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THE HOUSING FINANCING SUBSIDY AND DEFAULT

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Resumo/Abstract

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Abstract

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Keywords: Credit default; *Minha Casa Minha Vida Program*; Government subsidies.

1 Introduction

Housing policies in Brazil have undergone major changes since the implementation of the *Minha Casa, Minha Vida Program* (PMCMV) which was implemented in 2009. The expansion of an offer of credit to low-income families, as subsidized housing financing, has enabled the acquisition of a first property for those who could not buy one before (Magnabosco, 2011).

The purpose of PMCMV is to reduce the housing deficit and promote the acquisition of properties for low-income families (Brasil, 2009). One of its great challenges is to provide quality of life in the housing sphere, making it possible to pay long-term financing in a timely manner. One of the main criticisms attributed to the PMCMV is related to the high default rate, which is shown to be higher than those registered in the real estate credit lines market that did not receive subsidies.

Default causes inconvenience for both the creditor and the borrower. The effect of default on the borrower implies the negation of registration information, inability to access credit, emotional distress, social stigma, possible denial of a job, and reduced career opportunities (Ngene, 2016, Araújo, Lustosa & Dantas, 2018). Research has identified factors that influence home borrowers toward delaying payments. The main reasons involve: the relationship between the debt value and the value of the collateralized property; the compromise of the family income in relation to the value of the benefit; the effects of fiscal, monetary policies, and periods of economic recession. (Jackson, 1980, Goodstein, 2017, Hatchondo, 2015, Ngene, 2016, Campbell, 2013).

In his research, Goodstein (2017) identified that proponents who obtained housing credit through the american government (Government-sponsored enterprise) behaved differently than those who did not: they are more likely to be strategically in default to achieve benefits in debt renegotiation with the financial institution or by judicial means.

The behavior of families who received subsidies in housing financing was also studied in countries like Mexico and Chile (Lopez-Silva, Abreu-Lastra, Saracho-Martínez & Paulín-Hutmacher, 2011, Ruprah & Marcano, 2007). For both, the contracts that received the benefit did not have default rates higher than those that were not benefited. In this context, Brazil presents a favorable environment for the study of the relationship between defaults and subsidies in housing financing. The importance of PMCMV can be seen in numbers it has made since its launch in 2009. Were delivered 3.68 million housing units and represent an investment in the productive chain of the country of a value which is approximately R \$ 398.5 billion, according Ministry of Planning For information, Development and Management, which characterizes it as the most far-reaching housing policy program ever implemented in the

country.

The objective of this research is to analyze the association between defaults on housing financing from the *Minha Casa Minha Vida Program* (PMCMV) - ranges 2 and 3 - and the subsidy received by borrowers in the form of a discount on the amount of the loan and a reduction in the interest rate. It is intended to verify whether debtors who received subsidies with discounts in the amount of financing and in the interest, rate respond differently to the factors that explain the default of contracts that did not receive the subsidy, according to the literature in the area.

There is a gap in the literature, as there are no records of studies carried out in Brazil that have analyzed the impact of the PMCMV subsidy on the default of housing financing. This research is necessary, in order to highlight the reality of the Brazilian subsidized housing credit program and its implications for default.

To answer the research question, a linear regression model was developed, based on data from PMCMV housing financing borrowers, ranges 2 and 3. Demographic information was collected: gender; age, marital status, contract data: income compromise, interest rate contracted, number of installments in arrears; financing value; value of the quota financed in relation to the value of the asset, and the subsidy value. The variables that were also included were GDP and unemployment rates as macroeconomic controls that can directly influence defaults.

The results found show that a subsidy, received in the form of discounting the financed amount, and discounting the PMCMV, encourages default and reinforces the need to create public policies that are viable in the long term, and are aligned both with the credit market and the well-being of families, which when financing your first property has the ability to comply with the payment of the installments and does not lose all the good won, due to default.

This research hopes to contribute to identifying contractual arrangements that would allow, at the same time, the implementing of public housing policies, and make housing financing viable for low-income families. Such policies should provide the proponent to comply with his or her financing obligations, without one becoming indebted more than the income of one's family.

2 Theoretical Framework

2.1 Housing Financing in Brazil

The credit destined for the purchase of real estate in Brazil was initially encouraged by a private capital initiative originating from agricultural and commercial activities, which directed the credit offer to the higher-income classes (Botelho, 2007). Initiatives to provide housing for the low-income population began to be implemented from 1946 with the creation of the Casa Popular Foundation (FCP), however, after the implementation of the Housing Finance System (SFH) in 1964, the interest rates on housing financing started to be subsidized (Silva & Alves, 2014).

Established by Law No. 4380, dated 8/21/1964, the Housing Financial System (SFH) aimed to enable the capture of resources and their application in the housing area, seeking to solve problems such as: scarce resources eroded by inflation; population increase in large urban centers; and inexistence of criteria for granting housing financing. As a result, the housing market was divided into three levels, served by different agents of the SFH: medium market, economic market, and popular market (Da Costa, 2003).

The average market is served by financial agents of the Brazilian Savings and Loan System (SBPE), these institutions are obliged to direct a percentage of the amounts deposited in a savings account to finance real estate, these deposits have the same remuneration, regardless of which the creditor bank (De Araújo, Barroso & Gonzalez, 2016). The economic and popular markets are basically financed by resources from the Guarantee Fund for Time of

Service (FGTS), which were used to implement public housing policies for low-income populations (Da Costa, 2003). The credit line with FGTS resources has a lower interest rate than the SBPE, however there is a family income limiter so that the applicant can have access to the credit line.

With the increase in earmarked credit, there is an expansion of the supply of housing credit as of 2004. It was during this period that important institutional changes were implemented so that financial institutions could raise more resources and have greater guarantees controls, among them Law 10.931 / 04 of Fiduciary alienation and the Resolution of the National Monetary Council (CMN) that allowed fundraising of savings and FCVS for real estate loans (Mioto, 2015).

In this scenario, the *Minha Casa Minha Vida Program* (PMCMV) was born, which was created in 2009 by means of provisional measure 459 and later converted into Law 11,977, under the responsibility of the Ministry of Cities. The program aims to create mechanisms to encourage the production and acquisition of housing units for low-income families to reduce the housing deficit in the country (Brasil, 2009).

The PMCMV covers three income brackets. Bracket 1 provides high subsidies and is intended for families with an income up to R \$ 1800, (one thousand and eight hundred reais) and families with children born with microcephaly, who live in an area of priority, high-risk or unhealthy people who have been displaced, women responsible for the family unit and people with disabilities (Brasil, 2009). Band 2 is intended for families with an income between three and six minimum wages, and offers moderate subsidies. Band 3 does not provide subsidies and covers applicants with an income between six and ten minimum wages. All income brackets are covered by FGHAB (Guarantee Fund for Popular Housing), a type of insurance that covers financing in the event of death, permanent disability, and property damage, and ensures payment of some benefits in the event of the borrower's unemployment (Brasil, 2009).

The program covers both rural and urban areas and its greater relevance is related to the incentive to the real estate sector, which receives resources for production (Mioto, 2015).

One of the great challenges of the PMCMV is the increasing rates of default, which are higher when compared to other credit lines for unsubsidized real estate financing from the period 2011 to 2018, despite presenting a lower volume of contracts for the period, as can be seen in figures 1 with data provided by the Central Bank and Caixa Econômica Federal (unique database).

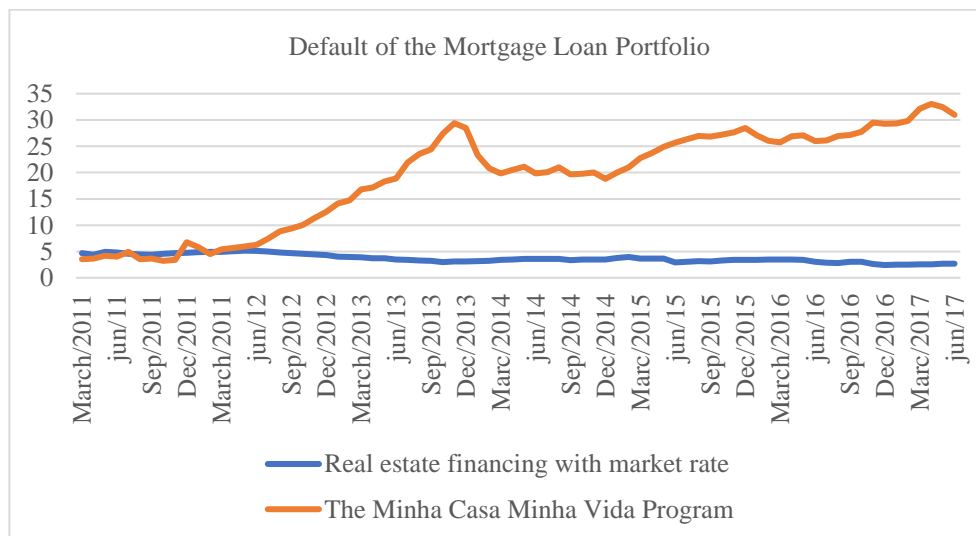


Figure 1. Default of the mortgage loan portfolio

Source: (BACEN, 2019; Caixa Econômica Federal, 2019)

Note: Adapted by authors.

2.2 Housing Benefit

Magnabosco (2011) defines the housing subsidy as an instant transfer of resources that can be used to pay part of the property value. A housing subsidy policy increases the level of household savings, which facilitates access to housing credit for those who are critically affected by lack of access to the housing market. Subsidy policies increase the demand for credit and the offer remains unchanged, without changing the balance of the real estate market (Brollo, 2004).

The granting of the subsidy in housing financing interferes with contractual conditions between the borrower and the grantor, which affects the banks' rate of return, the amount to be lent, and the offer of credit (Magnabosco, 2011). Simian (2010) identified that the subsidy on housing credit increases the probability of a family having access to credit and decreases the housing deficit of an economy. Studies by countries that had large contributions of housing subsidies, such as Chile, identified that the increase of this policy has an increase in the offer of credit to low-income families (Magnabosco, 2011)

The effect of the default rate of contracts that received subsidies was analyzed by Ruprah and Marcano (2007), who, in his research, identified that beneficiaries who received housing credit subsidies in the Chilean market did not show higher default rates than those who did not receive the subsidy. With conclusions along the same lines, (Lopez-Silva et al. 2011) examined a database of Mexico's main mortgage issuer. In his research, it was evidenced that borrowers who received subsidies in housing financing did not behave differently in relation to those who did not receive this financing, and took less time to present the first default.

In opposition to the research carried out in the Latin American market, Goodstein (2017), in his study, identified that proponents who obtained housing credit through an incentive line from the American government (*Government-sponsored enterprise*) behaved differently from those who did not: they are more prone to default with the intention of obtaining benefits in debt renegotiation with the financial institution or by judicial means. The characteristics and formatting of the PMCMV is closer to the housing subsidy policies adopted in the Chilean market, which served as the basis for the creation of the Brazilian program (Magnabosco, 2011).

2.3 Default of Mortgage Loans

The two main theories that address the decision to default on payment and mortgage loans can be identified in the literature on mortgage default risk. The first is known as *Strategic Default Theory*, which means the strategic default by the debtor. This theory holds that borrowers base their decisions on non-payment on a rational comparison of the financial cost and returns involved in continuing mortgage loan payments. In this case, failure to comply occurs when the value of the collateral falls so that the benefits of paying the debt outweigh its costs and borrowers can return the property to pay off the debt. (Jackson, 1980, Goodstein, 2017)

The second theory is known as *Ability-to-Pay Theory of Default*. It is the case that mortgages will fail to be paid if family income is insufficient to meet obligations periodically in addition to other variables such as: financial, equity, demographic, monetary policies (Jackson, 1980, Goodstein, 2017). Aspects such as lower income compromise and less fragile guarantees influence the contracts not to be exposed to default (Locatelli, 2016). Likewise Ngene (2016) states that the most important factor that explains the borrower's default is in the debt / income ratio. Creditors must focus on the quality of the applicant for the credit transaction, seeking to avoid greater information asymmetry between the parties. Giliberto and Houston (1989) identified that family crisis events can influence the default on housing credit. At the time of credit origination, the amount of the benefit is generally compatible with what families are willing to pay, however, events in the life cycle such as, marriage, death, divorce,

and wage reduction aligned with economic events such as property devaluation or increased operating costs of the property make maintaining credit burdensome.

Default studies in the financial market identified that the volume of credit influences the non-payment of the debt (Magdalon, 2016, Costa Filho, 2017), however, it must be taken into account that they are operations with weaker guarantees in comparison to the mortgage or fiduciary alienation, and are exposed to the consequences of poorly designed creditor protection laws. Facilitation in the execution processes reduces the cost of financing, decreases the interest rate and allows more families to have access to credit (Brollo, 2004). The execution of real guarantees for housing credit as a result of default can encounter legal difficulties and the cost to the bank may rise. This cost is incorporated into the *spread* bank's financing (Magnabosco, 2011).

Research has identified the loan-to-value (ltv) relationship, which deals with the relationship between the financed amount and the value of the collateral as a predictive indicator of default, that is, the financed percentage of the property's value. Housing loans that have higher ltv, tend to have lower interest rates, however, families opt for lower ltv so that there is less commitment to income and to avoid default in the operation. The effect of ltv as a prevention of default on housing loans is more significant when there is a forecast of a fall in the value of the guarantee, that is, when the financed properties tend to depreciate (Hatchondo, 2015). Beatty (2012) identified that financial institutions are more likely to monitor credit when they have a greater proportion of the borrower's debt, and when information asymmetries are large

Another aspect analyzed in the literature concerns the default rate of the local area, which is an important factor to be observed by creditors. Borrowers can be influenced in their decision not to pay home financing, even if they have the capacity, this is due to the contagious effect that non-payers can have on other borrowers. Contagion effect is the excess correlation or a movement that goes beyond the explanations of economic effects (Bekaert, 2003). The contagion effect was also identified by Guiso (2013) who identified that mortgage owners with negative assets (when the debt value exceeds the value of the mortgage) are more likely to become strategically delinquent if they know others who have done the same thing. The actions of individual owners are a reflection of the common actions of neighborhood owners.

The lack of application of penalties to the defaulting debtor by the creditor financial institution is an incentive to increase the default of the credit operation. Mayer (2009) finds evidence that homeowners strategically downgraded their mortgages to take advantage of a judicial solution that would facilitate payment. Campbell (2013) and Harding (2009) identified that foreclosures reduce house prices in the neighborhood. Foreclosures have the most effect on inhibiting default and have the greatest effect on smaller communities, where members have greater ties to each other (Goodstein, 2017)

Monetary policy is the most effective tool for decreasing mortgage credit default and appreciation of real estate, in contrast to the government's alternative tax policies, aimed at making real estate credit more flexible (Ascheberg, 2014). Campbell (2013) pointed out that interest rate and *ltv policies* severe can inhibit the default of operations, however, they reduce the supply of credit, which would make the individual consume less products linked to housing credit. Ngene (2016) adds that such policies may not be effective in predicting the default of mortgage loans in the short term. Another aspect analyzed in previous studies traced the demographic profile of defaulters in real estate loans. The default on housing credit tends to be higher among male proponents, among married couples, and increases as age advances. (Locatelli, 2016).

2.4 Risk rating and the Basel Accord

Due to regulatory changes in the banking sector in recent years as a result of the Basel

I agreement, II and III, the analysis of the classification of credit risk has become prominent; the greater the risk of the customer holding the credit, the greater the counterpart of the financial institution against unexpected losses in its portfolio (Brito, 2008). The approach used in the last Basel agreement to measure credit risk is classified as standardized, which are factors for weighting the risk (*ratingrating*) to that established by external institutions, and the approach based on internal ratings (*Internal Rating Based - IRB*), which is similar to the standardized approach, but offers greater sensitivity when referring to risk exposure. Basel III has three main objectives: to increase the capacity of the banking sector to absorb shocks resulting from *stress* financial and economic; improve risk management and governance; and strengthen banks' transparency and disclosure (Basel, 2006).

In Brazil, financial institutions classify the risk of credit operations in AA, A, B, C, D, E, FG and H. The classification is of an ascending order in which AA presents less risk and those classified in H present higher risk of default (Niyama, 2001). The use of the client's risk classification (*rating*) for the analysis of the credit offer becomes fundamental for all financial institutions. Brito (2008) identified that customers who presented a *downgrade* in the alteration of their classification are twice as likely to have another fall in the next alteration. This demonstrates when measuring the risk analysis, the history of downgrade and /or upgrade in the analysis should be considered.

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In this context, based on the proposed objective and on the literature on defaults and housing credit, the following hypotheses arise:

H1: Borrowers who received greater subsidies in the form of a discount on the financed amount of the PMCMV have a higher default rate.

H2: Borrowers who received higher subsidies in the form of a discount on the PMCMV interest rate have a higher default rate.

3 Methodology and Research

This work is empirical, with a quantitative, descriptive, and transversal approach. It is quantitative, as it will make a statistical analysis of the data collected from individuals, as represented by numerical data. It is descriptive and cross-sectional, as it will examine data collected in the same time interval as amounts received from subsidies in the financing of the property impact on default. (Hair, 2005). To achieve the objective of this study, which was to analyze whether there is a positive relationship between default of housing financing from the Minha Casa Minha Vida Program (PMCMV) and the subsidy received by borrowers in the form of a discount on the amount of the loan and a reduction in the interest rate, by a quantitative study, with cross-sectional and secondary data. To carry out the research, PMCMV housing financing borrowers, ranges 2 and 3, who had their property financed in the period from 2009 to 2017 were used as a sample.

The data collection process took place by consulting a database with information on all borrowers (unique database), and randomly selected 1,001 samples among 1,249,814 operations contracted in the period, including defaulting and defaulting contracts. The concept defined by the Central Bank for default of the mortgage loan portfolio is characterized by contracts that have at least a portion overdue for more than 90 days, so it was considered that

those in the sample who had more than 3 overdue installments are holders of defaulting financing.

The following variables were used to explain whether the contractor was in default or not and the number of installments in arrears in housing financing. As an explanatory variable, the subsidy percentage of the operation in relation to the financed amount and the interest rate is used. The control variables used were: percentage of the subsidy in relation to the financed amount; interest rate; genre; marital status; age; *ltv*; *rating*; income commitment; financing value, GDP, and unemployment rate.

The description of each variable, their initials, as well as the reference source for use in the model are listed in Table 1.

Table 1
Description of Variables

Variables	Description	Reference
<i>INAD</i> ,	Default explained variable in the equation 1, that it is a <i>dummy</i> , differs from the fact that in default or not, where "0" represents no overdue installments and "1" represents three or more overdue installments.	The decision of the debtor to default on the payment of the housing credit is studied based on theories <i>Strategic Default Theory</i> Ability-to-Pay and Theory of default. (Jackson 1980, Goodstein 2017).
<i>P_inad</i>	Number of installments in arrears, variable explained in equation 2, which represents the number of installments in default in housing financing. Zero if the individual is in default.	
<i>subsidy</i>	Subsidy, is an explanatory variable that represents the percentage of the subsidy received by the borrower in relation to the amount financed.	Goodstein (2017) in his research showed that borrowers who received some form of government incentive to access real estate credit behaved less in default than those who did not have the same benefit.
<i>interest</i>	Interest, a control variable that represents the interest rate used in housing financing	Severe interest rate policies can inhibit default. (Campbell 2013)
<i>Log_value_fin</i>	Amount financed, is a control variable that represents the amount financed by the proposer	Magdalon (2016) identified a positive relationship in relation to the borrower's default and the volume of credit.
<i>Income</i>	Income, is a control variable that represents the income used for contracting the financing.	Ngene (2016) states that the most important factor that explains the default of the borrower is the debt / income ratio.
<i>ltv</i>	<i>ltv</i> - quota financed, is a control variable that represents the financed value in relation to the value of the property when contracting the operation, represents the percentage of the financed value of the property.	Financial institutions with lower <i>ltv</i> in their loan transactions are less exposed to the risk of default (Hatchondo 2015).
<i>comm_income</i>	Income commitment, is a control variable that represents the percentage of income committed to pay the installment.	Lower Income Commitment influences that contracts are not exposed to default. (Locatelli 2016)
<i>rating</i>	Rating, is a control variable that represents the risk rating assigned to the applicant in the credit assessment. For the approval of the credit, the applicant cannot present the classifications D, EF, G and H, so only those who obtained the classification between AA and C will be counted in the analyzed database, where: 3 = AA, 2 = A, 1 = B, 0 = C	Customers who have low risk rating indexes tend to remain in default (Brito 2008).

<i>genre</i>	Gender, is a variable <i>Dummy</i> control where 0 = female and 1 = male.	The default on housing credit tends to be higher among those with less education, male proponents, among married people, and increases as age advances. (Locatelli 2016)
<i>married</i>	Marital status, is variable <i>dummy</i> control that represents the applicant's marital status, with 0 = single, separated, divorced, widowed and 1 = married.	
<i>age</i>	Age, a control variable that represents the age of the applicant at the time of contracting the loan.	
<i>education</i>	Time of study, a control variable that represents the time of study categorized by level of education, with 0 = not literate, 1 = incomplete elementary school, 2 = complete elementary school, 3 incomplete high school, 4 = complete high school, 5 incomplete higher education, 6 = complete higher education.	Ascheberg (2014) studied economic policies that could influence the inhibition of default in mortgage loans.
<i>GDP</i>	Variation in real Gross Domestic Product (GDP) <i>per capita</i> for the year in which the contract was in default for the first time.	
<i>unemployment</i> <i>Unemployment</i>	rate in Brazil released by the Brazilian Institute of Geography and Statistics (IBGE) for the year in which the contract was in default for the first time.	

Source: Prepared by authors

To check the hypotheses of the research, two regression models will be estimated, which are described by equations 1 and 2.

$$\begin{aligned} \text{inad}_i = & \beta_0 + \beta_1 \text{subsidy}_i + \beta_2 \text{interest}_i + \beta_3 \log_value_fin_i + \beta_4 \text{ltvi}_i + \beta_5 \text{comm_income}_i \\ & + \beta_6 \text{rating}_i + \beta_7 \text{gender}_i + \beta_8 \text{married}_i + \beta_9 \text{age}_i + \beta_{10} \text{education}_i \\ & + \beta_{11} \text{gdp}_i + \beta_{12} \text{unemployment}_i + \xi_i \end{aligned} \quad (1)$$

$$\begin{aligned} \text{Pinad}_i = & \beta_0 + \beta_1 \text{subsidy}_i + \beta_2 \text{interest}_i + \beta_3 \log_value_fin_i + \beta_4 \text{ltvi}_i + \beta_5 \text{comm_income}_i \\ & + \beta_6 \text{rating}_i + \beta_7 \text{gender}_i + \beta_8 \text{married}_i + \beta_9 \text{age}_i + \beta_{10} \text{education}_i \\ & + \beta_{11} \text{gdp}_i + \beta_{12} \text{unemployment}_i + \xi_i \end{aligned} \quad (2)$$

The model described by Equation 1 aims to verify which variables, in particular the percentage of subsidy and the interest rate, affect an individual's default. Thus, the variable *inad* is a binary variable and the Probit estimator is the indicated one. Therefore, the effect of each regressor on the probability of default is verified.

$\text{inadi} = \{ 1 \text{ if individual } i \text{ has been in debt for more than 90 days } 0 \text{ otherwise}$

The second model, on the other hand, aims to verify the variables, in particular, the percentage of subsidy and the interest rate, which affects the number of installments in arrears. Unlike the first case, here we do not want to see the effect on the fact that someone is defaulting or not, but the effect on the number of overdue installments. Here it is necessary to use a tobit estimator, since it is suitable for modeling variables that involve data in which there is a large concentration of equal values (Wooldridge, 2006), in the case of this research the fact that almost half of the sample has zero default.

4 Analysis of the Results

4.1 Characterization of the sample

Table 2 presents the profile of the sample used of the borrowers of the housing financing of the Minha Casa Minha Vida Program, Range 2 and 3. When analyzing the financing data, it can be said that, on average, almost 50% of the individuals studied have defaults and that, on average, they owe a little more than two installments. When analyzing the percentage of the subsidy in relation to the amount financed, it is observed that the general average was 15%, presenting a great variability between the data of the sample, and in relation to the share of the financing of the analyzed group, it is approximately 78% of the value of the property.

Regarding education, it can be said that, on average, individuals have incomplete high school. Regarding gender, most of the entire database is composed of men, with an average of 63%, which indicates that among defaulting men stand out. Still, it can be said that married people represent less than 30% of all studied samples. Another point is that the average age is around 37 years old. The Pearson correlation analysis provides information from the univariate analysis that there is no correlation between variables that compromises the analysis by evidence of multicollinearity. Additionally, VIF analysis was performed and the results were that there is no multicollinearity.

Table 2
Descriptive statistics

Variable	obs.	Average	Coef. Var.	Minimum	1st quartile	Median	3rd quartile	Maximum
inad	10001	0.498	1.0042	0	0	0	1	1
P_inad	10001	2.1593	1.3996	0	0	0	3	24
allowance	10001	0.1512	0.9844	0	0.0283	0.1322	0, 2195	1.6633
interest	10001	5.1181	0.1717	4.5	4.5	5	5.5	8.51
log_value_fin	10001	11.1989	0.0285	9.4328	11.0405	11	11	12.4766
ltv	10001	0.7818	0, 1424	0.1507	0.7379	0.8	0.8597	1
comm_income	10001	0.2599	0.1456	0.0817	0.2419	0.2748	0.2891	0.3655
rating	10001	1.6219	0.4994	1	1	1	2	4
gender	10001	0.6358	0.7568	0	0	1	1	1
married	10001	0.2842	1.5872	0	0	0	1	1
age	10001	37.3488	0.2363	18	31	36	42	72
education	10001	3.6705	0.3276	0	3	4	4	9
GDP	10001	-0.4008	- 8.1846	-4.59	-4.4	0.2	2.07	6.49
unemployment	10001	7.6276	0.349	4.8	5.5	6.8	10.8	12, 7

Source: Prepared by the authors

4.2 Regression Analysis

Table 03 presents the results for the probit and tobit estimators, as well as the results of the marginal effect for the respective estimators represented, respectively, by equations (1) and (2). For the hypothesis test, two regression models were then estimated. The first has, as a dependent variable, the state of being in default or, conversely, not being in default, while the second has, as a dependent variable, the number of defaulting installments.

The variable that represents the subsidy has a statistically significant and positive coefficient in both models and with expected signs regarding the marginal effect, that is, the value of the PMCMV subsidy influences the default of operations and the greater this subsidy in relation to the financed amount, the greater the amount of arrears, even if one takes into account the effects of the economic recession represented by the variable GDP and unemployment rate.

When analyzing the interest variable, it is shown to be statistically significant only in model 2, with a positive coefficient and with the same signs for the marginal effect, which indicates that the subsidy in the form of interest rate discount does not influence the default of the contract and on average, contracted loans at higher interest rates have higher installments in arrears (Table 3). The results confirm only hypothesis 1 of this research, that customers who received higher subsidies in the form of discounts in the financed amount are more in default than the others. There is no relation between the subsidy in the form of interest rate reduction and default. The results indicate that loans contracted at higher interest rates have a higher number of arrears (Table 3).

This result is in line with a study by Goodstein (2017), in his research in the United States, who showed that borrowers who received some form of government incentive to access

real estate credit behaved less in a non-performing manner than those who did not have the same benefit. In Latin American countries (Mexico and Chile), previous studies have shown opposite results. Ruprah and Marcano (2007) and Lopez-Silva et al. (2011), did not show, in their research, that the subsidy influences default (Table 3). The variable financed value, which controls the volume of credit made available to the client, is negatively related to the variable defaults, a result that suggests that the lower the value of the financing, the greater the risk of the contract being in default, going against the analyses by Magdalon (2016), who identified a positive relationship between defaults and the volume of credit made available to the client.

Table 03
Regression analysis

Variable	p_inad		inad	
	Coefficient	Marginal effect	Coefficient	Marginal Effect
subsidy	0.5017***	0.5017***	1.8032***	1.8032***
interest	0.0094	0.0094	0.2891***	0.2892 ***
Log_value_fin	-0.3204 ***	-0.3204 ***	-1.3670 ***	-1.3670 ***
ltv	-0.1048	-0.1048	-0.3641	-0.3641
comm_income	1.6908 ***	1.6908 ***	5.0300 **	5.0300 **
rating	-0.0315 *	-0.0315 *	-1.1911 ***	-1.1911 ***
gender	0.3357	0, 0336	0.0345	0.0345
married	-0.001	-0.001	0.0484	0.0484
age	0.0017	0.0017	0.0041	0.0041
education	-0.0713 ***	-0.0713 ***	-0.2957 ***	-0.2957 ***
GDP	0.1617 ***	-0.0162 ***	-0.5036 ***	-0.5036 ***
unemployment	-0.0004	-0.0004	0.1194 ***	0,1194 ***
constant	3,2581 ***	3,2581 ***	12,5676 ***	12,5676 ***
Observations	10,001	10,001	10,001	10,001
pseudo R2	0.1379		0.0335	

Coefficients marked with an asterisk (*) are statistically significant with 10% significance, coefficients marked with two asterisks (**) are statistically significant with 5% significance and finally, coefficients marked with three asterisk (***) are statistically sig significant with 1% of significance. The definitions of the variables are presented in Table 2.

Source: Prepared by the authors

According to Hatchondo (2015), *ltv* can be used as a predictive indicator of default, as financial institutions that have borrowers who have smaller *ltv* are less exposed to the risk of non-payment of the credit operation. This was not confirmed in the research when analyzing the variable *ltv*, which has no significance in any of the tested models (Table 3). The divergent results of the variables financed value and *ltv* with that identified in previous research can be explained by the fact that customers who receive more subsidies end up financing a lower value, considering that they need less resources to purchase the property compared to those who do not. received the subsidy (Table 3).

The variable income compromise has a positive coefficient, compatible with the signs presented in the marginal effect, showing that those who showed greater commitment in the family income are more in default, which reinforces the theory *Ability-to-Pay Theory of Default* and researches that evidence use of the family income for payments of events considered priority over the payment of the debt. (Jackson 1980, Goodstein 2017, Locatelli 2016, Ngene 2016).

According to Brito (2008), customers who have low risk rating indexes tend to remain in default. The variable *rating* presents a statistically significant and negative coefficient, compatible with the expected signs in the marginal effect for the two models tested, demonstrating that customers *rated* low tend to be more in default, which makes sense, since better ratings are assigned to customers with better prospects for payment of the loan.

The education variable is statistically significant and has a negative coefficient. The

other demographic variables that sought to capture the influence of gender, age and marital status did not show statistically significant coefficients (Table 3). The results infer that customers who received the subsidy in the form of a discount on the financing amount are more willing to default on the housing financing of the Minha Casa Minha Vida Program, even when considering the effects of the economic recession, which corroborates with hypothesis 1 of this research (Table 3).

5 Conclusion

The present study investigated whether there is a relationship between default in housing financing and the subsidy from the Minha Casa Minha Vida program made available to the customer in the form of a discount on the financing amount and a reduction in the interest rate. The results infer that as the amount of the subsidy increases in relation to the amount financed, the greater the defaults on the mortgage loan portfolios, and customers who received higher subsidies have higher amounts of installments in arrears in housing financing. When the subsidy is analyzed in the form of a discount in the interest rate, the results do not confirm the research hypothesis, that is, they are not related to default. Properties that have been financed with higher interest rates have a higher number of installments in arrears.

This work presents empirical evidence that the subsidy provided by the PMCMV, in the form of a discount on the financing amount, encourages the default of operations, so the program does not fulfill its objective in a viable way when it uses it as a support mechanism for the production and acquisition of housing units with low-income families. Despite the fact that banks are negatively impacted by the housing subsidy policy due to the default it generates, it should be remembered that this is only one of the agents involved in the PMCMV and that previous research shows benefits achieved by the program, such as access to real estate for low-income families, improvement in the quality of housing, generation of employment, and income in the implementation of the program (Botelho, 2007, Brollo, 2004, Silva & Alves, 2014, Miotto, 2015), is proving to be effective in fulfilling its objective.

However, the results of this research reinforce, for PMCMV, the need to create public policies that are viable in the long term, which are aligned with the credit market and the well-being of families, who, when financing their first property, have the capacity to comply with the payment of the installments and do not lose the good won due to default. For that, the regulation must be revised in the way families are oriented after the debt, which is long term, allowing protection to investors and financial institutions. In this way, the objectives of achieving access to housing and quality credit for Brazilians can be achieved with less exposure to the risk of agents responsible for credit risk.

The evidence found in this research converges to the study carried out by Gooldstein (2017) and it can be concluded that the popular housing policy used in Brazil has negative implications for the mortgage loan portfolio of financial institutions when they use the discount as a subsidy mechanism. housing finance value. Identifying that the benefit of the subsidy in the form of a discount on the financed amount encourages future debtors does not solve the problem of the PMCMV's high default rates. Although this research has been dedicated to analyzing the relationship between defaults and the subsidy, other reasons have been identified that may lead to the financing not being paid in a timely manner and are related to social variables such as income, education, GDP and, unemployment.

It is suggested that future research on the topic could be an in-depth analysis of the income composition PMCMV beneficiary families, to identify the variables that impact on domestic spending, and which obligations have priorities in relation to the provision of housing financing. This is necessary to identify the expected consumption profile of future proponents of housing finance. The properties financed by the PMCMV have similar characteristics, it is common that they are located close to each other, usually in the same neighborhoods or even

in an entire condominium, this characteristic can provide the contagion effect, influencing the decision on non-payment of the financing. Because of this, it is also recommended for future research that the contagion effect be analyzed in Brazil, which deals with an excess correlation that goes beyond the explanations of the economic effects evidenced in the research by Bekaert (2003) and Guiso (2013) exerts some influence default in the PMCMV.

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