FUNDAÇÃO GETULIO VARGAS

ESCOLA DE ADMINISTRAÇÃO DE EMPRESAS DE SÃO PAULO

MAXENCE CARL FRANÇOIS SCICHILI

# LIQUIDITY PROXIES IN THE BRAZILIAN DEBENTURE MARKET

SÃO PAULO

2015

FUNDAÇÃO GETULIO VARGAS

ESCOLA DE ADMINISTRAÇÃO DE EMPRESAS DE SÃO PAULO

MAXENCE CARL FRANÇOIS SCICHILI

# LIQUIDITY PROXIES IN THE BRAZILIAN DEBENTURE MARKET

Thesis presented to Escola de Administração de Empresas de São Paulo of Fundação Getulio Vargas, as a requirement to obtain the title of Master in International Management (MPGI).

Knowledge Field: Gestão e Competitividade em Empresas Globais

Adviser: Prof. Dr. Lauro Gonzalez Farias

SÃO PAULO

2015

Scichili Maxence
Liquidity proxies in the Brazilian debenture market / Maxence Scichili– 2015
47f.

Orientador: Gonzalez Farias, Lauro
Dissertação (MPGI) - Escola de Administração de Empresas de São Paulo.

1. Debêntures - Brasil. 2. Mercado de capitais - Brasil. 3. Liquidez (Economia)I. Lauro, Gonzalez Farias. II. Dissertação (MPGI) - Escola de Administração de Empresas de São Paulo. III. Liquidity Proxies in the Brazilian Debenture Market

CDU 336.763.3(81)

MAXENCE CARL FRANÇOIS SCICHILI

# LIQUIDITY PROXIES IN THE BRAZILIAN DEBENTURE MARKET

Thesis presented to Escola de Administração de Empresas de São Paulo of Fundação Getulio Vargas, as a requirement to obtain the title of Master in International Management (MPGI).

Knowledge Field: Gestão e Competitividade em Empresas Globais

Approval Date

____/____/_____

Committee members:

_____

Prof. Dr. Lauro Gonzalez Farias

_____

Prof. Dr. Marcio Gabrielli

_____

Prof. Dr. Ricardo Rochman

## ABSTRACT

This study analyzes liquidity proxies in the Brazilian debenture corporate market and tests the Eurobond proxy to better understand which characteristics help predict the liquidity of debentures.

Although Brazilian capital markets have improved drastically over the past years, big Brazilian corporations have many options when deciding to raise capital (the issuance of Eurobond is one of them). This study seeks to fill a gap in the academic literature by seeing if a liquidity relationship exists between the 2 markets.

The Eurobond proxy was found to be significant at the 5% level and 1% level.
The other proxies that were found to be significant (Issue Amount, Initial Maturity, Rating) match the results of previous studies from our literature review.



**KEY WORDS:** BRAZILIAN CAPITAL MARKETS, LIQUIDITY PROXIES, DEBENTURES

## RESUMO

Este estudo analisa as variáveis de liquidez no mercado corporativo brasileiro de debêntures e testa a variável Eurobond para compreender quais características ajudam a prever a liquidez de debêntures.

Embora os mercados de capitais brasileiros tenham melhorado drasticamente nos últimos anos, as grandes empresas brasileiras têm muitas opções na hora de tomar a decisão de aumentar capital (emissão de Eurobônus é um deles). Este estudo busca preencher uma lacuna na literatura acadêmica vendo se existe uma relação de liquidez entre os dois mercados.

O proxy Eurobond foi encontrado significativo ao nível de 5% e o nível de 1%. Os outras proxies que foram significativos (valor de emissão, data de vencimento inicial, Avaliação) coincidem com os resultados de estudos anteriores.



**PALAVRAS CHAVE:** MERCADO DE CAPITAL, PROXIES DE LIQUIDEZ, DEBENTURES

**SUMMARY TABLE**

# 1 INTRODUCTION

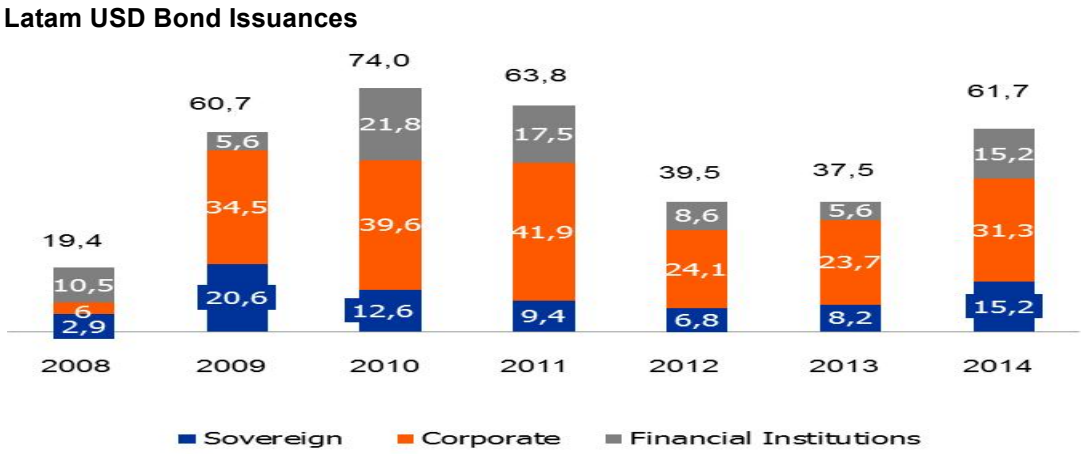
Corporate debenture market in Brazil is one of the most active markets in Latin America. According to Dealogic in 2013, Brazil ranked amongst the top LATAM countries in terms of corporate bond issuances with corporate bond activity reaching 1.71% of GDP. The Brazilian debt capital market displays unique characteristics such as high interest rates, overwhelming government bonds, high percentage of short to medium term maturity indexed or inflated adjusted security and low liquidity which differentiates it from other mature market.

The growth of this market has enabled to attend the growing credit demand from corporations (The volume of total debentures issued has gone from R$ 6.3 bn in 2008 to R$ 48.5 bn in 2011 according to Anbima). Regulatory changes orchestrated by the CVM such as instruction 476 have facilitated the issuance process which has resulted in a sharp increase in the local debt capital market primary market.

In parallel, issuance of Brazilian US$ denominated bonds have also grown at fast pace during the 2008-2014 period and the majority of the issuances have been from Corporate and Financial institution (graph 2). Foreign debt compared to Brazilian debt has generally longer terms which is one of the advantage for corporations. Although both capital markets can be seen as complimentary in the case of a Eurobond issued by a Brazilian company to fund a project abroad in US$; a Eurobond can also be a substitute to a debenture using a currency swap. Black and Munro (2010) have identified such reasons amongst the corporate issuers in the Asia Pacific region

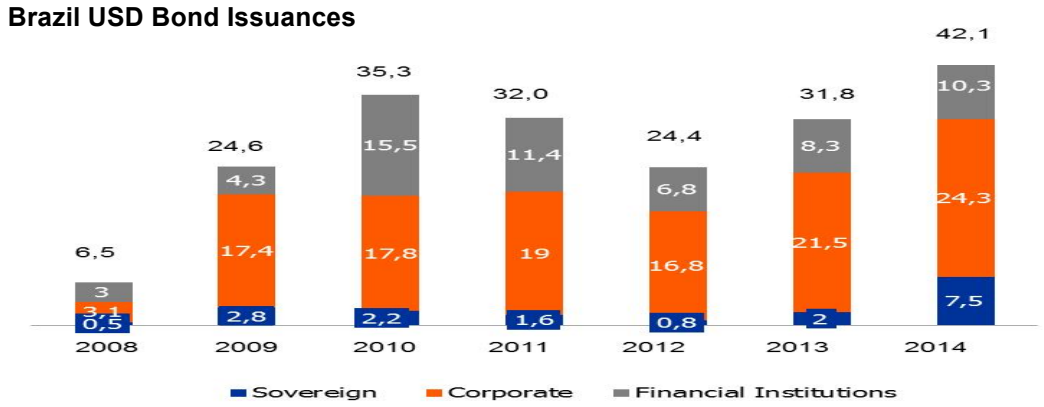
Liquidity is fundamental in both bond markets that are characterized by low trading activity as a more liquid bond market is more attractive for investors. According to the IMF, a more mature and liquid corporate capital market is extremely important for Brazil as it will ensure a steady financing of its economy, less reliance on the lending capacity of banks and foreign investors. In order to become mature, it is essential for the market to be liquid enough as illiquid assets hold back investors from investing more by fear of not having an exit to their investment.

Graph 1 LATAM USD Denominated Bond Issuances (volume in USD bn)[1]




Source: Anbima

Graph 2 Brazil USD Denominated Bond Issuances (volume in USD bn)[1]




Source: Anbima

This study seeks to analyze liquidity proxies in the Brazilian debenture corporate market and test the Eurobond proxy to better understand which characteristics help predict the liquidity of debentures. Although Brazilian capital markets have improved drastically over the past years, big Brazilian corporations have many options when deciding to raise capital (the issuance of Eurobond is one of them). This study seeks to fill a gap in the academic literature by seeing if a liquidity relationship exists between the 2 markets.

Liquidity as defined by Amihud and Mendelson (1991) is often seen as the ability to buy or sell a security relatively fast without affecting the price of that security. Due to the nature of the over the counter market with no centralized operations and little trading activity in which corporate bonds are exchanged, academics as well as investment banks have had to look for indirect measures.

In order to understand the proxies that best measure liquidity in the Brazilian debenture market we will ask ourselves the following question:

1) Does issuing a Eurobond for a Brazilian company increase the liquidity of its debenture?

First, we define proxies as indicators that estimate a phenomenon because of the lack of direct signs. The proxies that we will use to test for liquidity are rating, size of the issue, initial maturity, type of issuers and Eurobonds. Secondly, we define liquidity as an indicator of the depth, tightness and resilience of a market (Amante & Araujo, 2007). Depth measures the capability of a market to take in large transactions without a significant price movement, tightness measures the cost efficiency of transactions and resilience indicates the capability for the market to absorb shock.

The results of our analysis conclude that the Eurobond proxy is significant at the 1% confidence level in robust regression 1 and at the 5% confidence level in robust regression 2. The other proxies that were found to be significant (Issue Amount, Initial Maturity, Rating) are coherent with the results of previous studies from our literature review.

# 2 LITTERATURE REVIEW

Extensive research has been done on the liquidity of stocks as well as bonds in Europe and in the US and recently more research has been produced in Brazil due to the development of its capital markets and its influence in the LATAM region. In order to have the most complete literature review as possible the following sub topics will be discussed:

A) Liquidity concepts, liquidity proxies and liquidity modeling

B) Bond market in Brazil

C) Eurobonds

## 2.1 Definition of liquidity, proxies and modeling

Even though liquidity is a key attribute for any financial asset it is somewhat subjective, is not always easy to measure and is not as easy to define as other financial metrics such as profitability or credit risk. Amihud and Mendelson (1991) define liquidity as an "asset that can be bought or sold at the current market price quickly and at low cost" (Amihud; Mendelson 1991, p.56). For these two authors liquidity is a synonym of marketability and an asset that is less liquid will have higher cost of transactions and therefore investors will require a higher rate of return. This implies that both companies as well as public authorities have a major role to play in the structuring of those securities and in the setting of rules that define the market in which the trading activity takes place. Consequently, the authors see both of those entities as having an active role in enabling the improvement of existing liquidity conditions.

The costs of illiquidity can be divided into 4 categories: i) bid ask spread, ii) market impact cost, iii) delay and search costs and iv) direct transaction costs.

i)Bid and ask spread represent the price at which market makers are willing to buy and sell securities and liquidity is inversely related to this spread; ii) Market impact cost is the change in price due to the selling of a large order of an asset; iii) delay and search costs are due to the delay a trader may take to seek better trading conditions; iv)direct transaction costs include transaction taxes and broker commissions.

Chordia, Sarkar (2005) give a slightly different definition of liquidity which is "the ability to buy or sell large quantities of an asset quickly and at a low cost". By adding large quantities to

the definition they suggest that the market impact cost is the most important category of illiquidity cost.

Mahanti, Nashikkar and Mallik (2007) propose the new concept of latent liquidity to improve the measurement of liquidity in low liquid markets. The concept of latent liquidity measures the accessibility of an asset from the holders of the asset and therefore does not require transaction data unlike the more traditional measurement of liquidity. Latent liquidity tries to measure the "ability to buy or sell "and not the transaction itself. It is defined as "the weighted average turnover of investors who hold a bond, where the weights are the fractional investor holdings." (Mahanti, Nashikkar and Mallik, 2007, p.1). This new concept comes from the author's acknowledgment that liquidity varies greatly from a market to another. Indeed, an average liquid stock in the US would be one that trade every minute and for an average liquid bond that figure would vary between 12 and 18 days. Therefore, this concept helps measure for example the difference in liquidity between corporate bonds that trade once and twice a year as the insufficient number of transaction makes the more traditional measurement tools useless. The authors were able to measure latent liquidity by using the database of a large custodial bank that contained information of multiple dealers and which was therefore more representative of the aggregate market. Although very applicable to the debenture market we are trying to analyze, we will not use this concept in our analysis as we do not have access to data from a custodian bank.

The subtle differences in liquidity definition amongst scholars and the difficulty to obtain reliable liquidity measures for over the counter market transactions, has led scholars to search extensively proxies for liquidity. Proxies are indirect measures based on bond characteristics and direct measures are based on transaction data and can include: quoted bid-ask spreads, trade sizes, quoted frequencies and trading volume.

Howeling, Mentink and Vorst (2003) published a study considering 8 proxies of liquidity: issued amount, listed, euro, on the run, age, missing prices, yield volatility, number of contributors and yield dispersion. Because these authors tested an extensive list of proxies available from previous literature we will discuss in detail the proxies we have selected in our methodology section. We were only able to use some of these proxies based on the availability of the data for the Brazilian debenture market. Differences in the characteristics of the corporate bond and Treasury bond markets such as the non-existence of credit risk in the latter explain why certain proxies have been more used in certain markets. Based on an overview of these proxies from the same authors, we can see that the on the run criteria has been almost exclusively used for the Treasury bond market by Elton and Green (1998), Fleming (2002) and Jankowitsch et al. (2002) and Howeling, Mentink and Vorst (2003). This proxy is easier to

implement for the Treasury bond market in which there are more off the run and on the run bonds presenting similar characteristics. Other characteristics such as issued amount and age have been considered by many academics for both corporate and treasury bonds. We note that both the listed proxies and number of contributor proxies have not been widely used in the bond liquidity literature. The listed criterion has been used by Alexander et Al. (2000) in the overview performed by P. Howeling et al. (2005) and the number of contributors has been used by Gehr and Martell (1992) and Jankowitsch et al. (2002).

There have been different models used to identify proxies for liquidity in the bond market based on the type of bonds analyzed and the objective of the research.

For Government bonds, the models used to calculate liquidity premiums are less complex as these bonds are risk free (no need to control for credit risk), and price data is easily available. Three main models that have been used in the literature to control for interest risk are :1) Creation of pairs of zero coupon bond with the same maturity , 2) Triplets of coupon bonds with suitable bond weights 3) Yield difference between off the run bond and on the run bond.

For corporate bonds the most common approach is to regress yields of individual corporate bonds on different ranges of indicators for interest rate, credit risk and liquidity. Studies that have used this method include Diaz and Navarro (2002), Elton et al. (2000), Mullineaux and Roten (2002), and Giacomoni and Sheng (2013). Because of the credit risk factor and the smaller number of bonds per issuer the approaches used in the treasury bond market of matching bonds by issuer is rarely used and only Crabbe and Turner (1995) was able to successfully use this approach.

## 2.2 Brazilian Bonds

In Brazil, the main academic articles have focused on the current status of debt capital market, liquidity in the ADR Market, characteristics of corporate bond under adverse economic environment as well as rating effect on credit spread.

Park (2012) describes the development of Brazilian capital markets in the last 10 years such as the improvement in diversity of the investor base and diversity in the type of securities. He also mentions the challenges faced such as the short term indexation as well as the low liquidity in the secondary market. Indeed he mentions the fact that over 90% of the bonds are linked to the

DI rate and that the turnover ratio in government bonds is one of the lowest in Brazil (0.90x in Brazil vs 15.24x in the US and 6,23x in the U.K). The indexation of the majority of bonds to the DI rate and short term maturities of local bonds implies less change in price when a change in interest rate occurs and therefore less active trading. The solution the author mentions to continue improving local capital markets is to manage the role of BNDES that provides an unfair "below market rate" long term financing option to corporations, reforms to insure macro stability and a continued focus to shift the yield curve.

Rodrigues (1999) studied the liquidity effect of ADR on the onshore equity market of Brazilian companies. The sample included 37 shares that had sufficient liquidity one year before the ADR listing and one year after the listing to perform the study. The results showed for example that liquidity improved by 25% for stock with ADR program. The author explained that by issuing ADRs companies have to be more transparent, abide to stricter accounting rules which in turn increases the visibility. Another explanation is that brokerage fees tended to decrease due to competition which favors more trading from investors. This article has been included in this literature review as the objective of the study is to similar to mine even though it applies to the equity market. Nevertheless the implications from this study cannot be transferred to the debenture market as an ADR represents a local share or specified number of local share when a bond represents a claim on the assets of the company that is different from the claim of a debenture.

Saito and Al (2004) as well as Filgueira and Leal (2001) studied contractual characteristics of debentures under particular economic circumstances. In the latter, 91 contracts were studied between the beginning of the implementation of the Real plan and 1997 and the results where compared with that of Anderson (1996). The main conclusion from this study were that after the Real Plan there has been less debenture with indexation in local inflation, more debentures with interest based on floating rates and less bonds that include anticipation terms.

Sheng (2005) studied the rating effect on the credit spread of debentures with the objective of understanding better the functioning of the debenture market. Two of the key findings were that ratings affect the spread of all indexed debentures and the origin of the rating agency is not important. This second point is important and goes against White (2001)'s as no difference in credibility between national and international agencies was found. This is especially important as rating agency is crucial to estimate the risk in an emerging market such as Brazil in which the trustworthiness of the information is not evident. Other important parameters that were identified by Sheng include the economic sector and the amount issued. The study also looked at the external environment to understand what external factors could also have an impact on the way investors perceived ratings. They discovered that in unfavorable environment, debentures

with poor ratings suffer much more because investors tend to be more conservatives and there is a preference for lower risk.

Sheng (2005) also studied the effect of standardization of contract to understand differences in contract terms for different ratings. As the CVM was just launching instruction 404 that seeked to simplify the registration process and the terms of contract, Sheng's study really became relevant in the current environment. The methodology used was a binomial test for issues between 1999 and 2001. The difference contract terms that were analyzed included monetary compensation, anticipated redemption, restrictive commitments on dividend, financing and investment. Sheng concluded that there are significant differences amongst covenants for different ratings. For example in the sample 93% of lower grade issues did not have any indexation against 67% for the quality issues, 14% of lower grade issues had restriction for subscription of additional debt against 8% for higher grade issues.

Saito and Sheng (2008) studied the liquidity in the Brazilian debenture market by analyzing 135 debentures between January 1999 and June 2004. Using a stepfoward regression the authors found that size of the issues and certain sectors are proxies of liquidity for the Brazilian market. This finding on size confirms Grabbe and Turner (1995)'s finding that also found a relationship between size and liquidity in the medium term notes market. The proxies tested were Ratings, Size, Initial Maturity, Sector, Listed and Age; all of which are also proxies of Howeling, Mentink and Vorst (2003) with the exception of Maturity and Sector. Adding the sector variable is justified for the Brazilian debt  capital market as the market is not mature and certain sectors have very few issues. For example, the utilities sector and the chemical sector had respectively only 5 and 6 issues in the sample and the lack of choice in some sectors could impact the liquidity. Unlike other studies, that need to control for risk and other variable to determine liquidity premium, this model only focused on determining which bond characteristics best explain direct measure of liquidity such as volume of transaction and number of transaction. The regression was performed for each of the 4 independent variables in the study (number of days of transactions in the last 12 months, number of transactions in the last 12 month, relative volume of transaction in the last 12 months and difference between minimum and maximum price) and a proxy was considered relevant if it was significant in all regressions. One can easily see that in this type of model, the more the number of regression , the harder it will be for a proxy to be considered significant.

Giacomoni and Sheng (2013) studied the impact of liquidity on the expected yield spread of debentures. They analyzed 101 debentures and the results were disappointing as only 3 out of the 7 (42%) liquidity proxies were proven to have a liquidity premium and even for those the premium was quite low (0.17 basis point for every 1000 debenture issued, 1.9 basis point for

every 100 point increase in the bid and ask spread and 0.5 points for an increase of 1% in the nominal value of the issue). One possible explanation is the clientele effect that states that investors with long investment horizon will invest in the less liquid assets while investors with shorter investment horizon will invest in more liquid assets. Interestingly this result goes against the findings from Howeling, Mentik and Vorst (2004) in which 8 proxies out of 9 (88%) were found to have a liquidity premium in the set of European corporate bonds and the liquidity premium was very significant reaching 13 to 23 basis points.

## 2.3 Offshore Bonds

Most studies dealing with international bonds have focused on the reasons that incentive a company to issue a bond outside its domestic market. Most studies have focused on the hedging aspect, the cost incentives as well as the characteristics of these issues.

According to Mendelson (1972) a Eurobond is " an international security floated and traded in an international market". An example of this would be a bond issued by an American company that is available in Europe in the euro currency.

Black and Munro (2010) studied the different reasons that may cause corporate issuers in the Asia Pacific region to issue bond offshore and understand the implications for these local markets. The results was that corporate residents of these countries issue bonds offshore because of the impossibility to access local markets in case of lower ratings, to access foreign investors and to issue longer term debt. Their implications differ from country to country. For example the maturity characteristic is not an indicator of foreign bonds for Japan, Australia and Singapore where establish pension funds provide demand for long term securities and enable them to be issued on shore. This implies that motivations and relationship between on shore and offshore bond are country specifics and can depend on many factors such as the maturity of local capital markets as well as the type of currency.

McBrady and Shill (2002) mention price arbitrage as another reason that would push investors to invest in foreign bonds. According to the results of their study active borrowers with no reason to borrow in another currency could gain between 5 and 19 basis points by borrowing in multiple countries. To test this hypothesis the authors only selected within their sample agencies and sovereign government that have only cash inflow in local currency and that therefore have no apparent reason to borrow in another currency. One of the stunning examples provided by the authors is the case of Fannie Mae that operates exclusively in the US housing market and

that nevertheless seeks to benefit from funding opportunities in diverse regions. A conclusion of the paper is that for firms to take part in such actions the traditional assumption interest rate parity must not hold.

Pimentel (2006) also mention that Brazilian firms use offshore bonds to issue longer maturity bonds. Nevertheless Gozzi and al (2012) find an opposite result that could come from the sample. Indeed it seems that the sample in Gozzi and al contains markets in which local demand for longer maturity already exists. This again supports the idea that off shore bonds motives vary from country to country.

Another disputed theme is whether offshore bonds are beneficial or complementary to the creation of complete local capital markets. Although beneficial may seem extreme, some authors sustain that both markets are complimentary while other warn about the potential risk. Gozzi and al (2012) for example explain that the fact that most company remain active in the onshore issuance after accessing external market suggests that both market are complementary. Another proof of complementarity used by the same authors is that companies use both market for different type of issuances. Black and Munro (2010) although they recognize the potential benefit of having competition from offshore markets to improve the efficiency and regulatory environment, also mention the fact that there is a risk of liquidity concentration offshore due to network externalities. Indeed the author mentions that offshore segment usually is composed of high quality bonds that are essential to developing lower grade segments of local markets.

In Brazil, authors have also studied motivations for Brazilian corporations to issue abroad as well as identification of opportunities for investors in bonds.

Nunes (2014) analyzed returns of Brazilian debentures and bonds from 2004 until 2013 to determine if on average one type of security is more interesting for investment than the other after controlling for interest, exchange rate and differences in maturity. Interestingly the result is that on average Brazilian offshore bonds provide yields 164 to 197 basis points higher than the local market. The potential reasons brought up by the author include that investors have more choices in more complete offshore markets and that therefore corporations need to pay a premium to attract those investors. Another argument is that the lack of competition amongst investment bank that structure debentures in Brazil is so limited that the issuing costs are higher and therefore there is less upside transferred to the investor. To explain why no one takes advantage of the price discrepancy the author mentions, lack of knowledge, cost of transaction as well as the preference from Brazilian investors for less volatility in their investments. One important point to note about this study is that it only took into account the point of view of the investor. Unfortunately, the point of view of the issuer could not be taken into account as the issuance cost is not easily accessible for Brazilian market.

Pimentel (2006) performed an explorative study on the characteristics of Eurobonds issued by Brazilian companies between 2002 and 2005. His findings show that Brazilian companies that issue bond in the international market on average show higher leverage, higher fixed assets, and longer term nevertheless the conclusions are only applicable to the sample studied. The date of the study should be taken into consideration as the maturity of bonds has constantly increased since 2006 and Brazilian companies are now able to issue longer term debentures on shore.

Unlike the analyses of Black and Munro and McBrady and Shill that seek motives for issuing Eurobonds my analysis will be more similar to that of Sheng that looks for proxies of liquidity.

# 3 METHODOLOGY

## 3.1 Description of the variables

This section describes and justifies the choice of dependent and independent variables used in the regression analysis to determine the variables that are best at indicating liquidity in the Brazilian debenture market. Our analysis applies Sheng's methodology (2004) to analyze a set of debenture active between January 2010 and January 2014. An additional binary variable "Eurobond" is added to understand the potential liquidity link between Eurobond and debenture.

### 3.1.1 Dependent variables

Many dependent variables used in American as well as European academic papers could not be chosen in this study due to the specificities of the Brazilian market and the lack of transactions.

### 3.1.2 Volume traded (AV)

This number represents the volume in R$ for debentures and US$ for Eurobonds that have occurred during the period 2010-2014. Intuitively, the bigger the amount traded the more liquid it is. Sheng (2008) used this dependent variable to analyze liquidity in the debenture market.

### 3.1.3 Number of transactions (NT)

This dependent variable represents the total number of overall transactions that occurred over the 2010-2014 period. As an example, the identification code (Cusip) 91912EAA3(NT) represents the number of transactions that occurred for Vale Sa Eurobond. The more transactions there are of a bond, the more liquid it is.

## 3.2 Independent variables

In this section, we discuss the variables that we will test to determine proxies for liquidity in the debenture market. One major difference in our study will be the inclusion of the binary variable Eurobond. Eurobond to our knowledge has never been used before to study corporate bonds liquidity. One of the reasons we chose to include this variable comes from Sanvicente (2001) findings on ADR and stock liquidity. We believe that a similar relationship could exist between Eurobonds and debenture. We have selected our variables to be tested based on proxies used in the empirical bond liquidity literature showed in the table 1. Based on the specificities of the Brazilian market, the availability of information for Trace bonds and the need to have consistent independent variables for all samples, we will not include some parameters that are listed below such as yield volatility, number of contributors and on the run bond in our independent variables.

We have considered active Eurobonds bonds when inputing the binary variable Eurobond for sample 1 and 2.Unlike ADR's, debenture can have more than 1 active Eurobond trading at the same time and a company can issue more than one debenture at the same time. Because the variable Eurobond is binary the variable will not indicate if one particular debenture has more than one Eurobond active at the same time. (Both will have 1 for Eurobond). We therefore assume that there will not be additional impact if a debenture has more than one Eurobond.

To collect the information for independent variables we had to use unique identifiers. For debentures the asset code provided by Anbima is unique to each debenture series. For example BRML11 represents the 1$^{st}$ serie of a debenture issued by BR Malls and BRML 12 represents the 2$^{nd}$ series of that debenture.

### 3.2.1 Rating (Rcp)

Rating reflects the probability of an issuer to default on the bond he has issued. Ratings agencies use two systems International ratings and National local ratings (for countries in which sovereign ratings are below 'AAA' which is the case of Brazil). Local ratings are only comparable with local ratings from the same country.

According to Sheng (2008) Brazilian investors are likely to trade more debentures with good ratings (and less risk) and therefore they should be more liquid. As there is more than one rating agency that grades the bonds we will use in order of preference the most reputable agency when there is a difference in the grading. (The table 1 below presents the equivalences of ratings between the rating agencies). A bond with AAA rating will have a grade of 16 in our scale. Rating being an ordinal qualitative variable it is possible to assign values to each rating to be able to use this proxy in the regression. This methodology has also been used by Sheng (2008) in which the authors converted the rating agency scale in a new scale from 1 to 10.

A con of this methodology is that it does not consider bonds that change rating during the period, nevertheless this simplifies the collection of the data as it would be very tedious to check for changes in rating for each debentures.

Table 1 Value allocated to Rating Agency Grades

| | S&P | Fitch | Moodys | Value |
|---|---|---|---|---|
| Investment Grade | AAA | AAA | Aaa | 16 |
| | AA+ | AA+ | Aa1 | 15 |
| | AA | AA | Aa2 | 14 |
| | AA- | AA- | Aa3 | 13 |
| | A+ | A+ | A1 | 12 |
| | A | A | A2 | 11 |
| | A- | A- | A3 | 10 |
| | BBB+ | BBB+ | Baa1 | 9 |
| | BBB | BBB | Baa2 | 8 |
| Junk Bonds | BBB- | BBB- | Baa3 | 7 |
| | BB+ | BB+ | Ba1 | 6 |
| | BB | BB | Ba2 | 5 |
| | BB- | BB- | Ba3 | 4 |
| | B+ | B+ | B1 | 3 |
| | B | B | B2 | 2 |
| | B- | B- | B3 | 1 |

### 3.2.2 Size of the issue (size)

This independent variable measures the size of the issuance in Reais for debentures and US$ for Eurobonds. According to Crabbe and Turner (1995) as well as John; Lynch and Puri (2003), a bigger issue translates into more liquidity because more information is available to the investors and more investors have analyzed the issues. Another argument from Amihud and Mendelson (1991) is that the size of the issue matters in portfolio strategy as smaller issues are more likely to get locked in buy and hold strategy.

### 3.2.3 Initial Maturity of Security

The initial maturity is defined as the total years of the debenture contract. Instead of grouping the bonds in categories such as long maturity, medium maturity and short term maturity we will simply put the amount of years. For example, 10 will be a debenture whose initial maturity is 10 years. We expect that securities with longer maturities will be more liquid. Sarig and Warga (1989) have argued that the the longer the maturity the bigger the liquidity premium.

### 3.2.4 Type of issuers

We will create dummy variables for each sector of type of issuers. The list of sectors is the following: Concession, Telecom, Other, Energy, Real estate, Financial and Other. The same methodology as in Sheng (2012) will be used which is allocate a value of 1 if the company is part of the sector and 0 if not. We expect the sectors with the most debentures to be more liquid as more choices for investors should translate in additional liquidity.

### 3.2.5 Eurobonds

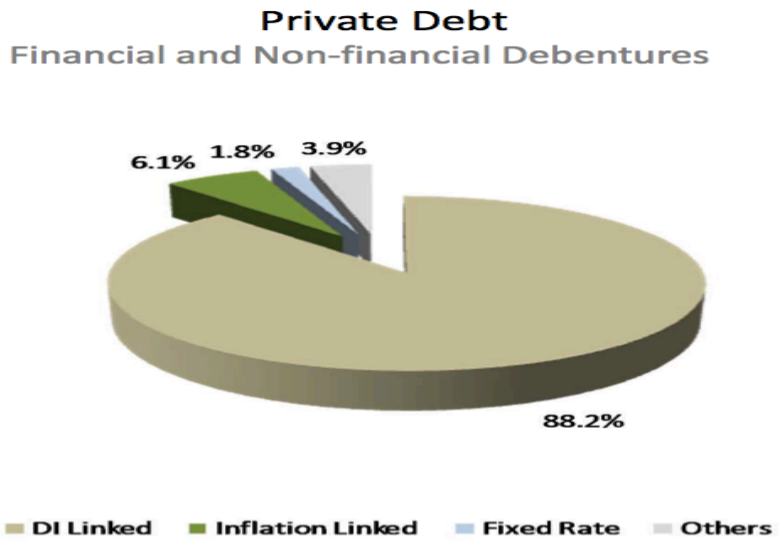
Similarly to Type of Issuers this variable is binary which means we will indicate as 1 if the company has issued a Eurobond in US$ during the 2010/2014 period. We will create a dummy variable: 1, if the issue has a Eurobond, 0 if it does not. Our hypothesis is that an issue that has a Eurobond is associated with more liquidity.

## 3.3 Selection of the samples

For debentures, we collected information on the corporate bonds that were listed on the National System of Debentures platform issued between January 1995 and January 2014. From this list we only selected DI indexed on the “taxa de deposito interbancario”, IPCA and IGPM indexed on the “indice geral de preços de Mercado that were actively traded during the January 2010-2014 period.

We chose to select DI, IPCA and IGPM bonds as these bonds are the most popular amongst investors and represent the majority of the private debt. According to the CVM, DI linked instrument represented 88.2% of all the debentures available.

**Table 2 : Source Ministry of Finance (January 2013)**




Each bond has a specific code such as ACEC11, which is a debenture of the company Aceco TI S/A. We then use the code of these bonds to download the trading information from 2010 to 2014.

To collect the Eurobond information we used the Bond search function in Bloomberg (SRCH). We entered the following criteria in our search:

- Country of risk: Brazil
- Trace Eligible: Yes
- Active: 01/01/2010 – 01/01/2014 Period

From the information obtained on Anbima and Bloomberg we then created a set of 2 samples. Sample 1 (debenture in terms of volume) and sample 2 (debenture in terms of number of trades)

### 3.5 Selection of the characteristics of our debentures

This section describes the method we will use to evaluate which independent variables are best at explaining liquidity.

### 3.5.1 Correlation

We performed parametric test (Pearson Correlation) to evaluate the correlation between the independent variables and will consider correlation a problem only if it reaches 0.70 or more. According to Anderson and Sweeney (2007) correlations below the 0.70 levels do not indicate multicollinearity issues likely to have a negative impact our regression model.

### 3.5.2 Regression analysis

For each dependent variable we will perform a linear regression with all the variables tested to have a sense of the p values of the independent variables.

A P value smaller than the confidence level means that the hypothesis that the coefficient is equal to 0 (no effect) is less than 10%. We will consider significant the independent variables that have have P value below 10%.

The multiple regression model takes on the following form:

$$Y = \mathrm{x0} + ax1 + bx2 + cx3 + dx4$$

Y: Dependent variable

A, B, C: Coefficient

X1, X2 : Independent variablse

To interpret the predictive power of our models, we will look at the $R^2$ and $R^2$ adjusted to see how well the regression fits with the data. Theoretically if a model had the ability to explain 100% of the variance the observed valued would all fall on the fitted regression line. Adjusted R square will account for the number of variables in the model and will decrease when adding variable that are not related to the dependent variable.

**Table 3 : Summary of Independent Variables to be tested**

| Proxies | Expected Sign | Rationale | Authors |
|---|---|---|---|
| Issued amount (RSmm) | + | Smaller issuers locked in hold strategy | Crabbe and Turner (1995) |
| Initial Maturity | + | The longer the maturity the bigger the liquidity premium | Sarig & Warga (1989) |
| Concession | Unknown | Each sector has a certain degree of liquidity | NA |
| Consumer | Unknown | Each sector has a certain degree of liquidity | NA |
| Energy | Unknown | Each sector has a certain degree of liquidity | NA |
| Financial | Unknown | Each sector has a certain degree of liquidity | NA |
| Other | Unknown | Each sector has a certain degree of liquidity | NA |
| Real Estate | Unknown | Each sector has a certain degree of liquidity | NA |
| Telecom | Unknown | Each sector has a certain degree of liquidity | NA |
| Rating | Positive | Fragile institutions should give incentives for investors to trade more secure debentures | Sheng (2008) |
| Eurobond | + | New variable never tested before | NA |

**Source: Author**

# 4 ANALYSIS

## 4.1 Descriptive analysis of samples

### 4.1.1 Descriptive analysis of Debenture sample 1

The first sample is composed of the 50 most active debentures by volume traded in 2010, 2011, 2012 and 2013 and contains 111 debentures that are divided amongst 7 sectors. (The sample only contains 111 debentures and not 200 because some debentures were part of the top 50 most active multiple years and we do not count them twice). The sectors that are most represented are Energy and Concession with 28% and 23% of the issues. If we look at the percentage of debentures whose company also have issued eurobond we see that a vast majority of the sample are also Eurobond issuers, especially the Telecom, Real Estate, and Consumer sector.

Table 4 Summary of Debenture Sample 1

| Type of issuer | Number of issues | Total Volume Issued (R$mm) | Average Initial Maturity | Percentage of Eurobonds | Ratings |
|---|---|---|---|---|---|
| Concession | 26 | 10 647 | 6,3 | 73% | A- |
| Telecom | 12 | 11 426 | 6,8 | 100% | AA+ |
| Other | 13 | 4 217 | 5,4 | 62% | BBB- |
| Energy | 31 | 18 736 | 6,7 | 77% | A |
| Real Estate | 13 | 3 747 | 5,4 | 100% | A- |
| Leasing | 10 | 7 474 | 5,1 | 20% | AA |
| Consumer | 6 | 2 537 | 4,7 | 100% | BBB |
| **Total** | **111** | **58 784** | **-** | **-** | **-** |
| **Weighted Average** | - | - | **6,1** | **76%** | **A** |

Source : Author

According to table 4, the average debenture was traded for a volume of R$ 223 mm had an issue amounting to R$ 529 mm and initial maturity of 6 years with A rating ( A rating according to Fitch and SP which is equivalent to an A1 rating for Moody's). This means that in our sample of liquid debentures, on average, 40% of the volume of the debenture was traded over the 4 year period. This was expected as we selected the 50 most liquid debentures between 2010 and 2014 which had more chances of being large Brazilian companies with international recognition and ability to access foreign capital markets.

Nevertheless, we note that certain sectors such as Leasing and Concession have lower chances of having a Eurobonds than other categories. This could be due to the already existing

possibility of issuing long maturity and large bonds on shore. Indeed we see that the energy and concession sectors had one of the highest initial maturities with 6.7 and 6.8 years respectively.

The highest issued debenture had a value of R$ 4,000 mm. This debenture was a 2006 issue of Vale Doce do Rio company and was the second most traded debenture over the 2010-2014 period just after a debenture from Concessionaria Rodoviaria do Tiete. The lowest issued debenture has a value of R$ 15 mm and was issued by Ouro Verde in 2014. This debenture was amongst the 10 least traded security in our sample over the period 2010-2014.

In terms of initial maturity we see from table 5 a high concentration of debentures that are concentrated below the 5 years range 60.4% and 31.5% between the 5 and 10 year range showing that most debenture are still short to medium term instrument. It is interesting to note that as times goes by the average maturity for debenture in our samples increases as showcased in table 5. The assimetricity is 1, meaning that data is pretty much equally distributed on both side of the mean and median (Table 5).

For issued amount we see a high concentration of issues (89.2%) below R$ 1,000 mm. Only 1 debenture was between the R$ 2000-3000 mm range and only one debenture was between the R$ 3000-4000mm range. These outliers cause the mean to be skewed to the right versus the median and the Asymmetry to be positive at 3.1.The fact that the data is slightly skewed to the right (assimetricity of 3) makes sense as no issue can be negative and some very high issue will tend to push the median to the right of the mean (Table 5).

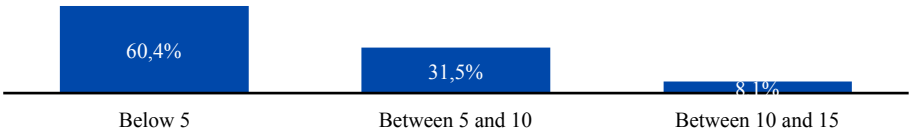
For ratings, we see that all debentures have high local ratings meaning that they have low expectation of default risk relative to all other issuers or obligations in the same country. We note that some debentures had no ratings and therefore the sample size decreases from 111 to 91. 46.15% of these debentures were between AAA and AA and even the most risky debentures remained above the A level. The sectors with the highest ratings are the telecom and energy sector. One of the reason for these high ratings come from the buyers of securities ( Asset Managers and Pension holders) that have very strict restrictions in the type of debenture they can invest. Another reason for high ratings is the fact that the high interest rate in Brazil give little incentives to purchase debenture with more risk given the already high level of return that “close to risk free securities” provide.

Table 5 Descriptive Analysis of Sample 1 (111 debentures)

| Volume Traded (R$) mm | | Issued amount (RSmm) | | Initial Maturity | | Rating | |
|---|---|---|---|---|---|---|---|
| Average | 223 | Average | 530 | Average | 6 | Average | 11 |
| Standard error | 24 | Standard error | 50 | Standard error | 0 | Standard error | 1 |
| Median | 139 | Median | 370 | Median | 5 | Median | 14 |
| Mode | 140 | Mode | 200 | Mode | 5 | Mode | 16 |
| Standard deviation | 140 | Standard deviation | 529 | Standard deviation | 3 | Standard deviation | 6 |
| Sample Variance | 63545 | Sample Variance | 280314 | Sample Variance | 8 | Sample Variance | 32 |
| Kurtosis | 8 | Kurtosis | 16 | Kurtosis | 1 | Kurtosis | 0 |
| Asymmetry | | Asymmetry | 3 | Asymmetry | 1 | Asymmetry | -1 |
| Interval | 1405 | Interval | 3985 | Interval | 14 | Interval | 16 |
| Minimum | 14 | Minimum | 15 | Minimum | 1 | Minimum | 0 |
| Maximum | 1420 | Maximum | 4000 | Maximum | 15 | Maximum | 16 |
| Sum | 24713 | Sum | 58784 | Sum | 673 | Sum | 1274 |
| Count | 111 | Count | 111 | Count | 111 | Count | 111 |

Source: Author

Graph 3 Frequency Distribution for Initial Maturity (Sample 1)



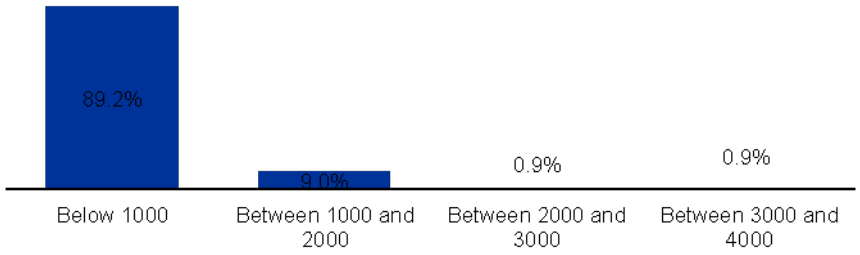

Source: Author

Graph 4 Maturity in function of Year (Sample 1)

| Year | Average maturity |
|---|---|
| 2010 | 4.9 |
| 2011 | 5.2 |
| 2012 | 6.7 |
| 2013 | 7.9 |

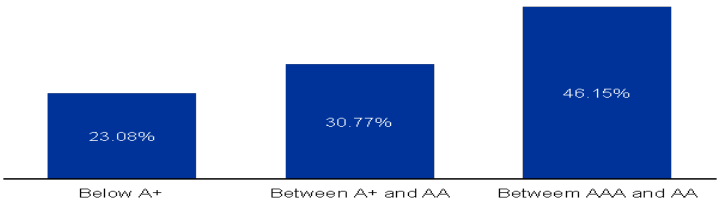
Source: Author

Graph 5 Frequency Distribution for Issued Amount in Million Reais (Sample 1)




Source: Author

Graph 6 Frequency Distribution for Ratings (Sample 1)




Source: Author

### 4.1.2 Descriptive analysis of Debenture sample 2

Sample 2 is composed of the 50 most traded debentures on a yearly basis, based on number of trades and contains 122 debentures that are divided amongst 7 sectors. The sectors that are most represented are the energy and other sectors with 29% and 18% of the issues respectively. The sectors for which there is high percentage of Eurobonds are Telecom, Real Estate and Consumer.

Table 6 Summary of Debenture (Sample 2)

| Type of issuer | Number of issues | Total Volume (R$mm) | Average Initial Maturity | Percentage of Eurobond | Ratings |
|---|---|---|---|---|---|
| Concession | 23 | 9 757 | 7,5 | 83% | AA- |
| Telecom | 12 | 11 508 | 6,1 | 100% | AA+ |
| Other | 22 | 276 799 | 5,5 | 64% | BBB |
| Energy | 36 | 20 484 | 6,2 | 89% | AA- |
| Real Estate | 13 | 305 919 | 5,9 | 100% | A+ |
| Financial | 8 | 6 049 | 5,8 | 25% | AA- |
| Consumer | 7 | 2 374 | 5,6 | 100% | AA- |
| **Total** | **121** | **632 890** | **-** | **-** | - |
| **Weighted Average** | | | **6,2** | **82%** | **A+** |

According to table 7, the average debenture was traded an average of 528 times over the 5 year period, had an issue amounting to R$ 5193 mm and initial maturity of 6.2 years with A+ rating.

According to graph 7 we see that there is an overlap between the sample 1 and sample 2 as securities that trade a lot tend to have high volume. Nevertheless it was necessary to include those 2 samples as a security that trades a lot for a very little volume does not truly represent liquidity neither does a security that trades once for a high volume (In the latter case the holder would only have one “liquidity moment” to sell his stake). According to graph 7 43% of the debentures in this sample were not present in sample 1 which seems significant to potentially alter the results of the regression analysis.

From table 7, we see that the highest volume issued debenture had a value of R$ 303,000 mm. This debenture was a 2010 issue of Camargo Correa. Unlike in sample 1, this security traded very poorly being the 2$^{nd}$ least traded security in terms of numbers of trade. The lowest issued debenture has a value of R$ 60 mm and was a 2009 issue from Energisa Minas Gerais.

Initial maturity showed an asymmetry of 1, meaning the data is pretty much evenly distributed on both sides of the mean.

For issued amount there is again a high concentration of issues 87.7% below R$ 1000 mm. Only 2 debentures are above the R$ 4000 mm threshold while 1 debenture is in both the 2000-3000 range and 3000-4000 range. The asymmetry is very strong, therefore the mean is much more skewed to the right 5193 than the median of 352 (Table 7).

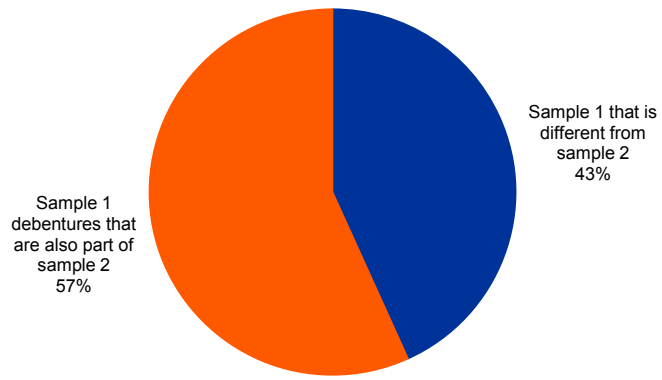
For ratings similar distribution is observed from sample 1 with a slightly lower number of debentures in the 14-16 range (AA-AAA range) and with more debentures below the A+ rating. The distribution was the following: 43.52% between AA-AAA, 28.70% between A+ and AA and 27.78% below A+ (Graph 9.1).

Table 7 Descriptive Analysis of Sample 2 (122 debentures)

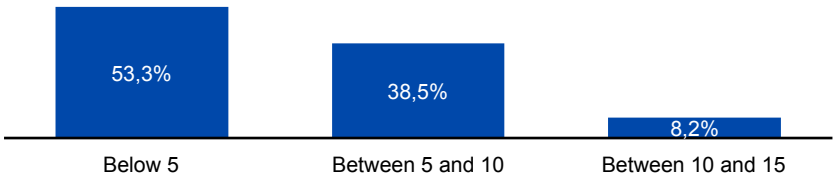
| Number of Trades | | Issued amount (R$mm) | | Initial Maturity | | Rating | |
|---|---|---|---|---|---|---|---|
| Average | 529 | Average | 5,193 | Average | 6 | Average | 12 |
| Standard error | 73 | Standard error | 3,307 | Standard error | 0 | Standard error | 0 |
| Median | 277 | Median | 352 | Median | 5 | Median | 14 |
| Mode | 277 | Mode | 200 | Mode | 5 | Mode | 15 |
| Standard deviation | 803 | Standard deviation | 36,531 | Standard deviation | 3 | Standard deviation | 5 |
| Sample Variance | 644,706 | Sample Variance | 280,314 | Sample Variance | 7 | Sample Variance | 22 |
| Kurtosis | 29 | Kurtosis | 59 | Kurtosis | 1 | Kurtosis | 2 |
| Asymmetry | 5 | Asymmetry | 8 | Asymmetry | 1 | Asymmetry | -2 |
| Interval | 6,515 | Interval | 302,940 | Interval | 14 | Interval | 16 |
| Minimum | 46 | Minimum | 60 | Minimum | 1 | Minimum | 0 |
| Maximum | 6,561 | Maximum | 303,000 | Maximum | 15 | Maximum | 16 |
| Sum | 64,487 | Sum | 633,570 | Sum | 758 | Sum | 1,467 |
| Count | 122 | Count | 122 | Count | 122 | Count | 122 |

Source: Author

Graph 7 Overlap Analysis (Sample 2)

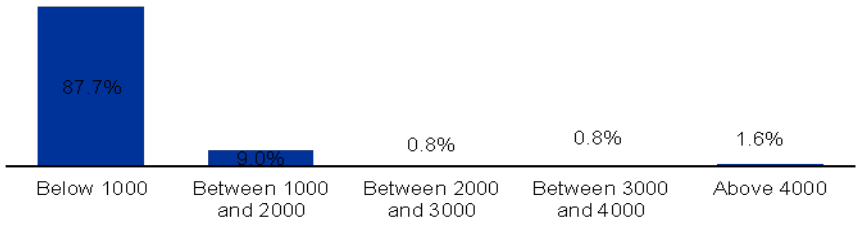



Graph 8 Frequency Distribution for Initial Maturity (Sample 2)



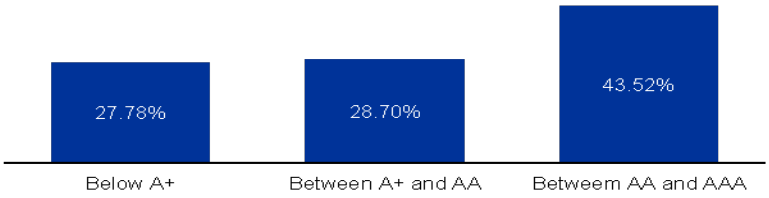

Source: Author

Graph 9 Frequency Distribution for Issued Amount in Million Reais (Sample 2)

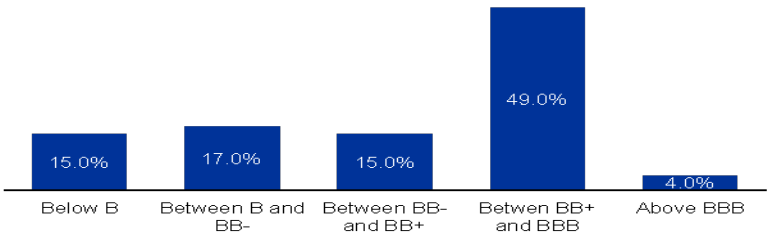



Source: Author

Graph 9.1 Frequency Distribution for Ratings (Sample 2)




Source: Author




Source: Author

## 4.2 Regression analysis

### 4.2.1 Regression of Debenture sample 1

Table 8 Correlation Matrix (Sample 1)

| | Issued amount | Initial Maturity | Concession | Consumer | Energy | Financial | Other | Real Estate | Telecom | Rating | Eurobond |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Issued amount | 1,00 | | | | | | | | | | |
| Initial Maturity | 0,05 | 1,00 | | | | | | | | | |
| Concession | -0,13 | 0,05 | 1,00 | | | | | | | | |
| Consumer | -0,05 | -0,12 | -0,13 | 1,00 | | | | | | | |
| Energy | 0,09 | 0,14 | -0,34 | -0,15 | 1,00 | | | | | | |
| Financial | 0,13 | -0,10 | -0,17 | -0,08 | -0,20 | 1,00 | | | | | |
| Other | -0,13 | -0,07 | -0,19 | -0,08 | -0,22 | -0,11 | 1,00 | | | | |
| Real Estate | -0,17 | -0,09 | -0,20 | -0,09 | -0,23 | -0,11 | -0,13 | 1,00 | | | |
| Telecom | 0,28 | 0,08 | -0,19 | -0,08 | -0,22 | -0,11 | -0,12 | -0,13 | 1,00 | | |
| Rating | 0,29 | 0,16 | 0,10 | -0,15 | 0,04 | 0,14 | -0,34 | -0,12 | 0,24 | 1,00 | |
| Eurobond | 0,14 | 0,07 | -0,10 | 0,12 | 0,06 | -0,32 | -0,12 | 0,18 | 0,17 | 0,13 | 1,00 |

Before performing our regression analysis we checked for any multicollinearity amongst the independent variables (Table 8). This test is important as it shows if a relationship exists amongst the independent variable that could damage the interpretation of the model. For example if independent variable x1 is highly correlated to another variable x2 it is harder for us to predict the effect that one unit change in x1 will have on y as x1 will also impact x2. By looking at the table below, we see that rating and issued amount have a correlation of 0.29 which is relatively low. According to Anderson and Sweeney (2007) correlations below the 0.70 levels do not indicate multicollinearity issues likely to have a negative impact our regression model.

We then performed a regression analysis that includes all the independent variables (Table 8). The independent variables are Issued amount, Initial Maturity, Concession, Consumer, Energy, Financial, Other, Real Estate, Retail, Telecom, Utilities, Rating and Eurobonds. In this raw model the $R^2$ is 0.59 and the $R^2$ adjusted is 0.54 meaning that knowing X will help predict Y up to 54%.

Table 9 Regression Multiple (Sample 1)

| Regression Statistics | |
|---|---|
| *R* | 0,77 |
| *R square* | 0,59 |
| *R square adjusted* | 0,54 |
| *Standard Error* | 170,40 |
| *Sample size* | 111,00 |

| | Coefficients | Standard Error | Stat t | P Value | H0 Rejected |
|---|---|---|---|---|---|
| **Interception** | -103,404 | 179,998 | -0,574 | 0,567 | |
| **Issued amount (RSmm)** | 0,341 | 0,034 | 9,951 | 0,000 | *** |
| **Initial Maturity** | 21,758 | 5,824 | 3,736 | 0,000 | *** |
| **Concession** | 139,833 | 174,983 | 0,799 | 0,426 | |
| **Consumer** | -39,999 | 184,978 | -0,216 | 0,829 | |
| **Energy** | 16,352 | 174,853 | 0,094 | 0,926 | |
| **Financial** | 24,153 | 182,714 | 0,132 | 0,895 | |
| **Other** | 6,720 | 179,606 | 0,037 | 0,970 | |
| **Real Estate** | -14,976 | 177,329 | -0,084 | 0,933 | |
| **Telecom** | -32,353 | 180,172 | -0,180 | 0,858 | |
| **Rating** | -8,319 | 3,379 | -2,462 | 0,016 | ** |
| **Eurobond** | 95,025 | 46,161 | 2,059 | 0,042 | ** |

| **Ho Rejected** | |
|---|---|
| **< 0.01** | *** |
| **<0,05** | ** |
| **<0,1** | * |

Source: Author

The coefficient of this regression were negative for certain economic sectors as well as ratings suggesting these variables have a negative relationship with the dependent variable. The negative relationship with the variable rating goes against the belief that investors tend to trade safer brazilian securities due to the the fragility of the institutions and the higer level of risk. In Sheng´s study (2004), ratings were expected to have a positive relationship with liquidity even though the link was not significant in any of the regression at the 5% level. Initial maturity, Issued amount, certain economic sectors as well as Eurobond had a positive relationship with the dependent variable. These positive signs are consistent with the work from previous authors. Amihud and Mendelson (1991) as well as Crabbe and Turner (1995) have both provided argument for this positive coefficient. The first argument being linked to the likelihood of smaller issues being locked in a portfolio strategy, the second argument being that smaller issues translate into smaller availably and scrutiny of information. The Eurobond sign of the coefficient confirms our intuition that having a eurobond brings additional liquidity to the local debenture.

From Table 9 we observe that majority of independent variables have P values considerably above the 0.1 level. Rating and Eurobond are significant at the 0.05 level whereas Initial maturity and concession are only significant at the the 0.1 level.

The interpreation of the results for the significant independent variables are the following:

- A million reais increase in the issued amount the average volume traded increases by R$ 0.34 mm.

- For an increase in 1 year in initial maturity the average volume traded will increase by R$ 22 mm.
- A decrease in 1 point in ratings (A to A-) will increase the average volume traded by R$ 8.3 mm.
- Eurobond that is a binary variable needs to be interpreted in a different way as it does not show the marginal effect of adding one unit. The interpretation for this variable is that a debenture with a Eurobond will have on average R$ 95 mm more volume traded.

Finally we need to check that the model has equal statistical variances (homoscedasticity) and that the residual values of the model are normally distributed. An ideal regression model should have a random dispersion of its residual values. If this is not the case this means there is still some explanatory power that has not been captured by the independent variables.

Graph 10 Breush Pagan and Koenker Tests for Heteroscedasticity (Sample 1)

```
Sample size (N)
  111

Number of predictors (P)
   11

Breusch-Pagan test for Heteroscedasticity (CHI-SQUARE df=P)
   92,072

Significance level of Chi-square df=P (H0:homoscedasticity)
    ,0000

Koenker test for Heteroscedasticity (CHI-SQUARE df=P)
   23,721

Significance level of Chi-square df=P (H0:homoscedasticity)
    ,0140
```

Source: Author

We perform the Breush Pagan and Koenker tests to determine if the homoscedasticity assumption is valid in our sample size. In both cases, the null hypothesis (H0) is that the sample presents homoscedasticity.

For both tests the P values are below 0,1 therefore we reject the null hypothesis which means there is heteroscedasticity issues in our sample. This implies that the standards errors associated with the beta weights are not accurate and that they need to be recalculated using a more robust regression.

Graph 11 Robust Regression (Sample 1)

```
Criterion Variable
 Vtraded

Model Fit:
       R-sq          F         df1         df2           p
      ,5888    12,0591    11,0000    99,0000      ,0000

Heteroscedasticity-Consistent Regression Results
              Coeff     SE(HC)          t      P>|t|
Constant  -103,2886   620,0838     -,1666      ,8680
Iamount       ,3411      ,0351     9,7238      ,0000
Imaturit    21,7558    11,1391     1,9531      ,0536
Concessi   139,8091   618,4844      ,2261      ,8216
Consumer   -40,0352   619,3748     -,0646      ,9486
Energy      16,3551   618,9165      ,0264      ,9790
Financia    23,9129   620,4198      ,0385      ,9693
Other        6,7236   618,6635      ,0109      ,9914
Realesta   -15,0241   618,2269     -,0243      ,9807
Telecom    -32,5308   621,4914     -,0523      ,9584
Rating      -8,3235     3,7130    -2,2417      ,0272
Eurobond    94,9777    35,1672     2,7007      ,0081
```

Source: Author

Using the robust regression model on SPSS, we observe that the coefficients stay the same but that new (hesterodesticity consistent) standard errors have been calculated. Initial Maturity for example that had a standard error value of 5,8 and a P value of 0,000 now has a (HC) standard error of 11,1 and a P value of 0,0536. At the 10% level we observe that Initial Maturity, Issued Amount, Rating and Eurobond are significant therefore the interpretation of the results still holds.

### 4.2.2 Regression of Debenture (sample 2)

Table 11 Correlation Matrix (Sample 2)

| | *Issued amount (RSmm* | *itial Maturit* | *Concessio* | *Consume* | *Energy* | *Financial* | *Other* | *Real Estate* | *Telecom* | *Rating* | *Eurobond* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Issued amount (RSmm)** | *1,* | | | | | | | | | | |
| **Initial Maturity** | *-0,04693* | *1,* | | | | | | | | | |
| **Concession** | *-0,06318* | *0,23217* | *1,* | | | | | | | | |
| **Consumer** | *-0,03292* | *-0,05827* | *-0,11892* | *1,* | | | | | | | |
| **Energy** | *-0,08224* | *-0,01106* | *-0,31185* | *-0,15963* | *1,* | | | | | | |
| **Financial** | *-0,03231* | *-0,04516* | *-0,12768* | *-0,06536* | *-0,17139* | *1,* | | | | | |
| **Other** | *0,09526* | *-0,12312* | *-0,22608* | *-0,11572* | *-0,30347* | *-0,12425* | *1,* | | | | |
| **Real Estate** | *0,17408* | *-0,03687* | *-0,16646* | *-0,0852* | *-0,22344* | *-0,09149* | *-0,16198* | *1,* | | | |
| **Telecom** | *-0,03844* | *-0,01578* | *-0,1592* | *-0,08149* | *-0,2137* | *-0,0875* | *-0,15492* | *-0,11407* | *1,* | | |
| **Rating** | *-0,32503* | *0,24007* | *0,06412* | *0,05101* | *0,09949* | *0,08285* | *-0,44084* | *-0,0018* | *0,21416* | *1,* | |
| **Eurobond** | *0,06102* | *0,13881* | *0,00804* | *0,11572* | *0,11648* | *-0,39252* | *-0,22364* | *0,16198* | *0,15492* | *0,04312* | *1,* |

The correlation matrix in sample 2 does no suggest any problem with multicollinearity amongst the independent variables as the highest correlation other with rating (-0.44) and Eurobond with Financial are both below the (0.7) level.

Table 12 Regression Multiple (Sample 2)

| Regression Statistics | |
|---|---|
| *R* | 0,50 |
| *R square* | 0,25 |
| *R square adjusted* | 0,17 |
| *Standard Error* | 729,37 |
| *Sample size* | 122,00 |

| | Coefficients | Standard Error | Stat t | P Value | H0 Rejected |
|---|---|---|---|---|---|
| **Interception** | -708,314 | 800,269 | -0,885 | 0,378 | |
| **Issued amount (R$mm)** | -0,001 | 0,002 | -0,663 | 0,508 | |
| **Initial Maturity** | 116,337 | 26,114 | 4,455 | 0,000 | *** |
| **Concession** | 771,160 | 746,663 | 1,033 | 0,304 | |
| **Consumer** | 372,540 | 780,617 | 0,477 | 0,634 | |
| **Energy** | 344,537 | 740,208 | 0,465 | 0,643 | |
| **Financial** | 640,190 | 788,124 | 0,812 | 0,418 | |
| **Other** | 409,580 | 756,880 | 0,541 | 0,590 | |
| **Real Estate** | 294,339 | 758,663 | 0,388 | 0,699 | |
| **Telecom** | 363,784 | 759,902 | 0,479 | 0,633 | |
| **Rating** | -13,642 | 17,217 | -0,792 | 0,430 | |
| **Eurobond** | 284,820 | 201,933 | 1,410 | 0,161 | |

| **Ho Rejected** | |
|---|---|
| **< 0.01** | *** |
| **<0,05** | ** |
| **<0,1** | * |

Source: Author

I again performed a regular regression analysis on sample 2 to observe the coefficients for the dependent variables (Table 12). In this raw model the $R^2$ is 0.25 and the $R^2$ adjusted is 0.17 meaning that knowing X will help you predict only 17% of Y.

In this second regression the indepedent variable rating had negative relationship with the dependent variable. The independent variable Issued amount althought it has a very low coefficient of -0,001 has a negative coefficient in regression 2 which goes agains the findings from the existing litterature review. All the other independent variables had positive relationship with the number of trade variable, including Telecom, Real Estate and Consumer that had negative signs in regression 1.

From Table 12, we observe that only the variable initial maturity is significant at the 0.1 level and no variables has any significance at the 0.05 or 0.01 level. The interpreation of the results for the significant independent variable is the following:

- An increase in one year of Initial Maturity increases the number of trades by 116.

We again check for any heteroskedasticity issues and non normal distribution of residual values in table 13.

Table 13 Breush Pagan and Koenker Tests for Heteroscedasticity (Sample 2)

```
Sample size (N)
  122

Number of predictors (P)
   11

Breusch-Pagan test for Heteroscedasticity (CHI-SQUARE df=P)
  204,549

Significance level of Chi-square df=P (H0:homoscedasticity)
    ,0000

Koenker test for Heteroscedasticity (CHI-SQUARE df=P)
   22,074

Significance level of Chi-square df=P (H0:homoscedasticity)
    ,0238
```

Source: Author

For the second time, the P values of both tests are below 0,1 therefore we again reject the null hypothesis which means there is heteroscedasticity issues in our sample. This implies that the standards errors associated with the beta weights are not accurate and that they need to be recalculated using a more robust regression.

Table 14 Robust Regression (Sample 2)

```
Criterion Variable
 Ntrades

Model Fit:
       R-sq          F        df1         df2          p
      ,2499      ,9231    11,0000   110,0000      ,5211

Heteroscedasticity-Consistent Regression Results
              Coeff     SE(HC)          t      P>|t|
Constant  -708,3143   879,9359     -,8050      ,4226
Iamount      -,0013      ,0029     -,4479      ,6551
Imaturit   116,3375    55,0175     2,1146      ,0367
Concessi   771,1603   846,4473      ,9111      ,3643
Consumer   372,5398   808,6943      ,4607      ,6459
Energy     344,5370   811,2019      ,4247      ,6719
Financia   640,1904   833,9724      ,7676      ,4443
Other      409,5796   815,6927      ,5021      ,6166
Realesta   294,3388   818,3863      ,3597      ,7198
Telecom    363,7841   830,5090      ,4380      ,6622
Rating     -13,6417    13,2114    -1,0326      ,3041
Eurobond   284,8205   114,5408     2,4866      ,0144
```

From this new robust regression we observe that the majority of standard errors have increased as well as the p values. For example Consumer that had a standard error of 780 and a P value of 0,634 now has a (HC) standard error of 808 and a P value of 0,64. As one can see, with the increase in P values in most cases the robust regression makes it harder for an independent variable to be significant in the regression. At the 10% level we observe that Initial Maturity and Eurobond are significant. This differs from the multiple regression in which only Initial maturity was significant.

In most cases, robust standard errors and robust p values tend to be higher than in the non robust regression. However, in cases in which the variance of the error terms tends to be lower when x is far from its mean, standard error will tend to be large and robust standard errors will tend to be smaller than standard errors.

## 4.3 Analysis of Results

### 4.3.1 Results from the regression analysis

First it is important to clearly understand the limitations of the analysis to have a better understanding of the overall results.

The first limitation has to do with the selection of the sample. In this work, I have selected my sample based on the 50 most liquid debentures on an annual basis, therefore we can say that the results only are applicable to the most liquid securities and the proxies found after performing our regression analysis will not be helpful in explaining increase in liquidity for securities that trade once or twice per year. This first limitation has also an implication on the significance of the binary variable Eurobond. As seen in table 1 and 6 the proportion of our sample that also have Eurobonds is very high.

Table 15 Summary of Results of the Robust Regression Analysis

| | Regression 1 | Signs of Independent Variable | Regression 2 | Signs of Independent Variable |
|---|---|---|---|---|
| Initial Maturity | Yes | + | Yes | + |
| Issued Amount | Yes | + | No | - |
| Eurobond | Yes | + | Yes | + |
| Rating | Yes | - | No | - |
| R Square | 0,58 | | 0,25 | |

Source: Author

Table 15 summarizes the results for the 2 regressions we performed. For the debentures, regression 1 (based on volume traded) there were 4 statistically significant independent variables (Initial Maturity, Eurobond, Rating and Issued Amount) versus two for regression 2.

We note that the $R^2$ in regression 2 is much lower than in regression 1 which has a high predictive value of 58%.

Comparing the results of this research with that of Sheng (2008), we observe that issued amount is confirmed as a good liquidity proxy and that hypothesis that having a Eurobond enables the debenture to gain in attractivity and expand its investor base. This result converges with the relationship found by Sanvicente (2001) between liquidity and ADR's and more work could be done to understand the causes of this relationship.

The results of this study should be helpful for investors looking for tools to analyze liquidity of debentures and understanding the impact of Eurobonds on liquidity. Corporations should also benefit from the results of this study as they should start considering the positive effect of issuing Eurobond on their debentures when deciding to raise capital.

## 5 Conclusions

To conclude, the relationship between initial maturity, issued amount, Eurobond, rating and liquidity was confirmed although only Initial maturity and Eurobond were significant in both regressions.

From our results it seems that investors have a clear preference for debentures that have Eurobonds, as it was significant in both robust regressions. (In robust regression 1 at the 1% confidence level and in robust regression 2 at the 5% confidence level). Having access to the investor base of the bonds would be very helpful in understanding the overlap that exists between holders of Eurobonds and holders of debentures for the same company. This information could explain if the increase in liquidity is due to interest from new investors.

Secondly, our results seem to indicate that the Eurobond market is complimentary and beneficial to the local Brazilian debenture market. This goes against the view that Eurobonds could be harmful to the development of the local debenture market by taking away liquidity.

Another important point is that our results only show characteristics that help explain liquidity in the debenture market. From our results we cannot make conclusions for the liquidity premiums of the dependent variables.

Our findings for the Eurobond proxy could lead to the following future research:

- Does the positive relationship between Eurobond and liquidity also applies to less liquid debentures ?

- Does the time of the issue of Eurobond matter ? ( Does it the issue need to be recent, does the issue of Eurobond need to be before the debenture)
- Does this relationship also exist in other developing countries.

# 6 REFERENCES

Alexander, G. J., Edwards, A. K., & Ferri, M. G. (2000). The determinants of trading volume of high-yield corporate bonds. *Journal of Financial Markets*, *3*(2), 177-204.

Amihud, Y., & Mendelson, H. (1991). Liquidity, asset prices and financial policy. *Financial Analysts Journal*, 56-66.

Anderson, R. W., & Sundaresan, S. (1996). Design and valuation of debt contracts. *Review of financial studies*, *9*(1), 37-68.

Black, S., & Munro, A. (2010). Why issue bonds offshore?. *Thursday 6 August 2010*, 97.

Chordia, T., Roll, R., & Subrahmanyam, A. (2008). Liquidity and market efficiency. *Journal of Financial Economics*, *87*(2), 249-268.

Chordia, T., Sarkar, A., & Subrahmanyam, A. (2005). An empirical analysis of stock and bond market liquidity. *Review of Financial Studies*, *18*(1), 85-129.

Crabbe, L. E., & Turner, C. M. (1995). Does the liquidity of a debt issue increase with its size? Evidence from the corporate bond and medium-term note markets. *The Journal of Finance*, *50*(5), 1719-1734.

Diaz, A., & Navarro, E. (2002). Yield spread and term to maturity: default vs. liquidity. *European Financial Management*, *8*(4), 449-477.

Elton, E. J., & Green, T. C. (1998). Tax and liquidity effects in pricing government bonds. *The Journal of Finance*, *53*(5), 1533-1562.

Elton, E. J., & Gruber, M. J. (2000). Corporate Bonds.

Filgueira, A., & Leal, R. (2001). An analysis of Brazilian bond indentures after the economic stabilization. *An analysis of Brazilian bond indentures after the economic stabilization*.

Fleming, M. J. (2002). Are larger treasury issues more liquid? Evidence from bill reopenings. *Journal of Money, Credit and Banking*, 707-735.

Gehr Jr, A. K., & Martell, T. F. (1992). Pricing efficiency in the secondary market for investment-grade corporate bonds. *The Journal of Fixed Income*, *2*(3), 24-38.

Giacomoni, B. H., & Sheng, H. H. (2013). The impact of liquidity on expected returns from Brazilian corporate bonds. *Revista de Administração (São Paulo)*, *48*(1), 80-97.

Gozzi, J. C., Levine, R., Peria, M. S. M., & Schmukler, S. L. (2012). *How firms use domestic and international corporate bond markets* (No. w17763). National Bureau of Economic Research.

Houweling, P., Mentink, A., & Vorst, T. (2005). Comparing possible proxies of corporate bond liquidity. *Journal of Banking & Finance*, *29*(6), 1331-1358.

Jankowitsch, R., & Pichler, S. (2002). Parsimonious estimation of credit spreads. *Available at SSRN 306779*.

Mahanti, S., Nashikkar, A., Subrahmanyam, M., Chacko, G., & Mallik, G. (2008). Latent liquidity: A new measure of liquidity, with an application to corporate bonds. *Journal of Financial Economics*, *88*(2), 272-298.

Mendelson, M. (1972). THE EUROBOND AND CAPITAL MARKET INTEGRATION*. The Journal of Finance, 27(1), 110-126.

Mullineaux, D. J., & Roten, I. C. (2002). Liquidity, Labels and Medium-Term Notes. *Financial Markets, Institutions & Instruments*, *11*(5), 445-467.

Park, J. (2012). *Brazil's capital market: Current status and issues for further development*. International Monetary Fund.

Pimentel, R. C. (2006). *O mercado de eurobonds e as captações brasileiras: Uma abordagem empírico-descritiva* (Doctoral dissertation, Universidade de São Paulo).

Sheng, H. H., & Saito, R. (2008). Liquidez das debêntures no mercado brasileiro. *Revista de Administração*, *43*(2), 176-185.

# 7 APPENDIXES

## 7.1 Appendix 1: Sample 1 Debenture

| Code | Volume Traded (R$mm) | Issued amount (R$mm) | Initial Maturity | Sector | Rating | Eurobond | Issued Year |
|---|---|---|---|---|---|---|---|
| CVRD27 | 1365 | 4000 | 7 | Energy | 16 | 1 | 2006 |
| TNLE15 | 750 | 1754 | 4 | Telecom | 16 | 1 | 2010 |
| CVRD17 | 576 | 1500 | 4 | Energy | 16 | 1 | 2006 |
| ITSP22 | 506 | 749 | 5 | Financial | 16 | 0 | 2007 |
| BRTO29 | 434 | 1600 | 8 | Telecom | 16 | 1 | 2012 |
| TLNL11 | 411 | 1620 | 5 | Telecom | 16 | 1 | 2006 |
| TAEE33 | 400 | 702 | 12 | Energy | 16 | 1 | 2012 |
| VIVO24 | 396 | 640 | 10 | Telecom | 16 | 1 | 2009 |
| ANHB14 | 356 | 965 | 5 | Concession | 16 | 1 | 2012 |
| TSPP22 | 355 | 800 | 10 | Telecom | 16 | 1 | 2005 |
| ITSP12 | 339 | 751 | 3 | Financial | 16 | 0 | 2007 |
| AMBV21 | 304 | 1248 | 6 | Consumer | 16 | 1 | 2006 |
| TAEE13 | 272 | 665 | 5 | Energy | 16 | 1 | 2012 |
| TLNL24 | 211 | 2035 | 3 | Telecom | 16 | 1 | 2009 |
| TAEE23 | 208 | 793 | 8 | Energy | 16 | 1 | 2012 |
| BNDP24 | 114 | 610 | 6 | Financial | 16 | 0 | 2009 |
| ECRV11 | 105 | 461 | 4 | Concession | 16 | 1 | 2009 |
| BNDS35 | 99 | 525 | 7 | Financial | 16 | 0 | 2010 |
| BNDP36 | 87 | 1289 | 7 | Financial | 16 | 0 | 2012 |
| VIVO34 | 70 | 72 | 10 | Telecom | 16 | 1 | 2009 |
| ANHB15 | 69 | 450 | 5 | Concession | 16 | 1 | 2013 |
| PETR12 | 61 | 750 | 10 | Energy | 16 | 1 | 2002 |
| BNDP12 | 41 | 500 | 6 | Financial | 16 | 0 | 2006 |
| VIVO14 | 32 | 98 | 10 | Telecom | 16 | 1 | 2009 |
| TLNL14 | 26 | 964 | 2 | Telecom | 16 | 1 | 2009 |
| PETR13 | 19 | 775 | 8 | Energy | 16 | 1 | 2002 |
| TIET11 | 491 | 900 | 5 | Concession | 15 | 1 | 2010 |
| CMTR12 | 484 | 1566 | 2 | Energy | 15 | 1 | 2010 |
| ELSP19 | 299 | 250 | 13 | Energy | 15 | 1 | 2005 |
| SBSP1A | 293 | 810 | 5 | Utilities | 15 | 1 | 2010 |
| TEEP11 | 274 | 491 | 5 | Energy | 15 | 1 | 2009 |
| CMTR33 | 223 | 670 | 10 | Energy | 15 | 1 | 2012 |
| SBSP2A | 203 | 405 | 3 | Utilities | 15 | 1 | 2010 |
| ELSP12 | 187 | 400 | 4 | Energy | 15 | 1 | 2010 |
| TRAC13 | 163 | 600 | 2 | Energy | 15 | 0 | 2009 |

| Code | Volume Traded (R$mm) | Issued amount (R$mm) | Initial Maturity | Sector | Rating | Eurobond | Issued Year |
|---|---|---|---|---|---|---|---|
| IVIA11 | 153 | 308 | 5 | Concession | 15 | 0 | 2010 |
| CMTR23 | 148 | 200 | 7 | Energy | 15 | 1 | 2012 |
| CMTR13 | 112 | 480 | 5 | Energy | 15 | 1 | 2012 |
| GASP23 | 66 | 269 | 5 | Energy | 15 | 1 | 2013 |
| GASP33 | 60 | 142 | 7 | Energy | 15 | 1 | 2013 |
| BPAR22 | 47 | 660 | 2 | Financial | 15 | 1 | 2009 |
| BPAR12 | 14 | 140 | 1 | Financial | 15 | 1 | 2009 |
| ENPP13 | 1108 | 800 | 10 | Energy | 14 | 0 | 2006 |
| TELE28 | 511 | 460 | 7 | Telecom | 14 | 1 | 2008 |
| CCCI12 | 500 | 1000 | 10 | Other | 14 | 1 | 2012 |
| TSAE22 | 442 | 367 | 7 | Concession | 14 | 1 | 2013 |
| VFIN14 | 347 | 1250 | 10 | Financial | 14 | 0 | 2005 |
| TELE18 | 347 | 1150 | 5 | Telecom | 14 | 1 | 2008 |
| IGTA12 | 241 | 330 | 5 | Real Estate | 14 | 1 | 2011 |
| BRPR11 | 197 | 369 | 5 | Real Estate | 14 | 1 | 2012 |
| APAR12 | 161 | 232 | 4 | Energy | 14 | 1 | 2009 |
| AVIA11 | 139 | 285 | 5 | Concession | 14 | 1 | 2010 |
| CMDT33 | 120 | 654 | 12 | Energy | 14 | 1 | 2013 |
| BRPR21 | 79 | 231 | 7 | Real Estate | 14 | 1 | 2012 |
| LSEL16 | 62 | 250 | 2 | Energy | 14 | 1 | 2009 |
| AVIA21 | 61 | 120 | 7 | Concession | 14 | 1 | 2010 |
| RDVT11 | 1420 | 1065 | 15 | Concession | 13 | 1 | 2013 |
| ECOV22 | 739 | 681 | 11 | Concession | 13 | 1 | 2013 |
| CVIA11 | 253 | 286 | 5 | Concession | 13 | 0 | 2010 |
| GEPA14 | 198 | 250 | 5 | Energy | 13 | 1 | 2013 |
| CYRE22 | 192 | 250 | 10 | Real Estate | 13 | 1 | 2008 |
| ECOV12 | 164 | 200 | 7 | Concession | 13 | 1 | 2013 |
| CCRD15 | 92 | 350 | 3 | Concession | 13 | 1 | 2009 |
| ALGA22 | 87 | 233 | 7 | Telecom | 13 | 1 | 2012 |
| VIAN11 | 80 | 154 | 5 | Concession | 13 | 0 | 2010 |
| CVIA21 | 51 | 120 | 7 | Concession | 13 | 0 | 2010 |
| ELTR12 | 49 | 50 | 7 | Energy | 13 | 0 | 2007 |
| SUZB13 | 44 | 333 | 10 | Other | 13 | 0 | 2004 |
| VIAN21 | 33 | 100 | 7 | Concession | 13 | 0 | 2010 |
| AEPA13 | 28 | 190 | 3 | Other | 13 | 1 | 2009 |
| CART12 | 578 | 380 | 12 | Concession | 12 | 1 | 2012 |
| BRML21 | 179 | 270 | 9 | Real Estate | 12 | 1 | 2007 |
| MRVE16 | 141 | 500 | 5 | Real Estate | 12 | 1 | 2012 |
| GFSA18 | 95 | 288 | 5 | Real Estate | 12 | 1 | 2010 |
| VOES13 | 74 | 150 | 4 | Concession | 12 | 0 | 2011 |
| CMDT13 | 73 | 411 | 5 | Energy | 12 | 1 | 2013 |

| Code | Volume Traded (R$mm) | Issued amount (R$mm) | Initial Maturity | Sector | Rating | Eurobond | Issued Year |
|---|---|---|---|---|---|---|---|
| CART22 | 59 | 370 | 12 | Concession | 12 | 1 | 2012 |
| MRVP15 | 46 | 500 | 5 | Real Estate | 12 | 1 | 2011 |
| BISA23 | 42 | 150 | 5 | Real Estate | 12 | 1 | 2011 |
| BISA13 | 30 | 150 | 4 | Retail | 12 | 1 | 2011 |
| SBSP29 | 22 | 120 | 7 | Utilities | 12 | 1 | 2008 |
| HYPE13 | 21 | 201 | 4 | Consumer | 12 | 1 | 2010 |
| SBSP19 | 17 | 100 | 5 | Utilities | 12 | 1 | 2008 |
| DASA12 | 293 | 700 | 5 | Other | 11 | 1 | 2011 |
| ENSE12 | 32 | 60 | 5 | Energy | 11 | 0 | 2009 |
| TRIS11 | 31 | 200 | 5 | Real Estate | 11 | 1 | 2008 |
| OVTL22 | 30 | 15 | 5 | Other | 11 | 1 | 2011 |
| ALLG18 | 263 | 539 | 5 | Other | 10 | 1 | 2011 |
| RDNT12 | 156 | 200 | 5 | Concession | 10 | 0 | 2010 |
| HYPE23 | 48 | 336 | 5 | Consumer | 10 | 1 | 2010 |
| HYPE33 | 32 | 114 | 6 | Consumer | 10 | 1 | 2010 |
| CROD32 | 750 | 750 | 5 | Concession | 0 | 1 | 2011 |
| BNDS25 | 486 | 1000 | 4 | Financial | 0 | 0 | 2010 |
| CROD22 | 479 | 550 | 4 | Concession | 0 | 1 | 2011 |
| LSVE17 | 372 | 650 | 5 | Energy | 0 | 1 | 2011 |
| GLEX13 | 340 | 400 | 3 | Consumer | 0 | 1 | 2012 |
| AMLP33 | 217 | 151 | 5 | Other | 0 | 0 | 2010 |
| LDCS11 | 213 | 600 | 15 | Energy | 0 | 0 | 2009 |
| AMLP23 | 160 | 300 | 4 | Other | 0 | 0 | 2010 |
| CPCO11 | 136 | 165 | 2 | Energy | 0 | 1 | 2009 |
| AMLP13 | 109 | 300 | 3 | Other | 0 | 0 | 2010 |
| OAEP15 | 107 | 209 | 3 | Real Estate | 0 | 1 | 2012 |
| MRSS15 | 73 | 300 | 6 | Other | 0 | 1 | 2012 |
| CPTE11 | 67 | 220 | 12 | Energy | 0 | 1 | 2011 |
| ENMG17 | 66 | 60 | 5 | Energy | 0 | 0 | 2009 |
| AGUT12 | 65 | 400 | 2 | Real Estate | 0 | 1 | 2012 |
| SAEL11 | 62 | 80 | 5 | Energy | 0 | 0 | 2009 |
| ATDC11 | 60 | 90 | 5 | Other | 0 | 1 | 2012 |
| AMLP43 | 48 | 149 | 5 | Other | 0 | 0 | 2010 |
| MRFG23 | 40 | 238 | 4 | Consumer | 0 | 1 | 2011 |
| IRTH11 | 34 | 50 | 4 | Real Estate | 0 | 1 | 2012 |

## 7.2 Appendix 2: Sample 2 Debentures

| Code | Number of Trades | Issued amount (R$mm) | Initial Maturity | Sector | Rating | Eurobond | Issued Year |
|---|---|---|---|---|---|---|---|
| RDVT11 | 6561 | 1065 | 15 | Concession | 13 | 1 | 2013 |
| ECOV22 | 3862 | 681 | 11 | Concession | 13 | 1 | 2013 |
| CART12 | 3356 | 380 | 12 | Concession | 12 | 1 | 2012 |
| CVRD27 | 2424 | 4000 | 7 | Energy | 16 | 1 | 2006 |
| TNLE15 | 2095 | 1754 | 4 | Telecom | 16 | 1 | 2010 |
| CBAN21 | 1590 | 550 | 14 | Concession | 13 | 1 | 2010 |
| CBAN11 | 1561 | 550 | 14 | Concession | 13 | 1 | 2010 |
| BRPR21 | 1555 | 231 | 7 | Real Estate | 14 | 1 | 2012 |
| TPIS24 | 1455 | 392 | 5 | Financial | 0 | 1 | 2012 |
| CMTR33 | 1428 | 670 | 10 | Energy | 15 | 1 | 2012 |
| TIET11 | 1282 | 900 | 5 | Energy | 15 | 1 | 2010 |
| UNDA22 | 1249 | 80 | 5 | Other | 10 | 1 | 2011 |
| TSAE22 | 1180 | 367 | 7 | Concession | 14 | 1 | 2013 |
| BRTO29 | 1089 | 1600 | 8 | Telecom | 16 | 1 | 2012 |
| BNDP36 | 1016 | 1289 | 7 | Financial | 16 | 0 | 2012 |
| LSVE17 | 968 | 650 | 5 | Energy | 0 | 1 | 2011 |
| ENGI25 | 955 | 271 | 7 | Energy | 13 | 1 | 2012 |
| IGTA12 | 881 | 330 | 5 | Real Estate | 14 | 1 | 2011 |
| UNDA12 | 877 | 420 | 5 | Other | 10 | 1 | 2011 |
| ALLG28 | 853 | 271 | 7 | Other | 10 | 1 | 2011 |
| ALLG18 | 843 | 539 | 5 | Other | 10 | 1 | 2011 |
| CMTR23 | 668 | 200 | 7 | Energy | 15 | 1 | 2012 |
| ECOV12 | 652 | 200 | 7 | Concession | 13 | 1 | 2013 |
| TAEE33 | 648 | 702 | 12 | Energy | 16 | 1 | 2012 |
| AMLP33 | 632 | 151 | 5 | Other | 0 | 0 | 2010 |
| DASA12 | 552 | 700 | 5 | Other | 11 | 1 | 2011 |
| LRNE25 | 536 | 80 | 7 | Consumer | 15 | 1 | 2012 |
| HYPE33 | 529 | 114 | 6 | Consumer | 10 | 1 | 2010 |
| BISA22 | 519 | 81 | 6 | Consumer | 12 | 1 | 2010 |
| LRNE14 | 511 | 215 | 5 | Consumer | 15 | 1 | 2011 |
| DVIX11 | 494 | 100 | 4 | Energy | 11 | 1 | 2012 |
| TEEP11 | 493 | 491 | 5 | Energy | 15 | 1 | 2009 |
| SBSP1A | 484 | 810 | 5 | Utilities | 15 | 1 | 2010 |
| VIVO24 | 469 | 640 | 10 | Telecom | 16 | 1 | 2009 |
| CROD22 | 455 | 550 | 4 | Concession | 0 | 1 | 2011 |
| PANA13 | 432 | 250 | 5 | Other | 11 | 0 | 2005 |
| BNDS35 | 407 | 525 | 7 | Financial | 16 | 0 | 2010 |

| Code | Number of Trades | Issued amount (R$mm) | Initial Maturity | Sector | Rating | Eurobond | Issued Year |
|---|---|---|---|---|---|---|---|
| ALLG16 | 397 | 700 | 8 | Other | 10 | 1 | 2006 |
| CMTR12 | 395 | 1566 | 2 | Energy | 15 | 1 | 2010 |
| BRML21 | 386 | 270 | 9 | Real Estate | 12 | 1 | 2007 |
| TAEE23 | 380 | 793 | 8 | Energy | 16 | 1 | 2012 |
| TAES11 | 371 | 345 | 5 | Energy | 15 | 1 | 2010 |
| CVIA11 | 370 | 286 | 5 | Concession | 13 | 0 | 2010 |
| SBESB7 | 360 | 395 | 7 | Utilities | 15 | 1 | 2013 |
| BISA12 | 352 | 285 | 4 | Consumer | 12 | 1 | 2010 |
| FJTA11 | 339 | 103 | 4 | Other | 0 | 1 | 2010 |
| BNDS25 | 339 | 1000 | 4 | Financial | 16 | 0 | 2010 |
| AMLP13 | 337 | 300 | 3 | Other | 0 | 0 | 2010 |
| TSAE12 | 327 | 324 | 7 | Concession | 15 | 1 | 2013 |
| ELSP10 | 313 | 600 | 6 | Energy | 11 | 1 | 2007 |
| SBSP2A | 300 | 405 | 3 | Utilities | 15 | 1 | 2010 |
| AMBV21 | 300 | 1248 | 6 | Consumer | 16 | 1 | 2006 |
| AMLP23 | 299 | 300 | 4 | Other | 0 | 0 | 2010 |
| TRAC13 | 297 | 600 | 2 | Energy | 15 | 0 | 2009 |
| ELSP12 | 294 | 400 | 4 | Energy | 15 | 1 | 2010 |
| TAMM11 | 294 | 500 | 6 | Other | 11 | 1 | 2006 |
| CVRD17 | 282 | 1500 | 4 | Energy | 16 | 1 | 2006 |
| VIAN21 | 281 | 100 | 7 | Concession | 13 | 0 | 2010 |
| IGTA11 | 278 | 200 | 7 | Real Estate | 14 | 1 | 2007 |
| TEPE41 | 277 | 75 | 12 | Energy | 15 | 1 | 2013 |
| TEPE31 | 277 | 75 | 12 | Energy | 15 | 1 | 2013 |
| TEPE21 | 277 | 75 | 12 | Energy | 15 | 1 | 2013 |
| TEPE11 | 277 | 75 | 12 | Energy | 15 | 1 | 2013 |
| BRML22 | 276 | 239 | 7 | Real Estate | 14 | 1 | 2012 |
| IGTA13 | 275 | 300 | 6 | Real Estate | 15 | 1 | 2012 |
| LSEL16 | 259 | 250 | 2 | Energy | 14 | 1 | 2009 |
| ALGA22 | 252 | 233 | 7 | Telecom | 13 | 1 | 2012 |
| APAR12 | 250 | 232 | 4 | Financial | 14 | 1 | 2009 |
| BRTO19 | 248 | 400 | 5 | Telecom | 16 | 1 | 2012 |
| CYRE25 | 247 | 280 | 5 | Real Estate | 13 | 1 | 2011 |
| VIVO34 | 239 | 72 | 10 | Telecom | 16 | 1 | 2009 |
| ENGI15 | 238 | 129 | 5 | Energy | 13 | 1 | 2012 |
| TRAC12 | 237 | 350 | 7 | Energy | 15 | 0 | 2007 |
| CEPE14 | 236 | 360 | 6 | Energy | 9 | 1 | 2011 |
| ALLG15 | 235 | 200 | 9 | Other | 10 | 1 | 2005 |
| BNDP24 | 229 | 610 | 6 | Financial | 16 | 0 | 2009 |
| RDNT12 | 228 | 200 | 5 | Concession | 10 | 1 | 2010 |

| Code | Number of Trades | Issued amount (R$mm) | Initial Maturity | Sector | Rating | Eurobond | Issued Year |
|---|---|---|---|---|---|---|---|
| JHSP13 | 228 | 270000 | 10 | Other | 0 | 1 | 2010 |
| ECCR32 | 219 | 400 | 10 | Concession | 15 | 1 | 2012 |
| TELE18 | 215 | 1150 | 5 | Telecom | 14 | 1 | 2008 |
| MMGP13 | 212 | 316 | 5 | Other | 14 | 0 | 2012 |
| BRML12 | 208 | 166 | 5 | Real Estate | 14 | 1 | 2012 |
| CPSC11 | 206 | 600 | 4 | Other | 0 | 1 | 2012 |
| GFSA18 | 205 | 288 | 5 | Real Estate | 12 | 1 | 2010 |
| ANHB14 | 205 | 965 | 5 | Concession | 16 | 1 | 2012 |
| TLNL24 | 204 | 2035 | 3 | Telecom | 16 | 1 | 2009 |
| CNCP15 | 200 | 160 | 4 | Concession | 0 | 1 | 2012 |
| IVIA12 | 199 | 300 | 5 | Concession | 15 | 0 | 2010 |
| CPGE14 | 199 | 680 | 7 | CPFL | 14 | 1 | 2011 |
| CMTR13 | 197 | 480 | 5 | Energy | 15 | 1 | 2012 |
| ALLG29 | 195 | 216 | 5 | Other | 10 | 1 | 2011 |
| SBESC7 | 192 | 180 | 10 | Utilities | 15 | 1 | 2013 |
| BTOW11 | 189 | 350 | 5 | Consumer | 11 | 1 | 2008 |
| IVIA11 | 180 | 308 | 5 | Concession | 15 | 0 | 2010 |
| CBRD16 | 178 | 540 | 6 | Energy | 11 | 1 | 2007 |
| TAES21 | 177 | 255 | 5 | Energy | 15 | 1 | 2010 |
| PALF15 | 177 | 484 | 5 | Energy | 14 | 1 | 2011 |
| TELE28 | 168 | 460 | 7 | Telecom | 14 | 1 | 2008 |
| ECRV11 | 167 | 461 | 4 | Concession | 16 | 1 | 2009 |
| EVEC25 | 166 | 125 | 5 | Real Estate | 10 | 1 | 2011 |
| PCARA1 | 166 | 1200 | 3 | Energy | 10 | 1 | 2012 |
| CYRE22 | 163 | 250 | 10 | Real Estate | 13 | 1 | 2008 |
| COEL16 | 163 | 354 | 7 | Energy | 13 | 1 | 2007 |
| VFIN14 | 153 | 1250 | 10 | Financial | 14 | 0 | 2005 |
| ENMG17 | 151 | 60 | 5 | Energy | 0 | 0 | 2009 |
| ABNB11 | 150 | 180 | 5 | Other | 0 | 1 | 2008 |
| GASP23 | 150 | 269 | 5 | Energy | 15 | 1 | 2013 |
| AMLP14 | 142 | 300 | 3 | Other | 13 | 0 | 2011 |
| SUZB13 | 141 | 333 | 10 | Other | 13 | 0 | 2004 |
| CSNA14 | 130 | 600 | 6 | Energy | 13 | 0 | 2006 |
| CPCO11 | 128 | 165 | 2 | Energy | 0 | 1 | 2009 |
| PLIM16 | 122 | 580 | 7 | Telecom | 12 | 1 | 2006 |
| AEPA13 | 121 | 190 | 3 | Other | 13 | 1 | 2009 |
| PRVI11 | 120 | 150 | 5 | Other | 11 | 0 | 2007 |
| BKEM14 | 107 | 500 | 5 | Energy | 11 | 1 | 2006 |
| TLNL14 | 99 | 964 | 2 | Telecom | 16 | 1 | 2009 |
| TLNL11 | 92 | 1620 | 5 | Telecom | 16 | 1 | 2006 |
| SBSP29 | 72 | 120 | 7 | Utilities | 12 | 1 | 2008 |
| INHA14 | 65 | 240 | 5 | Real Estate | 11 | 1 | 2006 |
| TMPE12 | 63 | 400 | 7 | Energy | 12 | 1 | 2007 |
| CCHOA3 | 48 | 303000 | 1 | Real Estate | 0 | 1 | 2010 |
| ITSP12 | 46 | 751 | 3 | Financial | 16 | 0 | 2007 |