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Article

The Determinants of the Long Term Private Investment in Brazil: An Empyrical Analysis Using Cross-section and a Monte Carlo Simulation

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ABSTRACT

Empirical studies regarding the determinants of private investment in developing countries, including Brazil, have demonstrated the high inflation's rates negative impact on investment. However, the recent Brazilian's experience clearly shows that stabilization is not capable of recovering investment's rates. Therefore, the objectives of this study are: a) to analyze the long term private investment's determinants in Brazil; b) analyze if the Brazilian economy has been impacted by the crowding-in or crowding-out effetcs; and c) analyze the macronomic variables' behavior during the 2012 to 2017 period. In order to do this, we used a cross section econometric analysis and a Monte Carlo Simulation for the data analysis. The paper presents the main investment theories, and recent developments of these theories, as well as how they can be applied to the Brazilian data. The results show evidences of a public investment crowding-in effect in infrastructure over the private investment. All the analyzed variables' signs are consistent with the theory, with the exception of the real interest's rates, where the coefficient is positive and insignificant in the estimated equation. The reduction in the credit's volume and the existence of political and economic instabilities showed that they are harmful to private investment in the analyzed period. The implementation of public policies in order to guarantee economic stability and improve the government's credibility, along with the increase of credit offer, could boost private investment in Brazil.

Determinantes de la inversión privada a largo plazo en Brasil: análisis empírico utilizando secciones transversales y una simulación Montecarlo

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RESUMEN

Los estudios empíricos dedicados a los determinantes de la inversión privada en los países en vías de desarrollo, incluido Brasil, han demostrado que la inflación elevada produce un efecto negativo en la inversión. Sin embargo, la experiencia reciente de Brasil muestra claramente que la estabilización no puede recuperar las tasas de inversión. Por lo tanto, los objetivos de este estudio son: a) analizar los determinantes de la inversión privada a largo plazo en Brasil; b) analizar si la economía brasileña se ha visto afectada por los efectos atracción o de exclusión; y c) analizar el comportamiento de las variables macroeconómicas en el período de 2012 a 2017. Para hacerlo, utilizamos un análisis econométrico transversal y una simulación de Montecarlo para analizar los datos. Este documento presenta las principales teorías de inversión y los desarrollos recientes de estas teorías, así como el modo en que pueden aplicarse a los datos de Brasil. Los resultados muestran la evidencia de un efecto de atracción de inversiones públicas en infraestructura por encima de la inversión privada. Todos los signos de variables analizados se corresponden con la teoría, excepto las tasas de interés real, en que el coeficiente es positivo e insignificante en la ecuación estimada. La reducción del volumen de crédito y la inestabilidad política y económica manifestaron que son dañinas para la inversión privada en el período analizado. La implementación de políticas públicas para garantizar la estabilidad económica y para mejorar la credibilidad del Gobierno, así como el aumento de la oferta de crédito, podrían incentivar la inversión privada en Brasil.

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1. Introduction

Empirical studies on private investment determinants in developing countries, including Brazil, show the high inflation rates' negative impacts, interest rates, exchange rates and international crisis of private investment. However, the recent Brazilian experience shows that stabilization by itself is not enough to recover the investment rate.

The investment in fixed capital can be considered a major component to determine the national product, the employment and income in a country´s economy, since it promotes the production activity's increase and expands the economic activity's level.

In Brazil during the last ten years, 89%, in average, of the gross fixed capital formation has been determined by the private sector, which accounts for approximately 15% of the Gross Domestic Product [GDP] during this period. The investment's pace and pattern in fixed capital are the central topics to be able to understand economic activity, and their volatility contributes greatly to aggregate fluctuations. From this perspective, theoretical models and empirical results stimulate investment and provide information for economic policy discussions.

Historically, the fixed capital gross formation with relation to the Brazilian GDP, measured with constant prices, decreased in average 23% in the 70's, 18.5% in the 80's and 15.2% during the 1990-1995 period (IPEA, 2012).

Empirical studies have been seeking to identify the private investment's determinants in Brazil. Some studies, such as Melo and Rodrigues Junior (1998) and Ribeiro and Teixeira (2001) among others, are the most frequently cited in the Brazilian literature. In order to specify an investment equation, these authors combine different theories –such as the accelerator model, the neoclassical model, the credit crunch effects, public investment and macroeconomic instability– and analyze the impact of these variables on the private investment level. The results suggest the aggregate demand's positive effects on investment, the negative relationship between private and public investment in the short term, the positive influence on credit availability and the economic instability's adverse impact on the private sector's investment in Brazil.

Thus, the objectives of this study are: a) to analyze the private investment's determinats in Brazil during the 1996 to 2011 period, using a cross section econometric analysis, in order to explain the fluctuations in the private investment; and b) to analyze the long term determinants' impacts on the private investment in Brazil, during the period of 2012 to 2017, using the Monte Carlo Simulation method.

This article differs, at least for three reasons, from existing work about the private investment's determinants in Brazil. First of all, the study uses a new database from the National Accounts' New System from the Brazilian Institute of Geography and Statistics; secondly, considering the number of observations and econometric data used characteristics, this study uses autoregressive distributed lag models (ARDL) to estimate the effects of the traditionally variables that are considered important for the private investment and; thirdly, the use of the Monte Carlo Simulation in order to analyze the long term macroeconomic variables' impacts on the private investment.

This study is divided into five sections: the first is the introduction; the following section describes the literature that are related to the investment determinants; third section presents the data and methods which describes the econometric model; section four presents the tests results and the econometric simulation during the period 1996-2011, and the Monte Carlo Simulation of the 2012-2017 period; lastly, the conclusions.

2. Literature review

Some of the first Brazilian empirical studies about private investment's determinants were developed in the 70's and 80's. These studies contemplated the basic variables which, theoretically, could reflect the existing conditions of aggregated demand on the economy. The data used was about products, growth rates, private sector production and capacity utilization, among others. The results indicate that, in general, the aggregate demand appears to be an important variable with positive and significant coefficients, while capital cost was less relevant. An exception that could be made was the work of Reis, Cavalcanti, Castro, Rossi, Emerson, and Hernandes (1999), in which the interest rate was positive and statistically significant.

Dailami's (1987) study, one of the first to empirically investigate the investment's determinants in Brazil, used the annual gross domestic product variation, the capital cost's variation and the real wages, as also a measure of the economic instability as measured by the stock's volatility. The studied period comprised the years of 1958 to 1984 where the author found aggregate demand's positive effects and the changes in the real wages and the negative effects on the capital's cost and the economic instability on the private investment.

Studart (1992), Jacinto and Ribeiro (1998) and Ribeiro and Teixeira (2001) include financial variables such as credit availability in their empirical studies, where they found positive impacts in the various measures of investment. There is, however, the possibility of reverse causality, that is, the investment decisions have determined credit expansion (Rama, 1993).

The studies carried out by Studart (1992), Rocha and Teixeira (1996), Jacinto and Ribeiro (1998) and Cruz and Teixeira (1999), among others, studied the public investment's impact on the private sector´s gross fixed capital formation.

Ronci (1991), Melo and Rodrigues Junior (1998), and Santos and Pires (2007), included the public investment's measures in their aggregate models as a control variable. Some results indicate complementarity between public and private investment (Ribeiro & Teixeira, 2001) while others point to a displacement effect (Santos & Pires, 2007).

The vital role of the capital formation for a sustainable economic growth is widely recognized. However, in Brazil and in many other developing countries, investment rates had been declining up to the mid 90's, as a result, mainly, of the external debt crises and the lack of inflationary control.

The period of analysis in this study covers the macroeconomic impacts of the East Asian Crisis during the period of 1997 to 1998, the Russian Crisis in 1998, the Argentinean Crisis and the Brazilian Currency Devaluation, and the Global Financial Crisis, which started in 2008.

The results of other studies which have conducted empirical analysis of the private investment's determinants, as done here, are presented in Table 1.

The investment behavior study, specifically in the private sector, results from the fact that this is a typically endogenous variable and from the observation that the adoption of specific economic actions in the market will increase the relative importance of private investment in the creation of aggregated capital. The methodology in the analysis of the private investment should address two important issues: (1) the endogenous investment's nature with respect to the rest of economic activity; and (2) the government intervention's impact.

3. Methods and data

Time series macroeconomic data is often non-stationary, which makes regression results unreliable. Before developing our regression model, we tested all variables because of stationarity and co-integration.

The data covers the time period from 1996 to 2011. This timeframe is relevant for the determination of Brazil's private