# Testing Static Tradeoff against Pecking Order Models of Capital Structure in Brazilian Firms*

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**Abstract**

We test two models with the purpose of finding the best empirical explanation for the capital structure of Brazilian firms. The models tested were developed to represent the Static Tradeoff Theory and the Pecking Order Theory. The sample consists of firms listed in the Sao Paulo (Brazil) stock exchange from 1995 through 2002. By using panel data econometric methods, we aimed at establishing which of the two theories has the best explanatory power for Brazilian firms. The analysis of the outcomes led to the conclusion that the pecking order theory provides the best explanation for the capital structure of those firms.

## 1. Introduction

The determining factors affecting the choice of the capital structure of firms can be broken down into four categories, according to their purpose towards: (a) improving the conflicts between the various stakeholders with claims upon the firm resources, including managers (the agency approach); (b) conveying private information to the capital markets or mitigating the effects of adverse selection (the asymmetric information approach); (d) influencing the nature of products or competition in the product/input markets; and (e) influencing the result of disputes over corporate control (Harris and Raviv, 1991).

Factors influencing firms in their decision on a certain capital structure has been cause for debate for decades among academics. Several theories have been put forward on the subject, but it seems consensus is yet to be reached. Among those, there is the Static Tradeoff Theory (STT), which asserts that firms decide for a predetermined capital structure and try to stick to it through time, although they might eventually deviate from it for various reasons. Another well-known theory in the literature is the Pecking Order Theory (POT), which states that the firms' capital structure is

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determined by the difference between the internally generated cash flow and the financial deficit. Other theories, such as those based on agencWe test two models with the purpose of finding the best empirical explanation for the capital structure of Brazilian firms. The models tested were developed to represent the Static Tradeoff Theory and the Pecking Order Theory. The sample consists of firms listed in the Sao Paulo (Brazil) stock exchange from 1995 through 2002. By using panel data econometric methods, we aimed at establishing which of the two theories has the best explanatory power for Brazilian firms. The analysis of the outcomes led to the conclusion that the pecking order theory provides the best explanation for the capital structure of those firms. y costs and asymmetric information are often considered branches of the STT (Frank and Goyal, 2003b).

A few studies were performed using Brazilian data[1] attempting to verify whether alternative capital structure theories yield results comparable to those obtained with respect to developed countries (mainly the US and some European countries). Recently, De Medeiros and Daher (2004) provided evidence that the semi-strong form of the pecking order theory explains well the capital structure of Brazilian firms. Previous joint tests of the two prevailing theories (STT and POT) using Brazilian data are unknown to us.

The purpose of this study is to test the STT and the POT using Brazilian data in order to establish which theory best explains the capital structure of local firms. The study uses data obtained from financial reports of non-financial firms listed in the Brazilian stock markets and disclosed by Economatica® from 1995 to 2002. The remainder of the paper is divided as follows: Section 2 presents the theoretical framework and previous empirical studies on the subject, Section 3 describes the methods used, Section 4 shows the empirical results, and section 5 concludes.

## 2. Theoretical Framework

Myers (1984) divides the contemporary thinking on capital structure into two theoretical currents. The first one is the Static Tradeoff Theory (STT), which presumes that firms set up a debt target ratio and moves towards it. This target would be set up as a tradeoff between the costs and the benefits of debt, i.e. bankruptcy costs against tax benefits. The second theory put forward by Myers (1984) himself and Myers and Majluf (1984), is the Pecking Order Theory (POT), which sustains that firms follow a hierarchy of financial decisions when establishing its capital structure. Initially, firms prefer internal financing. In case they need external financing, the sequence would be the issuing of debt and convertible debt, before opting for issuing stock. The POT holds that firms that are more lucrative are naturally less indebted since they can finance their new projects without the need to issue debt or equity. The reluctance in issuing new equity is mainly due to asymmetric information between the management and the new stockholders. Myers and Majluf (1984) pointed out that

[1] Famá and Grava (2000), Famá et al (2001), Famá and Melher (1999), Kayo and Famá (1997) analyzed separately various existing theories using Brazilian data.

underpricing would be the result of lesser information held by potential investors vis-à-vis management with respect to the expected cash flows on the firm assets, both current and future. Conscious of possessing a lower degree of information, investors would infer that the management would issue stock only when they are overpriced. Hence, the market would set the stock price with a discount. Underpricing would lead to underinvestment, since if a stock issue were made at unfavorable prices this would be regarded as a wealth transfer from existing investors to the new ones. This problem could be circumvented if the firms use internally generated resources, such as retained earnings.

The POT admits two forms: the strong and the semi-strong or weak form (Chirinko and Singha, 2000). Under the strong form, firms never issue equity, financing themselves exclusively with internal resources and debt. The semi-strong form admits a certain level of equity issues, which Chirinko and Singha, 2000 consider more plausible and likely to be found and tested. The POT does not reject entirely the issue of new shares. It could happen in two specific situations without confronting the theory. The first one is when the firm needs a financial fund for future events not yet forecasted (Myers, 1984, Myers and Majluf, 1984, Shyam-Sunder and Myers, 1999, Frank and Goyal, 2003a). The second is when the information asymmetry ceases for some reason temporarily to exist, permitting the firm to take advantage of this and to issue new stock at a fair price (Myers, 1984). Lemmon and Zender (2002) and Fama and French (2002, 2003) emphasized these issuing possibilities. Lemmon and Zender (2002) pointed out the debt capacity factor as an important limitation for issuing new debt. Firms with their debt capacity depleted could not issue new debt. The remaining option would be the issue of new equity. If this happened, the POT could not be rejected. According to Fama and French (2002), there is also another possibility leading the firms to issue new equity without violating the POT. This would happen when firms anticipate that they will need new external financing in the near future for the implementation of new projects. Should this foreseen debt requirement become unfeasible by a future debt ratio above the firms' capacity, it will issue new shares now to be able to issue more debt in the future.

Frank and Goyal (2003a) and Shyam-Sunder and Myers (1999) proposed similar ways to test the validity of the POT. In their model, the change in debt ($\Delta D$) is explained by the deficit of funds (*DEF*), which is the difference between investments in fixed and working capital, and cash generated. This is represented by the accounting identity

$$DEF_{it} \equiv DIV_{it} + I_{it} + \Delta W_{it} - C_{it} \equiv \Delta D_{it} + \Delta E_{it}, \quad (1)$$

where *DEF* is the financial deficit, *DIV* is dividend payments, *I* is net investment in fixed assets, $\Delta W$ is the change in net working capital, *C* is cash generated after interest and taxes, $\Delta D$ is net debt issued, and $\Delta E_{\text{is}}$ net equity issues. Subscripts *i* and *t* stand for each individual firm in for the time period.

The basic equation tested is:

(2) $$\Delta D_{it} = \alpha + \beta DEF_{it} + e_{it} \ ,$$

where $e_{it}$ is the error term. Since the deficit (*DEF*) is given by (1), it can be substituted for by the right hand side of (1)

(3) $$\Delta D_{it} = \alpha + \beta_1 DIV_{it} + \beta_2 I_{it} + \beta_3 \Delta W_{it} - \beta_4 C_{it} + e_{it} \ .$$

In equation (2), testing the validity of POT in its strong form means testing the null $H_0$: $\alpha = 0$ and $\beta = 1$, whereas in the semi-strong form it means testing $H_0$: $\beta < 1$, but close to 1 (e.g. $H_0$: $\beta = 0.8$). Rejection of $H_0$ in the semi-strong form implies the rejection of POT. When equation (3) is used, the null will be $H_0$: $\alpha = 0$ and $\beta_j = 1$, $\forall$ j, for the POT's strong form. According to Shyam-Sunder and Myers (1999), DEF is exogenous, so that the equations can be estimated by OLS without simultaneity bias.

The competing Static Tradeoff Theory (STT) states that firms decide for a certain capital structure and that they move towards it through time. The STT includes at least three branches, focusing respectively on: (a) the tradeoff between taxes and bankruptcy costs; (b) agency conflicts; and (c) stakeholders' co-investments (Frank and Goyal, 2003b). The first branch (taxes x bankruptcy) compares the debt benefit of a reduced tax burden with a higher vulnerability of the firm due to its higher financial leverage. The agency theory states that debt helps solving problems deriving from the firm's excess cash flow[2]. The stakeholders' co-investments stream holds that the stock option is the best way to induce all stakeholders to fight for the firms' survival and growth. Under the viewpoint of the SST, several factors might determine the debt level. In our study, these determinants were restricted to those raised by Harris and Raviv (1991) e tested by Rajan and Zingales (1995). The STT assumes that firms tend to pursue an optimal debt level, which would be reached if there were neither transaction cost nor asymmetric information. One of the models developed in connection with the STT and used in our study is the one put forward by Rajan and Zingales (1995):

(4) $$D_{it} = \alpha + \beta_T T_{it} + \beta_{MBV} MBV_{it} + \beta_{LS} LS_{it} + \beta_{LCR} PRF_{it} + \varepsilon_{it} \ ,$$

where $D_{it}$ is the debt level (leverage), T is Asset Tangibility, $MBV_{it}$ is the market to book value ratio, $LS_{it}$ is the natural log of sales, and $PRF_{it}$ is profitability. We expect a positive signal for coefficients $\beta_T$ and $\beta_{LS}$ and a negative signal for $\beta_{MBV}$ and $\beta_{PRF}$, as explained later. All variables are scaled by total assets for each firm, to normalize the sample with respect to firm size. It is expected that firms with more tangible assets present higher debt levels, since tangible assets can be used as collateral for debt. The market to book value ratio was used as a proxy for growth opportunities by Titman and Wessels (1988), Rajan and Zingales (1995), Baker and Wurgler (2002), Korajczyk and Levy (2003), and Frank and Goyal (2003a,

[2] The excess of funds available could lead the management to create a series of benefits for themselves, which would be detrimental to shareholders, who would like to have these funds back in the form of new projects or dividends. With the obligation to pay interest, managers would be more careful with the use of these resources and those conflicts would be diminished (JENSEN, 1986).

2003b). The natural log of sales is generally used as proxy to firm size. The use of the log of sales instead of sales is justified by the non-linearity between sales and size from some point onwards. For Titman and Wessels (1989), the rationale for this is that if there is a size effect to debt, it will be higher for small firms. Profitability is a strong point of dissent between the two theories focused. For the STT, the higher the profitability of the firm, more reasons it will have to issue debt, reducing its tax burden. On the other hand, the POT presupposes that larger earnings lead to the increase of the main source firms choose to cover their financial deficit: retained earnings. Therefore, the STT expects a positive relationship between profitability and leverage, whereas the POT expects exactly the opposite. As a measure of profitability, operating earnings before interest payments and income tax are used (EBIT). The following comments about the variables appearing in (4) and their expected signals are necessary:

Debt ratio - Frank and Goyal (2003b) state that the difference between a debt ratio based on market value and one based on book values is that the former tends to regard the firm's future situation whereas the latter shows the past situation. Fama and French (2002) point out some inconsistencies from using two different debt ratios. According to them, both theories apply to the debt book value, and there are doubts if the predictions may be extended to the debt market value.

Asset Tangibility (Net Tangible Assets = Net Assets minus Goodwill) - the expected signal for the coefficient of asset tangibility is positive for the STT, since fixed assets serve as collateral for new loans, favoring debt. However, on the POT viewpoint, as argued by Harris and Raviv (1991), firms with low levels of fixed assets would have more problems of asymmetric information, making them to issue more debt, since equity issues would only be possible by underpricing them. On the other hand, firms with higher levels of asset tangibility are generally larger firms, which can issue equity at fair prices, so they do not need to issue debt to finance new investment. According to them, the expected relationship between asset tangibility and debt should then be negative.

Market to Book Value Ratio - this is generally used as a proxy for growth opportunities. A negative relationship with debt is expected for the STT, since high debt ratios could jeopardize the expected future growth. For the POT, there are two possibilities for the signal of this variable: one the one hand, firms with high growth opportunities would tend to keep their debt ratios at low levels so as to preserve their credit capacity when it becomes necessary (negative impact), and on the other hand, this growth requires investments which are usually made with the issue of new debt (positive impact). Fama and French (2002) named these two possibilities as the complex and simple versions of the POT, respectively. We considered for this variable only the complex version of the POT (negative signal).

Natural Log of Net Sales – for the STT, the larger the firm, the greater the possibility it has of issuing debt, resulting in a positive relationship between debt and size. One of the reasons for this is that the larger the firm the lower is the risk of bankruptcy. With respect to the POT, Frank and Goyal (2003a) remark that this relationship could be negative,

since larger firms have larger assets and are more subject to the effects of adverse selection proposed by Myers and Majluf (1984). Besides, if this variable is more correlated with earnings than size, the relationship is definitely negative.

Profitability - all the STT streams sustain that a positive relationship must exist between profitability and debt. The stream based on bankruptcy costs states that these costs increase when earnings fall so that leverage tends to be lower for less profitable firms or those with higher earnings volatility. For the stream focusing on tax benefits, the more profitable the firm the more it benefits from the tax shield provided by interest payments. The agency stream believes that large amounts of free cash flows build up the dispute between shareholders and managers, which make those firms to issue more debt in order to diminish the problem (Fama and French, 2003). According to the POT, retained earnings are the firm's best financing option. This type of resource does not produce information asymmetries and can be used promptly for new projects. The information asymmetry caused by equity issues or by more complex securities that require a higher degree of communication with the market is the basis of the POT. It is exactly to dodge the adverse selection premium brought by the information asymmetry that firms opt for internal financing as their major source of resources (Myers, 1984). The relationship between these two variables must be therefore negative.

Dividends - according to the STT, dividend payments is a variable negatively related to leverage (Frank and Goyal, 2003b). The reason for this comes from the agency theory. According to it, to avoid that managers create for themselves a series of privileges due to excess cash, firms would have two options: issuing debt, which would make them more cautious because of the commitment with interest payments or adopting an aggressive dividend payment policy. Therefore, debt and dividends are inversely correlated (Jensen, 1986). On the other hand, the POT holds that dividends are a component of the firm's financial deficit, thus being positively correlated to debt (Frank and Goyal, 2003a, 2003b; Halov and Heider, 2003; Fama and French, 2002).

Financial Deficit - according to one of the STT streams, the agency theory, free cash flow (which is the opposite of financial deficit) would lead to higher debt requirements. Exceeding cash would bring some consequences to the firm, which would further deteriorate the already delicate relationship between shareholders and management. Another possibility is the manager's use of exceeding cash in self-benefit. Debt has the power to prevent both possibilities (Jensen, 1986). Therefore, whereas the POT holds that excess cash is generally used to reduce debt, the STT says exactly the opposite.

## 3. Methods

In this study, we used panel-data regression analysis in order to test the models associated to the two competing theories. Panel data analysis makes possible to capture the behavior of variables in both time series and cross-section

dimensions. The cross-section dimension refers to a set of observations of different units, i.e. firms. This type of analysis offers a series of advantages over traditional analyzes of cross section and time series (Baltagi, 2001, p. 5-7).

We utilized static panel-data models with fixed and random effects for all equations tested as we opted for using the same model tested by Rajan and Zingales (1995), where lagged debt values were not included among the regressors. This procedure diverges from Sogorb-Mira and López-Gracia (2002), who utilized a dynamic model for the STT equation. The Breusch-Pagan Lagrange-Multiplier (LM) test and the Hausman test were performed in order to guarantee the robustness of empirical results[3]. In order to choose between a simpler panel-data model without effects and a model with fixed or random effects, we used the Breusch and Pagan (1980) LM test. This test statistic, based on the residual correlation, has a chi-square distribution. If the values obtained for the LM statistics are superior to the critical value, we reject the null that the model without effects applies. It is also necessary to choose between a fixed effects and a random effects panel-data model. For this, we used the Hausman (1978) test, which tests the orthogonality between the effects and the regressors and make possible to choose between one model and the other. The null states that there is no correlation, against the alternative that there is correlation. If the null is not rejected, the random effects model is chosen and vice-versa.

Because the necessary assumption of homoscedasticity of the residuals is likely to be violated, since firms of very different sizes compose the sample, we used White's (1980) covariance-matrix estimator, which allows for heteroscedasticity and gives a more precise inference.

Our sample involved 371 non-financial firms with shares listed in the Brazilian stock exchanges from 1995 to 2002. The data were obtained from balance sheets available in Economatica®'s database. Having in mind that Brazilian inflation has not been negligible even after the Real stabilization plan of April 1994, all accounting data were adjusted for inflation according to the Brazilian general price index (IGP-DI).

We tested the two theories using two different models. The POT was tested using the model originally developed by Shyam-Sander and Myers (1999) and modified by Frank and Goyal (2003a)[4] (FG Model), which is represented by equations (2) and (3), shown in section 2. The STT was tested with the model developed by Rajan and Zingales (1995) (RZ Model), which in turn derives from Harris and Raviv's model (1991), and is represented by equation (4).

In our study, following the majority of the authors, we used initially two measures for the debt of firms: book value of debt and market value of debt. In the numerator, debt was defined as total interest-bearing liabilities (short and long

[3] Unit-root tests were not used to check for stationarity. Baltagi (2001, p. 233-236) argues that these tests are only justified for macro-panels (i.e. when both time-series and cross-section data tend to infinity). In the case of micro-panels (where time-series are small whereas cross-section data tend to infinity), unit-root tests are not necessary. The data in our study are a typical case of micro-panel.

[4] Frank and Goyal (2003a) modified the original model by removing from the financial deficit the portion corresponding to the long-term debt.

term) and alternatively as the total long-term interest-bearing liabilities only. In the denominator, four different values were utilized. The first one took into account the net asset value of the firm, i.e., total assets minus the non-interest bearing liabilities. The second was the total asset value. The third one, the book value of liabilities added to the stock market value, providing a quasi-market value for the firm. The fourth and last added the interest-bearing liabilities to the firm's net worth. This produced eight measures of debt. Among these measures, only those divided by total assets were statistically significant, and are analyzed in the next section. Among those measured in terms of quasi-market (equity market value plus debt book value) only two were statistically significant: the natural log of sales and profitability. When the denominator of the debt ratios was net worth or net assets (total assets minus non-interest bearing liabilities), the debt ratios showed unsatisfactory results in terms of both $R^2$ and *t* statistics, and were discarded.

## 4. Results

Table 1 presents a summary of the fixed-effects and random-effects results obtained for the RZ model, represented by equation (4), with two dependent variables: total debt ratio and long-term debt ratio the debt ratio, both measured in terms of book values.

**Table 1 – Estimated Results for the RZ model - equation (4)**

| Model | Independent Variable | Dependent Variable | |
|---|---|---|---|
| | | TD | LTD |
| Fixed effects | AT | -0.807* | -0.535* |
| | | (0.118) | (0.107) |
| | MBV | 11.602 | -10.454 |
| | | (63.810) | (54.900) |
| | LS | 1737.143* | 1499.122* |
| | | (67.166) | (58.050) |
| | PRF | -2.816* | -2.656* |
| | | (0.119) | (0.105) |
| | $R^2$ | 0.64 | 0.56 |
| | Adjusted $R^2$ | 0.57 | 0.47 |
| | N | 2,226 | 2,188 |
| Random effects | AT | -0.320* | -0.176** |
| | | (0.101) | (0.080) |
| | MBV | -9.390 | -13.267 |
| | | (63.469) | (54.140) |
| | LS | 1813.409* | 1568.667* |
| | | (50.922) | (42.671) |
| | PRF | -2.791* | -2.336* |
| | | (0.107) | (0.091) |
| | Constant | 0.915* | 0.347* |
| | | (0.067) | (0.043) |
| | $R^2$ | NA | NA |
| | N | 2,226 | 2,188 |

In Table 1, figures between brackets represent the standard error, (*) and (**) indicate that the coefficient is statistically significant at 1% and 5%, respectively, and TD and LTD represent alternative concepts for the dependent

variable: total debt and long-term debt, respectively, both measured in book-value terms. N represents the number of observations and NA means not available. Although the Hausman statistic and corresponding p-values favors the fixed-effects model, we report both results, since they lead to similar conclusions. We now discuss the signals and the significance of these results:

Asset Tangibility - the negative signal favors the POT, according to Harris and Raviv (1991).

Market to Book Value Ratio - its coefficient was found statistically non-significant.

Natural Log of Sales – its coefficient behaved as foreseen by both the STT and POT, with a positive relationship with debt.

Profitability - the value found for its coefficient is significant but it signal is incorrect with respect to the STT. The conclusion might be that higher profitability keeps firms away from debt instead of encouraging it, exactly as foreseen by the POT.

Table 2 presents a summary of the expected signals of the coefficients according to each theory (STT X POT), and the signals actually obtained in our regressions for the RZ model. From the four explanatory variables, only LS presented coefficients with the correct expected signals according to the STT. On the other hand, all explanatory-variable signals are consistent with the POT except for MBV, which had non-significant coefficients. From Tables 1 and 2, we can conclude that the SST is not a good theoretical explanation for the capital structure of Brazilian firms.

**Table 2 – Expected vs. obtained signals for the RZ model**

| Explanatory Variable | Expected | | Obtained | |
|---|---|---|---|---|
| | STT | POT | TD | LTD |
| AT | + | – | – | – |
| MBV | – | – | NS | NS |
| LS | + | + | + | + |
| PRF | + | – | – | – |

NS: not statistically significant.

To test the POT using the FG model, equations (2) and (3) were estimated. Equation (2) tests the FG model with the deficit in aggregate form, and equation (3) tests the FG model with the deficit in disaggregate form. The results of the estimation by fixed effects and random effects panel-data regressions are shown in Tables 3 and 4.

When the explanatory variable is analyzed in aggregate form (Table 4), the expected result is that its coefficient is very close to unity for the strong form of the POT. The result obtained was highly favorable to this theory. In all models (fixed individual effects and random effects), the estimated coefficient for the deficit was very close to unity. The $R^2$ obtained was also quite high, suggesting that in the period from 1995 to 2002, the firms in the sample have followed what is

predicted by the POT. What the results show is that these firms issued new debt when their investment was larger than the generated cash flow and repaid their debt when their cash flow was larger than their investment requirements. The issue of new shares was hardly utilized.

| **Table 3 –Results for the aggregate FG model – equation (2)** | | |
|---|---|---|
| Model | Explanatory Variable | Coefficient |
| Fixed effects | DEF | 0.996* |
| | | (0.002) |
| | $R^2$ | 0.998 |
| | N | 2,317 |
| Random effects | DEF | 0.996* |
| | | (0.001) |
| | Constant | -0.036* |
| | | (0.006) |
| | $R^2$ | NA |
| | N | 2,317 |
| The dependent variable is ΔD = debt change; DEF = deficit; Standard errors between brackets; NA = not available, N = number of observations. | | |

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| **Table 4 – Results for the disaggregated FG model – equation (3)** | | |
|---|---|---|
| Model | Variables | Coefficients |
| Fixed effects | DIV | 0.926* |
| | | (0.156) |
| | I | 0.996* |
| | | (0.001) |
| | C | 0.979* |
| | | (0.004) |
| | ΔW | -0.966* |
| | | (0.019) |
| | $R^2$ | 0.998 |
| | N | 2,317 |
| Random effects | DIV | 1.017* |
| | | (0.149) |
| | I | 0.996* |
| | | (0.001) |
| | C | 0.975* |
| | | (0.004) |
| | ΔW | -0.955* |
| | | (0.016) |
| | Constant | -0.039* |
| | | (0.006) |
| | $R^2$ | NA |
| | N | 2,317 |
| The dependent variable is ΔD = debt change; DIV = dividend payments; I = investment; C = generated cash; ΔW = change in working capital; Standard errors are between brackets; NA = not available; N = number of observations. | | |

It is worthwhile to say that from the equation estimated with the aggregate deficit, where the random effects model performed better than the fixed effects model, it is possiblr to generalize the results to the population, whereas in the equation with the disaggregated deficit the estimated results are valid for the sample only.

Frank and Goyal (2003a) stressed the importance of studying separately the components of the financial deficit, which allows analyzing the impact of each component on debt. They make clear that the disaggregating is not required to validate the POT, but when the deficit components are tested separately, their behavior may be analyzed more thoroughly under the STT viewpoint.

With respect to dividend payments (*DIV*), the positive signal found confirms what is predicted by the POT, i.e. that the relationship between dividend payments and debt is positive. Fama and French (2002) suggested that firms tend to adjust their dividend payments so that they fit in their internally generated resources, without requiring new debt.

With regards to the other variables that make the financial deficit, cash flow (*C*) should be stressed. As widely discussed previously, the behavior of this variable is predicted differently by the two theories. Cash flow is what is pointed out by Jensen (1986) as the major cause of agency conflicts. As in the case of profitability, the positive sign found here for cash flow is also highly favorable to the POT. Table 5 summarizes what each theory holds for the disaggregated FG model.

Table 5 – Expected vs. obtained signals for the FG disaggregate model

| Explanatory variable | Expected signal | | Signal found |
|---|---|---|---|
| | STT | POT | |
| DIV | − | + | + |
| I | + | + | + |
| C | + | + | + |
| ΔW | + | − | − |

In order to test the POT fully, it is also necessary to determine if the slopes are close to unity (or at least very close to it). If positive, the strong form of the POT shall be accepted. On the other hand, if the estimated coefficient is different, but close to unity (0.8, for instance) then the semi-strong form is predominant. The null hypothesis tested is that $\beta = 1$ against the alternative hypothesis that $\beta < 1$, both for equation (2) and (3), for the significance levels of 1% and 5%. The results obtained are shown in Table 6.

The confidence interval for the constant was computed for the random-effects model only, since in the fixed-effects model there is a different value for the constant for each firm. From Tables 3, 4, and 6 it can be seen that the estimated coefficients for all variables lie within the confidence intervals established both for 1% and 5%, so that the null hypotheses

$H_0$ that the true population parameters are equal to one cannot be rejected. However, the confidence interval for the constant shows that its value (0.039) lies within the confidence interval [0.03, 0.05], which means it is not equal to zero. This leads to the conclusion that the semi-strong form of the POT provides the best theoretical explanation for the capital structure of Brazilian firms, since the POT's strong form requires that the constant be equal to zero.

**Table 6 – Confidence Intervals for Slopes of Equations (2) and (3)**

| Significance level | | 1% | | 5% | |
|---|---|---|---|---|---|
| Variable | Interval | Fixed Effects | Random Effects | Fixed Effects | Random Effects |
| DEF | Lower | 0.99 | 0.99 | 0.99 | 0.99 |
| | Upper | 1.00 | 1.00 | 1.00 | 1.00 |
| DIV | Lower | 0.69 | 0.79 | 0.73 | 0.83 |
| | Upper | 1.17 | 1.25 | 1.13 | 1.21 |
| I | Lower | 0.99 | 0.99 | 0.99 | 0.99 |
| | Upper | 1.00 | 1.00 | 1.00 | 1.00 |
| C | Lower | 0.97 | 0.97 | 0.97 | 0.97 |
| | Upper | 0.99 | 0.98 | 0.98 | 0.98 |
| ΔW | Lower | (0.99) | (0.98) | (0.99) | (0.98) |
| | Upper | (0.94) | (0.93) | (0.94) | (0.93) |
| Constant | Lower | | (0.03) | | (0.03) |
| | Upper | | (0.05) | | (0.05) |

Therefore, the results summarized in Tables 3, 4, 5, and 6 grant strong support to the POT. All the results lead to accepting that the firms in the sample follow a pecking order when they choose how to finance their financial deficits.

## 5. Conclusions

The comparative analysis of results for both models led to the conclusion that the POT is the dominant stream in the determination of the capital structure of Brazilian firms within the focused period. With respect to the variables tested specifically in the RZ model, the tangibility of assets and profitability behaved as foreseen under the POT and not under the STT. Since these variables are considered central for accepting one theory against the other (Frank and Goyal, 2003a, Fama and French, 2003), the results strongly support the POT. The behavior foreseen for the natural log of sales is the same under both theories and the upshot obtained was the expected one by both. The "market to book value", considered important in previous studies, has shown non-statistically significant in our study.

Frank and Goyal (2003a) considered "asset tangibility" as the fundamental factor for validating either the POT or the STT. For Fama and French (2003), the behavior of profitability should be pointed instead as cause for unconditionally discarding the STT. As the signal for these two variables was the one predicted for the POT and not by the STT, it is concluded that the former is the theory which best explained the determination of the capital structure of Brazilian firms. Although the wrong signal obtained for asset tangibility can be attributed to the absence of monetary correction of balance sheets in Brazil since 1995, together with high inflation rates, the signal found for profitability can be taken as a

fundamental reason for discarding the STT. The STT predicts that the debt increases with firm earnings, which is exactly the opposite of what the POT foresees. The features of the Brazilian economy, with very high real interest rates and reduced long-term credit supply, makes Brazilian firms to avoid debt when internally generated resources are available. These resources are usually used to repay debt, which is exactly what the POT foresees and is just what our results show.

The POT establishes that the financial deficit is covered by debt, permitting the issue of new shares in exceptional cases only. The FG model states that the deficit coefficient must be equal to zero in order to validate the strong form of the POT. Therefore, the most important test was the one which determined the value of this coefficient. The results obtained in our study support the POT in its semi-strong form, since both for the aggregate and the disaggregate equations we were led to accept the null that the slopes are equal to one, but to reject the null that the intercepts are equal to zero.

Besides, the variables that have shown controversial under the two theories were dividend payments and cash flow. Here too the results were totally favorable to the POT. The positive signal found for dividend payments is contrary to the idea that dividends could replace debt in the resolution of agency conflicts. In addition, the interpretation of the signal of cash flow is the same given to profitability, which supports the POT and weakens the STT at the same time.

It should be mentioned that the Brazilian economy and market conditions differ from those under which the tested theories were developed and consequently there are some aspects that need to be pointed out. First, the Brazilian capital market has a secondary role in the capitalization of Brazilian firms, both in terms of stock or debt issues. Besides, Brazil characterizes by having a relative small number of publicly listed firms and preferred stock makes the majority of shares. The theory of finance treats this type of stock as debt, whereas the Brazilian business regulations define it as equity. Hence, the POT should accept the issuing of preferred stock, since it represents debt, but in Brazil, it goes against the POT because it is regarded as equity. Second, Brazilian interest rates, both short and long-term, are very high in real terms. This, together with credit restrictions and the incentive given to banks to invest in government bonds, there is a short supply of private credits. Long-term lending is virtually supplied by the BNDES (the state-owned development bank) only with subsidized interest rates, which is a situation extremely favorable to the POT. Altogether, these factors lead to the conclusion that even if there were a debt target level to pursue, the country's institutional and economic conditions would impose strong obstacles to it. Therefore, it is not difficult to explain why the POT beats the STT in Brazil.

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