EXPLOITING OLD CUSTOMERS AND ATTRACTING NEW ONES: THE CASE OF BANK DEPOSIT PRICING

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Abstract: Economic theory has identified switching costs as potentially important factor in explaining the pricing of products or services. Applied to the banking industry, recent theoretical contributions suggest that deposit interest rates should be more attractive to customers in areas characterized by greater in-migration and should be less attractive to customers of banks that have greater numbers of locked-in depositors. Empirical evidence on the first to these propositions has been quite limited, and on the second of these points it has been nonexistent. In this paper, we seek to test both of these propositions by using data that allow as to distinguish between a bank’s new depositors and those that may be regarded as “locked in.” To obtain more efficient estimates, our empirical test entails joint estimation of an equation explaining the extent to which banks generate new deposit accounts and an equation explaining deposit rates. The analysis is applied to a rich data set obtained for the Spanish banking industry. Results confirm that, all else equal, banks offer higher deposit rates in territories characterized by greater in-migration, and also that they tend to offer lower rates, the larger the number of their locked-in depositors.

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1. Introduction

For many products and services, consumers who have purchased from one firm incur costs (either real or psychic) if they switch to the products or services of another, and it has long been recognized that such “switching costs” can have important implications for the pricing of products or services. The nature of those implications has been the subject of a vast theoretical literature, but studies that seek to apply data to the issue of firm behavior in the presence of switching costs have been much rarer.

Recently, a few studies –most of them using data from the United States banking industry- have sought to test the pricing implications of switching costs by exploiting the following identifying assumption: while existing customers incur switching costs to change accounts from one bank to another, in-migrants into an area do not face (or are less likely to face) switching costs relevant to their choice of bank. This assumption, combined with the presumption that customers require some local access to the branches of a bank, yields, among other things, the testable implication that prices should be more attractive to customers in areas characterized by greater in-migration.

Three studies report evidence consistent with this implication of switching costs. The first, by Sharpe (1997), employed data on deposits rates offered by 222 U.S. banks in the early 1980s, together with data on the proportion of new “movers” in each of 105 metropolitan areas as calculated from an earlier period and extrapolated to the 1980s. Using a pooled time series of 5 annual cross sections (and adjusting for time effects), Sharpe found that, consistent with predictions, the proportion of household migration in a metropolitan area has a positive (pro-competitive) effect on deposit rates, all else equal. Since deposit rates are paid to customers rather than by customers, this is equivalent to a
finding of lower prices in areas characterized by greater in-migration, in the more typical case in which the price is paid by the customer to the firm.

Hannan, et. al., (2003) also employed a measure of migration in their investigation of the decision by U.S. banks to levy a surcharge for the use of their automated teller machines (ATMs) by non-depositors. Although not the primary focus of their paper, they report that banks in local markets with higher levels of in-migration are more likely to impose a surcharge—a finding consistent with the hypothesis that ATM surcharges, because they can attract rather than repel new depositors,\(^1\) are more likely to be imposed in areas where a greater proportion of the population can be more readily attracted.

A much larger study that is more focused on the relationship between in-migration (as well as out-migration) and bank pricing was reported recently by Hannan (2008). Using a sample of over 13,000 U.S. banks observed annually from 1989-2006, Hannan finds that banks tend to offer higher deposit rates in areas and at times characterized by greater in-migration. Hannan also reports that banks tend to offer lower deposit rates in areas and at times characterized by greater out-migration, all else equal—a finding consistent with the hypothesis that banks find it in their interest to offer less attractive deposit rates to attract new depositors, the shorter the period that new depositors are expected to remain with the bank. The effect on deposit rates of the interaction between in-migration and out-migration, as implied by this hypothesis, is also supported by the results.

\(^1\) The reason is that depositors typically do not pay surcharges for the use of their own bank’s ATMs, making it more desirable to open an account at a bank with many ATMs if it is surcharging.
There are also empirical studies dealing directly or indirectly with measures of switching costs. Kim et al. (2003) explore the impact of switching costs on the Norwegian banking industry from 1988 to 1996. The empirical estimations of switching costs are derived from a multiperiod model of customers’ transition probabilities. This model also indirectly estimates a lock-in effect as the estimated impact of the t−1 market share on the firm’s current market share. The results suggest that more than a quarter of the customer’s added value is attributed to the lock-in phenomenon generated by switching costs. Other studies have only indirectly offered some evidence on the relevance of switching costs on related areas such as payment systems. Ausubel (1991) provides some information that switching costs may explain the high interest rates on credit card balances, and Stango (2002), using variables related to switching, finds that switching costs have a significant impact on pricing in that market.

In this paper, we derive from theory and test the pricing implications of switching costs using data applying to the Spanish banking industry. We claim several contributions that stem from this effort. It is the first study to estimate the relationship between prices and the extent of in-migration in the case of firms outside of the U.S. banking industry. More importantly, data available for the Spanish banking industry (and not for the U.S. banking industry) allow us to go much further in testing some of the pricing implications of switching costs. The primary reason is that data routinely reported for Spanish banks distinguishes between new and old deposit accounts. This means that a fundamental prediction of more recent contributions to the theory of switching costs—that firms with a larger number of “locked-in” customers, all else equal, charge higher prices—can for the first time be explicitly tested. As discussed in more
detail below, it also means that underlying relationships can be more efficiently estimated, since an equation explaining the extent to which banks generate new account can be estimated along with a price equation to obtain more precision in underlying estimates.

The plan of the paper is as follows: Section 2 describes the theory employed and derives the pricing implications of switching costs to be tested. Section 3 presents the empirical model and discusses issues of estimation. Section 4 describes the Spanish data, while section 5 presents estimation results. A final section concludes. Consistent with predictions, we find strong evidence that, all else equal, banks located disproportionately in areas with greater levels of in-migration offer higher deposit rates, and banks with greater numbers of locked in depositors offer lower deposit rates.

2. The Theory

The theoretical literature on switching costs is vast, and we refer the reader to Klemperer (1995) and Farrell and Klemperer (2006) for extensive reviews of it. A common feature of this literature has been the two-period model, wherein customers are “locked in” during the second period, and firms complete to attract them during the first period. While the two-period assumption has proved to be useful in analyzing certain questions relevant to firm pricing, it is less useful for analyzing competition over many periods when new customers are entering the market in every period, some old customers are leaving, and firms are unable to discriminate between new and old customers. Because the empirical environment that we wish to explore contains all three of these
elements, we will employ as a frame of reference in this paper a multi-period model of

Our application of this model to the banking industry proceeds as follows: In the
\( n \)th period of the multi-period model, assume initially that bank \( i \) operates only in local
market \( m \) and prices to maximize total discounted future profits, represented by

\[
V_i = (r_i^t - r_d^t)[x_{im}^t + \text{new}_{im}^t Z_{im}^t(r_d^t, r_d^t, \ldots)] + \partial V_i^{\text{shift}}[\rho_m^{\text{shift}}(x_i + \text{new}_{im}^t Z_{im}^t(r_d^t, r_d^t, \ldots))] 
\]

where \( V_i \) denotes the discounted future profits of bank \( i \) at time \( t \), \( r_i^t \) denotes the rate that
banks can earn at time \( t \) by investing deposit funds in securities, \( r_d^t \) denotes the rate that
bank \( i \) offers depositors for deposits at time \( t \), \( r_d^t \) denotes the deposit rate offered by rival
bank \( j \), \( x_{im}^t \) denotes the number of firm \( i \)'s locked-in depositors in market \( m \) at time \( t \), each
of which is assumed to have one unit of deposits per period, \( \text{new}_{im}^t \) represents the number
of new customers entering the market at period \( t \), \( \rho_m^{\text{shift}} \) represents the proportion of
depositors in the market \( m \) at period \( t \) that survive to period \( t+1 \), \( \delta \) denotes a discount
factor, defined as the reciprocal of 1 plus the discount rate, and \( Z_{im}^t(r_d^t, r_d^t, \ldots) \) represents
bank \( i \)'s share of market \( m \)'s new customers, assumed to be a positive function of bank \( i \)'s
deposit rate, a negative function of rival bank \( j \)'s deposit rate, and potentially a function
of other characteristics, to be discussed below.

For simplicity, we do not model the bank’s loan pricing decision. We assume
instead that banks hold some securities in their portfolios and that these are perfectly
elastically supplied. This common assumption means that both deposit rates and loan
rates are determined in part by the exogenous security rate, and that deposit pricing and loan pricing can be treated as separable.\(^2\)

The first term on the right-hand side of (1) represents “current” period-\(t\) profits, defined as the gain earned on a unit of deposits, \((r'_i - r'_{d,i})\), multiplied by the number of depositors (each with one unit of deposits). The number of depositors is divided between “locked-in” depositors \((x'_{i,m})\) and the number of new depositors choosing bank \(i\) at time \(t\), or \(\text{new}_t Z'_m(r'_{d,j}, r'_{d,j}, \ldots)\), the number of new customers moving into the market, multiplied by share of them that choose bank \(i\). The second term in (1) reflects the discounted value of future profits at time \(t+1\), \(V'_{i+1}\), which is a function of the number of customers that become locked in at time \(t\) (including new depositors attracted at time \(t\)), multiplied by \(\rho^{t+1}_m\), the proportion of depositors in market \(m\) that “survive” to time \(t+1\).

To make the model more relevant to an empirical examination, we must consider in more detail the determinants of the share of new customers that choose bank \(i\), as express by \(Z'_m(r'_{d,j}, r'_{d,j}, \ldots)\) above. To make their model tractable, Beggs and Klemperer (1992) assume two firms that face each other at the opposite ends of a uniformly populated line. This implies that, beyond the prices that firms charge, a large firm has no advantage over a small one in attracting new customers. This is probably not true for most industries, and it would certainly not be true of the banking industry, where the most observable, and probably most important, distinction between large and small firms is the greater number of branch location offered by larger firms.

To account for this issue, we will redefine \(Z'_m(r'_{d,i}, r'_{d,i}, \ldots)\) as

\[
Z'_m = b_{i,m} \text{share}_{i,m} (r'_{d,j}, r'_{d,j})
\]

\(^2\) See Klein (1971) for a fuller discussion.
where \( \text{brshare}_i^m \) represents bank \( i \)'s share of total branches in market \( m \) at time \( t \), and 
\( g_m^{t}(r_{d,i}, r_{d,j}) \), which may be thought of as the ratio of new customer share to branch share
in market \( m \), is some function that is increasing in bank \( i \)'s deposit rate and decreasing in rival bank \( j \)'s deposit rate. This treatment assumes (quite plausibly, in our opinion) that, given deposit rates, the share of new customers that open accounts at bank \( i \) rises proportionately with the bank’s share of branch locations in the market.

Substitutions of (2) into (1) and differentiation with respect to \( r_{d,i} \) yields the first-order condition:

\[
-x_{im}^{t} + (\text{brshare}_{im}^{t}, \text{new}_{im}^{t}) \cdot g_{im}^{t}(r_{d,i}, r_{d,j}, \ldots) + (r_{d,i} - r_{d,j}) \frac{\partial g_{im}^{t}}{\partial r_{d,i}} \cdot \delta_{im}^{t} + \delta V_{t+1}^{r_{d,i}}(\text{brshare}_{im}^{t}, \text{new}_{im}^{t}) \frac{\partial g_{im}^{t}}{\partial r_{d,i}} = 0. \tag{3}
\]

This condition implies that the loss in current-period profits resulting from a one unit increase in the deposit rate offered locked-in depositor, \( -x_{im}^{t} \), must equate with the sum of the current-period gain from attracting new depositors (the second term in (3)) and the gain in discounted future profits that results from attracting new depositors in the current period (the third term in (3)).

Given second-order conditions for maximization, it follows that an exogenous increase in the number of locked-in customers (\( x_{im}^t \)) will cause optimal deposit rates to decline, as the tradeoff between exploiting locked-in customers and attracting new ones shifts in favor of exploiting locked-in customers, while an exogenous increase bank \( i \)'s attractiveness to new customers as a result of location (\( \text{brshare}_{im}^{t}, \text{new}_{im}^{t} \)) would cause an

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3 Assuming that the discounted value of future profits at time \( t+1 \) is increasing in the number of depositors at time \( t+1 \), or \( V_{t+1}^{r_{d,i}}(\cdot) > 0 \), the third term is positive. The second term is positive if the term in brackets, which is in essence period \( t-1 \) marginal revenue, is positive.

4 In the interest of simplicity, formal comparative statics are not presented. This may be seen by noting that, with an increase in \( x_{im}^t \), the expression on the left-hand side becomes more negative, requiring a reduction in bank \( i \)'s deposit rate to restore it to zero.
optimal increase in deposit rates, as this tradeoff shifts in favor of attracting new
customers. Similar reasoning implies that an increase in the security rate \( (r'_s) \), an increase
in the proportion of depositors in market \( m \) that “survive” to time \( t+1, \rho^{t+1}_m \), and an
increase in the discount factor \( (\delta) \) all result in an increase in bank \( i \)’s optimal deposit
rate.

While (3) refers to the case in which bank \( i \) operates only in one market, most
commercial and savings banks in Spain operate in numerous areas that we will call
markets. For such firms, data on deposit rates and the number of locked-in customers
cannot be determined for individual markets, making an aggregation across markets
necessary. Because of this, we revise (1) to account explicitly for the summation of
profits earned in all the markets in which bank \( i \) operates:

\[
V_i = (r'_i - r'_{d,j}) \sum_m [x'_m + \text{new'}_m Z'_m (r'_{d,j}, r'_{d,j}, \ldots)] + \delta V'_i \sum_m [\rho^{t+1}_m (x'_i + \text{new'}_m Z'_m (r'_{d,j}, r'_{d,j}, \ldots))] \tag{1'}
\]

There is strong evidence that such banks tend to offer the same deposit rates in all the
areas in which they operate.\(^5\) This being the case, we posit that this uniform deposit rate
is chosen to maximize \((1')\), yielding the revised first-order condition:

\[
-x'_i + \sum_m (\text{brshare'}_m \text{new'}_m) [-g'_m (r'_{d,i}, r'_{d,j}, \ldots) + (r'_i - r'_{d,i}) \frac{\partial g'_m}{\partial r'_{d,i}} + \delta V'_i (\rho^{t+1}_m \frac{\partial g'_m}{\partial r'_{d,i}}) = 0 \tag{3'}
\]

Note that since \( x'_i = \sum_m x'_m \), it is defined as the number of locked-in customers of the bank
as a whole, rather than the number residing in a specific market. If the expression in
brackets does not differ markedly across the markets in which bank \( i \) operates, then the
expression \( \sum_m \text{brshare'}_m \text{new'}_m \) can be used as a rough multimarket measure of the bank’s
attractiveness to new customers as a result of location. With no data on the terms that

\(^5\) This is shown, \textit{inter alia}, in Jaumandreu and Lorences (2002) and Carbó \textit{et al.} (2003).
make up this expression, we must assume this to be the case, with the understanding that
the more this expression varies across markets, the more problematic this measure will
be.\(^6\)

Equation (3’) in particular highlights the “tension” between the pricing
implications of two aspects of firm size. By virtue of their greater number of locked-in
customers (\(x_i\)), one would expect larger firms to offer a higher price (lower deposit rate
in this application). However, by virtue of the nonprice advantages that larger firms may
have in attracting new customers (locational advantages in this application), one would
expect larger firms to offer lower prices (higher deposit rates in this application). It is
interesting to note in this context the prediction by Beggs and Klemperer (1992) and
Klemperer (1995) that larger firms find it in their interest to charge higher prices. The
reason for this prediction is that in the Beggs and Klemperer model, larger firms differ
from smaller one only with respect to the number of locked in customers that they have
and are assumed to have no inherent advantage in attracting new customers. In the
context of the Spanish banking industry, we seek to test this and other implications using
empirical proxies for the number of locked in customers of banks and for the nonprice
advantages that banks have in attracting new customers.

3. The Test

We propose to test the pricing implications of switching costs, as derived above,
by estimating the following relationships:

\(^6\) The issue is whether the expression in brackets can be factored out of the summation, so that the second
term in (3’) becomes \(\sum_{m} \text{brshare}_m \text{new}_m\). It is easily shown that the less the market-specific values of the
expression in brackets diverge from the mean across markets, the closer the second term in (3’) approximates this functional form.
\[ \ln(r'_{it}) = \beta_0 + \beta_1 \ln(oldaccts_{it}) + \beta_2 \ln(inmigbr_{t-1}) + \beta_3 \ln(ta_{t-1}) + \beta_4 \ln(mktgdp_{t-1}) + \nu^i_t + \mu^i_t + \epsilon^i_t, \tag{4} \]

which assumes a log-linear functional form and expresses the bank’s deposit rate as a function of the current number of “old accounts,” denoted \textit{oldaccts}, a variable calculated as the lagged value of the of the product of it’s branch share in each market and immigration into the market, summed over all the markets in which the bank operates (denoted \textit{inmigbr}_{t-1}), the lagged value of the total assets of the bank (\textit{ta}_{t-1}), and a variable indicating the lagged value of a weighted average of the gross domestic product of the markets in which the bank operates (denoted \textit{mktgdp}_{t-1}). The symbol \( \nu^i_t \) denotes a time-specific fixed effect, \( \mu^i_t \) denotes a bank-specific fixed effect, and \( \epsilon^i_t \) denotes an idiosyncratic error term.

The number of old accounts of the bank (\textit{oldaccts}) is designed to proxy the number of locked-in customers (denoted \textit{x}^i_t above), while \textit{inmigbr} is the measure of \( \sum brshare_{i,m}'_{new}'_m \), defined above. The above considerations yield the predictions:

\[ \beta_1 < 0 \text{ and } \beta_2 > 0. \]

Note from (4) that, because differences in bank size can be associated with differences in deposit rates for reasons unrelated to the number of locked-in customers or locational advantage in attracting new depositors, a variable measuring the banks total assets is included to account for the collective influence of these other size-related considerations. The measure of market gross domestic product (\textit{mktgdp}) is also included to account for differences in product demand and market size over time.

An advantage of the data set to be employed is that it also indicates the number of new accounts that the bank has attracted in a current period of time. We have assumed that the share of new depositors that a bank \( i \) obtains in market \( m \) may be expressed as
\[ Z_m' = \text{brshare}_{im}^m \cdot g_{im}^m(r_{d,i}'^m, r_{d,j}'^m). \]

Multiplying this by the number new depositors migrating into market \( m \) and then summing over all the markets in which bank \( i \) operates yields

\[ \text{newaccts}_i^t = \sum_m \text{new}_{im}^t \cdot \text{brshare}_{im}^m \cdot g_{im}^m(r_{d,i}'^m, r_{d,j}'^m), \]

where \( \text{newaccts}_i^t \) denotes the number of new accounts obtained by bank \( i \) at time \( t \). We again propose to employ the expression \( \sum_m \text{new}_{im}^t \cdot \text{brshare}_{im}^m \) as a separate variable under the assumption that market-specific values of \( g_{im}^m(r_{d,i}'^m, r_{d,j}'^m) \) do not differ too markedly across the markets in which bank \( i \) operates. Assuming a log linear functional form, we propose to estimate this relationship as

\[
\ln(\text{newaccts}_i^t) = \alpha_0 + \alpha_1 \ln(\text{inmigbr}_{i}^{t-1}) + \alpha_2 \ln(\text{inmigbr}_{i}^{t-1}) + v_i^t + \mu_i^2 + e_i^2, \quad (5)
\]

where \( v_i^t \) denotes a time-specific fixed effect, \( \mu_i^2 \) denotes a bank-specific fixed effect, \( e_i^2 \) denotes an idiosyncratic error term, and all other terms are as previously defined. Note that in this estimating equation, explanatory variables are lagged because, in the data to be employed, accounts are designated as “new” several months after they are booked. Because the number of new accounts obtained by a bank should increase with greater representation of the bank in markets that experience greater in-migration, increase with the bank’s deposit rate, and decrease with the deposit rates offered by rivals, it follows that

\[ \alpha_1 > 0 \text{ and } \alpha_2 > 0. \]

Two main caveats determine the selection of our estimation method. First, endogeneity is a potential concern in estimating these equations, particularly in the case of equation (5), which regresses a quantity, \( \text{newaccts}_i^t \), on, among other things, the price of that quantity. Secondly, cross-equation relationships are present, since the log of deposits
interest rates, $\ln(r_{ij})$ enters equation (4) as a dependent variable and also enters equation (5) as an explanatory factor within the term $\ln(r_{ij}^t/r_{ij}^{t-1})$. To obtain efficient estimates and address the issue of endogeneity, we propose to estimate (4) and (5) jointly using 3-stage least squares (3SLS) with fixed effects and time dummies.

With the exception of $\ln(oldaccts_{ij})$, which by definition reflects decisions made prior to time $t$, all explanatory variables in (4) and (5) are lagged. Lagged values of these explanatory variables (ie., variables lagged an additional period) are used as instruments. Focusing for a moment on the estimation of (4), this treatment eliminates perhaps the most obvious source of endogeneity, but, as is well understood, it does not eliminate all such sources if errors are correlated over time. The primary concern here is that some unmeasurable aspect of the environment in which banks operate is associated with the bank’s deposit rates as well as the variables measuring the number of “old accounts” and the extent of migration into the markets in which the bank operates. Our primary defense is to include market-specific measures which control for those otherwise unmeasurable aspects of the change in markets over time. The measure of lagged market gross domestic product ($gdp_{t-1}$) is included in equation (4) for that purpose. We have also included measures of market population, population density, percentage of urban population, total employment, and regional unemployment rates (not reported) with no material difference to the results reported below.

In assessing the potential for endogeneity in the estimates of (5), the primary concern is that unmeasurable characteristics of the market or bank are associated with the number of new accounts that a bank is able to attract, as well as with its deposit rate relative to the deposit rates of its rivals or with the extent of in-migration into the markets
in which the bank operates. In addition to using an additional lag of the explanatory values as instruments, we also employ as instruments in estimating (5) the total assets of the bank, the average gross domestic product of the markets in which the bank operates, and the ratio of the size of the bank to the average size of the banks that operate in the same markets as the bank.

The 3SLS procedure is a combination of a two-stage least squares (2SLS) and a seemingly-unrelated regression (SUR estimation). In the first stage of the three-stage procedure, the endogenous variables are regressed on all the exogenous variables in the system. In the second stage, the fitted values of the endogenous variables are used to obtain two-stage least-squares parameter estimates for all equations in the system. In the third stage, generalized least-squares estimates are obtained taking into account cross-equation correlation among the disturbance terms (Zellner and Theil, 1962; Wooldridge, 2002). The objective function for three stage least squares is the sum of squared transformed fitted residuals, and the estimates are obtained by estimating equations (4) and (5) simultaneously with a diagonal covariance matrix of the disturbances across equations.

4. The data

The data consist of semiannual information on 65 banks (29 commercial banks and 46 savings) banks in Spain during 1986:1-2003:2, resulting in a balanced panel of 2,700 observations, less exclusions due to the use of lagged variables. These banks represent an average of 92% of total bank assets in Spain during that period. The data have been obtained from balance sheet, income statement, and memo and report items
provided by the Spanish Banks Association (AEB) and the Spanish Savings Banks Confederation (CECA). Data on in-migration in the 52 provinces of Spain have been obtained from the National Statistical Office (INE). The main definitions and summary statistics for variables employed in the empirical study are shown in Table 1.

A fundamental presumption is that conditions pertaining to the provinces in which each bank operates are relevant to the bank’s pricing behavior and the number of new accounts that it registers. Area-specific variables, such as the extent of immigration and GDP, are aggregated to the level of the bank by using the territorial distribution of branches of the bank as a weighting factor. Measures of the number of old “locked-in” depositors, bank total assets, and deposit rates, are all calculated using data that apply to the bank as a whole. In the sample periods, several bank mergers took place. In order to get a balanced panel and to concentrate the analysis on the relationship between deposit rates, in-migration and locked-in customers, data for merging banks correspond to a pro-forma combination of merging institutions in the years prior to the merger.

For a number of reasons, the Spanish banking sector provides a good “laboratory” for research on locked-in depositors, immigration and deposit interest rates. First, information is available on the number of new and old deposit accounts, and this allows us to distinguish between new and old (‘locked-in’) customers. Secondly, commercial and savings banks have fiercely competed to attract new customers. With the lifting of branching restrictions in 1989, which permitted savings banks to open branches outside their original territories, commercial and savings banks started the so-called “super-accounts price war” in the deposit market. During the 1990s and the early 2000s, it has been demonstrated that Spanish banks priced their deposits below their marginal costs in
a loss-leader behavior that aimed to attract new depositors. During the period, there has been a great deal of variation in the evolution of interest rates, mainly as a consequence of monetary policy decisions (including Spain’s entry into the European Monetary Union).

5. The results

Table 1 presents variable definitions and summary statistics, while remaining tables present econometric results. As indicated, the period from 1986 to 2003 was one of generally declining interest rates. Other variables exhibited increases over the period, with total assets (ta) showing a particularly sharp increase.

Table 2 presents econometric results obtained using both two-stage least squares (2SLS) and three-stage least squares (3SLS) for the full sample of both commercial banks and savings banks. The second and third columns of table 2 report the results of estimations of equations (4) and (5), respectively, using 3SLS, while, to assess robustness, the final two columns report equivalent estimations using 2SLS.

Note first that in the “deposit rate” regression estimated as part of the 3SLS estimation and presented in the second column, the coefficients of both ln(oldaccts) and ln(inmigbrt−1) bear the hypothesized signs and are highly significant, suggesting that banks with more locked-in depositors offer lower deposit rates and banks located in areas exhibiting more in-migration offer higher deposit rates, all else equal. Coefficient magnitudes suggest that a 10 percent rise in the number of “locked-in” accounts would cause the deposit rate to decline by about 1.2 percent, while a 10 percent increase in

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7 The loss-leader behaviour in deposit markets is a common feature of the EU banking sectors in the last two decades (Maudos and Fernández de Guevara, 2007).
inmigbr_{t-1} would cause the deposit rate to increase by about 1.8 percent. The coefficient of the log of total assets, $ln(ta_{t-1})$, is also positive and highly significant, implying that unidentified aspects of bank size not associated with the number of locked-in deposits or the bank`s locational attractiveness for in-migrants are on average positively associated with the bank`s deposit rate. The coefficient of the log of market GDP, $ln(mktgdp_{t-1})$, is negative and highly significant, perhaps because an increase in market GDP indexes the supply of deposit Euros to local banking institutions.

Coefficients in the “new accounts” regressions, estimated with 3SLS and presented in the third column, also bear the hypothesized signs and are highly significant. Coefficient magnitudes suggest that a 10 percent increase in $inmigbr_{t-1}$, the variable indicating the attractiveness of the bank to in-migrating customers for reasons of location, is associated with a 2.4 percent increase in the number of new accounts, while a 10 percent increase in the ratio of a bank’s own deposit rate to that of its rivals would be associated with a 10 percent increase in the number of new accounts attracted to the bank.

Thus it appears that the predictions of the model are validated by the observed coefficients in the “new accounts” equation. Our primary interest, however, centers on the coefficients of $ln(oldaccts_i)$ and $ln(inmigbr_{t-1})$ in the “deposit rate” equation, since they relate to the hypothesized roles of locked-in customers and locational attractiveness to new customers in determining the deposit rates that banks choose to offer.

The final two columns in table 2 present the results of estimations obtained using 2SLS rather than 3SLS. As may be seen, results are similar. Results are qualitatively similar to those obtained using 3SLS. It is interesting to note, however, that, especially in the case of the coefficients of primary interest, magnitudes tend to be somewhat larger,
and standard errors tend to be somewhat smaller, in the case of the 3SLS estimations, suggesting that it is of some importance to account for covariances across equation disturbances.

Because the full sample is composed of both commercial banks and savings banks, table 3 reports 3SLS results obtained separately for each type of institution. As indicated, coefficients bear the predicted signs and are statistically significant for both commercial banks and savings banks. Coefficient magnitudes, however, tend to be smaller in the case of savings banks. This difference may be due to the fact that savings banks operate, on average, in fewer provinces. Thus they may not always be able to exploit in-migration advantages as most commercial banks do.

In an alternative breakdown of the sample, table 4 reports 3SLS results obtained for each of two subsamples, one applying to all banks the period 1989-1995 and the other applying to all banks for the period 1996-2003. For both subsamples, the coefficients of primary interest bear the hypothesized signs and are highly significant. Coefficient magnitudes, however, are different in the case of $\ln(\text{oldaccts}_t)$ and $\ln(\text{inmigbr}_{t-1})$. In the tradeoff between exploiting old customers and attracting new ones, as expressed by these coefficients, capturing new customers appears to have taken on greater weight in the later period. This may be related to the fact that the later period was one of substantially greater in-migration, causing more banks to consider the implications of in-migration in their pricing decisions.

In a final breakdown, table 5 presents results obtained for those institutions that operate in less than 10 provinces, 10 to 25 provinces, and in more than 25 provinces. This breakdown closely corresponds to a breakdown by size below and over the median
total assets (not shown). Again, the coefficients of interest bear the hypothesized signs and are statistically significant in all three subsamples. A rather stark difference in coefficient magnitudes appears in the coefficient of \( \ln(\text{inmigbr}_{t-1}) \) in the “new accounts” equation. The number of new accounts appears to be much more responsive to changes in in-migration for larger banks operating in more provinces. A possible explanation for these differences in that larger banks operating in more provinces enjoy a wider range of choices for location and therefore a higher probability of being located in the provinces where in-migration offers more opportunities to banks. Another possible explanation is that small banks operating in few provinces may benefit from informational privileges on their borrowers, and that the value of the informational privilege is inversely related to the value of switching costs, as suggested by Vesala (2007).

6. Conclusions

In this paper, we have derived and tested the pricing implications of switching costs using data from the Spanish banking industry. Of the two findings that we consider most important, one confirms results reported previously by researchers using data from the US banking industry, and one confirms results predicted in the literature but, to our knowledge, never before subjected to empirical testing. First, we find strong evidence that banks located disproportionately in areas with high levels of in-migration offer higher deposit rates, all else equal. Second, and unique to this study, we find that banks with more locked-in customers offer lower deposit rates, all else equal. These two findings confirm the existence of the tradeoff much emphasized in recent theories of pricing in the presence of switching costs—the tradeoff between exploiting old customers...
and attracting new ones. This tradeoff implies that banks located in area with much in-
migration and that have fewer locked-in depositors will tend to offer higher rates, while
banks not located in areas with substantial in-migration and that have more locked-in
customers will offer lower deposit rates.

Because the Spanish banking data allows us to distinguish between new and old
deposit accounts, we also estimate the relationship between new account formation and
its determinants, and here too we find results consistent with predictions. By estimating
the resulting two-equation empirical model using three-stage least squares, and thereby
accounting for correlation of errors across equations, we report greater precision in most
coefficient estimates than that obtained with simple two-stage least squares.

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differenciation and many firms (an application to the Spanish loans market), European


Table 1. Variable definition and summary statistics

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( r'_{d,i} )</td>
<td>0.0655</td>
<td>0.0774</td>
<td>0.0738</td>
<td>0.0545</td>
<td>0.0280</td>
<td>0.0296</td>
<td>0.0547</td>
<td>0.020</td>
</tr>
<tr>
<td>( newaccts_t )</td>
<td>23,126</td>
<td>29,491</td>
<td>30,250</td>
<td>27,303</td>
<td>31,891</td>
<td>33,977</td>
<td>29,340</td>
<td>4,920</td>
</tr>
<tr>
<td>( oldaccts_t )</td>
<td>672,980</td>
<td>782,814</td>
<td>839,040</td>
<td>820,923</td>
<td>897,355</td>
<td>946,893</td>
<td>826,668</td>
<td>93,139</td>
</tr>
<tr>
<td>( inmigbr_t )</td>
<td>31,126</td>
<td>36,505</td>
<td>43,344</td>
<td>53,280</td>
<td>63,242</td>
<td>75,619</td>
<td>50,519</td>
<td>15,726.7</td>
</tr>
<tr>
<td>( ta )</td>
<td>2,035,643</td>
<td>3,525,126</td>
<td>5,695,663</td>
<td>7,434,062</td>
<td>10,266,125</td>
<td>14,403,233</td>
<td>7,226,643</td>
<td>4,234,103</td>
</tr>
<tr>
<td>( \ln(mktgdp_{t-1}) )</td>
<td>17.28</td>
<td>17.31</td>
<td>17.37</td>
<td>17.58</td>
<td>17.80</td>
<td>18.02</td>
<td>17.55</td>
<td>0.27</td>
</tr>
</tbody>
</table>

\( r'_{d,i} \) Deposit rate that bank \( i \) offers depositors for deposits at time \( t \). Deposit interest rates are computed as interest expenses divided by total deposits.

\( r'_{d,j} \) Deposit rate offered by rival bank \( j \) for deposits at time \( t \). The rivals' deposits have been computed as an average of the rivals' deposit rates in the provinces where the banks operate using the branches distribution of the bank in those territories as a weighting factor.

\( newaccts_t \) Total number of new deposit accounts opened in period \( t \).

\( oldaccts_t \) Total number of old deposit accounts (‘lock-in’ customers) in period \( t \).

\( inmigbr_t \) A relative measure of in-migration, calculated as the summation across all the “markets” in which a bank operates of the product of it’s branch share in each market and in-migration (new population) into the market in period \( t \).

\( ta \) Total assets, a proxy for bank size.

\( \ln(mktgdp_{t-1}) \) Logarithm of “market” GDP in real terms, computed as an average of the GDP in the provinces where the banks operate using the branches distribution of the bank in those territories as a weighting factor.
Table 2. Simultaneous equations results. All banks
Bank level fixed and time effects included in all the equations
(estimates for the time dummies not shown for simplicity)
Standard errors (clustered at the firm level) in parenthesis

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>All banks (3SLS)</th>
<th>All banks (2SLS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ln($r_{d,i}'$)</td>
<td>ln(newaccts$_i$)</td>
</tr>
<tr>
<td>$\beta_0$</td>
<td>-0.001***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td></td>
</tr>
<tr>
<td>ln(oldaccts$_i$)</td>
<td>-0.121***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td></td>
</tr>
<tr>
<td>ln(inmigbr$_{i-1}$)</td>
<td>0.176***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td></td>
</tr>
<tr>
<td>ln(ta$_{i-1}$)</td>
<td>0.078***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td></td>
</tr>
<tr>
<td>ln(mktgdp$_{t-1}$)</td>
<td>-1.457***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.048)</td>
<td></td>
</tr>
<tr>
<td>$\alpha_0$</td>
<td>-</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.001)</td>
</tr>
<tr>
<td>ln(inmigbr$_{i-1}$)</td>
<td>-</td>
<td>0.236**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.099)</td>
</tr>
<tr>
<td>ln($r_{d,i}'$/$r_{d,j}'$)</td>
<td>-</td>
<td>1.055***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.129)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.68</td>
<td>0.73</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>1527.8***</td>
<td></td>
</tr>
<tr>
<td>n. observations</td>
<td>2,400</td>
<td>2,400</td>
</tr>
</tbody>
</table>

*** Indicates p-value of 1%
** Indicates p-value of 5%
Table 3. Three stage least squares results.

Commercial and savings banks.
Simultaneous equations estimation

Bank level fixed and time effects included in all the equations (estimates for the time dummies not shown for simplicity)
Standard errors (clustered at the firm level) in parenthesis

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Commercial banks</th>
<th>Savings banks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ln($r'_{d,i}$)</td>
<td>ln(newaccts$_{i}$)</td>
</tr>
<tr>
<td>$\beta_0$</td>
<td>-0.001***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td></td>
</tr>
<tr>
<td>ln(oldaccts$_{i}$)</td>
<td>-0.106***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.031)</td>
<td></td>
</tr>
<tr>
<td>ln(inmigbr$_{i-t-1}$)</td>
<td>0.381***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td></td>
</tr>
<tr>
<td>ln(ta$_{i-t-1}$)</td>
<td>0.024***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td></td>
</tr>
<tr>
<td>ln(mktgdp$_{i-t-1}$)</td>
<td>-1.114***</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.108)</td>
<td></td>
</tr>
<tr>
<td>$\alpha_0$</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.001**</td>
<td></td>
</tr>
<tr>
<td>ln(inmigbr$_{i-t-1}$)</td>
<td>-</td>
<td>1.002***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.181)</td>
</tr>
<tr>
<td>$\ln(r'<em>{d,i}/r'</em>{d,i})$</td>
<td>-</td>
<td>1.270***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.115)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.84</td>
<td>0.61</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>682.5***</td>
<td></td>
</tr>
<tr>
<td>n. observations</td>
<td>928</td>
<td>928</td>
</tr>
</tbody>
</table>

*** Indicates p-value of 1%
** Indicates p-value of 5%

Bank level fixed and time effects included in all the equations
(estimates for the time dummies not shown for simplicity)
Standard errors (clustered at the firm level) in parenthesis

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\ln(r_{d,i}^t)$</td>
<td>$\ln(\text{newaccts}_i)$</td>
</tr>
<tr>
<td>$\beta_0$</td>
<td>-0.001***</td>
<td>-0.001*</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>$\ln(\text{oldaccts}_i)$</td>
<td>-0.248***</td>
<td>-0.102***</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>$\ln(\text{inmigbr}_{t-1})$</td>
<td>0.151***</td>
<td>0.294***</td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>$\ln(\text{ta}_{t-1})$</td>
<td>0.084***</td>
<td>0.075***</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.019)</td>
</tr>
<tr>
<td>$\ln(\text{mktgdp}_{t-1})$</td>
<td>-1.479***</td>
<td>-1.433***</td>
</tr>
<tr>
<td></td>
<td>(0.051)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>$\alpha_0$</td>
<td>-</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.001)</td>
</tr>
<tr>
<td>$\ln(\text{inmigbr}_{t-1})$</td>
<td>-</td>
<td>0.201**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.094)</td>
</tr>
<tr>
<td>$\ln(r_{d,i}^t / r_{d,i}^t)$</td>
<td>-</td>
<td>1.051***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.127)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.74</td>
<td>0.78</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>1699.4***</td>
<td>886.7***</td>
</tr>
<tr>
<td>$n. observations$</td>
<td>1,120</td>
<td>1,120</td>
</tr>
</tbody>
</table>

*** Indicates p-value of 1%
** Indicates p-value of 5%
Table 5. Three stage least squares results.
Simultaneous equations estimation
Bank level fixed and time effects included in all the equations
(estimates for the time dummies are not shown for simplicity)
Standard errors (clustered at the firm level) in parenthesis

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Banks operating in less than 10 provinces</th>
<th>Banks operating in 10-25 provinces</th>
<th>Banks operating in more than 25 provinces</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \ln(r_{d,i}^t) )</td>
<td>( \ln(\text{newaccts}_{d,i}^t) )</td>
<td>( \ln(r_{d,i}^t) )</td>
<td>( \ln(\text{newaccts}_{d,i}^t) )</td>
</tr>
<tr>
<td>( \beta_0 )</td>
<td>-0.001*** (0.001)</td>
<td>-</td>
<td>0.001*** (0.001)</td>
</tr>
<tr>
<td>\ln(\text{oldaccts}_{d,i}) )</td>
<td>-0.010*** (0.002)</td>
<td>-</td>
<td>-0.022*** (0.001)</td>
</tr>
<tr>
<td>\ln(\text{inmigbr}_{d,i}) )</td>
<td>0.022*** (0.004)</td>
<td>-</td>
<td>0.064*** (0.002)</td>
</tr>
<tr>
<td>\ln(\text{ta}_{d,i}) )</td>
<td>0.061** (0.002)</td>
<td>-</td>
<td>0.030*** (0.001)</td>
</tr>
<tr>
<td>\ln(\text{mktgdp}_{d,i}) )</td>
<td>-1.606*** (0.056)</td>
<td>-</td>
<td>-1.237*** (0.042)</td>
</tr>
<tr>
<td>\alpha_0 )</td>
<td>-</td>
<td>-0.001 (0.001)</td>
<td>-</td>
</tr>
<tr>
<td>\ln(\text{inmigbr}_{d,i}) )</td>
<td>-</td>
<td>0.035** (0.002)</td>
<td>-</td>
</tr>
<tr>
<td>\ln(r_{d,i}^t / r_{d,i}^t) )</td>
<td>-</td>
<td>1.363*** (0.014)</td>
<td>-</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.68</td>
<td>0.68</td>
<td>0.72</td>
</tr>
<tr>
<td>( \chi^2 )</td>
<td>965.3***</td>
<td>195.6***</td>
<td>272.1***</td>
</tr>
<tr>
<td>n. observations</td>
<td>1,270</td>
<td>1,270</td>
<td>650</td>
</tr>
</tbody>
</table>

*** Indicates p-value of 1%
** Indicates p-value of 5%