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DANIEL BATISTA DA SILVA

ON THE FORWARD-LOOKING BEHAVIOR OF BRAZILIAN NON-EARMARKED

HOUSEHOLD CREDIT

FORTALEZA

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Monografia apresentada Curso de Ciências
Econômicas da Universidade Federal do Ceará,
como requisito parcial à obtenção do título de
Bacharel em Economia.

Orientador: Prof. Dr. Paulo Rogério Faustino
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Aprovada em: ___/___/_____.

_____
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RESUMO

Este trabalho busca modelar a dependência linear entre decisões de crédito de famílias e variações de expectativas das variáveis macroeconômicas mais relevantes no Brasil. Abordar essa questão é relevante, uma vez que o mercado de crédito doméstico brasileiro parece ser heterogêneo, aparentemente inconsequente, impulsionado por variáveis de demanda e explosivos. As evidências sugerem que, dada uma má sinalização da austeridade fiscal do governo, as famílias tendem a reduzir os níveis de inadimplência e atrasos. Também descobrimos que os aumentos inflacionários esperados induzem aumentos na concessão de crédito e também estimulam as famílias a amortizar suas dívidas.

Palavras-chave: Crédito Doméstico, Risco de Crédito Doméstico, Expectativas de variáveis macroeconômicas.

ABSTRACT

This work aims to model the linear dependence between non-earmarked household credit decisions and variations of expectation of most relevant macroeconomic variables in Brazil. Addressing this issue is relevant since Brazilian household credit market seems to be heterogeneous, apparently inconsequential, driven by demand variables and explosive. The evidences suggest that given a bad signaling of government fiscal austerity, household tend to reduce levels of delinquency and arrears. We also find that expected inflationary increases induce increases in credit grant and also stimulate household to amortize their debt.
Keywords: Household loan, Household credit risk, Expectation of macroeconomic variables.

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SUMMARY

1 INTRODUCTION

Brazilian economy has followed other Latin American countries' experience by moving toward a financial liberalization. One of the consequences is the growth rate of Brazilian credit-to-GDP ratio from 2004 to 2011, 11.4% according to the World Bank dataset, one of the highest rates worldwide.

This context would be unquestionably interesting if the firms were in debt for productive investments, or if the increase of household credit was due to earmarked resources aiming to improve real estate and agricultural credit. Moreover, we should not be concerned if this evolution was being homogeneous, associated with fundamentals and thus, not explosive.

However, according to Matos et al. (2013) there is a discriminatory credit policy evidenced by the formation of two clubs characterized by a regional bias, with, a representative presence of states located in the Northeast and North regions included in the second group. Matos and Correia (2017) study this cross-state heterogeneity and find that the demand for credit plays a more important role than supply from 2004 to 2013. Still concerning cross-state analysis, the evidence reported in Matos et al. (2015) suggest that Brazilian household loan delinquency is driven by poverty and unemployment.

Methodologically, building on Bohn's (2007) fiscal reaction function, Matos and de Jesus Filho (2018) propose an approach to infer about the solvency of Brazilian household credit disaggregated by source of financial resources: non-earmarked, earmarked and total. They find that non-earmarked and total household credit are insolvent based on negative causality from debt-to-GDP to surplus between amortization and granting of credit as a proportion of GDP.

One can summarize Brazilian household credit market as heterogeneous, apparently inconsequential, driven by demand variables and explosive. In this scenario, we are convinced that it is worthwhile to broaden this discussion by modeling household credit decisions based on a forward-looking framework.

We enter this debate, by proposing a model to better understand the variation in some of the main non-earmarked household credit variables: amortization-to-GDP, concession-to-GDP, percentage of credit portfolio with arrears and delinquency rate. We use the expectations series for the economic variables monitored by Market Report - Focus of the Central Bank of Brazil that reflect the market perception for the macroeconomic performance

of the country. We apply this forward-looking approach in an empirical exercise with monthly frequency, during the period from April 2011 to August 2017.

This paper is structured into five sections including this introduction. Section 2 gives an account of a brief overview about household credit in Brazil, before presenting data and discussing our empirical analysis in the third and fourth sections. Concluding remarks are offered in the fifth section.

2 BRAZILIAN HOUSEHOLD CREDIT

Over the whole last decade from 2007 to 2016, household credit portfolio balance in Brazil has grown at an average monthly rate of 1.2%, while firm credit has grown at a monthly rate lower than 1%. In terms of share, accounting for historical time series available at Central Bank of Brazil, in December 2016 household credit has played for the first time the most important role in the Brazilian financial system. More recently, in August 2017, household credit portfolio balance reached 52.8% of the total credit balance in the country, which corresponds to 25% of GDP.

Regardless of the benefits due to firm or household credit, we need to better understand the drivers of Brazilian households, its role in the financial market and if its evolution is worrying.

According to Matos and de Jesus Filho's (2018) analysis about total household credit, amortization-to-income ranges from 10.5% to 13.5% during the period from March 2005 to July 2017, displaying a downward trend from mid-2014. They also evidence a robust growth of the income commitment that accounts for loan interest rates. The difference between amortization-to-income and interest payment-to-income, which was already higher than 6% at the beginning of the sample period, is lower than 0.8% at the end of the sample period. It is still very troublesome the growth of debt-to-cumulative income, rising from almost 20% in March 2005 to more than 46% in April 2015. In the last two years, this ratio has dropped and is currently 41. 6%.

In terms of loan terms, while household credit concession has grown until June 2013 in an environment characterized by a strong reduction in loan rates, during the last four years, household credit has risen, with more volatility and along with growth in loan rate. This concession has risen from R$ 136 billion in June 2013 to R$ 159 in December 2016, due to excessive demand, while loan rates have increased from 27.4% to 41.9% during the same period. This scenario is even more worrying when we analyze specifically non-earmarked credit, whose share of total household credit grant ranges from 83.4% to 92.1% during the period from April 2011 to August 2017. The medium term of this kind of credit is 48.7 months and its loan rate ranges from 39.5% to 74.5% per year while spread ranges from 30.5% to 62.6%, during this same period.

3 THE DATA

Our main limitation for time series span regards the credit, since some of the relevant variables are available only from 2011, even extracting these series from the most important economic data in Brazil, Central Bank of Brazil. In this sense, our sample covers the period from April 2011 to August 2017, comprising 77 monthly observations. Aiming to understand the behavior of our endogenous variables, in Table 1 we report summary statistics of endogenous variables while, we plot their evolution in Figure 1.

Table 1: Summary statistics of endogenous variables

Endogenous variables	Mean	St. dev.	Minimum	Maximum
Amortization-to-GDP (%)	2.70685%	0.07451%	2.51275%	2.88366%
Concession-to-GDP (%)	2.28435%	0.14477%	1.85572%	2.58035%
Percentage of credit portfolio in arrears	5.74623%	0.61220%	4.63000%	7.11000%
Delinquency (%)	6.12143%	0.55193%	5.16000%	7.20000%

Data Source: Central Bank of Brazil

Figure 1: Brazilian non-earmarked household loan credit variables (April 2011 to August 2017). Source: Central Bank of Brazil

1. a Credit-to-GDP   1. b Credit risk proxies
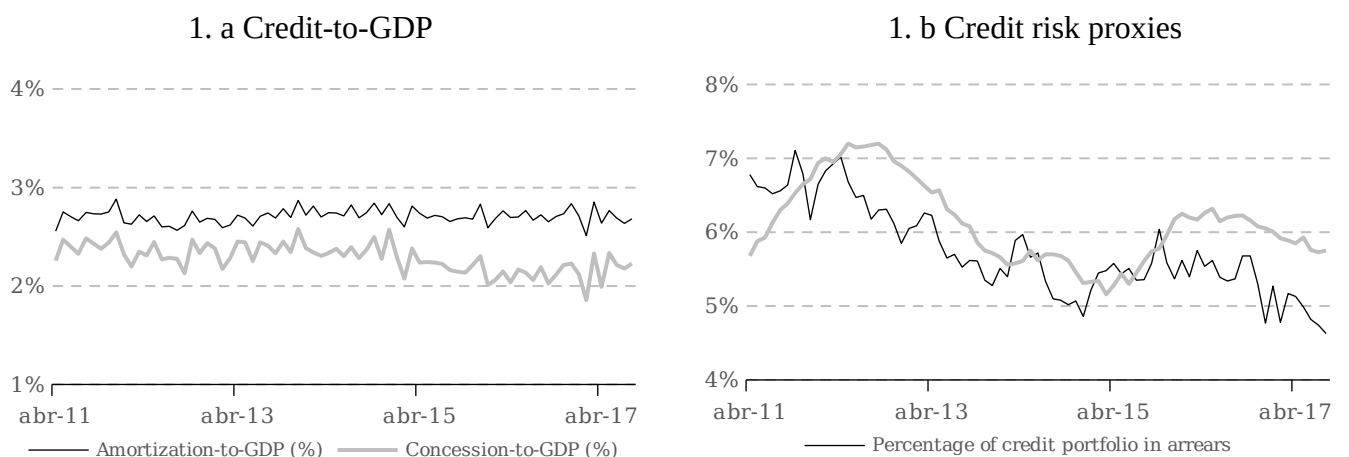
Amortization and concession-to-GDP series seem to be smooth and without trend, ranging from 1.8% and almost 3%. The difference between them is growing and reached 0.42% on average. Credit risk proxies are more volatile and they seem to follow a co-movement with a with a strong and decreasing trend from the end of 2012 to mid-2015.

Concerning our exogenous variables, Table 2 reports for each one a simplified notation in the first column and its respective detailed description. To summarize, we are working with monthly series of expectations of the main macroeconomic indicators in Brazil: inflation measures, exchange rate against the US dollar, basic interest rates, public debt to GDP, GDP growth, industrial production, current account, trade balance, foreign direct investment and administered prices.[1]

For our purposes, and aiming to deal with stationary series, we need to work with change of expectations. Other relevant detail is the forecast horizon. The series correspond to market expectations of the closing value of the year following the year in which the information is collected at the Central Bank.

The question we want to answer is, for instance, if on October 31, 2012, following the disclosure about change of market forecast on GDP growth for 2013 in relation to previous forecast disclosed a month before, this information affects the variation of household credit decision.

According to descriptive statistics reported in Table 2, some of the expectations of variables show little variability, which may be a limitation to our model, compromising the ability to explain credit changes.

1These series of expectation with weekly frequency have been used to model Central Bank of Brazil demand for foreign reserves in Matos (2016), as well as, to explain conditional volatility of Brazilian sectorial indices in Matos et. al. (2017).

Table 2: Statistics of expectations series for the economic variables

Notation	Detailed description	Mean	Standard deviation	Minimum	Maximum
$\Delta ipca^{exp}$	First difference time series of expectation of anual inflation measured by Price Index to Broader Consumer (known in Brazil, as IPCA)	-0.01312%	0.25501%	-1.07000%	0.60000%
$\Delta igpdi^{exp}$	First difference time series of expectation of anual inflation measured by Generalized Price Index - Domestic Availability (known in Brazil, as IGP-DI)	-0.01299%	0.13378%	-0.64000%	0.37000%
$\Delta igpm^{exp}$	First difference time series of expectation of anual inflation measured by Generalized Price Index to Market (known in Brazil, as IGP-M)	-0.01052%	0.16382%	-1.02000%	0.29000%
Δipc^{exp}	First difference time series of expectation of anual inflation measured by Price Index to Consumer (known in Brazil, as IPC)	-0.00610%	0.20742%	-0.69000%	0.43000%
$\Delta forex^{exp}$	Variation (%) time series of expectation of spot foreign exchange rate (R$/US$)	0.01107%	0.04172%	-0.25816%	0.11111%
$\Delta selic^{exp}$	First difference time series of expectation of anual SELIC rate	-0.09740%	0.56625%	-2.50000%	1.13000%
$\Delta debt^{exp}$	First difference time series of expectation of anual net public sector debt to GDP ratio	0.20519%	0.87580%	-3.05000%	4.26000%
Δgdp^{exp}	First difference time series of expectation of anual GDP grwoth	-0.00909%	0.57458%	-0.91000%	3.65000%
Δind^{exp}	First difference time series of expectation of anual industrial production grwoth	-0.02649%	0.74727%	-1.49000%	5.00000%
Δcur^{exp}	Variation (%) time series of expectation of current account balance	0.01992%	0.06986%	-0.11111%	0.29221%
$\Delta trade^{exp}$	Variation (%) time series of expectation of balance of trade	0.04207%	0.23096%	-0.25000%	1.10200%
Δfdi^{exp}	Variation (%) time series of expectation of foreing direct investment	0.00472%	0.03695%	-0.14462%	0.09091%
Δadm^{exp}	First difference time series of expectation of anual inflation measured by administered prices	-0.01234%	0.50180%	-2.00000%	1.15000%

Data source: Market Report (Focus) from Central Bank of Brazil.

4 THE MODEL AND MAIN FINDINGS

Our innovation key is incorporating the dependence of the variation in relevant household credit decisions in relation to the change in expectation of the macroeconomic variables. Our forward-looking model is given by:

$$AM_t = \alpha + \beta\, AM_{t-1} + \sum_{j=1}^{13} \gamma_j\, x_{j,t} + \varepsilon_t \qquad\qquad (1)$$

$$CC_t = \alpha + \beta CC_{t-1} + \sum_{j=1}^{13} \gamma_j x_{j,t} + \varepsilon_t \qquad (2)$$

$$AR_t = \alpha + \beta AR_{t-1} + \sum_{j=1}^{13} \gamma_j x_{j,t} + \varepsilon_t \qquad (3)$$

$$DE_t = \alpha + \beta DE_{t-1} + \sum_{j=1}^{13} \gamma_j x_{j,t} + \varepsilon_t \qquad (4)$$

Formalizing, AM_t denotes amortization-to-GDP in t, CC_t is concession-to-GDP in t, AR_t means percentage of credit portfolio in arrears in t, while delinquency in t is given by DE_t. Finally, $x_{j,t}, j=1,\ldots,13$ denotes each one of the variation of expectations of macroeconomic variables reported at Focus.

More specifically, we have to find the best specification for each credit model by identifying which forward-looking explanatory variables must be incorporated into the final specification framework, a non-trivial step, according to Tsay (2005). We have thirteen macro variables and thus, more than 8,000 possible combinations with these variables. Aiming at the most parsimonious model, we consider only the Schwarz criterion information, to be more severe in penalizing the inclusion of regressors than Akaike criterion.

Table 3 reports main results.

Table 3: Results of model estimation (April 2011 to August 2017)[2]

	Amortization-to-GDP (%)	Concession-to-GDP (%)	Percentage of credit portfolio in arrears	Delinquency (%)
Constant	0.0289 *** [0.0000]	0.0140 *** [0.0000]	0.0069 ** [0.0180]	0.0019 [0.2430]
Endogenous lagged once	-0.0657 [0.6354]	0.3870 *** [0.0010]	0.8790 ** [0.0000]	0.9706 *** [0.0000]
Δigpdi^{exp}		0.2773 *** [0.0010]		
Δipc^{exp}	0.0762 * [0.0738]			
Δdebt^{exp}			-0.1004 *** [0.0043]	-0.0312 ** [0.0204]
Complementary results				
Wald test	1.8061 [0.1716]	12.3378 *** [0.0000]	207.4052 *** [0.0000]	919.4390 *** [0.0000]
Adjusted R^2	0.0472	0.2322	0.8463	0.9608

2 Linear models estimated through OLS with the Newey-West robust covariance. Respective p-values are in the box brackets. * p-value<0.1. ** p-value<0.05. *** p-value<0.01. Data source: Central Bank of Brazil.

First, except for amortization-to-GDP series, all other variables exhibit inertial but not explosive behavior, given the significant parameters related to lagged variables. According to our main findings, there seems to be intuitively a negative dependence between the credit risk proxies and an increase in expectation of net public debt-to-GDP. In other words, given a bad signaling of government fiscal austerity, household tend to reduce levels of delinquency and arrears. We also find that expected inflationary increases induce a higher credit grant level as well as stimulate household to amortize their debt, possibly due to the monetary pass through that relates inflation increase with future interest rates increases, i.e. a more expensive credit in the future. Finally, our forward-looking approach seems to provide a reasonable fitting, except for amortization decisions, based on adjusted explanatory power which ranges from 5.7% to almost 96%, in the delinquency model.

5 CONCLUSION

We claim that Brazilian household decisions seem to be forward-looking accounting for changes in expectation of main macroeconomic variables. As our main implications in practice, we invite researchers in this related literature to allow for this behavior when writing credit models. We recognize that our approach affords some generality, in the sense of performing the same exercise based on longer time-series span or considering more explanatory variables.

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