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Homogeneity Versus Heterogeneity in Debt Structure: A Study Using Panel Data

Angela Cristiane Santos Póvoa
Ph.D., Graduate Program in Management, Business School of the Pontifical Catholic University of Paraná.
E-mail: angelapovoa@gmail.com

Wilson Toshiro Nakamura
Adjunct Professor III, Graduate Program in Management, Center of Social and Applied Sciences, Mackenzie Presbyterian University.
E-mail: wtnakamura@uol.com.br

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ABSTRACT

This article argues that new contributions to the study of capital structure can be obtained from the study of corporate debt structure. More specifically, it addresses the issue of homogeneity and heterogeneity in debt structure, including its relevance and determinants, and incorporates a theoretical discussion. Because of the novelty of this topic in Brazil, a study was conducted that analyzed the debt structure of 113 companies over a period of 5 years. The results show that homogeneous and heterogeneous debt patterns are present in the debt structures of companies operating in Brazil and are associated with variables such as company size, market to book value, and the presence of rating grades.

Keywords: Debt structure, Homogeneity, Heterogeneity.

1 INTRODUCTION

Capital structure is one of the main topics studied in the field of corporate finance. In general, the academic literature on this issue is devoted largely to the study of two major issues: (1) understanding the dynamics of the optimal choice between equity and debt capital; and (2) relating a company's level of overall indebtedness to its characteristics, its industry sector, or even its macroeconomic aspects (Nakamura, 1992; Perobelli & Fama, 2003; Gomes & Leal, 2001; Terra, 2002; Calabrez, 2003; Machado, Temoche, & Machado, 2004; Silva & Brito, 2005; Moraes, 2005; Forte, 2007, among others).

However, all of these studies show that theoretical models generally treat debt capital as though it is formed from a single source of funds (Rauh & Sufi, 2010; Johnson, 1997) and thus fail to observe that a company's debt structure can consist of several fundraising instruments that are distinct from one another. It should be noted that debt instruments differ from one another in various aspects, such as source of funds, maturity, collateral, accessibility, priority of receipt and impact on cash flow, transaction costs, incentives to managers, and others. By treating debt from third parties as a uniform source of funds, these differentiating features are ignored, although in reality they are potentially relevant to understanding the way in which companies structure their debt (Denis & Mihov, 2002; Johnson, 1997; Rauh & Sufi, 2010; Colla, Ippolito, & Li, 2012).

In Brazil, aggregate variables (which are proxies for overall indebtedness) are commonly used as dependent variables in studies of the determinants of corporate debt. These dependent variables are "aggregated" by condensing all sources of corporate debt into a single measure (such as debt from banks, corporate bonds, loans from affiliates, and capital leases, among others) and thus do not make a distinction related to the specific effects of each source of debt on debt-related decisions. From this perspective, debt structure is treated as homogeneous with respect to its sources. The relevance of this issue is demonstrated by Colla, Ippolito, and Li (2012), who find that the variable "profitability" (which usually is negatively associated with total debt, in view of the hierarchy of sources theory) has a partially positive effect on bank debt. This finding emphasizes the importance of understanding the specific effects that different debt instruments have on decisions related to corporate debt, showing that new contributions can be obtained for the study of capital structure from the point of view of debt structure.

By understanding the factors that may determine the choice of specific sources of debt, capital structure can also be better understood. Given that the study of debt structure is still rare, especially in Brazil, one of the first questions about this subject is related to the manner in which companies form their indebtedness patterns. On this issue, the literature review shows an interesting discussion polarized into two theoretical strands. The first strand offers models that explain the choice of certain sources of debt based on the characteristics or specifics of the borrowing companies, and therefore the company is expected to focus its debt on sources specified by the theoretical model. The second strand argues that companies do not concentrate their debt on a single source, but instead obtain funds from several sources simultaneously.

Therefore, to investigate which of these theories best fits the reality of Brazilian companies, and given the implications of the treatment of debt structure as a homogeneous source of funds, this study aims to answer the following question: do companies that operate in Brazil tend to adopt a homogeneous debt structure in the sense of focusing a significant portion of their debt on one funding source, or do they have heterogeneous debt patterns that are characterized by "spreading" their debt among different sources?

This issue is relevant due to several factors, including but not limited to the following: (1) the impact on transaction costs associated with one or more sources of funding; (2) potential conflicts of interest between corporate creditors, which extends the discussion beyond the previous focus on the shareholder-creditor relationship described by agency theory; (3) the transmission of information to the market regarding the accessibility of funding sources; and (4) potential tax benefits. Furthermore, the literature on capital structure is dedicated to establishing relationships between business characteristics and decisions surrounding corporate debt and in this effort, as already mentioned, treats debt capital as a homogeneous variable. However, by dealing with a potentially heterogeneous variable as if it is homogeneous, one runs the risk of establishing inaccurate causal relationships, such as those observed by Colla et al. (2012). The use of "aggregate" dependent variables in the study of debt determinants can mask the specific effects that each debt instrument has on a company's financing decisions. Rauh and Sufi (2010, p.2) reinforce this argument by stating that "correlations shown in the literature between leverage rates and firm characteristics vary significantly when the components of debt are analyzed separately". Thus, although it is possible to find a meaningful theoretical framework that underpins the argument of debt heterogeneity (Park, 2000; Bolton & Freixas, 2000; DeMarzo & Fishman, 2007; David, Obrien, & Yoshikawa, 2008; Johnson, 1997; Denis & Mihov, 2002; Chemma-

nur & Fulghieri, 1994; Diamond, 1991; Faulkender & Petersen, 2006; Rauh & Sufi, 2010; Lucinda, 2004; Figueiredo, 2007), most studies on capital structure still treat third-party capital as a homogeneous source of funds. The recognition of the existence of heterogeneity in debt structure can bring a new perspective to the study of capital structure, thus enriching the literature on this subject.

This work differs from the few previous studies conducted in Brazil on this subject by promoting a more detailed categorization of debt instruments that goes beyond the traditional separation between public and private sources (Lucinda, 2004; Figueredo, 2007) and by employing a new methodology for the Brazilian case. This study is also justified by the fact that Brazil has an undeveloped capital market with limited credit options and high interest rates. Therefore, it is a different environment than the one investigated by Rauh and Sufi (2010) and Colla et al. (2012), and the conclusions of these authors may not apply to the reality of companies operating in Brazil.

However, the purposes of this study are not limited to identifying the presence or absence of homogeneous or heterogeneous debt patterns. The second stage of this study seeks to identify the explanatory factors for the observed debt patterns using multivariate regression analysis.

Accordingly, the debt structures of 113 companies operating in Brazil were analyzed, with data collected in panel format over a 5-year period between 2007 and 2011. The results show that both debt patterns are found among companies operating in Brazil, with heterogeneity generally present in larger companies with a greater ratio between market value and book value (market to book value) and with ratings assigned by risk-rating agencies. Contrary to expectations, variables related to companies' credit quality (such as risk, time of initial public offering (IPO), and profitability) are not relevant to explaining homogeneity or heterogeneity in the debt structure of Brazilian companies, contradicting the findings of Rauh and Sufi (2010) and Colla et al. (2012).

2 THE DEBATE ABOUT HOMOGENEITY AND HETEROGENEITY IN DEBT STRUCTURE

The literature review on the subject of debt structure is polarized into two major strands. The first strand explains, through theoretical models, borrowing companies' access to or choice of debt sources based on their characteristics and/or specificities. From this perspective, the following theoretical models can be cited: (1) a model based on information asymmetry; (2) a model based on moral hazard; and (3) a model of efficient liquidation.

The model regarding information asymmetry is based on the findings of Diamond (1991), who identifies relationships between information asymmetry and the choice of specific sources of debt. This model argues that the greater the information asymmetry about a company, the greater the tendency to borrow through bank sources. Diamond (1991) argues that new borrowers start the process of building a reputation through the use of debt subject to monitoring (bank debts) and then replace those debts with publicly issued debts, such as debentures and commercial paper. This is the case because a history of monitoring reduces moral hazard and information asymmetry, thus enabling borrowing from non-bank sources. From this perspective, banks act as receptor agents and information producers for their borrowers, which, compared to other lenders, gives the borrowers an advantage in monitoring and control (Berlin & Loeys, 1988; Fama, 1985).

The moral hazard model is grounded on the assumption that it is impossible for either party to monitor or predict the behavior of the other in a transaction that involves lending and borrowing resources. Krishnaswami, Spindt, and Subramaniam (1999) state that there are 2 types of moral hazards that affect decisions about a company's debt: asset substitution and underinvestment. The problem of asset substitution arises because of adverse incentives due to shareholders' limited liability (Krishnaswami, Spindt, & Subramaniam, 1999). Thus, in an attempt to reduce moral hazard, the parties incur contracting costs to establish contracts that monitor the actions of shareholders and managers. Krishnaswani et al. (1999) find that companies that have high contracting costs relative to moral hazard and that operate under severe information asymmetry prefer to borrow from bank sources.

The model of efficient liquidation seeks to explain decisions about debt through corporate bonds or banks, taking into account the costs associated with a company's liquidation process. Starting from the premise that banks enjoy a superior ability not only in dealing with companies that face financial difficulty but also in making decisions between forcing companies to either liquidate or renegotiate their debts, it is expected that companies with a greater propensity for financial difficulties have a tendency to borrow from banks (Rajan & Myers, 1998; Berlin & Loeys, 1988; Chemmanur & Fulghieri, 1994; Shleifer & Vishny, 1992).

Thus, in general, the profile of borrowers through

corporate bonds can be summarized as large companies, with a high ratio of fixed assets to total assets, less volatility in results, high credit quality and reputation, less asymmetric information, and more profitability compared to bank and non-bank borrowers. The inverse of such characteristics are related to borrowers from banks (Denis and Mihov, 2002; Diamond, 1991; Johnson, 1997; Nakamura, 1993). As a result, companies' debt structures tend to concentrate on or specialize in a specific source of debt, which is defined from the set of characteristics of borrowing companies.

In opposition to this first theoretical perspective, there are models that defend the coexistence of various debt instruments in a company's debt composition. The proponents of this view include, but are not limited to, Besanko and Kanatas (1993), Johnson (1997), Bolton and Freixas (2000), DeMarzo and Fishman (2007), Boot and Thakor (1997), Repullo and Suarez (1997), and Rauh and Sufi (2010).

Besanko and Kanatas (1993) propose a model of competitive equilibrium that shows the coexistence of funds obtained through banks and through securities in the capital market. The model that these authors propose shows that attempts to raise funds in the capital market may fail in the absence of bank credit, given that banks perform a monitoring function that helps a company to establish its reputation with other lenders (Diamond, 1991). Thus, by acquiring bank debt, a company indicates to its investors that it has the ability to pay its debts, thereby facilitating its access to capital markets.

Johnson (1997) finds evidence of the persistent use of bank debt, even for companies that have access to funds through corporate bonds, suggesting that the benefits attributed to banks in theoretical models remain important even after a company gains access to capital markets. Rauh and Sufi (2010) identify the simultaneous use of multiple sources of debt by companies with lower credit quality, a finding contrary to the hypothesis that a company chooses its source of debt by opting for either bank debt or corporate bonds. The spreading of debt among different sources can be explained as a way to reduce agency conflicts between shareholders and creditors because it reduces the ability to monitor the creditor.

DeMarzo and Fishman (2007) propose an optimal model for long-term financing that combines different debt instruments, such as corporate bonds, bank lines of credit, and stocks for project financing, emphasizing the heterogeneity of a company's debt structure. Similarly, Bolton and Freixas (2000) propose a model of corporate financing in a scenario in which there is information asymmetry and no tax, observing that various sources of debt, such as corporate bonds, banks, and stocks, coexist in balance. Repullo and Suarez (1997) propose a model that seeks to explain why many companies do not borrow funds exclusively from informed sources (banks) or uninformed sources (bond issuers), but promote a mix of both types of lenders. Thus, it is possible to observe that the literature on the factors that explain corporate debt structure provides theoretical support for both the concentration of indebtedness in a single source and for spreading debt among different sources.

Johnson (1997, p.48) states that "Most theoretical models do not allow firms to use mixtures of public and private debt, and much of the previous empirical work uses discrete choice models that allow firms only one debt source." From this perspective, debt structure tends to be homogeneous due to a limitation in the proposed theoretical models, which may not correspond to the reality faced by companies.

Two recent empirical studies aim to shed light on this issue. In the first study, Rauh and Sufi (2010) investigate the debt structure of 305 public companies in the U.S. between 1996 and 2006. These authors are pioneers in establishing categories of debt that recognize the differences among the debt instruments available in the U.S. credit market, thus inaugurating a new way of analyzing corporate debt structure. Thus, 7 categories of debt are identified. The results show that companies, including companies with lower ratings, simultaneously use 2 or more types of debt, including in companies that have lower ratings. The study concludes that corporate debt structure is marked by heterogeneous patterns of indebtedness.

However, Colla et al. (2012), conducting a similar study, establish 5 categories of debt in a sample of 3,332 U.S. companies and find that simultaneous indebtedness involving various funding sources is only observed among larger companies with better credit ratings and is not applicable to most of the companies participating in the study. These authors conclude that corporate debt structures show a tendency to specialize or concentrate their main debts in a single source; i.e., indebtedness has homogeneous patterns. Colla et al. (2012) explain that the results obtained by Rauh and Sufi (2010) are due to the specific characteristics of their sample, which includes only companies with ratings assigned by risk-rating agencies.

In summary, Rauh and Sufi (2010) conclude that heterogeneity in debt structure is present in most companies, whereas Colla et al. (2012) argue that most companies tend to be homogeneous with respect to debt structure, with heterogeneity reserved for larger companies with higher credit ratings. Companies' credit quality is cited as a key factor for understanding the homogeneous or heterogeneous debt patterns.

2.1 The Types of Debt Present in Corporate Capital Structures

With regard to the types of debt available in the credit market, the literature review shows a classic distinction between private sources of debt and publicly issued corporate bonds (Chemmanur & Fulghieri, 1994; Houston & James, 1996; Krishnaswami et al, 1999; Lucinda, 2004; Figueiredo, 2007). However, although the distinction between bank debt and corporate bonds is classic, it is not the only distinction that can be identified in studies on corporate debt structure. Johnson (1997) and Denis and Mihov (2002) note differences between 3 types of debt: bank debt, non-bank debt, and debt through corporate bonds.

The study by Rauh and Sufi (2010) can be seen as pioneering in the sense that it promotes the categorization of various debt instruments that make up third-party capital, distinguishing these debt instruments by their essential features. This analysis is subsequently followed by Colla et al. (2012). The categories of debt identified by Rauh and Sufi (2010) are as follows: (1) bank debt; (2) bonds; (3) program debt (which is exempt from Securities and Exchange Commission registration); (4) private placements (covering both debt not included under Rule 144A and securities with an ambiguous classification); (5) convertible debt; (6) mortgage or equipment debt; and, finally, (7) "other" debt, which includes debts not included in the categories described above. Similarly, Colla et al. (2012) have established 5 categories of debt: (1) commercial paper; (2) revolving credit lines; (3) term loans; (4) senior and subordinated bonds; and (5) capital leases. It is important to note that the classifications from Rauh and Sufi (2010) and Colla et al. (2012) refer to the U.S. credit market.

3 METHODOLOGICAL PROCEDURES

This study followed the same line as Rauh and Sufi (2010) and Colla et al. (2012), who both investigate the U.S. credit market, but differ in that they analyze in detail the debt structure of companies operating in Brazil. The analysis that this study proposes is unprecedented in view of the categorization of the debt structure of the companies in its sample. Thus, this study investigates whether companies operating in Brazil tend to raise a significant portion of their funds from third parties through a single source (homogeneity) or through different sources simultaneously (heterogeneity). Second, this study seeks to identify the determinant factors for the homogeneous or heterogeneous debt patterns in the debt structures of the companies analyzed.

For this purpose, it was first necessary to establish categories of debt capable of reflecting the sources of funds for companies operating in Brazil. The first step was to find support from empirical studies on the topic. From the work of Johnson (1997) and Denis and Mihov (2002), 3 types of different debt sources were identified: private bank debt, non-bank private debt, and publicly issued bonds, which are, respectively, the first, second, and third categories of debt defined for this study. These sources were considered relevant to the Brazilian reality. Next, the particularities of the Brazilian financial system were observed. According to Lucinda (2004), they are marked by significant government intervention in lending to the private sector, mainly through development banks such as the National Bank for Economic and Social Development (Banco Nacional de Desenvolvimento Econômico e Social—BNDES). Thus, we identified a fourth category of debt, whose primary source of funding is the result of government intervention in the private credit system; this category was called "subsidized debt."

The fifth category of debt was proposed to record the relevance of foreign sources of funds to Brazilian companies given the recent global liquidity crisis. In this category, only debts contracted in a foreign currency were considered, and this category was subdivided into 2 subcategories: (1) funding through banks; and (2) funding through corporate bonds issued abroad by Brazilian companies. The sixth category of debt was proposed to assess the relevance of capital leases as a way of financing a company's assets, in which the asset itself was pledged. This category of debt is also identified in the work of Rauh and Sufi (2010) and Colla et al. (2012), which also led to its inclusion in this study. The seventh category was intended to encompass other forms of debt that did not fit into any of the other proposed categories. In summary, the following categories of debt were proposed:

1. Bank private debt: funds raised through this source originate from banks operating in the country of origin and promote loans in domestic currency through various credit products.
2. Non-bank private debt: this source of funding is characterized by borrowing through nonfinancial intermediaries, such as non-bank financial institutions and similar affiliated companies.
3. Corporate bonds: this source of funding includes funding through the issuance of private or public corporate placement bonds that can be traded on the stock exchange or the over-the-counter (OTC) market.

4. Subsidized debt: this category includes all forms of financing obtained from government intervention through development banks and lending programs to the private sector.
5. Foreign debt: this category includes all forms of direct funding in foreign currency.
6. Capital leases: this category includes all forms of leasing contracts that use the financed asset as collateral.
7. Other unclassified sources: this category includes debts not subject to categorization in the categories proposed above.

Thus, the debt structures of Brazilian companies were categorized in view of the origin or source of funds, and it was possible to establish 7 distinct categories. It is emphasized that the debt categories established for Brazilian companies were distinct from each other in various aspects, such as source of funds, transaction costs, collateral, accessibility, and disclosure of information to the market, among others.

After the categories of debt proposed for this study were identified, it was necessary to establish criteria to distinguish between homogeneous and heterogeneous debt structures. To do so, following the example of Colla et al. (2012), this study calculated the Herfindahl-Hirschman Index (HHI) for the type of debt present in the debt structure of the companies in the sample. The calculation of this index involved the sum of the squares of the 7 categories of debt divided by total debt from third parties, as follows:

$$SS_{it} = \left(\frac{BD_{it}}{TD_{it}}\right)^2 + \left(\frac{NBD_{it}}{TD_{it}}\right)^2 + \left(\frac{CB_{it}}{TD_{it}}\right)^2 + \left(\frac{SD_{it}}{TD_{it}}\right)^2 + \left(\frac{DE_{it}}{TD_{it}}\right)^2 + \left(\frac{AM_{it}}{TD_{it}}\right)^2 + \left(\frac{OT_{it}}{TD_{it}}\right)^2$$

where SS_{it} is the sum of the squares of the ratios of the 7 types of debt set for company "i" at time "t"; BD, NBD, CB, SD, FD, CL, and OT are acronyms that represent bank debt, non-bank debt, corporate bonds, subsidized debt, foreign debt, capital leases, and other types of debt, respectively. TD refers to the total debt owed to third parties or interest-bearing liabilities.

To obtain the HHI, the following calculation was performed:

$$HHI = \frac{SS_{it} - \frac{1}{7}}{1 - \frac{1}{7}}$$

If a company used only 1 type of debt (homogeneous), HHI was equal to 1. If the company simultaneously used all 7 types of debt in equal proportions, then HHI equaled 0. It was defined that HHI values above 0.7 would indicate homogeneity in the debt structure, whereas values below this value would indicate heterogeneity. However, calculating the HHI of heterogeneous companies showed results ranging between 0.1120 and 0.6986, and thus companies with HHIs close to 0 were classified as heterogeneous in the same way as companies with HHIs near 0.7. Thus, it was deemed appropriate to separate heterogeneous companies into 2 smaller groups, the first formed by "strongly heterogeneous" companies that had HHIs less than or equal to 0.40, and the second formed by the "weakly heterogeneous" companies that had HHIs greater than or equal to 0.41 but less than 0.70.

Last, seeking to understand the explanatory factors for the observed debt patterns, an analysis of determinants was performed through multivariate regressions with panel data. Considering that both Rauh and Sufi (2010) and Colla et al. (2012) have found that a company's credit quality is associated with debt patterns, several variables directly associated with the companies' credit quality were selected. The operationalization of independent variables is shown in Table 1.

Table 1 *Operationalization of independent variables in the study*

Independent Variables	Acronym	Operational Definition	References
IPO	time	Time in years since the company's IPO	Diamond (1991); Johnson (1997)
Size	size	Natural logarithm of total assets	Minardi, Sanvicente and Artes (2006); Blume, Lim and MacKinlay (1998)
Market to Book	market	Market value of equity/book value of equity	Colla et al. (2012); Bastos, Nakamura and Basso (2009)
Tangibility	fixedstock	(fixed assets + stock)/total assets	Jorge e Armada (1999); Perobelli e Famá (2003); Famá and Kayo (1997)
Business risk measured by earnings volatility	busrisk	(Standard Deviation of EBIT—Average)/Net operating revenue	Nakamura et al. (2007)
Profitability	roa	Net profit/total assets	Minardi, Sanvicente and Artes (2006); Kaplan and Urwitz (1979)
Leverage	dtta	Short- and long-term debt/total assets	Kaplan and Urwitz (1979). Blume, Lim and MacKinlay (1998)
Rating	rating	Dummy for the presence of a rating attributed by risk-rating agencies (Moody's, Fitch, or Standard and Poor's)	Rauh and Sufi (2010); Colla et al. (2012)

The dependent variable was represented by the HHI of the companies in the sample, bearing in mind that this index reflects the homogeneity or heterogeneity of their debt structures. The tested model is as follows:

$$HHI_{it} = \alpha + \beta_1 time_{it} + \beta_2 size_{it} + \beta_3 market_{it} + \beta_4 fixedstock_{it} + \beta_5 busrisk_{it} + \beta_6 roa + \beta_7 dttat + \beta_8 rating + E_{it}$$

It is noteworthy that the proxy variable for leverage (dtta) is most likely endogenous, given that it is expected that both the companies' level of debt and their debt composition are defined jointly by the companies. However, because this variable is present in the work of Colla et al. (2012), we chose to maintain it in this study.

The final sample consisted of 113 companies that provided explanatory notes with sufficiently clear and complete information for the categorization proposed by this study. Data for the categorizations were collected in a panel format covering the years 2007-2011, obtained from notes obtained from the website of the Brazilian Securities and Exchange Commission (Comissão de Valores Mobiliários—CVM). In general, data on corporate debt in the notes are located under "Loans and financing".

3.1 Description of the Results

The first group of companies analyzed was composed of those companies that met the homogeneity requirements for debt sources. Thus, companies are considered homogeneous when they show an HHI below 0.7. Based on the sample of 113 companies, 38 companies are identified with an HHI greater than or equal to 0.7, which corresponds to 33.3% of the sample.

In analyzing the group of homogeneous companies, it is observed that 15 of the 38 companies in this group show an HHI equal to 1, i.e., 39% of homogeneous companies concentrate all of their debt in a single source, and another 16 companies show an HHI equal to or greater than 0.8 but less than 1. The other companies in this group (7 companies) show an HHI greater than or equal to 0.7 but less than 0.8. These results indicate the concentration of debt in a specific funding source for this group.

The analysis of debt composition for homogeneous companies shows that the source of debt that provides the most funds for this group is bank debt, which is the main source of funding for 28 companies (or 73.68% of homogeneous companies) during the observation period. The second main source of debt is government-subsidized funds, which is the main source of funds for 8 homogeneous companies, amounting to 21% of homogeneous companies.

The other sources of debt, although present, are not significant for this group. Given that a source of debt should add at least 10% of total funds from third parties to be considered relevant, this group used an average of 1.2 sources of debt over the observation period. Among the few companies with more than one source of debt, it is generally observed that the debt structure is essentially composed of a combination of bank sources and government-subsidized funding sources.

Another striking feature of this group is the "fidelity" of these companies to their main funding sources because the companies rarely altered the main source of funds during the years of panel observation. Figure 1 shows which sources are the biggest contributors to financing through corporate debts for the homogeneous group.

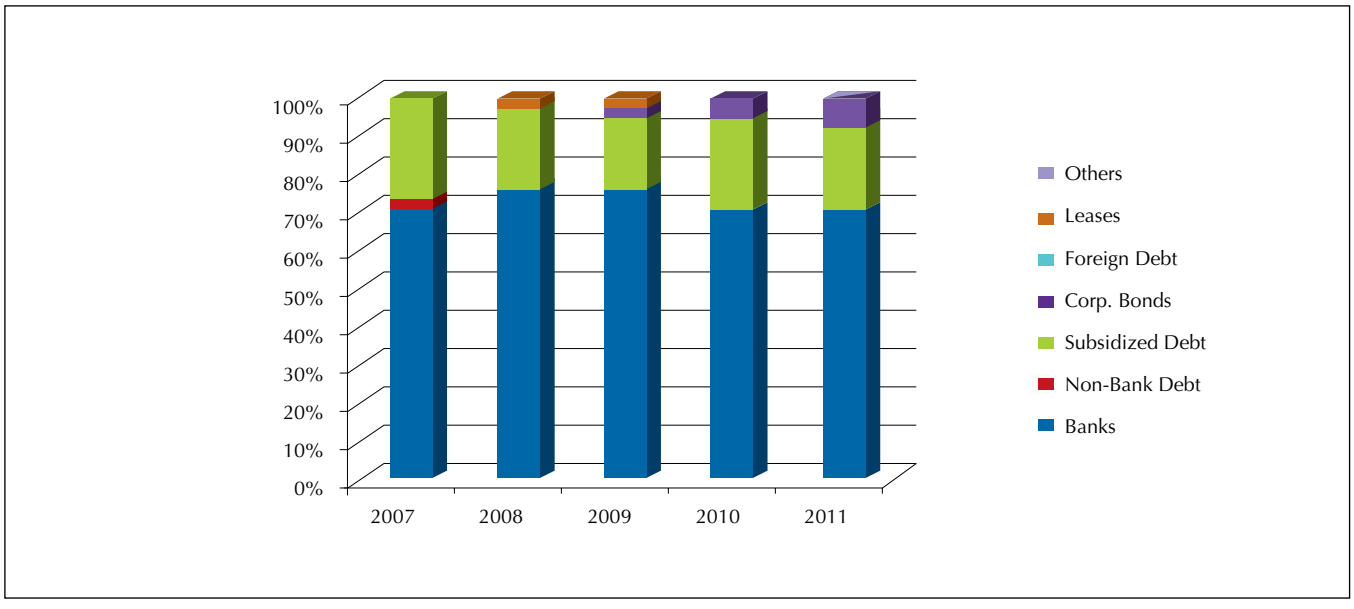

Figure 1 *Debt composition according to the main sources of funds for homogeneous companies*

To analyze the group of homogeneous companies in more detail, Table 2 lists the statistical information of the companies in that group.

Table 2 *Descriptive statistics of homogeneous companies*

Statistics/ Coefficient	HHI
Mean	0.9079
Median	0.9269
Mode	1.0
Minimum	0.7349
Maximum	1.0
Standard Deviation	0.0992
Coefficient of Variation	0.1092
Variance	0.0098

The measures of central tendency—mean, median, and mode—highlight the high HHI values and show a high concentration of debt from specific funding sources. Additionally, the measures of dispersion, such as standard deviation, variation coefficient, and variance, have numbers close to 0, which points to the low variability of the mean HHIs of companies in this group.

The second group analyzed consists of 40 companies classified as strongly heterogeneous, i.e., companies with an HHI of less than or equal to 0.40 in a sample of 113 companies, representing 35.4% of the sampled companies.

The debt-composition analysis shows that the strongly heterogeneous companies use an average of 3.8 funding sources simultaneously in their debt structures. Of these, the main sources of funds, i.e., those that contribute the most to financing the companies in this group, are, in order of importance, bank sources, corporate bonds, foreign debt, and subsidized debt. Non-bank sources and capital leases are identified as important sources of funds for only 2 companies in this group.

Figure 2 shows the main debt sources used by companies in the heterogeneous group from 2007-2011.

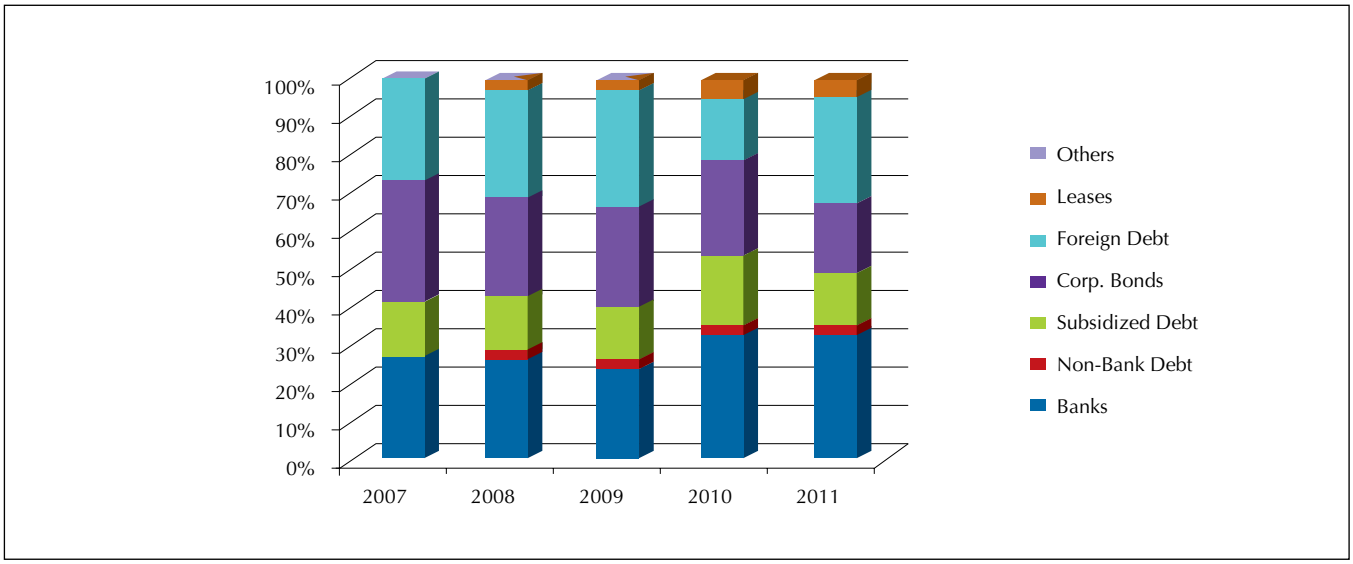

Figure 2 *Debt composition based on main sources of funds for strongly heterogeneous companies*

A characteristic feature of this group is the constant turnover in the main source of funds. Unlike the homogeneous group of companies, the strongly heterogeneous companies do not remain loyal to a particular funding source, but have a tendency to change their main sources of funds over the observation period. Only 5 of the companies belonging to this group do not exhibit this turnover.

Thus, the debt structure for companies in this group is diversified. The coexistence of various sources of debt, including corporate bonds and bank sources, is evident, a fact that contradicts the theoretical models of information asymmetry, moral hazard, and efficient liquidation. It is noteworthy that the heterogeneity observed in this group is persistent over the 5-year study period, meaning that companies generally maintained a diversified debt structure throughout the period of analysis, demonstrating a robust pattern of heterogeneous debt.

The statistical indicators for strongly heterogeneous companies are set forth in Table 3.

Table 3 *Descriptive statistics for strongly heterogeneous companies*

Statistics/ Coefficient	HHI
Mean	0.2856
Median	0.2819
Mode	- - -
Minimum	0.1120
Maximum	0.3850
Standard Deviation	0.0675
Coefficient of Variation	0.2351
Variance	0.0045

The statistical analysis shows a low degree of concentration of the debt structure in a single source, with mean and median HHIs of approximately 0.28. Additionally, the low values for the measures of dispersion show low variability of HHI in the companies belonging to this group.

The third group consists of companies that meet the requirements for weak heterogeneity. Weak heterogeneity is assigned to companies in the sample with HHIs between 0.41 and 0.69. This group consists of 35 companies from a sample of 113, representing 31% of the companies in the sample. Bank sources are again the main source of funds for companies in this group. Government-subsidized funding is the second main source of funds, followed by corporate bonds and foreign debt.

In terms of their main funding sources, this group shows a debt structure closer to that of homogeneous companies because it concentrates its most significant funding sources in bank debt and government-subsidized funds. However, this group differs from the homogeneous group by showing greater access to funds obtained through corporate bonds and from foreign markets. Thus, it is possible to observe that weakly heterogeneous companies seem to experience less access to funds raised through the capital market and from the foreign market when compared to strongly heterogeneous companies, but show greater access to these funds when compared to homogeneous companies.

Figure 3 shows the main funding sources for the weakly heterogeneous group.

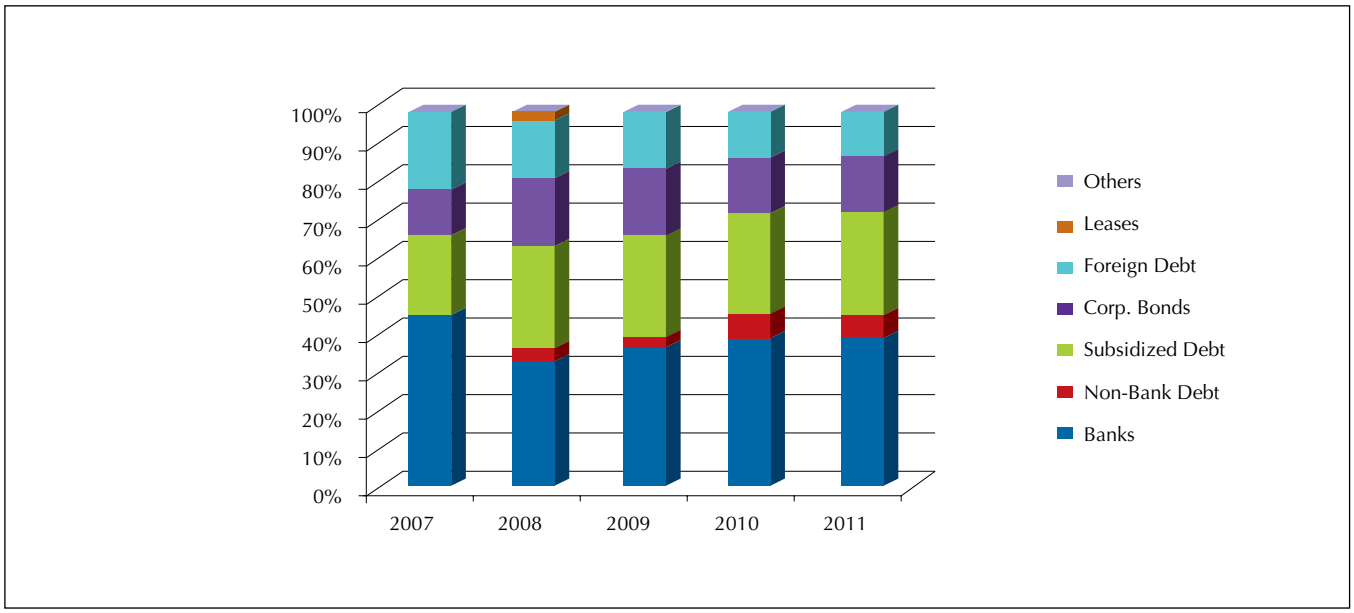

Figure 3 Debt composition based on main sources of funds for weakly heterogeneous companies

On average, the companies in this group use 2.4 funding sources simultaneously in composing their capital structures. Thus, although they show debt structures that do not concentrate third-party debt in a single source, the debt structures of these companies are less diversified than those of strongly heterogeneous companies. Moreover, in general, this group selects one primary source of funds, but makes significant use of ancillary sources. Of the 35 companies in this group, 15 did not change their main source of funds between the years 2007 and 2011, demonstrating lower fidelity to their main funding sources as compared to homogeneous companies. Table 4 shows the main descriptive statistical indicators for weakly heterogeneous companies.

Table 4 *Descriptive statistics for weakly heterogeneous companies*

Statistics/ Coefficient	HHI
Mean	0.5267
Median	0.5075
Mode	- - -
Minimum	0.4180
Maximum	0.6989
Standard Deviation	0.1634
Coefficient of Variation	0.322
Variance	0.0267

The statistical analysis shows that the measures of central tendency are approximately 0.5, showing an intermediate degree of debt concentration between the extremes observed in the homogeneous and strongly heterogeneous groups. The measures of dispersion show higher values, indicating greater variability in HHI among the companies in this group.

3.2 Joint Analysis of Homogeneous and Weakly and Strongly Heterogeneous Companies

Analysis of the debt structure of companies in the sample shows that the strongly heterogeneous companies borrow the most funds from the market, in a higher amount than the other two groups combined. This fact is shown in Figure 4, which sets forth the average of the absolute values taken from each funding source by groups of companies analyzed. Due to the high amount borrowed by strongly heterogeneous companies, the debt of weakly heterogeneous and homogeneous companies seems less significant. This fact highlights the importance of recognizing the heterogeneity of debt structure in Brazil because such heterogeneity is present among the major borrowers in the financial market.

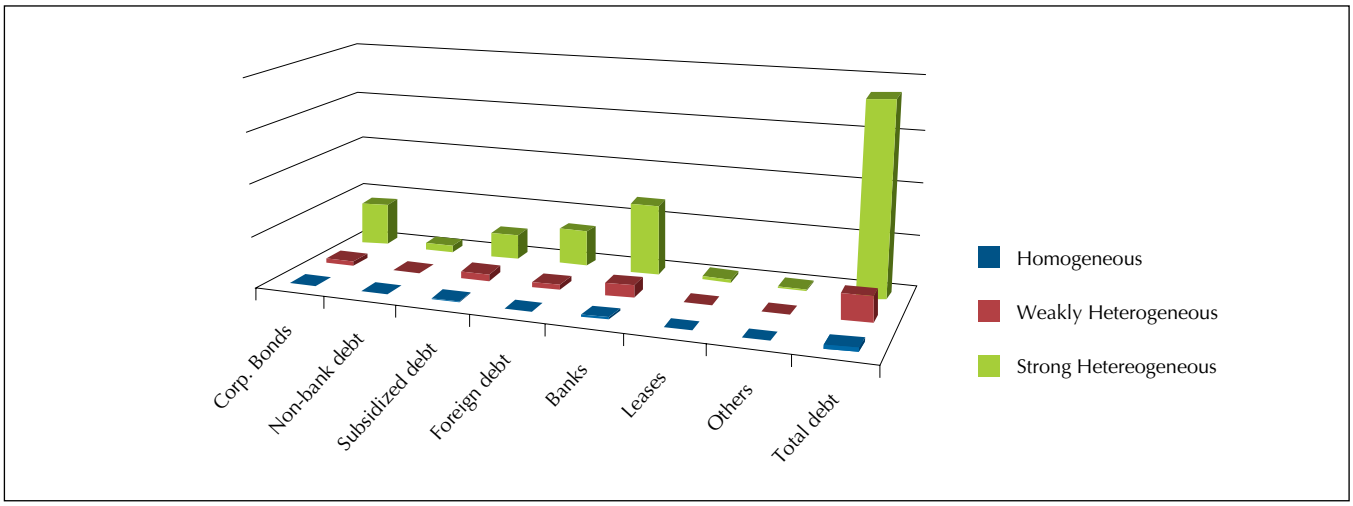

Figure 4 *Debt composition by group, by absolute value*

From another perspective, when analyzing financial sources in relative terms, one can determine, on average, the main sources of funds elected by each group of companies.

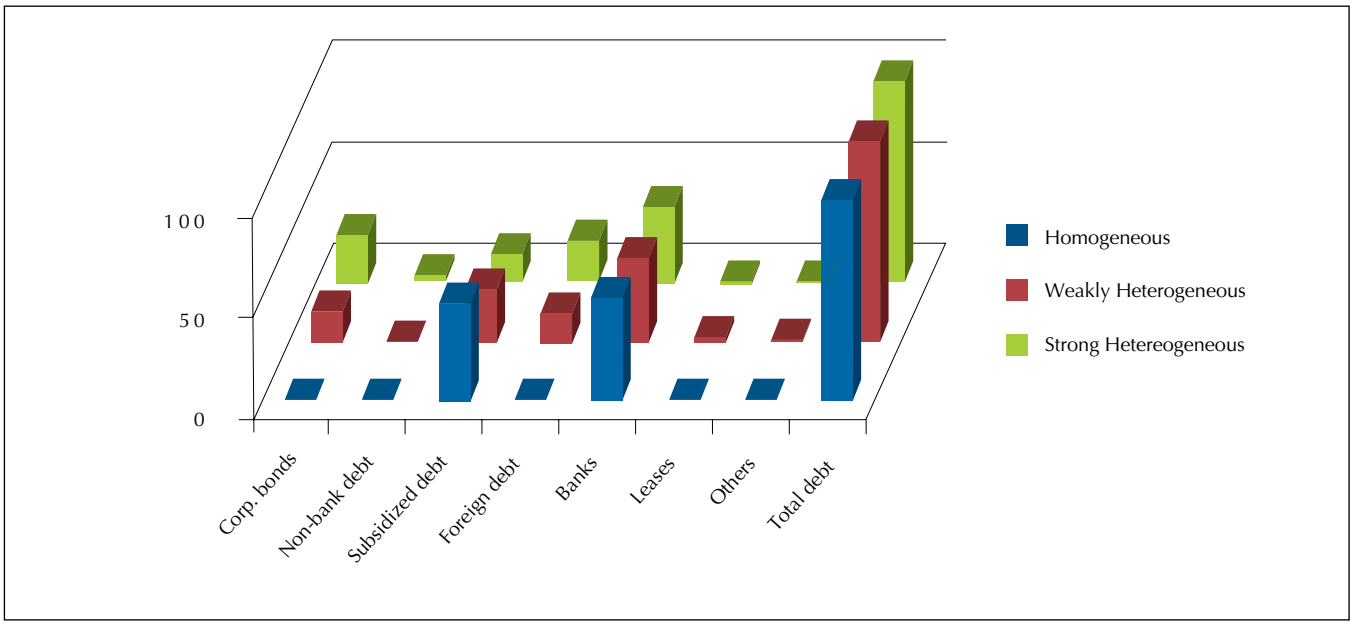

Figure 5 Debt *composition of various groups, by relative values*

Table 5 shows the share of different types of debt in relation to total debt for the companies in the sample during each year of observation, without distinguishing among the different groups of companies. The aim of Table 5 is to show the relevance of each funding source to the debt composition of companies operating in Bra-

zil, regardless of group. The reduction of bank participation over time and the nearly stable participation of other funding sources between 2009 and 2011 should be emphasized.

Table 5 *Evolution of indebtedness over time*

	2007	2008	2009
Banks	0.4124	0.4167	0.3497
Non-bank debt	0.0114	0.0056	0.0357
Corporate bonds	0.2013	0.2614	0.2301
Subsidized debt	0.1859	0.1353	0.1293
Foreign debt	0.1733	0.1405	0.2297
Leases	0.0021	0.0337	0.0183
Other sources	0.0137	0.0068	0.0072
Total debt	1	1	1

Table 6, in turn, shows the average share of each funding source for each group of companies. This table shows the relevance of bank and government-subsidized sources for the homogeneous companies and the "spreading" of debt by strongly heterogeneous companies, but with bank sources as the main source of funds for all groups.

Table 6 *Average share of each source of debt for the 3 groups of companies*

	Homogeneous	Weakly heterogeneous	Strongly heterogeneous
Banks	0.7124	0.3767	0.2747
Non-bank debt	0.0261	0.0356	0.0753
Corporate bonds	0.0069	0.1472	0.2481
Subsidized debt	0	0.1327	0.2297
Foreign debt	0.0026	0.0081	0.0183
Leases	0.0014	0.0044	0.0066
Other sources	1	1	1

3.3 Determinants of the Degree of Debt Concentration

In the second stage, this study investigates the factors that can potentially explain the patterns of homogeneity and heterogeneity identified among companies operating in Brazil. To that end, the following econometric model was tested:

$$HHI_{it} = \alpha + \beta_1 time_{it} + \beta_2 size_{it} + \beta_3 market_{it} + \beta_4 fixedstock_{it} + \beta_5 busrisk_{it} + \beta_6 roa + \beta_7 dtta + \beta_8 rating + E_{it}$$

To estimate the regressions for a company's specific factors, the fixed effects model was chosen because it accounted for the unique characteristics of each unit (company) of the cross section by varying the intercept for each unit, but considered slope coefficients as constant across units. The choice of this model was supported by the Hausman test, which indicated the greater relevance of a fixed effects panel compared to a random effects panel.

The results of the regression model indicate that the proxy variables for company size (size), market to book value (market), and the dummy variable for the presence of a rating (rating) are statistically significant in explaining the HHI of the companies in the sample, with negative partial effects (Table 7). This result suggests that the value of HHI tends to be lower, i.e., a company tends to be more heterogeneous, when it is larger in size, has a higher ratio between market value and book value, and has a rating grade assigned by risk-rating agencies. The R2 value obtained for this regression was 0.5862.

The analysis of violations of basic assumptions for the regression show lack of multicollinearity in the VIF (Variance Inflation Factor) test, but indicate the presence of heteroskedasticity (Breusch-Pagan and White tests) and serial autocorrelation (Wooldridge test for panel data). All of the analyses were conducted using Stata software, version 12 (Statacorp, College Station, Texas – USA). To correct the problems identified and following the guidelines of Greene (2003), the regression was re-estimated using Feasible Generalized Least Squares (FGLS). The results are available in Table 8. The results confirm the statistical significance of the same independent variables identified above.

Table 7 *Estimation of the static panel regression model with fixed effects*

HHI	Coeff.	Std Err.	Z	P>|z|	95% Conf. Interval	
time	-0.00118	0.001197	-0.99	0.322	-0.00351	0.001161
size	-0.07875	0.010971	-7.18	0.000	-0.10027	-0.0572
market	-0.00667	0.002052	-3.22	0.001	-0.01066	-0.00257
fixedstock	-0.03818	0.02642	-1.05	0.294	-0.08117	0.02459
busrisk	-0.00125	0.00928	-0.07	0.944	-0.00018	0.000178
roa	-0.06378	0.049278	-1.29	0.198	-0.1600	0.33089
dtta	0.170364	0.090964	-1.07	0.161		0.007912
rating	-0.14529	0.047543	-3.06	0.002	-0.23842	-0.05209
cons	1.85738	0.147982	12.50	0.000	1.56027	2.14033

Source: Study data, generated by Stata 12 software.

Table 8 *Estimation of the model by Feasible Generalized Least Squares*

HHI	Coeff.	Std Err.	Z	P>|z|	95% Conf. Interval	
time	-0.00076	0.000645	-1.19	0.233	-0.00202	0.000493
size	-0.79554	0.006897	-11.54	0.000	-0.09307	-0.06603
market	-0.08157	0.00279	-3. 50	0.000	0.012656	-0.00357
fixedstock	0.086773	0.02795	1.87	0.112	0.031281	0.140966
busrisk	0.00479	0.00563	0.07	0.943	-0.0001	0.001111
roa	-0.05489	0.067281	-0.81	0.417	-0.18614	0.07731
dtta	0.16242	0.103469	1.57	0.116	0.36527	0.40374
rating	-0.13342	0.026444	-5.04	0.000	-0.18551	1.830516
cons	1.80442	0.095326	18.93	0.000	1.61706	1.99922

Source: Study data, generated by Stata 12 software.

4 ANALYSIS OF RESULTS

The analysis of our results suggests that the debt structure of companies operating in Brazil can be both homogeneous and heterogeneous. The study shows that there are companies that are more heterogeneous than others and therefore, a distinction is proposed between strongly heterogeneous and weakly heterogeneous companies. It is also observed that approximately two-thirds of companies in the sample are classified as heterogeneous.

As previously mentioned, the literature on "capital structure" treats debt capital as a homogeneous source of funds and based on this premise, causal relationships between company characteristics and corporate debt have been established over the years. The recognition of the presence of heterogeneity in debt structure is therefore a factor that must be considered when conducting academic studies devoted to understanding decisions on corporate debt because recognition of this factor has the potential to make new contributions to this topic.

Among the explanatory factors for debt heterogeneity, the relevance of the proxy variable for "company size" is observed, with negative partial effects in the dependent variable HHI. This finding can be explained from the empirical studies conducted by Houston and James (1996), Johnson (1997), Krishnaswami et al. (1999), Colla et al. (2012), and others. These authors state that larger companies achieve economies of scale by issuing corporate bonds and therefore, access the capital market more frequently. In addition, larger companies find investors more easily because they have lower information asymmetries. With respect to the dummy variable for the presence of a rating grade, the Brazilian results corroborate the findings of Rauh and Sufi (2010) and Colla et al. (2012), namely, that the presence of a rating is a factor that encourages debt heterogeneity.

However, a comparison of the results of studies conducted in the U.S. and Brazil show that in the American case, the larger and more heterogeneous companies exhibit the lowest market to book values (Rauh & Sufi, 2010; Colla et al., 2012). Rajan and Zingales (1995) explain that companies with greater growth opportunities (market to book value as a proxy for growth opportunities) generate greater risk awareness, which may hinder access to diversified sources of funds. Therefore, debt heterogeneity is associated with lower market to book values. In the Brazilian case, this study finds that larger and more heterogeneous companies have a higher market to book value. In analyzing the debt of publicly traded companies in emerging countries, Bastos, Nakamura, and Basso (2009) observe that these companies because they enjoy greater growth opportunities, need resources that often are not sufficiently generated by retained earnings. Therefore, companies with higher market to book values generally have higher levels of debt, which is a factor that favors heterogeneity in debt structure. In Brazil, an emerging country, greater growth opportunities combined with larger company size and the presence of a rating grade apparently promote access to more diverse sources of funding, most likely due to the potential return on investment for creditors.

Other explanatory variables tested in the Brazilian case are not relevant to the homogeneity or heterogeneity of corporate debt structure, contradicting the results obtained by U.S. studies. These results may be related to the specific differences existing in the credit markets of the two countries analyzed, which underscore the importance of conducting further studies to investigate the Brazilian case in greater depth.

It is also observed that banks are the main funding sources for Brazilian companies, whereas corporate securities in the form of bonds and notes are the main funding sources for North American companies (Colla et al. 2012; Rauh & Sufi, 2010). This finding was expected given the lack of development of Brazil's capital market; dependence on banks is characteristic of less-developed markets (Boot & Thakor, 1997).

We also emphasize the marked presence of borrowing from banks even among the most heterogeneous com-

panies, a finding that does not corroborate the theoretical models of information asymmetry, moral hazard, and efficient liquidation because it would be expected that debt through corporate bonds (publicly issued) is the most important source of funds. However, Yosha (1995) notes that because of the high need for information, debt through corporate bonds might not be of interest to larger companies because it incites a competitive response from rival companies. In addition, bank debt can protect the confidentiality of corporate information. Lucinda (2004) states that debt through private sources (such as "banks"), in addition to involving less publicity about a company's operation and information, is also more flexible in terms of funding volume and presupposes a long-term relationship with the funding agents. Another possible explanation is offered by Boot and Thakor (1997), who state that an underdeveloped financial system (i.e., one in its "infancy") is marked by the presence of major banks as credit sources and according to Lucinda (2004), this is the case with the Brazilian financial system.

The concentration of funds in a specific source, also observed in the Brazilian case, can be explained in light of the theoretical models of information asymmetry, moral hazard, and efficient liquidation. Together, these models posit that this concentration can be explained by factors such as the need to reduce moral hazard and reputation effects (Diamond, 1991), information production costs and accessibility (Nakamura, 1993), company size (Krishnaswami et al, 1999; Nakamura, 1993; Fama, 1985), and propensity for financial distress (Chemmanur & Fulghieri, 1994), among others.

By analyzing groups of companies with a higher degree of concentration of debt, it is observed that such companies show a significant dependence on bank funds. Diamond (1991) clarifies that reputation is one of the factors that can alleviate problems associated with moral hazard and that companies take bank-monitored loans until they have built good reputations. Accordingly, new borrowers start the reputation-building process through monitored (i.e., bank) debt. Nakamura (1993) reinforces that bank debt may reduce information and monitoring costs for small businesses. The intensive use of a single source of debt also corroborates the results of studies by Colla et al. (2012), who find associations between low credit quality and specialization in relation to debt sources, but do not confirm the findings of Rauh and Sufi (2010). More generally, for all groups, a strong dependence is identified for companies in relation to bank loans and government-subsidized funds. The intensive use of such funds could be an indicator of the poor development of the Brazilian credit market (Boot & Thakor, 1997; Lucinda, 2004). Corroborating the statements of Lucinda (2004), the Brazilian credit market is quite dependent on government intervention, as evidenced by the constant presence of "subsidized debt" in all groups, but especially among homogeneous and weakly heterogeneous companies. This finding points to the importance of development banks as an important tool for obtaining financing, especially for companies with less access to the credit market. Therefore, development banks seem to address the lack of a more mature capital market in Brazil.

Finally, the results of this study show that the theoretical models that defend either homogeneity or heterogeneity of the debt structure do not compete with each other, but explain how different groups of companies in the same economy borrow funds. The literature on debt structure, although apparently divided into two schools of thought, explains the debt patterns adopted by different groups of companies. Therefore, these trends are two sides of the same coin, which complement and enrich our understanding of the factors that may explain the debt structure composition of different companies.

5 CONCLUSIONS

This study finds that among companies operating in Brazil, it is possible to find patterns of homogeneous and heterogeneous debt that are related to variables such as company size, the ratio between market value and book value, and the presence of rating grades.

This finding has potentially significant implications for the study of capital structure, which has treated debt capital as a homogeneous source of funds. Recognizing the existence of heterogeneity in debt structures, especially among the major borrowers in the market, indicates the need to analyze the specific effects of each type of debt on decisions relating to corporate indebtedness. Therefore, this raises a question about using variables of overall indebtedness (aggregated) as dependent variables in studies of the determinants of capital structure. Debt homogeneity may reflect an involuntary condition for companies that do not have access to diversified sources of funds because of their smaller size, smaller growth opportunity, and lack of rating grades.

Finally, a theoretical framework for the subject of debt structure is still virtually unexplored in Brazil and has the potential to bring new, relevant contributions to understanding companies' capital structures. By considering heterogeneity in debt composition, a new approach is proposed for the study of companies' capital structure. Thus, the literature on the topic of capital structure can be enriched as new contributions are generated. New challenges arise for those who are willing to forge new paths.

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