Search costs and the dispersion of loan interest rates in Brazil

Resumo

A dispersão entre bancos das taxas de empréstimo tem sido bastante elevada no Brasil. Vários possíveis fatores podem explicar esta característica, incluindo, entre outros, custos de busca e de mudança significativos, baixa concorrência e heterogeneidade entre os bancos. O propósito do presente trabalho é avaliar o papel dos custos de busca na explicação dos níveis de dispersão observados. Uma medida adotada pelo Banco Central em outubro de 1999 disponibilizando em sua *homepage* as taxas de empréstimo praticadas por cada instituição financeira é utilizada como um experimento natural. Os resultados indicam que os custos de busca explicam parcela significativa da dispersão das taxas de empréstimo.

Abstract

The dispersion of loan interest rates across banks has been remarkably high in Brazil. Many factors can account for such feature including, among others, significant search and switching costs, lack of competition, and bank heterogeneity. The aim of the paper is to evaluate the role of search costs in explaining the size of the loan interest rate dispersion found in data. A policy change undertook in October 1999, by which the Central Bank started to make the bank lending rates available in its homepage, is used as a natural experiment. The results show that search costs can account for a significant share of the price dispersion.

Keywords: loan interest rates, price dispersion, search costs, Brazilian banks.
JEL classification: G21; E43.

1) Introduction

In October 1999, the Brazilian Central Bank launched a set of policies and actions with the declared purpose of reducing the high bank interest spread found in the industry. One of the first actions undertook by the Central Bank was to start publishing at its website homepage the average lending rates charged by each commercial bank for each loan category. Currently, in addition to the average rate, the Central Bank also makes available the minimum and the maximum rates charged by each bank. The aim of this action was to increase bank competition, which would make them reduce their loan rates as well as the interest spread. It is interesting to add that the Central Bank had no declared intention to affect the interest rate dispersion across banks with this policy action, and we use this information as a way to identify the role of search costs in price dispersion.

Significant price dispersion across producers in a market can be found due to several reasons, such as [see Roberts and Supina (1997)]: a) existence of search costs; b) existence of consumer switching costs; c) product differentiation, i.e. the products are not perfectly homogeneous because producers offer different services, have different locations, have different costs, etc; d) macroeconomic factors like the inflation rate, which can affect the behavior of price dispersion across time; e) market power and lack of competition, which makes possible for some producers to systematically charge higher prices than their rivals.

Since the seminal paper by Stigler (1961), economists have accepted the idea that price dispersion can be found as an equilibrium outcome in information-based models even in competitive homogeneous goods markets. Imperfect information by customers and search costs may generate equilibrium price dispersion even in such markets [Salop and Stiglitz (1982)].

The empirical literature on price dispersion has tried to devise clever identification strategies to single out the contribution of the different factors. The difficulty lies in pinpointing the contribution of search costs as opposed to the alternative explanation that price dispersion is due to product differences (e.g. in quality, in costs, etc) that are not observed by the econometrician. Dahlby and West (1986) study prices for auto insurance policies and find that premiums are less dispersed among those driver classes for which search is more likely to occur. Using a similar identification strategy, Sorensen (2000) analyzes the market for prescription drugs and found that price dispersion is lower for prescriptions that must be purchased frequently. Kessner and Polborn (2000) uses a tax change to identify the relevance of search costs in explaining dispersion in the German life insurance market. The identification strategy pursued in this paper is similar to Kessner and Polborn (2000) in the sense that we also make use of a policy change to measure the relevance of search costs.

The first purpose of this paper is to document the behavior of loan rate dispersion across banks for different loan categories. Section 2 describes the data and presents some indicators trying to follow both the temporal evolution of loan rate dispersion as well as the heterogeneous patterns across different loan categories. Section 3 tries to quantify the role played by search costs to account for the rate dispersion found in the data. Section 4 concludes the paper.

2) Descriptive analysis for the loan rate dispersion for Brazilian banks

The primary source of data was the daily average loan rates reported by each financial institution for each loan category to the Central Bank. The reported values are gross rates (rates paid by the borrower) by including financial taxation plus commissions and fees. We report results for the monthly rates, which were calculated through the capitalization of the daily rates standardized for a 21-working day month, according to the application of the following expression:

$$i_{k,M} = \left[\prod_{d=1}^{n} (1 + i_{k,d}) \right]^{\frac{21}{n}} - 1$$

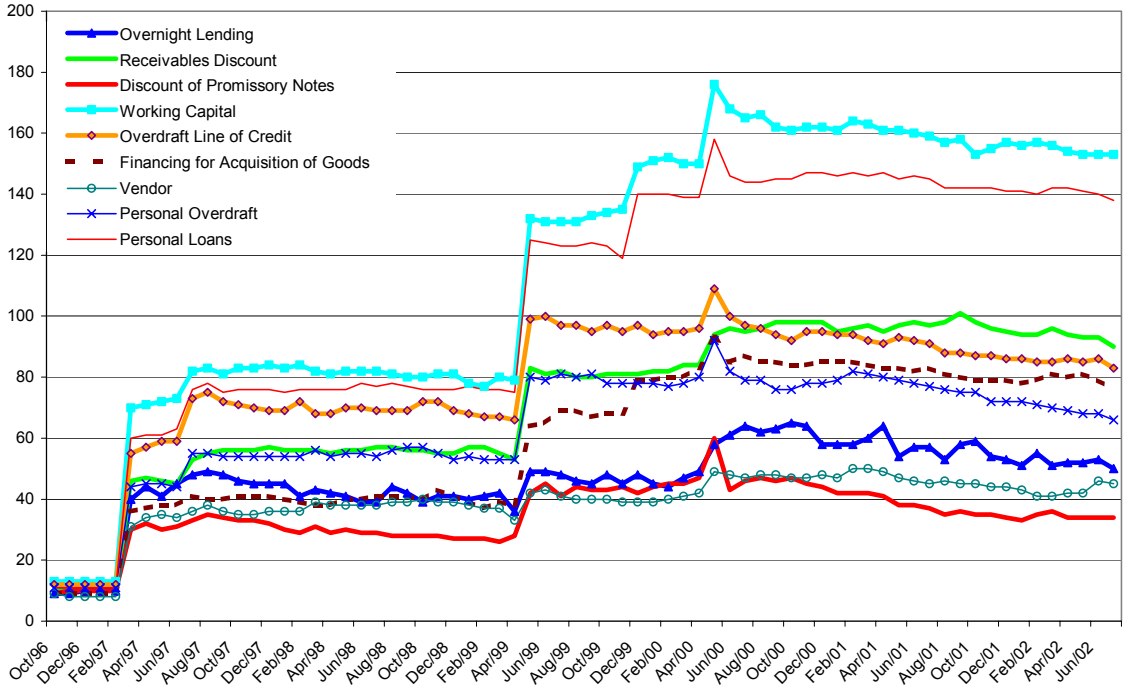
where: n corresponds to the number of working days in a particular month;
i_d is the average daily loan rate reported by a particular bank for loan category k;
$i_{k,M}$ is the monthly loan rate charged by a particular bank for loan category k.

Some outliers were also excluded from the analysis. All rates above the 99% quantile were eliminated. This procedure resulted in the exclusion of 11 observations from a total of 53,527 values. We examined nine fixed-rate loan categories, namely overnight lending, receivables discount, discount of promissory notes, working capital finance, overdraft line of credit, finance of acquisition of goods, and vendor for the corporate sector as well as personal overdraft, and personal loans for the household sector. We excluded from the analysis all the floating-rate loan categories as well as the fixed-rate loan categories related to goods acquisition finance for households, real estate finance and other not-specified categories. The main reason for the exclusion of such categories was the non-availability of any information for them previous to October 1999, which would preclude us to evaluate the role played by the availability of bank-level lending rates in the Central Bank homepage as a mechanism to reduce interest rate dispersion.[1]

The Brazilian Central Bank started to collect daily data on loan interest rates in October 1996. However, due to the small number of surveyed institutions at the beginning of the period, as one can see from the observation of Figure 1, our analysis is restricted to the period beginning in March 1997 and ending in July 2002, totaling 65 monthly observations in the time series dimension. The number of surveyed banks differs across loan categories because not all banks grant loans in all categories.

[1] For the excluded loan categories, the starting collection date was May 2000.

Figure 1: Evolution of the number of surveyed banks (October/1996 to July/2002)



A first measure of loan rate dispersion across banks that we calculated was the monthly interquartile distance, which corresponds to the difference between the third and the first distribution quartiles. Figures 2 to 4 report the interquartile distance for each loan category.

The first noteworthy observation is the high value found for the loan rate dispersions. For some corporate loan categories, the interquartile distance reached values in excess of 3.5% per month (or 51.1% per year). That is, in a same month, one could find banks operating in the market whose lending rates differ by factors superior to 3.5% per month. The interquartile distance is even greater for household loan categories (Figure 4). For such categories, the difference in the loan rates between banks located in the third and first quartiles reached values as high as 5.0% per month (79.6% per month).

Figure 2: Evolution of the interquartile distance by loan category – Corporate loans

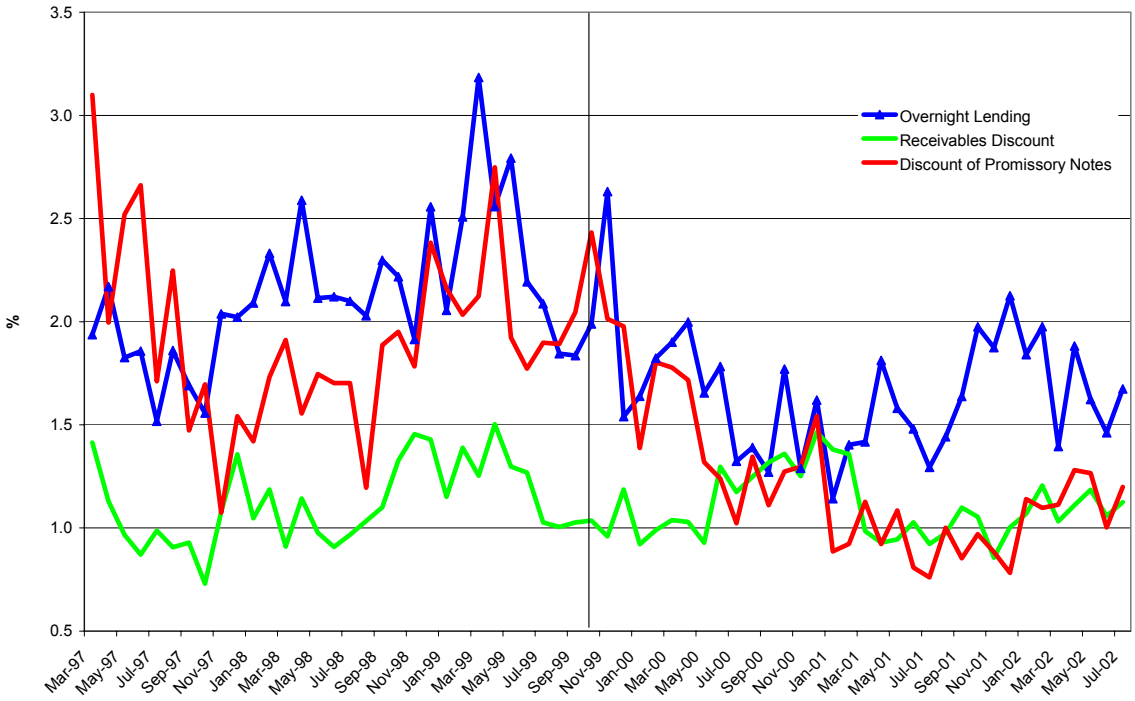


Figure 3: Evolution of the interquartile distance by loan category – Corporate loans

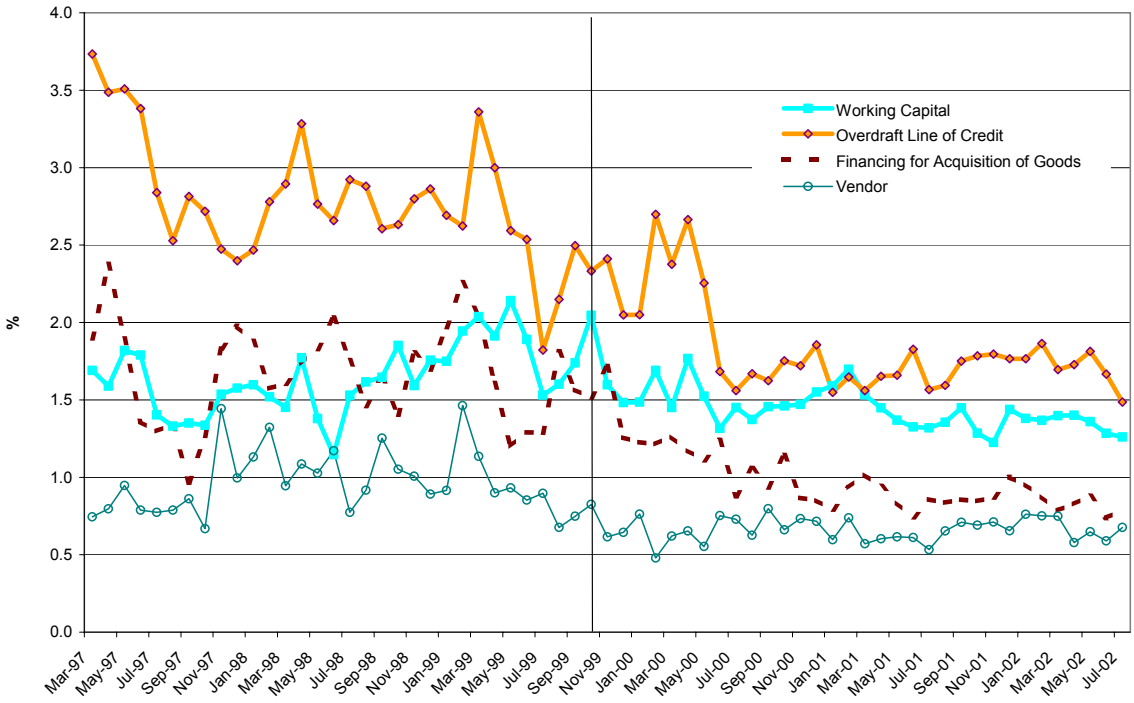
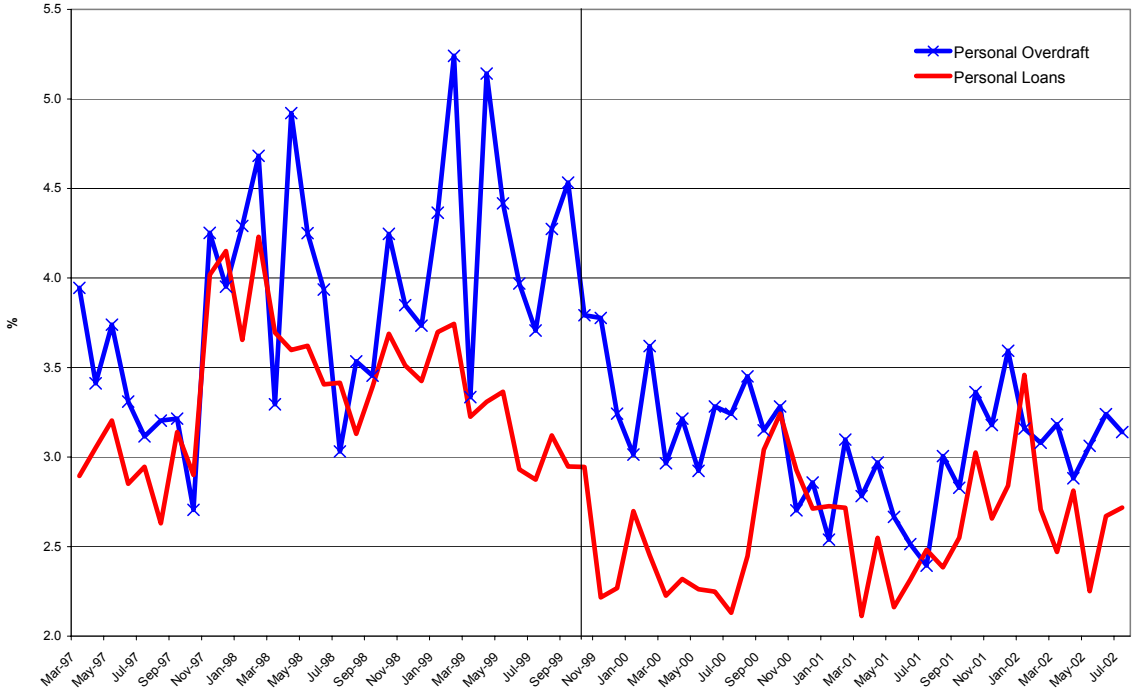


Figure 4: Evolution of the interquartile distance by loan category – Household loans



The second point we want to stress from the observation of Figures 2 to 4 is the temporal evolution of the dispersion measures. One can verify that, as a general pattern, the dispersion of all loan categories show high volatilities at the beginning of the sample period (from March 1997 to April 1999). After May 1999, there is an overall decreasing trend. Such behavior is particularly more pronounced in the period from November 1999 to July 2000. One possible reason for this fall in the loan dispersions may be related to the reduction of search costs promoted with the Central Bank initiative to start reporting the loan rates in its homepage.[2] Finally, towards the end of the sample period (after September 2001), loan dispersions started to increase again, probably due to uncertainties related to the worsening of overall economic conditions in the country.

The third and last comment about Figures 2 to 4 is related to the great heterogeneity across loan categories. Overdraft credit for both corporate and household sectors show the largest rate dispersions. Such loan categories are very short-term in nature and they are both linked to the keeping of a demand deposit account by the borrower, which greatly increases switching costs for them. On the other extreme are the rate dispersions related to vendor and to receivables discount. One possible reason for the lower rate dispersion for them is that these operations are backed by securities owned by the borrower and offered as collateral, which works towards reducing the borrowing costs of such loans as well as the rate dispersion.

It is possible that the loan rate dispersion follows the behavior of the loan rate level. In other words, it is possible that high dispersion is found during periods where the level of the average lending rates is also high. Table 1 reports the correlation coefficients between dispersion and central location measures for each loan category The results suggest that, with the exception of receivables discount, the correlations found in the data are in fact very high.

[2] Section 3 aims at investigating this claim more carefully.

Table 1: Correlation between dispersion and location measures

Loan Categories	Correlation between interquartile distance and median	Correlation between interquartile distance and mean	Correlation between standard deviation and mean
Overnight Lending	74%	76%	54%
Receivables Discount	37%	38%	5%
Discount of Promissory Notes	57%	60%	71%
Working Capital	51%	56%	43%
Overdraft Line of Credit - Corporate	57%	74%	67%
Goods Acquisition - Corporate	79%	84%	69%
Vendor	79%	82%	75%
Personal Overdraft	80%	80%	92%
Personal Loans	86%	73%	55%

We therefore adjusted the dispersion measures controlling for the behavior of the average rates. Table 2 shows the results. This table reports the annual means for two measures of dispersion, namely the coefficient of variation and the ratio of the interquartile distance to the median.

Table 2: Measures of dispersion – Annual means

Loan Categories	Measure	1997	1998	1999	2000	2001	2002
Overnight Lending	Coefficient of Variation	0.45	0.44	0.55	0.47	0.38	0.39
	Interquartile Distance/ Median	0.51	0.51	0.61	0.46	0.46	0.44
Receivables Discount	Coefficient of Variation	0.24	0.23	0.28	0.29	0.30	0.30
	Interquartile Distance/ Median	0.37	0.30	0.42	0.34	0.32	0.31
Discount of Promissory Notes	Coefficient of Variation	0.36	0.24	0.34	0.30	0.25	0.26
	Interquartile Distance/ Median	0.44	0.33	0.49	0.38	0.27	0.29
Working Capital	Coefficient of Variation	0.56	0.40	0.44	0.43	0.36	0.35
	Interquartile Distance/ Median	0.49	0.43	0.57	0.49	0.49	0.43
Overdraft Line of Credit - Corporate	Coefficient of Variation	0.54	0.47	0.54	0.47	0.43	0.44
	Interquartile Distance/ Median	0.73	0.67	0.67	0.54	0.47	0.51
Goods Acquisition - Corporate	Coefficient of Variation	0.38	0.39	0.52	0.38	0.32	0.32
	Interquartile Distance/ Median	0.54	0.46	0.50	0.43	0.36	0.32

Vendor	Coefficient of Variation	0.39	0.33	0.38	0.33	0.25	0.24
	Interquartile Distance/ Median	0.50	0.43	0.46	0.34	0.29	0.31
Personal Overdraft	Coefficient of Variation	0.33	0.34	0.36	0.32	0.34	0.35
	Interquartile Distance/ Median	0.36	0.41	0.48	0.38	0.38	0.37
Personal Loans	Coefficient of Variation	0.50	0.49	0.52	0.55	0.54	0.54
	Interquartile Distance/ Median	0.60	0.61	0.62	0.53	0.56	0.57

OBS.: For 1997, mean is from March to December; for 2002, mean is from January to July.

One can observe that, with the exception of the coefficient of variation for receivables discount and for personal loans, there is a reduction in the dispersion for 2000 when contrasted to 1999, the date when the Central Bank started to publish the bank level lending rates.

Another interesting finding is that loan categories like personal loans and overnight lending are still ranked amongst those with the highest levels of dispersion whereas vendor operations keep showing the smallest levels of dispersion. By contrast, the mean-adjusted measures of dispersion for personal overdraft show much smaller relative figures than the previous ones.

A better account of the rate dispersion behavior across loan categories can be gauged by the observation of box plot type graphs. Box plot graphs show a shaded area divided in two regions by the median observation. The upper and the lower limits of the shaded area correspond to the third and first quartiles respectively. The shaded area shows therefore the 50% central observations. The finer limits of the graphs show the maximum and the minimum rates observed in each month when there are no aberrant observations.[3] Figures 5 to 13 show the box plot graphs for each loan category. All the plots are centered around the median value.

[3] Aberrant observations are all observations that distance more than 1.5 times the interquartile distance from the first and the third quartiles. When aberrant observations are detected the finer limits show the maximum and the minimum rates once such observations are eliminated.

Figure 5: Box Plot of Centered Monthly Rates - Overnight Lending

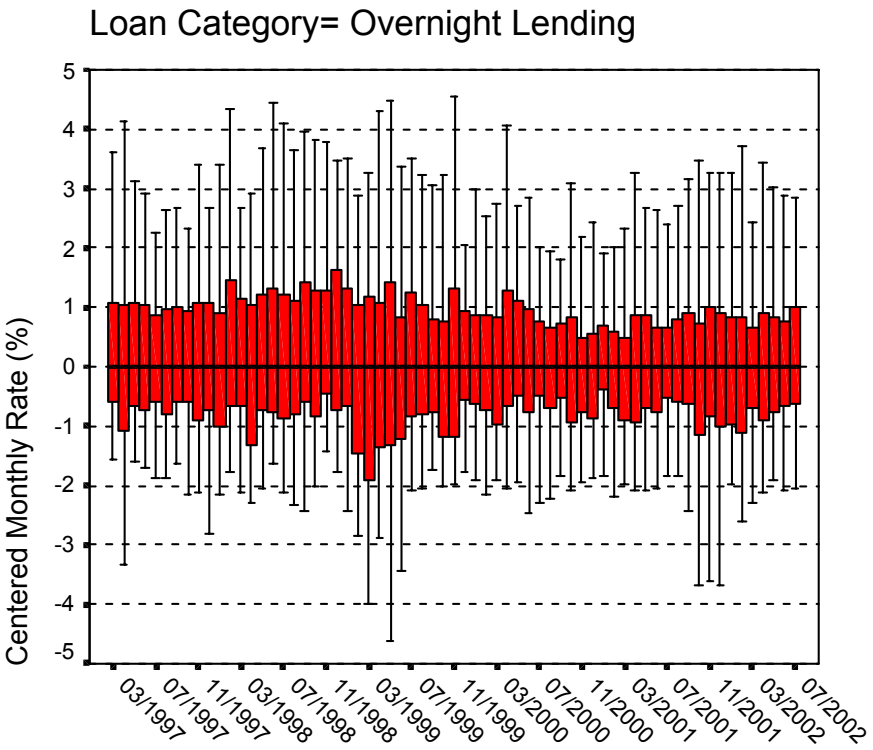


Figure 6: Box Plot of Centered Monthly Rates – Receivables Discount

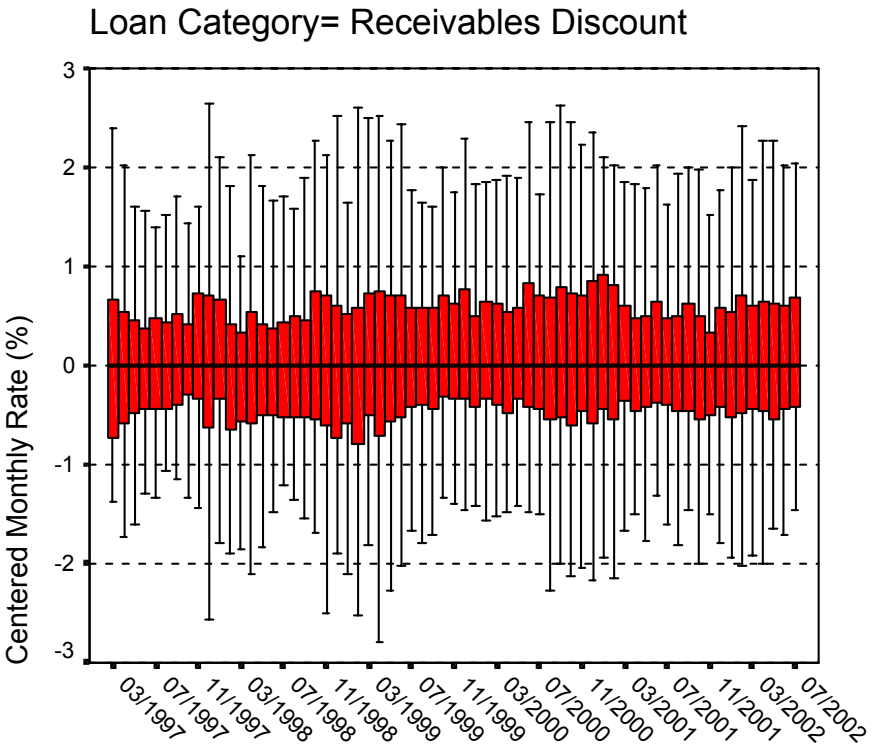


Figure 7: Box Plot of Centered Monthly Rates – Discount of Promissory Notes

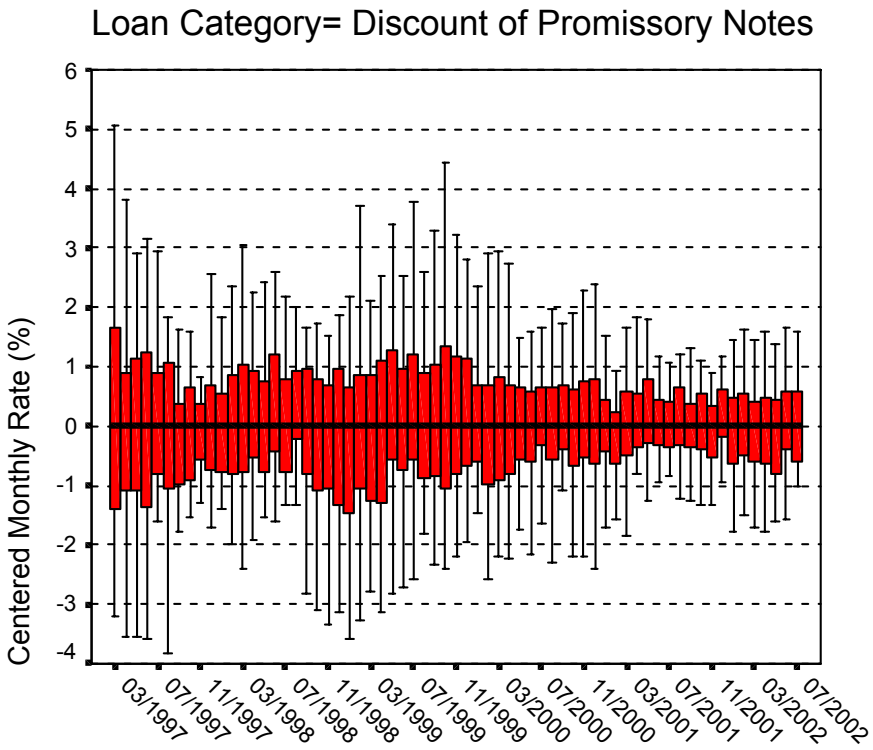


Figure 8: Box Plot of Centered Monthly Rates – Working Capital

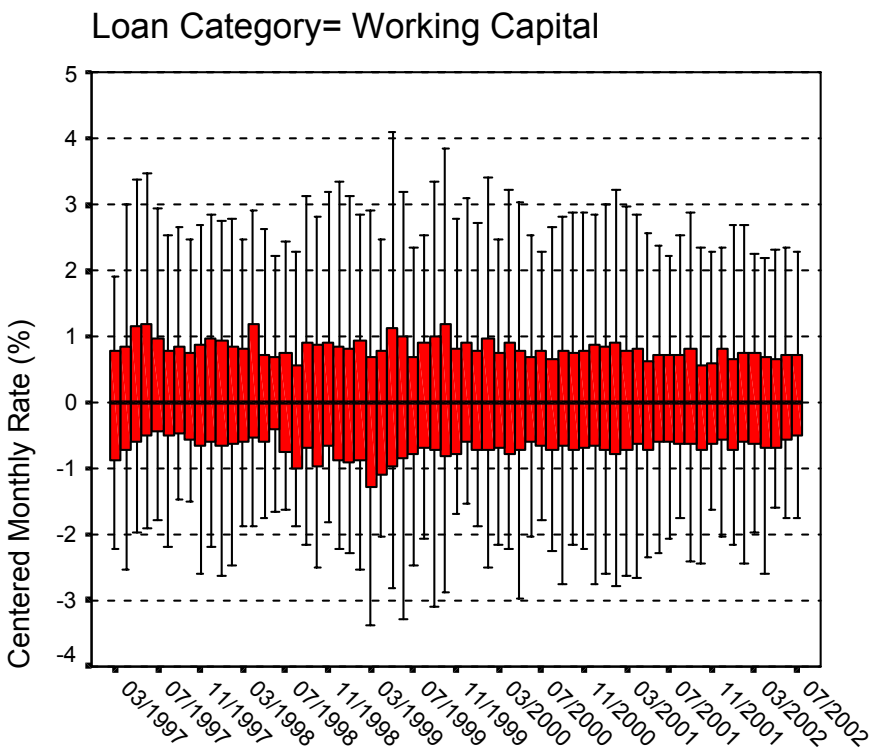


Figure 9: Box Plot of Centered Monthly Rates – Overdraft Line of Credit

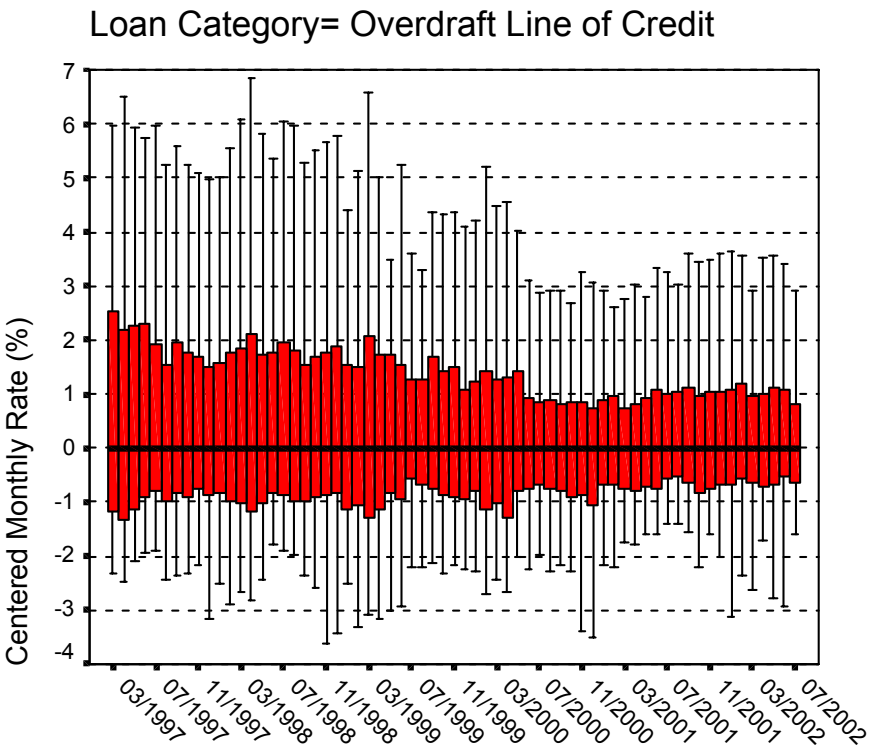


Figure 10: Box Plot of Centered Monthly Rates – Financing for Acquisition of Goods

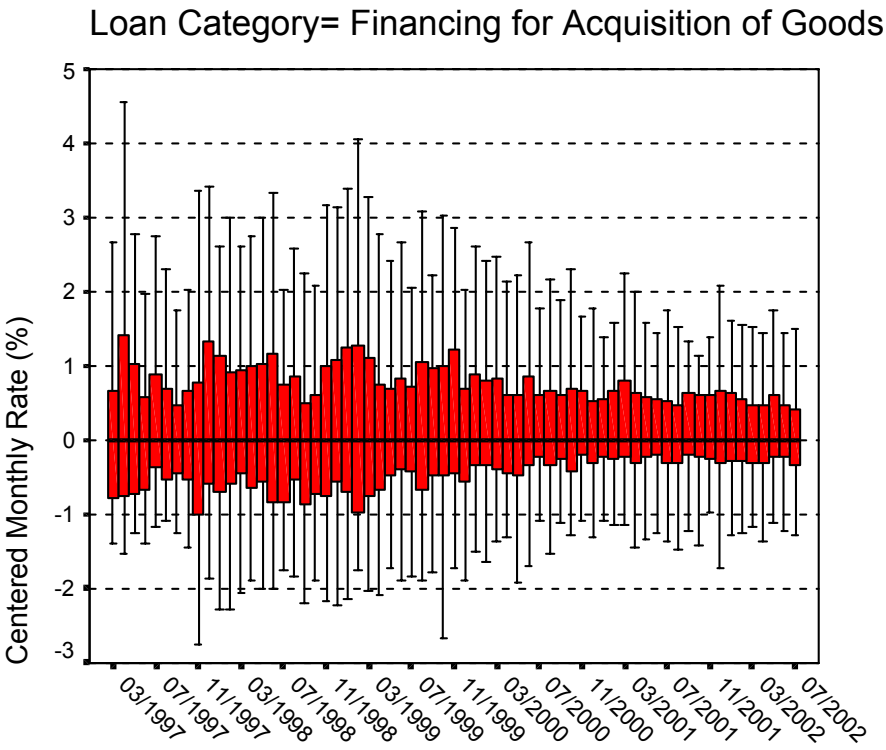


Figure 11: Box Plot of Centered Monthly Rates – Vendor

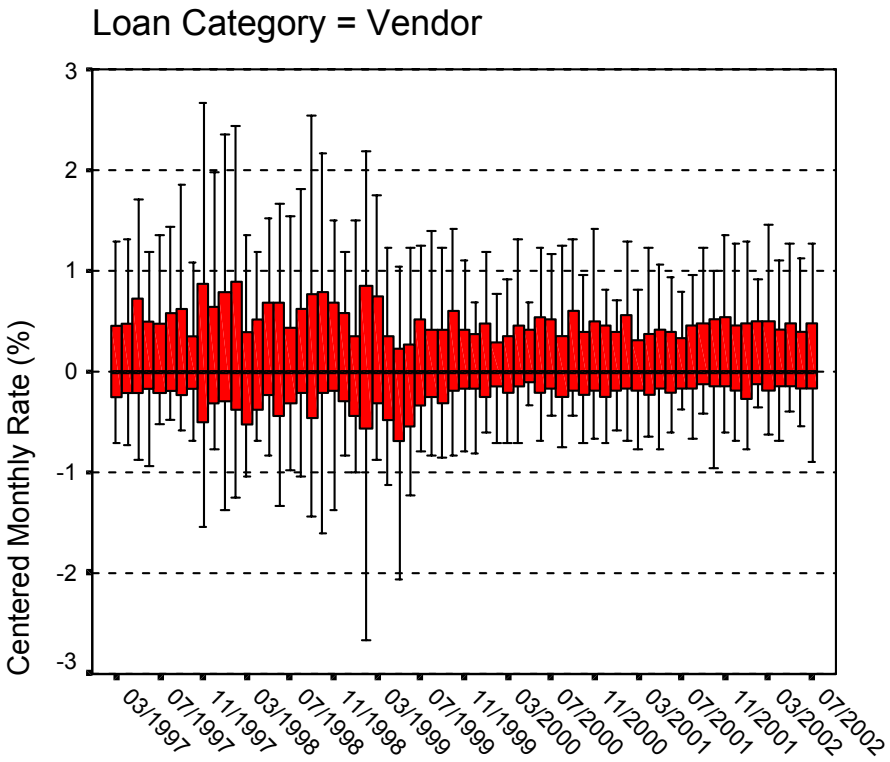


Figure 12: Box Plot of Centered Monthly Rates – Personal Overdraft

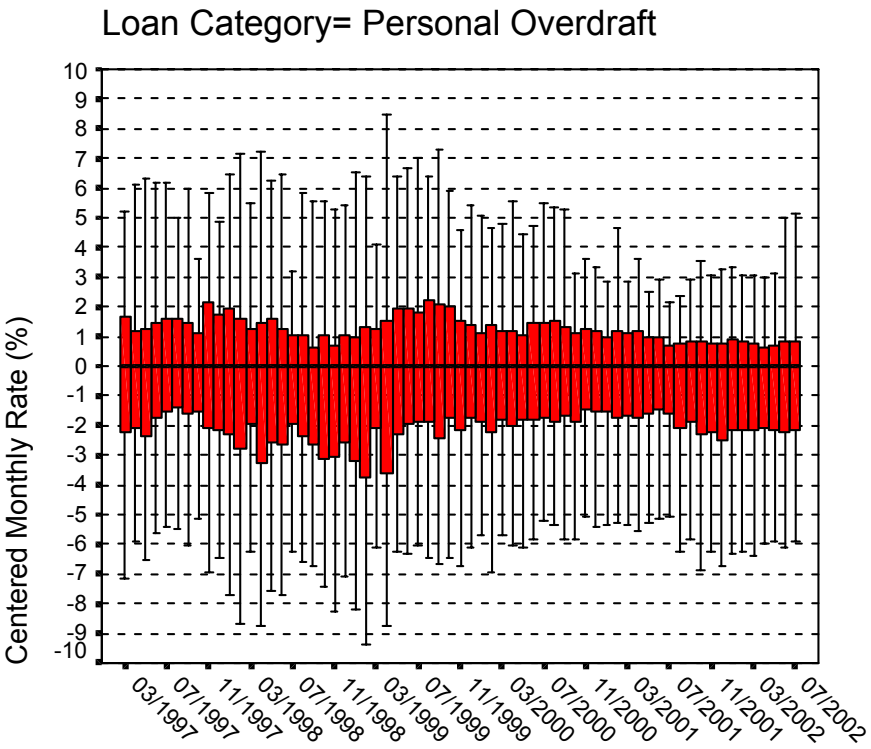
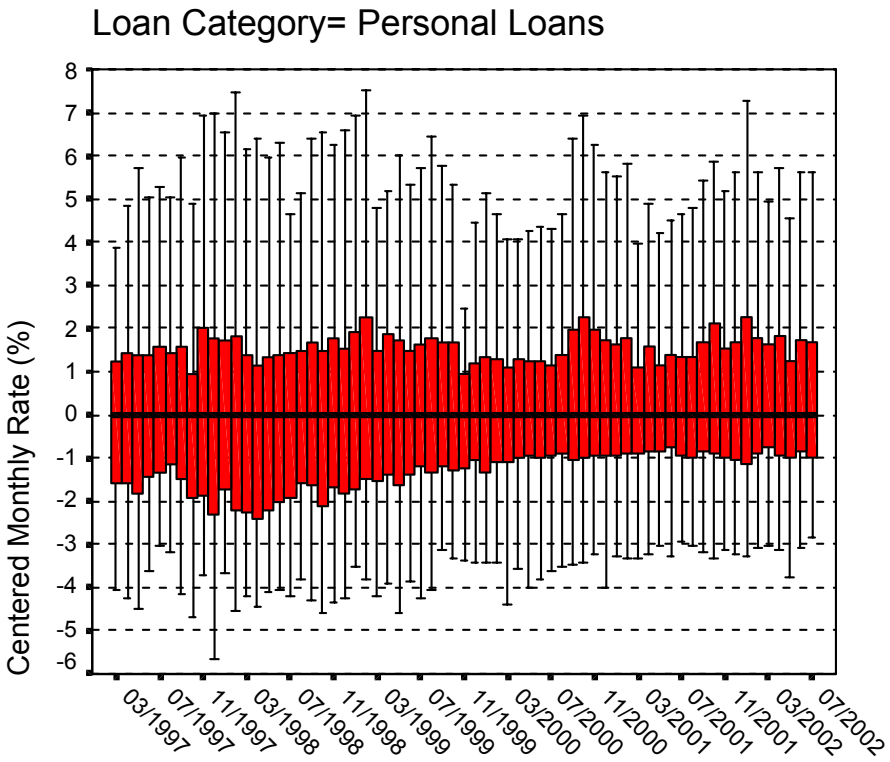


Figure 13: Box Plot of Centered Monthly Rates – Personal Loans



From the analysis of Figures 5 to 13 one can make the following comments:

- For overdraft line of credit and for personal loans one observes several rates well above the average values in a systematic way. This pattern is not observed for overnight lending, receivables discount, working capital, finance for goods acquisition, and vendor, for which the occurrence of high rates is less frequent and, when they happen they turn out to be either concentrated in some few months or distributed in no systematic way. Both overdraft line of credit and personal loans are typically very diluted markets with a large number of small borrowers.
- For receivables discount and for personal overdraft one finds a large number of rates both above and below the average values. For the first loan category, the borrowers have heterogeneous risk characteristics, which reflect the quality of both the borrower himself and the receivables issuer. For personal overdraft, the existence of very small rates is an indication of the financial institution policy to offer loan lines to highly regarded customers with low risks. For the upper rates, switching costs can explain the extraction of informational rents by banks on these customers.
- For overnight lending, overdraft line of credit, goods acquisition, and vendor, one notices that the dispersion for the rates above the median was larger than the dispersion for the rates below it. The opposite happens for personal overdraft and for personal loans. Finally, receivables discount, discount of promissory notes, and working capital show a more symmetric pattern of rate dispersion. Thus, some loan categories display asymmetries with greater dispersion in one direction (above or below the median). Quantile regression techniques will be used in the next section to try to account for such patterns.

Another interesting issue is the dispersion persistence. In other terms, one wishes to investigate whether the same banks systematically occupy the distribution extremities or, alternatively, whether there is high mobility across the dispersion distribution. High persistence can be an indication of some bank heterogeneity that makes a particular configuration of lending rate distribution to be reproduced over long intervals of time.

We evaluate the degree of dispersion persistence through transition matrices for each quartile. Our goal is to verify how banks that are in a certain quartile during month *t* will be distributed across the quartiles in month *t*+*s*. Table 3 reports the results. The results are only shown for all the loan categories due to the small number of observations for some of them. The transition matrices are calculated taking July 2002 as the final period and different starting periods. The largest window takes the whole sample period from March 1997 to July 2002.

Table 3: Transition Matrices

		Period 2:		Jul/02		
	Quartiles	1	2	3	4	
Period 1:	1	74%	19%	4%	3%	100%
	2	19%	50%	27%	4%	100%
Jun/01	3	5%	24%	56%	15%	100%
	4	2%	5%	17%	76%	100%

		Period 2:		Jul/02		
	Quartiles	1	2	3	4	
Period 1:	1	66%	26%	4%	5%	100%
	2	21%	44%	29%	6%	100%
Jun/00	3	7%	25%	48%	19%	100%
	4	4%	6%	23%	67%	100%

		Period 2:		Jul/02		
	Quartiles	1	2	3	4	
Period 1:	1	51%	26%	14%	9%	100%
	2	23%	37%	34%	7%	100%
Jun/99	3	18%	31%	33%	18%	100%
	4	7%	13%	34%	47%	100%

		Periodo 2:		Jul/02		
	Quartiles	1	2	3	4	
Period 1:	1	41%	39%	8%	12%	100%
	2	28%	34%	26%	12%	100%
Jun/98	3	11%	30%	47%	11%	100%
	4	4%	19%	29%	47%	100%

		Period 2:		Jul/02		
	Quartiles	1	2	3	4	
Period 1:	1	44%	29%	18%	9%	100%
	2	16%	37%	32%	16%	100%
Mar/97	3	17%	29%	32%	22%	100%
	4	4%	19%	40%	37%	100%

The degree of persistence can be evaluated by observing the values along the main diagonal. The persistence is very high for the extreme quartiles. Thus, 76% of the banks that were in the top quartile by June 2001 remained in this position in July 2002. Similarly, 74% of the banks located in the bottom quartile by June 2001 remained there 13 months later.

The degree of persistence reduces when the time between the initial and the final periods of comparison increase. For the largest window considered in the analysis, 37% of the banks in the top quartile in March 1997 remained in this quartile 65 months later. For the banks in the bottom quartile, the proportion is 44%.

3) Search costs and interest rate dispersion

Many different factors can account for the observed pattern of loan interest rate dispersion described in the previous section. The aim of this section is to access the role played by search costs in explaining some of these trends.

We use a dummy variable representing the period after which the Central Bank started to make available bank level lending rates at its homepage as our proxy for search costs. Our identifying assumption is that this event characterizes as a natural experiment. This measure was implemented to "stimulate competition among financial institutions and to promote greater transparency in bank operations"[4] as part of a Central Bank sponsored project with the declared aim to reduce the bank interest spread. Thus, the Central Bank had no intention to interfere in the loan interest rate dispersion with this measure. We therefore take it as an exogenous event as far as the interest rate dispersion is concerned.

Since our results in the previous section show that the dispersion is correlated with the mean level of the lending rates, the dispersion measure we consider in this section are adjusted to take into account this effect.

We present two kinds of results. In the first one, monthly dispersion measures are first obtained and then regressed on our measure of search costs. In the second, quantile regressions are performed for the bank-level lending rates.

3a. Two-step regressions

Apart from search costs, many other factors can explain the behavior of the loan rate dispersion. We use a two-step approach to parsimoniously control for the effect of these other factors.

In the first step, the bank-level lending rates for all loan categories are pooled and regressed on a set of bank dummies and time dummies for each month. There are 37,590 observations for an unbalanced panel data set with 225 commercial banks and 65 months. The residual from this first step is a measure of the bank lending rate for a given loan category free of the effects of both time-invariant bank characteristics and of macroeconomic factors.[5]

[4] Banco Central do Brasil (2000), p. 35.

[5] Nakane and Koyama (2002) show that the lending rate dispersion differs for retail and wholesale banks. Another bank characteristic to affect the dispersion is whether the bank is a customary or an occasional player in a certain loan category market.

Monthly dispersion measures adjusted for the median value are then formed for each loan category from the residuals from the first-step regression. The interquartile distance is our measure of dispersion. This variable is the dependent variable in the second step. The set of regressors in the second step include dummies for each loan category and interaction terms between the loan category dummies and a dummy taking one for the months after October 1999. The sign of this last coefficient is of our primary interest. A negative sign is to be interpreted as an indication of the relevance of search costs.

Table 4 reports the results. Two sets of results are shown. The first ones have no interaction terms. Thus, the impact of search costs is assumed to be the same across all the loan categories. The second regression includes the interaction terms allowing for different responses according to each loan category.[6]

Table 4: Regressions for the interquartile distance

	No Interactions		With Interactions	
	Coefficient	Std. Error	Coefficient	Std. Error
Constant	1.6040	0.0399	1.6229	0.0647
Dummy Receivables Discount	-0.3139	0.0514	-0.5841	0.0766
Dummy Discount of Promissory Notes	-0.0634	0.0616	-0.1365	0.1073
Dummy Working Capital	-0.2901	0.0420	-0.4362	0.0726
Dummy Overdraft Line of Credit	0.4908	0.0518	0.6415	0.0872
Dummy Goods Acquisition - Corp	-0.2590	0.0439	-0.3186	0.0755
Dummy Vendor	-0.2940	0.0444	-0.4305	0.0778
Dummy Personal Overdraft	1.3814	0.0816	1.6207	0.1368
Dummy Personal Loans	0.7019	0.0556	0.8269	0.0980
Dummy October 99	-0.4182	0.0285		
Oct 99 X Overnight Lending			-0.4556	0.0701
Oct 99 X Receivables Discount			0.0765	0.0450
Oct 99 X Discount of Promis. Notes			-0.3115	0.1026
Oct 99 X Working Capital			-0.1678	0.0366
Oct 99 X Overdraft Line of Credit			-0.7525	0.0660
Oct 99 X Goods Acquisition – Corp			-0.3380	0.0539
Oct 99 X Vendor			-0.1867	0.0487
Oct 99 X Personal Overdraft			-0.9268	0.1357
Oct 99 X Personal Loans			-0.7018	0.0809
Number of Observations	585		585	
R Squared	0.7540		0.8034	

When no interaction terms are included, the dummy variable for observations after October 99 captures the average effect impact of all loan categories. The coefficient is negative and highly significant. The point estimate indicates that the monthly loan rate dispersion saw a

[6] Overnight lending is the excluded base group. Reported standard errors are White heteroskedasticity-robust standard errors.

reduction of 0.418 percentage points (41.8 basis point) after the availability of the rates at the Central Bank's homepage.

The results with the inclusion of the interaction terms show that the impact of search costs is not homogeneous across the loan categories. The only loan category for which the interaction term does not have the expected negative sign is for receivables discount. The positive coefficient for this variable is not statistically significant though. For all the other loan categories, the interaction term is negative and highly significant. For personal overdraft and for overdraft line of credit, the reduction in the mean dispersion after October 1999 reached 92.7 and 75.3 basis point, respectively.

The results therefore provide strong support for the relevance of search costs in affecting the dispersion of lending rates in Brazil. It is important to emphasize that such impact is measured after accounting for any bank-level fixed effects, macroeconomic factors, and the behavior of the average lending rate.

3b. Quantile regressions

The second-step regression in the previous section does not make full use of all the information available in the sample because it just pays attention to the interquartile distance. A more accurate view is provided by regressions of the loan interest rate against the proxy for search costs for each quantile of the distribution.[7] This section presents the results of this exercise.

The quantile regressions were run for each loan category. The dependent variable is the residual from the first-step regression from the previous section. In other terms, the dependent variable is the loan interest rate once the bank-level fixed effects and the macroeconomic factors captured by time dummies are netted out. Apart from a constant term, the only regressor included is the dummy variable for the observations after October 1999. An indication of a reduction in the loan rate dispersion due to a reduction in search costs would be captured by monotonically decreasing coefficients for the dummy variables as one goes from the bottom (.10) to the top (.90) quantile. Table 5 reports the estimated coefficients for the dummy variable (standard errors are reported in parentheses).

Table 5: Quantile regressions: coefficient of the October 99 dummy

Quantile	Overnight Lending	Receivables Discount	Discount Prom. Notes	Working Capital	Overdraft Line Credit	Goods Acqui	Vendor	Personal Overdraft	Personal Loans
.10	0.4134 (0.054)	0.1286 (0.043)	0.5909 (0.059)	-0.0294 (0.051)	0.3209 (0.055)	0.2534 (0.048)	0.2240 (0.037)	0.7506 (0.1148)	0.5953 (0.046)
.20	0.2332 (0.047)	0.1831 (0.032)	0.5597 (0.062)	-0.0290 (0.030)	0.1574 (0.036)	0.2949 (0.051)	0.1773 (0.035)	0.4580 (0.166)	0.3894 (0.036)
.25	0.1958 (0.045)	0.1740 (0.025)	0.5707 (0.064)	-0.0307 (0.024)	0.1186 (0.042)	0.3182 (0.050)	0.1628 (0.033)	0.6929 (0.109)	0.2963 (0.035)
.30	0.1621 (0.036)	0.1494 (0.028)	0.5031 (0.045)	-0.0398 (0.028)	0.0978 (0.040)	0.3054 (0.041)	0.1599 (0.033)	0.7260 (0.076)	0.2093 (0.041)
.40	0.1392 (0.037)	0.1314 (0.031)	0.3727 (0.061)	-0.0519 (0.024)	0.0102 (0.037)	0.2694 (0.041)	0.1571 (0.042)	0.4446 (0.091)	0.1163 (0.041)
.50	0.1120 (0.042)	0.1952 (0.034)	0.3037 (0.048)	-0.0594 (0.026)	-0.0101 (0.050)	0.1900 (0.033)	0.1345 (0.041)	0.2782 (0.070)	0.0183 (0.049)

[7] See Koenker and Bassett (1978) for an exposition of quantile regressions.

.60	-0.0095 (0.049)	0.2004 (0.031)	0.2271 (0.054)	-0.0876 (0.024)	-0.0793 (0.051)	0.1615 (0.041)	0.0672 (0.050)	0.1887 (0.091)	-0.1381 (0.056)
.70	-0.1485 (0.067)	0.2109 (0.041)	0.2616 (0.050)	-0.1629 (0.030)	-0.3447 (0.063)	0.0403 (0.033)	0.0640 (0.052)	-0.1028 (0.077)	-0.3176 (0.061)
.75	-0.2352 (0.057)	0.2269 (0.048)	0.1542 (0.056)	-0.2099 (0.027)	-0.5760 (0.062)	-0.002 (0.040)	0.0048 (0.061)	-0.2328 (0.076)	-0.3539 (0.072)
.80	-0.3443 (0.077)	0.2451 (0.045)	0.1052 (0.069)	-0.2803 (0.033)	-0.8259 (0.084)	-0.043 (0.056)	-0.022 (0.069)	-0.4888 (0.082)	-0.3585 (0.091)
.90	-0.5944 (0.166)	0.2470 (0.062)	0.0348 (0.080)	-0.5105 (0.061)	-0.9389 (0.134)	-0.309 (0.076)	0.1463 (0.075)	-1.2460 (0.105)	0.3129 (0.172)

Overall, the results confirm the findings of the previous section, which concentrated in the 75^{th}-25^{th} spread. Apart from receivables discount, the evidence favoring the idea that reduction in search costs helped to reduce the loan rate dispersion is rather strong.

For some loan categories such as overnight lending, and overdraft line of credit the coefficient on the dummy variable decreases monotonically across all the quantiles. Moreover, banks charging lower lending rates have actually increased their rates after October 1999 whereas those charging higher lending rates have decreased their rates after that date. Thus, the reduction in the loan rate dispersion for these loan categories reflect a convergence movement for all the banks across the quantiles.

For vendor and for personal loans there is a monotonically decreasing pattern for the dummy variable coefficient apart from the top (.90) quantile. That is, reduction in the dispersion after October 1999 is found for all the banks excepting those charging the highest lending rates. But, even for these banks, one would observe reduction in the dispersion when contrasted to the banks in the bottom quantile, i.e. if one takes the 90^{th}-10^{th} dispersion measure.

For discount of promissory notes, working capital, finance for goods acquisition, and for personal overdraft the monotonic pattern is observed for the top quantiles but not for the bottom quantiles. So, for these loan categories banks charging the lowest lending rates do not conform to the expected pattern. However, for all these loan categories one can see that the 90^{th}-10^{th} dispersion reduces after October 1999.

Another interesting finding is that only for working capital one notices negative signs for the dummy variable coefficient across all the quantiles. That is, only for this loan category it is true that banks across the rate distribution have reduced their lending rates after October 1999. The general pattern for the other loan categories is for banks in the bottom side of the distribution to have increased their lending rates while banks in the upper side of the distribution to have reduced their lending rates after October 1999.

4) Conclusions

This paper showed some evidence related to the inter-bank dispersion of lending rates for different loan categories in Brazil.

The main findings of the paper can be summarized as follows: a) the dispersion is very high in numerical terms; b) there is great heterogeneity in the dispersion behavior across loan categories; c) there is great time variation in the dispersion measures; d) dispersion keeps

being significant even after controlling for the behavior of the mean levels of the lending rates; e) dispersion shows high persistence, specially in the extreme quartiles; f) reduction in search costs helped to reduce dispersion for all loan categories apart from receivables discount.

References

BANCO CENTRAL DO BRASIL (2000): *Juros e Spread Bancário no Brasil – Avaliação de 1 ano do projeto*. Departamento de Estudos e Pesquisas. (available online at www.bcb.gov.br)

DAHLBY, Bev, & WEST, Douglas S. (1986); "Price dispersion in an automobile insurance market", *Journal of Political Economy*, **94**, 418-438.

KESSNER, Ekkehard & POLBORN, Mattias K. (2000): "A new test of price dispersion", *German Economic Review*, **1**, 221-237.

KOENKER, Roger & BASSETT, Jr., Gilbert (1978): "Regression quantiles", *Econometrica*, **46**, 33-50.

NAKANE, Márcio I., & KOYAMA, Sérgio Mikio (2002): "Dispersão das taxas de empréstimos bancários no Brasil" in BANCO CENTRAL DO BRASIL, *Economia Bancária e Crédito – Avaliação de 3 anos do projeto Juros e Spread bancário*, Chapter 6, 80-100. (available online at www.bcb.gov.br)

ROBERTS, Mark J., & SUPINA, Dylan (1997): "Output price and markup dispersion in microdata: the roles of producer heterogeneity and noise", NBER Working Paper 6075.

SALOP, Steven C., & STIGLITZ, Joseph E. (1982): "The theory of sales: a simple model of equilibrium price dispersion with identical agents", *American Economic Review*, **72**, 1121-1130.

SORENSEN, Alan T. (2000): "Equilibrium price dispersion in retail markets for prescription drugs", *Journal of Political Economy*, **108**, 833-850.

STIGLER, George J. (1961): "The economics of information", *Journal of Political Economy*, **69**, 213-225.