1. Introduction

Why do policymakers and academics care about fiscal credibility? Although the empirical literature on the consequences of fiscal credibility is scarce, some studies provide evidence that fiscal credibility is important to the expectations formation process related to macroeconomic variables (Montes and Acar 2018; de Mendonça and Silva 2016) and to financial markets (Montes and Souza 2020), as well as to the conduction of fiscal policy (de Mendonça and Auel 2016). Therefore, once fiscal credibility affects the economy, it is important to investigate its determinants, in order to adopt policies aimed to improve it.

The use of discretionary fiscal policies generates excessive deficits and increases public debt. Evidences suggest fiscal policy is more sustainable, disciplined and effective when the government reduces the use of discretionary fiscal policies (e.g., Fatás and Mihov 2003a, 2003b and 2009; Ciro and de Mendonça 2017). The fiscal impulse captures the discretionary behavior of the government in relation to fiscal policy, and it reveals the changes in fiscal policy resulting from intentional actions of the policymaker which are not due to the economic cycle, but due to new political preferences. Montes and Luna (2018) show that the adoption of discretionary fiscal policies increases the uncertainties regarding the future behavior of public debt and the budget balance, whilst Montes and Valpassos (2018) reveal that when the government adopts discretionary fiscal policies, an increase in sovereign risk occurs. Therefore, higher discretion in fiscal policy can lead to higher public debt and budget imbalances, resulting in increases in the risk perception related to government's fiscal solvency. Hence, a pertinent question this study seeks to answer is: Does the adoption of discretionary fiscal policies harm fiscal credibility?

On the other hand, fiscal communication emerges as a useful tool to improve fiscal transparency. Fiscal communication enhances government's accountability and increases the society's confidence in the fiscal management, forcing governments to take better fiscal decisions (Montes et al., 2019). However, the literature investigating the consequences of fiscal communication on the economy is also scarce. While de Mendonça and Nicolay (2017) provides evidence that the communication released from the fiscal authority is important to reduce expectations about the public debt, Montes et al. (2019) show that as clarity of fiscal announcements increases, the stronger is the effect of improvements in fiscal communication in reducing public debt uncertainty. In order to contribute with the incipient literatures on fiscal communication and fiscal credibility, this study also seeks to answer the following questions: Does fiscal communication improve fiscal credibility? Can fiscal communication mitigate the effect of discretionary fiscal policy on fiscal credibility?

Thus, this paper aims at providing empirical evidence regarding the effects of discretionary fiscal policy (captured by the fiscal impulse) and fiscal communication on the Brazilian fiscal credibility. Brazil is an interesting case study once it presents problems of public accounts deterioration, but at the same time it has also made efforts to adopt more transparent policies and improve government communication with the public. Furthermore, Brazil is one of the few countries to provide free series of expectations related to fiscal variables.

Analyzing the literature on discretionary fiscal policies, there are studies concerned with the development of measures able to capture the discretionary fiscal policy (e.g., Agnello et al. 2013; Attinasi and Klemm 2016), as well as there are studies seeking to understand the determinants (or the causes) of discretionary fiscal policy and, thus, seeking to develop mechanisms to mitigate such discretionary policies (e.g., Buti and Noord 2004; Agnello and Souza 2014; Ciro and de Mendonça 2017). There are also studies addressing the effects of discretionary fiscal policy on the economy (e.g., Fatás and Mihov 2003b; Attinasi and Klemm 2016; Montes and Luna 2018; Montes and Valpassos 2018). Although these studies bring

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Effects of discretionary fiscal policy and fiscal communication on fiscal credibility: Empirical evidence from Brazil

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Abstract

Since empirical evidence suggest fiscal credibility is important to the expectations formation process related to macroeconomic variables, it is important to identify the policies able to improve or deteriorate fiscal credibility. Once the adoption of discretionary fiscal policies can lead to higher public debt and budget imbalances, and to the extent that fiscal communication is important to improve fiscal transparency, this paper seeks to answer the following questions: Does the adoption of discretionary fiscal policies harm fiscal credibility? Does fiscal communication improve fiscal credibility? The study is the first to investigate whether fiscal communication and the adoption of discretionary fiscal policy (captured by the fiscal impulse) affects fiscal credibility in an important developing country (Brazil). The results indicate the adoption of discretionary fiscal policies harms fiscal credibility, and fiscal communication plays an important role in the task of improving fiscal credibility.

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important contributions to the literature, none of them have so far addressed the relationship between discretionary fiscal policy and fiscal credibility. Hence, our study is the first to estimate this relationship.

On the other hand, the study also contributes to the literatures addressing the consequences of fiscal communication and the determinants of fiscal credibility. Regarding the determinants of fiscal credibility, as far as we know, there are only two studies: one developed by Montes and Acar (2015) and the other developed by Nicolay et al. (2019), which also did not investigate the effects of both discretionary fiscal policies and fiscal communication on fiscal credibility. In this sense, this paper is the first to address such relations.

As measures of fiscal credibility, we use the fiscal credibility indexes proposed by Montes and Acar (2018) and de Mendonça and Machado (2013) – the study prepared by Montes and Acar (2018) presents the criticisms related to each of the existing fiscal credibility indexes. Concerning the measure of discretionary fiscal policy, we use two different types of fiscal impulse indicators, which can be found in Fatás and Mihov (2003b), Ciro and de Mendonça (2017), Montes and Luna (2018) and Montes and Valpassos (2018). Regarding fiscal communication, we follow de Mendonça and Nicolay (2017) and Montes et al. (2019) and we use the same index.

The paper provides interesting insights and policy implications about the conduction of fiscal policy and practices adopted by the government aimed at improving fiscal transparency. The results suggest the adoption of discretionary fiscal policies harms fiscal credibility. Hence, the use of discretionary fiscal policies should be avoided by the government once it causes fiscal credibility deterioration. In addition, the findings reveal that fiscal communication represents a useful tool to improve fiscal credibility as well as to mitigate the adverse effect that the use of discretionary fiscal policies causes on fiscal credibility.

For inflation targeting developing countries (such as: Brazil, Colombia, Chile, Peru, Mexico and Turkey), anchoring inflation expectations is essential for meeting the targets set by the monetary authority. However, as suggested by Mishkin (2007), the inflation targeting regime requires coordination between fiscal and monetary policies and fiscal balance. Montes and Acar (2018) point out that coordination between fiscal and monetary policies is essential for success in the task of guiding inflation expectations towards the inflation target. Furthermore, Montes and Lima (2018) point to the importance of fiscal transparency for controlling both inflation and inflation expectations in developed and developing countries. In this sense, improvements in fiscal communication (greater fiscal transparency) and fiscal credibility (less public debt) increase public confidence in fiscal management and help to guide inflation expectations towards the inflation target. Therefore, for developing countries, which have a history of fiscal imbalance and out-of-control inflation, it is important to maintain balanced fiscal results, increase communication with the public and develop fiscal credibility, in order to strengthen the inflation targeting regime.

In this sense, seeking to verify the determinants of fiscal credibility, this study provides empirical evidence on the effects of discretionary fiscal policy and fiscal communication on Brazilian fiscal credibility. Due to the relevance of fiscal policy results for inflation targeting countries, the study contributes to the literature that analyzes the impacts of fiscal policies for the expectations formation process and, therefore, for the consequences of fiscal policies in inflation targeting developing countries.

2. Fiscal credibility: measures and empirical evidence on its determinants

Fiscal credibility is usually related to expectations about public debt sustainability. According to Blanchard and Cottarelli (2010), an important condition to earn fiscal credibility is that the public debt to GDP ratio does not jeopardize the government's intertemporal fiscal solvency. A high public debt rises the government's likelihood of default on its debt, worsening credibility. Hence, a low fiscal credibility reduces the public's belief regarding the government's commitment to fiscal balance, increasing uncertainties about the behavior of both the public debt and the fiscal balance.

Despite the difficulties on how to accurately measure fiscal credibility through a single indicator, some economists have made efforts to develop measures aimed at describing an approximate behavior of fiscal credibility.

The work of de Mendonça and Machado (2013) developed a fiscal credibility index based on the deviations of expectations about the net public debt-to-GDP from the prudential benchmark for the debt suggested by the International Monetary Fund and the literature (see Cristina et al. 2011). However, the index tends to overestimate credibility, since it considers the expectation about the net public debt. Kuncoro (2015) builds a measure of credibility related to the fiscal rules using the deviation from the current budget in relation to the planned one. However, once the measure considers past events, it cannot be considered a forward-looking indicator that captures credibility in its strong version.

The index developed by de Mendonça and Silva (2016) uses the expectations for the budget balance provided by the Central Bank of Brazil (CBB), and the primary surplus targets as benchmarks. However, the tolerance intervals of the index are not well-defined (in fact, they are defined ad-hoc), and some caveats deserve to be made about the use of the primary surplus targets as a parameter of sustainability. As pointed out by Bova et al. (2014), a fiscal rule, although rigid, cannot replace the commitment to follow the rule, which is largely a political decision, and thus difficult to measure. Moreover, the several revisions of the primary surplus targets in recent years in Brazil show that the targets do not indicate a commitment with sustainability, and consequently do not represent a parameter robust enough.

In turn, Montes and Acar (2018) develops a fiscal credibility indicator using expectations formed in relation to the budget balance, characterizing it as a forward-looking variable and therefore adherent to the concept of credibility. Since the main goal of the National Treasury is to ensure the debt sustainability according to the Fiscal Responsibility Law (FRL), the index captures how distant the public's belief regarding the budget balance is from the fiscal goal. Ultimately, the sustainability goal can be inferred through the effective fiscal effort that the government must do to bring (or keep) gross debt to a sustainable level.

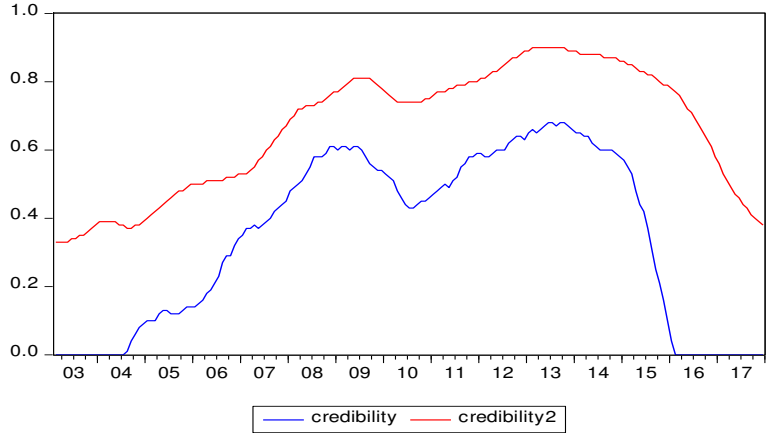
The main difference of the index developed by Montes and Acar (2018) in relation to the other existing indicators lies in its ability to indirectly capture the agents' perceptions regarding the evolution of the gross debt, since it compares the expectation for the primary surplus with the primary surplus required to bring the gross debt to a value considered as ideal. Such idea is in line with the findings of Cimadomo et al. (2016), which assess that experts form their expectations about future government bond spreads taking into account the expected evolution of the fiscal balance and expectations about economic growth. Therefore, we use the fiscal credibility index *(credibility)* developed by Montes and Acar (2018).

In order to check robustness, we also use the fiscal credibility index developed by de Mendonça and Machado (2013). The fiscal credibility index developed by de Mendonça and Machado (2013) (*credibility2*) takes into account the deviation of expectations from the government commitment with public debt sustainability.

Figure 1 shows the behavior of both fiscal credibility indexes *(credibility* and *credibility2)*. Analyzing figure 1, we observed that both indexes show a similar behavior. There is a period of credibility building, but due to the Global Financial Crisis *(*Subprime*),* both indexes capture a decrease in fiscal credibility, and after overcoming the crisis, the indexes

increase again. In 2015, due to the fiscal crisis that affected the country (which resulted in a downgrade of sovereign ratings and loss of investment grade by the three largest risk rating agencies – S&P, Moody's and Fitch), fiscal credibility reduced abruptly, showing the loss of confidence in the government's ability to commit itself to a sustainable public debt.

Figure 1 Fiscal credibility indexes (*credibility* and *credibility*2)



Regarding the determinants of fiscal credibility, the work of Montes and Acar (2015) aims to explain how fiscal policies and public debt management affect fiscal credibility in Brazil. So far, this is the only empirical study that has sought to analyze the determinants of fiscal credibility. The findings provided by Montes and Acar (2015) are in line with the policy recommendations found in Calvo and Guidotti (1990), Giavazzi and Pagano (1990), Missale et al. (2002) and Giavazzi and Missale (2004) with regard to public debt management, i.e., the Brazilian National Treasury has promoted improvements in public debt management that were important to build fiscal credibility. The results suggest that the commitment to a proper debt management policy and responsible fiscal policies are important to build fiscal credibility.

In the present paper, we seek answers to new questions concerning the determinants of fiscal credibility. In addition to the controls used by Montes and Acar (2015) and Nicolay et al. (2019), we also estimate the effects of discretionary fiscal policies and fiscal communication on fiscal credibility.

3. Data and methodology

Empirical studies addressing the effects of fiscal policies must have a reliable measure of discretionary fiscal policy actions (Attinasi and Klemm, 2016). Following Fatás and Mihov (2003b), Ciro and de Mendonça (2017), Montes and Luna (2018) and Montes and Valpassos (2018), we use the term discretionary fiscal policy to refer to changes in fiscal policy that do not represent reaction to economic conditions. According to Fatás and Mihov (2003b), in theory, it is useful to think about fiscal policy as consisting of three components: (1) automatic stabilizers, (2) discretionary fiscal policy that reacts to the state of the economy, and (3) discretionary policy that is implemented for reasons other than current macroeconomic conditions. In this study, we focus on the last component of fiscal policy.

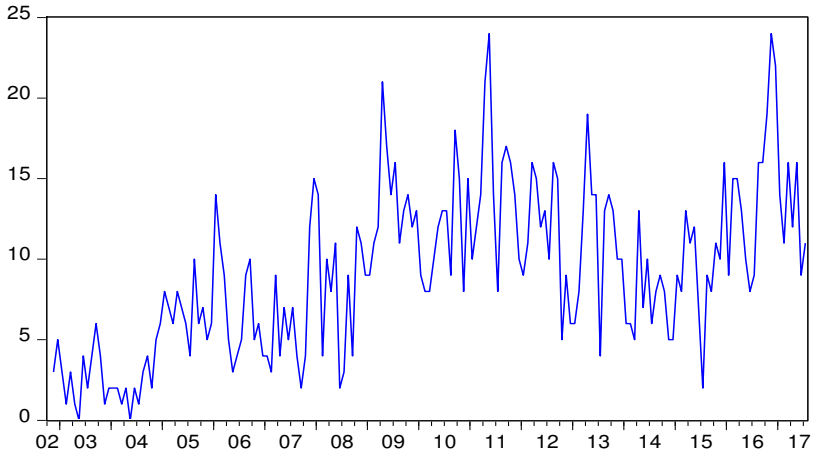
According to Fatás and Mihov (2003b), there is no consensus in the literature on the appropriate methodology for building a discretionary fiscal policy measure. Fatás and Mihov (2003b) focus on government spending as opposed to the budget deficit. Their choice is driven both by theoretical arguments as well as by empirical estimates. Fatás and Mihov (2003b) estimate an equation for the government spending and use the error term of this equation as a quantitative estimate of discretionary policy. In this sense, the discretionary component

captures exactly the discretionary policy that is implemented for reasons other than current macroeconomic conditions.

Thus, the methodology that we use to obtain the fiscal impulse follows the literature that investigates the effects of the fiscal impulse on the economy (e.g., Fatás and Mihov 2003b; Afonso et al. 2010; Ciro and de Mendonça 2017; Montes and Luna 2018; Montes and Valpassos 2018). In a recent study, Montes and Luna (2018) built two fiscal impulse indicators. The first one based on Ciro and de Mendonça (2017) and the second based on Fatás and Mihov (2003b). Following Montes and Luna (2018), we build two fiscal impulse indicators *(Impulse and Impulse2)*. The first indicator *(Impulse)* captures the discretionary change in fiscal policy and is based on Ciro and de Mendonça (2017). The second measure of discretionary fiscal policy (*Impulse2*) is based on Fatás and Mihov (2003b) and Montes and Luna (2018). We also use the *Impulse2* in the analysis because, as Fatás and Mihov (2003b) argue, there is no consensus in the literature about the appropriate methodology for the construction of a discretionary fiscal policy measure. Therefore, we use this other measure to check if the results hold. Appendix B presents the methodologies to calculate both indicators (*Impulse* and *Impulse2*).

Regarding fiscal communication, we use the index proposed by de Mendonça and Nicolay (2017), which is also used by Montes et al. (2019). To build the index we consider the number of releases through "official notes", which recently become "news", available from the website of the Ministry of Finance (https://www.gov.br/economia/pt-br/centrais-de-conteudo/publicacoes/). The index (*communication*) counts only communications concerning fiscal policy actions. We discard any other release, as, for example, calls for contests. The index uses a discrete and positive scale, measuring the volume of releases inside the month. Each announcement receives the value +1. Hence, the index is the number of releases about fiscal policy in the month. Figure 2 shows the behavior of the fiscal authority communication index. The graph reveals that the fiscal communication index increased during the period, suggesting that the level of transparency in relation to fiscal policy is increasing due to the high volume of announcements from the fiscal authority to the public. In the estimates, we use the average daily communications in a month.

Figure 2 Fiscal communication index *(communication)*



The choice of the set of control variables follows the work of Montes and Acar (2015), which estimates the determinants of fiscal credibility. We present below the description of each control variable.

With respect to fiscal policy variables, we use the gross public debt to GDP (*debt*), the budget balance to GDP (*budget*) and the public spending to GDP (*spending*). Such as Montes and Acar (2015), we expect a negative relation between public debt and fiscal credibility and

between *spending* and credibility, and a positive relation between budget balance and fiscal credibility.

Aiming at capturing the effect of the Brazilian public debt management policies on fiscal credibility, we follow Montes and Acar (2015) and create two indicators of public debt indexation. The first indicator of public debt indexation (*debt_indexation1*) is built through the sum of the proportion of fixed-rate bonds with the proportion of price indexed bonds. According to Giavazzi and Missale (2004), most of the Brazilian public debt should consist of fixed-rate bonds and price indexed bonds. In turn, the second indicator of public debt indexation (*debt_indexation2*) is built through the sum of the proportion of exchange-rate indexed bonds with interest-rate (over/SELIC) indexed bonds. According to Giavazzi and Missale (2004), the proportion of exchange-rate indexed bonds and interest-rate indexed bonds should be reduced in order to improve the composition of public debt. Moreover, following the ideas of Giavazzi and Pagano (1990), Calvo and Guidotti (1990) and Missale et al. (2002) that a more extended period of maturity is important to reduce the amount of bonds that need to be rolled over in a period of crisis, we also use the series of the average maturity of the public debt (*debt_maturity*).

We also use the volatilities of both public debt (*debt_volatility*) and budget balance (*budget_volatlity*). We use these variables because when the volatility of a certain series increases, the uncertainty about the behavior of the series also increases. Thus, we expect that greater volatility in both gross debt and budget balance series would increase the uncertainty about the future of these series and would reduce fiscal credibility. We also use a dummy variable to control for the effect of the subprime crisis (*Subprime*). Table A1 in the Appendix A presents the details and the source of each control variable, and table A2 presents the descriptive statistics.

Since our analysis is based on time series methodology, a first condition to be analyzed before applying the econometric analysis is to verify if the series are stationary. Therefore, the ADF, PP and KPSS tests were applied (Table A3 in the Appendix). Based on the tests, one can observe that the variables *debt, budget, credibility, credibility2, debt_indexation1, debt_indexation2* and *debt_maturity* are I(1), and the other variables are stationary, i.e., I(0). Thus, the variables *debt, budget, credibility, credibility2, debt_indexation1, debt_indexation2* and *debt_maturity* are used in the first difference, where Δ is the first difference operator (Δ*debt,* Δ*budget,* Δ*credibility,* Δ*credibility2,* Δ*debt_indexation1,* Δ*debt_indexation2* and Δ*debt_maturity*). The vector of control variables (*X*) is composed by the following variables: $\Delta debt_t$, $\Delta budget_{t-1}$, $debt\_volatility_t$, $budget\_volatility_t$, $\Delta\ debt\_indexation1_{t-3}$, $\Delta\ debt\_indexation2_{t-4}$, $\Delta\ debt\_maturity_{t-1}$, $spending_t$ and *Subprime*. The lags of the variables were determined empirically, following the general-to-specific method, observing the statistical significance of the coefficients and the principle of parsimony – as suggested by Hendry (2001). It is important to highlight that when we estimate the equation with the fiscal credibility index in the first difference, we are particularly observing the occurrence of improvement or worsening of fiscal credibility.

In order to verify the effects of both fiscal impulse and fiscal communication on fiscal credibility, we estimate the model expressed by equation (1).

$$\Delta credibility_t = \beta_0 + \beta_1 X + \beta_2 communication_t + \beta_3\ Impulse_t + \beta_4 Impulse_t * communication_t + \zeta_t \quad (1)$$

Where, ζ_t is the random error term, β_0 is the intercept, β_1 is a vector of parameters associated with the control variables, and *X* is the vector of control variables defined above. While β_2 and β_3 are the parameters associated to the effects of fiscal communication and fiscal impulse, respectively, the coefficient β_4 captures the interaction term between the fiscal communication and the fiscal impulse. Due to the fact that the adoption of discretionary fiscal

policies deteriorates budget balance and tends to increase public debt, and since fiscal communication increases transparency and reduces information asymmetries, we expect the following: $\beta_2 > 0$, $\beta_3 < 0$ and $\beta_4 > 0$. Therefore, we expect the adoption of discretionary fiscal policies deteriorates fiscal credibility, and fiscal communication improves fiscal credibility. It is important to highlight that, once we include the interaction term in the analysis, the effect of the fiscal impulse (*Impulse*) on the fiscal credibility variations (Δ*credibility*) depends on the fiscal communication (*communication*).

The analysis covers the period from February 2003 to August 2017 (monthly data), thus, in equation 1, "*t*" represents a month – the period was defined by data availability. We perform estimations of equation (1) using ordinary least squares (OLS), one-step generalized method of moments (GMM) and two-step generalized method of moments (GMM-2). Both OLS and one-step GMM estimates use the Newey-West (HAC) matrix to deal with heteroscedasticity and autocorrelation problems that we identified. The two-step GMM (GMM-2) estimation uses Windmeijer (2005) correction to address small-sample downward biases on standard errors.

4. Results

Table I presents the results of the estimates related to equation 1 using the fiscal credibility index developed by Montes and Acar (2018) as dependent variable. The findings obtained for the fiscal impulse reveal negative and statistically significant coefficients, indicating that the use of discretionary fiscal policies reduces fiscal credibility. Therefore, when the government makes use of discretionary fiscal policy, it occurs a deterioration of expectations about the budget balance and, consequently, in relation to the effort of the fiscal authority to keep the public debt stable.

Regarding fiscal communication, the results show that providing more information about fiscal policy increases fiscal credibility. Taking the average of the statistically significant coefficients, when we consider a positive one standard-deviation shock on the average daily communications in a month, we observe a 0.0037 basis points increase in *Δcredibility*. In turn, all coefficients for the interaction term are positive and significant, suggesting fiscal communication is important to mitigate the adverse effect that the use of discretionary fiscal policies exerts on fiscal credibility. Taking the average of the coefficients of the interaction term we obtain the value of 0.095. Once the average of the coefficients of the fiscal impulse is -0.046, one can observe that communication can be an effective tool to mitigate the adverse effect of the adoption of discretionary fiscal policies on fiscal credibility variations. From the results found, we used the parameter equality test (Wald test) to investigate whether the "compensation effect" occurs. To test this possible compensatory effect, we performed an equality test of parameters (Wald test), so that, considering the parameters described in equation (1), the null hypothesis is H_0: $\beta_2 + \beta_3 = 0$. In all equations, the null hypothesis is not rejected (Wald - $Prob(F)_{OLS} = 0.26$; Wald - $Prob(F)_{GMM} = 0.21$; Wald - $Prob(F)_{GMM\text{-}2} = 0.29$), suggesting the existence of the "compensation effect".

With respect to the control variables, the coefficients of all variables show the expected relations and corroborate the findings of Montes and Acar (2015). The results suggest when *spnding* and *Δdebt* increase, a negative and significant impact on fiscal credibility variation occurs. Thus, the difficulties in stabilizing the gross debt to GDP ratio generate a loss of fiscal credibility. In turn, the results for the variable *Δbudget* present positive and significant coefficients. Thus, as the government improves the results in relation to the budget balance (increasing the primary surplus), fiscal credibility increases.

With respect to debt management policies, the findings also corroborate the results of Montes and Acar (2015), suggesting that the actions adopted by the National Treasury contributed to increase fiscal credibility, and reinforcing the arguments and recommendations

of Calvo and Guidotti (1990), Giavazzi and Pagano (1990) and Giavazzi and Missale (2004). The estimates suggest that increasing the share of fixed-rate bonds and the share of price indexed bonds (captured by *debt_indexation1*) has a positive effect on fiscal credibility. Moreover, the findings suggest that an increase in both the share of exchange-rate indexed bonds and the share of interest-rate (over/SELIC) indexed bonds (captured by *debt_indexation2*) harms fiscal credibility. Te results also indicate that a longer period of public debt maturity (*debt_maturity*) has a positive and significant effect on fiscal credibility.

For the volatility variables, the results indicate that an increase in *debt_volatility* or in *budget_volatility* has a negative and statistically significant impact on fiscal credibility. In turn, regarding the *Subprime* crisis, the estimates present positive and significant coefficients. This result suggests that with the crisis, agents began to form expectations that the government would make efforts to increase the primary surplus tin order to keep the public debt stable.

Table I – OLS, GMM and GMM-2 estimates for equation (1)

Equation with *Impulse* and *communication* (dependent: *Δcredibility*)			
Estimator	**OLS**	**GMM**	**GMM-2**
Variables			
Constant	0.0358***	0.0494***	0.0366***
	(0.0120)	(0.0128)	(0.0119)
Δdebt	-0.0030**	-0.0019**	-0.0023**
	(0.0012)	(0.0009)	(0.0010)
Δbudget(-1)	0.0099**	0.0095**	0.0129**
	(0.0047)	(0.0044)	(0.0060)
debt_volatility	-0.0075***	-0.0166***	-0.0079**
	(0.0028)	(0.0035)	(0.0035)
budget_volatility	-0.0773**	-0.1004**	-0.1198*
	(0.0352)	(0.0447)	(0.0612)
Δdebt_ indexation1(-3)	0.0029**	0.0024***	0.0020*
	(0.0013)	(0.0007)	(0.0010)
Δdebt_ indexation2(-4)	-0.0019**	-0.0021***	-0.0022**
	(0.0008)	(0.0007)	(0.0009)
Δdebt_maturity(-1)	0.0008	0.0018*	0.0029**
	(0.0013)	(0.0010)	(0.0011)
spending	-0.1463**	-0.1513*	-0.1405*
	(0.0694)	(0.0806)	(0.0745)
communication	0.0127	0.0201*	0.0247**
	(0.0098)	(0.0106)	(0.0100)
Impulse	-0.0345*	-0.0516**	-0.0516**
	(0.0179)	(0.0217)	(0.0243)
*Impulse*communication*	0.0804*	0.0932*	0.1104*
	(0.0420)	(0.0538)	(0.0631)
Subprime	0.0127***	0.0302***	0.0098***
	(0.0048)	(0.0114)	(0.0039)
Adj. R2	0.26	0.26	0.21
F-statistic	6.20		
Prob (F-statistic)	0.00		
LM test	63.30		
Prob (LM)	0.00		
ARCH test	73.51		
Prob (ARCH)	0.00		
J-statistic		20.78	17.57
Prob (J-statistic)		0.93	0.98
D-W-H test		5.74	6.57
Prob (D-W-H)		0.84	0.83
N° Instr./N° Obs.		0.26	0.26

Note: Marginal Significance Levels: *** denotes 0.01, ** denotes 0.05 and *0.1. Standard errors are in parentheses. Prob (F-statistic) reports the p-value of the F-test. Prob (J-statistic) reports the p-value of the J-test. Prob (LM) reports the p-value of the LM-test to detect serial autocorrelation. Prob (ARCH) reports the p-value of the ARCH-test to detect heteroskedasticity. D-W-H test is the Durbin-Wu-Hausman test (difference in J-stats) and null hypothesis is the regressors are exogenous. Prob (D-W-H) reports the p-value of the D-W-H-test.

In order to verify the robustness of the results, we provide other estimates using two different measures of discretionary fiscal policies: *Impulse2* and the discretionary government spending *(discretionary_spending)* – this series is provided by the Central Bank of Brazil (Series 24390); the ADF, PP and KPSS tests (Table A1 in the Appendix) were applied to this series. Based on the tests, one can see that the series is I(0). Table II presents OLS, GMM and GMM-2 estimates using these two other measures of discretionary fiscal policy.

The results in table II confirm the previous findings reported in table 1, and indicate that the use of discretionary fiscal policies reduces fiscal credibility. On the other hand, only two of the six coefficients obtained for *communication* are statistically significant, suggesting that one cannot neglect the importance of fiscal communication to improve fiscal credibility. In turn, for the coefficients of the interaction term, the findings reveal that fiscal communication is able to mitigate the adverse effect that the use of discretionary fiscal policies exerts on fiscal credibility. Regarding the control variables, in general, the results confirm the previous findings reported in table I.

Table II – OLS, GMM and GMM-2 estimates using *Impulse2, discretionary_spending* and *communication*

Equation with Impulse2 and communication (dependent: Δcredibility)				Equation with discretionary_spending and communication (dependent: Δcredibility)			
Estimator	**OLS**	**GMM**	**GMM-2**	**Estimator**	**OLS**	**GMM**	**GMM-2**
Variables				Variables			
Constant	0.0532**	0.0756***	0.1019***	*Constant*	0.0415***	0.0510***	0.0340*
	(0.0254)	(0.0156)	(0.0376)		(0.0144)	(0.0142)	(0.0178)
Δdebt	-0.0026**	-0.0016*	-0.0019	*Δdebt*	-0.0028***	-0.0023**	-0.0022
	(0.0010)	(0.0009)	(0.0020)		(0.0010)	(0.0011)	(0.0020)
Δbudget(-1)	0.0098**	0.0102**	0.0034	*Δbudget(-1)*	0.0064	0.0066*	0.0080
	(0.0046)	(0.0041)	(0.0066)		(0.0049)	(0.0038)	(0.0075)
debt_volatility	-0.0061**	-0.0075***	-0.0158**	*debt_volatility*	-0.0069***	-0.0125***	-0.0101**
	(0.0024)	(0.0024)	(0.0066)		(0.0022)	(0.0034)	(0.0044)
budget_volatility	-0.0925**	-0.1487***	-0.1256**	*budget_volatility*	-0.0642*	-0.1713***	-0.2059***
	(0.0385)	(0.0352)	(0.0595)		(0.0366)	(0.0443)	(0.0665)
Δdebt_indexation1(-3)	0.0027**	0.0028**	0.0027*	*Δdebt_indexation1(-3)*	0.0020**	0.0029***	0.0025*
	(0.0011)	(0.0011)	(0.0015)		(0.0010)	(0.0008)	(0.0014)
Δdebt_indexation2(-4)	-0.0018**	-0.0034***	-0.0028*	*Δdebt_indexation2(-4)*	-0.0015*	-0.0033***	-0.0026**
	(0.0008)	(0.0009)	(0.0016)		(0.0008)	(0.0008)	(0.0011)
Δdebt_maturity(-1)	0.0013	0.0021*	0.0036*	*Δdebt_maturity(-1)*	0.0014	0.0032***	0.0030*
	(0.0014)	(0.0011)	(0.0021)		(0.0013)	(0.0010)	(0.0016)
spending	-0.1008	-0.1098*	-0.0926	*spending*	-0.0901	-0.1512*	-0.0606
	(0.0641)	(0.0596)	(0.1385)		(0.0796)	(0.0827)	(0.1164)
communication	-0.0097	-0.0691	-0.0794	*communication*	-0.0183	0.0239*	0.0285*
	(0.0530)	(0.0492)	(0.0730)		(0.0122)	(0.0142)	(0.0161)
Impulse2	-1.0042	-1.8833***	-2.5868**	discretionary_spending	-1.45E-06***	-1.13E-06***	-1.05E-06**
	(0.9239)	(0.6419)	(1.0383)		(5.23E-07)	(3.70E-07)	(4.28E-07)
*Impulse2*communication*	0.8904	4.0066**	4.5733*	discretionary_spending*communication	2.67E-06***	2.05E-06**	1.70E-06*
	(2.1241)	(1.8332)	(2.7228)		(8.36E-07)	(8.83E-07)	(1.01E-06)
Subprime	0.0118***	0.0191***	0.0156***	*Subprime*	0.0101**	0.0185***	0.0184*
	(0.0044)	(0.0069)	(0.0092)		(0.0041)	(0.0046)	(0.0103)
Adj. R2	0.28	0.21	0.21	*Adj. R2*	0.33	0.26	0.20
F-statistic	6.72			*F-statistic*	8.18		
Prob (F-statistic)	0.00			*Prob (F-statistic)*	0.00		
LM test	60.13			*LM test*	56.85		
Prob (LM)	0.00			*Prob (LM)*	0.00		
ARCH test	63.66			*ARCH test*	56.37		
Prob (ARCH)	0.00			*Prob (ARCH)*	0.00		
J-statistic		23.60	20.70	*J-statistic*		19.25	17.71
Prob (J-statistic)		0.88	0.93	*Prob (J-statistic)*		0.96	0.98
D-W-H test		6.39	4.35	*D-W-H test*		5.35	5.49
Prob (D-W-H)		0.89	0.97	*Prob (D-W-H)*		0.91	0.90
N° Instr./N° Obs.		0.26	0.26	*N° Instr./N° Obs.*		0.26	0.27

Note: Marginal Significance Levels: *** denotes 0.01, ** denotes 0.05 and *0.1. Standard errors are in parentheses. Prob (F-statistic) reports the p-value of the F-test. Prob (J-statistic) reports the p-value of the J-test. Prob (LM) reports the p-value of the LM-test to detect serial autocorrelation. Prob (ARCH) reports the p-value of the ARCH-test to detect heteroskedasticity. D-W-H test is the Durbin-Wu-Hausman test (difference in J-stats) and null hypothesis is the regressors are exogenous. Prob (D-W-H) reports the p-value of the D-W-H-test.

Still in order to check if the results are robust, we repeat the estimates using the fiscal credibility index proposed by de Mendonça and Machado (2013) (*credibility2*) as dependent variable, and the main fiscal impulse indicator *Impulse* of our study as a regressor. Table III shows the results.

One can see that the results confirm the previous findings reported in tables I and II. The estimates indicate that when the government makes use of discretionary fiscal policies, fiscal credibility deteriorates. Besides, fiscal communication is important to improve fiscal credibility and to mitigate the adverse effect of the fiscal impulse on fiscal credibility. Regarding the control variables, in general, the results confirm the previous findings.

Table III – OLS, GMM and GMM-2 estimates using *Impulse, communication* and *credibility2*

Equation with *Impulse* and *communication* (dependent: *Δcredibility2*)			
Estimator	**OLS**	**GMM**	**GMM-2**
Variables			
Constant	0.0244***	0.0315***	0.0317***
	(0.0063)	(0.0050)	(0.0085)
Δdebt	-0.0014***	-0.0015***	-0.0012*
	(0.0004)	(0.0005)	(0.0006)
Δbudget(-1)	-0.0030	0.0004	0.0011
	(0.0031)	(0.0022)	(0.0045)
debt_volatility	-0.0039***	-0.0040***	-0.0042*
	(0.0014)	(0.0013)	(0.0021)
budget_volatility	-0.0384*	-0.0412*	-0.0677*
	(0.0221)	(0.0222)	(0.0403)
Δdebt_ indexation1(-3)	0.0018***	0.0030***	0.0027***
	(0.0006)	(0.0005)	(0.0007)
Δdebt_ indexation2(-4)	-0.0010	-0.0022**	-0.0022*
	(0.0006)	(0.0006)	(0.0012)
Δdebt_maturity(-1)	0.0001	0.0004	7.92E-05
	(0.0006)	(0.0007)	(0.0009)
spending	-0.0921***	-0.1544***	-0.1442***
	(0.0340)	(0.0277)	(0.0430)
communication	-0.0034	0.0072**	0.0097*
	(0.0060)	(0.0035)	(0.0055)
Impulse	-0.0346***	-0.0473***	-0.0440**
	(0.0103)	(0.0114)	(0.0177)
*Impulse*communication*	0.1013***	0.1266***	0.1029**
	(0.0273)	(0.0253)	(0.0400)
Subprime	0.0106***	0.0132***	0.0129***
	(0.0019)	(0.0025)	(0.0032)
Adj. R2	0.27	0.18	0.16
F-statistic	6.44		
Prob (F-statistic)	0.00		
LM test	45.68		
Prob (LM)	0.00		
ARCH test	15.34		
Prob (ARCH)	0.00		
J-statistic		23.82	23.68
Prob (J-statistic)		0.85	0.88
D-W-H test		4.05	4.09
Prob (D-W-H)		0.98	0.98
N° Instr./N° Obs.		0.26	0.26

Note: Marginal Significance Levels: *** denotes 0.01, ** denotes 0.05 and *0.1. Standard errors are in parentheses. Prob (F-statistic) reports the p-value of the F-test. Prob (J-statistic) reports the p-value of the J-test. Prob (LM) reports the p-value of the LM-test to detect serial autocorrelation. Prob (ARCH) reports the p-value of the ARCH-test to detect heteroskedasticity. D-W-H test is the Durbin-Wu-Hausman test (difference in J-stats) and null hypothesis is the regressors are exogenous. Prob (D-W-H) reports the p-value of the D-W-H-test.

5. Conclusion

A growing literature recognizes the importance of fiscal credibility to several economic aspects – such as macroeconomic performance, expectations regarding fiscal policy and

sovereign risks. On the other hand, the literature on the determinants of fiscal credibility is still scarce. Aiming at contributing to this literature, we use two fiscal credibility indexes to analyze the determinants of fiscal credibility, and more specifically, to assess the effect that the use of discretionary fiscal policies has on fiscal credibility. In addition, due to the importance of fiscal communication as a tool to improve transparency, we also contribute to the literature by analyzing, for the first time, the effect of fiscal communication on fiscal credibility.

Using Brazil as a case study, we sought to contribute to the literature by estimating the effects of discretionary fiscal policies and fiscal communication on fiscal credibility. The study empirically analyzed relationships not yet explored in the literature, whose evidence bring important practical implications in terms of fiscal policy guidelines for a developing economy.

In general, the evidence suggests the use of discretionary fiscal policies reduces fiscal credibility. Thus, a new perspective on the effects of discretionary fiscal policy and the determinants of fiscal credibility arises, which points to the following economic policy recommendation: the use of discretionary fiscal policies should be avoided by the government since it reduces fiscal credibility. Another interesting policy recommendation that the paper provides concerns fiscal communication. The estimates are favourable to the use of fiscal communication as a tool to improve fiscal credibility.

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Appendix A

Table A1 – Control variables

Variable name	Description
debt	"debt" is the series "gross public debt as a percentage of GDP - Total consolidated public sector" (series 4537 obtained from the CBB).
budget	"budget" is the series "PBSR (%GDP) - Flows accumulated in 12 months - Primary result - Total - Consolidated public sector" (series 5793 obtained from the CBB).
spending	This series is built using public spending as a percentage of GDP. Both series, for the public spending and for the GDP, are provided by the CBB (code 7547 for the public spending, and code 4382 for the GDP).
debt_indexation1	This series is the sum of the proportion of fixed-rate bonds ("Letras do Tesouro Nacional – LTN" and "Notas do Tesouro Nacional Série F – NTN-F") with the proportion of price indexed bonds ("Notas do Tesouro Nacional Série B – NTN-B" and "Notas do Tesouro Nacional Série C – NTN-C"). All series are provided by the CBB (code 4178 for the proportion of fixed-rate bonds, code 12001 for the proportion of bonds indexed to the IPCA, code 4175 for the proportion of bonds indexed to the IGP-M and code 4176 for the proportion of bonds indexed to the IGP-DI).
debt_indexation2	This series is the sum of the proportion of exchange-rate indexed bonds ("Notas do Tesouro Nacional Série D – NTN-D") with interest-rate (over/SELIC) indexed bonds ("Letras Financeiras do Tesouro – LFT"). Both series are provided by the CBB (code 4173 for the proportion of exchange-rate indexed bonds and code 4177 for the proportion of interest-rate (over/SELIC) indexed bonds).
debt_maturity	Average maturity of the public debt. Series provided by the CBB (code 10618).
debt_volatility and budget_volatility	In line with the work of Capistrán and Timmermann (2009), Ehrmann et al. (2012) and Montes and Luna (2018), which use GARCH models to calculate volatility series, the gross debt volatility series and the volatility of budget balance were constructed using the "debt" and "budget" series in a GARCH model (1, 1) (a variation of the ARCH model). a GARCH model was used to obtain the series of gross debt volatility and budget balance volatility, whose averages equations are given by: debt(t) = C(0) + C(1).debt(t-1) + ξ(t), and budget(t) = W(0) + W(1).budget(t-1) + ε(t), where, ξ and ε are the random error terms.
Subprime	This dummy variable assumes value equal to 1 between August 2008 and February 2009, and zero otherwise.

Table A2 – Descriptive statistics

	credibility	credibility2	debt	budget	spending	debt_indexation1	debt_indexation2	*debt_volatility*	*budget_volatility*	communication	Impulse	Impulse2	debt_maturity
Mean	0.35	0.67	64.94	1.95	0.17	59.93	38.81	1.59	0.06	9.21	0.00	0.03	41.53
Median	0.44	0.74	63.14	2.75	0.17	63.64	34.99	1.44	0.05	9.00	0.01	0.03	41.21
Maximum	0.68	0.90	81.03	4.08	0.33	80.14	83.26	5.27	0.32	24.00	0.56	0.03	55.73
Minimum	0.00	0.33	57.03	-3.05	0.13	14.73	19.37	0.93	0.04	0.00	-0.54	0.01	27.28
Std. Dev.	0.25	0.18	5.99	2.01	0.03	17.36	16.80	0.64	0.04	5.06	0.14	0.00	9.07
Observations	175	175	175	175	175	175	175	175	175	175	175	175	175

Table A3 – Unit root and stationarity tests (ADF, PP and KPSS)

		ADF				PP				KPSS			
Variables	Test	eq.	Lag	t-stat	prob.	eq.	Band	t-stat	prob.	eq.	Band	t-stat	5%
FI	Level	N	3	-2.975	0.003	I	9	-11.551	0.000	I	9	0.064	0.463
	1st difference												
FI_2	Level	I	0	-5.078	0.000	I	4	-5.167	0.000	I/T	8	0.172	0.146
	1st difference									I/T	18	0.047	0.146
debt	Level	N	6	0.069	0.704	N	5	0.906	0.902	I	11	0.356	0.463
	1st difference	I	5	-4.971	0.000	I	6	-18.048	0.000				
budget	Level	N	0	-1.179	0.218	N	6	-1.187	0.215	I	11	1.317	0.463
	1st difference	I	0	-12.948	0.000	I	5	-12.982	0.000	I	5	0.158	0.463
Vol_debt	Level	I	0	-8.869	0.000	I	3	-8.890	0.000	I	5	0.312	0.463
	1st difference												
Vol_budget	Level	N	7	-2.885	0.004	I	7	-3.050	0.032	I	10	0.394	0.463
	1st difference												
ind1	Level	I	6	-2.568	0.102	I	6	-2.568	0.102	I	11	1.411	0.463
	1st difference	N	6	-2.411	0.016	I	8	-15.283	0.000	I/T	6	0.087	0.146
ind2	Level	I/T	6	-1.710	0.743	I/T	6	-0.002	0.996	I	11	1.383	0.463
	1st difference	N	5	-2.125	0.033	I/T	7	-15.788	0.000	I/T	6	0.088	0.146
exp_gdp	Level	I/T	11	-2.294	0.435	I	5	-11.091	0.000	I/T	7	0.106	0.146
	1st difference	I	10	-16.377	0.000								
term	Level	I	12	-1.912	0.326	N	1	0.695	0.865	I	11	1.487	0.463
	1st difference	I	5	-4.303	0.001	I	0	-15.569	0.000	I	1	0.435	0.463
GS	Level	I/T	0	-13.411	0.000	I	8	-6.382	0.000	I/T	4	0.132	0.146
	1st difference												
Fiscalcom	Level	I	0	-5.682	0.000	I/T	0	-7.062	0.000	I	9	1.075	0.463
	1st difference									I	49	0.160	0.463

Note: ADF - the final choice of lag was made based on Schwarz information criterion. PP and KPSS tests - Band is the bandwidth truncation chosen for the Bartlett kernel. "I" denotes intercept; "I/T" denotes intercept and trend and; "N" denotes none.

Appendix B

Both indicators of fiscal impulse (*Impulse* and *Impulse*2) are built in two stages.

Therefore, in order to obtain *Impulse*, first, we estimate the elasticities of government spending in relation to the main macroeconomic variables. In this sense, for analyzing fiscal policy in Brazil and considering the components of responsiveness, persistence, and discretion in government spending, we estimate equation ($B1$). Based on equation ($B1$), we can remove the influence of the economic environment over the indicator, leaving only the term associated to the discretionary posture of the government. Equation ($B1$) is:

$$G_t = \alpha_0 + \alpha_1 G_{t-1} + \alpha_2 r_{t-1} + \alpha_3 Y_{t-1} + \alpha_4 INF_{t-1} + \varepsilon_t \qquad (B1)$$

where G is the log of the government spending, G_{t-1} represents the persistence of the fiscal policy, r is the real short-term interest rate, Y is the log of real GDP seasonally adjusted, INF is the inflation rate, and ε_t is the random error term. The variables Y, INF and r capture the responsiveness of fiscal policy to the state of the economy (Montes and Luna, 2018). The series of government spending (G) was obtained from the CBB - series number 7547 (Primary Result of the Central Government - Total Expenditure). The real interest rate is obtained through the difference between the nominal interest rate (Selic) obtained from the CBB (series number 4189) and the inflation rate obtained from the Consumer Price Index (IPCA) (series number 13522). Real GDP was obtained from the series of GDP accumulated in the last 12 months - current prices (R$ million) – obtained from the CBB (series number 4382), deflated by the Consumer Price Index (IPCA) (series number 13522) and seasonally adjusted.

The discretionary fiscal policy is captured through the residual denoted by ε, since it does not represent reaction to economic conditions. Due to the fact that we are using a database on a monthly basis, and once fiscal policy does not respond instantaneously to the variables related to the business cycle, we follow Montes and Luna (2018) and the variables associated with the business cycle were lagged one period.

After estimation of equation ($B1$), the residual is used to observe the changes in the discretionary fiscal policy, i.e., the fiscal impulse (*Impulse*). Therefore, based on Montes and Luna (2018), equation ($B2$) gives the indicator of fiscal impulse (*Impulse*). Such as Montes and Luna (2018), we use a lag of 12 months because it is long enough to measure important changes in the fiscal position.

$$Impulse_t = \varepsilon_t - \varepsilon_{t-12} \qquad (B2)$$

Equation ($B1$) is estimated through ordinary least squares (OLS). In order to calculate *Impulse*, we follow Agnello et al. (2013), Ciro and de Mendonça (2016) and Montes and Luna (2018), and we use the residual series obtained from the estimation of equation ($B1$) through OLS. Then, the residual series is used in equation ($B2$) to obtain the fiscal impulse.

Regarding *Impulse2*, following Montes and Luna (2018), we build the second measure of discretionary fiscal policy by calculating – using a GARCH model – the volatility of the residual series obtained from the estimation of equation ($B1$) through OLS. Thus, the GARCH model was used to obtain *Impulse2*, whose mean equation is given by $\varepsilon_t = A_0 + A_1 . \varepsilon_{t-1} + \epsilon_t$, where, ϵ is a random error term.

Figure B1 presents both *Impulse* and *Impulse2.*

Figure B1 Fiscal impulse *(Impulse* and *Impulse2)*