Determinants of Private Investment in Brazil: An Empirical Analysis of the Period 1996-2011

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Abstract: Empirical studies regarding the determinants of private investments in developing countries including Brazil have demonstrated the negative impact of high inflation rates on investments. However, the recent Brazilian experience clearly shows that stabilization in and of itself is not capable of recovering the investment rates. With this in mind, this study's goal is to answer with the help of econometric simulation models, the questions: what are the key-drivers to assess the Brazilian economy and what are the key-factors to bes considered when investments are made? To answer the 1st question, it was evaluated the impacts of macro-seconomic variables on private investments using a strategic bias and a long term cash management vision plan. The estimates demonstrate empirical crowding-in evidence of public investments in infrastructure over private investments. As for public investments (non-infrastructural), the researchers suggest that the crowding-in impact dislocates private investments. All these indicators were obtained as presented in the therory with the exception of the real interest rates variable (r) in which the researchers observed that the coefficient is positive and insignificant in the estimated equation.

Key words: Econometric models, private investment, simmulation models, cash management, innovation

INTRODUCTION

Several studies show the necessity of developing econometric models using reliable information in order to obtain further determinants related to private investments in Brazil, especially since the period related to the implementation of the real plan until now. The econometric model is only possible by taking into account the advances in the theories regarding simulation and the national macro-economic principles. Consequently, it is observed an interesting combination of information, simulation models and analysis that enable decision making processes which can be seen in Lenderman *et al.* (2000), Serven (2002), Rossiter (2002) and Luporini and Joana (2010).

Thus, the objective of this study is to elaborate an econometric simulation model focused on private investments with true possibilities of economic growth during the coming years, due to increases in internal consumption, entrepreneurship and oncoming major sports events such as the World Cup, the Confederations Cup and the Olympic games.

Due to their crucial aspects, it is necessary to correctly assess the performance of banks as agents of development. Commonly known as Cash Management (CM), this department is responsible for allocating resources for organizations going through financial difficulties with the proposal of a new conceptual approach for their operations. In this study, researchers describe the CM and a few characteristics of Brazilian private investments and its economy.

The volatility in the economic environment and in the management of organizations as well has led to a need for gradual changes and responsibilities in CM. Bort (2004) argues that CM is related to bureaucratic and administrative issues. However, the economic behavior and the constant recessions of recent years have favored the creation of a new model related to fundraising and the stimulation of growth in organizations. In this case, it is up to the banks to develop a profound understanding of the economy and its dynamics in order to create financial products, something which at the moment is far removed from the reality of these institutions. Recent advances in the models of information technology and the urge for new financial tools with greater proximity to organizational reality are enabling the development of strategic CM (Fernandez, 2001).

Connecting CM to economic performance is something new especially considering the search for sector assessments focused on indicating the proper financial products for medium sized organizations. Basic responsibilities such as minimizing financial risks and

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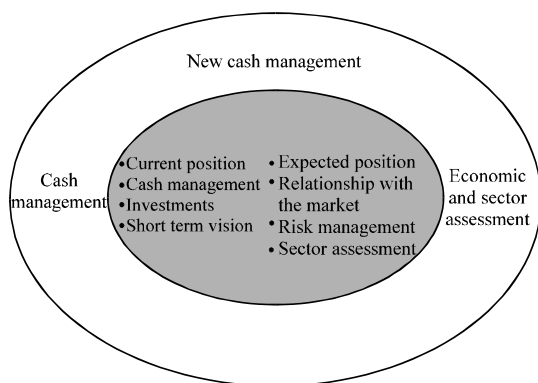3071 Santo Agostinho, Belo Horizonte, 30140-083 Bradesco Innovation Center, Brazil

Fig. 1: Strategic management of cash management adapted from Iturralde *et al.* (2009)

operational costs and maximizing cash returns should be responsibilities of CM, according to Lopez which is the opposite of the current operational models which are still focused on the evaluation of cash flow, liquidity, banking management, risk analysis, payment capacity and associated information technology.

To achieve this, CM must be a department in banking institutions with extensive responsibilities and with connections with other areas, generating benefits for clients as shown in Fig. 1.

The basic aspects of the new CM are necessary due to a new economic vision and long term planning is also necessary but essentially this need stems from culture management and perceived benefits according to Parker (2000).

MATERIALS AND METHODS

The data used refers to the period between 1996-2011 due to the implementation of the Real Plan and the unfolding of the ongoing international economic crisis of 2007. The goal of the panel data econometric model in question is to test the hypothesis that the series of private investments, governmental investments, the GDP, interest rates, inflation among other factors are correlated which enables the modeling of long term behavior of private investments.

To measure the impact of public investments on private investments it was used public investments in a disaggregated form, separating public investments in infrastructure from the investments in electric energy, telecommunications and transportation. All other public investments are considered as non-infrastructural. It is crucial to verify if there is empirical evidence of the crowding-in theoretical effect of public investments in infrastructure over Brazil's private investments and if not

does the expected crowding-out effect occur. The econometric equation for the 1996-2011 timeframe with expresses variables in natural logarithms (except for the real interest rates variable) in order to directly obtain the elasticity of the variables are presented as follows:

$$LInvest\_priv_t = \beta_0 + \beta_1 LogY_t + \beta_2 LogUCAP_t +$$
$$\beta_3 LogInves_t\_pub\_infra_t +$$
$$\beta_4 LogInvest\_pub\_nao\_infra_t +$$
$$\beta_5 r_t + \beta_6 LogP\_rel\_bens\_k_t +$$
$$\beta_8 LogEmprest\_BNDES_t +$$
$$\beta_9 LogT_t + \beta_{10} EE_t + \beta_{11} LogE_t + \beta_{12} D1 + \varepsilon_t$$

In which:

Invest_priv	=	Strictu sensu gross investment of the private sector (excludes state organizations)
Y	=	Real Gross Domestic Product
UCAP	=	Average utilization of the industrial capacity
Invest_pub_infra	=	Public investments in infrastructure
Invest_pub_não_infra	=	Non-infrastructural public investments
r	=	Real interest rate
P_rel_bens_k	=	Relative prices of capital goods
IGP_DI	=	Inflation
Emprest_BNDES	=	Real disbursement of the BNDES
T	=	Tax burden as a percentage of the GDP
EE	=	External restriction using as a proxy the series debt service/GDP (%)
E	=	Real exchange rate
Dummy	=	Control variable for times of international crises

RESULTS

For the econometric analysis, all variables with the exception of the real interest rates variable were log-linearized using the natural logarithm and the remaining series were calculated using the fixed prices of 1995.

Initially, the series were subjected to Augmented Dickey and Fuller (ADF) unit root tests (Dickey and Fuller, 1981) in level and in first difference. The ADF test is well known and will be described in this study (Hayashi, 2000).

The unit root tests for the selected on level variables do not reject the possibility of the existence of a unit root in all cases at a 1% level, the only rejection occurred in the LnIGP-DI variable.

Table 1 shows a summary of the variables used to explain private investments in Brazil in annual series from 1996 onwards and the expected signals for the relationship between each one of them and private investments.

Furthermore, the analysis specified a dynamic model including the lag in the private investment variable (DLnInv_Priv(-1)). The first lag of the private investment variable is commonly used in several studies due to the

Table 1: Private investment determinants. Ordinary least squares- dependent variables: Private investment (1996-2011)

Explanatory variables	Coefficients	Expected signal	Obtained signal
Constant	-9.3598 (-6.0383) [0,0000]	Negative	Negative
DLogInv_Priv(-1)	0.4876 (3.76613) [0.0009]	Positive	Positive
LogY	0.510 (1.8263) [0.0697]	Positive	Positive
LogUCAP	2.866 (9.7258) [0.0000]	Positive	Positive
LogInv_Pub_infra	0.113 (7.3445) [0.0000]	Positive	Positive
LogInv_Pub_ninfra	-0.0741 (-8.0360) [0.0000]	Negative	Negative
R	0.0040 (1.9522) [0.0527]	Positive/negative	Positive
LogP_rel_bens_k	-1.3593 (-9.8211) 0.0000	Negative	Negative
LogIGP-DI	-0.0474 (0.0522) [0.0000]	Negative	Negative
LogEmp_BNES	0.1705 (9.791057) [0.0000]	Positive	Positive
LogT	-1.1800 (0.008) [0.0000]	Negative	Negative
LogE	-0.09251 (-2.19204) [0.03720]	Negative	Negative
Dummy 1	-6.45 (-3.0061) [0.9951]	Negative	Negative
R^2	0.956458		
Adjusted R^2	0.953631		
DW	2.59		
Log likelihood	338.5426		
Statistic F	338.2824		
Prob (F)	0.0000		

Elaborated by the researchers; t statistics are between parentheses and p-values are between brackets

fact that some investments cannot be completed in only 1 year which explains the use of this variable to assess the inertia effect on investments.

In the 1st equation estimated it was inserted a control variable for times of political instability, represented by a Dummy (D1) which assumes unitary values for the years of 1997 (Asian Crises), 1998 (Russian Crises), 1999 (Argentinean Crises and the Brazilian Currency Devaluation) and 2008 (World Financial Crises).

Overall the model presented a satisfactory explanatory rate ($R^2 = 0.95$) which is a result coherent with the majority of the studies shown in Table 1. One can also observe the importance of the irreversibility of the investment, reflected in the coefficient of the first lag of private investment which was positive and significant, indicating that current investments depend on their past values.

The signs found for the estimated coefficients were positive, statistically significant and are in accordance with the economic theory. This result is compatible with the majority of the existing empirical studies concerning the determinants of investments in Brazil and in other developing countries where the variables used to assess the conditions of demand were also significant and relevant in the estimated models.

The results show empirical evidence of the crowding-in effect on public investments in infrastructure (LnInv_Pub_infra) over private investments, a positive sign. This means that a stimulus of 1% in public investments for infrastructure will result in a 0.113% increase in private investments.

As for non-infrastructural public investments (LnInv_Pub_ninfra) the sign obtained is also correct (negative) which suggests that the impact of the crowding-out effect dislocates private investments. This means that a stimulus of 1% in non-infrastructural public investments will result in a 0.0741% decrease in private investments.

However, the theory suggests that after the initial perverse effect of the competition for resources between private and non-infrastructural public investments, it is reasonable to suppose that these investments can also contribute (even if just a little when compared to the infrastructural investments) to increase the productivity of private capital to be invested in the future (public investments in education, health, housing, etc.).

In the case of the real interest rates variable (R), it is observed that the coefficient is positive and non-significant in the estimated equation. In the Brazilian case, especially, cost capital coefficients so close to zero can be explained, on one hand by the organizational tradition of not seeking external financing for the company and on the

other hand by the volatility of the interest rates during periods with high inflation which made interest rates a negligible reference for calculating the opportunity costs of investments.

Literature also indicates that if interest rates rise and if competition for limited resources increases this will result in the dominance of the crowding-out effect over the crowding-in effect. This can be partially explained by the progressive deterioration of the Brazilian's government capacity to invest in infrastructure because it is the type of public spending that presents the most evident complementarities with private inversions.

Results indicate that an increase in the offer of credit (LnEmp_BNES) by means of elevating credit operations aimed at the private sector will increase private investment in the subsequent years which confirms the hypothesis that Brazilian organizations face credit restrictions.

The uncertainties caused by international crisis (assessed by the dummy 1 international crisis variable) were also relevant in the determination of investments in Brazil and the negative coefficient obtained indicates that in times of international economic crisis private investments decrease.

The researchers tried to investigate the impact of external conditions on private investments in Brazil using the external restriction variable (EE) having as a proxy the series Debts of Service/GDP (%). As for external conditions, the researchers suggest that external debts of service did not affect private investments in a significant way during the analyzed timeframe. In fact, the effect of this variable was insignificant in the model and thus was not included in the final model.

Finally, the estimated coefficient for exchange rates (LnE) was significant and presented a negative sign, indicating that increased (or devalued) exchange rates do not encourage imports of capital goods and consequently reduces economic investments.

DISCUSSION

This study analyzed the major determinants of private investments in Brazil for the period of 1996-2011 using data obtained from the Novo Sistema de Contas Nacionais do IBGE (New System of National Accounts of the IBGE) which were recently published by the IPEA. The researchers proposed the elaboration of a model of econometric simulation focused on private investments connected to the real possibilities of economic growth for the coming years. The study focuses on Fig. 1 which initially assesses the national levels of economic activity. The empirical evidence obtained in the models tested confirm the predominance of quantitative variables such as product and capacity of use which indicates that increases in income and in economic activity encouraged private investments in Brazil over the course of the studied period. Besides credit, external factors and exchange devaluations caused in general, adverse effects on the gross formation of fixed capital in the private sector and on the Brazilian economy during the timeframe analyzed. These reults indicate the existence of credit restrictions for Brazilian organizations and also indicate the importance of macro-economic stability and the execution of public policies as an encouraging factor for private investment.

The analysis conducted identified very few researches conducive to econometric studies analyzing sector performance especially in the financial sector and in the insertion of products or services. As a result of these analysis, it is essential that data surveys be conducted to simulate the impacts of macro-economic variables on private investments, by regions and by productive sectors in Brazil, adopting the Monte Carlo simulation models in an attempt to obtain long term estimates. And finally, the researchers hope that this study encourages new studies with strategic biases and long term vision of CM as well as sector analysis in order to propose innovation strategies for the financial sector.

CONCLUSION

The researchers conclude that the determinants for private investments in Brazil are not only associated to the economic performance but also depend on the behavior of all sectors. From this perspective, it is necessary that new studies be developed in order to better understand what are the most representative segments of the country's economy and to encourage the discovery of financial innovations.

ACKNOWLEDGEMENTS

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