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Foreign activity effects and capital structure: Brazilian evidence

Efectos de la actividad internacional y estructura de capital: la evidencia de Brasil

ABSTRACT

This paper analyzes whether Brazilian companies with foreign activities (MNC) have different capital structure from those with mainly local activities (DC). If so, is the upstream-downstream hypothesis prediction valid – which states that internationalized companies use more debt than those with local activities? Our sample consists of 131 companies within the period from 2004-2008. We found that Brazilian MNCs use more debt due to international activities, with 9.6% more leverage of which 5.8% comes from long-term sources. Our results also show that international activity is positively related to foreign debt usage, and on average MNCs carry 12.7% more foreign debt in their capital structure. Although the access to international capital markets is frequently suggested as a motivation for companies to internationalize, this is the first study to test empirically whether international activity and debt financing are related.

Key words: International activity, capital structure, foreign debt, MNC.

RESUMEN

Este trabajo analiza si las empresas brasileñas con actividades en el extranjero (MNC) tienen una estructura de capital diferente de las que desarrollan sus actividades principalmente a nivel nacional (DC). Si es así, ¿la predicción

de la hipótesis de *upstream-downstream* es válida, esto es, que las empresas internacionalizadas utilizan más deuda que las que realizan actividades locales? La muestra se compone de 131 firmas en el período 2004-2008. Encontramos que las empresas multinacionales brasileñas utilizan más deuda debido a las actividades internacionales, con un aumento de 9,6%, de los cuales 5,8% proviene de fuentes a largo plazo. Nuestros resultados también muestran que la actividad internacional se relaciona positivamente con el uso de la deuda en moneda extranjera, y en promedio las empresas multinacionales llevan más de 12,7% de deuda en moneda extranjera en su estructura de capital. Aunque con frecuencia se sugiere que el acceso a los mercados internacionales de capital es una motivación para que las empresas se internacionalicen, éste es el primer estudio que pone a prueba empíricamente si la actividad internacional y la financiación de la deuda están relacionadas.

Palabras clave: actividad internacional, estructura de capital, deuda en moneda extranjera, multinacionales.

1. INTRODUCTION

In this paper we study the impact of internationalization on the capital structure of Brazilian companies. There is broad evidence that international corporate activity is one of the determinants of capital structure. Many studies (Burgman, 1996; Chen, Cheng, He & Kim, 1997; Fatemi, 1988; Kwok & Reeb, 2000; Lee & Kwok, 1988) have suggested that U.S. based multinational corporations (MNC) are less leveraged than their domestic counterparts (DC). Although most studies, to date, are restrictedly based on data from U.S. companies, Kwok and Reeb (2000), Singh and Nejadmalayeri (2004) and Mittoo and Zhang (2008) found that cross-border considerations play an important role in explaining how internationalization influences capital structure. In a nutshell, studies indicate that international activity has the opposite effect on non-U.S. based MNCs.

Previous non-U.S. studies analyzing the impact of international activity on leverage, allowing for non-linearities, were based on Canadian (Mittoo & Zhang, 2008) and French (Singh & Nejadmalayeri, 2004) multinational corporations. However, even though these countries have unquestionable differences from the U.S. economy, they are both still developed, and therefore, stable countries. Thus, the interest in the evidence of an emerging country is naturally increased. We investigate the impact of international activity on both short- and long -term debt. Singh and Nejadmalayeri (2004) found that international activity impacts the short -term leverage of French MNCs, but it does not have a statistically significant impact on long-term debt. We investigate whether this is also true for Brazilian MNCs. In this sense, the Brazilian evidence helps to test the Upstream-Downstream hypothesis (Kwok & Reeb, 2000), which predicts a higher debt usage for MNCs based on less stable economies due to risk reduction. The results are also of particular interest for the Brazilian literature, since, as far as we are concerned, no

previous capital structure study of Brazilian corporations has taken international activity into consideration.

This paper tests whether there is a link between international activity and foreign debt financing, in order to search for additional explanations other than that offered by Kwok and Reeb (2000) in the Upstream-Downstream hypothesis to explain cross-border differences. Does the access to foreign debt help to explain why MNCs use more debt than DCs? The access to foreign debt markets is usually mentioned by international finance researchers as one of the possible reasons for firms to engage in internationalization (Fatemi, 1988; Mittoo & Zhang, 2008). However, we are not aware of any empirical work supporting this hypothesis. In this paper we analyze how international exposure affects the Brazilian MNCs' ratio of foreign to total debt. The Brazilian context is well suited to test this hypothesis because credit is very scarce and only a small number of Brazilian companies have access to either domestic or foreign debt markets.

We analyzed a sample of 131 companies and 538 firm-year observations within the period 2004-2008, and the results are: (1) Brazilian MNCs use more debt due to international activity whose average for MNCs are 9.6% more leverage than those with local activity of which 5.8% comes from long-term sources. The results are significant to both short- and long-term leverage, providing more consistent support to the Kwok and Reeb (2000) Upstream-Downstream hypothesis than previous literature, due to the Brazilian context; and (2) they also have more foreign currency debt to finance their operations with an average increase of about 12.7% of foreign debt to total debt ratio due to international operations.

The remainder of this paper proceeds as follows: Section 2 discusses the related literature. Section 3 presents some characteristics of the Brazilian context. Section 4 describes our data set and variables. Section 5 provides the empirical results, while a robustness check is conducted in Section 6. We end with the conclusion in Section 7.

2. LITERATURE REVIEW

In this section, we present the reasoning connecting the impact of MNC international activity and capital structure. Debt policy is influenced by foreign involvement due to international environmental factors that change firm characteristics, which can, in turn, increase or decrease risk and, as a result, debt capacity. In Section 2.1 we discuss some factors that only affect MNCs and others that impact the capital structure of internationally diversified firms in a differentiated way when compared to DCs. We end the literature review in Section 2.2 by showing the previous empirical findings in the subject.

2.1. Environmental factors that impact MNCs differently than DCs

In this section we present some of the factors that impact MNCs differently than DCs. Modigliani and Miller (1958), hereafter noted M-M, derived a model that under some drastic simplifications stated that capital structure does not affect the company's value. However, M-M clearly stated

in their conclusion that the assumptions used in their approach were a necessary step to start to solve the problem, and "they can now be relaxed in the direction of greater realism and relevance" (Modigliani & Miller, 1958, p. 296). A description of these assumptions as reported by Fama (1978) is provided in Table 1.

Table 1
Common assumptions on arbitrage proofs of value proposition.

Assumption 1: Perfect Capital Market
There are no transaction costs to investors and firms when they issue or trade securities; bankruptcy likewise involves no costs; there are no taxes; and there are no costs in keeping a firm's management decision rules set by its security holders.
Assumption 2: Equal Access
Individuals and firms have equal access to the capital markets. This means that the types of securities that can be issued by firms can be issued by investors on personal account. (…) Moreover, the prices of securities are determined by the characteristics of their payoff streams and not by whether they are issued by investors or firms. Equal access could logically be included as a characteristic of a perfect capital market, but it plays such an important role in capital structure propositions that it is stated separately.
Assumption 3: Complete Agreement or Homogeneous Expectations
Any information available is freely available to all market agents (investors and firms), and all agents correctly assess the implications of the information for the future prospects of firms and securities.
Assumption 4: Only Wealth Counts
Aside from effects on security holder wealth, the financing decisions of a firm do not affect the characteristics of portfolio opportunities available to investors. Thus the effect of a firm's financing decisions on the welfare of its security holders can be equated with effects on security holder wealth.
Assumption 5: Given Investment Strategy
To focus on the effects of a firm's financing decisions on the welfare of its security holders, all proofs of capital structure propositions take the investment strategies of firms as given. Although decisions to be made in the future are unknown, the rules that firms use to make current and future investment decisions are given. In addition, investment decisions are made independently of how the decisions are financed.

Source: Fama, 1978.

In order to adapt M-M irrelevance theory, further research explained how optimal capital structure was affected when some assumptions were dropped. Since debt service reduces taxable income, also called tax shield, the introduction of corporate taxes in the M-M model creates incentives for firms to utilize debt in their capital structure. This correction was introduced by Modigliani and Miller (1963). Since companies are not totally financed by debt, there should be other factors that discourage the use of debt. The result can be described as the agency cost / tax shield trade-off model, as reviewed by Megginson (1997), and presented in Table 2. We will focus on the elements that are central to the international finance literature.

Table 2
The agency cost/tax shield trade-off model of corporate leverage.

1.	Corporate income taxes
2.	Personal taxes on investment income (dividends, capital gains, and interest)
3.	Deadweight costs of bankruptcy and financial distress
4.	Agency problems (and costs) between managers, stockholders, and bondholders
5.	Contracting costs associated with writing and enforcing financial agreements
6.	Asset characteristics, earnings volatility, and a firm's investment opportunity set
7.	Ownership and corporate control

Source: Megginson, 1997, pp. 323-328.

2.1.1. *Corporate international diversification*

One of the reasons for corporations to not take 100% debt in their capital structure is the risk of insolvency. Since this 'risk of ruin' is probably not linear but increasing with higher levels of debt, firms can limit their leverage to avoid incurring bankruptcy costs (Baxter, 1967; Warner, 1977). Hughes, Logue, and Sweeney (1975) point out asset diversification as one of the main reasons for multinational firms to exist. Agmon and Lessard (1977) and Fatemi (1988) argue that international diversification increases debt capacity due to a reduction in bankruptcy costs. Risk is reduced by portfolio effects, since foreign cash flows are not perfectly correlated (Shapiro, 1978).

2.1.2. *Different sources of capital: Internal capital and international availability of capital*

Internal capital flow in MNCs can impact their capital structure in two different ways, according to Doukas and Pantzalis (2003). They argue that the international activity affects debt constraints faced by MNCs due to differences in agency costs and information asymmetries. First, diversified firms can use internal capital flows to make investments with positive NPVs that otherwise would be overlooked by the lack of external credit. On the other hand, more debt can be used as internal capital markets tend to have fewer problems with asymmetric information.

2.1.3. *Foreign exchange risk*

The exposure to foreign exchange can affect corporate risk. Cash flows generated by foreign operations can be considered as transaction exchange exposure, and can be hedged. For instance, Fatemi (1988) suggests that this risk can be eliminated by matching the maturity and currency denomination of cash inflows and outflows. Burgman (1996) argues that there is also exposure to economic exchange rate, which is harder to measure and hedge. Since markets are integrated, even domestic corporations can be affected by foreign exchange. Foreign exchange can be unfavorable due to pressures on price implied by foreign competitors or suppliers. On the other

side, MNCs tend to show much more flexibility by shifting production to low-cost areas. For this reason, MNCs can be less sensitive than DCs to variations in foreign exchange rate.

2.1.4. Political risk

International subsidiaries can suffer interference from local government, such as expropriation and nationalization (Shapiro, 1978). Although this tends to raise capital cost, MNCs are inclined to rely on large amounts of debt in the foreign-subsidiary to minimize this risk. As noted by Burgman (1996), the risk of political events occurring abroad cannot be ignored, and they also have a discrete nature and are quite hard to diversify; consequently, the riskier the countries where MNC operate the greater their debt ratio tends to be. Government control over capital flow is also part of the political risk faced by MNCs (Fatemi, 1988).

2.1.5. Agency costs

Jensen and Meckling (1976) put together the concepts of agency costs and ownership and control. Inside the firm, agency problems can emerge from conflicts of interest between managers, outside equity owners and debt-holders. Managers can make decisions in order to maximize their own utility, consuming perquisites and deviating from the objective of maximizing the value of the firm. As a result, the benefits of debt should be counterbalanced by the emergence of expenditure monitoring and bonding costs. Since MNCs are geographically diversified, agency costs tend to be more pronounced on MNCs than DCs. Information asymmetries and monitoring costs are higher, since it is harder to gather and process information from geographically diversified firms. For this reason, higher agency costs will make MNCs less prone to have debt in their capital structure (Doukas & Pantzalis, 2003). Myers (1977) presented a special case of agency cost, the underinvestment problem. He argues that borrowing risky debt will make managers, by acting in the interest of shareholders, choose a suboptimal investment strategy – situations in which positive NPV projects that would maximize firm value are not accepted, because they just transfer value from shareholders to debt-holders. The more similar the investment opportunities are to options, the greater is this problem. Therefore, companies with many available growth options tend to have little or no debt in their capital structure. According to Kim and Lyn (1986), MNCs tend to have more growth opportunities, which results in more constraints to debt financing.

2.1.6. The internationalization measure

Previous literature suggests a composite-measure for DOI, built on three measures of internationalization: foreign sales to total sales, percentage of foreign assets to total assets and number of geographical segments where the firm operates (Sullivan, 1994). However, such data is not always available. Some aspects contribute for the use of a simple foreign sales measure when it is the only internationalization proxy available for the econometric estimation procedures. First, the factor analysis methodology used to build such a measure requires a high

correlation among the attributes, which can be observed in Mansi and Reeb's (2002) study, where foreign assets ratio and number of geographic segments had correlations of 89% and 79% with foreign sales ratio. Additionally, Johanson and Vahlne (1977) create a model of the internationalization process of the firm which predicts that companies internationalize with "incrementally increasing commitments" and state that this process can be slow because some knowledge can only be learned by experience. Therefore, the internationalization process usually begins with exports and gradually increases the commitment with the international operation.

2.2. Empirical evidence on debt financing and firm internationalization

Although our interest lies in the impact of internationalization on capital structure, we also reviewed the previous literature on the cost of debt, once they are interconnected. So far, the mainstream results come from U.S.-based MNCs data. This section begins with the review of this literature, because it includes some of the first studies that link internationalization and capital structure and the results that are usually compared in non-US. However, the results obtained by Kwok and Reeb (2000), Singh and Nejadmalayeri (2004), and Mittoo and Zhang (2008) indicate that cross-country differences exist and, outside the U.S., international activity is positively related to firm leverage.

2.2.1. Evidence on capital structure for U.S.-based MNCs

Based on the trade-off theory, Fatemi (1988) argued that the impact of international activity is the net effect between additional agency costs and lower bankruptcy costs and found that MNCs have target leverage ratios significantly below those of their domestic counterparts. A similar conclusion —that firm international activity leads to greater risk and agency costs— was reached by Burgman (1996), Chen *et al.* (1997), Kwok and Reeb (2000), and Lee and Kwok (1988).

2.2.2. Evidence on cost of debt for U.S.-based MNCs

Reeb, Mansi and Allee (2001) found evidence of lower cost of debt financing due to firm international activity. To support the reduction in debt financing costs, Shapiro (1978) says that MNCs can be better off due to portfolio effects originated by the diversification of foreign cash flows, which with less than perfect correlations among company earnings and / or asset values in various countries help to reduce bankruptcy costs. The MNC is more diversified than their DCs counterparts, and therefore, its returns are less correlated with the market and its systematic risk is lower. In addition, MNCs have the ability to arbitrage segmented capital markets, obtaining lower cost of debt (Errunza & Senbet, 1981). In the presence of barriers to portfolio capital flows, MNCs have an advantage over DCs due to the ability to internationally diversify, and according to Agmon and Lessard (1977), investors recognize the extent of multinational diversification. However, empirical evidence against this theory was provided by Lee and Kwok (1988) and Burgman (1996).

2.2.3. Non-linear specification

An answer to the question as to why U.S. MNCs use less debt despite benefiting from lower cost of debt has been suggested by Mansi and Reeb (2002), by assuming a non-monotonic relation between firm international activity and both cost of debt and leverage. According to Mansi and Reeb (2002), the benefits of international activity are more pronounced in early stages of international activity. Many of the benefits of diversification and the ability to arbitrage segmented capital markets can be obtained with expansions to a few countries. However, exchange risks and agency costs tend to be lower for low levels of international activity, although when MNCs are present in a greater number of markets, such costs tend to become higher.

2.2.4. Non-U.S. evidence, cross-border considerations - Upstream-Downstream hypothesis

Kwok and Reeb (2000) propose an alternative theory. They suggest that cross-border considerations can also lead to changes in firm capital structure. When firms from more stable countries make investments, they usually face increased risk and reduced debt usage. On the other side, a firm from an emerging market can expand to developed countries and benefit from a reduction in their risk and, as a result, an increase in their debt capacity. Two studies also support this theory. Singh and Nejadmalayeri (2004) found that French firm international activity is positively related to total and long-term debt ratios. Mittoo and Zhang (2008) examined Canadian versus U.S. corporations. They found evidence that Canadian MNCs have higher long-term debt ratio when compared to domestic corporations. When matched with Canadian corporations, U.S. MNCs tend to use less debt than their DCs. They also point out that in Canada the main explanatory capital structure determinant is firm size, while profitability is also important to the U.S. case. A study comparing the capital structure of foreign subsidiaries with Brazilian national companies from 1985 to 1994 found that foreign subsidiaries used more debt (Novaes & Werlang, 1998). In that period, political risk was considerable, supporting a hypothesis that foreign subsidiaries use more leverage as a hedge against expropriation and nationalization.

3. DATA AND VARIABLE MEASURES

3.1. Data and sample selection

The sample consists of Brazilian firms that are listed in São Paulo Stock Exchange (BM&FBovespa). Accounting data, such as annual balance sheets and income statements, financial ratios and monthly stock come from Economatica® database, which contains 639 companies. To be consistent with previous studies, we removed 68 companies that are classified as finance and funds in Economatica®. We also needed the market value of the companies, which reduced the database to 141 companies. The total debt, short-term debt, long-term debt, foreign currency debt values and the proxy for internationalization (foreign sales to total sales ratio)

come from the companies' statements presented to Comissão de Valores Mobiliários (CVM –Brazilian equivalent to the Securities Exchange Commission) or were requested from the company's investor relations office. Also, the companies were allowed to enter and withdraw the sample on a year-by-year basis in order to minimize survivorship bias. Combining the results from the two databases in 538 firm-year observations, we covered 131 companies within the period 2004-2008. Due to data restriction, the number of firm-year observations was reduced to 501 in the regression with foreign currency debt ratio as the dependent variable.

3.2. Variable measures and sample statistics

To test whether Brazilian MNCs use more debt in their capital structure, we used three leverage measures: Total Leverage, Short-term Leverage (ST Leverage) and Long-term Leverage (LT Leverage). ST Leverage is defined as short-term debt over the sum of total assets. LT Leverage is defined as the long-term debt over total assets. Total Leverage is measured as the sum of ST Leverage and LT Leverage. We used foreign currency debt to total debt (Foreign debt ratio) to verify whether international activity also implies more access to the international debt market.

As a proxy for firm degree of internationalization (DOI), we used foreign sales to total sales ratio. To control for non-linearities, we also included in our regression specifications the square of the ratio of foreign sales to total sales (DOI²).

The remaining measures are control variables. Size is the natural log of firm total assets. Market to book ratio (MTB) is a control variable for the company's growth opportunities. We expect this variable to be inversely related to leverage (Myers, 1977). Volatility is the standard deviation of EBITDA scaled by mean EBITDA over the past five years and controls for probability of default. The greater the volatility is, the lower debt capacity the company would have.

Year dummies and industry dummies were included in all regressions. The industry dummies are: Food and Beverages, Trade, Construction, Electronics, Utilities, Non-Metallic Minerals, Industrial Machinery, Other, Pulp and paper, Oil and Gas, Chemistry, Steel and Metallurgy, Software & Data, Telecommunications, Textile, Transport Service and Vehicle and Parts. Year 2004 dummy and Agriculture and fishing industry dummy were naturally omitted. For the sake of brevity, the coefficients and p-values of these dummies were omitted in the tables, but they are available under request.

All variables, except for Size, are in percentage points. In Table 3 the sample statistics are provided. Mean, median, and standard deviation are provided in Panel A, Table 3. Our sample has mean Leverage of 24.47%, while only the companies with greater than zero DOI (MNC) have mean Leverage of 26.87%. Greater debt usage by MNC is also observed when ST and LT Leverage are separately considered. Another dependent variable, Foreign Debt Ratio, has an average of 33.93% for all companies in our database, while the ratio increases to 44.28% when only companies with greater than zero DOI are considered. These results suggest that internationalization improves debt capacity as well as Brazilian MNCs' access to international markets.

Table 3
Sample statistics.

Total Leverage is measured as the sum of ST Leverage and LT Leverage. ST Leverage is defined as short-term debt over the sum of total assets. LT Leverage is defined as the sum of long-term debt to total assets. Foreign debt ratio is the ratio of foreign currency debt to total debt. DOI, the proxy for firm internationalization, is the ratio of foreign sales to total sales. Size is the natural logarithm of total sales. MTB is the market value of equity divided by the book value of equity. Volatility is the standard deviation of EBITDA scaled by the mean EBITDA over the past five years.

Panel A: Descriptive statistics						
	All companies			DOI > 0 only		
Variables	**Mean**	**Median**	**Std. Dev.**	**Mean**	**Median**	**Std. Dev.**
Total Leverage	24.47	23.45	15.86	26.87	26.21	16.70
ST Leverage	9.88	7.21	9.05	11.86	10.32	9.43
LT Leverage	14.60	11.95	13.16	15.01	12.06	13.46
Foreign debt ratio	33.93	27.41	32.81	44.28	44.00	32.22
DOI	10.95	0.00	18.17	22.23	16.97	20.49
Size	14.19	14.14	1.66	14.03	13.86	1.68
MTB	232.71	165.85	240.07	227.65	177.59	196.56
Volatility	61.37	38.02	119.95	47.16	35.47	48.88

Panel B: Correlation matrix					
Variables	**Leverage**	**DOI**	**Size**	**MTB**	**Volatility**
Total Leverage	1.00				
DOI	0.21	1.00			
Size	0.29	0.11	1.00		
MTB	0.19	-0.04	0.09	1.00	
Volatility	-0.11	-0.10	-0.21	-0.06	1.00

Variables	**ST Leverage**	**LT Leverage**	**Foreign debt ratio**
DOI	0.24	0.09	0.35
Size	-0.17	0.46	0.31
MTB	0.04	0.20	0.00
Volatility	0.06	-0.18	-0,14

Contrary to our expectations, we found that Brazilian companies with international activity present smaller Size and MTB, although only Size presents a statistically significant difference at the 5% level. Volatility is also lower for MNCs, which is consistent with less than perfectly correlated cash flows due to international diversification. Volatility is 119.95 for all companies and only 48.88 for MNCs.

Average DOI is 10.95%, which is greater than the 10% reference value used in the literature to distinguish MNCs from DCs (Mittoo & Zhangh, 2008). On the other side, median DOI is zero, which is a result of 273 observations (50.74%) without any international activity.

The correlation matrix for the variables in our sample is provided in Panel B, Table 3. The correlation between two explanatory variables is not a matter of concern, as the highest absolute value is only 21%. As expected, DOI has positive correlation with total, ST and LT Leverage, as well as with Foreign Debt Ratio. On the other hand, MTB has positive correlation with all of the dependent variables. This result is usual in Brazilian studies (Matsuo, Rochman, & Eid Jr., 2008). In Section 6, we will test for alternative proxies for the growth opportunities.

The correlation between ST Leverage and the explanatory variables is different from other dependent variables. More specifically, Size is negatively related to ST Debt and Volatility is positively correlated. This result is reasonable, as we expect smaller companies and those with more volatile earnings (i.e., firms with higher probability of default) to have less access to long-term and international debt.

4. EMPIRICAL FINDINGS AND DISCUSSION OF RESULTS

4.1. Leverage and international diversification

In this section, we examine whether Brazilian MNCs have different leverage due to international activity after controlling for firm-specific capital structure determinants. The model is estimated by using pooled ordinary least square regression (POLS) with standard errors corrected for heteroskedasticity using White's (1980) procedure. Our test specifications are:

(I) Total Leverage$_{i,t}$ = β_0 + β_1 (DOI$_{i,t}$) + β_2 (DOI²$_{i,t}$) + β_3 (Size$_{i,t}$) + β_4 (MTB$_{i,t}$) + β_5 (Volatility$_{i,t}$) + $\varepsilon_{i,t}$

(II) ST Leverage$_{i,t}$ = β_0 + β_1 (DOI$_{i,t}$) + β_2 (DOI²$_{i,t}$) + β_3 (Size$_{i,t}$) + β_4 (MTB$_{i,t}$) + β_5 (Volatility$_{i,t}$) + $\varepsilon_{i,t}$

(III) LT Leverage$_{i,t}$ = β_0 + β_1 (DOI$_{i,t}$) + β_2 (DOI²$_{i,t}$) + β_3 (Size$_{i,t}$) + β_4 (MTB$_{i,t}$) + β_5 (Volatility$_{i,t}$) + $\varepsilon_{i,t}$

Where i represents the ith firm at time t for each variable. Year and Industry dummies were included.

Regression results are shown in Table 4. DOI and DOI² coefficients are both statistically significant at the 1% level for Total Leverage and LT Leverage, but only DOI is significant for ST Leverage. As expected in the upstream-downstream hypothesis, the greater the degree of international activity the more debt the Brazilian companies have in their capital structure; however, DOI squared is negative. Economically, coefficients of DOI² are rather low, which implies that international activity is associated with greater leverage.

Table 4

Relationship between leverage ratios and international diversification.

This table shows the results for pooled regression with robust standard errors (White, 1980). ST Leverage is defined as short-term debt over the sum of total assets. LT Leverage is defined as the sum of long-term debt to total assets. Total Leverage is measured as the sum of ST Leverage and LT Leverage. DOI, the proxy for firm internationalization, is the ratio of foreign sales to total sales. DOI^2 is the square of DOI. Size is the natural logarithm of total sales. MTB is the market value of equity divided by the book value of equity. Volatility is the standard deviation of EBITDA scaled by the mean EBITDA over the past five years. Four year dummies and seventeen industry dummies (not reported) are included to control for year and industry effects. P-values are reported in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% level, respectively.

Variable	Total Leverage	ST Leverage	LT Leverage
Intercept	-3.782	23.415***	-27.196***
	(0.50)	(0.00)	(0.00)
DOI	0.431***	0.169***	0.262***
	(0.00)	(0.01)	(0.00)
DOI^2	-0.005***	-0.001	-0.004***
	(0.00)	(0.28)	(0.00)
Size	1.696***	-1.209***	2.905***
	(0.00)	(0.00)	(0.00)
MTB	0.013***	0.002	0.011***
	(0.00)	(0.20)	(0.00)
Volatility	-0.008**	0.004	-0.012***
	(0.05)	(0.31)	(0.00)
Number of observations	538	538	538
Adjusted R^2	0.2776	0.2129	0.3593
F-Value	45.32***	18.16***	34.79***

In terms of control variables, Size, MTB and Volatility have a statically significant impact on Total Leverage and LT Leverage at the 1% level. Companies with larger size and lower earnings volatility have more leverage primarily attributed to lower default risk. The smaller the companies are the more ST Leverage they have, which is consistent with the limited access to long-term debt seen in the Brazilian economy.

Results show that firms with international activity (greater than zero DOI) and mean level of internationalization have 9.6% more leverage than DCs, from which 5.8% come from long-term sources.

4.2. International activity and foreign debt

Based on the Upstream-Downstream hypothesis and previous international capital structure literature on non-U.S. MNCs, we found that Brazilian MNCs use more debt in their capital structure, but the question whether international activity is linked to the access to international debt financing is still unanswered. MNCs can use more foreign debt because they have access to local financial markets, as posited by Faulkender and Petersen (2006), Miller and Puthenpurackal (2002) and Mittoo and Zhang (2008). Another reason is that limited access to credit due to

home conditions can explain why MNCs would try to finance their operations with foreign debt. Also, foreign currency debt can be used as a manner to match assets and liabilities in order to control foreign exchange risk.

Our test specification is:

(I) Foreign debt ratio $_{i,t}$ = β_0 + β_1 (DOI $_{i,t}$) + β_2 (DOI² $_{i,t}$) +
β_3 (Size $_{i,t}$) + β_4 (MTB $_{i,t}$) + β_5 (Volatility $_{i,t}$) + $\varepsilon_{i,t}$

Where *i* represents the ith firm at time *t* for each variable. Year and Industry dummies were included.

Regression results are provided in Table 5. International activity is statistically significant at the 1% level, and the average MNC has about 12.74% more foreign currency debt to total debt than DCs. Therefore, operational internationalization also affects how a firm chooses between domestic and foreign sources when it comes to debt financing. This result also implies that MNCs are able to use more debt in their capital structure due to higher access to international debt markets. The square of DOI is not significant, suggesting a linear relationship between internationalization and the use of foreign debt.

Table 5
Foreign debt and international diversification.

This table shows the results for pooled regression with robust standard errors (White, 1980). Foreign debt ratio is foreign currency debt divided by total debt. DOI, the proxy for firm internationalization, is the ratio of foreign sales to total sales. DOI² is the square of DOI. Size is the natural logarithm of total sales. MTB is the market value of equity divided by the book value of equity. Volatility is the standard deviation of EBITDA scaled by the mean EBITDA over the past five years. Four year dummies and seventeen industry dummies (not reported) are included to control for year and industry effects. P-values are reported in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% level, respectively.

Variable	Foreign debt ratio
Intercept	-57.621***
	(0.00)
DOI	0.537***
	(0.01)
DOI²	-0.002
	(0.49)
Size	5.346***
	(0.00)
MTB	0.008
	(0.23)
Volatility	-0.019***
	(0.00)
Number of observations	501
Adjusted R²	0.2755
F-Value	37.85***

The signs of the coefficients of the control variables Size and Volatility are consistent with the theoretical predictions. Size and Volatility are also statistically significant at the 1% level. It can be noted that the Size coefficient is higher for foreign currency debt when compared to the firm's total debt, which is a sign that only large, well-established companies have access to international markets.

5. ROBUSTNESS CHECK

5.1. Alternative dependent variables

We used Total Leverage, ST Leverage and LT Leverage as the debt (total, short-term and long-term, respectively)-total asset ratio. We used Market Total Leverage (MTL), Market ST Leverage (MTSL) and Market LT Leverage (MLTL) as alternative variable measures, where total assets are replaced by (Total Assets – Book Value of Equity + Market Value of Equity).

Results using market leverage ratios (total, short-term and long-term) as dependent variables by using the regression specifications (I), (II), and (III) from Section 4.1 are reported in Table 6. The impact of DOI is lower when using market values; however, they are still statistically significant at the 5% level. The use of market values also influences the signals and statistical significance of the coefficients from the control variables.

5.2. Alternative control variables

Return on assets (ROA) is commonly included to control for default of probability. Also, ownership and control —related to corporate governance issues— is a possible capital structure determinant. We used two proxies for this variable: the accumulated percentage of ownership by the five larger shareholders and the percentage of shares in free-float. Lastly, MTB is possibly a noisy proxy for growth opportunities, which could be the cause of the positive correlation with leverage. We used capital expenditures (capex) scaled by depreciation and price earnings ratio as alternative proxies for growth opportunities. The results, which for brevity are not reported, show that the impact of DOI and DOI² is similar when additional and different control variables are considered. ROA is statistically significant at the 1% level for leverage ratios and under 5% for foreign debt ratio regression specification. The percentage of shares in free-float is statistically significant under the 5% level for foreign debt ratio regression. Price earnings are statistically significant at the 1% level to explain the use of foreign debt. Other variables were not significant below the 10% level.

Table 6

Relationship between market leverage ratios and international diversification.

This table shows the results for pooled regression with robust standard errors (White, 1980). MST Leverage is defined as short-term debt over the sum of (total assets – bve + mve). LT Leverage is defined as the sum of long-term debt to (total assets – bve + mve). Total Leverage is measured as the sum of MST Leverage and MLT Leverage. DOI, the proxy for firm internationalization, is the ratio of foreign sales to total sales. DOI² is the square of DOI. Size is the natural logarithm of total sales. MTB is the market value of equity divided by the book value of equity. Volatility is the standard deviation of EBITDA scaled by the mean EBITDA over the past five years. Four year dummies and seventeen industry dummies (not reported) are included to control for year and industry effects. P-values are reported in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% level, respectively.

Variable	MTotal Leverage	MST Leverage	MLT Leverage
Intercept	24.990***	25.209***	-21.982***
	(0.00)	(0.00)	(0.00)
DOI	0.141**	0.139**	0.171**
	(0.02)	(0.02)	(0.02)
DOI²	0.000	0.000	-0.003***
	(0.63)	(0.66)	(0.00)
Size	-1.378***	-1.405***	2.622***
	(0.00)	(0.00)	(0.00)
MTB	-0.007***	-0.007***	-0.005***
	(0.00)	(0.00)	(0.00)
Volatility	0.004	0.004	-0.009***
	(0.32)	(0.31)	(0.01)
Number of observations	538	538	538
Adjusted R²	0.2246	0.2256	0.2954
F-Value	8.09***	8.09***	16.25***

6. CONCLUSION

In this paper, we used a sample consisting of 131 Brazilian corporations within the period 2004-2008 to investigate whether Brazilian companies with foreign involvement (MNC) have different capital structure from domestic companies, and if so, whether the upstream-downstream hypothesis prediction is valid with internationalized companies using more debt than domestic corporations. We found that Brazilian MNCs use more debt due to international activity, with 9.6% more leverage, from which 5.8% come from long-term sources, which supports the upstream-downstream hypothesis. In the Brazilian context, international activity increases both short and long-term leverage.

This study also provides new empirical results that test whether international activity is linked to the use of more foreign debt to the total debt of the firm. A difference in the usage of foreign currency debt by MNCs is expected, as they can have access to cheaper debt (Faulkender & Petersen, 2006; Miller & Puthenpurackal, 2002; Mittoo & Zhang, 2008), or alternatively, motivated by credit scarcity in the company's home country and also used as a manner to match assets and liabilities in order to control foreign exchange risk. Does the access to foreign debt help to explain why MNCs use more debt than DCs? Our results show that international activity is positively related to foreign debt usage, and average MNCs carry 12.7% more foreign debt in their capital structure.

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