

THE CAUSES OF PRIVATE INVESTMENT IN BRAZIL: AN EMPIRICAL ANALYSIS

Carlos Gilbert Conte Filho^a

Marcelo Savino Portugal^b

^a Adjunct professor in the Economics Department at the Federal University of Santa Maria (UFSM).
Santa Maria, RS, Brazil. ORCID: <https://orcid.org/0000-0003-3753-9723>.

^b Full professor at the Department of Economics and International Relations at the Federal University of
Rio Grande do Sul (UFRGS). Porto Alegre, RS, Brazil. ORCID: <https://orcid.org/0000-0002-2132-013X>.

Received: 2023/3/22

Accepted: 2023/12/13

Recebido: 22/03/2023

Aceito: 13/12/2023

ABSTRACT: This study aims to analyze the determinants of private investment in Brazil from 1971 to 2019 based on the peculiarities of emerging economies. These economies have characteristics that are different from those observed in developed countries and constitute the axioms that support the empirical studies usually carried out on the subject. The uncertainty of the political-economic environment, the low availability of credit, the scarcity of foreign exchange, exchange rate policies, and the precariousness of infrastructure are factors that influence investment decisions in emerging economies. Therefore, they should be part of empirical studies. The results of the econometric analysis—based on the Autoregressive Vectors (VAR) methodology and the Error Correction Model (VECM)—indicate that, both in the short and long term, public investment complemented private sector investment (crowding-in effect). This result indicates that public sector investments were channeled into infrastructure or into areas in which the private sector had no interest or capacity to act. This effect is confirmed by the positive result that investments in infrastructure have on the private sector in Brazil.

KEYWORDS: Capital. Investment. Private sector. Autoregressive vector. Brazil.

JEL CODES: C32; E22; E60.

Corresponding author: Carlos Gilbert Conte Filho; Marcelo Savino Portugal
Email address: carlos.c.filho@ufsm.br; mstp@ufrgs.br



AS CAUSAS DO INVESTIMENTO PRIVADO NO BRASIL: UMA ANÁLISE EMPÍRICA

RESUMO: Este estudo teve como objetivo analisar os determinantes do investimento privado no Brasil entre 1971 e 2019 a partir das peculiaridades das economias emergentes. Essas economias apresentam características distintas daquelas observadas nos países desenvolvidos e que constituem os axiomas que sustentam os estudos empíricos realizados usualmente sobre o tema. A incerteza do ambiente político-econômico, a baixa disponibilidade de crédito, a escassez de divisas, as políticas cambiais e a precariedade da infraestrutura são fatores que influenciam as decisões de investimento do setor privado nas economias emergentes. Portanto, devem fazer parte do estudo empírico. Os resultados da análise econométrica — a partir da metodologia dos Vetores Autorregressivos (VAR) e do Modelo de Correção de Erros (VECM) — indicam que, tanto no curto como no longo prazo, o investimento público complementou o investimento do setor privado (efeito *crowding-in*). Esse resultado indica que os investimentos do setor público foram canalizados para infraestrutura ou em áreas em que o setor privado não tinha interesse ou capacidade para atuar. Esse efeito é confirmado pelo resultado positivo que os investimentos em infraestrutura exercem sobre o setor privado no Brasil.

PALAVRAS-CHAVE: Capital. Investimento. Setor privado. Vetor autorregressivo. Brasil.

CLASSIFICAÇÃO JEL: C32; E22; E60.

INTRODUCTION

The literature on private investment usually uses two basic arguments. The first relates changes in aggregate demand by the acceleration of income. The second concerns the prices of capital and labor. Therefore, empirical work on private investment usually considers variables identified by Keynesian and neoclassical economic theory as determinants of gross fixed capital formation (Rama, 1990).

In emerging economies, however, apart from the normally used variables, the intrinsic peculiarities of these economies are added. These peculiarities are credit restrictions, currency shortages, the level of infrastructure, and economic instability. Servén and Solimano (1994) and Dixit and Pindyck (2012) also highlight external restrictions—due to the external debt crisis that affected emerging economies during the 1980s—in addition to the effect that changes in exchange rates have on the formation gross fixed capital.

Another relevant issue that must be considered in the analysis when it is channeled to emerging economies is the effect that public investment has on private sector investment decisions. Overall, two hypotheses arise regarding this effect. The first of these is that investments in infrastructure increase the productivity of production factors with positive externalities (Ferreira, 1996; Ferreira; Araújo, 2006). Capitalists understand that, by improving infrastructure, investment projects become more viable as risks are minimized and, consequently, profits will be greater. However, the public sector can act in areas in which the private sector has no interest or financial capacity to act. These are scenarios in which the public sector complements the private sector (called the crowding-in effect).

The second hypothesis is that due to the incipient financial markets in emerging countries, public investment may compete with the private sector for scarce resources, thus increasing the cost of capital. Furthermore, the public sector can operate in sectors in which the private sector could operate. In these cases, public investment has a substitutive effect (called the crowding-out effect) (Cruz; Teixeira, 1999; Melo; Rodrigues, 1998; Ribeiro; Teixeira, 2001; Rocha; Teixeira, 1996).

That said, the objective of this study is to analyze the determinants of private investment in Brazil from 1971 to 2019 by considering the peculiarities of emerging economies. Predominantly, we will seek to analyze the effect that public investment has on private sector investment. To this end, this study is organized into four more sections in addition to this introduction. Section two presents the macroeconomic peculiarities of emerging economies. Section three presents a brief review of the literature on the topic. In section four the econometric analysis is carried out. Finally, there are final considerations.

1. PRIVATE INVESTMENT IN DEVELOPING COUNTRIES

In emerging economies, traditional economic theories have failed to explain the determinants of private investment (Rama, 1990). Therefore, Pindyck and Solimano (1993) and Dixit and Pindyck (2012) present an alternative theory to elucidate the behavior of private investment in these economies, that is, environments that are characterized by a higher level of uncertainty and poorly developed financial markets.

The presence of asymmetric information, adverse selection, and incentive effects can make creditors prefer to ration credit, increasing the cost of financing, a point that is relevant in emerging economies (Stiglitz; Weiss, 1981). According to Ronci (1988), the amount of financial resources available in these economies is even more important than the cost of capital. Therefore, a significant portion of firms are faced with credit rationing and the impact on private investment is amplified by the existence of a weak structure of the financial system. However, the precarious infrastructure, or lack thereof, also appears as obstacles to private investment (Ferreira, 1996). That said, apart from the usual macroeconomic variables used in the analysis when it is aimed at emerging economies, the analysis of the determinants of private investment must consider the peculiar and inherent factors of these economic environments. These peculiarities are the uncertainty and irreversibility of investments; financial constraints; the scarcity of foreign exchange; exchange rate policy; the stability of the economy; and public sector investment. These are the points discussed below.

1.1. UNCERTAINTY AND IRREVERSIBILITY

The decision to invest in a context of uncertainty involves the choice between waiting for new information and the opportunity cost of postponing the investment project (Sonaglio; Braga; Campos, 2010). In economies whose uncertainties are more prominent and characterized by poorly developed secondary markets, the question arises whether firms should wait for new information (Falco *et al.*, 2014). In emerging economies, the irreversibility of investments arises from the fact that, once the investment has been made, the economic destination of the capital asset cannot be changed without incurring substantial losses. Due to inefficient secondary markets that are difficult to absorb capital goods with high value and great specificity, investments become even more risky. Since most of the time the costs of acquiring a specific capital asset are high, if the project does not respond as expected, this investment will represent substantial losses when resold on the secondary market.

Faced with this set of factors (uncertainties and irreversibility of specific investments), the entrepreneur may be led to choose to wait for new information before making the investment. Therefore, in scenarios such as this, capitalists only invest when expected profits largely exceed the cost of the enterprise (Sonaglio; Braga; Campos, 2010).

Therefore, we move toward a new theoretical treatment of private sector investment decisions in emerging economies. The central point is to measure the value of the option between waiting for new information and the opportunity cost of postponing an investment project.

1.2. FINANCIAL CONSTRAINT

An approach that has been gaining ground in the literature on the determinants of private investment in emerging economies is financial constraints. This approach highlights that the number of resources available is even more relevant than the spread in capital allocation (Lachman; Shaw, 1974; MacKinnon; Haug; Michelis, 1999). This is because a significant portion of firms are faced with some type of credit rationing.

For an investment to be carried out, firms need sources of financing that enable it to be carried out. Thus, it can be said that the growth rate of an economy is directly linked to the availability of resources for investment. In general, there are four ways to leverage resources: i) bank financing; ii) the capital market; iii) external financing; and iv) financing via internal resources (reinvested profits or self-financing).

In emerging economies with poorly developed financial markets, companies are not only faced with the cost of credit. In these economies, there are no unlimited sources of credit (even if they are subjected to fluctuations in market interest rates or linked to the debt-equity of the company in question). The reality for firms in such economies is that they have access to a credit limit. This limit, in turn, does not depend only on the number of resources available; in many cases, there are political interventions benefiting specific sectors or companies.

However, given the characteristics of emerging economies—even more due to the estimated existence of asymmetric information, adverse selection, and/or incentive effects—creditors may be led to ration credit and impose quantitative limitations on resources. Such measures take on an even greater proportion due to the existence of a weak capital market structure, which contributes to limiting the access of firms to financial resources by alternative means (Rama, 1990).

Quantitative credit restrictions may also be relevant in industrialized countries because of information asymmetry (both on the part of creditors and debtors). However, in emerging economies these are characterized by administered interest rates (defined at low levels) and directly allocated to credit in certain sectors eligible as strategic. In other words, the scarce availability of credit is often directed to specific sectors whose privileges are often obtained by lobbying the government.

Servén and Solimano (1994) also emphasize the perfect non-substitutability between internal financing (profit retention) and external financing (via bonds or credit banks). For these authors, the discrepancy in the cost of financing is also the result of asymmetric information: external creditors are unable to assess in a timely manner the quality of investment opportunities that arise in emerging economies. The asymmetric information increases the cost of external financing.

The result of this set of factors limiting access to credit is that companies will often only invest according to current cash flow (with variations in cash flow and liquidity being related to economic conditions) (Pindyck; Solimano, 1993). Therefore, in emerging economies, movements in aggregate economic activities affect investment, especially in firms that use a high proportion of self-financing.

1.3. FOREIGN EXCHANGE SHORTAGE

Servén and Solimano (1994) highlight the importance of external restrictions on investment decisions. The relation with the external sector becomes relevant due to the impact that the external debt crisis had on emerging economies during the 1980s.

The existence of external commitments—such as the payment of external debt service—can substantially affect the level of investment. In emerging economies, most capital goods are produced externally and therefore need to be imported. Thus, the existence of external commitments can restrict the amount of currency available that would otherwise be allocated to the import of capital goods.

Furthermore, emerging economies are exposed to the consequences of adjustment policies carried out by governments to overcome economic crises (generally resorting to exchange rate policies to control imports or exchange rate devaluation/appreciation). Consequently, already incurred debts can discourage investors as they imply possible tax increases in the future (via Ricardian equivalence). The hypothesis taken here is that due to the rationality of economic agents, they anticipate the taxes that will be charged in the future, which will reduce the return on investments and, therefore, discourage their accomplishment (Brunner, 1977; Kydland; Prescott, 1977).

In short, macroeconomic instability associated with external shocks, uncertainty about the behavior of external debt, and the measures necessary to overcome possible economic crises tend to reduce private sector investment.

1.4. EXCHANGE POLICY

The exchange rate can influence private investment in an ambiguous way (Dixit; Pindyck, 2012; Pindyck; Solimano, 1993). According to Servén and Solimano (1994), the effect of changes in the exchange rate on private investment can be analyzed using the J curve.

An exchange rate appreciation causes investments to initially decrease due to the increase in the prices of imported capital goods. However, over time, exchange rate depreciation stimulates an increase in exports and, consequently, investment (initially in the tradable goods sector and, later, in other sectors of the economy via a multiplier effect) (Melo; Rodrigues, 1998).

On the other hand, exchange rate appreciation makes imported goods cheaper in relation to domestic goods, which makes investments based on capital goods from abroad more accessible. On the other hand, while access to capital goods is facilitated, it also makes the domestic market more competitive due to the landing of a wide range of imported goods.

In addition to influencing the various goods produced or imported, the exchange rate can have effects on the real values of external financing. In firms that have debts in foreign currency, exchange rate depreciation increases financial commitments and, under imperfect markets (in addition to the higher cost of financing), may incur restrictions on credit. Therefore, the financial pressure resulting from an exchange rate devaluation may jeopardize the investments of firms already in debt.

Changes in the exchange rate can also indirectly harm the inflow of foreign investment (one of the main components of gross fixed capital formation). The devaluation of the domestic currency stimulates the entry of foreign investment, increasing private sector investment. However, exchange rate appreciation reduces the expected return on investment projects, thus discouraging them from occurring (Servén, 2002).

Finally, in emerging economies, governments can manage the exchange rate to achieve some specific result. The government can devalue the exchange rate when it wishes to pursue an expansionary fiscal policy by increasing exports. Otherwise, the exchange rate can appreciate when economic policy aims to control an inflationary process (as occurred in Brazil in the first years of the Real Plan in 1994) (Giambiagi *et al.*, 2016).

1.5. ECONOMIC STABILITY

Some of the variables that are relevant to private investment decisions fluctuate even more in emerging economies than in industrialized countries. In part, this is due to a more fragile economic structure, particularly about sectoral diversification (for example, when exports are concentrated in primary products). Interferences in the exchange rate, credit availability, and variations in aggregate demand – in addition to other macroeconomic variables which are affected by unexpected changes in economic policy and/or institutional structure – result in an environment whose uncertainty is amplified (Ahmad; Qayyum, 2008).

Therefore, even if entrepreneurs were averse to risk, periods of instability will result in low levels of investment due to the great variability of expectations regarding expected profits. This result can last if the investments are – in some way – irreversible (Pindyck, 1986).

Furthermore, even if entrepreneurs were risk neutral and capital goods could be resold, there would still be relevant consequences. Drastic changes in economic policy would tend to confirm Lucas' criticism. Due to the rationality of economic agents – even if they are risk averse – they will tend to wait for a better time for investment projects to be carried out.

1.6. PUBLIC SECTOR INVESTMENT

Investments made by the State (public investment) – depending on how and where they are made – can positively or negatively affect private sector investment.

A higher level of public investment in infrastructure and the service system tends to generate positive externalities. These stimulate private sector investment, especially in emerging economies that are characterized by a lack of infrastructure and/or low provision of public goods. According to Ferreira and Araújo (2006) and Frischtak and Mourão (2017), the expansion and improvement of infrastructure (such as better roads, abundant and cheap energy, and communications) imply the greater productivity of private factors of production. This greater productivity of production factors translates into greater profitability of investment projects, which encourages their implementation. In short, investments in infrastructure tend to complement private sector investment as it provides better conditions for it to set up shop¹ (Barat, 2004).

¹ An issue raised in the literature regarding the effects of infrastructure is the temporal precedence between it and economic growth, that is, do variations in infrastructure temporally precede product growth or is this precedence reversed?

However, the public sector may invest and operate in areas in which the private sector has no interest (due to sunk costs) or capacity to establish itself (due to the need for high financial resources). Thus, goods and/or services would be offered that would otherwise not be available. Still regarding the benefits of public investment, in addition to the positive externality generated by the provision of infrastructure and public goods, government investment can act in a countercyclical manner, increasing demand for inputs and services from the private sector in periods of crisis. In all these listed situations, public investment has a complementary effect to private sector investment (crowding-in effect).

On the other hand, increases in public spending that result in unsustainable fiscal deficits can reduce private sector investment via the substitution effect (crowding-out effect). It is usually accepted that private investment can decline because of greater public investment when these are carried out using scarce financial resources. In emerging economies – which face financial constraints – public investment ends up using physical and financial resources that would otherwise be available to the private sector. Consequently, the lower availability of credit and the higher cost of capital contribute to reducing private sector investment (at least in the short term) (Braga Tadeu; Moreira Silva, 2013). In industrialized countries, this substitution effect is predominantly induced by higher interest rates. In emerging economies – in which there is financial repression – substitution can also arise from a credit crunch. Furthermore, public investment can produce goods that compete with those produced by the private sector or even operate in sectors in which the private sector could enter.

2. EMPIRICAL EVIDENCE

Scientific production on the determinants of private investment has substantially advanced over recent years. However, what is observed are non-consensual results. The period under analysis, as well as the used econometric methodology, lead to discrepant results. Table 1 summarizes some studies selected for the Brazilian economy:

Table 1 - Selected studies on the determinants of private investment in Brazil

Author(s)	Methodology	Effect of the variable of interest on private sector investment					
		Public investment (short term)	Public investment (long term)	Economic growth	Infrastructure	Instability	Available credit
Rocha and Teixeira (1996)	VECM (1965-1990)	-	Negative (<i>crowding-out</i>)	Positive	-	-	-
Ferreira (1996)	VAR (1970-1993)	-	-	-	Positive	-	-
Melo and Rodrigues (1998)	OLS (1970-1995)	Negative (<i>crowding-out</i>)	-	-	-	Negative	-
Jacinto and Ribeiro (1998)	VAR (1973-1989)	Negative (<i>crowding-out</i>)	-	Positive	-	-	-
Cruz and Teixeira (1999)	VAR/VECM (1947-1990)	Negative (<i>crowding-out</i>)	Positive (<i>crowding-in</i>)	Positive	-	-	-
Ribeiro and Teixeira (2001)	VAR (1956-1996)	-	Positive (<i>crowding-in</i>)	-	-	Negative	Positive
Luporini and Alves (2010)	ARDL (1970-2005)	-	-	Positive	-	Negative	Positive
Sonaglio, Braga, and Campos (2010)	VECM (1995-2006)	Negative (<i>crowding-out</i>)	-	-	-	-	-
Lélis; Bredow; Cunha (2015)	VECM (1996-2012)						
Gonzales, Sbardellati, and Santos (2014)	VECM (1995-2013)	Positive (<i>crowding-in</i>)	-	Positive	Positive	-	-
Costa Junior (2016)	DSGE ²	No significant effect	-	-	-	-	-
Santos <i>et al.</i> (2016)	VAR (1996-2013)	Positive (<i>crowding-in</i>)	-	Positive	-	-	-
Fernandez <i>et al.</i> (2017)	ARDL (1995-2014)	Positive (<i>crowding-in</i>)	-	-	-	-	-
Borja Reis, Araújo, and Gonzales (2019)	VECM (1983-2013)	Positive (<i>crowding-in</i>)		Positive			
Scotti (2021)	DSGE (2000-2014)	Negative (<i>crowding-out</i>)	-	-	-	-	-
Meyer and Paula (2023)	ARDL (2007-2017)	-	-	Positive	-	Ambiguous	-

Note: OLS – Ordinary Least Squares methodology; VAR – Autoregressive Vectors methodology; VECM – Error Correction Model methodology; ARDL – Autoregressive Distributed Lag methodology; and DSGE – Dynamic Stochastic General Equilibrium Models. Source: prepared by the authors.

² The analysis of Costa Junior (2016) uses calibrated parameters to simulate the Brazilian economy. Therefore, there is no period under analysis.

When analyzing only the results regarding the effect that the increase in public sector investment has on private sector investment, it is observed that the results are heterogeneous.

Using the OLS methodology with data from 1970 to 1995, the result obtained by Melo and Rodrigues (1998) highlights the substitutive effect between public and private investment. Using the VAR/VECM methodology, the same result was found in (i) Rocha and Teixeira's (1996) analysis using data from 1965 to 1990; (ii) Cruz and Teixeira (1999), with data from 1947 to 1990; and (iii) Sonaglio, Braga, and Campos (2010), with data from 1995 to 2006. Scotti (2021), using the micro foundation DSGE methodology, with quarterly data from 2000 to 2014, also found a crowding-out effect between public and private investment in Brazil.

However, Fernandez *et al.* (2017), using the ARDL methodology with data from 1995 to 2014, found a crowding-in effect between public and private investment. The positive result was also found (i) in the analysis carried out by Gonzales, Sbardellati, and Santos (2014) using data from 1995 to 2013; and (ii) in the analysis of Borja Reis, Araújo, and Gonzales (2019,) with data from 1983 to 2013, using the VECM methodology. Santos *et al.* (2016), using the VAR methodology with quarterly data from 1996 to 2013, also found a complementary effect between public and private investment.

Notably, studies that included investments in infrastructure as an explanatory variable point to beneficial effects on private sector investment (Ferreira, 1996; Gonzales; Sbardellati; Santos, 2014). The positive result was also found when the available credit variable was tested (Ribeiro; Teixeira, 2001; Luporini; Alves, 2010); as well as the effect that product growth has on private sector investment (Jacinto; Ribeiro, 1998; Rocha; Teixeira, 1996).

3. EMPIRICAL ANALYSIS

This section aims to perform an empirical analysis of the determinants of private investments in Brazil based on annual data from 1971 to 2019. For this purpose, the econometric software E-views 12 was used.

Initially, the function and the database of time series used, as well as the expected signs of the variables included in the model, are presented. Secondly, the chosen methodology is presented. Finally, empirical tests are carried out.

The function presented below was used to analyze the determinants of private investments in Brazil. Table 2 summarizes the information about the variables included in the analysis.

$$I^p = f(IG, Inst, Infra, AC, RER, IC, EDS) \quad (1)$$

Table 2 – Variables, expected signs, and data sources

Variable	Description	Expected signal from a positive shock	Data source
IP	Private sector gross fixed capital formation	–	Instituto Brasileiro de Geografia e Estatística (2023)
IG	Public sector gross fixed capital formation	Undetermined	Instituto Brasileiro de Geografia e Estatística (2023)
Inst	Instability present in the Brazilian economy	Negative	Banco Central do Brasil (2023a) Fundação Getúlio Vargas (2023)
Infra	Investments in infrastructure	Positive	Instituto de Pesquisa Econômica Aplicada (2023)
AC	Credit available in the economy via the National Bank for Economic and Social Development (BNDES)	Positive	Banco Nacional de Desenvolvimento Econômico e Social (2023)
RER	Real exchange rate	Undetermined	The World Bank (2023) Fundação Getúlio Vargas (2023)
IC	International currencies	Positive	Banco Central do Brasil (2023b)
EDS	External debt service	Negative	Banco Central do Brasil (2023c)

Source: Elaborated by the authors.

Data regarding private investments, public investments, and investments in infrastructure are presented as a percentage of the gross domestic product (GDP). Data referring to credit was made possible by BNDES (2023) (at 2010 prices), investment in infrastructure (in millions of R\$), international reserves (in millions of US\$), debt service (US\$ million), and instability were transformed into natural logarithms. For the nominal exchange rate, the average between the purchase and sale value at the end of the period (R\$/US\$) was used.

To create the instability series for the Brazilian economy, data relating to the inflation rate (IGP-DI) (π), obtained from FGV Ibre (2023), the real interest rate (r), and the exchange rate (R\$/US\$) were used.

The real interest rate series was obtained from the equation below:

$$Real\ exchange\ rate = \frac{CN \times \pi EUA}{IGPDI} \quad (2)$$

In (2), CN is the nominal exchange rate; πUSA is the time series referring to the official inflation rate of the US economy, obtained from the World Bank (2023) database; and data relating to inflation in Brazil – general price index/internal availability (IGP-DI) – was obtained from the FGV Ibre (2023) database. The equation below was then applied to prepare the time series referring to economic instability:

$$Inst = (1 + \pi) + \Delta r + \Delta CN \quad (3)$$

The first step of the econometric analysis is to verify the presence of a unit root in the time series included in the model. When time series do not have a unit root, they are level stationary series, that is, they have constant mean, variance, and autocorrelation. Otherwise, if the series presents a discrepant trend or variance, it means that it needs to be differentiated at least once to become stationary (Hamilton, 1994; Patterson, 2000; Verbeek, 2004).

To analyze the presence of a unit root in the time series used in the empirical analysis, three tests were applied: Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS). The critical values to establish the existence or not of a unit root were tabulated by MacKinnon, Haug, and Michelis (1999). The number of lags used in the tests was defined based on the minimization of the Schwartz criterion. The results are presented in Table 3:

Table 3 – Unit root tests

Variable	ADF	PP	KPSS	Integration Order
I ^P	-1.797081 [-2.923780]	-1.676116 -2.923780	0.651038 [0.463000]	I(1)
D(I ^P)	-5.732944 [-2.929734]	-7.019435 [-2.925169]	0.236367 [0.463000]	
I ^G	-2.719917 [-2.923780]	-2.719917 [-2.923780]	0.126662 [0.463000]	I(1)
D(I ^G)	-8.100464 [-2.925169]	-8.088038 [-2.925169]	-	
Instability	-5.656463 [-2.923780]	-5.808264 [-2.923780]	0.143083 [0.463000]	I(0)
Log(Infrastructure)	-2.615863 [-2.923780]	-2.593714 [-2.923780]	0.226961 [0.463000]	I(1)
D(log((Infrastructure)))	-7.486108 [-2.925169]	-7.476362 [-2.925169]	-	
Log(Available credit)	-2.163538 [-2.925169]	-2.396626 [-2.923780]	0.629170 [0.463000]	I(1)
D(log((Available credit)))	-2.163538 [-2.925169]	-4.064591 [-2.925169]	0.213003 [0.463000]	
Real exchange rate	0.052152 [-2.923780]	0.185139 [-2.923780]	0.822067 [0.463000]	I(1)
D(Real exchange rate)	-7.352977 [-2.925169]	-7.338746 [-2.925169]	0.172774 [0.463000]	
Log(International currencies)	-1.229838 [-2.925169]	-1.888093 [-2.923780]	0.865438 [0.463000]	I(1)
D(log(International currencies))	-11.03049 [-2.925169]	-32.13835 [-2.925169]	0.226608 [0.463000]	
Log(External debt service)	-3.720345 [-2.925169]	-5.888778 [-2.923780]	0.819646 [0.463000]	I(0)
D(log(External debt service))	-	-	0.147889 [0.463000]	

Notes: The ADF and PP tests assume the existence of a unit root as a null hypothesis. However, the null hypothesis of the KPSS test indicates that there is no unit root; values in brackets indicate the critical value at the 5% significance level; for the unit root tests, it was assumed that the time series have an intercept.

Source: Elaborated by the authors with results obtained using the E-views 12 software application.

The test results indicate that six of the eight variables included in the model have a unit root, that is, they are integrated series of order 1.

If the variables are not stationary in level (that is, if the variables that make up the function to be estimated have at least one unit root), the cointegration hypothesis must be tested to avoid the problem of spurious regression (Sims, 1980). Since the variables are stationary only in first difference, their combination can still be stationary. In this case, the regression is said to be cointegrated and makes economic sense, which allows statistical inference based on the t and F distributions over the cointegrating vector. This will occur when the variables are integrated and the cointegration equation reveals stationary residuals. This linear combination (called cointegration equation) is interpreted as the long-term equilibrium relationship between variables (Hamilton, 1994; Patterson, 2000; Verbeek, 2004).

Among the options to analyze the presence or absence of a co-integrating vector, we opted for the vector autoregressive (VAR) methodology. The VAR approach was chosen among other possible methodologies since it is not necessary to arbitrate which variables are exogenous and which are endogenous (Hamilton, 1994). By treating variables without predefinitions, the VAR model captures interactions between the all-time series included in the analysis, relating them not only to the lagged values of the other n variables, but also to the lagged value of the explained variable.

Therefore, based on the results obtained regarding the order of integration of the variables included in the analyzed function, the next step is to check whether: (i) there is at least one cointegration vector to verify that the regression is not spurious, that is, to ensure that the model has economic significance and (ii) whether the variables included in the model have a long-term relationship.

Therefore, the methodology of Johansen (1991) must be applied to check whether there is at least one co-integrating vector. However, it is first necessary to find out what is the best number of lags to be included in the VAR. Table 4 presents the results of five lag tests:

Table 4 – Number of ideal lags to be included in the VAR

Lag	Criteria				
	LR	FPE	Akaike	Schwarz	Hannan-Quinn
0	NA	6.12e-10	1.488025	1.809209	1.607759
1	220.3574*	2.41e-11*	-1.788571	1.102089*	-0.710962*
2	67.85290	4.82e-11	-1.367445	4.092691	0.668039
3	82.47565	3.04e-11	-2.646783*	5.382828	0.346576

Notes: LR - sequential modified LR test statistic (each test at 5% level); FPE - final prediction error; "*" indicates the optimal value. Source: Elaborated by the authors with results obtained using the E-views 12 software application.

In total, four of the five information criteria (LR, FPE, Schwarz, and Hannan-Quinn) indicate that VAR should be used with one lag. Once this is done, the next step is to analyze whether there is at least one cointegrating vector. Table 5 summarizes the trace and maximum eigenvalue cointegration tests with different specifications (with or without the presence of intercept and trend):

Table 5 – Johansen cointegration tests

Data trend	None	None	Linear	Linear	Quadratic
	No intercept	Intercept	Intercept	Intercept	Intercept
	No trend	No trend	No trend	Trend	Trend
Trace test	6	7	8	4	8
Maximum eigenvalue test	1	2	2	2	2

Note: Critical values tabulated by MacKinnon, Haug, and Michelis (1999)

Source: Elaborated by the authors with results obtained using the E-views 12 software application.

It is observed that the Trace test indicates the presence of at least four co-integrating equations, whereas the d Maximum Eigenvalue test indicates at least the presence of two co-integrating equations. Therefore, it can be said that the time series included in VAR have stationary residuals and a long-term relationship.

The next step is to verify – via the Wald block causality/exogeneity tests of the VAR Granger – the order of entry of the time series into the VAR. The result is presented in Table 6:

Table 6 – VAR Granger block exogeneity test

Variable	Chi-squared	Probability
Instability (Ins)	1.914231	0.9644
Real Exchange rate (RER)	3.203677	0.8655
International currencies (IC)	3.474100	0.8380
Public investment (IG)	7.819850	0.3487
Available credit (AC)	8.530428	0.2881
External debt service (EDS)	8.622858	0.2809
Infrastructure (Infra)	14.86624	0.0378

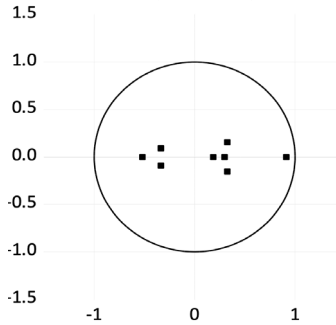
Source: Elaborated by the authors with results obtained using the E-views 12 software application.

According to the results obtained, the order of entry of the variables into the estimated model is:

$$IP \rightarrow Inst \rightarrow RER \rightarrow IC \rightarrow IG \rightarrow AC \rightarrow EDS \rightarrow Infra$$

Once the entry order of the time series has been established, the stability of the VAR must be analyzed. The roots of the polynomial created in the construction of the VAR must all be greater than 1 in modulus. However, in the E-views software (12), these roots are inverted (x^{-1}) and, therefore, must be inside the unit circle. Figure 1 presents the result of the polynomial present in the VAR:

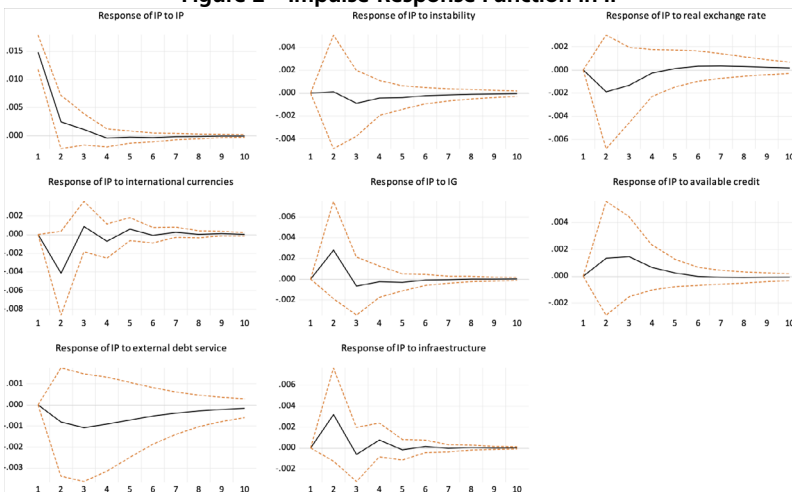
Figure 1 – Inverted polynomial generated in VAR



Source: Elaborated by the authors with results obtained using the E-views 12 software application.

The roots of the inverted polynomial are inside the unit circle. Since the VAR is stable, the impulse-response function can be applied to analyze the effects that a positive and isolated shock in the explanatory variables has on the explained variable (private sector investment). The impulse-response function was analyzed over a time horizon of 15 periods. Figure 2 illustrates the results:

Figure 2 – Impulse-Response Function in IP



Source: Elaborated by the authors with results obtained using the E-views 12 software application.

The positive and isolated shock in public investment has a positive impact on private sector investment (crowding-in) until the third subsequent period. Thus, the results indicate that investment by the public sector predominantly occurred in infrastructure, the service system, or in areas in which the private sector had no interest or capacity to act. The crowding-in effect is confirmed from the result of a positive and isolated shock to infrastructure: investments in infrastructure have a positive impact on private sector investments. Likewise, a positive and isolated shock in the amount of credit made available by BNDES has a positive effect on private sector investment.

As for the effect that a positive and isolated shock in the real exchange rate has on private sector investment, it is observed that this is negative. The result indicates that exchange rate devaluation, while it encourages exports of tradable goods, also affects imports of capital goods. In this context, the result indicates that the negative effect of increased imports outweighs the gains from greater exports of produced goods. Likewise, the negative result is obtained from a positive and isolated shock in the amount spent on external debt service and when applied to the economic instability variable.

Finally, the effect of a positive and isolated shock on international reserves proved to be negative. Therefore, expanding reserves does not prove beneficial in encouraging private sector investment. This result differs from what was expected. A possible interpretation for the result presented would be the hypothesis that the level of reserves is already at an optimal level and that increases in international currency should be channeled into policies for the acquisition of imported capital goods.

Having presented the effects of shocks on private sector investment based on the variables included in the analysis, the next step is to estimate the Vector Error Correction (VECM). VECM presents the long-run relationship, as well as the cointegration equation that adjusts the variables between the long and short run. The VECM results are found in Table 7:

Table 7 – Error Correction Vector

Variable	Estimated Coefficient	Probability of accepting H0
Cointegrating equation	-0.466331	0.0008 ^a
Private investment (IP)	0.373027	0.0111 ^a
Instability (Ins)	0.000172	0.0300 ^a
Real Exchange rate (RER)	-0.001462	0.7894
International currencies (IC)	-0.004988	0.0084
Public investment (IG)	0.610099	0.0906 ^b
Available credit (AC)	-0.001625	0.8597
External debt service (EDS)	-0.021567	0.3213
Infrastructure (Infra)	-0.002641	0.8611
Coefficient of Determination	0.4257	
Adjusted Coefficient of Determination	0.2860	

Notes: The variable significance test assumes as a null hypothesis (H0) that the estimated coefficient is statistically significant; "a" indicates that the estimated coefficient is significant at the 5% level, while "b" indicates that the estimated coefficient is statistically significant at the 10% level.

Source: Elaborated by the authors with results obtained using the E-views 12 software application.

The coefficients estimated in the VECM indicate that the variables included in the model account for 42.57% of the variations in private investment in the long term.

Just like the results obtained in the VAR, the VECM indicates a complementary effect (crowding-in) between public and private sector investments in the long term.

Results also indicate that previously made private investment positively influences the making of new investments. A 1% increase in previously made investment results in a 0.373% increase in long-term private sector investment. Furthermore, the increase in instability in the economy has a positive impact in the long term on private sector investments: for every 1% increase in instability present in the economy, the private sector responds with an increase of 0.00017% in investments. Even if the effect is marginal, it still differs from what was expected. A possible explanation for the obtained result lies in the hypothesis that economic instability is part of the macroeconomic scenario of emerging economies and that its variability does not exert a substantial influence on private sector investment decisions.

VECM also estimates the cointegration equation. This equation must present a negative and statistically significant result, which denotes that, with each period, the distance between the short- and long-term decreases (Pesaran; Shin; Smith, 2001). In this sense, the estimated coefficient for the cointegration equation proved to be statistically significant and indicates that there is an adjustment of 46.63% in each period between the short and long terms.

The last step is the analysis of the variance decomposition of private investment. This indicates the weight that each variable included in the model exerts on private sector investment over time. As the data used in this study has annual periodicity, the variance decomposition was analyzed based on a time horizon of 10 periods. Table 8 presents the results:

Table 8 – Decomposition of Private Investment Variance

Period	Private investment	Instability	Real Exchange rate	International currencies	Public investment	Available credit	External debt service	Infrastructure
1	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	84.49634	0.014427	2.874477	6.036926	3.512051	0.254216	0.000919	2.810649
3	83.68784	0.142091	2.956275	6.091807	3.462852	0.644768	0.010819	3.003550
4	83.16370	0.144811	2.984032	6.384483	3.442161	0.704073	0.015146	3.161594
5	83.09655	0.148264	2.982348	6.423160	3.443398	0.712067	0.024171	3.170047
6	83.05766	0.148206	2.985412	6.447588	3.442444	0.711754	0.030368	3.176571
7	83.04701	0.148186	2.985981	6.449861	3.443361	0.712441	0.036704	3.176457
8	83.03805	0.148272	2.985939	6.451950	3.443349	0.713968	0.041637	3.176836
9	83.03248	0.148340	2.985844	6.451515	3.443619	0.715620	0.045979	3.176606
10	83.02740	0.148433	2.985661	6.451593	3.443668	0.717171	0.049512	3.176557

Source: Elaborated by the authors with results obtained using the E-views 12 software application.

Variance decomposition shows the weight that each explanatory variable exerts throughout the period under analysis on the variable of interest (PI).

According to the results, it is observed that international reserves are the ones that have the greatest effect on private sector investment: 6.45% after 10 periods. Next, public-sector investment emerges as the most representative variable: it has a weight of 3.44% after 10 periods. Infrastructure and exchange rate appear as other relevant variables in this analysis: a weight of 3.17% and 2.98% after 10 periods, respectively. Finally, the exchange rate over 10 periods has a weight of 2.98% on private sector decisions.

FINAL CONSIDERATIONS

This study presented the peculiarities of emerging economies and carried out an empirical analysis with data from the Brazilian economy from 1971 to 2019.

Studies on the determinants of private investment usually use variables indicated from Keynesian and neoclassical theories such as the cost of capital (interest rate) and the performance of the economy (product growth). Here, unlike the usual analyses carried out to investigate the determinants of the private sector, intrinsic variables from emerging economies were used.

Based on this analytical arrangement, it was observed that public investment is predominantly complementary to private sector investment both in the short and long term. Furthermore, variance decomposition showed that this variable is one of those that weighs most on private sector investment over the subsequent years (3.43% in the 10th period).

The results obtained indicate that the increase in public investment is complementary to private sector investment due to the positive externalities that these generate in the Brazilian economy. This result is rejected by the positive effect that investments in infrastructure have on private sector investments (another variable with relevant weight in determining private sector investment – 3.17% in the tenth period). Therefore, it would be up to the State — regarding public investment — and the State and the private sector (in areas in which there are concessions or public-private partnerships) to expand investments, mainly in infrastructure. That said, economic policymakers must outline policies that result in the expansion and improvements of highways, ports, airports, as well as the expansion of energy generation and the telecommunications capacity in the country.

The econometric analysis indicates that the expansion of credit available in the economy positively influences private sector investments. Therefore, policies that increase disbursements and access to credit via BNDES must be implemented.

Finally, in the short term, increased instability in the Brazilian economy is detrimental to private sector investment, although marginally positive in the long term. Therefore, seeking to maintain a stable political-economic environment that minimizes uncertainties is a necessary condition for the expansion of investments made by the private sector.

The results also indicate that the external sector is relevant within the context of emerging economies such as Brazil. While currency devaluation encourages exports, it makes imports of capital goods more expensive. This negative effect on imports of capital goods overlaps with the beneficial effect arising from exports. Still in relation to the external sector, the increase in spending on external debt service has a negative impact on private sector investment. These two variables indicate that exchange rate devaluation — by making the import of capital goods more expensive and implying an increase in external debt service (in current currency) — is harmful to private sector investments.

As for international reserves, their expansion has a negative impact on private sector investments. This result differs from what was expected. However, this is a variable whose weight in determining private investment is relevant even after 10 periods. Therefore, one of the possible justifications for the result obtained lies in the fact that the international reserves of the country are already at a high level. Therefore, these resources, instead of being under the supervision of the State, should be the subject of policies that facilitate access to imported capital goods.

Finally, given what has been presented, two research agendas emerge. The first of these is to specifically analyze how each of the infrastructure sectors (transport, energy, and telecommunications) impacts private investments. The second is to simulate a country with the same characteristics as the variables included in this study but in which public sector investment does not decline, as occurred in Brazil following the external debt crisis. Thus, the question would arise: what would be the magnitude of the positive effect on private sector investment if public investments were maintained at higher levels during and after the 1980s?

REFERENCES

- Ahmad, I.; Qayyum, A. Effect of government spending and macro-economic uncertainty on private investment in services sector: Evidence from Pakistan. *European Journal of Economics, Finance and Administrative Sciences*, issue 11, 2008. Available at: <https://mpra.ub.uni-muenchen.de/11673/>. Accessed on: 9 Oct. 2023.
- Banco Central do Brasil. SGS - *Sistema Gerenciador de Séries Temporais - v2.1*. Estatísticas de crédito. Taxas de juros. [S.l.] BCB, 2023a. Available at: <https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries>. Accessed on: 10 Oct. 2023.

- Banco Central do Brasil. *SGS - Sistema Gerenciador de Séries Temporais - v2.1*. Estatísticas do setor externo. Reservas internacionais. [S.l.] BCB, 2023b. Available at: <https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries>. Accessed on: 10 Oct. 2023.
- Banco Central do Brasil. *SGS - Sistema Gerenciador de Séries Temporais - v2.1*. Estatísticas do setor externo. Dívida externa. Indicadores de endividamento externo. [S.l.] BCB, 2023c. Available in: <https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries>. Accessed on: 10 Oct. 2023.
- Banco Nacional de Desenvolvimento Econômico e Social. *Central de Downloads*. Estatísticas Operacionais Consolidadas do Sistema BNDES. Desembolsos do sistema BNDES, 1995 a 31/12/2023. [S.l.] BNDES, 2023. Available at: <https://www.bndes.gov.br/wps/portal/site/home/transparencia/centraldedownloads>. Accessed on: 12 Sept. 2023.
- Barat, J. *Infraestruturas e crescimento: reforma do Estado e inclusão social*. São Paulo: CL-A Cultural, 2004.
- Borja Reis, C. F.; Araújo, E. C.; Gonzales, E. O. Public investment boosted private investment in Brazil between 1982 and 2013. *Journal of Economic Issues*, v. 53, n. 3, p. 813-840, 2019. DOI: 10.1080/00213624.2019.1644931.
- Braga Tadeu, H. F.; Moreira Silva, J. T. The determinants of the long term private investment in Brazil: An empirical analysis using cross-section and a Monte Carlo simulation. *Journal of Economics Finance and Administrative Science*, v. 18, p. 11-17, 2013. DOI: 10.1016/S2077-1886(13)70025-8.
- Brunner, K. (Ed.). *The Phillips Curve and labor markets*. Amsterdam; New York: North-Holland, 1977. (Carnegie-Rochester Conference Series on Public Policy, 1)
- Costa Junior, C. J. *Understanding DSGE models: Theory and applications*. Wilmington, DE: Vernon, 2016.
- Cruz, B. O.; Teixeira, J. R. The impact of public investment on private investment in Brazil, 1947-1990. *CEPAL Review*, v. 67, p. 75-84, 1999.
- Dixit, R. K.; Pindyck, R. S. *Investment under uncertainty*. Princeton, NJ: Princeton University Press, 2012.
- Falco, G. P.; Altaf, J. G.; Troccoli, I. R.; Vellasco, M. M.; Lazo, J. G. Teoria de opções reais: Uma perspectiva para a valoração econômica do meio ambiente sob incerteza. *Perspectiva Econômica*, v. 10, n. 1, p. 29-38, 2014. DOI: 10.4013/pe.2014.101.03.
- Fernandez, R. N.; Shikida, C.; Menezes, G. R.; Almeida, R. H. M. Análise dos efeitos crowding-in e crowding-out para a economia brasileira. *Sinergia*, v. 21, n. 2, p. 71-80, 2017.
- Ferreira, P. C. Investimento em infraestrutura no Brasil: Fatos estilizados e relações de longo prazo. *Pesquisa e Planejamento Econômico*, v. 26, n. 2, p. 231-252, 1996.
- Ferreira, P. C.; Araújo, C. H. On the Economic and fiscal effects of infrastructure investment in Brazil. *Ensaios Econômicos*, n. 613, p. 1-31, 2006.
- Fundação Getúlio Vargas. Instituto Brasileiro de Economia. Estatísticas. IGP. Série Histórica [S.l.] FGV Ibre, 2024. Available at: <https://extra-ibre.fgv.br.aspx> Accessed on: 15 Oct. 2023.

- Frischtak, C. R.; Mourão, J. O estoque de capital de infraestrutura no Brasil: Uma abordagem setorial. [S.l.] IPEA, 2017. Available AT: <https://epge.fgv.br/conferencias/modernizacao-da-infraestrutura-brasileira-2017/files/estoque-de-capital-setorial-em-infra-brasil-22-08-2017.pdf>. Accessed on: 10 Aug. 2023.
- Giambiagi, F.; Castro, L. B.; Hermann, J.; Villela, A. *Economia brasileira contemporânea*. 3. ed. Rio de Janeiro: Elsevier, 2016.
- Gonzales, E. O.; Sbardellati, E. C. A.; Santos, A. S. Uma investigação empírica sobre os determinantes do investimento no Brasil (1995-2013). In: ENCONTRO NACIONAL DE ECONOMIA. n. 42, Natal, 9 – 12 dez., 2014. Available at: https://www.anpec.org.br/encontro/2014/submissao/files_I/i6-302e9e2238644d522bf5126210be53d9.pdf. Accessed on: 25 Oct. 2023.
- Hamilton, J. D. *Time Series Analysis*. Princeton, NJ: Princeton University Press, 1994. 820 p. ISBN 9780691042893.
- Instituto Brasileiro de Geografia e Estatística. *SCN - Sistema de Contas Nacionais*. Brasil. Tabelas - 2021. Tabela 16 - Principais agregados macroeconômicos das Contas Nacionais, setores institucionais empresas não financeiras e empresas financeiras, por origem do capital, privado e público - 2010-2021. [S.l.] IBGE, 2023. Available at: <https://www.ibge.gov.br/estatisticas/economicas/contas-nacionais/9052-sistema-de-contas-nacionais-brasil.html>. Accessed on: 15 Set. 2023.
- Instituto de Pesquisa Econômica Aplicada. *Ipeadata*. Ipeadata macroeconômico - Investimento bruto (formação bruta de capital fixo) - infraestrutura. [S.l.] IPEA, 2023. Available at: <http://www.ipeadata.gov.br/Default.aspx>. Accessed on: 20 Sept. 2023.
- Jacinto, P. A.; Ribeiro, E. P. Cointegração, efeitos crowding-in e crowding-out entre investimento público e privado no Brasil: 1973-1989. *Teoria e Evidência Econômica*, v. 6, n. 11, p. 145-158, 1998.
- Kydland, F. E.; Prescott, E. C. Rules rather than discretion: The inconsistency of optimal plans. *Journal of Political Economy*, v. 85, n. 3, p. 473-491, 1977. DOI: 10.1086/260580.
- Lachman, D.; Shaw, E. S. Financial deepening in economic development. *The Economic Journal*, v. 84, n. 333, p. 227, 1974. DOI: 10.2307/2230515.
- Lélis, M. T. C.; Bredow, S. M. S.; Cunha, A. M. Determinantes macroeconômicos dos investimentos no Brasil: Um estudo para o período 1996-2012. *Revista de Economia Contemporânea*, v. 19, n. 2, p. 203-234, 2015. DOI: 10.1590/198055271922.
- Luporini, V.; Alves, J. Investimento privado: Uma análise empírica para o Brasil. *Economia e Sociedade*, v. 19, n. 3, p. 449-475, 2010. DOI: 10.1590/S0104-06182010000300002.
- MacKinnon, J. G.; Haug, A. A.; Michelis, L. numerical distribution functions of likelihood ratio tests for cointegration. *Journal of Applied Econometrics*, v. 14, p. 563 - 577, 1999.
- Melo, G. M.; Rodrigues, W. *Determinantes do investimento privado no Brasil: 1970-1995*. Rio de Janeiro: IPEA, 1998. (Texto para Discussão, n. 605).
- Meyer, T. R.; Paula, L. F. Determinantes do investimento privado no Brasil em 2007-2017 a partir de uma perspectiva pós-keynesiana: Uma análise empírica. *Revista de Economia Contemporânea*, v. 27, p. 1 - 38, 2023.
- Patterson, K. *An introduction to applied econometrics: A time series approach*. Houndmills, Basingstoke: MacMillan, 2000.

- Pesaran, M. H.; Shin, Y.; Smith, R. J. Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, v. 16, n. 3, p.289-326, 2021.
- Pindyck, R. S. *Capital risk and models of investment behavior*. Cambridge MA: MIT, Sept. 1986. (Working Paper, n. 1819-86.) Available at: <https://dspace.mit.edu/bitstream/handle/1721.1/2151/SWP-1819-15686388.pdf>. Accessed: 15 July 2023.
- Pindyck, R. S.; Solimano, A. *Economic Instability and aggregate investment*. Cambridge, MA: The World Bank, 1993.
- Rama, M. *Empirical investment equations in developing countries*. Washington, DC: World Bank, Dec. 1990. (Working Paper Series, n. 563). Available at: <https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/985091468781551980/empirical-investment-equations-in-developing-countries>. Accessed: 29 Feb. 2024.
- Ribeiro, M. B.; Teixeira, J. R. An econometric analysis of private-sector investment in Brazil. *CEPAL Review*, n. 74, p. 153 - 168, 2001.
- Rocha, C. H.; Teixeira, J. R. Complementaridade versus substituição entre investimento público e privado na economia brasileiro: 1965-90. *Revista Brasileira de Economia*, v. 50, p 378 - 384, 1996.
- Ronci, M. V. Uma nota sobre a especificação da função de investimento agregado para países em desenvolvimento. *Revista Brasileira de Economia*, v. 42, p. 179 - 194, 1988.
- Santos, C. H. M.; Modenesi, A. M.; Squeff, G.; Vasconcelos, L.; Mora, M.; Fernandes, T.; Moraes, T.; Summa, I.; Braga, J. Revisitando a dinâmica trimestral do investimento no Brasil: 1996-2012. *Revista de Economia Política*, v. 36, n. 1, p. 190 -213, 2016. DOI: 10.1590/0101-31572016v36n01a11.
- Scotti, B. G. (Ed.). *Avaliando os impactos da política fiscal sobre o investimento privado no Brasil através de um modelo DSGE estimado*. 2021. Dissertação (Mestrado em Economia) – Faculdade de Ciências Econômicas, Universidade Federal do Rio Grande do Sul, Porto Alegre, 2021.
- Servén, L. Real Exchange rate uncertainty and private investment in developing countries. *Policy Research Working Papers*, The World Bank, Apr. 2002. DOI: <https://doi.org/10.1596/1813-9450-2823>.
- Servén, L.; Solimano, A. *Striving for growth after adjustment: The role of capital formation*. Washington, DC: World Bank, 1994. (World Bank Regional and Sectoral Studies.)
- Sims, C. A. Macroeconomics and reality. *Econometrica*, v. 48, n. 1, p. 1 - 48, 1980. DOI: 10.2307/1912017.
- Sonaglio, C. M.; Braga, M. J.; Campos, A. C. Investimento público e privado no Brasil: Evidências dos efeitos crowding-in e crowding-out no período 1995-2006. *Revista EconomiA*, v. 11, n. 2, p. 383 – 401, 2010.
- Stiglitz, J. E.; Weiss, A. credit rationing in markets with imperfect information. *The American Economic Review*, v. 71, n. 3, p. 393 - 410, 1981.
- The World Bank. *World Bank Open Data*. Official exchange rate. [S.l.] The World Bank, 2023. Available at: [https:// data.worldbank.org/indicator/PA.NUS.FCRF](https://data.worldbank.org/indicator/PA.NUS.FCRF). Accessed on: 15 Aug. 2023.
- Verbeek, M. *A guide to modern econometrics*. 2nd ed. Chichester, West Sussex: John Wiley and Sons, 2004. 429 p. ISBN 0-470-85773-0.