SWITCHING COSTS AND THE EXTENT OF POTENTIAL COMPETITION IN BRAZILIAN BANKING

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Abstract

Switching costs are the leading cause for customer lock-in in banking, reducing the extent of competition and increasing market power of suppliers. This paper tries to estimate the extent of such costs, using a methodology which does not require microdata about customers. The estimates obtained in this study—by using the banks' accounting information collected in a quarterly basis from 2009 to 2011—indicate there are substantial switching costs in the deposit market, and these costs tend to be lower for customers of larger banks. Additionally, there is some evidence that much of a bank's market share is due to its continued relationships with customers over the quarters (lock-in effect). Thus, the extent of potential competition in Brazilian banking could be severely limited by these costs.

Resumo: Custos de mudança são a causa mais importante para a fidelização de consumidores no mercado bancário, o que reduz a competição e aumenta o poder de mercado dos produtores. O presente artigo busca estimar a magnitude destes custos, usando uma metodologia que prescinde de microdados dos consumidores. As estimativas aqui obtidas – a partir de informações contábeis trimestrais entre 2009 e 2011 – indicam que existem elevados custos de mudança no mercado de depósitos bancários, e que estes custos tendem a ser menores para os consumidores de bancos maiores. Adicionalmente, foi encontrada evidência que uma grande parte da participação de mercado de um banco se deve às suas relações continuadas com os consumidores ao longo do tempo. Portanto, a competição potencial no mercado brasileiro de depósitos bancários pode ser fortemente reduzida por estes custos.

Keywords: switching costs, banking, industrial organization

Palavras-Chave: Custos de mudança; setor bancário; organização industrial

JEL Codes: L13; G21

Area 8: Microeconomics, Quantitative Methods and Financial Economics.

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1. Introduction

Even though there are anecdotal and incomplete evidence switching costs are important in the Brazilian banking sector, academic studies regarding the relevance of switching costs are scarce. The present paper aims to fill this gap, by measuring the switching costs in the Brazilian bank deposits' market.

There are some striking examples of the high value of the acquisition of a customer in Brazil. The first one is the existence of the so-called "university accounts", which reduce the customer's bank fees throughout his or hers college education. Another example is the aggressiveness of banks in bidding for the right to manage public institutions' payroll services, and a third one is the requirement, valid until a short time ago, for employees to receive their salary in a bank account defined by the employer.

All these examples point to a market in which customers face a high cost to switch suppliers. These costs increase incentives to capture customers, may confer market power to the incumbent companies and act as a barrier to potential entrants, with important consequences for the competitiveness of the banking sector.

These high switching costs may also explain to some extent the difficulty for new suppliers to gain market share. An example is HSBC, which even being a major global player, has a lower market share in Brazil. Despite being in Brazil since 1997 and have reached the sixth position among the largest banks, HSBC total assets (BRL 146.6 billion) are only 34.0% of the ones of the next one in the ranking (Santander, with BRL 431.8 billion)[3]. The other banks in this ranking are either the institutions already large in the past or those that became so by acquiring of other large institutions – such as HSBC.

The model used to estimate the switching costs, developed by Kim, Kliger and Vale (2003), besides not requiring microdata on individual customers' behavior, also makes possible to estimate some implications for the competitive structure of the market. These implications shed some light on the market power to the largest players derived from the switching costs.

In order to do so, this paper is divided in five sections, including this introduction. The section two presents the methodology for estimating switching costs. The session three presents the dataset and the baseline specification, followed by the discussion of the results in section four. And finally, the session five concludes.

2. Methodology

The methodology used in this work follows the framework developed by Kim, Kliger and Vale (2003). They apply the model to the market of bank loans model, and here the focus will be on the provision of bank deposit services.

The model is formulated to allow estimation of the structural parameters using aggregate data. It is based on the theoretical analysis of the effect of customer's switching costs in the market developed in Klemperer (1987a), with the additional assumption the customer can change banks at every time period.

[3] According to information from December 2011, from the Central Bank of Brazil (Accounting Information from the 50 largest banks).

The model considers an *n* firm oligopoly with price competition (Bertrand), with non-storable goods. Consumers have inelastic total demand and maximize their utilities deciding from which firm to buy, given the charged prices. It is assumed that, when comparing prices, consumers have in mind that the transfer between firms costly only to the extent of an additional cost on top of prevailing prices. This additional cost subsumes all implicit costs of changing suppliers.

The customer's behavior described in the model produces transition probabilities which are functions of prices and switching costs. The aggregation of these transition probabilities generates the demand faced by the firm.

The probability to continue purchasing from the same firm is defined as

$$\Pr_{i\to i,t} = f\left\{p_{i,t}, \vec{\mathrm{p}}_{\mathrm{iR,t}} + \vec{\mathrm{s}}\right\} \tag{1}$$

in which $\Pr_{i\to i,t}$ is the probability that a customer who bought in the previous period from firm *i* keep buying from the same firm in the next period. $p_{i,t}$ is the price charged by firm *i*. $\vec{\mathrm{p}}_{\mathrm{iR,t}}$ is an $(n-1)$ vector of prices offered by rivals other than *i*. And $\vec{\mathrm{s}}$ is a vector of switching costs, equal to the scalar "s" multiplied by a unit vector $(n-1)$: $\vec{s} \equiv s.\vec{I}$. Thus, the equation (1) means that the probability the consumer continues his relationship with the bank depends on the price all banks, taking the switching cost into account.

Since the switching costs are probably different for each client, "s" is interpreted as the average switching cost. Customer specific deviations from this mean are captured by the slope of the transition probability function, while the firm specific changes in average cost of a bank are captured by the level of the function.

The conditional probability of changing the rival firm *j* to firm *i* is given by

$$\Pr_{j\to i,t} = f\left\{p_{i,t} + s, \vec{\mathrm{p}}_{\mathrm{iR,t}} + \vec{\mathrm{s}}_{\mathrm{j}}\right\}, \tag{2}$$

where $\Pr_{j\to i,t}$ is the probability that a customer who bought in the previous period $t-1$ of firm *j* purchases from firm *i* in the subsequent period. The intuition for this equation is very similar to the previous one.

Since the transitions are not known with aggregate data, the probability of passing the purchase of firm *I*, not conditional on the identity of the rival, is given by

$$\Pr_{iR\to i,t} = \sum_{j\neq i}\left(f\left\{p_{i,t} + s, \vec{\mathrm{p}}_{\mathrm{iR,t}} + \vec{\mathrm{s}}_{\mathrm{j}}\right\}.\frac{y_{j,t-1}}{\sum_{k\neq i} y_{k,t-1}}\right), \tag{3}$$

where $\Pr_{iR\to i,t}$ is the probability that a customer of a rival go to buy the firm *i*. The product of firm *j* in t-1 is $y_{j,t-1}$. So $\frac{y_{j,t-1}}{\sum_{k\neq i} y_{k,t-1}}$ is the probability that a customer of a randomly selected rival is one who bought from firm *j* in the previous period.

The total demand of firm *i* in period *t*, $y_{i,t}$, depends on its own product in the previous period, the products of rivals in the previous period and the transition probabilities, which are the basis of current prices and costs:

$$\mathrm{y_{i,t}} = \left(\mathrm{y_{i,t-1}Pr_{i\to i,t}} + \mathrm{y_{iR,t-1}Pr_{iR\to i,t}}\right)\mathrm{g_t} \tag{4}$$

where $g_t = \sum y_{i,t} / \sum y_{i,t-1}$ is multiplied by the demand to allow customers to change the amount consumed over time.

To obtaining the demand as a function of companies' market shares, a linear first order approximation in the transition probabilities has been applied.

From this linearization, the aggregation of transition probabilities results in the demand faced by firms, which determines the market share (σ) of each firm [4]:

$$\sigma_{i,t} = -\sigma_{i,t-1} \frac{n}{n-1} s\alpha_1 + \alpha_0^i + \alpha_1 \left(p_{i,t} - \vec{p}_{iR,t} + \frac{s}{n-1} \right) \tag{5}$$

This result, directly from Kim, Kliger and Vale (2003), implies an inelastic total demand is inelastic, adopting the hypothesis that $\alpha_1 = -\alpha_2$, implying that a small increase in $p_{i,t}$ would have the same effect as a decrease in the same order in $\vec{p}_{iR,t}$ [5].

In the supply side, it is assumed that the firm acts to maximize the present value of profits. For any moment, τ, we have:

$$V_{i,\tau} = \sum_{t=\tau}^{\infty} \delta^{t-\tau} \pi_{i,t} \ , \tag{6}$$

where δ is the discount factor for one period, $\pi_{i,t} \equiv y_{i,t}.p_{i,t} - c_{i,t}$ the firm's period t profits and $c_{i,t} = c\{\vec{w}_{i,t}, y_{i,t}\}$ is the cost function, which specifies the technology of the firm.

Solving the maximization problem, the price-cost margin equation for period t is obtained:

$$pmc_{i,t} = -\delta.\sigma_{i,t+1} \frac{n}{n-1} sg_{t+1} - \frac{\sigma_{i,t}}{\alpha_1} \ , \tag{7}$$

where $pmc_{i,t} \equiv p_{i,t} - mc_{i,t}$ and $mc_{i,t}$ is the marginal cost of production, obtained from the cost function varying on time from bank i.

Some important results from the model developed are below. From equation (5) market share, we have

a) L*ock-in* effect - the impact of t-1 market share on the firm's current market share is positive: $\frac{\partial \sigma_{i,t}}{\partial \sigma_{i,t-1}} = -\frac{n}{n-1} s\alpha_1 > 0$ [6]

b) The impact of the existing market share (period t-1) in the current market share is increasing as the switching cost increases: $\frac{\partial \left(\partial \sigma_{i,t} / \partial \sigma_{i,t-1} \right)}{\partial s} = -\frac{n}{n-1} \alpha_1 > 0$

c) Switching costs effect: the switching costs' impact in market share is dubious: $\frac{\partial \sigma_{i,t}}{\partial s} = \left(\frac{1}{n} - \sigma_{i,t-1} \right) \frac{n}{n-1} \alpha_1 \begin{cases} < 0 & se \sigma_{i,t-1} < 1/n, \\ > 0 & se \sigma_{i,t-1} > 1/n. \end{cases}$

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[4] α_0^i are firm-specific intercepts, which capture the heterogeneity of the firm. The α_1 coefficient measures the sensitivity of the probability of transition to the price charged by the firm itself and α_2 is the cross-price sensitivity.

[5] This assumption can be easily relaxed, as done in Alencar et al. (2005), to test it directly on estimation.

[6] α_1 is less than zero and s is always positive

The switching costs operate in favor of firms which are greater than average and against firms lower than average. Thus, the existence of switching costs results in larger market shares for firms larger than the average.

From equation (7), cost marginal price, one has:

d) The first term on the right side of the equation represents the benefit to the firm to capture customers in period *t*, which will be locked in future periods. The higher this benefit (higher s or g_{t+1}), the lower the price-cost marginal optimal in period *t* to capture customers.

e) The second term of the equation represents the power of oligopoly in the current period of the firm. The larger the market share, the greater the net price – the marginal cost.

3. Data and model specification

3.1. Data

Two databases have been used in the analysis. The main data source for the paper is the accounting information of financial institutions operating in Brazil, obtained from Central Bank of Brazil (in Portuguese, Banco Central do Brazil or BCB). The database contains accounting information for financial institutions, broken down by Brazilian Tax ID Number (Report 4010), between 2009 and 2011 on a quarterly basis. Additional information was obtained from the Central Bank, also on a quarterly basis, by Brazilian Tax ID Number, with respect to the number actives and non-actives accounts and the number of dependencies. From this dataset, only commercial or multiple banks with commercial activities with more than 20 or more accounts and more than one branch were kept.

Thus, the final sample contains 57 institutions, 46 multiple banks and nine commercial banks, together with public owned Bank of Brasil and Caixa Economica Federal.

The next issue on the construction of the variables was the definition of deposit services, with implications on how to derive the correct price of service measure. To define the price of banking deposit price, we followed Nakane, Alencar and Kanczuk (2005), which set the price (*p_serv*) as the ratio of revenues from services and the balance of bank deposits.

This definition of price is quite broad, encompassing income from fund management, investment brokerage income rates, technical advice rents, lace package of services for individuals, among others. In this database, the average revenue from services is BRL 215.00 million, with an average price is BRL 0.0085 for each deposited dollar.

An alternative is to consider only the income from maintaining the account and the transaction charges, since they are directly related to the usage of the current account.

For this, the variable *renda_cc* was defined considering just some of the items of income from services. The items considered were earned income from services provided to individuals and priority services to businesses (Registration costs, account statement providing, transfers, credit card, among others) and the revenues from registration, deposit accounts, transfer funds, loans and other banking fee incomes.

In considering this narrower concept of income, the price (*p_cc*) was defined as the ratio of revenues with tariffs strictly related to current account balance. The average price is BRL 0.0368 for each BRL in sight deposit account.

As a comparison, the variable *renda_cc* is about 30% of *renda_servicos*. Since there is uncertainty on which of the two concepts would be more appropriate, estimates were provided under both alternatives[7].

[7] To work with the information on a quarterly basis was necessary to adjust the revenue and expenditure information. According to Brasil Central Bank methodology, the accounting data relating to revenue and

It is important to notice that, especially in the narrower concept, only the direct and transactional fees are considered. Since the opportunity cost of resources held in the account is not considered, this measure understates the effective economic cost of keeping the account open. However, since data on the investment alternatives is not available, this was the only possibility.

Another variable for which there might be disagreement is the number of bank accounts. The empirical analysis was carried out using the total number of accounts (cc), whose average is 2.4 million accounts in the database, and the number of active accounts (cca), averaging 1.5 million accounts. Exercises were also carried out considering both alternatives.

In the period 2009-2011, it is observed that there is a high variability in bank sizes and most of them are relatively small. In the sample, 50% of banks have nine or fewer dependencies and less than 1881 active accounts on their balance sheets. Considering the market share, measured by deposits value, note also that 50% of banks have up to 0,147% of market share, according to the table below.

Table 1: Detailed descriptive statistics for selected variables

Statistics	Number of Branches	Market Share*	Total Accounts	Active Accounts
N	684	684	684	684
Minimum	1	0,0001%	179	42
Maximum	5201	22%	41900000	23200000
Mean	342	2%	2390299	1493461
Std. Dev.	1002	5%	7605237	4604556
Variance	3	3	3	3
Skewness	3	3	4	3
Percentiles (p) 10	2	0,008%	443	173
p25	3	0,030%	2593	514
p50	9	0,147%	8675	1880
p75	61	0,387%	186708	108343
p90	865	4,558%	5988125	4116869
p95	3375	16,410%	19900000	14700000

* Market share based on deposits' value
Source: Central Bank of Brazil.

From these values, only 5% of banks have more than 3375 branches and more than 14.7 million active accounts. However, each of these banks holds 16.41% or more market share, an indication that few banks concentrate most of the banking market.

Between 2009 and 2011, the country's biggest banks are Banco do Brasil, Bradesco, Itaú, CEF, HSBC and Santander. From the point of view of assets, in 2009 Banco do Brasil was the largest, while in 2010 this position has to be occupied by Itaú and in 2011 returned to Banco do Brasil.

expenditure of June and December record the accumulated between January and June and between July and December, respectively. I.e., the values reported in June and December refers to biannual. However, once in March and September data correspond to balances accumulated between January and March and between July and September, respectively, it was possible to obtain information relating to the second and fourth quarter, subtracting from June the March information and from December the September information. Reference: **http://www4.bcb.gov.br/top50/port/esc_met.asp**

If the number of total accounts (or active accounts) is used for ranking the institutions, the ordering may change, but not by much. In 2009, the three criteria indicate the Banco do Brasil as the largest bank; in 2010, while Itaú has the largest asset base, the Banco do Brasil remains the institution with the largest number of accounts, regardless of criterion used. In 2011, Bradesco has the largest number of active accounts, while the total number of accounts and the number of assets is still higher in the BB.

The second place is disputed by Bradesco and Itaú, depending on the year and the criteria used. HSBC ranks sixth in the ranking of banks, whatever the criterion.

Table 2: Share of the six largest banks

		2009		
	Bank	**Share - Assets**	**Share CC[1]**	**Share CCA[2]**
1	BB	20,7%	29,3%	27,0%
2	BRADESCO	16,5%	14,9%	23,0%
3	ITAU	18,3%	25,2%	18,1%
4	SANTANDER	11,3%	14,4%	12,3%
5	CEF	11,3%	5,6%	8,1%
6	HSBC BANK	3,3%	4,4%	4,9%
		2010		
	Bank	**Share - Assets**	**Share CC[1]**	**Share CCA[2]**
1	BB	19,0%	29,3%	25,7%
2	BRADESCO	17,0%	15,2%	23,8%
3	ITAU	19,6%	23,4%	17,7%
4	SANTANDER	10,6%	14,9%	12,3%
5	CEF	10,9%	6,3%	9,3%
6	HSBC BANK	3,3%	4,8%	5,1%
		2011		
	Bank	**Share - Assets**	**Share CC[1]**	**Share CCA[2]**
1	BRADESCO	17,2%	15,8%	25,3%
2	BB	19,6%	27,8%	24,8%
3	ITAU	18,8%	24,7%	18,7%
4	CEF	11,9%	6,9%	10,6%
5	SANTANDER	10,7%	12,9%	10,2%
6	HSBC BANK	3,3%	5,2%	3,9%

[1] Number of total accounts
[2] Number of active accounts
Source: Central Bank of Brazil.

The market shares of banks show a quite stable pattern over time. The correlation between current market share and market share lagged by one quarter is 0.9969, 0.9960 in two quarters, three quarters 0.9952, 0.9948 in four quarters, five quarters 0.9944 and six quarters 0.9929.

Such a pattern may be an indication that there is little change of customers from one bank to another in a quarter or even a year. However, as noted by Kim, Kliger and Vale (2003), *"strictly speaking, a high correlation between intertemporal market shares can also results from intensive switching between banks, resulting in (near) zero change in net market share"* (p. 42). The model to be estimated has the aim to unveil the actual changes hide in the evolution of market share.

3.2. Model Specification

The starting point for the econometric analysis is the system of equations formed by equations (5) and (7), presented here again for the sake of convenience:

$$\sigma_{i,t} = -\sigma_{i,t-1}\frac{n}{n-1}s\alpha_1 + \alpha_0^i + \alpha_1\left(p_{i,t} - \vec{\mathrm{p}}_{\mathrm{iR,t}} + \frac{s}{n-1}\right) \tag{5}$$

$$pmc_{i,t} = -\delta.\sigma_{i,t+1}\frac{n}{n-1}sg_{t+1} - \frac{\sigma_{i,t}}{\alpha_1} \tag{7}$$

Kim, Kliger and Vale (2003) estimated these equations simultaneously using nonlinear 3SLS[8]. In this system the variables $\sigma_{i,t}$, $\sigma_{i,t+1}$, time differences of prices, time differences of deposits and market shares are to be endogenous. The instruments used were the lags of the deposits, of the number of branches and of market shares.

As noted in the model presentation, the coefficient *s* indicates the magnitude of switching costs. Another check on the adequacy of the estimates is the sign of the α_1 coefficient, as demand is expected to be negatively related to prices.

In the original model estimated by Kim, Kliger and Vale (2003), the variable *pmc* is defined as the difference between price and marginal cost. In this paper, it is assumed the marginal cost of a bank in the provision of services is 20.03% of the price of the service[9], in a similar way to Alencar et al. (2005), who apply this assumption to the marginal cost of borrowing.

The 20.03% figure was computed from two studies: Fundação Instituto de Pesquisas Contábeis, Atuariais e Financeiras (FIPECAFI) (2004) and Nakane, Alencar and Kanczuk (2005). The results suggest that 33% of interest income on loans is used to pay administrative costs. However, as 38.89% of the administrative costs would be related to the funding activity, 20.03% of the income from lending activities would be used to cover administrative costs. The same proportion is assumed to hold for the provision of deposits.

Equation (7), after the incorporation of marginal cost, is defined by

$$p\hat{m}c_{i,t} = -\delta.\sigma_{i,t+1}\frac{n}{n-1}sg_{t+1} - \frac{\sigma_{i,t}}{\alpha_1} \tag{8}$$

In which $p\hat{m}c = p - c\hat{m}g_y_1$.

Equation (5) is estimated by first differences to eliminate effects numerous firm specific fixed effects firms:

$$d\sigma_{i,t} = -\frac{n}{n-1}s\alpha_1(d\sigma_{i,t-1}) + \alpha_1\left(dp_{i,t} - d\vec{\mathrm{p}}_{\mathrm{iR,t}}\right) \tag{9}$$

[8] The second equation is estimated on first difference to eliminate fixed effects

[9] Initially, we have tested several specifications for the cost function in order to obtain the necessary parameters for estimating the marginal cost of banks. However, it was not possible to obtain reasonable results, which fulfill the desired purpose, since the estimation led to marginal costs predicted much higher prices found for the vast majority of banks in the sample, which does not seem reasonable.

Equations (8) and (9) were jointly estimated by nonlinear generalized method of moments (GMM)[10]. The variables relating to prices, market share and product are endogenous and were instrumented with two to four lags of deposits, of the number of branches (agencies) and of the market share.

4. Results

An important issue to be addressed during the estimation is the product dimension of the market, with the implication of which banks should be in the sample. As observed Kim, Kliger and Vale (2003), *"if the size of the branch network affects the state and the degree of competition, for example, due to location preferences, then banks that have a very small number of agencies cannot be a good matching in a model that has the chance to mutual competition"* (p. 43).

A first filter was applied to limit the sample to banks that are potential competitors in the retail banking market, offering current account and related services. Investment banks, "multiple" banks with no retail services, credit unions, development banks that are not part of conglomerate and conglomerates and independent institution non-bank were dropped from the sample at this time.

The same criterion was used to drop from the sample banks with less than 20 accounts on their balance sheets (active or not), as well as those that do not reach, throughout the sample period, more than one branch.

Despite all these filters applied on the raw data, the final sample still presents banks with very different sizes. Given this, the strategy suggested by Kim, Klieger and Vale (2003), estimating the system of equations with several subsamples, defined by different minimum numbers of branches in order to compare the estimated costs[11].

The first set of estimates (estimation 1) considers the broader definition of services whose charges are defined by the variable *renda_servicos*, discussed in the previous section, and the price by the ratio between these rates and total deposits (*p_serv*). For the second set of estimates (estimation 2) the definition of fees is restricted to include only those strictly related to current accounts (*renda_cc*), whose revenues were expressed as a share of demand deposits. The estimated coefficients are shown in the following table.

[10] The estimations were performed using the econometric software STATA / MP 11.2. We used the function Generalized Method of Moments (GMM) estimation, with the weighting matrix of the moment conditions robust to heteroskedasticity arbitrarily defined (wmatrix robust option) and initial parameter values equal to -0.5 for α_1 and 0.5 for s . The estimates were not sensitive to the initial values and, in general, showed convergence after a maximum number of six iterations for the first stage and four iterations for the second stage.

[11] The authors also suggest running the estimates according to loan sizes, as a way to measure the capacity of the bank to provide all banking services. Since the focus of the present paper is on deposit services, this test was not carried out.

Table 3: Switching costs - estimated parameters

Minimum of branches:			***1st***	***10***	***20***	***30***	***40***	***50***	***Average***
Estimation 1:	s	(coef.)	0,401	0,335	0,317	0,322	0,302	0,323	0,333
	(switching costs)	(standard-error)	0,001	0,000	0,000	0,000	0,000	0,001	
	α_1	(coef.)	-2,187	-2,600	-2,709	-2,659	-2,752	-2,598	-2,584
	(inclin. trans. prob.)	(standard-error)	0,005	0,001	0,003	0,004	0,003	0,004	
	Number of banks		57	29	21	20	17	15	
	SC (BRL by account)		4574	3710	3348	3404	3111	3334	3580
Estimation 2:	s	(coef.)	0,741	0,354	0,393	0,386	0,409	0,262	0,424
	(switching costs)	(standard-error)	0,002	0,000	0,001	0,001	0,001	0,003	
	α_1	(coef.)	-1,184	-2,131	-1,949	-1,975	-1,881	-2,688	-1,968
	(inclin. trans. prob.)	(standard-error)	0,003	0,001	0,002	0,004	0,003	0,024	
	Number of banks		55	27	20	19	17	15	
	SC (BRL by account)			393	435	427	451	289	471

* The table presentes the estimated parameters and heteroskedasticity-robust standard errors from the joint esimation of the system of equations composed of equations (21) and (22), for a balanced quarterly panel from 2009/1 to 2011/4. All coefficients are significant at 1%.
The column marked 1st is carried out with the full sample, the column marked 10 is the one using banks wih ten or more branches, and so forth.

First of all, it is important to notice that the s coefficient is in the range that implies transition probabilities between [0,1] in all estimations, so additional restrictions are not required.

In all estimates - for different concepts and subsamples - the parameter obtained for the average cost of changing providers s is positive and significant, which indicates the existence of switching costs in the Brazilian service banking market. Likewise, α_1 (gradient of the transition probability function) is also statistically significant for all models. The negative sign for α_1 is also in line with expectations.

Besides positive and significant for the Brazilian banking market, the estimated s coefficient indicates that the switching costs are high. The interpretation of the estimated coefficient suggests that switching costs account for 40% of deposits in estimation (1) with the full sample.

Since the average deposit by current account is close to BRL 11,400 for the full sample, the estimated coefficient indicates a cost of change would be, in average, BRL 4,574 per account.

A possible criticism of this estimate would be this is a result of the implied market definition, since the variables used are related to a broad definition of deposits, considering not only sight deposits, but also savings accounts, interbank accounts, among others.

Thus, another exercise was carried out in which the fees definition was restricted to those strictly related to sight deposit accounts (renda_cc). The estimated parameters implied an average switching cost for the full sample being 74% of the amount in the sight deposit accounts. For an average deposit of BRL 1,123 per account, this implies an average switching cost of BRL 832 for each sight deposit account.

As in Kim, Kliger and Vale (2003), the switching cost decreases as we consider the largest banks only, but remained significant for all considered samples. Switching costs reach 30.2% of deposits in the estimation 1 and 26.2% of sight deposits in estimation 2.

According to these authors, this result of lower switching costs for larger banks may be related to the fact that "banks with a larger network most often serve a greater portion of larger and more mobile clients (wholesalers) than smaller retail clients" (p. 44).

This, however, does not seem to be a plausible explanation for the market in question, since, for the sample used, smaller banks have, on average, customers with higher deposits per account.

One possible explanation for the results found in this work lies in evidence that customers of small banks have longer relationships than customers of big banks. This can be linked to the fact that large Brazilian banks are essentially retail banks, while smaller banks are generally more specialized. The service's specificity can lead to greater importance of maintaining the relationship between the customer and the bank, justifying thus the higher cost of change found.

An important conclusion is the estimated coefficients are similar regardless of the definition of services considered: either total or sight deposits. The decrease in the switching cost for larger banks is also observed in both sets of estimates.

The most significant differences between estimates were observed (i) in the estimated coefficient for the whole sample, which was significantly higher in the second estimation, and (ii) the estimated coefficient from the sample containing only the largest banks, which was lower in estimation 2.

4.1. Additional Implications of Switching Costs

The estimated parameters from the model developed by Kim, Kliger and Vale (2003), reported in section 8.2, can be used to compute quantitative information on various characteristics of the relationship between customer and the bank. The next table provides short descriptions of the characteristics to be explored, with information on how to compute these values from the estimates.

Table 4: Implications of the model

Probability of remain in the same bank	$\hat{P}r_{i\to i,t}$	$= \bar{\alpha}_0^i + \hat{\alpha}_1(p_{i,t} - \bar{p}_{iR,t} - \hat{s})$
Probability of changing to any other bank	$\hat{P}r_{iR\to i,t}$	$= \bar{\alpha}_0^i + \hat{\alpha}_1\left(p_{i,t} - \bar{p}_{iR,t} + \frac{\hat{s}}{n-1}\right)$
Average length of relationship between bank and customer	$\lambda_{k=0.99}$	$= ln(1-k) \div ln(1-\theta)$
Contribution of last period share to current period share	$\frac{\partial\sigma_{i,t}}{\partial\sigma_{i,t-1}}$	$= -\frac{n}{n-1} s\alpha_1$
Contribution of *lock-in* to bank's marginal profit	$\frac{mvl_{i,t}}{\partial V_{i,t}/\partial y_{i,t}}$	$= -\delta\frac{n}{n-1} s\alpha_1$
Annual rate of abandonmentabandon	θ	$= 1 - \left(\hat{P}r_{i\to i,t}\right)^4$

Source: Kim, Kliger e Vale (2003).

The next table uses the parameters obtained in the estimations ($\hat{\alpha}_1$ e $\hat{s}$) of the previous section applied for an average bank. An additional hypothesis necessary to make these calculations refers to the value of $\bar{\alpha}_0^i$, not directly estimated in the equations. Just like Kim, Kliger and Vale (2003), it is assumed $\bar{\alpha}_0^i = 1/n$.

Table 5: Model Implication – Various subsamples

Characteristics	Sample	$\widehat{\mathrm{P}}\mathrm{r}_{\mathrm{i}\to\mathrm{i,t}}$	$\widehat{\mathrm{P}}\mathrm{r}_{\mathrm{iR}\to\mathrm{i,t}}$	$\lambda_{\mathrm{k}=0.99}$	$\frac{\partial\sigma_{\mathrm{i,t}}}{\partial\sigma_{\mathrm{i,t-1}}}$	$\frac{\mathrm{mvl}_{\mathrm{i,t}}}{\partial \mathrm{V}_{\mathrm{i,t}}/\partial \mathrm{y}_{\mathrm{i,t}}}$	θ
	1[a]	0,910	0,018	12,203	0,892	0,808	0,314
	10	0,925	0,023	14,739	0,902	0,817	0,268
	20	0,926	0,025	14,994	0,901	0,816	0,264
Estimation 1:	***30***	0,927	0,025	15,275	0,902	0,818	0,260
	40	0,910	0,028	12,158	0,882	0,799	0,315
	50	0,925	0,026	14,811	0,899	0,814	0,267
	Mean	0,921	0,024	14,030	0,896	0,812	0,282
	1[a]	0,923	0,029	14,346	0,894	0,810	0,275
	10	0,839	0,056	6,567	0,783	0,709	0,504
	20	0,860	0,054	7,636	0,806	0,731	0,453
Estimation 2:	***30***	0,859	0,055	7,596	0,804	0,729	0,455
	40	0,871	0,053	8,354	0,818	0,741	0,424
	50	0,831	0,077	6,226	0,754	0,683	0,523
	Mean	0,864	0,054	8,454	0,810	0,734	0,443

Sample: * The table presentes the estimated parameters and heteroskedasticity-robust standard errors from the joint esimation of the system of equations composed of equations (21) and (22), for a balanced quarterly panel from 2009/1 to 2011/4. All coefficients are significant at 1%. The column marked 1st is carried out with the full sample, the column marked 10 is the one using banks wih ten or more branches, and so forth.

$\lambda_{\mathrm{k}=0.99}$ Represents the length of relationship based on the required time for k% of customers to change banks..

$\frac{\partial\sigma_{\mathrm{i,t}}}{\partial\sigma_{\mathrm{i,t-1}}}$ represents the contribution of last period Market share to Market share in period t. The term $\frac{\mathrm{mvl}_{\mathrm{i,t}}}{\partial \mathrm{V}_{\mathrm{i,t}}/\partial \mathrm{y}_{\mathrm{i,t}}}$ representes the share of marginal value of locked in customer to the increase in presente value of the bank, and. θ is the annual rate of abandonment.

The estimates above suggest that for a medium bank, the average probability of a customer to continue using the services from one quarter to the next is between 91.0% and 93%. In sight deposits, such probability goes from 83% to 92%.

The average probability a customer that use the services of rivals migrate to a specific bank varies between 1.8% and 2.8%, averaging 2.4% in the estimation 1, and 2.9% to 7.7% in estimation 2. Note that such probabilities increase for samples with the largest banks, while the probability of getting on the same bank decreases.

Once the estimates made are based on a quarterly period annual defection rate is given by $\theta = 1 - \left(Pr_{i\to i,t}\right)^4$. Thus, on average, 31.4% of customers change banks every year in the estimation 1 and 44.3% in estimation 2. The time required for k percent of customers to switch can be defined as $\lambda = \ln(1-k) \div \ln(1-\theta)$. For k = 99%, λ changes from 12.2 to 15.3 years, with an average of 12.2 years for the estimation 1. As for the second estimation, the results suggest that the average length of relationship between bank and customers would be around 8.5 years on average, and the minimum value was 6.2 years and a maximum of 14.3 years.

This result is in line with the estimates for other countries, in terms of the average length of relationship between customer and bank. Kim, Kliger and Vale (2003) found that the time-client relationship bank in Norway is between 11.3 and 16.7 years if markets are defined by the

size of the branch network, or between 7.5 and 19.4 years if markets are defined according to the size of loans[12].

For Brazil, the results found by Alencar et al. (2005) suggest that the average bank-client relationship would be 5.03 years, below the results found in this study, but that was considered low by the authors themselves. Other features of the bank's relationship with the customer can be deduced from the estimated model.

From market share equation (5), the contribution of market share in the previous period to the current period (lock-in effect) is given by $\frac{\partial \sigma_{i,t}}{\partial \sigma_{i,t-1}} = -\frac{n}{n-1} s\alpha_1 > 0$ [13]. According to the obtained results, the lock-in effect for the market for banking services in Brazil is 0.892 for the full sample of total deposits in the market. In other words, 89.2% of the market share in a given quarter is due to the relationship between the banks and their clients in the previous quarter. The average for this estimation is 89.6% and for the estimation 2 is 81.0%.

Another important result that can be derived from the model is the ratio of the marginal value of customer captured (locked-in) to the growth of the present value of the bank. Estimates suggest that the value of this ratio is, on average, 0.812 for the total market deposits. Thus, 81.2% of value added by the client is derived from the lock-in phenomenon generated by switching costs. For sight deposits, the value found was 73.4% on average.

With the proposed approach, it is also possible to observe that the effect of switching costs impact in market shares is ambiguous and favor firms that are larger than average, against firms smaller than the average:

$$\frac{\partial \sigma_{i,t}}{\partial s} = \left(\frac{1}{n} - \sigma_{i,t-1}\right)\frac{n}{n-1}\alpha_1 \begin{cases} < 0 & if \sigma_{i,t-1} < 1/n, \\ > 0 & if \sigma_{i,t-1} > 1/n. \end{cases}$$

As an example, the impact of switching costs for banks with higher and lower market shares was estimated. In September 2011, the largest volume of services income was observed for Itaú Unibanco (21.6%), while the lowest was of the La Nacion Argentina Bank (0.00011%). Considering the estimated coefficients, the impact of switching costs on market share is negative for La Nacion Argentina bank, corresponding to about -0.04. On the other hand, the contribution of the switching costs for the market share of Itaú Unibanco is estimated at +0.44. In this sense, switching costs tend to act toward greater banking concentration.

5. Conclusions

Several examples suggest switching costs may be relevant for the Brazilian banking sector. The existence of college accounts, the aggressiveness of banks bidding for the right to manage the payroll of public servants and the requirement, the requirement, valid until a short time ago, for the salary to be paid to a bank account defined by the employer are just some of them.

Despite anecdotal and incomplete evidence that the Brazilian banking sector has significant switching costs, presented above, studies regarding its magnitude and implications for the competitive structure are still scarce.

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[12] Kim, Kliger e Vale (2003) note that these estimates are in line with findings for other countries, citing that in Italy the average duration of the customer-bank relationship is 14 years, 13 years in Germany, the United States seven years, 7.8 years in Belgium.

[13] Since α_1 is less than zero and s is always positive.

In this context, the present study aimed to estimate the costs of switching suppliers in the bank deposit market in Brazil, using the methodological alternative developed by Kim, Kliger and Vale (2003). The methodology allows us to test the existence of switching costs without requiring the use consumer data, which are rarely available.

The database used contains financial information, on a quarterly basis, between 2009 and 2011 about commercial banks, "multiple" banks with commercial portfolio, as well as public banks with commercial banking activities (Banco do Brasil and Caixa Economica Federal), with more than 20 accounts.

In general, the results showed the cost of change is significant for the market of deposit services of the Brazilian banking sector. Estimates suggest that customers with sight deposits have an average cost of around BRL 471.17 per account to change the bank. Switching costs appear to be inversely proportional to the average size of the banks, indicating that customers of larger banks have lower switching costs. One explanation for this evidence is the fact that customers of smaller banks attribute more value to preserve the relationship with the institution, which may be associated with greater specialization of the smaller banks, in general specialized wholesale banks.

As for features derived from switching costs, it was estimated that the average duration of the customer relationship with the bank is 8.4 years in Brazil, with evidence that for smaller banks this length is even greater.

The estimates also indicate that 81.0% of market share in a given time period is due to the relationship between the bank and the client in the previous quarter (lock-in effect) and 73.4% of value added by the client is derived from the lock-in generated by switching costs, a further evidence that the switching costs are relevant for the Brazilian banking market. Even considering that the switching costs are lower for holders of larger banks, they are still high enough to restrict potential competition between banks - either latecomers in national scale or latecomers in geographically limited scale.

Finally, it is noteworthy that the switching costs work in favor of firms which are greater than average and against firm smaller than average. Switching costs tend to act toward greater banking concentration and an unexpected effect of the recent wave of subnational governments to auction their payrolls is reduced competition. It is possible that part of the funds paid by the banks for acquiring the payroll services have been raised by higher mark-ups – with the already known negative effects in economic efficiency.

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