



## Pricing corporate bonds in Brazil: 2000 to 2004<sup>☆</sup>

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### ABSTRACT

This paper analyzes the factors that influence the issuing price of debentures in Brazil in the period from year 2000 to 2004, applying a factor model, in which exogenous variables explain return and price behavior. The variables in this study include: rating, choice of index, maturity, country risk, basic interest rate, long-term and short-term rate spread, the stock market index, and the foreign exchange rate. Results indicate that the index variable, probability of default and bond's maturity influence pricing and points out associations of long-term bonds with better rating issues.

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### 1. Introduction

In Brazil, Debentures are equivalent to Bonds and are the most important credit instrument for corporations' capitalization in the local market. Nevertheless, its total outstanding is minor when comparing to the volume of governmental bonds due to the crowding out phenomenon: as of December 2005, Brazilian treasuries totalizes US\$ 410 billions for a US\$ 36 billions outstanding of debentures (BCB, 2005). Less offering of treasuries will increase demand on corporate bonds and broadening the understanding of the price behavior is then fundamental.

This paper develops an exploratory analysis of factors that influence the pricing of debentures' first issuing in Brazil: the relative importance of factors in spread pricing, the existence of choice by indexes and the clustering of issues regarding maturity and rating. Important in this work is the discussion on the relation between credit quality and maturity, relevant to the capitalization of companies that access local capital markets.

The securities under analysis are Brazilian corporate Bonds with local market issuing, with a rating, and where the calculation of the

money value of principal and coupon payments includes an index variation. These indexes are the CDI, a one day inter-bank market rate, and the IGPM, a Brazilian inflation index, and they represent the majority of primary market. Rating, indexing, maturity, country risk, basic interest rate, long-term and short-term rates premium, stock index, and foreign exchange rate are the variables in the analysis. The period under consideration is between years 2000 and 2004.

The text has five sections, including this introduction: a background with prior studies and relevant literature, the methodological procedures showing the discussion of sample formation and variables, the data analysis and empirical results of multivariate techniques, and the conclusions.

### 2. Background

Cochrane (2001) defines the asset pricing models in which the return is a linear function of a set of independent variables as factor pricing models. Haugen (1997) supports the application of such models with the argument of computational simplicity. The CAPM – Capital Asset Pricing Model is a one factor model, and the APT – Arbitrage Pricing Theory extends for a multi-factor model. Also, Litterman and Scheinkman (1991) explain the behavior of the term structure of interest rates with factor model, based on Principal Component Analysis.

Fisher (1959) first applied factor models to bond valuation and studies the relation of corporate bonds' risk premium and selected factors. Elton et al. (1995) applies the APT model to the bond market in order to study the return of corporate bonds.

Literature states some factors that affect a bond's price. Fridson and Garman (1998) show that the price of new corporate issues depends on its rating, maturity, embedded options, capital structure of the firm,

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coupons, or if a commercial bank participates of the underwriting process. For Perraudin and Taylor (2004) as well, the rating alone is not enough to justify the credit spread. Factors such as tax regime, liquidity and risk premium are also important, especially for high yield corporate bonds. Garman (2000) concludes that four major factors affect issuing prices in the European market: credit rating, size of the offer, coupons and secondary market spreads. Dignan (2003) relates credit spread to factors other than default probability, like liquidity and spread volatility, in line with Elton et al. (2001, 2004), who include factors referring to taxes and to those that commonly explain stock risk premium. Carty (2000) includes the dependence on macroeconomic variables, like real and nominal interest rates, and also GDP growth, in the analysis of default risk.

For Bevan and Garzarelli (2000), credit spread is a diffuse matter and they suggest the separation of credit spread in risk premium and default premium, but, although this separation may be arbitrary, one may not be able to do it, as they state. Fons (1994) and Kealhofer (2003) show that bonds with better ratings tend to have lower spreads, which increase as maturity approaches, and those with worse rating tend to have wider spreads, which narrow by the time of term.

Huang and Huang (2003) confirm that the credit risk allows for no more than 30% of the credit spread, still less for bonds with small maturity. Other influencing factors are: liquidity, embedded options, tax regimes, equity premium, firm leverage, stock payout, stock volatility, default probability, and recovery rate. For Lucas et al. (2001) factors like systematic risk, issuer credit quality, and maturity impact the default performance of a credit portfolio.

Altman (1989) demonstrates the relationship between default probability and rating, while Cantor and Falkenstein (2001) state that credit rating incorporates information about the credit quality of a bond issuer, including default probability and severity of loss. Nevertheless, the probability of default is not constant, as Zhou (2001) shows, and the historical average is a biased estimator of the expected default probability, as well as of rating migration probability.

### 3. Method

Rating represents the view of independent agencies regarding an issuers' credit worthiness. This opinion relates dynamically to the changes in the perception of credit quality, although the market reaction is faster than the change of the firm's rating. The issuing rate is a consequence of an in-depth work of rating agencies, including information not available to investors; therefore, the best moment of the trustworthiness of the opinion about an issuer is in the underwriting, strengthening the idea of working with data of primary market.

This work studies the primary offer of non-convertible new bonds, in the period between years 2000 and 2004, with at least one rating. The study evaluates the effects on spreads of security issues – dependent variable – regarding the independent variables, selected after the literature: rating of the issue, indexer, maturity, Brazilian country risk, basic interest rate, difference between long and short-term rates, stock index and exchange rate, and also evaluates: the relative importance of the selected factors in spread pricing; the

**Table 1**  
Coefficients – regression model.

Variables	Coefficients		t test		Correlation with "spread"
	Unstandardized	Standardized	t	p-value	
Constant	−0.003575		−0.64	0.522	
d_index	0.010158	0.49	5.82	0.000	0.29
probdef	0.024188	0.38	4.45	0.000	−0.28
matur	−0.000004	−0.32	−4.22	0.000	0.36
Dollar	0.007003	0.24	3.11	0.002	0.19
sprtx	0.059637	0.15	1.99	0.049	0.09

F statistics: 15.73 (p-value: 0.0001); adjusted  $R^2$ : 0.363.

**Table 2**  
Logistic regression – variables in the equation.

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for Exp(B)	
							Inferior	Superior
"spread"	96.53	26.75	13.02	1	0.000	8.36 E + 41	1.43 E + 19	4.90 E + 64
"probdef"	−22.13	12.47	3.15	1	0.076	0.000	0.000	10.086
Constant	−1.14	0.52	4.87	1	0.027	0.321		

existence of choice by indexes; and the clustering of issues regarding maturity and rating. The final sample, after outliers' exclusion, comprises 130 cases (80 in the CDI group and 50 in the IGPM group).

The underwriting process, generally on the basis of auctions, defines the issuing price, taken as a spread over Treasury. The name of this variable is "spread".

The rating variable refers to independent opinions given by the rating agencies: Standard & Poors, Moodys Investors Service, Fitch Ratings, SR Rating and Austin Asis; the last two are local. Three segments divide the final sample: High rating, Medium rating and Low rating, representing, respectively, high, medium and low credit risk and its name is "xRating". Altman's criterion (Caouette et al., 2000) enables to transform the agency's rating into a metric variable. Thus, each rating refers to a default probability and this variable has the name "probdef".

The difference, in days, between the issuing date and the date of the last payment of the contract determines maturity, the variable "matur". The ordinal variable is "xMatur", with three categories: short-term, medium-term and long-term maturity.

The model considers the macroeconomic independent variables: (1) the long-term (one year) and short-term (one month) premium of fixed rates of swaps "sprtx"; (2) the Selic rate, the one day financing rate of federal government bonds, usually taken as the basic rate of economy "txselic"; (3) the inflation index "igpm"; (4) the exchange rate dollar-real "dollar"; (5) the stock index of the São Paulo Stock Exchange, "ibovespa"; and (6) Brazilian country risk "embi". The dummy variable "d-index" represents the index groups, CDI or IGPM.

The study uses three different techniques, according to the objectives:

- (1) The multiple regression technique examines the importance of dependent variables in the explanation of the spread composition.
- (2) The logistic regression analyzes the existence of preference regarding the indexing groups (CDI-interest rates and IGPM-inflation).
- (3) The correspondence analysis evaluates the formation of groups regarding maturity and rating characteristics.

## 4. Empirical results and conclusions

### 4.1. Multiple regression

The regression model (Table 1) shows a prevalence of the variable of the indexing group in the composition of the spread, along with the variables default probability and maturity. The importance of the

**Table 3**  
Classification table.

Observed	Predicted						
	Selected cases			Unselected cases			
	"index"		Correct percentage	"index"		Correct percentage	
	DI	IGPM		DI	IGPM		
"index"	DI	64	6	91.4%	DI	4	50.0%
	IGPM	9	30	76.9%	1	12	92.3%
total				86.2%			76.2%

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