Securitization of assets and risk transfer in the Brazilian Economy

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Abstract

This study relates to the literature that analyzes the role of securitization in risk-taking by financial institutions. We analyze the impact of securitization on financial soundness (measured by z-score) through the two main securitization products in Brazil: Credit Rights Investment Funds (FIDC) and Real Estate Receivables Certificates (CRI). Hence, based on a panel data analysis regarding 92 financial institutions from 2003 to 2016 (quarterly data) we performed several regressions for different samples and methods. The findings suggest that securitization may increase the probability of insolvency risk. These results may indicate that financial institutions prefer to issue securitization with underlying assets of higher credit quality in order to obtain positive credit ratings for their financial products.

Key words: securitization assets, insolvency risk, z-score, Credit Rights Investment Funds, Real Estate Receivables Certificates.
JEL Classification: G14, G21, G28.

Resumo

Este estudo relaciona-se com a literatura que analisa o papel da securitização na tomada de riscos pelas instituições financeiras. Analisamos o impacto da securitização na solidez financeira (medida pelo z-score) através dos dois principais produtos de securitização no Brasil: FIDC (Fundos de Investimento em Direitos de Creditórios) e CRI (Certificados de Recebíveis Imobiliários). Para isso, com base em uma análise de dados em painel de 92 instituições financeiras entre 2003 a 2016 (dados trimestrais), realizamos várias regressões para diferentes amostras e métodos. Os resultados sugerem que a securitização pode aumentar a probabilidade do risco de insolvência. Esses resultados podem indicar que as instituições financeiras preferem originar operações de securitização com ativos subjacentes com maior qualidade de crédito, a fim de obter classificações de risco de crédito positivas para seus produtos financeiros.

Palavras chave: securitização de ativos, risco de insolvência, z-score, Fundos de Investimento em Direitos Creditórios, Certificados de Recebíveis Imobiliários.
Classificação JEL: G14, G21, G28.

Área 4: Macroeconomia, Economia Monetária e Finanças

1. Introduction

Asset securitization has been used by financial institutions not only as a tool for transferring risks, but also to diversify and broaden their portfolio by managing their risk.[1] In particular, securitization may lead to a less careful credit assessment in lending and a decrease in the monitoring of its borrowers by originator financial institutions.[2] Moreover, financial institutions also have incentive to securitize good credit quality assets in order to obtain a high reputation or credit rating on the financial products offered in the market (Greenbaum and Thakor, 1987; Instefjord, 2005). This high credit risk retention behavior by financial institutions associated with a high risk appetite is often cited as one of the causes of the 2007-09 global financial crisis.[3] However, the literature does not present conclusive evidence on the effect of securitization on the financial institutions' risk taking.

In order to observe the impact of securitization on risk-taking by financial institutions, this study presents evidence from the Brazilian experience. It is important to note that, in spite of the recent growth of structured finance operations, particularly asset securitization, there is little empirical evidence related to the impact of securitization on insolvency risk in emerging countries. In general, when compared to developed countries, emerging economies have a less sophisticated capital market and a gap for the development of structured financial products aimed at meeting complex and highly customized demands. Nonetheless, the securitization market in Latin America totaled 65 billion dollars in 2016, with Brazil accounting for 66% (US$ 42.8 billion). In addition, the securitization/GDP ratio in Brazil was approximately 2.5% in 2016, while in the other countries (Mexico, Argentina, Colombia, and Chile) this ratio was less than 1.5% (Standard & Poor's, 2016).

This study encompasses the two main securitization products in Brazil: Credit Rights Investment Funds (FIDC) and Real Estate Receivables Certificates (CRI) issued between 2003 and 2016. These two products together correspond to 92% of the securitization market in Brazil in this period.[4] Hence, this study considers quarterly data from 52 financial institutions that originated 578 securitization transactions (141 issues of FIDC and 437 issues of CRI) between 2003 and 2016. In addition, we introduced in the sample financial institutions that did not use securitization but that have similar size.

Based on a panel data analysis, we perform several estimates using Fixed Effects method (FOLS), Robust Least Squares method (MQR), and Systemic Generalized Moments Method (S-GMM). The findings suggest that securitization may increase the probability of insolvency risk of financial institutions. These results may indicate that financial institutions prefer to issue securitization with underlying assets of higher credit quality in order to obtain positive credit ratings for their financial products.

A differential of this study is the inclusion of macroeconomic variables in the analysis. Many studies have concluded that the macroeconomic scenario is the most important factor in determining bank's risk-taking (Jiménez and Saurina, 2006, Bonfim, 2009, and Castro, 2013). Furthermore, we take into account samples from FIDC and CRI due to the underlying characteristics of each market. In particular, we observe that CRI operations increased considerably since 2010, while FIDC operations have declined in the same period (CVM, 2017 - http://sistemas.cvm.gov.br/). In brief, due to the representativeness of the Brazilian securitization market in Latin America and the growth of these operations, which has underlying assets from real estate financing, this study brings relevant considerations that can be observed in the case of emerging economies with a developed financial system.

[1] Several studies emphasize that securitization is a risk management tool widely used by financial institutions (Cebenoyan and Strahan, 2004; DeMarzo, 2005; Allen and Carletti, 2006; Wagner and Marsh, 2006; Affinito and Tagliaferri, 2010; Norden, Buston, and Wagner, 2014; Ben Salah and Fedhila, 2014; and Buchanan, 2016).

[2] For different versions of this argument, see: Gorton and Pennacchi, 1995; Duffee and Zhou, 2001; Petersen and Rajan, 2002; Morrison, 2005; Wagner, 2007; Parlour and Plantin, 2008; Chiesa, 2008; Ashcraft and Santos, 2009; Keys et al., 2010; Gennaioli et al., 2012.

[3] See: Dell'Ariccia, Igan, and Laeven (2008); Brunnermeier (2009), Casu et al. (2013), Guo and Wu (2014), Fratzscher, König, and Lambert (2016).

[4] We take into account public offerings of FIDC and CRI available at CVM (2017, http://sistemas.cvm.gov.br/).

In addition, it contributes to the literature that explores the relationship between securitization and risks in order to mitigate possible financial crises.[5]

This study is organized as follows. Section 2 summarizes the research in literature regarding the effects of securitization of assets on financial institutions' risk-taking. Section 3 presents the specification and the empirical strategy. Section 4 describes the data. Section 5 presents the regressions and the interpretation of the results. Finally, section 6 concludes the study.

2. Securitization and insolvency risk

This section provides a brief review of the main aspects pointed out in the literature that allow us to conjecture that the securitization of assets can affect the insolvency risk of financial institutions. Securitization of assets, as a risk transfer mechanism, permits the transference of part of the credit risk from the originators to outside investors (see, Acharya, Schnabl, and Suarez, 2013). The possibility of transferring risk has been pointed out as responsible for excessive risk-taking by financial institutions and therefore the creation of financial crises. Although this idea is compelling, the literature has no conclusive evidence whether asset securitization has positive or negative impact on the stability of the financial system.

Many studies, especially before the subprime crisis, highlight the benefits from securitization activities due to the distribution of credit risk among investors (Allen and Carletti, 2006; Berger and Bowman, 2009). According to Loutskina (2011), because securitization provides an additional funding source, it reduces the need for financial institutions to maintain liquid assets in their balance sheets. In line with this argument, the results found by Casu et al. (2013) suggest that financial institutions typically use securitization as a funding mechanism rather than a risk management mechanism. In addition, the transfer of credit risk provided by securitization can produce a more efficient use of capital and a reduction of costs for financial intermediation by reducing regulatory capital requirements (Duffie, 2008). In this sense, Dechow, Myers and Shakespeare (2010) consider that securitization allows the originator of the transaction to focus credit risk on a part of the capital structure, resulting in a risk-free liability.

Despite the aforementioned advantages associated with securitization, the high complexity and lack of transparency of its operations increase investors' difficulties in assessing potential losses arising from this financial product. Gorton (2009) states that the asymmetry of information in asset securitization arises from the loss of information related to the quality of the underlying assets, resulting from the complex set of structures inherent to the securitization process. Because of private information about asset quality, financial institutions can use securitization to increase risk-taking and to reduce the monitoring of their borrowers (see, Parlour and Plantin, 2008; Dell'Ariccia, Igan, and Laeven, 2008; Purnanandam, 2011; Gennaioli, Shleifer, and Vishny, 2012; and, Wang and Xia, 2014).

Brunnermeier (2009) points out how the transformation of the banking sector with the consolidation of the new model of banking intermediation (originate to distribute) has altered the relationship between lenders and borrowers. According to this perspective, securitization and other structured financial products cause a relaxation of the criteria for lending and, consequently, deterioration in the credit quality of financial institutions that originate these operations. Keys et al. (2010) taking into account data on subprime loans in the United States for the period 2001 to 2006 provide empirical evidence regarding the negative effect caused by securitization on the monitoring of subprime lenders.

In addition to the analysis of the increase in credit risk due to the decrease in the monitoring of borrowers, recent studies investigate the effects of securitization on the stability of the financial system. Because securitization operations reduce the need to maintain liquid assets (Loutskina, 2011; Casu et al., 2013), these operations result in an increase in the volume of bank loans. Gambacorta and Marques-Ibáñez (2011), Hirtle (2009), Carbó-Valverde, Marques-Ibanez, Rodríguez-Fernández (2012), Bedendo

[5] It is important to highlight that de Mendonça and Barcelos (2015) performed an analysis for the relation between securitization and credit risk for the Brazilian economy. The main drawback in their analysis is that the sample used by these authors does not permit to observe the entire securitization market. Hence, this study surpass their analysis in several aspects: (i) we use a sample from FIDC and CRI operations, while they use only a sample from FIDC; (ii) we use macroeconomic control variables in the models; and (iii) our sample regarding financial institutions an period is larger than that used by them.

and Bruno (2012) provide empirical evidence that securitization has stimulated excessive credit growth which in turn can affect financial stability.

A large number of recent studies have used the z-score to analyze the risk of financial institutions (Boyd and Runkle, 1993; Santos and Winton, 2008; López-Andión et al., 2015). However, the results are ambiguous and vary according to the type of securitized asset. Bedendo and Bruno (2012), based on a sample of US commercial banks for the period 2001 to 2009, find empirical evidence of a negative effect of securitization on bank stability.

Chen et al. (2017), using data from 342 commercial banks in the U.S. during the period 2002 to 2012, observe that bank loan securitization has a significant and positive impact on z-score. In particular, these authors show that securitization may encourage excessive risk-taking by banks and have different impacts between mortgage and non-mortgage securitization. Moreover, the securitization of real estate assets is not likely to help banks reduce their risk in the short term, while the securitization of non-real estate assets provides a more efficient transfer of risk.

The relationship between financial innovations and bank fragility (as measured by z-Score), as well as the effect of financial innovations on economic growth is analyzed by Beck et al. (2016) from a sample of 32 countries in the period from 1996 to 2010. The findings denote that financial innovations imply an increase in bank's fragility, as well as, profit volatility.

3. Framework of analysis

This section explores our empirical specification and estimation strategy.

3.1. Empirical specification

In order to verify the effect of securitization of assets on the insolvency risk of financial institutions we use the following specification as the baseline model:

(1) $$RISK_{i,t} = \eta_i + \alpha SEC_{i,t-1} + \beta Z_{i,t} + \varepsilon_{i,t},$$

where i = 1,2, …, 92 are financial institutions; t = 1, 2, ..., 56 are time periods (quarterly frequency) from 2003 to 2016, regarding securitization market in Brazil, which includes both credit rights transactions (FIDC) and real estate asset transactions (CRI); *RISK* is the insolvency risk of the financial institutions as a result of the z-score measure; *SEC* is a dummy variable that assumes value equal to 1 from the first issuance of FIDC or CRI by the financial institutions and value equal to 0 otherwise; Z is a vector of financial control variables (capitalization, liquidity and profitability); η_i represents a vector of financial institution specific factors; and, $\varepsilon_{i,t}$ is the stochastic error term.

The z-Score is a measure that reveals how far the bank is from insolvency (Roy, 1952). The z-Score has been widely used in recent literature as a measure of financial soundness and represents the number of standard deviations by which profits would have to fall below average in order to deplete social capital (Nicolo, Jalal, and Boyd, 2006).[6] A higher z-score indicates a lower probability of bank insolvency and, therefore, lower financial fragility.

In equation (1) the coefficient α measures the effect on the insolvency risk in t due to the securitization in the previous period. Because the main objective of this paper is to analyze whether Brazilian financial institutions have used securitization as a tool to transfer part of their risk, the sign of this coefficient is relevant. A negative α coefficient indicates an increase in the risk of financial institutions. In other words, we can interpret as a reduction in the bank's distance from insolvency and therefore an increase in the likelihood of bank insolvency. This result is in consonance with the idea that, in order to obtain a high credit rating of the securitized products, banks tend to securitize better-quality assets and to hold lower-quality assets. On the other hand, a positive α coefficient indicates a decrease in risk (an increase in z-score). This result is in line with the possibility that banks hold assets of better quality in their balance sheets in comparison with those passed on to investors through securitization.

As already discussed in the previous section, the banking literature shows that the use of accounting variables are important to explain the behavior of risk because they reflect characteristics of

[6] See Boyd and Runkle, 1993; Santos and Winton, 2008; Bedendo and Bruno, 2012; Michalak and Uhde, 2012; López-Andión et. al, 2015).

financial institutions. Kashian and Tao (2014) show evidence that high capitalization ratio is associated with a high z-score. This result is consistent with the interpretation that the greater the capital in relation to the total risk exposure, the greater the probability that the bank can survive losses. Loutskina and Strahan (2009) and Loutskina (2011) show that by reducing the need to hold net assets, securitization has a positive impact on bank lending. Ahn and Breton (2014) point out that by reducing lending monitoring incentives, securitization reduces ex ante competition, which may affect the efficiency of the lending market and lead to higher equilibrium profits for banks. Based on the literature on securitization and risk, financial capitalization (*CAP*), liquidity (*LIQ*) and profitability (*ROE*) are used as control variables. Hence, equation (1) can be rewritten as:

(2) $RISK_{i,t} = \eta_i + \alpha_1 SEC_{i,t-1} + \beta_1 CAP_{i,t} + \varepsilon_{i,t}$,

(3) $RISK_{i,t} = \eta_i + \alpha_2 SEC_{i,t-1} + \beta_2 CAP_{i,t} + \beta_3 LIQ_{i,t} + \varepsilon_{i,t}$, and

(4) $RISK_{i,t} = \eta_i + \alpha_3 SEC_{i,t-1} + \beta_4 CAP_{i,t} + \beta_5 LIQ_{i,t} + \beta_6 ROE_{i,t} + \varepsilon_{i,t}$.

Due to the specificities of the different securitization modalities mentioned in the previous section, an analysis of how the different products available in Brazil (FIDC and CRI) affect the risk of financial institutions becomes relevant. Chen et al. (2017) find different impacts of securitization on the z-Score according to the type of asset underlying the transaction. According to these authors, the securitization of real estate assets (mortgages) does not help banks reduce their risks in the short term, while securitizing other types of assets can provide a more efficient transfer of risk. Therefore, in order to capture the specificities of each product regarding securitization in Brazil, the same models considered for the full sample are also estimated for the Receivables market (FIDC) and for the real estate receivables market (CRI) separately.[7]

3.2. Estimation strategy

This study uses modeling techniques for panel data. Although the Ordinary Least Squares (OLS) method is simple, it is widely used in the literature.[8] However, it is important to control unobserved factors specific to each financial institution through a fixed effect (η_i). The OLS estimators are sensitive to the presence of outliers, which may result in the estimation of coefficients that do not accurately reflect the relation that is intended to be explained. In order to increase the robustness of the results, besides fixed effect regressions, we also use Robust Least Squares (MQR) method, which consists of a variety of methods designed to be robust or less sensitive to the presence of outliers (see Yohai, 1987).[9] It is also important to note that a drawback in the OLS estimates is the risk of simultaneity in the models, because insolvency risk can also affect securitization. Therefore, there is a risk of endogeneity in the models, which may render the OLS estimators biased and inefficient.

In order to reduce the risk of endogeneity in regressions, this study also makes use of a more robust analysis with the use of exogenous instruments based on the Generalized Moment Method (GMM). In short, this method has the advantage of estimating consistent parameters even in the case of endogeneity of the explanatory variables and in the presence of measurement errors (Bond, Hoeffler and Temple, 2001). In particular, Arellano and Bover (1995) and Blundell and Bond (1998) suggest the addition of momentary conditions. As a result, System GMM (S-GMM) combines moment conditions for the model in first differences with moment conditions for the model in levels.[10]

According to Wooldridge (2002), in order to achieve a more efficient GMM estimator than the OLS, there must be some restriction on the instrumental variables. To validate the effectiveness of the instruments used in the GMM models, as suggested by Arellano (2003), we perform the Sargan test (J-statistic) to verify if the overidentification restrictions on the moment conditions are valid. In addition, in order to obtain robust standard errors, we apply White's covariance matrix consistent with heteroscedasticity. Furthermore, as proposed by Arellano and Bond (1991), we also perform the serial

[7] For sample FIDC, i = 1, 2, ...,60, and for sample CRI, i = 1, 2, ..., 32 in equations 2 to 4.

[8] See Calomiris and Mason (2004), Jiangli and Pritsker (2008), Krainer and Laderman (2014), and Beck et al. (2016).

[9] We use MM-estimation type, which takes into account the presence of outliers in both the dependent variable and the independent variables.

[10] We also use other variables present in the banking literature as instruments: indebtedness (ND), return on assets (ROA) and total assets (proxy for the size of financial institutions).

correlation test of first (AR (1)) and second (AR (2)). Finally, in order to avoid the excessive use of instruments in the models that may bias the result of the regressions, the ratio between the number of instruments and the number of cross sections is less than 1.

4. Data

In order to obtain the necessary information for the construction of a panel data set (quarterly frequency) to analyze the effect of securitization on risk in Brazil, we use two main sources: Brazilian Securities Commission (CVM) and Central Bank of Brazil (CBB). The construction of the database comprises four steps. The first step is to identify the issuances of Credit Rights Investment Funds (FIDC) and Real Estate Receivables Certificates (CRI) from the public offerings made available by the CVM.[11] From these aggregated data it is possible to obtain information related to each issuance, such as: the issuance date and the financial institution that originated the transaction. This information is fundamental for the construction of the securitization variable, because it allows identifying the financial institution that uses these financial products (FIDC or CRI) and in what period (quarter) this start. We do not consider operations that have more than one originator. For the analysis period (January 2003 to December 2016), 578 securitization operations were identified, 141 of which correspond to FIDC issuances and 437 CRI issuances, originated by 52 financial institutions (32 banks that issued FIDC and 20 securitizers that issued CRI).

In order to prevent a possible selection bias, the second step consists in a construction of a counterfactual by identifying other financial institutions with similar size to those that issued FIDC or CRI. In this step, the accounting data provided by the BCB are used for the banks, while the data related to the securitizers (financial institutions responsible for the issuance of CRI) are made available by the CVM.[12] In the Balance Sheet, in line with other studies, the "total assets" account is used as proxy for the size of financial institutions.[13] Taking as reference the interval that corresponds to the minimum and maximum value of the total assets, we identified the other financial institutions that make up the sample, but did not issue FIDC and/or CRI in the period. Therefore, in addition to the previous sample (institutions that carried out securitization operations), 40 financial institutions were identified (28 institutions that did not issue FIDC and 12 that did not issue CRI).

From the total sample (92 financial institutions), the third step is to obtain economic indicators based on the balance sheets collected in the previous step.[14] These accounting data are important because they allow the elaboration of indicators that reflect the economic-financial situation of financial institutions. Insolvency risk (*RISK*), measured by the z-score variable, captures the probability of insolvency by financial institution, and it is computed as:

$$(5) \qquad RISK_{i,t} = \frac{ROAA_{i,t}+EA_{i,t}}{\sigma(ROAA)_{i,t}},$$

where, $ROAA_{i,t}$ denotes the return on average assets of the financial institution i in the quarter t, $EA_{i,t}$ it represents the ratio of equity to total assets, and $\sigma(ROAA)_{i,t}$ is the standard deviation of the returns on average assets that is calculated by means of a rolling window for 12 quarters (see, for example, Nicolo, Jalal, and Boyd, 2006; Michalak and Uhde, 2012; Bertay, Dermirgüç-Kunt, Huizinga, 2013; Beck et al., 2016; and Chen et al., 2017).[15] In addition to *RISK*, based on accounting variables, we also calculated: capitalization (*CAP* = Equity/Total Assets, see Aysun and Hepp, 2011; and Ben Salah and Fedhila, 2012),

[11] All the primary and secondary public offers registered or exempted from registration by the CVM are available for consultation at the Systems Center (sistemas.cvm.gov.br).

[12] The balance sheet data of the securitizers are extracted from the External Disclosure System (DIVEXT), made available by the CVM for the download of accounting reports, such as: Quarterly Information (ITR) and Standardized Financial Statements (DFP).

[13] For examples of studies that use total assets as proxy for the size of financial institutions, see: Bonfim (2009), Kara, Marqués-Ibanez, Ongena (2011), Kashian and Tao (2014), and Le, Narayanan, and Vo (2016).

[14] All the accounting data obtained from the balance sheets of financial institutions were deflated by the Extended National Consumer Price Index (IPCA – official price index).

[15] In order to eliminate the bias caused by outliers, we considered only the observations in which their values are within the difference between the mean and twice their standard deviation.

liquidity (*LIQ* = Liquid Assets/Total Assets Ratio – see Hollander and Prokop, 2015; and López-Andión, 2015), and profitability (*ROE* = Net Income/Shareholder's Equity Ratio - see Jiangli and Pritsker, 2008; and Berger and Bouwman, 2013).

The fourth step consists in obtaining data on macroeconomic variables used in the literature on securitization and risks that are available from CBB. These variables are the change in the monetary policy interest rate (SELIC), the gross domestic product (GDP – growth rate), and the change in the exchange rate (ΔEX - US dollar/Brazil Real).

Table A.1 describes all variables and data sources which are used for building a balanced panel with quarterly frequency. Table A.2 summarizes the descriptive statistics for the full sample, FIDC, and CRI. In general, we observe that the mean of CR in CRI sample (0.4545) is greater than that for the full sample (0.3702) and for the FIDC sample (0.3104).

Based on the period from 2003 to 2016, Table A.3 shows the correlation between securitization and insolvency risk. The negative correlation between RISK and SEC suggests that the higher the securitization, the greater is the insolvency risk. In other words, an increase in securitization reduces the z-score and therefore increases the likelihood of bank insolvency. The result for the consolidated securitization market, which aggregates FIDC and CRI, presents a slightly greater correlation (-0.17) than observed for FIDC and CRI samples (correlation of -0.15 for both cases).

5. Empirical results

This section presents the results of estimations regarding the relationship between asset securitization and insolvency risk in the Brazilian financial market. We perform several data panel regressions through fixed effects method (FOLS), Robust Least Squares (MQR) method, and Systemic Generalized Moments Method (S-GMM).[16] In order to consider the characteristics of securitization in Brazil, the first part of this section presents the results regarding the three models proposed for the Brazilian securitization market, which encompasses the two main securitization products in Brazil: Credit Rights Investment Funds (FIDC) and Certificates of Real Estate Receivables (CRI). The following two subsections, present the results of the same models for two different samples (FIDC and CRI). In the last subsection, we present the results for the model, which includes the macroeconomic variables.

5.1. Securitization and risk: evidence from FIDC and CRI

Table 1 presents the results of the impact of securitization on insolvency risk. Based on the data described in section 4, model 1 includes liquidity (*LIQ*) as a control (financial) variable, model 2 considers the profitability of financial institutions as control (*ROE*), and model 3 takes into account both variables (*LIQ* and *ROE*). We present the results in two steps. The first presents the results of regressions through FOLS, MQR, and S-GMM methods. The second, from the estimated coefficients, we observe the impact of shocks on the variables used in the model on the insolvency risk.

The results regarding the adjusted coefficients of determination and F-statistics in FOLS models indicate that the regressors are relevant to explain the insolvency risk. Regarding S-GMM models, the results show that all models accept the null hypothesis of the Sargan tests (J-Statistic) and, therefore, the overidentification restrictions are valid. In addition, AR(1) and AR(2) tests do not indicate the presence of serial autocorrelation in the models.

It is observed that, regardless of the model and the method used, all estimated coefficients on securitization are negative and have statistical significance (see table 1). This result is in line with the literature that presents empirical evidence on an increase in the risk of financial institutions associated with securitization operations. According to this view, financial institutions do not use securitization as a financial instrument to transfer part of their risk, but rather to increase their liquidity. As a consequence, financial institutions that originate securitization operations hold risky assets in their balance sheets which

[16] List of instruments used in GMM estimations are in table A.3 (appendix).

in turn increase their insolvency risk (see Dionne and Harchaoui, 2003; Franke and Krahnen, 2005; Haensel and Krahnen, 2007; Le, Narayanan, and Vo, 2016; Chen et al., 2017).

The risk retention can also be a result of credit enhancement mechanisms by originating financial institutions. Credit enhancement mechanisms may include contractual (explicit recourse) and non-contractual (implicit recourse) agreements (see, Calomiris and Mason, 2004; Vermileya, Webb, and Kish, 2008; and Casu et al., 2011). Among contractual agreements, the subordination of quotas by the originating financial institution is a mechanism widely used in Brazil.

Capital is important in bank risk-taking by financial institutions (Calomiris and Mason, 2004, Berger and Bouwman, 2013, Lambert, Noth, Schüwer, 2017). According to Ashcraft (2008) capitalization of the bank affects the amount of nonperforming loans it can absorb before harming its creditors. The positive and significant coefficient on the capitalization ratio (*CAP*) indicates a decrease in risk. On the other hand, liquidity and profitability are pointed out in the literature as decisive factors in the securitization of assets by banks. Taking into account the S-GMM method as benchmark because it permits to control the possible endogeneity in the models, we observe that both coefficients on liquidity (*LIQ*) and on profitability (*ROE*) have negative sign and statistical significance. Regarding the negative effect of liquidity on risk, this observation is in consonance with the idea that securitization provides an additional funding source for the originator (see, Loutskina and Strahan, 2009). The negative coefficient on the *ROE* is associated with the trade-off between risk and return. Bannier and Hänsel (2008) note that the search for increased profitability is an important factor for securitization of assets by banks.

5.2. Securitization and risk: evidence from FIDC

Taking into account only the FIDC sample, the same models presented in the previous section for the total sample (FIDC and CRI) are re-estimated. In line with the results for the consolidated securitization market in Brazil, regardless of the model and method used, all coefficients on securitization are negative and significant. This result may indicate that securitization, through the issuance of FIDC, increases risk. This evidence is consistent with the argument that financial institutions prefer to hold worse-quality assets in their balance sheets and to securitize better-quality assets. The coefficient on capitalization ratio is positive and may indicate that securitization, by allowing the transfer of part of the risk, reduces regulatory capital requirements. The coefficients on liquidity and profitability are negative and significant (S-GMM method), which it turn indicates that an increase in these variables may lead to an increase in the risk.

5.3. Securitization and credit risk: evidence from CRI

Table 3 presents the results of the impact of the securitization on the risk regarding the market of Real Estate Receivables Certificates (CRI). In Brazil, this type of securitization has as underlying assets, exclusively, real estate receivables (mainly those derived from real estate financing and rental agreements). Using CRI sample, the same models considered in the previous subsections are re-estimated. The findings are similar to those observed for the consolidated securitization market in Brazil and for the FIDC market. Regardless of the model and method, all coefficients on securitization are negative and statistically significant, which can indicate that securitization, through the issuance of CRI, increases the risk. On the other hand, the coefficient on capitalization is positive and significant in all models. Moreover, the coefficients on liquidity and profitability are negative and significant in S-GMM models, and thus there is evidence that an increase in these variables implies an increase in the risk.

Table 1

Effect of securitization on risk (full sample - FIDC and CRI)

Method:	**Fixed effect – OLS (FOLS)**			**Robust Least Squares (RLS)**			**System Generalized Method of Moments (S-GMM)**		
Regressors:	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
SEC(-1)	-0.1919 ***	-0.1907 ***	-0.1918 ***	-0.0714 ***	-0.0810 ***	-0.0711 ***	-0.7058 ***	-0.9876 ***	-0.6479 ***
	(0.0474)	(0.0472)	(0.0474)	(0.0070)	(0.0069)	(0.0070)	(0.1037)	(0.0923)	(0.0906)
CAP	0.0081 *	0.0083 *	0.0081 *	0.2599 ***	0.2158 ***	0.2594 ***	0.0076 ***	0.0077 ***	0.0073 ***
	(0.0048)	(0.0049)	(0.0047)	(0.0020)	(0.0020)	(0.0020)	(0.0002)	(0.0014)	(0.0003)
LIQ	0.0381		0.0375	-0.3391 ***		-0.3410 ***	-0.0475 **		-0.0763 ***
	(0.0239)		(0.0231)	(0.0369)		(0.0369)	(0.0187)		(0.0153)
ROE		-0.0002 ***	-0.0003 ***		-0.0004	-0.0006		-0.0147 ***	-0.0019 **
		(0.0001)	(0.00002)		(0.0005)	(0.0005)		(0.0035)	(0.0009)
N. Obs.	3568	3642	3568	3568	3642	3568	2630	3002	2630
Adj. R^2	0.75	0.77	0.75						
F-statistic	124.05	139.48	122.81						
Prob(F-statistic)	(0.00)	(0.00)	(0.00)						
Rw				0.14	0.11	0.14			
N. Inst./N. cross. sec.							0.74	0.75	0.79
J-statistic							64.21	65.89	66.20
Prob(J-statistic)							(0.36)	(0.34)	(0.40)
AR(1)							-0.19	-0.28	-0.19
p-value							(0.00)	(0.00)	(0.00)
AR(2)							-0.02	-0.03	-0.01
p-value							(0.32)	(0.15)	(0.44)

Note: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denote s 0.1. Robust standard errors (White – FOLS and S-GMM, and Huber – RLS) between parentheses. FOLS and RLS - constant is omitted for convenience. S-GMM - two-step estimation of Arellano and Bover (1995). Tests for AR(1) and AR(2) check for the presence of first order and second-order serial correlation in the first-difference residuals. The sample is an unbalanced panel quarterly data of 92 financial institutions from the first quarter of 2003 to the fourth quarter of 2016.

Table 2

Effect of securitization on risk (FIDC)

Method:	**Fixed effect – OLS (FOLS)**			**Robust Least Squares (RLS)**			**System Generalized Method of Moments (S-GMM)**		
Regressors:	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
SEC(-1)	-0.1175 ***	-0.1182 ***	-0.1176 ***	-0.0787 ***	-0.0770 ***	-0.0785 ***	-0.7404 ***	-0.9346 ***	-0.8120 ***
	(0.0344)	(0.0345)	(0.0344)	(0.0080)	(0.0080)	(0.0080)	(0.0358)	(0.0549)	(0.0329)
CAP	0.9441 ***	1.0194 ***	0.9441 ***	0.3982 ***	0.4205 ***	0.3968 ***	0.8988 ***	0.9712 ***	0.9018 ***
	(0.0555)	(0.0865)	(0.0556)	(0.0205)	(0.0200)	(0.0205)	(0.0181)	(0.0269)	(0.0194)
LIQ	-0.1266		-0.1268	-0.1911		-0.1923	-0.5865 **		-0.9970 ***
	(0.1762)		(0.1761)	(0.1404)		(0.1404)	(0.2628)		(0.2513)
ROE		0.0007	-0.0001		-0.0028	-0.0035		-0.0218 **	0.0282
		(0.0022)	(0.0017)		(0.0041)	(0.0042)		(0.0087)	(0.0193)
N. Obs.	2661	2699	2661	2661	2699	2661	2397	2599	2520
Adj. R^2	0.79	0.79	0.79						
F-statistic	166.05	167.65	163.34						
Prob(F-statistic)	(0.00)	(0.00)	(0.00)						
Rw				0.17	0.17	0.17			
N. Inst./N. cross. sec.							0.97	0.93	0.98
J-statistic							57.78	55.01	58.15
Prob(J-statistic)							(0.34)	(0.40)	(0.36)
AR(1)							-0.12	-0.11	-0.11
p-value							(0.00)	(0.00)	(0.00)
AR(2)							-0.02	-0.02	-0.01
p-value							(0.37)	(0.26)	(0.59)

Note: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denote s 0.1. Robust standard errors (White – FOLS and S-GMM, and Huber – RLS) between parentheses. FOLS and RLS - constant is omitted for convenience. S-GMM - two-step estimation of Arellano and Bover (1995). Tests for AR(1) and AR(2) check for the presence of first order and second-order serial correlation in the first-difference residuals. The sample is an unbalanced panel quarterly data of 60 financial institutions from the first quarter of 2003 to the fourth quarter of 2016.

Table 3

Effect of securitization on risk (CRI)

Method:	**Fixed effect – OLS (FOLS)**			**Robust Least Squares (RLS)**			**System Generalized Method of Moments (S-GMM)**		
Regressors:	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
SEC(-1)	-1.0702 ***	-1.0707 ***	-1.0703 ***	-0.0974 ***	-0.1164 ***	-0.0972 ***	-2.1315 ***	-1.3991 ***	-2.1215 **
	(0.0037)	(0.0031)	(0.0038)	(0.0105)	(0.0097)	(0.0105)	(0.1936)	(0.5128)	(0.9054)
CAP	0.0524 **	0.0476 **	0.0521 **	0.2311 ***	0.1983 ***	0.2309 ***	4.5957 ***	4.6684 ***	4.2655 ***
	(0.0256)	(0.0216)	(0.0258)	(0.0014)	(0.0013)	(0.0014)	(0.0924)	(0.9908)	(0.2505)
LIQ	0.0297		0.0306	-0.1426 ***		-0.1433 ***	-1.8790 ***		-1.3160 ***
	(0.0191)		(0.0187)	(0.0284)		(0.0286)	(0.2819)		(0.2813)
ROE		-0.0002 *	-0.0002 ***		0.00003	-0.0001		-0.0513 **	-0.0526 ***
		(0.0001)	(0.0001)		(0.0004)	(0.0004)		(0.0250)	(0.0137)
N. Obs.	848	879	848	848	879	848	646	672	670
Adj. R^2	0.67	0.66	0.67						
F-statistic	63.21	60.84	61.07						
Prob(F-statistic)	(0.00)	(0.00)	(0.00)						
Rw				0.36	0.32	0.35			
N. Inst./N. cross. sec.							0.86	0.71	0.81
J-statistic							17.10	11.56	10.14
Prob(J-statistic)							(0.31)	(0.48)	(0.68)
AR(1)							-0.28	-0.34	-0.44
p-value							(0.00)	(0.00)	(0.00)
AR(2)							-0.06	-0.04	-0.04
p-value							(0.17)	(0.31)	(0.29)

Note: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denote s 0.1. Robust standard errors (White – FOLS and S-GMM, and Huber – RLS) between parentheses. FOLS and RLS - constant is omitted for convenience. S-GMM - two-step estimation of Arellano and Bover (1995). Tests for AR(1) and AR(2) check for the presence of first order and second-order serial correlation in the first-difference residuals. The sample is an unbalanced panel quarterly data of 32 financial institutions from the first quarter of 2003 to the fourth quarter of 2016.

5.4. Robustness analysis

Although the financial situation of banking firms plays a central role in explaining risk, macroeconomic conditions are also important in explaining the probability of insolvency over time (Bonfim, 2009). As a consequence, this section includes macroeconomic variables in the model as a way of considering economic factors to explain insolvency risk. Thus, the benchmark model (equation 5) is extended to: (6) $$RISK_{i,t} = \eta_i + \alpha_4 SEC_{i,t-1} + \beta_7 CAP_{i,t} + \beta_8 LIQ_{i,t} + \beta_9 ROE_{i,t} + \beta_{10} \Delta SELIC_{i,t} + \beta_{11} GDP_{i,t} + \Delta EX_{i,t} + \varepsilon_{i,t},$$

where, ΔSELIC (change in the monetary policy interest rate), GDP (GDP growth rate), ΔEX (change in the exchange rate).

Based on the studies on securitization and banking risk (see, for example, Casu et al., 2011; Kashian and Tao, 2014; and Le, Narayanan, and VO, 2016), the macroeconomic control variables (ΔSELIC, GDP and ΔEX) are included in the model. It is important to note that in addition to the coefficient on securitization being negative and significant in all models and methods, the results regarding the coefficients on the banking control variables do not differ from those observed in the previous subsections (see table 4). In relation to the macroeconomic variables, we observe that the coefficient on the monetary policy interest rate (SELIC) is positive and significant for almost all models and, therefore, an increase in this variable can reduce the risk. In other words, an increase in SELIC can lead financial institutions to a conservative position, which in turn can imply a decrease in the risk. The coefficient on GDP is positive and significant in most models. This result is in line with the idea that in periods of economic growth banks have better results and a lower probability of insolvency (see, Kashian and Tao, 2014). In a different way from the previous coefficients on macroeconomic control variables, the coefficient on EX is negative. Thus, currency devaluations may lead to an increase in the risk. In particular, financial institutions that have liabilities exposed to currency risk are subject to a deterioration in the quality of their credit portfolio.

6. Concluding remarks

The empirical evidence from a representative sample of the securitization market in Brazil indicates that financial institutions do not use securitization as a tool to transfer part of their risk. The increase in the insolvency risk can be explained by the fact that financial institutions securitize better-quality assets and to hold lower-quality assets. The results from the consolidated securitization market, which encompasses both Credit Rights Investment Funds (FIDC) and Real Estate Receivables Certificates (CRI), are confirmed by the individual analysis of each of these segments of securitization in Brazil. Furthermore, the introduction of macroeconomic variables in the models also confirms that securitization has a positive impact on the bank risk.

In summary, regardless of the differences in securitization vehicles, this financial product seems to increase the risk of financial institutions that originate these operations in Brazil. Based on the 2008 international financial crisis and its consequences, these findings reinforce concerns about macroprudential measures for the sustainable development of the securitization market in emerging economies.

Table 4

Effect of securitization on risk (macroeconomic variables)

Method:	**Ordinary Least Squares - Fixed OLS**						**Robust Least Squares - RLS**						**Generalized Method of Moments - S-GMM**					
Regressors:	**FIDC+CRI**		**FIDC**		**CRI**		**FIDC+CRI**		**FIDC**		**CRI**		**FIDC+CRI**		**FIDC**		**CRI**	
SEC(-1)	-0.2333	***	-0.1602	***	-1.1045	***	-0.0781	***	-0.0899	***	-0.0838	***	-2.7006	***	-0.4094	***	-2.3443	**
	(0.0504)		(0.0379)		(0.0355)		(0.0073)		(0.0082)		(0.0112)		(0.0432)		(0.0577)		(0.7525)	
CAP	0.0079	*	0.9084	***	0.0479	*	0.2567	***	0.3893	***	0.2444	***	1.1199	***	0.7398	***	2.9725	***
	(0.0047)		(0.0658)		(0.0281)		(0.002)		(0.02)		(0.0014)		(0.0525)		(0.0359)		(0.4146)	
LIQ	0.0348		-0.0654		0.0148		-0.3511	***	-0.2330	*	-0.1470	***	0.0261		-0.1603	**	-1.6315	***
	(0.0249)		(0.2155)		(0.0377)		(0.0367)		(0.1369)		(0.0285)		(0.0281)		(0.078)		(0.4289)	
ROE	-0.0003	***	-0.0002		-0.0003	***	-0.0006		-0.0036		-0.0001		-0.0616	***	-0.0213	***	-0.0298	**
	(0.00003)		(0.0018)		(0.00004)		(0.0005)		(0.004)		(0.0004)		(0.0135)		(0.006)		(0.0095)	
ΔSELIC	0.0036		0.0002		0.0042		0.0037		0.0043		-0.0037		0.0275	***	0.0214	***	0.4022	***
	(0.0027)		(0.003)		(0.0045)		(0.0033)		(0.0038)		(0.0049)		(0.0021)		(0.0018)		(0.0962)	
PIB	0.0013	**	0.0014	**	0.0013		0.0007	**	0.0013	***	-0.0005		0.0097	***	0.0025	***	0.0623	***
	(0.0006)		(0.0005)		(0.0014)		(0.0002)		(0.0003)		(0.0003)		(0.0007)		(0.0003)		(0.0057)	
ΔEX	-0.0299	**	-0.0058		-0.0371	*	0.0247		0.0358		-0.0052		-0.0573	***	0.0070		-3.0947	***
	(0.0097)		(0.0121)		(0.0211)		(0.0194)		(0.0222)		(0.0267)		(0.0055)		(0.0050)		(0.3520)	
N. Obs.	3.513		2.661		793		3.513		2.661		793		3.053		1.877		553	
Adj. R^2	0.75		0.79		0.59													
F-statistic	117.56		155.47		38.29													
Prob(F-statistic)	(0.00)		(0.00)		(0.00)													
Rw							0.15		0.19		0.37							
N. Inst./N. cross. sec.													0.87		0.90		0.90	
J-statistic													71.78		54.98		10.13	
Prob(J-statistic)													(0.23)		(0.20)		(0.51)	
AR(1)													-0.43		-0.11		-0.29	
p-value													(0.00)		(0.00)		(0.00)	
AR(2)													-0.01		-0.01		-0.06	
p-value													(0.46)		(0.58)		(0.17)	

Note: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denote s 0.1. Robust standard errors (White – FOLS and S-GMM, and Huber – RLS) between parentheses. FOLS and RLS - constant is omitted for convenience. S-GMM - two-step estimation of Arellano and Bover (1995). Tests for AR(1) and AR(2) check for the presence of first order and second-order serial correlation in the first-difference residuals. The sample is an unbalanced panel quarterly data of 32 financial institutions from the first quarter of 2003 to the fourth quarter of 2016.

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Appendix

Table A.1 - *Sources of data and description of the variables*

Variable name	Variable description	Data source
SEC	Assumes value equal to 1 from the first issuance of FDIC by the financial institutions and value equal to 0 otherwise.	CVM, from Registrations of Public Offerings.
RISK (z-Score)	Ratio of the sum of equity capital to total assets plus the return on average assets before taxes (ROAA) divided by standard deviation of ROAA (stdevROAA).	CBB, document *"7002 Balance Sheet"*, authors' calculation.
ROAA	Net Income before taxes/Average Total Assets (avAssets).	CBB, document "*7002 Balance Sheet*", authors' calculation.
avAssets	Average of a financial institution's Total Assets calculated by "rolling window" techniques using 12 quarters as benchmark.	CBB, document "*7002 Balance Sheet*", authors' calculation.
stdevROAA	Standard deviation of a financial institution's ROAA.	CBB, document *"7002 Balance Sheet"*, authors' calculation.
CAP	Equity/Total assets ratio.	Banks – CBB, document *"7002 Balance Sheet"* and Securitizers -ITR report - CVM, authors' calculation.
LIQ	Liquid Assets/Total Assets Ratio.	CBB, document *"7002 Balance Sheet"*, authors' calculation.
ROE	Net Income/Shareholder's Equity Ratio	CBB, document "*7002 Balance Sheet*", authors' calculation.
Δ IR	Change in the monetary policy interest rate (average quarterly) - Selic in annual terms (basis 252).	TSMS/CBB (Code 1178)
GDP	Quarterly GDP - seasonally adjusted data - GDP at market prices – growth rate	TSMS/CBB (Code 22109).
Δ EX	Change in the exchange rate - US dollar/Brazil Real (c.m.u./US$).	TSMS/CBB (Code 3695).
AT	Total assets – financial institutions	Banks – CBB, document *"7002 Balance Sheet"* and Securitizers -ITR report - CVM, authors' calculation.
ROA	Net Income before taxes/Total Assets	Banks – CBB, document *"7002 Balance Sheet"* and Securitizers -ITR report - CVM, authors' calculation.
END	Ratio between Current Liabilities plus Long-term Liabilities and Total Liabilities plus Shareholders' Equity.	Banks – CBB, document *"7002 Balance Sheet"* and Securitizers -ITR report - CVM, authors' calculation.

Note: CBB – Central Bank of Brazil. The documents "7002 Balance Sheet" available in the report Quarterly Financial Information (IFT – Informações Financeiras Trimestrais) from CBB. CVM means Securities and Exchange Commission of Brazil; CBB means Central Bank of Brazil; and TSMS - Time Series Management System.

Table A.2 - *Descriptive statistics* – full sample (FIDC + CRI), FIDC, and CRI

	Mean	Median	Maximum	Minimum	Standard deviation	Obs.	Mean	Median	Maximum	Minimum	Standard deviation	Obs.	Mean	Median	Maximum	Minimum	Standard deviation	Obs.
All financial institutions – full sample							*All financial institutions – FIDC*						*All financial institutions – CRI*					
RISK	0.3702	0.2123	3.4777	-2.4454	0.4857	3698	0.3104	0.2209	1.5371	-2.4454	0.2906	2739	0.4545	0.1488	6.3341	-0.2121	0.7933	889
CAP	0.1289	0.1350	1.6604	-200.2470	3.4694	4512	0.1941	0.1259	1.0515	-1.6477	0.2045	3156	-0.0228	0.2226	1.6604	-200.2470	6.3200	1356
LIQ	0.0432	0.0031	2.1032	0.0000	0.1520	4397	0.0075	0.0020	0.5122	0.0000	0.0265	3110	0.1295	0.0141	2.1032	0.0000	0.2584	1287
ROE	0.2237	0.0274	351.0000	-49.9167	6.9535	4451	0.0537	0.0312	48.0748	-7.6608	0.8890	3156	0.6382	0.0139	351.0000	-49.9167	12.8105	1295
IR	13.2059	12.2741	26.2390	7.1267	4.2375	5096	13.2059	12.2741	26.2390	7.1267	4.2377	3360	13.2059	12.2741	26.2390	7.1267	4.2383	1736
GDP	151.2405	155.1400	176.5000	116.4800	18.9468	5096	151.2405	155.1400	176.5000	116.4800	18.9478	3360	151.2405	155.1400	176.5000	116.4800	18.9504	1736
ΔEX	-0.0036	-0.0293	0.6091	-0.5056	0.1846	5005	-0.0036	-0.0293	0.6091	-0.5056	0.1846	3300	-0.0036	-0.0293	0.6091	-0.5056	0.1847	1705
Financial institutions that issued FIDC or *CRI*							*Financial institutions that issued FIDC*						*Financial institutions that issued CRI*					
RISK	0.3312	0.1717	3.3323	-0.2121	0.4557	1831	0.2956	0.1901	1.5371	-0.0904	0.2771	1443	0.3932	0.0772	6.3341	-0.2121	0.9016	364
CAP	0.0358	0.1545	1.6604	-200.2470	4.7246	2424	0.1796	0.1441	0.9346	-0.8714	0.1348	1659	-0.2759	0.3595	1.6604	-200.2470	8.4030	765
LIQ	0.0720	0.0043	2.1032	0.0000	0.1994	2357	0.0097	0.0020	0.5122	0.0000	0.0354	1659	0.2202	0.0590	2.1032	0.0000	0.3164	698
ROE	0.3408	0.0256	351.0000	-49.9167	9.2665	2365	0.0609	0.0279	48.0748	-4.0770	1.1949	1659	0.9986	0.0123	351.0000	-49.9167	16.8511	706
IR	13.2059	12.2741	26.2390	7.1267	4.2378	2912	13.2059	12.2741	26.2390	7.1267	4.2383	1792	13.2059	12.2741	26.2390	7.1267	4.2390	1120
GDP	151.2405	155.1400	176.5000	116.4800	18.9482	2912	151.2405	155.1400	176.5000	116.4800	18.9502	1792	151.2405	155.1400	176.5000	116.4800	18.9534	1120
ΔEX	-0.0036	-0.0293	0.6091	-0.5056	0.1846	2860	-0.0036	-0.0293	0.6091	-0.5056	0.1847	1760	-0.0036	-0.0293	0.6091	-0.5056	0.1847	1100
Financial institutions that did not issued FIDC or *CRI*							*Financial institutions that did not issued FIDC*						*Financial institutions that did not issued CRI*					
RISK	0.4085	0.2439	3.4777	-2.4454	0.5107	1867	0.3269	0.2440	1.5079	-2.4454	0.3042	1296	0.4970	0.2096	3.6427	-0.1072	0.7063	525
CAP	0.2124	0.1450	1.2436	-0.8714	0.2114	2250	0.2102	0.0989	1.0515	-1.6477	0.2600	1497	0.3048	0.1523	1.2436	-0.3259	0.3283	591
LIQ	0.0129	0.0023	0.9963	0.0000	0.0503	2248	0.0050	0.0019	0.0559	0.0000	0.0074	1451	0.0219	0.0031	0.9963	0.0000	0.0776	589
ROE	0.0990	0.0251	109.3763	-4.0770	2.5264	2248	0.0457	0.0337	5.3839	-7.6608	0.2903	1497	0.2063	0.0155	109.3763	-3.4534	4.5111	589
IR	13.2059	12.2741	26.2390	7.1267	4.2380	2408	13.2059	12.2741	26.2390	7.1267	4.2384	1568	13.2059	12.2741	26.2390	7.1267	4.2405	616
GDP	151.2405	155.1400	176.5000	116.4800	18.9489	2408	151.2405	155.1400	176.5000	116.4800	18.9510	1568	151.2405	155.1400	176.5000	116.4800	18.9603	616
ΔEX	-0.0036	-0.0293	0.6091	-0.5056	0.1846	2365	-0.0036	-0.0293	0.6091	-0.5056	0.1847	1540	-0.0036	-0.0293	0.6091	-0.5056	0.1848	605

Table A.3 - *Correlation matrix*

Full sample (FIDC + CRI)								
	SEC	*RISK*	*CAP*	*LIQ*	*ROE*	*SELIC*	*GDP*	*ΔEX*
SEC	1.00	-0.17	-0.03	0.17	0.01	-0.24	0.30	0.11
RISK	-0.17	1.00	0.08	-0.01	-0.02	0.16	-0.11	-0.04
CAP	-0.03	0.08	1.00	-0.29	0.00	-0.02	0.00	0.02
LIQ	0.17	-0.01	-0.29	1.00	-0.03	-0.04	0.10	0.05
ROE	0.01	-0.02	0.00	-0.03	1.00	0.00	0.01	0.00
SELIC	-0.24	0.16	-0.02	-0.04	0.00	1.00	-0.76	-0.26
GDP	0.30	-0.11	0.00	0.10	0.01	-0.76	1.00	0.37
ΔEX	0.11	-0.04	0.02	0.05	0.00	-0.26	0.37	1.00
FIDC								
	SEC	*RISK*	*CAP*	*LIQ*	*ROE*	*SELIC*	*GDP*	*ΔEX*
SEC	1.00	-0.15	0.02	0.11	0.01	-0.25	0.28	0.10
RISK	-0.15	1.00	0.43	-0.08	-0.02	0.18	-0.04	0.00
CAP	0.02	0.43	1.00	-0.09	-0.02	-0.06	0.09	0.04
LIQ	0.11	-0.08	-0.09	1.00	0.00	0.01	0.05	0.03
ROE	0.01	-0.02	-0.02	0.00	1.00	-0.02	0.00	-0.01
SELIC	-0.25	0.18	-0.06	0.01	-0.02	1.00	-0.76	-0.25
GDP	0.28	-0.04	0.09	0.05	0.00	-0.76	1.00	0.36
ΔEX	0.10	0.00	0.04	0.03	-0.01	-0.25	0.36	1.00
CRI								
	SEC	*RISK*	*CAP*	*LIQ*	*ROE*	*SELIC*	*GDP*	*ΔEX*
SEC	1.00	-0.15	-0.08	0.39	0.03	-0.18	0.35	0.12
RISK	-0.15	1.00	0.07	-0.02	-0.02	-0.09	0.05	0.02
CAP	-0.08	0.07	1.00	-0.31	0.00	-0.04	-0.01	0.05
LIQ	0.39	-0.02	-0.31	1.00	-0.05	-0.08	0.17	0.08
ROE	0.03	-0.02	0.00	-0.05	1.00	0.01	0.02	0.00
SELIC	-0.18	-0.09	-0.04	-0.08	0.01	1.00	-0.74	-0.22
GDP	0.35	0.05	-0.01	0.17	0.02	-0.74	1.00	0.36
ΔEX	0.12	0.02	0.05	0.08	0.00	-0.22	0.36	1.00

Table A.4

List of instruments (S-GMM)

Table 1	Model 1	RISK(-2) ROA(-2 to -16) CAP(-1 to -6) END(-1 to -4)
	Model 2	RISK(-2) ROA(-2 to -11) CAP(-1 to -6) END(-1 to -4) ROE(-1 to -1)
	Model 3	RISK(-2) ROA(-2 to -16) CAP(-1 to -6) END(0 to -4) AT(-2 to -4)
Table 2	Model 1	RISK(-2) CAP(-1 to -7) END(-1) ROE(-1)
	Model 2	RISK(-2) CAP(-1 to -2) ROE(-1)
	Model 3	RISK(-2) CAP(-1 to -3) END(-1) ROE(-1) AT(-1 to -2)
Table 3	Model 1	RISK(-1 to -7) LIQ(-1 to -5) ROE(-0 to -3) ROA(-1) END(-1)
	Model 2	RISK(-1 to -6) LIQ(-1 to -4) ROE(-1 to -4) ROA
	Model 3	RISK(-1 to -6) LIQ(-1 to -4) ROE(-1 to -4) ROA(-1) END(-1 to -2)
Table 4	Model 3 (FIDC+CRI)	RISK(-2) ROE(-1) CAP(-1 to -4) LIQ(-1 to -7) ROA(0 to -2) END(-1 to -4) ΔEX(-1 to -3) ΔSELIC(-1) AT(0 to -3)
	Model 3 (FIDC)	RISK(-2) ΔCAP(-1 to -2) ROE(-1 to -3) ΔLIQ(-1 to -3) ROAA(-2 to -7) INF(0 to -1) END
	Model 3 (CRI)	RISK(-2 to -6) LIQ(-1 to -6) ROE(-1 to -3) END(-2 to -4) EX(-2)

Note: Numbers within parentheses denote the lags associated with each variable.