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Abstract
This paper discusses the determinants of capital structure with a focus on both publicly-owned and privately-owned firms. We use annual financial statement data for over 1,000 publicly-owned and privately-owned Brazilian firms covering the 2012-2015 period. This enables us to use financial statements under the prevailing IFRS regime. The methodology takes into account the interdependency between debt and dividend policies, recognized in the literature on determinants of both capital structure and dividend policies. We also take into account that both debt and dividend policies can be used to mitigate agency problems, and that the presence of agency problems may in turn affect the choice of capital structure and dividend policy in a firm. As a proxy for the agency cost of equity, the firm's inverted asset turnover ratio is used. Our empirical strategy treats debt and dividend policies and agency cost as dependent variables and leads to the use of a system of three equations, which are estimated with the generalized method of moments (GMM). In particular, we find that both payout and previous debt levels are positive and significant determinants of debt levels, but that there are differences in how important they are for privately-owned firms, on one hand, and publicly-owned firms, on the other. Also, some usual determinants of capital structure are significant for one group: for privately-owned firms (cash flow), for publicly-owned firms (intangibility), but not for the other, pointing out the importance of analyzing such firms separately.

Keywords: Agency cost of equity; capital structure, dividend policy; financial constraints; simultaneity bias.

1. Introduction

Ample literature has focused on the determinants of the level of debt usage by business firms, and the main competing explanations have been the *static trade off* theory (STOT) developed from Modigliani and Miller (1958; 1961) and the *pecking order* theory (POT) as proposed, among others, by Myers (1984).

In STOT, the choice of debt level results from balancing the benefits from using debt, i.e., the fact that interest expenses are deductible for corporate income tax purposes, meaning that a valuable debt tax shield increases with the use of debt in the firm's capital structure, and the cost of financial distress, also increasing with the use of debt, and resulting from the agency cost of debt associated with the temptation of the firm's owners to expropriate the firm's creditors through, for example, asset substitution and/or underinvestment decisions. An optimal debt proportion would then result, namely that which equates the marginal value of debt tax shields with the marginal cost of financial distress.

Since the various firms have different degrees of business risk and profitability, these characteristics should in turn determine especially how a firm's cost of financial distress would vary with the proportion of debt used. For example, higher business risk would tend to affect the cost of financial distress directly, and it would tend to determine a lower level of debt in the firm's capital structure; higher profitability before income taxes would tend to increase the advantage of using debt in order to produce lower income tax payments.

Alternatively, in POT the discussion of when and how to use debt is associated with information asymmetry between the firm's insiders (executives and/or controlling shareholders) and outsiders, especially creditors. POT, as the name indicates, recommends that, in order to minimize the impact of market discounting of share prices when new funds are necessary, the firm should resort to internal funds, then new debt, and last to new equity. In this case, higher profitability, in contrast to STOT, would recommend giving priority to the retention of earnings (internal equity) before new debt issues are considered. Hence, a lower level of debt should result. Of course, information asymmetry is at the root of agency problems and cost.

In the present paper, we attempt to test for the usual determinants of a firm's capital structure, as proxied by its proportion of debt, not as a competition between the two major theories, but with an interest at assessing the impact of the following aspects: (1) the possible interdependency between debt and dividend policies, (2) the possible differences with which the usual determinants variously affect financially constrained and unconstrained firms, using a seldom employed criterion for classifying firms as constrained or unconstrained.

It should also be noted that there is literature concerned with the determinants of a firm's dividend policy. We believe that debt and dividend policies should not be treated as unrelated to each other. This leads us to propose a methodology that considers their mutual endogeneity. In addition, in most of the literature that uses criteria for classifying constrained/unconstrained firms, in which the focus is usually on testing the firm's investment sensitivity to cash flow, the classification criteria involve variables which are often used as determinants of either debt and/or dividend policy. We propose a criterion – separating firms into publicly-owned versus privately-owned – that we believe to be arguably exogenous to both debt and dividend policy.

In a principal-agent relationship involving manager (or controlling shareholder) and shareholder (or minority shareholder) in a business firm, the literature has proposed the notion of the so-called "agency cost of equity" (JENSEN and MECKLING, 1976; COPELAND et al., 2005; BERK and DEMARZO, 2014).

When there is separation between ownership and control, the relationship involves manager and shareholder; when the separation between ownership and control is less extensive, as is the case in Brazil, the relationship involves a managing, controlling shareholder, as the agent, and minority shareholders as principals. From this point on, the paper will refer to the agent simply as

"manager", and to the principal simply as "shareholder". The context is similar to that observed in Europe, as pointed out by Tirole (2006, p. 15): "As severe agency problems continued to impair corporate performance both in companies with strong managers and dispersed shareholders (as is frequent in Anglo-Saxon countries) and those with a controlling shareholder and minority shareholders (typical of the European corporate landscape)…"

The agency cost of equity, as usually discussed in the literature, encompasses all the costs and losses caused by decisions taken by the manager according to the manager's interests, and at the expense of the shareholder's interests. Frequent examples of consequences of such a conflict of interest are the consumption of perquisites ("perks") and the use of free cash flow to finance unprofitable "pet projects" and/or paying excessive amounts in the acquisition of other companies. Or, in Tirole's words (2006, p. 17) in his definition of entrenchment strategies: "… actions that hurt shareholders in order to keep or secure managers' positions (invest in lines of activities that make them indispensable; manipulate performance measure to make them 'look good') may be excessively conservative when their performance is satisfactory, so as not to run the risk of their performance falling below the level that would trigger a board reaction."

According to the literature (LONG and WALKLING, 1984), higher managerial ownership or, in the Brazilian case greater ownership concentration would attenuate the possibility of value-reducing decisions. However, the possibility of punishing managers or controlling shareholders for such decisions is reduced when ownership is concentrated, a situation characterized as "entrenchment".

The shareholders could resort to the use of such tools as independent boards, variable compensation, external governance quality ratings, and lobbying for shareholder protection legislation. If these tools fail or are insufficient in reducing the agency cost of equity, they could hope that the manager, in order to avoid being penalized in the market for such a cost, would propose some kind of bonding mechanism, of which dividend and/or debt policies are two important examples.

The distribution of income through dividend payments and/or share repurchases could reduce the agency cost of equity by taking excessive funds from the hands of managers. The use of higher leverage, by forcing regular payments to creditors, would also limit a firm's free cash flow. That is, debt could be used as a governance mechanism. According to Tirole (2006, p. 51), "… debt is often viewed as a disciplining device, especially if its maturity is relatively short".

Presumably, this is true also when dividend payout is higher. In Brazil, for example, legislation establishes, since 1976, that firms organized as corporations are required to include, in their bylaws, a minimum dividend payout level. At the time, this was introduced as a measure designed to protect minority shareholders. As claimed by Berk and DeMarzo (2014, p. 607): *"*according to the managerial entrenchment theory of payout policy, managers pay out cash only when pressured to do so by the firm's investors," [or the law, one might add].The same authors (p. 607) add that "the managerial entrenchment theory of capital structure argues that managers choose low leverage to avoid the discipline of debt and preserve their job security", since low leverage would reduce the risk of financial distress.

The paper is organized as follows. Section 2 presents a review of the literature on proxies for the agency cost of equity and the determinants of both capital structure and dividend policies, with an emphasis, in the case of such determinants, on the empirical Brazilian literature.

In Section 3 we describe our sample and present our variable definitions. We then specify our empirical model, taking into account the possible simultaneity of capital structure and dividend policies and a proxy for agency cost of equity, as revealed by the discussion of the empirical literature, by using a system of three simultaneous equations. In Section 4, we estimate our system of equations using the generalized method of moments (GMM) with instrumental variables. Finally, Section 5 concludes.

2. Review of literature

Following up on our Introduction, this non-exhaustive literature discussion is focused on analyses of debt and dividend policy determinants, with special attention to studies involving Brazilian firms, and the various criteria used for classifying constrained/unconstrained firms.

In firms where there is separation between manager and owner, as is more likely the case of publicly-owned firms, which tend to be large, both debt and dividend policies may be used as monitoring tools regarding the actions by managers, or bonding mechanisms proposed by managers. The issuance of debt securities creates greater opportunities for outside monitoring, in this case by creditors, as discussed by Jensen and Meckling (1976). In turn, higher payout, since it is usually followed by the issuance of new securities in order to finance investments, also creates greater opportunities for outside monitoring, as pointed out by Rozeff (1982). Hence, since two of the tools used for reducing (equity) agency costs are associated with better outside monitoring, they may be substitutes or complements for each other, and thus they are interdependent: the observed capital structure may be partly determined by dividend policy, and vice versa.

Concerning the choice of capital structure, since Modigliani and Miller (MM) (1958; 1963) published their classical "irrelevance theorem" papers on capital structure decisions and their possible impact on firm value, a large portion of the financial economics and corporate finance literature has been concerned with (a) building on the MM propositions with the addition of capital and managerial labor market imperfections, and (b) testing the implications of the theories arising from such additions.

In short, it has been variously shown that market imperfections cause the capital structure decision to become relevant, i.e., that there is an optimal capital structure in the sense that its implementation maximizes the value of the firm. This is the contribution of the so-called *static trade off* theory (STOT) of capital structure, whose main driver is the existence of market imperfections in the form of costs of financial distress that arise from information asymmetry and transactions costs which in turn generate an agency problem involving firm owners/managers and creditors. Similarly, a dynamic version of the theory, most commonly known as the *pecking order* theory (POT) of capital structure, deals with the choice between debt and internal versus external equity when the firm needs new funds to finance long-term investments. This theory, in turn, is predicated on the acknowledgement of information asymmetry between managers and owners, on one hand, and outside equity and debt suppliers, on the other hand.

In several cases documented in the abundant literature on capital structure decisions, two other important corporate decisions are used as independent or control variables. One is the firm's dividend policy or payout decision, also dealt with by Miller and Modigliani (1961) in another "irrelevance theorem" paper. The other is the ownership or property concentration decision, most notably discussed by Jensen and Meckling (1976), as one of the main aspects of the agency relationships involving owners, managers and creditors in a corporation.

Recent empirical examinations of the determinants of capital structure choice and dividend policy involving data for Brazilian firms are papers by Forte et al. (2013), Canongia and Perobelli (2015) and Vancin and Procianoy (2015).

Forte et al. (2013) focus on the capital structure decisions of small and medium-sized Brazilian unlisted companies. They use a panel data sample of 4,400 firms with yearly data ranging from 1994 through 2006. They find that profitability is negatively related to leverage, and asset growth positively related to leverage, results that are consistent with POT. Even though they used a robust estimator for dynamic endogeneity, they used a single multiple linear regression equation, without controlling for agency cost nor dividend payout.

Canongia and Perobelli (2015) discuss the determinants of capital structure in Brazilian listed companies. Their paper is an attempt at obtaining evidence for either STOT or POT, or both, taking into account the idea that some firms may be financially constrained, as proposed in Almeida and

Campello (2010). Their sample covers quarterly financial statement data for the 2000 to 2013 period, covering up to 613 companies, and their method is to estimate a single multiple linear regression equation with panel data.

As a proxy for the agency cost of equity, their proposed determinants of the capital structure variable (leverage) includes the sales expense/revenue ratio, or "singularity". They also use dividend payout as one of their regressors. The competing theories of capital structure would predict an inverse relationship between payout and leverage. Their specification does not allow, however, for the possibility of leverage determining payout, as considered in the dividend policy paper commented on in the subsequent paragraphs of our paper. It does not consider the possibility of leverage determining the agency cost of equity either.

Their results indicate that the agency cost proxy (sales expense/revenues) is positively and significantly associated with leverage, but no separate result is provided for dividend payout as a determinant of capital structure.

Vancin and Procianoy (2015) deal with the determinants of dividend policy in Brazilian listed companies. Their main contribution, vis-à-vis the preceding literature on the same companies, results from the contention that one must take into account the legislation requiring that companies set a minimum payout ratio and may set another (higher) ratio of their own accord, as defined in their company bylaws. Thus, Brazilian companies would have to meet both legally and contractually required minimum payout ratios when making dividend payment decisions. Their effective decision, therefore, would involve how much, over and above those minimum ratios, they would be paying to investors. This then redefines the dependent variable used in empirical work.

Concerning the explanatory variables that we refer to here as "determinants of dividend policy", they include, among others, leverage, as measured by the ratio of current liabilities plus long-term liabilities to total assets, and they expect a negative association between debt and payout, because higher debt would require larger debt service payments, leaving fewer resources available for dividend payments.

As a proxy for the agency cost of equity, they propose ownership concentration, in the belief that higher ownership concentration would attenuate agency problems involving managers and stockholders. This should lead to the expectation that the two variables are positively associated. Since they also claim that dividend payments could be used to reduce such agency problems, a simultaneous equation specification would have seemed to be in order, but their estimation procedure is ordinary least squares for a single equation using panel data for the 2007-2013 period, involving 1,531 dividend payments. For future comparison, it must be mentioned that they find ownership concentration to be significantly and positively associated with dividend payout in their sample for the firms that pay dividends over and above the legal and contractual minima, containing 969 dividend payments in the 2007-2013 period.

In conclusion, recent empirical Brazilian literature on both capital structure and dividend policy determination, therefore, has three peculiarities: (a) in each case the other policy is considered as a determining variable; (b) some proxy for the agency cost of equity is also used as a determinant; but (c) in no case is it adopted a specification that allows for the simultaneity between the three variables: leverage, payout, and agency cost of equity, and this is what we try to contribute with in our paper. If this simultaneity is significant, those papers would have been using a biased and inconsistent estimator (WOOLDRIDGE, 2003, p. 530).

We think it is reasonable to argue that how much a choice of debt (dividend) policy influences dividend (debt) policy, controlling for the presence of agency cost of equity in a firm, would depend on whether the firm is financially constrained or unconstrained.

Specifically, we include lagged values of our dependent variables as determining variables, given the literature that has found, particularly in the case of debt policy, that firms tend to (in the United States) maintain stable leverage over long periods. This has led Lemmon et al. (2008) to

claim that the most important factor in the determination of leverage in year t is leverage in year t-1, thus dominating the other usual determining characteristics. However, this has come under question, as in DeAngelo and Roll (2015). Using data for U.S. firms as far back as 1926, they present evidence to the effect that the belief in stable capital structures is incorrect, as originally proposed by Lemmon et al. (2008), and conclude that explaining the time series of leverage ratios is as important as explaining the cross section of leverage ratios, which is what we do in this paper. The relevance of that criticism to our paper is limited, however, since we constrain ourselves to considering that leverage at year t is a function only of leverage at year t-1, and not a long series of past leverage ratios. DeAngelo and Roll (2015) explain that leverage does tend to be sticky over horizons of a few years (our case), but that a company's current leverage becomes an increasingly poor predictor of its future leverage as the time between leverage observations increases.

It is interesting to note that, since DeAngelo and Roll (2015) are concerned with explaining *changes* in capital structures over time, as opposed to leverage *levels*, they include, as explanatory variables, the rate of asset growth as a proxy for investment policy, and conclude that it tends to dominate the usual determinants of capital structure, such as size, growth opportunities, asset tangibility, and profitability. In fact, these variables are found not be significant in their analysis.

Our non-exhaustive search for the criteria that have been proposed and used for classifying firms as *financially constrained* versus *non-financially constrained* is described in what follows, including their use in studies of Brazilian firm data.

The concern with this classification arose in Fazzari et al. (1988), in which it was argued that the sensitivity of firms' investment to the usual incentives – changes in the cost of capital, in asset prices, and/or taxes – would depend on how easily firms could access debt and equity markets in order to finance new investments. Fazzari et al. (1988) coined the term *financially constrained firm* to refer to firms whose investment would have *excess sensitivity* to their own (internal) cash flow as a source of finance, due to their more limited access to external finance. According to Lemmon and Zender (2010), when firms must seek external funding, unconstrained firms primarily use debt to fill their financing deficits while financially constrained firms exhibit a heavy reliance on internal equity.

Our search in the literature focused on finding out how much attention was given to the use of some type of classification in the case of privately-owned (i.e., unlisted) firms, and also to whether the fact that a firm is unlisted would, in itself, be used as a criterion for classifying it as a constrained firm.

For Fazzari et al. (2008), the criterion was based on dividend payment policy. They argued that a rapidly growing firm would exhaust all of its internal funds, whereas a mature firm would be able to pay dividends.

Lemmon and Zender (2010) tried to measure the firm's debt capacity, one form of financing constraint, as a high likelihood of being able to access public debt markets. To do so, they estimated a logit model in which the dependent variable was set to one if a firm had a debt rating in a particular year, and zero otherwise. The firm characteristics used in their logit regression were: firm size (log of total assets), profitability (ROA), the fraction of total assets that were tangible, market to book ratio, leverage, firm age, standard deviation of stock returns, and industry dummies.

Almeida and Campello (2010) claimed that the inverse relationship between internal finance and outside finance (debt or equity), predicted by pecking order theory, would be stronger in unconstrained firms, since market frictions would not be as strong in their case. In their own worlds, "testing the implications of our model requires separating firms according **a priori** [our emphasis] of the financing frictions that they face. There are a number of plausible approaches to sorting firms into 'financially constrained' and 'financially unconstrained' categories. We do not have strong priors about which approach is best." (p. 602)

Hence, they opted for using the following alternative variables:

a. Size (assets): “small firms are typically young, less well known, and thus more vulnerable to credit imperfections” (p. 602).
b. Payout, or total distribution to shareholders (dividends + stock repurchases): “the intuition is that financially constrained firms have significantly lower payout ratios follows from Fazzari et al. (1988), among many others.” (p. 602)[i]
c. Existence of bond ratings: the firm would be classified as unconstrained if a rating existed over their sample period, constrained otherwise.
d. Existence of commercial paper ratings: treated identically as in the case of bond ratings.

Later, Campello et al. (2013), in a survey with CFOs of U.S. public companies, used a similar classification:
a. Size: unconstrained if sales > US$1 billion in 2008Q4.
b. Dividends: 1 (unconstrained) if positive.
c. Ratings: speculative (constrained) if lower than or equal to BB+ by Standard & Poor’s; investment otherwise.
d. Profitability: 1 (unconstrained) if positive.

In their test of STOT versus POT for listed Brazilian firms, Canongia and Perobelli (2015) replaced the use of bond and/or commercial bond ratings, rarely available for Brazilian firms, with the company’s presence in or absence from the Ibovespa portfolio.[ii] They went on to construct, with the use of cluster analysis, an index for classifying constrained/unconstrained firms.

In other studies involving Brazilian financially constrained, Castro et al. (2015) used both the WW and the KZ indices, which are described shortly. Their study involved a sample of 404 Brazilian manufacturing companies, including both publicly-owned and privately-owned firms, with data for the 1998 to 2006 period. The authors were concerned with the impact of financial development and financial structure on the possible mitigation of the cash flow sensitivity of a firm’s investment.

The so-called Whited and Wu (WW) (2006) index is represented by the following equation:

$$WW = -0{,}091(CF/TA) - 0{,}062DIVPOS + 0{,}021(LTD/TA) - 0{,}044LNTA + 0{,}0102ISG - 0{,}035SG \quad (1)$$

Where (all values measured in the same year t):
CF = operating cash flow
TA = total assets
DIVPOS = 1 if dividends are paid, 0 otherwise
LTD = long term debt
LNTA = natural logarithm of total assets
ISG = 3-digit industry sales growth
SG = firm sales growth

In turn, the KZ index (LAMONT et al., 2001) has the following specification:

$$KZ = -1{,}002(CF/K) + 0{,}283Q + 3{,}139(D/TA) - 39{,}368(DIV/K) - 1{,}315(CASH/K) \quad (2)$$

Where, in addition to the previously defined variables:
K = fixed assets, measured in year t-1
Q = Tobin’s Q ratio
D = short-term plus long-term debt
DIV = value of dividend payments
CASH = cash plus short-term investments

Since approximately half of the sample firms in Castro et al. (2015) were privately-owned firms, Tobin's Q and dividend payment information, being unavailable, led to the omission of the corresponding variables from the WW and KZ indices.

The higher the value of WW (KZ), the more likely a firm would be classified as financially constrained. This index is frequently cited, but, in our search, it was mentioned as an alternative for a paper on privately-owned firms – small and medium-sized German firms – by Behr et al. (2013): "there is little evidence on … financial constraints of private firms." (p. 3472)[iii] In addition to using the WW index, they used size and asset tangibility as criteria. In the case of asset tangibility, proxied by the proportion of fixed assets, the argument is that fixed assets are more easily used as collateral when raising debt; hence, a firm would be less financially constrained if it could more easily offer its assets as collateral.

Crisóstomo et al. (2014), in a study of the effect of financial constraints on firm investment, used a sample of 289 listed nonfinancial firms over the 1995 to 2006 period. Their criterion for classifying firms as financially unconstrained was based on the occurrence of dividend payments and/or new stock issues. This classification involved three different versions: (1) the firm pays dividends and has maintained or increased payout in period t; (2) pays dividends and maintains or increases payout, and does not issue new stock in period t; (3) pays dividends and maintains or increases payout, and does not issue new stock in periods t and t-1. In that paper, t+1 is the year in which the firm's investment ratio is observed.

They also point out that previous studies of Brazilian firms and markets had obtained similar results for the cash flow sensitivity of firm investment, such as Bassetto and Kalatzis (2011) and Terra (2003). Bassetto and Kalatzis (2011) classified 367 firms, over the 1997 to 2004 period, using a clustering technique involving the values of accounting and financial variables. This approach is similar to that employed in Canongia and Perobelli (2015). Terra (2003), in turn, used data for the 1986 to 1997 period, covering 468 Brazilian firms, including both privately-owned and publicly firms, as in Castro et al. (2015). Of interest, her criterion for classifying firms as financially unconstrained/constrained was based on various criteria: (1) size, with larger firms being less constrained than smaller firms; (2) the Rajan-Zingales (1998) external finance dependency ratio – a less dependent firm would be classified as financially unconstrained; (3) whether firms were multinational or not, with multinationals being less constrained.

Majumdar (2014) studies the determinants of capital structure of privately-owned companies in India. This is a panel data analysis including only privately-owned companies, and no comparison is made to public companies. However, the choice of explanatory variables is based on literature for publicly-owned firms, since the intention was to find out whether the same variables are relevant. The conclusion is that private companies depend more on bank credit, as expected, since listed companies have the possibility of issuing bonds. The existence of assets that can be used as collateral is important, supporting the choice of asset tangibility as a criterion for classifying a firm as unconstrained, even if it is not listed.

For obvious reasons, the literature in which the classification of firms into financially constrained/unconstrained has concentrated on data for publicly-owned firms. For example, the KZ index contains a firm's Q ratio as a factor, and this requires the availability of a market value for the firm's equity. The omission of that variable could lead to incorrect classifications.

We claim, however, that a "more exogenous" criterion would be based on whether the firm is publicly-owned or not.

In Brazil, limited liability companies are not allowed to issue bonds to finance their investments and operations. In order to be able to issue bonds, a company must be organized as a corporation, and its issuance must be approved by shareholders, and not directly by company executives.

The distribution of corporate bonds to the investing public can be done only by publicly-owned corporations, after its registration with the Brazilian securities and exchange commission (Comissão de Valores Mobiliários - CVM).

In contrast, privately-owned corporations may issue and distribute bonds, but their distribution is limited to private placements with shareholders or specific groups of investors. In the case of external equity, privately-owned firms may appeal to current shareholders for additional funds, but have no access to the organized capital markets, either in the initial distribution of new shares and much less their trading in secondary markets.

In this paper, we believe that access to funding via new external equity or the issuance of bonds, being more difficult and costly for privately-owned firms, would render such firms more constrained than publicly-owned firms, and hence our choice of criterion for separating financially constrained from non-constrained firms.

The impact of this distinction, for example, on the choice of debt and dividend policy, however, seems to be a matter of empirical determination. In this sense, we regard this paper as a first attempt at a *description* of firms' debt and dividend policies, especially in the case of privately-owned firms. For example, the absence of market prices from public trades of both bonds and stocks would increase the impact of information asymmetry, and likely lead to lower debt levels. On the other hand, the ownership of privately-owned firms is almost certainly more concentrated than that of publicly-owned firms. They would then be closer to the owner-managed firm discussed in Jensen and Meckling (1976), leading to a reduction in the incentive to incur agency costs.

Saunders and Steffen (2011), for example, argue that costs of information production should be higher in privately-owned firms, resulting from the absence of secondary security market trading, and they would tend to pay higher debt costs. In a study of bank loans to UK firms, however, they do not find significant loan spread differentials between publicly-owned and privately-owned firms. We believe that disadvantage may be compensated by the benefits (to lenders) of higher firm ownership concentration.

In a study of dividend policy determinants with a focus on privately-owned U.K. firms by Michaely and Roberts (2012), in which the classification criterion between constrained and unconstrained firms is based on the private-public dichotomy, they find that privately-owned firms have both higher payout and debt levels than their publicly-owned counterparts. In the particular case of dividends, they conjecture that, since in the U.K. wages are taxed at a higher rate than dividend income, owner-managers could be using dividend policy to meet consumption needs. Since we find a similar result for our sample of Brazilian firms, the explanation could be the same, since wages are taxed, but dividend income is not.

3. Data and methodology

Given the literature review, three simultaneously determined equations are proposed below, including the expected signs for the coefficients. These equations are estimated using the Generalized Method of Moments (GMM) with panel data (WOOLDRIDGE, 2002; ARELLANO and BOND, 1991; BLUNDELL and BOND, 1998). All monetary values were measured in U.S. dollars.

In the following equations, the variable definitions are:

$GDEBT_t$ = gross debt (total debt/total assets at the end of year t);
$PAYOUT_t$ = dividends paid/net income during year t;
$INVTURN_t$ = 1/total asset turnover = total assets/total sales revenue during year t;[iv]
$CFLOW_t$ = operating cash flow = earnings before interest, taxes, depreciation and amortization expenses/total assets in year t;
$CRATIO_t$ = current liquidity ratio = current assets/current liabilities at the end of year t;
$MARGIN_t$ = operating margin = earnings before interest and taxes/sales revenue in year t;
$SIZE_t$ = natural logarithm of total assets (million US dollars) during year t;
$INTANG_t$ = intangible assets/total assets at the end of year t;
$OPNPV_t$ = proxy for positive net present value investment opportunities = earnings before interest and taxes/total assets.
$STDEBT_t$ = proportion of short-term debt = current liabilities/total assets.

In all three equations, i represents the firm and t represents the year, the term a_i for each equation is the firm's non-observed effect and ε_{it} is the idiosyncratic error. A lagged value for the dependent variable was included in all three equations, since it is expected that the levels of such variables are not susceptible to significant changes from one year to the next, as observed by Florackis and Ozkan (2009). If this is true, the coefficient of the lagged dependent variable will be positive and the variable itself will be significant. The stability of capital structure choices, in particular, is documented for the U.S. market by Lemmon et al. (2008).

Finally, year dummy variables are included, where 2012 is the base year.

Capital structure decision equation:

$$GDEBT_{it} = c_{10} + c_{11} \times GDEBT_{it-1} + c_{12} \times PAYOUT_{it} + c_{13} \times INVTURN_{it} + c_{14} \times CFLOW_{it} + c_{15} \times CRATIO_{it} + c_{16} \times MARGIN_{it} + c_{17} \times SIZE_{it} + c_{18} \times INTANG_{it} + c_{19} \times OPNPV_{it} + a_{1i} + \varepsilon_{1it} \quad (3)$$

Both fundamental capital structure theories predict that c_{12} will be negative, as indicated by Canongia and Perobelli (2015). As to a proxy for the agency cost of equity, they find a positive c_{13}, albeit with the use of a different proxy.

The expected signs for some of the other coefficients of equation (3) – c_{14}, c_{15}, c_{16} - are negative, under POT, because the CFLOW, CRATIO and MARGIN variables are proxies for the availability of internally-generated funds (equity), which are a preferred source of financing, according to Myers (1984).[v] A positive sign for c_{16} would be consistent with STOT. The expected sign for c_{18} would be negative, since intangible assets are not adequate for use as collateral.

Payout decision equation:

$$PAYOUT_{it} = c_{20} + c_{21} \times PAYOUT_{it-1} + c_{22} \times GDEBT_{it} + c_{23} \times INVTURN_{it} + c_{24} \times CFLOW_{it} + c_{25} \times CRATIO_{it} + c_{26} \times MARGIN_{it} + c_{27} \times OPNPV_{it} + a_{2i} + \varepsilon_{2it} \quad (4)$$

Vancin and Procianoy (2015) explicitly predict that c_{22} will be negative. As to c_{23}, since they expect a positive association between their proxy for agency cost (ownership concentration)

and dividend payout, and our proxy estimates the level of such cost, the corresponding prediction would be a negative sign for c_{23}.

Concerning c_{24} to c_{26}, one would expect positive signs, under the argument that those variables measure the availability of funds for distribution to shareholders. A negative sign for c_{27} would indicate that, with the existence of profitable investment opportunities, managers would decide to reinvest a larger proportion of the firm's current income.

Agency cost equation:

$$INVTURN_{it} = c_{30} + c_{31} \times INVTURN_{it-1} + c_{32} \times GDEBT_{it} + c_{33} \times PAYOUT_{it} + c_{34} \times STDEBT_{it} + \\ + a_{3i} + \varepsilon_{3it} \quad (5)$$

We expect c_{32}, c_{33} and c_{34} to be negative, because the corresponding variables would be set at higher levels in order to reduce the agency cost of equity.

In the estimation of the equation system (3)-(5), the instruments used include: (a) the lagged variables of GDEBT, PAYOUT and INVTURN; (b) the exogenous variables in equations (3)-(5), i.e., CFLOW, CRATIO, MARGIN, SIZE, OPNPV, INTANG and STDEBT.

The sample involves Brazilian privately (unlisted) and publicly-owned (listed) firms, with annual data available for the period between 2012 and 2015. The values for all variables were obtained in the Capital IQ database. The period chosen was such that all information would have been produced after the implementation of International Financial Reporting Standards (IFRS) in Brazil, and the sample does not include financial institutions, since the nature of their financial statements differs very much, particularly in terms of capital structure, from those of industrial/commercial/service firms. Also excluded were the firms whose payout ratio in the period was negative. The database contains 6,115 private firms and 638 public firms with available data in the period. However, in order to take part in a regression model with panel data, the firms must have data in at least two consecutive years, which resulted in a database containing 1,217 private firms and 564 public firms.

The comparison of the capital structures of private and public companies is the main contribution of this article. However, there is a selection bias if the analysis of the two groups of companies is performed directly. This is due to the fact that sample selection is not random, which means that some members of the population are less likely to belong to one group than to another (HECKMAN, 1979). Considering the situation of the groups used here, it is easy to conclude that a certain firm is more likely to be in the group of private firms and that the group of public firms has some specific characteristics that do not allow it to be compared to all private firms. If the selection bias is not taken into account, then statistical conclusions may not be accurate.

As discussed in Heckman et al. (1998) and Zhao (2004), one of the ways to eliminate the selection bias is by matching the firms; i.e. for each public company (treatment group) we select a private company with similar characteristics to construct the control group. This is done with the use of the propensity score matching procedure. Thus, the private firms have similar characteristics to the public companies, but have decided not be listed for some reason. This would lead to the two groups being randomly selected, thereby eliminating the selection bias.

The propensity score matching procedure is described as follows:

i) propensity score: we estimate a logit model with panel data to forecast the probability that a firm belongs to the treatment group (public firms), conditional on a set of observable characteristics that may affect the decision to be public or private (debt, payout, invturn, cflow, cratio, margin, size, intang, opnpv and stdebt);

ii) matching algorithm: for each public firm, we select the private firm that has the more similar probability to be in the treatment group (nearest neighbor method) and a pair is thus created. The

selection of private firms is done with replacement. As mentioned by Stuart (2010), matching with replacement can often decrease bias, and the author suggests that matching with replacement is preferred to matching without replacement if the number of reduplications is not too large (approximately 10% of the private firms entered twice in the matched sample);

iii) checking for balance: a t-test was used for comparing the means of all variables in the propensity score in order to determine whether the groups are statistically similar. In medical studies, where matching methods are generally applied, the match between individuals in the treatment and control groups should involve identical independent variables. This is because these variables are discarded later and the study usually focuses on the comparison of means. In our case, the independent variables are used in the regressions even after the matching procedure, that is, the comparison between the groups takes into account the variability of the independent variables. Regardless, we calculate two measures to evaluate the matching method, in line with Stuart (2010). The standardized difference of means of the propensity score of our sample was 0.0032, close to zero and under 0.25 as desirable, and the ratio of the variances of the propensity score between the groups was 0.993, close to 1 as desirable and between 0.5 and 2 according to the criterion described in Stuart (2010).

The sample's corresponding descriptive statistics for each year between 2012 and 2015 and the correlation coefficients are displayed in Tables 1 and 2, respectively. Overall, for both public and private Brazilian firms, there has been a slightly increase of 17% in gross debt from 2012 to 2015, and net debt has increased slightly more, 22%, in the same period. The proportion of short-term debt (STDEBT) also increased, by approximately 11%. On the other hand, operating margin decreased significantly, by 25% and 37% for private and public firms, respectively. While the current liquidity ratio (CRATIO) remained constant for public firms, it increased by 25% for private firms in the period. In the last two years, we can notice that the inverted asset turnover ratio (INVTURN) showed a strong downward trend (32%) for private firms, whereas it increased 12% for public companies.

Comparing the means for the firms in the treatment and control groups, we found evidence of balance between all covariates. The means of payout and invturn are statistically different with a confidence level of 95%, but they are expected to being so, as they are dependent variables. Then, we decided to estimate equations (3) to (5) using this propensity score matching because these two variables are considered endogenous variables and we control for all other variables, even though they are statistically equivalent on average for the groups.

Table 1. Descriptive statistics for the firms included in the matched sample, from 2012 to 2015.

Variable	Year	Mean	Median	SD	n	Mean	Median	SD	n	t-test
GDEBT	2012	0.298	0.300	0.256	142	0.294	0.299	0.169	141	0.876
	2013	0.337	0.344	0.243	142	0.307	0.314	0.179	141	0.244
	2014	0.339	0.354	0.262	142	0.317	0.316	0.192	140	0.434
	2015	0.350	0.397	0.259	138	0.347	0.343	0.227	142	0.925
NDEBT	2012	0.176	0.201	0.298	142	0.171	0.205	0.220	141	0.862
	2013	0.197	0.233	0.290	142	0.183	0.215	0.222	141	0.644
	2014	0.212	0.219	0.294	142	0.187	0.212	0.237	140	0.431
	2015	0.215	0.223	0.286	138	0.219	0.231	0.269	142	0.911
PAYOUT	2012	58.13	51.32	68.35	142	42.67	29.98	47.18	141	0.098
	2013	66.87	55.62	79.55	142	42.94	30.88	42.21	141	0.002
	2014	74.71	54.27	112.03	142	52.18	32.68	57.86	140	0.035
	2015	66.08	32.05	137.19	138	50.56	32.75	65.10	142	0.230
INVTURN	2012	7.712	1.603	22.41	142	2.150	1.437	2.498	141	0.004
	2013	8.316	1.694	44.86	142	2.001	1.557	1.665	141	0.540
	2014	8.986	1.517	54.21	142	2.008	1.531	1.511	140	0.127
	2015	6.059	1.586	15.77	138	2.246	1.674	2.352	142	0.006
CFLOW	2012	0.123	0.098	0.125	142	0.118	0.115	0.080	141	0.734
	2013	0.132	0.113	0.110	142	0.119	0.115	0.071	141	0.223
	2014	0.125	0.112	0.118	142	0.112	0.114	0.070	140	0.269
	2015	0.115	0.092	0.137	138	0.091	0.102	0.086	142	0.170
CRATIO	2012	1.469	1.129	1.412	142	1.991	1.549	2.060	141	0.114
	2013	1.688	1.161	1.853	142	1.914	1.553	1.198	141	0.224
	2014	1.452	1.139	1.357	142	2.031	1.689	1.997	140	0.095
	2015	1.841	1.266	4.189	138	1.814	1.550	1.217	142	0.941
MARGIN	2012	0.184	0.114	0.201	142	0.138	0.127	0.198	141	0.098
	2013	0.348	0.157	0.981	142	0.147	0.134	0.159	141	0.087
	2014	0.259	0.127	0.740	142	0.138	0.135	0.161	140	0.160
	2015	0.138	0.109	0.479	138	0.087	0.099	0.253	142	0.270
SIZE	2012	7.408	7.749	3.150	142	7.920	8.022	1.518	141	0.123
	2013	8.290	8.247	2.119	142	8.070	8.141	1.468	141	0.311
	2014	8.184	8.192	2.523	142	8.128	8.247	1.519	140	0.819
	2015	8.392	8.242	2.317	138	8.204	8.320	1.580	142	0.429
INTANG	2012	0.186	0.032	0.267	142	0.189	0.075	0.223	141	0.930
	2013	0.195	0.057	0.260	142	0.194	0.088	0.225	141	0.966
	2014	0.189	0.055	0.260	142	0.195	0.085	0.226	140	0.831
	2015	0.190	0.060	0.251	138	0.195	0.089	0.222	142	0.885
OPNPV	2012	0.106	0.068	0.115	142	0.089	0.083	0.076	141	0.143
	2013	0.104	0.090	0.092	142	0.088	0.077	0.069	141	0.116
	2014	0.097	0.081	0.097	142	0.083	0.085	0.068	140	0.168
	2015	0.080	0.063	0.126	138	0.061	0.067	0.086	142	0.135
STDEBT	2012	0.271	0.199	0.230	142	0.269	0.239	0.190	141	0.933
	2013	0.302	0.239	0.222	142	0.276	0.220	0.228	141	0.345
	2014	0.302	0.243	0.220	142	0.271	0.234	0.193	140	0.217
	2015	0.301	0.253	0.213	138	0.299	0.245	0.230	142	0.937

The following results stand out from Table 1:

a) The relative debt levels, both gross and net, are not significantly different between publicly-owned and privately-owned firms. Thus, even though listed firms have easier access to the

public debt market, privately-owned firms seem to compensate this disadvantage by possibly using bank and supplier credit more extensively.

b) The payout ratios at privately-owned firms are higher than those for publicly-owned firms, and significantly so, at least in 2013 and 2014. As observed in Michaely and Roberts (2012) for U.K. firms, it is possible that dividend payments are being used as substitutes for higher wages, for tax reasons.
c) In 2012 and 2015, the observed values for the proxy for agency cost of equity (INVTURN) are significantly higher for the privately-owned firms, which is contradicts the expected cost attenuation that would be produced by their being closer to the Jensen and Meckling (1976) owner-manager firm. Possibly, this is due to the fact that publicly-owned firm performance is more closely scrutinized by public markets and/or the more extensive and intensive use of variable compensation schemes in such firms.
d) In general, for all other indicators the differences between privately-owned and publicly-owned firms are not significant.

4. Results

Table 2 presents the estimated models for capital structure, payout decision and agency costs – equations (3), (4) and (5) respectively – for private and public firms. Using the J statistic, introduced in Hansen (1982), we conclude that all models are correctly specified (values approximately equal to zero). The residual analysis suggests the presence of heteroskedastic of errors, and therefore robust standard errors are calculated. There is no problem of serial correlation, because the Durbin-Watson (DW) statistic is close to two.

Focusing on equation (3), we observe that the persistence of capital structure is much higher for privatelyowned firms, as denoted by the magnitude of its lagged variable. Operating cash flow is positively related to capital structure of private firms, which is inconsistent with POT, and irrelevant for public firms. The positive coefficient of the current liquidity ratio for private firms and negative coefficient for public firms leverage could be due to the effect of financial constraints. While unconstrained firms have easier access to long term debt at better rates, such as the BNDES subsidized long term interest rate, constrained firms may have access only to short term liabilities. We also find evidence of the size of the company to be relevant only for privately-owned firms.

Concerning equation (4), with dividend payout as dependent variable, one observes that GDEBT is both significant and inversely related to payout, indicating that, in terms of the control of agency cost, a firm's debt and dividend policies seem to be substitutes to each other. GDEBT is not relevant to payout by privately-owned firms. Payout is persistent for publicly-owned firms, and this may be explained by clientele arguments. Finally, OPNPV, as proxied by a profitability ratio (EBIT/Total assets) is both significant and positively related to payout by privately-owned firms. This indicates that such firms distribute more of the earnings when they are more profitable.

In equation (5), in which the proxy for agency cost of equity is the dependent variable, the results indicate that debt seems to be significantly used to attenuate that cost, and that short-term debt is a relevant component. Payout policy, in the case of publicly-owned firms, seems to be used as a mechanism for attenuating agency problems. In addition, and in spite of the adoption of variable/incentive compensation schemes, agency cost of equity is persistent in the case of publicly-owned firms.

Table 2. GMM estimated models for equations (3), (4) and (5), for privately-owned and publicly-owned firms.

	GDEBT		PAYOUT		INVTURN	
Variable	Private	Public	Private	Public	Private	Public
GDEBT			-10.288	-39.443***	22.2601***	1.6906
			(20.7417)	(15.0957)	(7.2047)	(1.3756)
$GDEBT_{t-1}$	0.7242***	0.5631***				
	(0.0284)	(0.1187)				
PAYOUT	0.0002***	8.48E-05*			-0.0181***	0.0024***
	(5.8E-05)	(5.2E-05)			(0.0070)	(0.0006)
$PAYOUT_{t-1}$			0.1938	0.2124***		
			(0.1366)	(0.0573)		
INVTURN	7.9E-05	7.8E-05	-0.3833	-0.6501		
	(0.0002)	(0.0030)	(0.3118)	(0.4383)		
$INVTURN_{t-1}$					0.0269	0.5929***
					(0.1665)	(0.1001)
CFLOW	0.4361***	0.3736	-87.7047	154.1211		
	(0.1341)	(0.3346)	(57.6092)	(118.0038)		
CRATIO	0.0041*	-0.0128***	-0.7669*	-1.5398		
	(0.0026)	(0.0043)	(0.4618)	(1.9227)		
MARGIN	0.0037	0.0123	-5.1519	23.5280		
	(0.0116)	(0.0151)	(10.1711)	(15.2880)		
SIZE	0.0161***	0.0171				
	(0.0027)	(0.0116)				
INTANG	-0.0333	-0.0203***				
	(0.0321)	(0.0055)				
OPNPV	-0.2748**	-0.7731*	201.9169***	-77.2735		
	(0.1377)	(0.4102)	(65.8774)	(146.5816)		
STDEBT					18.4213**	-0.5577**
					(9.6589)	(0.2912)
D2013	-0.0805***	0.0044***	3.9918*	2.3677***	-9.4395***	-0.0835***
	(0.0166)	(0.0015)	(2.1683)	(0.5074)	(1.3623)	(0.0219)
D2014	-0.1046***	0.0093***	13.8211***	13.5814***	0.1721	-0.0848**
	(0.0168)	(0.0015)	(5.1391)	(0.7093)	(0.3120)	(0.0428)
D2015	-0.0927***	0.1243***	4.4243	22.4877***	-3.1537***	1.3353***
	(0.0170)	(0.0264)	(5.6153)	(1.8448)	0.4239)	(0.2641)
Constant	0.0253	0.0443	48.7076***	32.6285***	-2.9232	0.3708
	(0.0250)	(0.0509)	(8.9758)	(10.0908)	(4.5359)	0.3043
Adjusted R^2	0.6283	0.5116	0.0143	0.1032	0.0318	0.4197
DW statistic	1.9158	1.7178	1.8233	1.9147	2.2548	1.9060
J statistic	5.7E-23	1.8E-23	1.2E-26	2.1E-25	1.9E-28	1.0E-26

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in parenthesis. DW is the Durbin-Watson statistic for evaluating irst-order serial correlation and the J-statistic is used for evaluating model validity.

5. Conclusions

In this paper we have examined the determinants of capital structure for Brazilian firms over the 2012 to 2015 period. We considered privately-owned and publicly-owned firms separately, using such a distinction as a novel criterion for classifiying firms as constrained and unconstrained. We also considered the possibility of endogeneity involving debt and dividend policies, along with the level of agency cost of equity. These have been considered in many previous studies involving Brazilian firms, but seldom has this endogeneity been fully taken into account and modelled.

Based on the results obtained for our equation (3), we find that payout policy is a significant and positive determinant of debt, both for privately-owned and publicly-owned firms, but more strongly for the former, according to the coefficient values in Table 3. Of course, higher payout means a stronger need to compensating such larger distributions with new debt. For both groups of firms the preexisting level of debt is a strong determinant, and this has seldom been taken into account in other studies of Brazilian firms, meaning that this significant variable has usually been omitted.

In terms of the remaining determinants of capital structure, used here as control variables, important differences between the two groups of firms are observed involving (a) cash flow – significant and with a positive coefficient only for privately-owned firms – this is consistent with POT; (b) intangibility – significant and with a negative coefficient only for publicly-owned firms – this is consistent with their greater capacity for using assets as colateral for debt contracts.

In sum, the separate analysis of capital structure determinants for these two groups of firms has produced some very different results, indicating that studies that focus on listed companies due to the greater data availability may not be representative of what generally happens in Brazilian companies. This is not to speak of modelling problems due to the posible endogeneity that was discussed above in this paper.

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[i] In the case of both size and payout, they used the top (bottom) three deciles of the firm distribution, in the construction of the unconstrained (constrained) group.

[ii] This is consistent with the results in Damasceno et al. (2008), who find that this variable is a significant determinant of rating differences for listed Brazilian companies.

[iii] A sentence that adequately sums up the situation we are in. In principle, this would be true for Brazilian firms as well, hence our claim to contribution to the literature by having gone after data for a large number of privately-owned firms.

[iv] This is the proposed proxy for agency cost. The asset turnover ratio is a commonly used measure of the firm's operating efficiency. According to Florackis and Ozkan (2009, p. 499): "A low asset turnover ratio indicates poor investment decisions, insufficient effort, and consumption of perquisites, and hence suggests that agency costs arising from the conflicts between managers and shareholders may not be insignificant". The authors mention that another commonly used proxy for agency cost is the ratio of selling, general and administrative (SG&A) expenses to total sales revenue. They also test for a significant association between this second proxy for agency cost and their entrenchment index, and obtain similar results.

[v] If the firm is not capable of generating funds for investment purposes in its own operations, and does not possess sufficiently large current resources, it is expected that the firm will be forced to resort to new debt as a source of funds. This would be predicted by POT as proposed by Myers (1984). Therefore, the signs for the coefficients of CFLOW, CURR and MARGIN would be expected to be negative in equation (3).