BBR
BRAZILIAN BUSINESS REVIEW
Vol. 5, No.2
Vitória-ES, May – Aug 2008
p. 136-142 *ISSN 1808-2386* *DOI: http://dx.doi.org/10.15728/bbr.2008.5.2.4*

Are Brazilian Firms Savings Sensitive to Cash Windfalls?

Cristiano M. Costa[†]
Departmento de Economia, University of Pennsylvania

Lourenço Senne Paz[‡]
Departamento de Economia, University of Maryland

Bruno Funchal[♣]
FUCAPE Business School

ABSTRACT: Following Almeida, Campello and Weisbach (2003), we use the link between financial constraints and firm's demand for liquidity to test the effect of financial constraints on firm policies in Brazil. The effect of financial constraints can be captured by a firm's propensity to save cash out in addition of cash inflows. While constrained firms should have a positive cash flow sensitivity of cash, unconstrained firms' cash savings should not be systematically related to cash flows. Using 2SLS method to deal with endogeneity problems, we estimate the cash flow sensitivity of cash using a large sample of Brazilian manufacturing firms over the 1995-2007 period and, using the access to international financial markets trough ADRs as a criterion for financial constraint, we find that firms that are more likely to be financially constrained display a significantly positive cash flow sensitivity of cash, while unconstrained firms do not.

Keywords: cash flow sensitivity of cash, financial constraints, cash policy.

Received in 05/29/2008; revised in 06/02/2008; accept in 08/01/2008.

Corresponding authors:

[†] *PhD Student in University of Pennsylvania*
The author receives financial support from the Brazilian Government (CAPES/Fulbright Program).
Address: Department of Economics, 3718 Locust Walk, 160 McNeil Building
Philadelphia, PA, EUA, 19104
costam@econ.upenn.edu

[‡] *PhD Student University of Maryland*
Address: Department of Economics, 3105 Tydings Hall, College Park, MD, EUA, 20742
e-mail: paz@econ.umd.edu
Telephone: 301-405-3266

[♣] *Professor and Research in Fucape Business School.*
Address: Av. Fernando Ferrari, 1358, Vitória, ES, Brazil, CEP 29075-010
e-mail: bfunchal@fucape.br
Telephone: 27 4009-4444

Editor's note: *This paper was accepted by Alexsandro Broedel Lopes.*

1. INTRODUCTION

The role of financial constraints on investment choices made by firms is an important research topic on finance, because financially constrained firms won't choose the optimal level of investment, they'll under-invest. At the same time, economists have stressed the importance of a liquid balance sheet since it allows implementation of new profitable projects when they arise.[1] Therefore, the choices of liquidity are directly linked to firms' credit restrictions. Almeida, Campello and Weisbach (2003), hereafter ACW, modeled the framework in which a financially constrained firm would hold more liquid assets for precautionary reasons, whereas an unconstrained firm could borrow money if necessary. This model allows the estimation of the effects of financial constraints on firms' investments by using its prediction on firms' savings decisions, *i.e.* constrained firms will save cash when they receive cash windfalls.

In this paper we'll use the ACW methodology to estimate the Brazilian firms' savings sensitivity to cash windfalls. To do so, we used the access to international financial markets trough American Depository Receipts (ADRs) to split the sample between constrained and unconstrained firms. The idea is simple, companies that have outstanding ADRs, and had fulfilled the requirements to do so, have an easier access the American financial system, eliminating the financial constraints.

Using this criterion we found results supported ACW model predictions. Our estimation using the ADR criterion resulted in a positive and statistically significant coefficient for financially constrained firms and a not statistically significant *Cash flow* coefficient for unconstrained firms, both results as predicted by the theoretical model. The cash flow sensitivity of cash estimated using the augmented model was 0.108, using the ADR criterion. This result means that for each extraordinary dollar (normalized by assets) received by a constrained firm about eleven cents are channeled to firm savings, which is a result comparable to the ones obtained by ACW.

2. THEORETICAL MODEL

The ACW model has three periods. In the first period the firm has a cash holding of c_0 and the chance to invest in a project that costs I_0 and generates in the third period returns of $F(I_0)$, which is a standard increasing, concave, and continuously differentiable production function. Moreover, it may have another chance to invest I_1 in the second period and obtain a return of $F(I_1)$ on the third period. The firm will produce an uncertain cash flow on the second period, which can be high (c_1^h) with probability p or low ($c_1^l < c_1^h$) with probability $1-p$. The discount factor is one, all agents are risk neutral and the investment costs is one in periods *1* and *2*, and the investments I_0 and I_1 can be liquidated on the third period collecting a discounted income of $q(I_0 + I_1)$, with $q \leq 0$.

The total cash flow of the investments cannot be contracted, but the firm can raise external financial resources by pledging the productive assets as collateral, with a liquidation value of $(1-\tau)qI$, where $\tau \in (0,1)$. If τ is high, which means low capacity for external finance, the firm may become financially constrained. The final assumption is that the firm can hedge

[1] See Almeida and Campello (2002) and Hubbard (1998) for references.

all the future earnings at a fair cost. The firm's choice is the amount of cash to be held from the first to the second period (*C*).

This model generates a testable prediction that unconstrained firms (low *q* and/or high c_0 and c_1) will invest in the first-best level on both periods, satisfying all financial constraints. As a consequence, their cash holding policies won't be related to the investment choices, *i. e.*, $\partial C/\partial c_0$ is indeterminate for financially unconstrained firms. On the other hand, a constrained firm investment will stay below the first-best level, and its cash holdings will be sensitive to cash flows in a positive way, because in case of cash windfall the firm will distribute these funds across the two periods to take advantage of investment opportunities in the second period. That is, $\partial C/\partial c_0 > 0$ for financially constrained firms. This prediction was empirically confirmed by ACW using a sample of manufacturing American firms between 1971 and 2000.

Testing the model prediction that cash holdings of financial constrained firms are sensitive to cash windfalls requires split the sample between financially constrained and unconstrained firms according to some criterion. In addition, we will have to control for the size of the firm and by each firm's opportunities of investments. Because the first control is related to the scale economies in cash management, since a larger firm can better manage the allocation of money in its activities. The second control is due to the fact that the attractiveness of the investment may interfere on the choices of the firm's cash holdings. But this last control is very hard to implement, because it's difficult to measure. Following the literature, we'll construct a proxy variable well used by economists: the Tobin's *Q*. The first empirical model can be written as equation (8) of ACW paper, here presented as equation (1).

$$\Delta CashHoldings_{i,t} = \alpha_0 + \alpha_1 CashFlow_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 Size_{i,t} + \varepsilon_{i,t} \qquad (1)$$

where *i* is the firm and *t* is the year. According to the theoretical model α_1 is expected to be positive for constrained firms and not statistically significant for unconstrained firms.

An augmented model was proposed by ACW in order to include other variables to control for variations of non-cash net working capital because it may be a substitute for cash. Moreover, short-term debt is an explanatory variable because firms may use short-term debt to built cash reserves. This augmented empirical model, equation (9) in their paper, can be represented as follow:

$$\begin{aligned}\Delta CashHoldings_{i,t} = {} & \alpha_0 + \alpha_1 Cashflow_{i,t} + \alpha_2 Q_{i,t} + \alpha_3 Size_{i,t} + \alpha_4 Expenditures_{i,t} + \\ & + \alpha_5 Acquisitions_{i,t} + \alpha_6 \Delta NWC_{i,t} + \alpha_7 \Delta ShortDebt_{i,t} + \varepsilon_{i,t}\end{aligned} \qquad (2)$$

ACW argue that the sensitivity of cash coefficient (α_1) must to be higher in this last specification because we are adding controls for alternative uses of cash reserves. In this alternative setup we still expect that constrained firms are positively sensitive to cash and the unconstrained are not.

3. DATA SET

Our Brazilian firms annual data set encompass the 1995-2007 period and is composed by accounting data from 527 non-financial companies publicly traded at São Paulo Stock Exchange (Bovespa). Its source is *Economática* and contains 2972 observations. All monetary values were taken in 2007 Brazilian Reais (adjusted by the consumer price index, IPCA). Due to mergers, acquisitions and bankruptcy of many firms, we don't have data for all years for some companies.

We constructed the following variables: *Cash holdings, Cash flow, Tobin's Q, Expenditures*, *Acquisitions*, *Non-cash net working capital*, *Short-term debt*, and *Log of assets*. All these variables (except for *Log of assets*) were scaled by the respective firm total assets.[2] The variables *Tobin's Q*, *Cash flow* and *Short-term debt* were *winsorized* at levels between of 1% and 5%. The *winsor* procedure is commonly used to treat the outliers' problem.[3] Table 1 presents descriptive statistics for the dataset after using this method.

ACW used five criteria to qualify the firms as constrained or not for every year of the sample: payout ratio, total assets (firm size), bond ratings, commercial paper ratings, and Kaplan and Zingales (1997) rating. In order to measure the access of Brazilian companies to international financial markets we created a different criterion, specific for Brazil. Since Brazil is in the top three countries of number of firms cross-listed at the NYSE,[4] we are motivated to use a criterion that is if the firm has outstanding *American Depositary Receipts* (ADR). ADRs enable American investors to buy shares in foreign companies without undertaking cross-border transactions. ADRs are quoted in U.S. dollars, pay dividends in U.S. dollars, and are traded just like the shares of American companies.

The group of companies with ADR should be the unconstrained group since they have a broad access to financial market. We assigned to the financial constrained group the firm that does not have outstanding ADR of its securities, regardless of the level, in United States market in that year.

4. RESULTS

The augmented model given by equation (2) was estimated by 2SLS method using the following instruments: first lag of *Cash flow, Log assets, Capital expenditures, Acquisitions, Change in net working capital (NWC),* and *Short-term debt;* second lag of *Cash flow, Capital expenditure, Change in net working capital (NWC),* and *Short-term debt.* Table 2 reports the results obtained for the augmented model.

Our estimation using the ADR criterion resulted in a positive and statistically significant coefficient at 1% level for financially constrained firms and a not statistically significant *Cash flow* coefficient for unconstrained firms, both results as predicted by the theoretical model. The cash flow sensitivity of cash estimated using the augmented model was 0.108. This result means that for each extraordinary dollar (normalized by assets) received by a

2 See Table A.1 in the Appendix for variables definitions.

3 The winsor procedure takes the non-missing values of a variable x ordered such that x_1 <= ... <= x_n and generates a new variable y identical to x except that the h highest and h lowest values are replaced by the next value counting inwards from the extremes.

4 See the website http://www.adr.com.

a constrained firm about eleven cents are channeled to firm savings while unconstrained firms do nothing.

The Tobins' Q-sensitivity of cash is also positive and it is significant at 5% level in the constrained sample regression. This result is also consistent with the theory that future investment opportunities should only matter in the financial constrained sample since they cannot raise the cash easily at the financial market to enforce the investment.

We re-estimate the model using a technique that allows for extra care in treating the error term. In particular, to make sure that our results are robust to any possible temporal correlation among the firms, we introduce a cluster option in our methodology that allows for an unspecified correlation structure of errors within the cluster (each firm is a cluster). This is important since the errors can be correlated for a specific firm but not among firms. Analyzing the output of this procedure (Table 3) we conclude that our results still hold using this methodology and neither the coefficient magnitude nor its significance change considerably.

Thus, using a different criterion from ACW and Brazilian data we find a result comparable to the ones obtained by ACW empirical test and their theoretical model to explain the effect of financial constraints, leading constrained firms to save cash out in addition of cash inflows

5. CONCLUSIONS

The discussion about the effects of financial constraints on the firm decisions of investments is an important topic on corporate finance literature. Almeida, Campello and Weisbach (2003) developed an interesting framework that avoids most of the problems faced by models based on the demand for investments.

In this paper, we estimated their model using Brazilian firms' data. We created a criterion that fits better the characteristics of the Brazilian financial market and obtained results aligned to those presented in the original paper. Hence, the existence of ADRs can be seen as a measure of the level of the financial constraints faced by Brazilian companies.

6. REFERENCES

Almeida, H. and Campello, M. (2002). "Financial Constraints and Investment-Cash Flow Sensitivities: New Research Directions," *mimeo* (eletronic version).

Almeida, H., Campello, M. and Weisbach, M. S. (2003). "The Cash Flow Sensitivity of Cash," *Journal of Finance*, Vol. LIX, No. 4, 2004.

Fazzari S., R. G. Hubbard, and B. Petersen, 1988, "Financing Constraints and Corporate Investment," *Brooking Papers on Economic Activity*, 1, pp. 141-95.

Hubbard, R. G. (1998). "Capital Market Imperfections and Investment," *Journal of Economic Literature*, 36, 193-227.

Kaplan, S., and Zingales, L. (1997). "Do Financing Constraints Explain why Investments is Correlated with Cash Flow?," *Quarterly Journal of Economics*, 112, 169-215.

APPENDIX

Table 1: Descriptive Statistics

Variable	Average	Standard Deviation
Cash Holdings	0.09051	0.11804
Cash Flow	0.00369	0.11303
Tobin's Q	0.93093	0.83733
Expenditures	0.09018	0.15841
Acquisitions	0.00209	0.01968
Non-Cash Net Working Capital	0.29332	0.18651
Short-Term Debt	0.19669	0.15595
Log of Assets	13.8233	1.78229

Table 2: Augmented Model Using IV estimation

Dependent Variable	Independent Variables								
Δ *Cash holdings*	*Cash flow*	*Tobin's Q*	*Log assets*	*Expenditure*	*Acquisitions*	*Change in Net Working Capital*	*Change in Short-term Debt*	*F-statistic*	*Number Obs.*
Constrained Firms	0.10886	0.00531	-0.00038	-0.09609	0.31356	-0.29196	0.03022	3.06	1263
	(0.005)	(0.024)	(0.774)	(0.248)	(0.445)	(0.051)	(0.178)		
Unconstrained Firms	-0.33519	0.00961	-0.00033	-0.13545	-2.99782	-0.88524	0.03025	2.93	225
	(0.144)	(0.688)	(0.948)	(0.292)	(0.658)	(0.002)	(0.743)		

Endogenous Variables: Cash Flow, Log assets, Expenditures, Acquisitions, Change in Net-working Capital an Change in Short-term debt. Instruments: 1st lag of Cash flow, Log assets, Expenditure, Acquisitions, Change in n working capital and Change in short debt, and 2nd lag of Cash flow, Expenditure, Change in net working capit and Change in short debt.

Note: t-statistics in parentheses.

Table 3: Augmented Model Using IV estimation (Clustered Residuals)

Dependent Variable	Independent Variables								
Δ Cash holdings	*Cash flow*	*Tobin's Q*	*Log assets*	*Expenditure*	*Acquisitions*	*Change in Net Working Capital*	*Change in Short-term Debt*	*F-statistic*	*Number Obs.*
Constrained Firms	0.10886	0.00532	-0.00038	-0.09609	0.31356	-0.29196	0.03022	2.42	1263
	(0.01)	(0.014)	(0.768)	(0.231)	(0.460)	(0.091)	(0.204)		
Unconstrained Firms	-0.33519	0.00961	-0.00033	-0.13545	-2.99782	-0.88524	0.03025	3.86	225
	(0.145)	(0.731)	(0.941)	(0.366)	(0.727)	(0.002)	(0.754)		

Endogenous Variables: Cash Flow, Log assets, Expenditures, Acquisitions, Change in Net-working Capital an Change in Short-term debt. Instruments: 1st lag of Cash flow, Log assets, Expenditure, Acquisitions, Change in n working capital and Change in short debt, and 2nd lag of Cash flow, Expenditure, Change in net working capit and Change in short debt.

Note: t-statistics in parentheses.

Table A.1: Variables Description*

Variable	Description
Cash Holdings	Cash + Short-term Financial Investments
Cash Flow	Net Income + Depreciation and Amortization – Dividends
Tobin's Q	(Market Value + Total Debt) / Total Assets
Expenditures	Increase in Investments
Acquisitions	Investments in Subsidiaries + Inv. in Colligated + Inv. in othe
Non-Cash Net Working Capital	Other Short-Term Assets
Short Debt	Short-term Debt + Short-term Debentures
Log of Assets	ln(Assets)

* All variables divided by Total Assets, except *Log of Assets*.