TESOURONACIONAL

REVISTA
CADERNOS DE FINANÇAS PÚBLICAS

03 | 2022

Apoio:

BID
Banco Interamericano de Desenvolvimento

INCENTIVIZED DEBENTURES AND APPROPRIATION OF TAX BENEFITS

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Abstract

This paper sought to analyze the possible disparity in the appropriation of tax benefits granted to incentivized debentures (in the form of Law No. 12,431/2011) via price mechanism. According to economic theory, markets under normal operating conditions do not present room for arbitrage, and assets endowed with the same risk conditions should not present incompatible values. Therefore, it is expected that the spread exhibited by incentivized debentures in the secondary market is equivalent to that of regular debentures when adjusted by the respective tax and risk factors. Thus, a methodology was proposed for evaluating the parameters that potentially define the remuneration of debentures, in order to isolate the effect of this tax incentive to determine its impact on price formation. The results pointed to the statistical irrelevance of this parameter, assuring market conformity to the no-arbitrage theory and preventing the rejection of the hypothesis of effective appropriation of the tax benefit by the debenture issuer.

Keywords: infrastructure, debentures, tax incentives, capital markets.

JEL: C31, G12, H54.

SUMMARY

INTRODUCTION

Incentivized debentures or infrastructure debentures were established by Law No. 12,431 of June 24, 2011. From this law, it was established that, in the case of debentures issued by specific purpose companies, to raise funds to implement investment projects in the infrastructure sector, the income, earned by individuals or legal entities, would be subject to different rates; implying, in simplified terms, that the Individual Income Tax (IRPF) is equal to 0% and the Corporate Income Tax (IRPJ) is equal to 15%, according to the caput of art. 2 of that law.

Regarding the work itself, the first section is dedicated to the delimitation of the research problem. Its theoretical justification is based on the effectiveness of the subsidy as a resource for the problem of infrastructure financing, but which, endowed with its own weaknesses, gives rise to the object of research. In order to identify the degree of flaws associated with this development instrument, we resorted to a literature review on the subject. From this investigation, a trio of studies was chosen that examined the debenture market and provided an adequate methodology for its analysis.

The second section sets out the methodology for analyzing the debenture market and the impact of the tax incentive (introduced by Law 12,431/2011) on the pricing of these securities. The fundamental question to be investigated is the degree of impact that the presence of the tax benefit has on the remuneration of the debenture, in order to estimate whether the tax incentive is adequately internalized by the issuer in the pricing of the debenture, or whether part of the benefits are lost or appropriated by the financial market. This section also presents the criteria for sample typology and selection, subsequently justifying the choice of variables used, as well as the modeling developed for data treatment.

The third section deals with the results obtained from the suggested methodology. The descriptive statistics and the individualized results of each model are presented, discriminating them by each dependent variable used as a focus.

The fourth section is dedicated to the author's analysis of the results achieved in this way. Ultimately, it discusses the interpretation of the data in light of the future perspectives of the incentive instrument for the promotion of Brazilian infrastructure.

Finally, the conclusion section provides a summary of the findings of this paper, reaching a review of its main syntheses and proposing potential future research objects.

1. RESEARCH PROBLEM

The size reached by the domestic market of debentures justifies, in itself, the deepening of the production of knowledge on the subject. With data from the Ministry of Economy (2021), it is possible to identify that, as of 2019, the financial volumes issued via incentivized debentures already exceed the disbursements of the National Bank for Economic and Social Development (BNDES) in the infrastructure sector. Therefore, there is theoretical relevance in addressing the existence or not

of distortions in this market, as well as in testing the significance of parameters theoretically causal to the pricing of debentures. To enable the production of results that help in the evaluation of possible discrepancies produced intra-market, it is first necessary to conceptualize the problem inherent to allocative distortions.

1.1. MARKET FAILURES AND PUBLIC POLICY EFFECTS

Market failures are configured by economic situations where the market fails to generate a Pareto-efficient allocation of resources, and the insufficiency of endogenous provision (via the market) of public goods also constitutes a failure. Infrastructure is a type of public good, while its consumption, although rival, is not exclusive (STIGLITZ, 2000), and whenever there are market failures in any sector, the state will be prompted to intervene in its operation. In cases where this intervention is necessary for the provision of a good, exceptions to market equilibrium are naturally generated. Therefore, from the objectives pursued by the intervention, undesirable effects of state action on the economic domain arise as a consequence.

Asymmetric and imperfect information can lead to drastic differences in the nature of the market equilibrium (VARIAN, 2006). And because information asymmetry will be present in imperfect information markets, the government provision mechanism will sustain a market failure upon which there will naturally be inefficiency in the equilibrium allocation of infrastructure resources.

In general, an incentive scheme that shares the risks and provides appropriate incentives will be more appropriate (ibid.). In the case of direct state financing (via development banks), despite the gains from full direct lending, it shares a larger portion of the failures foreseen in economic theory (e.g. adverse selection, moral hazard, misallocation); and, since the fiscal incentive under discussion is theoretically more desirable under such assumptions - since it imposes greater sharing of debt risks and provides better incentives to avoid excessive fund raising -, the possible weaknesses of its operationalization will be evaluated.

1.2. THEORETICAL JUSTIFICATION

It is assumed that it is possible to estimate some degree of discrimination between the prices of debentures based on their type, and that the attribution of the infrastructure project seal, framed by Law 12,431/2011, is capable of showing a greater degree of appeal to investors without sophisticated tools for analyzing their effective return.

To test the hypotheses, we resort to the assumptions of economic theory, going through behavioral economics and finance theory: by reputation bias (rewarding experienced and recognized issuers), by credit conditions (rating), by sector asymmetry, by tax aversion bias, among others, in an attempt to verify the occurrence of violation of the non-arbitrage theory - in which there is an artificial and suboptimal equilibrium, with unequal remuneration of assets with the same credit conditions.

In general, an econometric estimator will be adopted, regarding the existence, or not, of a (statistically significant) deviation in relation to the average of the debentures' net returns, in the case of debentures with incentives. If the rejection of the null hypothesis of equality among the parameters of the debenture classes is confirmed (i.e. H0 : common = encouraged), the possibilities of deviation from the mean, informational asymmetry and room for arbitrage will be confirmed.

1.3. LITERATURE REVIEW

Besides the theoretical references cited above, for reference to the public policy problem and the relevance of its evaluation, the literature review seeks bases of comparison and methodological references in national and foreign academia.

At the applied level, the methodology for evaluating the incentivized debentures themselves was supported by the works of Delbem (2016) and Pereira and Miterhof (2019), in which the fraction of the tax cost, with tax waivers on incentivized debentures, transferred to infrastructure projects was previously analyzed. They assess the degree of tax efficiency of the subsidies granted by the Federal Government to infrastructure debentures, evaluating whether the tax waiver is effectively translated into a reduction in the cost of financing the projects or partially captured by other market mechanisms. In international bases, Flannery & Sorescu (1996) provide a supplementary methodological source, also in econometric analysis of the North American debenture market, serving as subsidies to the definition of the rationale adopted.

Compounding the fundamental problematic of this paper are the findings of Delbem (2016) and Pereira and Miterhof (2019), as the authors reached ambivalent results in the course of their respective investigations.

Delbem (2016) found positive inefficiency of the development instrument. For the analysis of the no-arbitrage theory, a test of the impact of the tax exemption on the formation of the credit spread was proposed; that is, adjusted for the tax rate, the significance of the incentivized debentures parameter on the formation of net profitability was tested. The result is shown below:

Table 1 – Delbem II Model

Rentabilidade Líquida	Coeficiente
BT	-0,12492*
	(0,00762)
Rating	-0,01181*
	(0,00086)
Cenário	0,00007***
	(0,00004)
Vencimento	0,00184**
	(0,00090)
Emissão	0,00000
	(0,00000)
Garantias	0,01372*
	(0,00473)
Indexador	-0,02256*
	(0,00569)
Experiência	0,00347
	(0,00444)
ICVM	0,00079
	(0,00409)
Ano de emissão	0,00512*
	(0,00092)
Constante	-10,10732*
	(1,85624)
N° de Observações	512
F(10,501)	85,38
R-quadrado	0,5442

Note: Robust Standard Errors; The symbols *, ** and *** represent significant coefficients at 10%, 5% and 1%, respectively.
OBS: BT = Tax Benefit (to incentivized debentures).
Source: Delbem (2016).

Therefore, it was inferred from the negative coefficient of 'BT' that "infrastructure debentures have a lower net profitability than other debentures"; that is, the issuers of the incentivized debentures remunerated premiums lower than the equivalence of the tax discount (i.e., a discount of more than 15% on the premium of the incentivized debentures), implying a more than proportional appropriation of the benefit by the issuer. The finding was entitled "positive inefficiency" because, despite the existence of market imbalance and room for arbitrage, the tax incentive, aimed at reducing the cost of raising debt for financing infrastructure projects, would be more than proportionally compensated by the

issuer, implying increased efficiency of the instrument - while discounting the project costs in an amount higher than the tax incentive (otherwise burdening the unwary debenture holder).

In Pereira and Miterhof (2019), negative inefficiency of the incentive instrument was found. At first, the coefficient of the presence of the tax incentive ('incentivada') seems to indicate, in the preliminary regression, a negative effect on the spread (emulating a result potentially similar to the previous finding):

Table 2 – BNDES Model Linear Estimates

Dependent variable: SPREAD_DAP
Method: Least Squares
Date: 01/31/19 *Time*: 16:58
Sample: 1 272
Included observations: 271
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	*Coefficient*	*Std. error*	*t-Statistic*	Prob. (distribuição normal)	PI *values* simulados *bootstrap**
C	3.656.520	1.656.454	2.207.438	0.0281	0.0030
INCENTIVADA	(1.467.317)	1.955.684	(0.750283)	0.4538	0.6058
RISCO_DE__PROJETO	8.509.549	2.146.060	3.965.197	0.0001	0.0000
DI	(1.591.550)	1.242.172	(1.281.264)	0.2012	0.0640
DURATION	1.045.033	3.832.901	2.726.481	0.0068	0.0015
DURATION*INCENTIVADA	(1.922.797)	5.667.802	(3.392.491)	0.0008	0.0005
RATINGNUMERO	1.790.594	2.583.834	6.929.987	0.0000	0.0000

R-squared	0.577296	Mean dependent var	8.710.461
Adjusted R-squared	0.567689	S.D. dependent var	8.607.571
S.E. of regression	5.659.509	Akaike info criterion	1.093.521
Sum squared resid	845593.1	Schwarz criterion	1.102.826
Log likelihood	(1.474.721)	Hannan-Quinn criter.	1.097.257
F-statistic	6.009.173	Durbin-Watson stat	0.959519
Prob(F-statistic)	0.000000		

Source: Pereira and Miterhof (2019).

However, in a later evaluation, the authors promote a more sophisticated analysis on the relative behavior of debentures, based on their duration; finding that "among high income investors that invest in 12,431 debentures [...], one observes the prevalence of strategies directed towards the directional bet of closing the yield curve", evaluating that "alternatively, 12,431 debentures allow such investors to capture extra fat in the portion of net remuneration resulting from the assumption of private credit risk". Concluding, finally, that, on average, "only about 60% of the subsidies reach the intended goal". Thus, here, although the individual strategy of temporal profitability of the assets does not concern the effectiveness of the benefit when issued, the labeling as "negative inefficiency" would be justified by the low degree of appropriation of the tax benefits by the issuer.

It should be noted that both models, for the estimation of the coefficient associated with the presence of the tax incentive, faced heteroscedasticity problems and obtained weak statistical significance of the parameter, being significant at 10% but not at 5% (the level traditionally accepted for the estimation of confidence intervals free of type I error).

Upon review, such findings, by violating the principles of the non-arbitration theory, constituted the central object of attention of this work, motivating this author to reevaluate the hypothesis of its configuration.

2. METHODOLOGY

The methodology used, as indicated, was supported by the models of Delbem (2016) and Pereira and Miterhof (2019), the version of the former being predominant, but having its format adapted by the redesign of the regression and the extension of the chronological period to the present.

The studies mentioned above share the use of regressors by rating, term, dummies for the DI rate and for the tax incentive (L 12431), as well as the regressor by interest spread. The most closely matched model, however, was the first, for its greater degree of detail and feasibility. Although the model to be specified here has a larger number of regressors, one variable of each model was dispensed with: project debentures (dummy that distinguishes issues for financing pre-operational projects from those of mature companies for additional investment), for the former; and project risk (dummy that distinguishes debentures by linking risk to the issuer or to the project), for the latter. In addition to not being the object of interest of this study (the aim being to estimate the global impact of the instrument), it was evaluated that they have potential correlation with the issuer's experience variables, in the first case, and with the issue guarantees, in the second case - both included in the model that will be presented below.

The period covered in the first study was 10 years, comprising the 2006-2015 interregnum; the period of the second study comprises the secondary market population between November 27 and 28, 2018; the period to be covered here will comprise the 10.6 years between 2011 and July/2021. In addition to updating to the present, we sought with this window to evaluate only the interval encompassed by the full validity of the tax incentive granted to debentures (from the enactment of Law No. 12,431/2011), in order to avoid any potential bias in the behavior of common debentures before and after the legislative advent.

Although the methodology draws primarily from national sources, it is also consistent with the international literature on the subject: in Flannery & Sorescu (1996), in analyzing the returns of the North American debenture market, the statistical regression of the variables issuer credit rating, bond maturity and spread in relation to risk-free assets (also parameterized by government bonds) was ratified.

2.1. TYPOLOGY AND SAMPLE

The structure of the data resembles the cross-section typology, but by including temporal characteristics, with variables that capture seasonality in the model, it becomes a clustered cross-section type (WOOLDRIDGE, 2012).

The data survey was carried out in the form of secondary data collection, i.e., data that have already been treated and organized by other sources, occurring directly from these, after collection, analysis and disclosure. The population to be investigated will be that inherent to the universe of debentures traded on the secondary market of securities in the over-the-counter market organized by the Bolsa, Brasil, Balcão (B3, 2021a, 2021b, 2021c) and disclosed by the Brazilian Association of Financial and Capital Market Entities (ANBIMA, 2021b, 2021c, 2021d) on the portal debentures.com.br (ANBIMA, 2021a).

2.1.1. SELECTION CRITERIA

In ANBIMA's total base of debenture records there are 5,706 issues. By filtering for simple debentures (excluding convertible and exchangeable debentures) and for active records (ignoring those already excluded), 1,906 observations remained, for the period from 1989 to today (August/2021). In order to avoid bias in the behavior of common debentures before and after the advent of Law 12,431/2011, a cut-off was established from the year of its enactment, leaving 1,786 lines.

For the sample selection, firstly, by keeping only the debentures with credit rating attribution by the main risk agencies (i.e. Fitch, Moody's and S&P), the database was filtered to 755 observations. Second, debentures with ratings below C categories (in receivership or bankruptcy proceedings), as well as those that had their rating listing discontinued by the agencies - criteria: NR (not rated) and WD (withdrawn) by Fitch[1]; WR (withdrawn rating) by Moody's[2]; NR by S&P[3] - or with restricted access, were also removed, additionally reducing the sample to 599 observations.

From the filtered database for the described criteria, there are 99 incompatible observations, due to the impossibility of comparing them with the remuneration rates of the National Treasury bonds (for measuring the spread in relation to the risk-free asset), of which: 2 debentures with remuneration linked to IGP-M[4] (since NTN-C were discontinued in 2007); 1 to the dollar[5] ; 1 to the TR rate[6] ;

1 "Fitch may also disclose issues relating to a rated issuer that are not and have not been rated. Such issues are also denoted as 'NR' on its web page." (FITCH, 2021)

2 "WR stands for "withdrawn rating". Reasons for withdrawals include: debt maturity; calls, puts, conversions, etc.; business reasons (e.g. change in the size of a debt issue), or the issuer defaults." (MOODY'S, 2021a)

3 "NR indicates that a rating has not been assigned or is no longer assigned." (S&P, 2021b)

4 CVRDA6 (Vale S/A) and GASP17 (COMPANHIA DE GAS DE SAO PAULO - COMGAS).

5 SBESA2 (CIA SANEAMENTO BASICO EST. SP - SABESP).

6 BLUE11 (AZUL S.A.).

and, finally, among the debentures linked to the DI index, only those remunerated by the "CDI + rate" methodology were kept, given the impossibility of comparing the 95 that adopted the "%CDI" standard with the remuneration of LFT (which adopt only the first criterion). In this vein, it should be noted that, although there is a legal provision for the remuneration of debentures "linked to the price index or the Referential Rate - TR" (BRASIL, 2011), there was no observation of remuneration by the latter or the IGP-M, linking them in full to the IPCA or fixed rate. This step reduced the sample to 500 observations.

Finally, from the observations on the distribution per type (encouraged or common), the presence of two outliers in the sample became evident, one in the case of common debentures and one in that of incentivized debentures. From their examination, it was clear that these were the only pair of securities with fixed-rate remuneration present in the sample, which, due to the absence of a correction index in the interest composition, naturally adopt significantly higher nominal magnitudes. Thus, to simplify the tests with interest rates, the two observations were removed from the sample.

The sample selection, consolidated by the aforementioned criteria, added up to 498 observations.

2.2. MODEL

In addition to the preliminary hypothesis of the study, about the potential of the tax incentive in the formation of net interest, the formation of the remuneration of debentures was estimated from the other parameters endowed with plausibility about its composition. Thus, we sought to determine the expected remuneration of debentures as a variable explained by the following explanatory variables:

i. rating (microeconomic risk);
ii. Brazil risk (macroeconomic risk + seasonal adjustment),
iii. economic sector (sectorial risk),
iv. term of the issue (risk of unpredictability or present bias),
v. volume of the issue (liquidity risk),
vi. guarantees of the issue (default risk),
vii. benchmark (remuneration indexer),
viii. experience of the sender (reputation bias),
ix. form of distribution per the Instructions of the Securities and Exchange Commission - ICVM (transparency risk), and
x. tax aversion bias.

The details of the respective justifications for the composition of the model are shown below.

2.3. VARIABLES OF INTEREST

Since different models will be tested, with different dependent variables, it is worth exposing them beforehand to the independent variables themselves, as specified below.

2.3.1. DEPENDENT VARIABLES

a) INTEREST

It is the preliminary, and most obvious, variable for explaining the remuneration given to debenture holders. However, given the eminent need for further refinements in its treatment, given that its gross consideration carries obvious inconsistencies, it will be used only as an initial illustration of the explanation on the nominal formation of the remuneration parameters.

b) NET PROFITABILITY

This is the secondary variable for explaining the remuneration of debentures, considering, in the return on interest, the taxation expected by the debenture holder on the remuneration of common debentures (for incentivized debentures, the values are identical to those in the previous item, i.e. taxation = 0%). The tax expectation is taken by the last range (term > 2 years) of the provisions of RFB Normative Instruction No. 1585, dated August 31, 2015:

> Art. 46 **Income from fixed income** and variable income **financial investments**, earned by any beneficiary, including exempt corporations, **are subject to withholding income tax at the following rates**:
> I - 22.5% (twenty-two point five percent), in investments with a term of up to 180 (one hundred and eighty) days;
> II - 20% (twenty percent), in investments with a term of 181 (one hundred and eighty-one) days up to 360 (three hundred and sixty) days;
> III - 17.5% (seventeen point five percent), in investments with a term of 361 (three hundred and sixty one days) up to 720 (seven hundred and twenty) days;
> **IV - 15%** (fifteen percent), **in investments with a term over 720** (seven hundred and twenty) **days.** [emphasis added] (BRASIL, 2021)

c) DEBENTURE CREDIT SPREAD

This is the definitive variable to explain the relative return on debentures, since it defines the parameter for equivalence between benchmarks, neutralizing nominal inter-rate disparities. In the variables explained above, the negative effect of the coefficient concerning debentures remunerated at the DI rate is evident, but this is justified by the internalization, in them, of the expectation of inflation plus real interest; while in debentures remunerated by the IPCA, real interest is fully translated by its premium.

The credit spread of the debentures was determined as from a comparison with the equivalent risk free asset, in this case, considered by government bonds (of the federal securities debt). For this purpose, the National Treasury (TN) bonds were used, of equivalent nature and term[7], with the day of issue pegged to the registration of the same trading date in the TN[8], and with identical or similar benchmark[9]. "Nature" refers, in addition to the benchmark, to the relation between the types of remuneration, with coupon or without (in the case of government bonds) and with amortization before maturity or without (in the case of debentures) - better described by the table below:

Table 3 – Equivalence of the nature of securities

Equivalência de natureza			
Debênture		**Título público**	
IPCA	com amortização	NTN-B	com cupom
	sem amortização	NTN-B Principal	sem cupom
DI	com amortização	LFT*	sem cupom*
	sem amortização	LFT	sem cupom
Pré-fixada	com amortização	NTN-F	com cupom
	sem amortização	LTN	sem cupom

* Due to the absence of a public security with coupon payments indexed to the Selic rate, the LFT will be used as a proxy.

Source: own elaboration.

To estimate the correlation between DI and Selic rates, the respective historical series were surveyed, obtaining the DI rate and Selic Over rate from B3 (2021b) and the Selic Target rate from BCB (2021). The DI rate series goes back to March/1986, while the Selic rate series goes back to July/1994 for the Over and March/1999 for the Target. Based on the collection of this data, the average historical relation between the rates was calculated, as follows:

$$\frac{\sum_{i=1}^{n} \frac{tx_i^{DI}}{tx_i^{Selic}}}{n} \tag{3}$$

7 The maturities, when not identical, assumed those of the equivalent series of government bonds with maturity dates closer to the maturity date of the respective debenture.

8 In the cases where the debenture issue day occurred on a date with no record of negotiations in the TN, the subsequent business day was considered (since the market enjoys the ability to anticipate interest rate fluctuations based on movements in the interbank market).

9 Similar only for the case of the linear relationship between DI and Selic, as explained later.

where n is the number of daily observations i available in each series, being 6,824 for the Selic Over rate and 5,656 for the Selic Target rate. This procedure gave the DI rate an average equivalence of 99.5% with the Selic Over and 98.7% with the Selic Target. As our variable of interest will be the rate at which the debentures are actually remunerated, it will be assumed that the DI rate is equivalent to 99.5% of the Selic rate, in the scope of the remunerations to the debenture holders. Having verified this, as it is impossible to predict the future Selic and DI rates, it was opted to adjust the interest paid by LFT to the relation $\frac{juro_i^{LFT}}{0,995}$ in order to normalize its relation with the remuneration of the debentures indexed to the DI rate; which, in spite of not solving the vice of unknowns, has the potential of minimizing them.

Finally, to enable the comparison between the 3 assets - TN bonds, common and incentivized debentures (being 2 taxed and 1 not) - it was necessary to adjust for their tax expectations. That is, as for the calculation of net profitability (2nd dependent variable) their respective tax forecasts were conformed, it is also necessary to price taxation on the remuneration of government bonds; since its absence would have the potential to bias downwards the expected premium for incentive debentures.

2.3.2. INDEPENDENT VARIABLES

a) RATING

Credit risk is one of the explanatory variables with the most trivial effect on the formation of bond premiums, describing a linear relationship with their interest rate (the lower the risk, the lower the return, and vice-versa). Nevertheless, it is important to point out that the methodology for converting textual ratings (e.g., Aa3, BrAA-) was adapted from Sheng & Saito (2006); in this case, transliterated for Moody's and S&P ratings, but extended to Fitch, due to its absence in their table. The result, is the following table:

Table 4 – Index for ratings

EQUIVALÊNCIA DE RATINGS				
FITCH	MOODY'S	S&P	Valores atribuídos	Observações
AAA(bra)	Aaa	BrAAA	10	Risco de inadimplemento em seu menor grau
AA+(bra)	Aa1	BrAA+	9,5	Risco de inadimplemento muito baixo (+)
AA(bra)	Aa2	BrAA	9	Risco de inadimplemento muito baixo
AA-(bra)	Aa3	BrAA-	8,5	Risco de inadimplemento muito baixo (-)
A+(bra)	A1	BrA+	8	Risco de inadimplemento baixo (+)
A(bra)	A2	BrA	7,5	Risco de inadimplemento baixo
A-(bra)	A3	BrA-	7	Risco de inadimplemento baixo (-)
BBB+(bra)	Baa1	BrBBB+	6,5	Risco de inadimplemento moderado (+)
BBB(bra)	Baa2	BrBBB	6	Risco de inadimplemento moderado
BBB-(bra)	Baa3	BrBBB-	5,5	Risco de inadimplemento moderado (-)
BB+(bra)	Ba1	BrBB+	5	Risco de inadimplemento significante (+)
BB(bra)	Ba2	BrBB	4,5	Risco de inadimplemento significante
BB-(bra)	Ba3	BrBB-	4	Risco de inadimplemento significante (-)
B+(bra)	B1	BrB+	3,5	Risco de inadimplemento significativamente alto (+)
B(bra)	B2	BrB	3	Risco de inadimplemento significativamente alto
B-(bra)	B3	BrB-	2,5	Risco de inadimplemento significativamente alto (-)
CCC(bra)	Caa	BrCCC	2	Risco de inadimplemento muito alto
CC(bra)	Ca	BrCC	1,5	Risco de inadimplemento em seu mais alto grau
C(bra)	C	BrC	1	Inadimplemento em curso (default)
RD(bra)	-	-	0,5	RJ/Concordata (insolvente mas sem falência)
D(bra)	-	BrD	0	Falência decretada

*RJ = Judicial Reorganization.

Source: adapted from Sheng & Saito (2006) with author's insertions and observations.

Note that the insertions and comments were all made considering the agencies' own descriptions: Fitch (2021), Moody's (2021b) and S&P (2021a).

Although the grade 0, assigned to the D(bra) and BrD ratings, has the potential to generate inconsistency estimates by the nullity of the coefficient of this parameter, it should be noted that credit ratings below grade 1 were removed from the sample (as described in item 3.1.1).

b) RISK-BRAZIL

To evaluate the quality of the macroeconomic scenario faced by issuers, the EMBI+ (Emerging Markets Bond Index Plus) methodology was used, an index calculated by JP Morgan (2021) that "estimates the daily performance of debt securities of emerging countries in relation to US Treasury bonds" (IPEA, 2021), in order to measure the risk perceived in the respective countries through the degree of premium offered by them. In Brazil, the popular nickname for the EMBI+ Brazil is Risk-Brazil, and is regularly published by the Institute for Applied Economic Research - IPEA (2021).

Additionally, as it relies on daily evaluation, the index will also be used to de-seasonalize the models. That is, given that each day is associated with a certain perception of risk, its measurement

will be able to classify the particularities of each scenario over time, encompassing the seasonal effects of each period in its calculation.

In the present methodology, the level of the Brazil-Risk disclosed on the same issue date of the respective debentures was adopted. In the cases in which there was no disclosure of the referred index on the same date on which the debenture was issued, it was opted to refer it to the Brazil-Risk disclosed on the date immediately prior to that (since the issuers probably did not have any prior notice on its measurement).

c) SECTOR

Sheng (2005) determined a dummy to denote the energy and telecommunications sectors, as he believes that "sectors of the economy are generally perceived differently in relation to their risks and returns", and that there is the occurrence of the so-called intersectoral spread when there is "a difference in interest rates in two bond issues from different sectors with the same maturity and the same level of credit risk". Besides this, at the time, they had incipient privatization processes and high indebtedness indices in national and foreign currency, printing a high degree of financial leverage, in addition to the obligations of compliance with a series of expansion goals and operational efficiency improvements established by the regulatory agencies.

This author chose to include it, despite the potential prescription of the scenario described, out of conservatism in the maintenance of eventual sectorial explanatory power. Moreover, the same scenario seems to be drawn now for sanitation companies; reason why these were included as a second control group suggested by the sector dummies.

d) WARRANTY

The guarantee offered by the debenture issuer is an indication of the degree of risk to which the debenture holder will be exposed, since in the event of a default the borrower will be covered according to the quality of the agreed guarantees. The guarantees listed at ANBIMA are of 4 types and have been arranged - in descending order by the degree of coverage - below:

> **Real guarantee** - the assets and rights guaranteed by the company in the issue cannot be pledged, so they can only be negotiated with the debenture holders' approval;
>
> **Floating security** - ensures a general privilege over the assets of the issuing company, but does not prevent it from trading the assets linked to the issue without prior authorization from the debenture holders;
>
> **Unsecured** - issues without guarantee or preference to the investor in case of liquidation of the company;
>
> **Subordinated** - issues without guarantee to the investor. In this case, if the company is liquidated, the debenture holders have preference in relation to the shareholders. (ANBIMA, 2021b)

Following the economic rationale of lower risk = lower return, it is expected that issues with better guarantees pay lower premiums. For this measurement, a dummy variable was proposed that captures only the effect of the real guarantees, assuming value 1 in this case and 0 in the others; because, although the immediately inferior guarantees offer some degree of coverage, all those that do not ensure inalienable rights over the company's assets are treated as weak guarantees - and since, even though there is priority over other creditors, in the case of the floating guarantee, the unbound assets are usually negotiated in the efforts prior to the formalization of default (exempting the debenture holder from coverage of all sorts).

e) SENDER EXPERIENCE

According to Delbem (2016), recurring issuers have the benefit of already being recognized by the market, and lower credit spreads tend to be required from them, in line with what is recommended by Esteves (2014, apud ibid.) and behavioral finance theory. To test this hypothesis, we created a dummy variable that assumes value 1 when the issuer has issued before and 0 otherwise.

f) BENCHMARK

According to Pereira and Miterhof (2019), offerings indexed to the DI rate tend to have a lower cost than IPCA papers. And the prohibition of referencing debentures to the overnight rate forces the demand for the instrument with longer duration and market risk. To test this relationship, a dummy variable was proposed that assumes value 1 when the debenture's benchmark is the DI and 0 otherwise.

A negative correlation was expected between the dummies of the DI rate and the tax incentive, since the sample of incentive debentures is fully pegged to the IPCA, while the sample of regular debentures has 83.5% of its composition pegged to the rate. However, no multicollinearity problem resulted from such relationship, as proved by the pairwise correlation matrix and the variance inflation factor test[10] (RAWLINGS et. al., 1998). Draper & Smith (1998) denote that VIF higher than 10 are indicative of potential damage to the estimation due to multicollinearity, and as the highest indicator among regressors was 2.53, the absence of concern regarding multicollinearity in the model was confirmed.

g) ISSUING PERIOD

Long issues are associated with greater uncertainties about the future; following the rationale of greater risk, it is expected that the longer the issue, the greater the premium offered. For this test, a natural logarithmic transformation was applied on the term, in days, resulting from the difference between the issue date and the maturity date of the debenture. This operation is justified for the purposes of normalizing the quantitative effect captured by the parameter (which otherwise would produce undersized coefficients) and normalizing the regression intercept (which otherwise would be oversized by the effect of the variable with a high nominal scale).

10 Variance Inflation Factor (VIF).

h) ISSUING VOLUME

The volume of the issue is associated with the liquidity of the offer, and for John et. al. (2003, apud DELBEM, 2016), larger issues offer lower premiums. For the parameter test, a natural logarithmic transformation was applied (with the same justification as in the previous item) to the product of the quantity issued by the face value of the debenture in the issue.

i) CVM INSTRUCTION

ICVM 400 requires several mechanisms for access to relevant information, registration of the offering at CVM, with payment of all mandatory fees - which can cost around R$ 2 million for the issuer and take around 10 months -, disclosure of events in the press and preparation of prospectuses. By establishing a series of market standards to make trading safer and more reliable for participants, CVM allows, in this type of issue, any interested parties to participate in the primary issue (CVM, 2021a).

As for the ICVM 476, the process is simplified, since the regulation is more restricted - no requirement for auditing and registration at CVM -, its procedure is less costly and faster - lasting about 2 months (CVM, 2021b). In this case, however, the access of investors to primary issue is limited, and it must be intended for professional investors - who, according to ICVM 539, in its Article 9-A, are the financial institutions or natural or legal persons with investments exceeding R$ 10 million (CVM, 2021c) - and may be traded by qualified investors - who, also according to ICVM 539, in its Article 9-B, are the professional investors or those who have investments exceeding R$ 1 million and who attest in writing their status as investors (ibid.).

Considering the explanation above, and considering the other CVM instructions (with a series of registration, publicity and transparency requirements), it is understood that under ICVM 476 (which waives several regulatory requirements), despite the celerity and economy of the issue, the premiums required should be higher, given that its transparency is reduced and makes it difficult to evaluate the risk inherent to the security. To test this hypothesis, a dummy variable was inserted that will assume value 1 when the debenture was issued under ICVM 476 and 0 otherwise.

j) TAX INCENTIVE

The explanatory potential of the tax incentive, provided by Law No. 12,431/2011 to debentures with incentives, was exhaustively discussed and, as it constitutes the central variable of interest in this work, no further comments are necessary. This variable will be represented by a dummy, assuming value 1 when the incentive exists and 0 otherwise.

3. RESULTS

3.1. DESCRIPTIVE STATISTICS

Table 5 – Descriptive Statistics

	mean	*sd*	*median*	*trimmed*	*mad*	*min*	*max*	*range*	*skew*	*kurtosis*	*se*
Juros	4,36	2,42	4,53	4,28	3,10	0,45	12,64	12,19	0,23	-0,65	0,11
Rating	9,09	1,69	10,00	9,53	0,00	1,00	10,00	9,00	-2,80	8,26	0,08
RiscoBR	5,60	0,17	5,57	5,60	0,13	4,98	6,14	1,16	0,14	1,85	0,01
Setor_1	0,08	0,27	0,00	0,00	0,00	0,00	1,00	1,00	3,18	8,14	0,01
Setor_2	0,50	0,50	0,50	0,50	0,74	0,00	1,00	1,00	0,00	-2,00	0,02
Garantia	0,21	0,41	0,00	0,14	0,00	0,00	1,00	1,00	1,43	0,04	0,02
XP	0,73	0,45	1,00	0,78	0,00	0,00	1,00	1,00	-1,02	-0,97	0,02
DI	0,40	0,49	0,00	0,37	0,00	0,00	1,00	1,00	0,42	-1,83	0,02
Prazo	7,93	0,49	7,85	7,93	0,50	6,31	9,12	2,81	0,07	-0,49	0,02
Volume	19,36	1,03	19,34	19,37	1,09	16,15	22,17	6,03	-0,13	0,01	0,05
ICVM_476	0,84	0,37	1,00	0,92	0,00	0,00	1,00	1,00	-1,82	1,32	0,02
L_12431	0,52	0,50	1,00	0,53	0,00	0,00	1,00	1,00	-0,10	-1,99	0,02

Source: own elaboration.

3.2. OF THE REGRESSIONS

From the general sample, multiple linear regression was performed from the specified parameters, in order to determine the regressors that have greater explanatory power on the remuneration of debentures. This operation was translated by the following equation:

$$\begin{aligned} Reg_i = \ & \alpha + \beta_1 Rating_i + \beta_2 RiscoBR_i + \beta_3 Setor\_1_i + \beta_4 Setor\_2_i \\ & + \beta_5 Garantia_i + \beta_6 XP_i + \beta_7 DI_i + \beta_8 Prazo_i \\ & + \beta_9 Volume_i + \beta_{10} ICVM\_476_i + \beta_{11} L\_12431_i + \varepsilon_i \end{aligned} \quad (4)$$

where: Reg will be the regress and; α is the estimation intercept; Rating is an index of the bond risk assessment (rating) by the credit agencies; RiscoBR is the Brazil Risk measured by Ipea at the date of issuance (with natural logarithmic transformation); Sector_1 is a dummy to identify the sanitation sector Sector_2 is a dummy for the identification of the energy and telecommunications sector; Guarantee is a dummy for the identification of the quality of the guarantee offered by the issuer; XP is a dummy for the indication of the previous experience of the issuer; DI is a dummy for the identification of the benchmark used to anchor the remuneration of the bond in CDI; Term is the term measured between the issue and maturity dates of the debenture (with natural logarithmic transformation); Volume is the financial volume raised by the debenture issue, obtained from the product of its quantity by the face value at issue (with natural logarithmic transformation); ICVM_476 is a dummy to identify the type of CVM normative instruction under which the debenture had its issue framed; L_12431 is a dummy to identify the debentures with incentives, i.e., considered priority by Law no. 12.431/2011 and with tax exemption; ε is the random error term or residual factors.

Note that the variable Rating was transformed into an index, to include scalar representation and allow the interpretation of the textual data; the variables RiskBR, Term and Volume underwent natural logarithmic transformation, in order to reduce their high nominal magnitudes and facilitate the interpretation of their coefficients; the transformations also served to normalize the linear coefficient of the regression.

3.2.1. REGRESSING I: INTEREST

The first regression, carried out from the above specification, sought to measure the explanatory power of the regressors on the formation of debenture remuneration rates. The regression by interest resulted in the following estimation:

Table 6 – Regression I (Interest) Total

	Dependent variable:
	Juros
Rating	-0.361^{***} (0.043)
RiscoBR	3.088^{***} (0.435)
Setor_1	-0.712^{***} (0.272)
Setor_2	-0.330^{*} (0.168)
Garantia	0.251 (0.196)
XP	-0.177 (0.184)
Prazo	1.237^{***} (0.209)
Volume	-0.341^{***} (0.072)
ICVM_476	-0.305 (0.213)
L_12431	2.225^{***} (0.217)
Constant	-13.483^{***} (3.532)
Observations	498
R^2	0.615
Adjusted R^2	0.607
Residual Std. Error	1.520 (df = 487)
F Statistic	77.842^{***} (df = 10; 487)
Note:	*p<0.1; **p<0.05; ***p<0.01

Source: own elaboration.

It should be noted that, in this first regression, as it seeks to explain only the effects on the formation of the interest rate, it was decided to remove the DI rate dummy. Explained: as there is indiscriminate treatment of the sample among debentures anchored to different benchmarks (i.e. IPCA and DI), there could be bias in the explanation of the regression when isolating the effect of

a parameter notably associated with lower nominal premiums - that is, as the IPCA+ premiums are based on the expectation of a net inflation interest rate, there is a tendency for their index to be higher than the premiums on DI+, which, as they are based on a rate tending to Selic, already integrate, in addition to the expectation of inflation, a fraction of real interest in their calculation; their net interest is already discounted of the opportunity cost[11].

In this vein, it is important to discuss the effect of the tax incentive dummy, which, with a positive angle, is strange at first glance. Like the explanation above, its inclination is justified by the uncalibrated comparison to the distinct benchmarks (i.e. IPCA>DI interest), since here the incentivized issues are all pegged to the IPCA. This incongruity will be solved in the third model; however, its decomposition should be explained preliminarily. When running the same regression for the sample filtered only for IPCA-linked debentures, the picture changes:

Table 7 – Regression I (Interest) IPCA

	Dependent variable:
	Juros
Rating	-0.418^{***} (0.039)
RiscoBR	3.646^{***} (0.350)
Setor_1	-1.134^{***} (0.293)
Setor_2	-0.320^{**} (0.152)
Garantia	0.536^{***} (0.154)
XP	-0.080 (0.157)
Prazo	-0.012 (0.187)
Volume	-0.216^{***} (0.062)
ICVM_476	0.089 (0.163)
L_12431	-0.898^{***} (0.205)
Constant	-5.484^{*} (2.903)
Observations	300
R^2	0.564
Adjusted R^2	0.549
Residual Std. Error	1.048 (df = 289)
F Statistic	37.413^{***} (df = 10; 289)
Note:	*p<0.1; **p<0.05; ***p<0.01

Source: own elaboration.

11 Real proof of this effect is today's (10/13/2021) observation on Treasury Direct rates:
(i) NTN-B 2026 = +4.71% = +4.71
(ii) LFT 2027 = +0.27

Therefore, the hypothesis that the premium decreases when the debenture receives the tax incentive, aimed precisely at raising debt at a discount due to the tax waiver associated with the instrument, is confirmed. The negative slope not only corroborates the initial hypothesis, but its high degree of significance (< 0.1%) anchors confidence in the result obtained when compared to the equivalent benchmark.

3.2.2. REGRESSING II: NET PROFITABILITY

In order to isolate the effect of taxation on interest formation, the variable explained for the net profitability, which is formed by the nominal interest rate for incentivized debentures and the adjusted rate for regular debentures, was adapted to a correction factor equivalent to the expected tax incidence, as per the provisions of item 2.3.1.

Table 8 – Regression II (RL) Total

	Dependent variable:
	Rent_Liq
Rating	-0.330^{***} (0.038)
RiscoBR	2.906^{***} (0.387)
Setor_1	-0.648^{***} (0.242)
Setor_2	-0.292^{*} (0.150)
Garantia	0.298^{*} (0.175)
XP	-0.174 (0.164)
Prazo	1.059^{***} (0.186)
Volume	-0.322^{***} (0.064)
ICVM_476	-0.227 (0.190)
L_12431	2.740^{***} (0.193)
Constant	-12.267^{***} (3.147)
Observations	498
R^2	0.698
Adjusted R^2	0.692
Residual Std. Error	1.354 (df = 487)
F Statistic	112.525^{***} (df = 10; 487)
Note:	*p<0.1; **p<0.05; ***p<0.01

Source: own elaboration.

By performing the same filter as in the previous item, for comparison only to debentures linked to the IPCA (isolating the inconsistency compared to the DI), there is the first indication that the tax incentive does not have a significant effect on price formation, when duly adjusted for tax and risk factors:

Table 9 – Regression II (RL) IPCA

	Dependent variable:
	Rent_Liq
Rating	−0.394*** (0.038)
RiscoBR	3.511*** (0.341)
Setor_1	−1.051*** (0.285)
Setor_2	−0.305** (0.149)
Garantia	0.559*** (0.150)
XP	−0.101 (0.153)
Prazo	−0.007 (0.182)
Volume	−0.226*** (0.060)
ICVM_476	0.072 (0.158)
L_12431	0.087 (0.200)
Constant	−5.789** (2.828)
Observations	300
R^2	0.547
Adjusted R^2	0.531
Residual Std. Error	1.021 (df = 289)
F Statistic	34.845*** (df = 10; 289)
Note:	*p<0.1; **p<0.05; ***p<0.01

Source: own elaboration.

The loss of significance of the tax incentive coefficient indicates the non-rejection of its insignificance for the composition of the net return. That is, when discounting the expectation of taxation on regular debentures, the return of the debentures with incentives is statistically equivalent to those.

3.2.3. REGRESSING III: INTEREST SPREAD

The final regression, and of greatest interest, is the one that actually compares the net effect of the explanatory variables on the interest spread in relation to risk-free assets. Here, we can include in the regression the DI remuneration dummy - since the nominal weight of the rates characteristic of each benchmark is relativized - as well as compare on equal terms the different correction indexes present in the total sample - the IPCA filter being dispensable here. The preliminary result of the regression is presented as follows:

Table 10 – Regression III (Spread)

	Dependent variable:
	Spread
Rating	−0.166*** (0.024)
RiscoBR	1.587*** (0.240)
Setor_1	−0.364** (0.150)
Setor_2	−0.405*** (0.093)
Garantia	0.541*** (0.109)
XP	−0.232** (0.102)
DI	−0.554*** (0.161)
Prazo	0.158 (0.123)
Volume	0.041 (0.040)
ICVM_476	0.368*** (0.119)
L_12431	−0.119 (0.158)
Constant	−7.362*** (1.974)
Observations	498
R^2	0.361
Adjusted R^2	0.347
Residual Std. Error	0.840 (df = 486)
F Statistic	25.001*** (df = 11; 486)
Note:	*p<0.1; **p<0.05; ***p<0.01

Source: own elaboration.

Despite the expectation that the new regression would internalize the heterogeneities of the benchmarks and smooth the dispersion of the residuals, the Breusch & Pagan (1979) test - to verify the relation of the variance of the regression errors with the independent variables - showed rejection of the homoscedasticity hypothesis in this regression. Its test statistic translated high significance on the rejection of the null hypothesis (< 0.1%), thus eliminating the efficiency properties of the model, in violation of one of the requirements for the Ordinary Least Squares method (MQO or OLS[12]) to provide the Best Linear Unbiased Estimators (MELNV or BLUE[13]).

It follows from the heteroscedasticity problem that, although the estimation of the coefficients remain correct, their standard errors are not, which may lead to incorrect inferences in the hypothesis tests. The same problem was presented in Pereira and Miterhof (2019), opting in that case for the application of the bootstrap technique, apprehended in Davidson & MacKinnon (2004, apud ibid.), which generates heteroscedasticity robust standard error estimators (henceforth, robust standard errors). The cited technique is supervening to the original method, of the standard errors of

12 Ordinary Least Squares.

13 Best Linear Unbiased Estimator.

White[14] (1980), and from its examination resulted relevant inputs to the option for the remedy to heteroscedasticity, as shown below.

Among the options to correct this problem, it was attempted (i) the identification of regressors conditional on heteroscedasticity, (ii) the alteration of the model for non-linear regressions or generalized linear models (MLG or GLM[15]) to distributions other than the Gaussian and, still, (iii) the alteration of the regression method, from MQO to Weighted Least Squares (WLS or MQP[16]) or to Generalized Least Squares (GLS or MQG[17]); However, none of the alternatives were successful in correcting for homoscedasticity.

Thus, we chose to adopt the corrections made possible by the method of robust standard errors. Since White[18] (Ibid.), the estimators for the robust standard errors comprise a markup relative to the original test statistics, in order to allow the correction of inadequate inferences on the hypothesis tests for the significance of the parameters, solving some efficiency problems. Subsequently to this innovation, improved versions of the method were developed by MacKinnon & White[19] (1985), Davidson & MacKinnon[20] (1993) and Cribari-Neto[21] (2004). It should be noted, each providing estimators in ascending degrees of severity for the standard errors of the regressors, respectively.

As the intent of this study is to provide the results with the highest assertiveness rigor available, we chose to adopt the most conservative method, also the most recent one, by Cribari-Neto (2004). The result of the new regression, adapted to avoid the probability of type I errors, was as shown in column 3 of Table 11. From the new regression, it was noted that only the variable DI suffered a relative decrease in the significance of its coefficient (no longer significant at 5%, but only at 10%). The final comparative result, among the three models presented, is as follows:

14 Heteroskedasticity-robust standard errors, a.k.a. white standard errors or robust standard errors.

15 Generalized Linear Model.

16 Weighted Least Squares.

17 Generalized Least Squares.

18 HC0 criterion in R.

19 HC1 criterion in the R.

20 HC3 criterion in R.

21 HC4 criterion in the R.

Table 11 – Comparison among the 3 models (Total)

	Dependent variable:		
	Juros	Rent_Liq	Spread
	(1)	(2)	(3)
Rating	−0.361***	−0.330***	−0.166***
	(0.043)	(0.038)	(0.043)
RiscoBR	3.088***	2.906***	1.587***
	(0.435)	(0.387)	(0.243)
Setor_1	−0.712***	−0.648***	−0.364***
	(0.272)	(0.242)	(0.118)
Setor_2	−0.330*	−0.292*	−0.405***
	(0.168)	(0.150)	(0.096)
Garantia	0.251	0.298*	0.541***
	(0.196)	(0.175)	(0.118)
XP	−0.177	−0.174	−0.232**
	(0.184)	(0.164)	(0.117)
DI			−0.554*
			(0.288)
Prazo	1.237***	1.059***	0.158
	(0.209)	(0.186)	(0.181)
Volume	−0.341***	−0.322***	0.041
	(0.072)	(0.064)	(0.050)
ICVM_476	−0.305	−0.227	0.368***
	(0.213)	(0.190)	(0.115)
L_12431	2.225***	2.740***	−0.119
	(0.217)	(0.193)	(0.230)
Constant	−13.483***	−12.267***	−7.362***
	(3.532)	(3.147)	(2.356)
Observations	498	498	498
R^2	0.615	0.698	0.361
Adjusted R^2	0.607	0.692	0.347
Residual Std. Error	1.520 (df = 487)	1.354 (df = 487)	0.840 (df = 486)
F Statistic	77.842*** (df = 10; 487)	112.525*** (df = 10; 487)	25.001*** (df = 11; 486)
Note:			*p<0.1; **p<0.05; ***p<0.01

Source: own elaboration.

It is important to note that, even relaxing the assumptions of robust standard errors and loosening the t-statistics for a common regression, the t-test did not confer statistical significance to the indicator coefficient of the debentures with incentives (contributing to the proof of its generalized statistical insignificance in the composition of the spread).

4. ANALYSIS

The F-statistic for the overall model fit test was highly significant for all specifications presented; helping to validate the suitability of the proposed modeling.

The results of the tests with each of the parameters are discussed below:

a) RATING

The coefficient of the credit rating evaluation was highly significant in all models, indicating its high explanatory power on the pricing of debentures. Also, in all models, it obtained a negative angular coefficient; that is, ratifying the theory about the positive relationship between risk and return, given that higher rating evaluations are associated with lower risk and return.

b) RISK-BRAZIL

The coefficient that evaluated macroeconomic risk, represented by EMBI+ Brazil (Brazil Risk), was also significant in all models and with positive slope. Ratifying, in turn, the underlying theory (positive relationship between risk and return) by determining higher premiums for higher risk scenarios.

c) SECTOR

Despite initial skepticism regarding the sector dummies, the energy and telecommunications sector was in fact significant in all models (at 5% in all IPCA models, at 10% in models 1 and 2 Total, and at 1% in model 3 Total); however, its impact was inverse to that recommended by Sheng (2005), except for 2005. Therefore, taking into account the very nature of the scenario described (in regulatory difficulties and occasional debts on its development, incipient at the time) it is natural that it was ephemeral and has already been overcome. In fact, it has been overcome in such a way that the consolidation of the sector was able to aggregate low-risk expectations associated with it.

The other one, suggested by this author, about the sanitation sector, had its intuition frustrated. Despite the recent bidding rounds and incipient regulation of the sector, the dummy presented a negative effect on the premium, having been highly significant (at 1%) in all models (except for model 3 IPCA, in which the null hypothesis of the parameter was not rejected). This effect, one can conjecture, may be explained by the use of the previous successful experiences of the energy and telecom sectors themselves, or even due to the high profitability evaluation of privatizations in the eyes of economic agents.

d) WARRANTY

The coefficient associated with the dummy of guarantees was significant in all IPCA models, but in the Total models: it was insignificant in model 1, significant at 10% in model 2, and at 1% in model 3. However, in all cases, positive angulation was estimated for the coefficient, dissonant with the underlying theory - that is, debentures with collateral, supposedly endowed with lower risk, offered higher premiums. The same result was reached by Delbem (2016), who explained that it is possible the formation of the opposite effect to the expected one, since eminently solid companies do not need to

offer guarantees to the market to enjoy credibility, and it is common, on the contrary, that guarantees are offered in less solvent issues, in order to remedy their low credibility.

e) SENDER EXPERIENCE

The dummy of the issuer's experience did not present statistical significance on the coefficient of its estimation in any of the tests. It is noteworthy, however, its significance at 5% in model 3 (Spread) Total, ensuring some confidence about its slope, which was negative in all regressions in confirmation of the theoretical intuition - by establishing lower returns when offered by a recurrent issuer, corroborating the reputation bias.

f) BENCHMARK

The coefficient of the dummy for debentures pegged to the DI rate, present only in model 3 (Spread) Total, was significant at 10% and of negative slope. Confirming, therefore, the intuition exposed by Pereira and Miterhof (2019), which predicted the market's preference for instruments pegged to the CDI (accepting lower premium) given their greater market depth and distribution base.

g) ISSUING PERIOD

The term parameter was not statistically significant in any of the IPCA models, nor in model 3 (Spread), but it was significant (at 1%) in models 1 and 2 Total. In the cases where the null hypothesis was rejected, the slope was recurrently positive, which seems to confirm the hypothesis that the risk of uncertainty, associated with longer issues, is rewarded with higher returns to the borrower.

h) ISSUING VOLUME

The coefficient associated with issue volume was significant in models 1 (Interest) and 2 (Net Profitability), but not in model 3 (Spread); its slope (in the cases where it was significant) was negative. The intuition inherent to the regressor, therefore, seems confirmed; that is, that large issues confer greater liquidity to the asset, relaxing the premium demands from its borrowers (i.e.: greater liquidity = lower profitability). In the case where it was not statistically significant, its weakly positive slope can be ignored.

i) CVM INSTRUCTION

The dummy for exemption from registration with the CVM (ICVM 476) showed statistical insignificance on the coefficient in the first two regressions, but was significant at 1% in the third. When significant, it was positively skewed, denoting agreement with the theoretical intuition that the lower transparency of the instrument would require higher levels of remuneration.

j) TAX INCENTIVE

Finally, the most awaited: the explanatory potential of the tax incentive, posed by Law No. 12,431/2011, to infrastructure debentures. The coefficient of the dummy, for the detection of the tax incentive in debentures, was highly significant in the first two models, when run with the inclusion of all benchmarks; that is, it confirmed the high power of the variable, significant below 1%, as explanatory to the formation of interest rates, even considering the tax discounts to ordinary debentures. In these

models, there was a positive sign; however, it should be considered that in the first two models there is a comparison with debentures remunerated at the DI rate, which, as pointed out above, derives from the bias naturally given by the lower premiums when the discrepancy of the real interest rates implicit in each benchmark is maintained (IPCA < DI). Therefore, its positive angular coefficient is easily explained by the incongruence between the encouraged benchmark (100% IPCA) and the majority benchmark of the common ones (83.5% DI).

In order to determine its effective impact on the formation of real interest rates and relative profitability, the third regression was run, net of deflators and compared to the spread. In this one, no evidence of statistical significance was detected, largely failing the test for rejection of the null hypothesis of the parameter. That is, the absence of statistical contribution of its coefficient confirms the hypothesis that it is not possible to reject that the tax incentive is appropriated by the issuer, since, if properly retransmitted to prices, any discrepancies on the formation of spreads should be neutralized - which in fact occurs.

When comparing the magnitude of the coefficient with the specific cases of the samples made compatible with the benchmark of those with incentives (IPCA), the figure is even clearer. In the net profitability calculation stage (discounting tax expectations), of the second model, the coefficient lost its statistical significance as an explainer of interest formation. It is worth pointing out, in a regression provided with homoscedasticity, the dissimilarity of the contrary results found in the consulted bibliography. Corroborating, once again, the instrument's global adequacy to the proposed purpose.

CONCLUSION

At the statistical level, the hypothesis that the issuer appropriates properly the tax benefit granted to it is not rejected.

Considering the difficulties to increase investments on the national infrastructure (currently at levels of about 1.5% of GDP; not even enough to replace the depreciation on the installed capacity, estimated at about 4% of GDP) and considering the instruments available to remedy them - direct or indirect public investments (through direct public financing) or subsidies to private investment - the specifics of each alternative were addressed. Presumably endowed with fewer vices, according to the underlying economic theory, the fiscal incentive (to subsidize private investment in infrastructure) was analyzed in detail.

As reviewed, the previous results found in the specialized bibliography on incentive debentures pointed to their ineffectiveness. The study, henceforth, was aimed at reassessing the assumptions; reaching, finally, a different result. In this sense, the chronological updating of the observations and the updating of the methodological specification proposed herein should be considered.

By way of conclusion, having confirmed the inability of the parameter for detecting incentivized debentures to indicate any statistically relevant effect on the pricing of debentures, adjusted for risk and tax factors, its consideration as an instrument of encouragement qualified to subsidize investment in national infrastructure is urgent. To this end, it will be necessary to claim attention in the legislative deliberations that deal with the debentures issue, in the Bill (PL) No. 2646, of 2020, in order to contemplate, with due rigor, the feasibility of its future maintenance.

The possibility of introducing a new series of subsidized debentures, as proposed in PL 2646/2020 - that is, with incentives to the issuer, via tax waivers on profits - will pose new challenges on the assessment of its effectiveness: a subject that will require renewed research efforts in order to measure it, being a potential object of future investigation in the academic field.

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