly sampling with replacement, the demand function for loans of bank j in market m with N_m banks is given by,

$$L_{jm} = \frac{1}{s\,N_m}\left(T_m - \left(R_{jm} - R_m^*\right)\right), \tag{2}$$

where R_m^* is the average of interest rates charged by banks in loan market m. Under similar assumptions about the structural parameters and search activity the supply of deposits offered to bank j is given by,

$$D_{jm} = \frac{1}{s\,N_m}\left(T_m + \left(r_{jm} - r_m^*\right)\right) \tag{3}$$

where rm* is the average interest rate paid in deposit market m.

Consider first the case where loan and deposit markets are separated by the interbank market with interest rate I. Let l_j represent the operating unit cost of loans and dj represent the operating unit costs of deposits for bank j. If B_m is the amount borrowed or lent in the interbank market, and the budget constraint $D_m + B_m = L_m$ is binding, the profit-maximizing problem of the bank is given by,

$$\underset{R_{jm}\, r_{jm}}{Max} \quad \left(R_{jm} - I - l_j\right)L_{jm} + \left(I - r_{jm} - d_j\right)D_{jm} \quad s.t. \quad (2),(3)\,. \tag{4}$$

Let l_m^* and d_m * be the average operating costs of loans and deposits in market m, respectively. Then, the first order conditions imply, after some algebraic manipulations,

$$R_{jm} - R_m^* = \frac{N_m - 1}{2N_m - 1}\left(l_{jm} - l_m^*\right) \tag{5}$$

$$R_m^* = I + l_m^* + \frac{N_m}{N_m - 1}T_m \tag{6}$$

$$r_{jm} - r_m^* = \frac{N_m - 1}{2N_m - 1}\left(d_m^* - d_{jm}\right) \tag{7}$$

$$r_m^* = I - d_m^* - \frac{N_m}{N_m - 1}T_m \text{ .} \tag{8}$$

These results are similar to those of Carlson and McAfee, adapted to loan and deposit markets and assuming constant returns to scale in production of banking services. Equations (5) and (7) refer to individual bank interest rates, and equations (6) and (8) refer to average market interest rates. The former will be used to formulate the hypothesis on the determinants of dispersion of interest rates and the latter on the determinants of average interest rates. From equation (5) the standard deviation, Sd, of the distribution of equilibrium interest rates of loans is given by $Sd\left(R_{jm} - R_m^*\right) = Sd\left(R_{jm}\right) = \frac{N_m - 1}{2N_m - 1}Sd\left(l_{jm}\right)$. A similar result is obtained for deposits from (7). Since $\frac{N_m - 1}{2N_m - 1}$ increases with N_m, the dispersion of the equilibrium interest rates of loans and deposits increases with the number of banks in the market; also, for a given number of firms, dispersion will be higher in markets where the differences in operating costs across firms are more pronounced [higher $Sd\,(l_{jm})$]. Notice that, under the assumption of separate loan and deposit markets, the dispersion of interest rates in the loan market is independent of the dispersion in the deposit market and vice versa.

According to equations (6) and (8), average equilibrium interest rates of loans (deposits) decreases (increases) with the number of banks N and increases (decreases) with the range of search costs T. Interest rates on loans and deposits both increase with the interbank rate; higher average unit operating costs increase the average equilibrium interest rate on loans and decreases that of deposits.

3.2 Non-separation between loan and deposit markets

Now banks use their deposits to finance the loans they grant. To simplify, we assume that all loans come from the bank deposits (otherwise the financial opportunity cost of loans would be a weighted sum of the interbank rate and of the interest rate of deposits). The profit maximizing problem for loans is now formulated as:

$$\underset{R_{jm}, r_{jm}}{Max} \quad \left(R_{jm} - r_{jm} - l_{jm} - d_{jm}\right)L_{jm} \quad s.t. \quad (2) \text{ and s.t. the supply equal to demand condition } T_m - \left(R_{im} - R_m^*\right) = T_m + \left(r_{jm} - r_m^*\right) \text{ .} \tag{9}$$

The first order conditions of optimum imply:

$$R_{jm} - R_m^* = \frac{N_m - 1}{4N_m - 3}\left(l_{jm} + d_{jm} - \left(l_m^* + d_m^*\right)\right) \tag{10}$$

$$R_m^* = r_m^* + l_m^* + d_m^* + \frac{2N_m - 1}{N_m - 1}T_m \tag{11}$$

$$r_{jm} = r_m^* - \frac{N_m - 1}{4N_m - 3}\left(l_{jm} + d_{jm} - \left(l_m^* + d_m^*\right)\right). \tag{12}$$

The basic predictions on the determinants of dispersion and average equilibrium interest rates of loans and deposits remain unchanged with respect to those obtained under separation of the loan and deposit markets, although the actual effects of the exogenous variables on the dispersion of equilibrium interest rates is different under integration than they were under separation. First, under integration, the dispersion of interest rates in loans and in deposits, in both cases, depends on the dispersion across banks of operating costs of producing loans and of producing deposits [equations (10) and (12)]. Second, the coefficient of dispersion in operating costs across banks is now lower than what it was under separation *[$(N_m\text{-}1)/(4N_m\text{-}3)$* is smaller than *$(N_m\text{-}1)/(2N_m\text{-}1)$].* If the number of firms N is sufficiently large, the coefficient of dispersion in operating costs in the equation that determines the dispersion in prices converges to ¼ in the case of markets integration and to ½ in the case of separation.

The comparison of the results of the Carlson and McAfee (1983) model of price dispersion in vertically integrated and vertically separated markets is new in the literature. We find that integration implies that dispersion in equilibrium prices in downstream and upstream markets will both be affected by the dispersion of operating costs for the two sides of the market; this is likely to contribute to higher equilibrium price dispersion, compared with separation, since the operating costs for each side of the market are unlikely to be negatively correlated. However, the weight (as a function of number of firms) of dispersion in unit operating costs in determining the dispersion in equilibrium prices is lower under integration than under separation. Consequently the overall net effect of vertical market integration versus separation in price dispersion is ambiguous.

3.3 Other determinants of price dispersion

In the absence of search costs, monopolistic competition with differentiated products and heterogeneous producers (i.e., different marginal costs) can create price dispersion in equilibrium [Perloff and Salop (1985; Barron, Taylor and Umbeck 2004)]. The theoretical prediction is that both price level and dispersion will decrease with the number of sellers in the market. Stahl (1989) considers a market with homogeneous producers, all with the same marginal cost, where buyers split into two groups: buyers with no search at all, so each of them knows the price that every firm is quoting; and uninformed buyers that perform costly search until they find a price lower than the respective reservation price. The Stahl model departs from Carlson and McAfee in that it assumes equal marginal costs across producers and search costs that are not uniformly distributed across buyers. The empirical prediction is that, in equilibrium, both price dispersion and average prices will now increase with the number of sellers in the market [Barron, Taylor and Umbeck (2004)].

Baye and Morgan (2001) and Baye, Morgan and Scholten (2004) extend the Varian (1980) results assuming that search costs are zero in clearing markets such as the Internet-based commerce, where the potential buyers receive a list of offers from different sellers. Not all of the buyers buy with the criterion of choosing the product with the lowest price, and strategic behavior by profit-maximizing sellers implies that the gap between the lowest and the next-to-the-lowest listed price (a measure of dispersion), and the average price listed on the page, will both decrease with the number of listed prices.

Early empirical work in price dispersion under search costs investigated the factors that affect the incentives of buyers to invest in information about prices in contexts of repeated purchases. One of these factors is price inflation. The argument is that changes in the price level for a particular product produce obsolescence of the stock of available information about the distribution of prices among sellers, so it is more difficult and costly for the search process to reduce price dispersion [Stigler and Kindhal (1970); VanHoomisen (1988)]. Thus, price dispersion will increase with product specific inflation. Another factor that affects price dispersion is the frequency of transactions in a repeated purchase process [Fishman and Rob (1995); Sorensen (2000)]. The prediction here is that a higher frequency of transactions lowers price dispersion because the information acquired.

4 Variables and empirical models

4.1 Variables

We postulate one empirical model to explain the level of interest rates in a province market and another empirical model to explain the dispersion in interest rates in each province. Since part of variability in observed interest rates may respond to banks' product differentiation policies and not to the existence of search costs in markets with homogeneous products, in estimating the determinants of the level of interest rates in a given market we use bank-level data (instead of the average interest rates for all banks in the market as postulated by equations (6) and (8) of the model); this will allow us to control for bank fixed effects in the estimation. The dependent variable in the model that explains the level of interest rates is $ln\ r_{jmt} - ln\ I_t$, the relative difference between interest rate of the bank in a given product, market and time period and the interbank rate for that time period. We explain relative differences because they are less sensitive to a time trend.

The measure of interest rate dispersion in a given province will be the coefficient of variation: $CV\ r_{imt} = \frac{\sqrt{\sum \frac{1}{n}(r_{ijmt} - Avg\ r_{imt})^2}}{Avg\ r_{imt}}$. In the robustness analysis, the coefficient of variation is substituted by the Range: that is the difference between the 90th and 10th percentiles on the interest rate distribution, normalized by the mean: $Range\ r_{imt} / Avg\ r_{imt}$ .. The interest rates used to calculate the values of the dependent variables —level and dispersion— correspond to the interest rate for the last quarter of the year, since the rest of the explanatory variables pertain to the end of the year.

The main explanatory variables include the number of banks (market structure), a proxy for search costs, and the parameters of the distribution of deposit interest rates (in the case of loans). Direct evidence of operating costs of each bank in each province is not available, and, therefore, it is not possible to perform direct tests with this variable. The variable $NBANKS_{imt}$ is equal to the number of banks with transactions in product i in province m at the end of year t. We use the density of bank branches in province m and period t, $DENBRANCH_{mt}$ (total number of bank branches per Km^2 in province m in year t) as a proxy, in an inverse way, of the search cost parameter T. To test the hypothesis of integration between loan and deposit markets we include as explanatory variables $LEV\ r_{jmt}^{deposit}$ in the level of interests model, and $CV\ r_{mt}^{deposit}$, in the model of dispersion. We choose the product Deposits to calculate the marginal cost of lending funds for an integrated bank because these deposits better represent the "stable pool of deposits" referred to by Berlin and Mester (1999).

The size of the market, which becomes a relevant variable when banks operate under decreasing or increasing returns to scale, is measured by two variables: the number of inhabitants of the market/province m. in period t, $POPULATION_{mt}$, and the per capita income of the province, $PINCOME_{mt}$. To account for the possible effect of product-specific inflation in interest rate dispersion we use the explanatory variable Dimt calculated as the absolute value of the average rate of change across banks in the interest rate of product i in time period t in province m. We also include the market share of loans plus deposits of national banks in the province, $SHARENA_{mt}$. A bank is national if it has branches in all provinces (only nine banks in the sample). The market share of national banks controls for possible errors resulting from not having data on the interest rates that they charge in each province.

The model to be estimated will also control for fixed effects, which include (depending on the equation being estimated) time dummy variables to control for the time-varying effects that are common to all banks (i.e., the decreasing trend in the interbank rate over time), fixed effects of province that capture the differences of state prices, salaries and other factors that may vary across markets; and bank effects (in the level equation) that capture sources of variation due to product differentiation by banks (branch network, complementary services, etc.).

Table 3 presents the descriptive statistics of the explanatory variables. Note that the average number of banks in each province market is large (around 30) and increasing over time.

4.2 Empirical model

The two main equations to be estimated are,

$$\begin{aligned} \ln r_{jmt} - \ln I_t = \quad & \delta^{LEV} + g_1 \ln NBANKS_{mt} + g_2 \ln DENBRANCH_{mt} + \\ & + g_3 \cdot LOAN \cdot LEV\, r_{jmt}^{deposit} + g_4 D_{mt} + Control\ Variables + \varepsilon_{jmt}^{LEV} \end{aligned} \tag{13}$$

$$\begin{aligned} CV\, r_{mt} = \quad & \delta^{CV} + \alpha^{CV}\, CV\, r_{mt-1} + h_1 \ln NBANKS_{mt} + h_2 \ln DENBRANCH_{mt} + \\ & + h_3 \cdot LOAN \cdot CV\, r_{mt}^{deposit} + h_4 D_{mt} + Control\ Variables + \eta_m^{CV} + \varepsilon_{mt}^{CV} \end{aligned} \tag{14}$$

$$\varepsilon_{jmt}^{LEV} \sim N\left(0, \sigma_{\varepsilon}^{LEV}\right) \qquad \varepsilon_{mt}^{CV} \sim N\left(0, \sigma_{\varepsilon}^{CV}\right) \qquad \eta_m^{CV} \sim N\left(0, \sigma_{\eta}^{k}\right),$$

where LOAN is a dummy variable that takes the value of 1 if the product is a loan and ηm are province fixed effects. The number of banks and the density of branches are in logs to allow for nonlinear effects. Also, eq. (14) is estimated with a range variable as the dependent variable.

Equation (13) has been estimated using instrumental variables to control for the potential endogeneity of *NBANKS*, *DENBRANCH* and $LEV\, r_{jmt}^{deposit}$ using the lags t-2 and t-3 of these variables as instruments. The Control Variables include dummy variables of time, bank, and province.

The dispersion equation (14) includes the lagged dependent variable as an explanatory variable because of the high persistence of the coefficient of variation that remained even after controlling for the fixed effects. As a consequence, we apply here panel data econometric techniques to avoid estimation biases. The model is estimated with the system-GMM technique [Blundell and Bond (1998)] instead of the traditional first-difference GMM estimator because the latter might have problems of inconsistency when the variables used in the regression have a high degree of persistence (which is our case). The Control variables include province and time dummy variables. Estimations of the models will be evaluated through the validity of the moment conditions (Hansen statistic of the Sargan test of over-identifying restrictions) and the test of the null hypothesis of the absence of second-order autocorrelation of the residual term (first-order autocorrelation is expected since we take first differences in the variables).

In the case of level of interest rates of loans, from (6) we expect g1<0; g2<0; and g3=0 if loans and deposits are separated by the interbank rate, and g3>0 if they are integrated [equation (11)]. For deposits, equation (8), we expect g1>0 and g2>0. If there is some time convergence in

interest rates, the product specific inflation will be inversely related to the average interest rate ($g4<0$). On determinants of price dispersion, equation (14), we expect $h1>0$, $h2<0$, and $h3=0$, if loans and deposits are separated markets, or $h3>0$ if they are integrated; we expect $h1>0$ and $h2<0$ also for deposits. From models that link price dispersion with product specific inflation we expect $h4>0$. From the Stahl model of homogenous sellers and non-uniform distribution of search costs, the main prediction that is different from Carlson and McAfee is $g1>0$ for loans and $g1<0$ for deposits.

Equations (13) and (14) are specified and estimated separately for each bank product (12 loan products and 10 deposit products). The null hypothesis of the same empirical model for the pool of all loans and for the pool of all deposits is rejected at high levels of significance. We also reject the null hypothesis that the model is the same for all products of different maturity within the same product class (for example the same model for all Personal loans of different maturity or the same model for Deposits of all maturity). So the data justify that each maturity within each product class be treated as a different product market.

5 Results

Tables 4 and 5 present the results of estimating models (13) and (14), respectively. The number of observations for the estimation of the level equations varies depending on the number of banks that supply every product, whereas the number of observations of the dispersion regression (14) is 750 (50 provinces and 15 time periods). The estimated coefficients shown in Table 5 are long term, since they have been obtained by dividing the original coefficient by one minus the estimated coefficient of the lagged dependent variable (positive and statistically significant in all estimations, although not reported to save space).

The estimations of the level equations (Table 4) show that the F-tests of aggregate significance of the bank, province and time groups of dummy variables (individually and jointly) reject the null hypothesis of non-statistical relevance. The results obtained from the estimation are robust to the set of instruments used, as we have regressed the model using different combinations of instruments from t-2 up to t-4 and the sign and significance of the —coefficients was not altered. The R^2 of all the regressions was close to 0.9, in part due to the high explanatory power of the groups of dummy variables. Further, the validity of the estimations of the dispersion equation is also accepted as they passed all the consistency tests (Table 5). First, the p-value from the statistic of the Sargan tests for compatibility of the orthogonal conditions is close or equal to 1 in all estimations. Second, the null hypothesis of absence of second-order autocorrelation cannot be rejected for any product at a significance level of 5%. Therefore, the models are well specified from an econometric point of view. We now describe the results under the lens of the predictions from the theory.

5.1 Determinants of average interest rates

Table 4 shows that the coefficients of *ln NBANKS* are positive in nine out of ten deposit products and statistically significant in four of them, as predicted by the Carlson and McAfee model. The sign of the estimated coefficients for the variable *ln DENBRANCH* is positive in all of the deposit products, and seven out of ten are statistically significant, which suggest that higher density of branches increases competition.

As for the control variables that are included in the model, the level of interest rates is, in general, lower in larger province markets (i.e., more populated) with a high level of per capita income (*POPULATION* has nine negative signs, four significant; *PINCOME* has eight negative signs, two significant). Next, all of the statistically significant coefficients of the product-specific inflation variable, *D*, are negative, which implies that markets with lower relative change in the average interest rate over time are those with higher interest rates (convergence). Finally, the statistically significant coefficients of the *SHARENA* variable suggest that the presence of national banks does not affect the level of deposit interest rates.

For loans, the estimated coefficient of *Ln NBANK* is negative, as predicted by the model, in all loan products but one, and it is significant in seven of them. The explanatory variable, $LEVr_{mt}deposit$, has a positive and statistically significant estimated coefficient for all loan products: in provinces with higher interest rates of deposits, the interest rates of loans are also higher. This result is consistent with the hypothesis that banks take the marginal interest rate paid for deposits as the marginal financial cost of their loans (integration).

Provinces with higher densities of branches tend to have higher average loan interest rates (ten out of twelve coefficients are positive, three of them statistically significant; in Mortgages, however, the density of branches has an unexpected negative sign). The coefficients of *POPULATION* and *PINCOME* are positive in some loan products and negative in others. In general, their estimated values are smaller in absolute values than for deposits, so the effect of the size of the market variables on the average interest rates of loans is less clear than in the case of deposits. The coefficients of the product-specific inflation variable are all negative, and all but two are statistically significant; evidence is thus found of the convergence effect in loan products as well. Six of the seven statistically significant coefficients of the variable *SHARENA* are negative, concentrated mainly in Personal loans and Mortgages. Therefore, the evidence suggests that the greater presence of national banks in a given province market tends to lower the average interest rates on loans to households, but does not affect the interest rates of loans to firms (Receivables and Credit lines) —perhaps because local firms may find it easier to engage in relational lending with local lenders than with distant ones.

5.2 Determinants of dispersion

Table 5 shows that, for deposits, the coefficient of the number of banks is positive in seven cases and negative in three. Four out of the seven positive coefficients are statistically significant, while all of the negative coefficients are statistically insignificant. The hypothesis from Carlson and McAfee's model that price dispersion will increase with the number of banks in the market cannot be rejected. The negative and significant sign of three estimated coefficients for density of branches is consistent with the prediction that dispersion decreases as the range of search costs decreases; however, the estimated coefficient for the variable is positive and significant in two cases. Consequently, overall, the conclusion as to the effect of density of branches on the interest rate dispersion of deposits is ambiguous.

For loan products the estimated coefficient of the variable number of banks is positive in ten of the twelve loan products; seven of the ten positive coefficients are significantly different from zero, and none of the three negative coefficients are statistically significant. Therefore, in loan products, the hypothesis that interest rate dispersion increases with the number of banks is also, in general, supported by the data. Table 5 also shows that all three of the statistically significant coefficients of the density of branches variable have a negative sign, which would be consistent with the prediction that lower search costs decrease price dispersion. The estimated coefficient of the variable CVr_{mt}*deposit* is positive in eight cases and four out of five significant coefficients have a positive sign, which supports markets integration. The sign and statistical significance of the coefficients of the control variables do not show a clear pattern in both deposit and loan products. However, all of the significant coefficients of the variable *PINCOME* are negative, which suggest a negative effect of customers' wealth on price dispersion. The negative sign also dominates among the statistically significant coefficients for the variable product-specific inflation (11 out of 13), so the empirical evidence suggests a negative association between product specific-inflation and price dispersion.

5.3 Robustness analysis

The empirical model (14) is estimated again with a range of interest rates, *Range* r_{mt}/*Avg* r_{mt}, as the dependent variable (Table 6). The Carlson and McAfee model predicts the same pattern of results, in terms of the signs of the coefficients of the explanatory variables, when dispersion is measured by range as when it is measured by the standard deviation. The results shown in Table 6, overall, confirm the conclusions obtained when dispersion is measured in terms of the standard deviation of residual interest rates for both deposit and loan products.

One potential limitation of our results is that we do not know whether national banks set interest rates with a national policy resulting in the same interest rate in each province, or whether they follow local market policies. To test the extent to which the results above are sensitive to the assumption on interest rates of national banks we perform robustness analyses in two ways: First, we estimate the empirical models of average level and dispersion of interest rates excluding the national banks data. Second we estimate the model with the full data set excluding the share of national banks (*SHARENA*) as an explanatory variable. In all cases the main results of the empirical analysis are maintained (i.e., the effect of the number of banks in average interest rates and their dispersion, and the effect of deposit interest rates' average and dispersion on the average and dispersion of loan interest rates).

Finally, the theoretical and empirical analysis has ignored the interaction of pricing decisions for a multi-product bank. The original model that we test in the paper was formulated for single-product firms, but here we treat each bank product as a separate market. The complexity of this issue is out of the reach of the present paper, but we have explored the possibility that banks apply mixed or randomized pricing strategies to avoid being identified as low or high price sellers [Varian (1980); Lach (2002)]. If banks use mixed strategies to set interest rates, the correlation between the interest rates of each bank across different products will be low, as banks will set relatively high interest rates in some products and relatively low rates in others. However, there is an alternative prediction based on common beliefs and expectations of the bank, which predicts that pricing decisions of that bank across products will be highly correlated [Dahlby and West (1986)].

The actual observed correlation among banks of the interest rates of two different products will help to discern which of the two explanations about pricing behavior is more likely to be true (mixed strategies or common future expectations). To perform the test, we compute the Spearman's rank order correlation coefficient of interest rates across bank products for each quarter and for five provinces, which amounts to 66,990 correlation coefficients. 18,295 (12,103) out of the total are statistically significant at a 5% (1%) confidence level, the vast majority with a positive sign. Therefore, only in 27% (18%) of the cases do we find evidence consistent with the hypothesis that common expectations about exogenous variables dictate the pricing strategy of the multi-product bank. This result contrasts with that of Dahlby and West, who find a positive and significant correlation in practically all cases, but it is consistent with the evidence of low correlation obtained by Sorensen (2000) and Lach (2002).

The second analysis performed refers to the correlation of interest rates across products over time, also measured through the Spearman's rank order correlation coefficient. The correlation between two consecutive years is positive and statistically significant at 5% (1%) in 91% (80%) of the cases in all of the periods. However, after six years (1997-2003) the number of positive and significant correlation coefficients has dropped to 26% (18.3%) of the total. Although the year-to-year changes in the ranking of interest rates are low, the cumulative changes over time are large, a conclusion similar to that of Dahlby and West for a single insurance product and one geographic market. Overall, the results point towards pricing strategies by banks that complicate consumer learning and perpetuate price dispersion in the markets.

6 Conclusion

This paper provides empirical support for the hypothesis that customers' search costs affect the level and dispersion of interest rates on loans and deposits by Spanish banks. The evidence supports the predictions from the search model proposed by Carlson and McAfee (1983) to explain price formation in markets with heterogeneous sellers and buyers with uniformly distributed search costs. That model predicts that the level of average prices in the market will decrease with the number of firms and that price dispersion will increase as the number of firms also increases, for a given distribution of marginal costs of the firms in the market. We find that, as the number of banks increases in a market, deposit (loan) interest rates tend to increase (decrease) while dispersion in interest rates in both markets increases with the number of banks.

We also find that the average level and dispersion of interest rates of loans are significantly explained by the level and dispersion of interest rates of deposits, which is consistent with theories of the banking firm that imply vertical integration between loans and deposits in banking decisions. Therefore, besides informing the literature of search costs, the results of the paper are also of interest for the theory of the banking firm and for the implementation of monetary policy.

We perform a product-by-product analysis (twelve loan products and ten deposit products) because any attempt to aggregate a set of bank products into a common model for all of them was empirically rejected (i.e., econometric tests gave strong evidence of model misspecification). Each bank product is more properly described as a separate market, where interest rate formation is the result of a competitive dynamic substantially different from the rest of the products. One implication of this evidence is that, besides the general conclusion about search costs as determinants of loan and deposit interest rates, there are some products for which the evidence is more conclusive than for others. This result suggests that there are other structural factors affecting the level and dispersion of interest rates of loans and deposits. In this respect, switching costs, informative advertising, and interest-rate smoothing are potential factors that explain interest rate formation and that should be accounted for in future research.

The results of the paper also show that brick-and-mortar markets can work quite differently from Internet markets under consumers' search costs. It will be interesting to see how the results of our paper may change with the diffusion of Internet banking.

REFERENCES

ANDERSON, S. P., and A. DE PALMA (2004). *Price dispersion and consumer reservation,* Working Paper 4618, Center of Economic Policy Research.

ANDERSON, S. P., and R. RENAULT (1999). "Pricing, product diversity, and search costs: a Bertrand-Chamberlin-Diamond model", *RAND Journal of Economics,* 30, pp. 719-735.

BARRON, J. M., B. A. TAYLOR and J. R. UMBECK (2004). "Number of sellers, average prices and price dispersion", *International Journal of Industrial Organization,* 22, pp. 1041-1066.

BAYE, M., and J. MORGAN (2001). "Information Gatekeepers on the Internet and the Competitiveness of Homogeneous Product Markets", *American Economic Review,* 91, pp. 454-474.

BAYE, M., J. MORGAN and P. SCHOLTEN (2004). "Price Dispersion in the Large and in the Small: Evidence from an Internet Price Comparison Site", *Journal of Industrial Economics,* 52, pp. 463-496.

BERGER, A., and G. UDELL (1992). "Some evidence on the empirical significance of credit rationing", *Journal of Political Economy,* 100, pp. 1047-1077.

BERLIN, M., and L. MESTER (1999). "Deposits and relational lending", *Review of Financial Studies,* 12, pp. 579-607.

BLUNDELL, R., and S. BOND (1998). "Initial conditions and moment restrictions in dynamic panel data models", *Journal of Econometrics,* 87, pp. 115-143.

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

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

CAMINAL, R., J. GUAL and X. VIVES. (1993). "Competition in Spanish banking", in J. Dermine (ed.), *European Banking after 1992*, Oxford: Blackwell Publishers.

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

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

ELLISON, G., and S. F. ELLISON (2005). "Lessons about Markets from the Internet", *Journal of Economic Perspectives,* Spring, pp. 139-158.

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,* Cambridge: MIT Press.

GOLDBERG, P., and F. VERBOVEN (2001). "The evolution of price dispersion in the European car market", *Review of Economic Studies,* 68, pp. 811-848.

HAYES, K., and L. ROSS (1998). "Is Airline Price Dispersion Result of Careful Planning or Competitive Forces?, *Review of Industrial Organizations,* pp. 523-541.

HONG, H., and M. SHUM (2006). "Using price distributions to estimate search costs", *RAND Journal of Economics,* 37, pp. 257-275.

HORTACÇU, A., and CH. SYVERSON (2004). "Product Differentiation, Search Costs, and Competition in the Mutual Fund Industry: A Case Study of S&P 500 Index Funds", *Quarterly Journal of Economics,* 119, pp. 403-456.

JANSSEN, M. W., and J. L. MORAGA-GONZÁLEZ (2004). "Strategic Pricing, Consumer Search and Number of Firms", *Review of Economic Studies,* 71, pp. 1089-1118.

KASHYAP, A., and J. STEIN (2000). "What do a million observations on banks say about the transmission of monetary policy?", *American Economic Review,* 90, pp. 407-428.

KISHAN, R., and T. OPIELA (2000). "Bank size, bank capital and the bank lending channel", *Journal of Money, Credit and Banking,* 32, pp. 121-141.

LACH, S. (2002). "Existence and Persistence of Price Dispersion: An Empirical Analysis", *Review of Economics and Statistics,* 84, pp. 433-444.

MARTÍN-OLIVER, A., V. SALAS and J. SAURINA (2007). "A test of the law of one price in retail banking", *Journal of Money, Credit and Banking,* 39, pp. 2021-2040.

PERLOFF, J. M., and S. C. SALOP (1985). "Equilibrium with product differentiation", *Review of Economic Studies,* 52, pp. 107-120.

PRATT, J. W., D. A. WISE and R. J. ZECKHAUSER (1979). "Price differences in almost competitive markets", *Quarterly Journal of Economics,* 92, pp. 189-211.

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

ROSENTHAL, R. W. (1980). "A Model in Which an Increase in the Number of Sellers Leads to a Higher Price", *Econometrica,* 48, pp. 1575-1580.

ROTHSCHILD, M. (1973). "Models of Market Organization with Imperfect Information: A Survey", *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.

SHESHINSKI, E., and Y. WEISS (1977). "Inflation and Costs of Price Adjustment", *Review of Economic Studies,* 44, pp. 287-303.

SORENSEN, A. T. (2000). "Equilibrium Price Dispersion in Retail Markets for Prescription Drugs", *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", *Journal of Political Economy,* 69, 213-225.

STIGLER, G. J., and J. K. KINDAHL (1970). The Behaviour of Industrial Prices. General Series 90. *New York: Columbia University Press.*

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

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

TABLE 1. EVOLUTION OF INTEREST RATES: AVERAGE AND DISPERSION ACROSS PROVINCES (%)

LOAN RATES

		CREDIT LINES				MORTGAGES			
Year	Interbank	Average	Std. Dev.	p90%-p10%	Coeff. variation	Average	Std. Dev.	p90%-p10%	Coeff. variation
1989	14.39	15.94	1.22	2.72	0.08	15.24	1.14	2.70	0.08
1990	14.76	17.03	1.42	2.89	0.08	16.62	1.20	2.63	0.07
1991	13.20	16.22	1.65	3.87	0.10	16.24	1.20	3.05	0.07
1992	13.01	15.75	1.44	3.29	0.09	15.08	0.89	2.26	0.06
1993	12.25	14.72	2.15	5.08	0.15	13.90	1.71	4.66	0.12
1994	7.81	11.15	1.89	4.46	0.17	10.23	0.98	2.51	0.10
1995	8.98	11.88	1.78	4.19	0.15	10.97	0.98	2.70	0.09
1996	7.65	10.16	1.90	4.58	0.19	9.40	1.11	2.91	0.12
1997	5.49	7.82	1.57	3.82	0.20	6.90	0.66	1.71	0.10
1998	4.34	6.50	1.53	3.44	0.24	5.65	0.46	1.21	0.08
1999	2.72	5.54	1.66	4.04	0.30	4.68	0.49	1.24	0.11
2000	4.11	6.75	1.55	3.75	0.23	5.72	0.62	1.61	0.11
2001	4.36	6.69	1.51	3.73	0.23	5.72	0.59	1.56	0.10
2002	3.28	5.99	1.71	4.05	0.28	4.79	0.40	1.06	0.08
2003	2.75	5.60	1.90	4.24	0.34	4.12	0.38	0.99	0.09

DEPOSIT RATES

		CURRENT ACCOUNTS				DEPOSITS			
Year	Interbank	Average	Std. Dev.	p90%-p10%	Coeff. variation	Average	Std. Dev.	p90%-p10%	Coeff. variation
1989	14.39	7.92	1.62	4.42	0.21	9.79	1.20	2.90	0.12
1990	14.76	9.15	1.84	5.35	0.20	10.84	1.46	3.61	0.14
1991	13.20	8.74	1.80	5.06	0.21	10.45	1.37	3.32	0.13
1992	13.01	8.12	1.70	4.64	0.21	10.10	1.28	3.08	0.13
1993	12.25	7.46	1.90	5.56	0.25	9.51	1.57	3.95	0.16
1994	7.81	5.32	1.38	4.17	0.26	6.93	0.88	1.96	0.13
1995	8.98	5.09	1.18	3.12	0.23	7.93	1.02	2.62	0.13
1996	7.65	4.42	1.18	3.16	0.27	6.47	1.05	2.63	0.16
1997	5.49	3.18	1.05	2.81	0.33	4.41	0.97	1.91	0.22
1998	4.34	2.43	0.83	2.34	0.34	3.29	0.73	1.61	0.22
1999	2.72	1.61	0.59	1.40	0.37	2.30	0.59	1.41	0.26
2000	4.11	1.98	0.83	2.10	0.42	3.44	0.86	2.24	0.25
2001	4.36	2.18	0.92	2.41	0.42	3.49	0.76	1.76	0.22
2002	3.28	1.73	0.68	1.74	0.39	2.85	0.56	1.30	0.20
2003	2.75	1.50	0.61	1.58	0.40	2.38	0.48	0.90	0.20

Note.- P90%-P10% is the difference between the 90^{th} percentile and the 10^{th} percentile of the product interest-rate distribution. We call it *range* in the paper.

TABLE 2. CONTRIBUTION OF THE SOURCES OF VARIATION OF INTEREST RATES.

This table presents, for loans and deposits, the results of the analysis of variance (ANOVA) applied to the interest rates net of the interbank rate. The dependent variable is $r_{ijmt} - I_t$ for loans and $I_t - r_{ijmt}$ for deposits, where It is the interbank interest rate at period t and rijmt is the interest rate quoted by bank j in product i in province m at time t. This dependent variable is regressed over four groups of dummy variables, identifying time (a_t), product class (a_i), bank (a_j), and province (a_m). The contribution of the province has been computed without the ai group as the province effect is an average of the banks operating in the province. Column Contribution shows the contribution of each group of dummy variables to explain the observed variation, and the Column F-test shows the p-value of the test of nullity of each group of dummy variables. The bottom of the table presents the R^2 and number of observations of each regression.

	Loans		**Deposits**	
	Contribution	F-test	Contribution	F-test
Time	46.65% ***	0.00	4.29% ***	0.00
Product class	11.84% ***	0.00	86.87% ***	0.00
Bank	26.55% ***	0.00	7.39% ***	0.00
Province	1.78% ***	0.00	1.05% ***	0.00
R^2	66.64%		63.58%	
Observations	1,216,714		1,049,757	

TABLE 3. DESCRIPTIVE STATISTICS OF THE EXPLANATORY VARIABLES

$NBANKS_{mt}$ is the number of banks with transactions in product i in province m at period t. $DENBRANCH_{mt}$ is the density of branches (total number of bank branches per square kilometer) in province m at period t. $Avg\ r_{mt}^{deposit}$ and $Sd\ r_{mt}^{deposit}$ are, respectively, the average level and standard deviation of the interest rates of Deposit products net of product and bank effects. $POPULATION_{mt}$ is the population of province m at time t. $PINCOME_{mt\ t}$ is the per-capita GDP in thousands of constant (1995) euros in province m at time t. D_{imt} is the specific inflation of product i in province m during period t. $SHARENA_{mt}$ is the percentage of the banks in province m at time t that operate nationwide.

	$NBANKS_{imt}$		$DENBRANCH_{mt}$		Avg $r_{m,t}^{deposit}$ (%)		Sd $r_{m,t}^{deposit}$ (%)		$POPULATION_{mt}$		$PINCOME_{mt}$		D_{imt} (%)		$SHARENA_{mt}$ (%)	
Year	*Average*	*Std. Deviation*	*Average*	*Std. Deviation*	*Average*	*Std. Deviation*	*Average*	*Std. Deviation*	*Average*	*Std. Deviation*	*Average*	*Std. Deviation*	*Average*	*Std. Deviation*	*Average*	*Std. Deviation*
1989	29.89	13.83	0.079	0.098	2.06	0.89	28.52	1.81	788361	920380	9.79	2.10	3.25	2.13	19.92	8.22
1990	29.59	13.37	0.086	0.106	2.06	1.10	27.06	1.96	795112	929647	10.06	2.07	2.00	2.50	28.72	9.35
1991	32.46	13.69	0.086	0.107	0.55	1.03	26.90	1.93	774961	915272	10.27	2.12	2.91	2.48	29.61	9.37
1992	34.02	13.99	0.087	0.108	-4.31	1.01	28.05	1.87	780231	920526	10.30	2.12	2.46	2.55	29.63	9.14
1993	35.04	13.97	0.086	0.108	-5.64	1.09	27.64	1.57	793173	935120	10.20	2.06	6.74	4.73	34.66	9.67
1994	35.10	13.65	0.086	0.110	-3.86	1.05	23.71	1.78	801882	944955	10.37	2.12	5.26	3.54	34.62	9.32
1995	35.62	13.87	0.088	0.114	-0.99	0.79	22.46	1.95	806444	948963	10.60	2.22	3.62	2.78	34.91	9.02
1996	35.31	13.72	0.090	0.117	-2.02	0.90	25.86	1.48	790820	924700	10.82	2.26	7.24	3.07	35.27	8.83
1997	37.29	13.37	0.091	0.120	-3.49	1.55	31.82	1.40	792615	929614	11.20	2.40	7.29	3.72	35.43	8.61
1998	36.40	12.91	0.094	0.124	-3.78	1.86	38.89	1.65	794409	934548	11.60	2.47	6.66	4.73	38.35	8.71
1999	36.37	11.99	0.094	0.125	-0.78	1.21	34.86	1.28	801431	943728	11.99	2.53	8.67	5.84	37.28	8.62
2000	35.23	11.12	0.094	0.126	5.12	0.93	28.41	1.16	807166	952926	12.42	2.64	8.06	4.25	37.94	8.93
2001	35.76	10.80	0.093	0.125	4.41	0.86	28.96	1.00	819447	975604	12.91	2.74	6.03	5.75	36.61	8.95
2002	35.82	10.26	0.092	0.125	5.68	0.96	28.76	1.08	833851	1000524	13.26	2.77	3.70	3.11	35.24	8.73
2003	36.67	10.11	0.094	0.127	5.74	1.46	29.03	1.03	851473	1033847	13.71	2.85	9.30	4.46	35.15	8.64

TABLE 4. DETERMINANTS OF INTEREST RATE DIFFERENCES ACROSS PROVINCES

The dependent variable is $ln\ r_{ijtm} - ln\ I_t$, where r_{ijtm} is the interest rate of product i quoted in province m at time t by bank j and It is the interbank interest rate. $NBANKS_{mt}$ is the number of banks with transactions in product i in province m at period t; $DENBRANCH_{mt}$ is the density of branches (number of branches per square kilometer) in province m at period t; $LEV\ r^{deposit}$ is the average of the interest rates of the Deposit products; D_{imt} is the specific inflation of product i in province m during period t; $SHARENA_{mt}$ is the percentage of the banks in province m at time t that operate nationwide; $POPULATION_{m,}$ is the population of province m at time t; $PINCOME_{mt}$ is the GDP per capita of the province. All the explanatory variables but Dimt and *SHARENAmt* are expressed in logarithms. We have estimated the coefficients with instrumental variables to control for the potential endogeneity of *NBANKS*, *DENBRANCH* and $LEV\ r^{deposit}$, using the lags t-2 and t-3. All of the estimations contain time, bank, and province dummy variables. The last column presents the F-statistics from the tests of aggregate significance of the time, province, and bank groups of dummy variables, where the number of observations is displayed in the table and the number of restrictions is 250. All of the tests reject the null hypothesis of insignificance.

	NBANKS	*DENBRANCH*	$LEV\ r^d$	*POPULATION*	*PINCOME*	D_{imt}	*SHARENA*	Number observ	F-statistic
DEPOSIT PRODUCTS									
DEPOSITSless3months	-0.042	1.968 *		-1.869	-1.129	-0.869	0.555	21,767	4761.2
DEPOSITS3months-6months	0.296 **	0.020		-0.110	-0.193	0.804	0.111	26,090	2891.6
DEPOSITS6months-1year	0.144 *	0.214 *		-0.477 **	-0.367 *	-3.125 ***	0.145	26,365	2854.3
DEPOSITS1year-2years	0.010	0.173		-0.603 ***	-0.387 *	-2.009 **	-0.011	25,992	4827.1
DEPOSITSmore2years	0.094	0.470 **		-0.950 ***	0.086	-1.851 **	-0.269	20,582	1394.1
REPOless3months	0.122 **	0.324 **		-0.416 **	0.148	0.524	-0.025	25,664	2592.0
REPO3months-6months	0.048	0.261 *		-0.329	-0.142	-1.261	0.159	22,686	1985.2
REPO6months-1year	0.167 *	0.035		-0.578	-0.301	-2.819 *	0.439	20,486	1403.6
CURRENT	0.604	0.037 *		-0.216	-0.297	-0.234	0.061	28,754	1570.7
SAVINGS	-0.707	0.071 **		1.142	-0.355	-0.483	-0.361 ***	24,836	452.6
LOAN PRODUCTS									
RECEIVABLEless3months	0.008	0.014	0.105 ***	-0.010	0.020	-0.685 ***	-0.009	25,193	587.8
RECEIVABLE3months-1year	-0.014 **	0.017	0.038 ***	0.012	0.029	-0.686 ***	-0.036	24,632	665.0
RECEIVABLE1year-3years	-0.014	0.021	0.039 ***	0.012	0.050	-0.053	0.017	17,964	186.6
CREDITLINEless3months	-0.031 **	0.042 *	0.137 ***	-0.107 **	-0.005	-0.607 ***	0.088 *	18,181	411.9
CREDITLINE3months-1year	-0.013	0.021	0.123 ***	-0.019	-0.013	-0.407 **	-0.013	24,141	664.7
CREDITLINE1year-3years	-0.018 *	-0.008	0.162 ***	-0.010	0.015	-0.626 ***	-0.058 *	25,892	673.2
CREDITLINEmore3years	-0.003	0.027	0.250 ***	-0.062 *	-0.001	-0.137	0.006	15,932	412.7
PERSONALless3months	-0.056 *	0.101 **	0.408 ***	-0.102 *	0.003	-0.616 ***	-0.122 *	22,177	442.6
PERSONAL3months-1year	-0.080 ***	0.086 **	0.130 ***	-0.043	-0.064	-0.439 **	-0.163 ***	26,358	670.9
PERSONAL1year-3years	-0.099 ***	0.033	0.032 **	-0.033	-0.039	-0.531 **	-0.152 ***	27,091	958.5
PERSONALmore3years	-0.022	0.021	0.059 ***	0.007	-0.007	-0.639 **	-0.078 *	26,440	751.1
MORTGAGEmore3years	-0.031 ***	-0.024 **	0.093 ***	0.001	-0.012	-0.166	-0.065 ***	25,598	699.6

Notes.- (***)= Significant at 1%. (**)=Significant at 5%. (*)= Significant at 1%.

TABLE 5. DETERMINANTS OF THE DISPERSION (COEFFICIENT OF VARIATION) OF INTEREST RATES ACROSS PROVINCES

The dependent variable is the coefficient of variation across banks of interest rates of product i quoted in province m at time t. $NBANKS_{mt}$ is the number of banks with transactions in product i in province m at period t; $DENBRANCH_{mt}$ is the density of branches (number of branches per square kilometer) in province m at period *t; CV* r_{mt}*deposit* is the coefficient of variation of the interest rates of the Deposit products; *Dimt* is the specific inflation of product i in province m during period t; $SHARENA_{mt}$ is the percentage of the banks in province m at time t that operate nationwide; $POPULATION_{mt}$ is the population of province m at time t; $PINCOME_{mt}$ is the *GDP per capita* of the province. All of the explanatory variables but D_{imt} and $SHARENA_{mt}$ are expressed in logarithms. We have estimated the coefficients through the *GMM-system* technique (first step) to take into account potential problems of persistence and endogeneity in the number of banks, branches and cost of deposits. All of the estimations contain time dummy variables. The coefficients are expressed in their long term value. We report the p-values of Sargan's test of overidentifying restrictions and second-order autocorrelation tests, whose null hypotheses are, respectively, compatibility of orthogonality conditions and absence of second-order autocorrelation in the error term. The last column presents the *F*-statistics from the tests of aggregate significance of the time and province effects, where the number of observations is 750 and the number of restrictions is 64 in all of the regressions. All of the tests reject the null hypothesis of non-significance.

	NBANKS	*DENBRANCH*	*CV* $r^{deposit}$	*POPULATION*	*PINCOME*	D_{imt}	*SHARENA*	Sargan test	Autocorrelation test	F-statistic
DEPOSIT PRODUCTS										
DEPOSITSless3months	0.045 ***	-0.015 *		-0.003	-0.018 *	-0.406 ***	-0.008	0.758	0.336	105.1
DEPOSITS3months-6months	0.003	0.011 ***		-0.013 **	-0.027 ***	-0.971 ***	-0.003	0.930	0.813	64.2
DEPOSITS6months-1year	-0.010	0.000		0.000	0.001	-0.654 **	-0.009	0.849	0.055	339.9
DEPOSITS1year-2years	-0.008	0.017		-0.016 **	-0.031 **	-0.671 **	-0.009	0.917	0.502	140.9
DEPOSITSmore2years	0.011	0.008 *		-0.009 **	-0.027 ***	0.203 ***	0.013	0.724	0.250	206.3
REPOless3months	0.040 *	-0.021 *		0.015	0.007	0.821 **	0.008	0.942	0.920	79.2
REPO3months-6months	0.006	-0.001		0.004	-0.011	-0.280 *	-0.022 *	0.836	0.112	320.8
REPO6months-1year	-0.008	0.014		-0.010 *	-0.019 *	0.278 *	0.002	0.718	0.245	219.7
CURRENT	0.031 **	-0.004		0.006	0.002	-0.340 *	-0.022	0.929	0.229	245.3
SAVINGS	0.071 **	-0.057 ***		0.039 **	0.066	-0.063	0.032	0.991	0.189	274.1
LOAN PRODUCTS										
RECEIVABLEless3months	-0.007	-0.015 ***	-0.014	0.022 ***	0.008	0.122	0.008	0.930	0.251	173.1
RECEIVABLE3months-1year	0.014 *	0.005	0.031 *	-0.004	-0.022 **	-0.162	0.026 **	0.799	0.212	129.1
RECEIVABLE1year-3years	0.037 **	0.002	0.058	-0.008	-0.025 *	-0.095	0.015	0.801	0.143	61.0
CREDITLINEless3months	0.018	-0.012	0.124 **	0.013	-0.015	0.149	0.018	0.849	0.536	179.9
CREDITLINE3months-1year	-0.004	-0.005 **	-0.065	-0.005	-0.015 ***	-0.329	0.002	0.923	0.227	550.4
CREDITLINE1year-3years	0.002	-0.001	-0.139 ***	-0.001	-0.007	0.155	-0.003	0.934	0.155	495.5
CREDITLINEmore3years	0.052 **	-0.008	0.159	-0.002	-0.043 **	-0.506 **	0.020	0.973	0.105	112.0
PERSONALless3months	0.026 **	0.000	-0.090	0.006	0.013	0.028	0.048 ***	0.815	0.833	254.1
PERSONAL3months-1year	0.014 *	-0.003	0.426 **	0.004	0.009	-1.590 **	-0.021	0.856	0.813	244.5
PERSONAL1year-3years	0.009	0.017	-0.296	-0.015	-0.041	0.085	-0.012	0.853	0.943	203.9
PERSONALmore3years	0.013 **	-0.038 *	0.292	-0.032	-0.057	-4.382 ***	-0.062	0.879	0.321	82.8
MORTGAGEmore3years	0.009 ***	0.001	0.111 **	0.003	0.000	0.660 ***	0.007	0.841	0.183	32.1

Notes.- (***)= Significant at 1%. (**)=Significant at 5%. (*)= Significant at 1%.

TABLE 6. DETERMINANTS OF THE DISPERSION (RANGE) OF RESIDUAL INTEREST RATES ACROSS PROVINCES

The dependent variable is the range (difference between percentiles 90th and 10th divided by the average of the distribution) across banks of interest rates of product i quoted in province m at time t. $NBANKS_{mt}$ is the number of banks with transactions in product i in province m at period t; $DENBRANCH_{mt}$ is the density of branches (number of branches per square kilometer) in province *m* at period *t*; *Range rmtdeposit* is the range of the interest rates (divided by their average) of the Deposit products; *Dimt* is the specific inflation of product *i* in province m during period *t*; $SHARENA_{mt}$ is the percentage of the banks in province m at time t that operate nationwide; $POPULATION_{mt}$ is the population of province m at time t; $PINCOME_{mt}$ is the *GDP per capita* of the province. All the explanatory variables but D_{imt} and $SHARENA_{mt}$ are expressed in logarithms. We have estimated the coefficients through the GMM-system technique (first step) to take into account potential problems of persistence and endogeneity in the numbers of banks and branches and the cost of deposits. All of the estimations contain time dummy variables. The coefficients are expressed in their long-term value. We report the p-values of Sargan's test of overidentifying restrictions and second-order autocorrelation tests, whose null hypotheses are, respectively, compatibility of orthogonality conditions and absence of second-order autocorrelation in the error term. The last column presents the F-statistics from the tests of aggregate significance of the time and province effects, where the number of observations is 750 and the number of restrictions is 64 in all the regressions. All of the tests reject the null hypothesis of non-significance.

	NBANKS	*DENBRANCH*	***RANGE*** $r^{deposit}$	*POPULATION*	*PINCOME*	D_{imt}	*SHARENA*	Sargan test	Autocorrelation test	F-statistic
DEPOSIT PRODUCTS										
DEPOSITSless3months	-0.104	0.012		0.008	-0.001	-0.642	-0.014	0.954	0.300	77.8
DEPOSITS3months-6months	0.011 **	-0.005		-0.008	-0.005	-0.528	0.010	0.878	0.986	47.7
DEPOSITS6months-1year	-0.007	-0.007		0.002	-0.008	-1.566 *	-0.004	0.767	0.928	116.3
DEPOSITS1year-2years	-0.030 *	0.013		-0.005	-0.036	-0.040	-0.035	0.870	0.844	68.8
DEPOSITSmore2years	0.012	0.008		-0.011	-0.045	1.250 ***	0.049	0.708	0.442	56.0
REPOless3months	0.105 **	-0.016		-0.008	-0.041	0.897	0.044	0.746	0.043	171.1
REPO3months-6months	0.045 *	0.011		-0.017	-0.062 ***	-1.109 ***	-0.011	0.959	0.124	396.6
REPO6months-1year	-0.040	0.020		-0.016	-0.041	-0.189	0.014	0.912	0.481	196.4
CURRENT	0.123 **	0.007		-0.003	-0.040	0.917	-0.072	0.728	0.702	76.9
SAVINGS	0.180 **	-0.034 *		0.001	-0.046	1.292 ***	0.105	0.853	0.059	99.7
LOAN PRODUCTS										
RECEIVABLEless3months	-0.048	-0.027 *	-0.166	0.057 ***	-0.019	0.884	-0.011	0.782	0.286	88.7
RECEIVABLE3months-1year	0.004	-0.003	0.029	0.016	-0.024	1.983 ***	0.031	0.861	0.058	80.9
RECEIVABLE1year-3years	0.044 ***	0.008	0.482 ***	-0.016	-0.053 **	-0.895 **	0.077 ***	0.887	0.462	48.2
CREDITLINEless3months	0.036	-0.008	0.625 ***	0.008	-0.043	-0.182	-0.002	0.794	0.236	218.6
CREDITLINE3months-1year	0.008	-0.020 *	-0.157	-0.023 *	-0.052 **	-0.630	0.035	0.769	0.825	287.4
CREDITLINE1year-3years	-0.012	0.002	0.006	0.008	-0.011	0.645 **	-0.025	0.888	0.911	400.6
CREDITLINEmore3years	0.077	-0.041 **	0.287 *	0.025	0.002	-0.433	0.034	0.728	0.007	63.6
PERSONALless3months	-0.194	-0.007	0.064	0.046	0.044	-1.742 ***	0.088	0.808	0.225	116.9
PERSONAL3months-1year	-0.097	0.017	0.855 ***	0.016	0.053	0.187	-0.023	0.818	0.622	152.8
PERSONAL1year-3years	-0.023	-0.027	-0.290	-0.007	-0.027	0.455	0.082 *	0.955	0.871	216.3
PERSONALmore3years	-0.032	-0.030 **	-0.157	0.011	0.022	-1.056 **	-0.030	0.906	0.195	191.1
MORTGAGEmore3years	0.051 ***	0.000	0.035	0.016 ***	-0.001	0.425	-0.016	0.790	0.192	65.8

Notes.- (***)= Significant at 1%. (**)=Significant at 5%. (*)= Significant at 1%.

BANCO DE ESPAÑA PUBLICATIONS

WORKING PAPERS[1]

0701 PRAVEEN KUJAL AND JUAN RUIZ: Cost effectiveness of R&D and strategic trade policy.
0702 MARÍA J. NIETO AND LARRY D. WALL: Preconditions for a successful implementation of supervisors' prompt corrective action: Is there a case for a banking standard in the EU?
0703 PHILIP VERMEULEN, DANIEL DIAS, MAARTEN DOSSCHE, ERWAN GAUTIER, IGNACIO HERNANDO, ROBERTO SABBATINI AND HARALD STAHL: Price setting in the euro area: Some stylised facts from individual producer price data.
0704 ROBERTO BLANCO AND FERNANDO RESTOY: Have real interest rates really fallen that much in Spain?
0705 OLYMPIA BOVER AND JUAN F. JIMENO: House prices and employment reallocation: International evidence.
0706 ENRIQUE ALBEROLA AND JOSÉ M.ª SERENA: Global financial integration, monetary policy and reserve accumulation. Assessing the limits in emerging economies.
0707 ÁNGEL LEÓN, JAVIER MENCÍA AND ENRIQUE SENTANA: Parametric properties of semi-nonparametric distributions, with applications to option valuation.
0708 ENRIQUE ALBEROLA AND DANIEL NAVIA: Equilibrium exchange rates in the new EU members: external imbalances vs. real convergence.
0709 GABRIEL JIMÉNEZ AND JAVIER MENCÍA: Modelling the distribution of credit losses with observable and latent factors.
0710 JAVIER ANDRÉS, RAFAEL DOMÉNECH AND ANTONIO FATÁS: The stabilizing role of government size.
0711 ALFREDO MARTÍN-OLIVER, VICENTE SALAS-FUMÁS AND JESÚS SAURINA: Measurement of capital stock and input services of Spanish banks.
0712 JESÚS SAURINA AND CARLOS TRUCHARTE: An assessment of Basel II procyclicality in mortgage portfolios.
0713 JOSÉ MANUEL CAMPA AND IGNACIO HERNANDO: The reaction by industry insiders to M&As in the European financial industry.
0714 MARIO IZQUIERDO, JUAN F. JIMENO AND JUAN A. ROJAS: On the aggregate effects of immigration in Spain.
0715 FABIO CANOVA AND LUCA SALA: Back to square one: identification issues in DSGE models.
0716 FERNANDO NIETO: The determinants of household credit in Spain.
0717 EVA ORTEGA, PABLO BURRIEL, JOSÉ LUIS FERNÁNDEZ, EVA FERRAZ AND SAMUEL HURTADO: Update of the quarterly model of the Bank of Spain. (The Spanish original of this publication has the same number.)
0718 JAVIER ANDRÉS AND FERNANDO RESTOY: Macroeconomic modelling in EMU: how relevant is the change in regime?
0719 FABIO CANOVA, DAVID LÓPEZ-SALIDO AND CLAUDIO MICHELACCI: The labor market effects of technology shocks.
0720 JUAN M. RUIZ AND JOSEP M. VILARRUBIA: The wise use of dummies in gravity models: Export potentials in the Euromed region.
0721 CLAUDIA CANALS, XAVIER GABAIX, JOSEP M. VILARRUBIA AND DAVID WEINSTEIN: Trade patterns, trade balances and idiosyncratic shocks.
0722 MARTÍN VALLCORBA AND JAVIER DELGADO: Determinantes de la morosidad bancaria en una economía dolarizada. El caso uruguayo.
0723 ANTÓN NÁKOV AND ANDREA PESCATORI: Inflation-output gap trade-off with a dominant oil supplier.
0724 JUAN AYUSO, JUAN F. JIMENO AND ERNESTO VILLANUEVA: The effects of the introduction of tax incentives on retirement savings.
0725 DONATO MASCIANDARO, MARÍA J. NIETO AND HENRIETTE PRAST: Financial governance of banking supervision.
0726 LUIS GUTIÉRREZ DE ROZAS: Testing for competition in the Spanish banking industry: The Panzar-Rosse approach revisited.
0727 LUCÍA CUADRO SÁEZ, MARCEL FRATZSCHER AND CHRISTIAN THIMANN: The transmission of emerging market shocks to global equity markets.
0728 AGUSTÍN MARAVALL AND ANA DEL RÍO: Temporal aggregation, systematic sampling, and the Hodrick-Prescott filter.
0729 LUIS J. ÁLVAREZ: What do micro price data tell us on the validity of the New Keynesian Phillips Curve?
0730 ALFREDO MARTÍN-OLIVER AND VICENTE SALAS-FUMÁS: How do intangible assets create economic value? An application to banks.
0731 REBECA JIMÉNEZ-RODRÍGUEZ: The industrial impact of oil price shocks: Evidence from the industries of six OECD countries.

---

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

0732 PILAR CUADRADO, AITOR LACUESTA, JOSÉ MARÍA MARTÍNEZ AND EDUARDO PÉREZ: El futuro de la tasa de actividad española: un enfoque generacional.

0733 PALOMA ACEVEDO, ENRIQUE ALBEROLA AND CARMEN BROTO: Local debt expansion… vulnerability reduction? An assessment for six crises-prone countries.

0734 PEDRO ALBARRÁN, RAQUEL CARRASCO AND MAITE MARTÍNEZ-GRANADO: Inequality for wage earners and self-employed: Evidence from panel data.

0735 ANTÓN NÁKOV AND ANDREA PESCATORI: Oil and the Great Moderation.

0736 MICHIEL VAN LEUVENSTEIJN, JACOB A. BIKKER, ADRIAN VAN RIXTEL AND CHRISTOFFER KOK-SØRENSEN: A new approach to measuring competition in the loan markets of the euro area.

0737 MARIO GARCÍA-FERREIRA AND ERNESTO VILLANUEVA: Employment risk and household formation: Evidence from differences in firing costs.

0738 LAURA HOSPIDO: Modelling heterogeneity and dynamics in the volatility of individual wages.

0739 PALOMA LÓPEZ-GARCÍA, SERGIO PUENTE AND ÁNGEL LUIS GÓMEZ: Firm productivity dynamics in Spain.

0740 ALFREDO MARTÍN-OLIVER AND VICENTE SALAS-FUMÁS: The output and profit contribution of information technology and advertising investments in banks.

0741 ÓSCAR ARCE: Price determinacy under non-Ricardian fiscal strategies.

0801 ENRIQUE BENITO: Size, growth and bank dynamics.

0802 RICARDO GIMENO AND JOSÉ MANUEL MARQUÉS: Uncertainty and the price of risk in a nominal convergence process.

0803 ISABEL ARGIMÓN AND PABLO HERNÁNDEZ DE COS: Los determinantes de los saldos presupuestarios de las Comunidades Autónomas.

0804 OLYMPIA BOVER: Wealth inequality and household structure: US vs. Spain.

0805 JAVIER ANDRÉS, J. DAVID LÓPEZ-SALIDO AND EDWARD NELSON: Money and the natural rate of interest: structural estimates for the United States and the euro area.

0806 CARLOS THOMAS: Search frictions, real rigidities and inflation dynamics.

0807 MAXIMO CAMACHO AND GABRIEL PEREZ-QUIROS: Introducing the EURO-STING: Short Term INdicator of Euro Area Growth.

0808 RUBÉN SEGURA-CAYUELA AND JOSEP M. VILARRUBIA: The effect of foreign service on trade volumes and trade partners.

0809 AITOR ERCE: A structural model of sovereign debt issuance: assessing the role of financial factors.

0810 ALICIA GARCÍA-HERRERO AND JUAN M. RUIZ: Do trade and financial linkages foster business cycle synchronization in a small economy?

0811 RUBÉN SEGURA-CAYUELA AND JOSEP M. VILARRUBIA: Uncertainty and entry into export markets.

0812 CARMEN BROTO AND ESTHER RUIZ: Testing for conditional heteroscedasticity in the components of inflation.

0813 JUAN J. DOLADO, MARCEL JANSEN AND JUAN F. JIMENO: On the job search in a model with heterogeneous jobs and workers.

0814 SAMUEL BENTOLILA, JUAN J. DOLADO AND JUAN F. JIMENO: Does immigration affect the Phillips curve? Some evidence for Spain.

0815 ÓSCAR J. ARCE AND J. DAVID LÓPEZ-SALIDO: Housing bubbles.

0816 GABRIEL JIMÉNEZ, VICENTE SALAS-FUMÁS AND JESÚS SAURINA: Organizational distance and use of collateral for business loans.

0817 CARMEN BROTO, JAVIER DÍAZ-CASSOU AND AITOR ERCE-DOMÍNGUEZ: Measuring and explaining the volatility of capital flows towards emerging countries.

0818 CARLOS THOMAS AND FRANCESCO ZANETTI: Labor market reform and price stability: an application to the Euro Area.

0819 DAVID G. MAYES, MARÍA J. NIETO AND LARRY D. WALL: Multiple safety net regulators and agency problems in the EU: Is Prompt Corrective Action partly the solution?

0820 CARMEN MARTÍNEZ-CARRASCAL AND ANNALISA FERRANDO: The impact of financial position on investment: an analysis for non-financial corporations in the euro area.

0821 GABRIEL JIMÉNEZ, JOSÉ A. LÓPEZ AND JESÚS SAURINA: Empirical analysis of corporate credit lines.

0822 RAMÓN MARÍA-DOLORES: Exchange rate pass-through in new Member States and candidate countries of the EU.

0823 IGNACIO HERNANDO, MARÍA J. NIETO AND LARRY D. WALL: Determinants of domestic and cross-border bank acquisitions in the European Union.

0824 JAMES COSTAIN AND ANTON NAKOV: Price adjustments in a general model of state-dependent pricing.

0825 ALFREDO MARTÍN-OLIVER, VICENTE SALAS-FUMÁS AND JESÚS SAURINA: Search cost and price dispersion in vertically related markets: the case of bank loans and deposits.

BANCO DE **ESPAÑA**
Eurosistema

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