

THE IMPACT OF FOREIGN DIRECT INVESTMENT IN SUSTAINABILITY OF THE COUNTRY: An Approach for Brazil

Jonny Mateus Rodrigues (Corresponding author)

*Faculdade de Economia Administração e Contabilidade de Ribeirão Preto,
University of São Paulo, Ribeirão Preto, Brazil*

E-mail: jonnymateus@usp.br

Lara Bartocci Liboni

*Faculdade de Economia Administração e Contabilidade de Ribeirão Preto,
University of São Paulo, Ribeirão Preto, Brazil*

Adriana Cristina Ferreira Caldana

*Faculdade de Economia Administração e Contabilidade de Ribeirão Preto,
University of São Paulo, Ribeirão Preto, Brazil*

ABSTRACT

The purpose of this paper is to contribute to the understanding of the relationship between foreign direct investment (FDI) and the value of adjusted net saving proposed by the World Bank as an indicator of sustainable economy using the methodology of the impulse response function. We analyzed FDI values from 1975 to 2010 to generalize the results. The results show that the relationship between them was negative and that in the long term the shock in the foreign direct investment tends to produce a reduction in the adjusted net saving. This result contributes to the verification of failure of the country in capturing this capital in a sustainable manner.

Keywords: *sustainability, foreign direct investment; vector autoregressive; impulse response function.*

1. INTRODUCTION

While in the 70's Brazil has made trading of raw materials for access to cheaper consumption of capital goods with other countries, the condition today is very distinct and the country is in the group of the five emerging economies (Brazil, Russia, India, China and South Africa – BRICS countries) and has the second largest input of foreign direct investment in the world, second only to China (Czarnecka-Gallas, 2012). In general, the attraction of foreign capital was driven by the release, deregulation and macroeconomic stabilization of the Brazilian market. However, studies are more focused on economic gain and on industrialization provided FDI rather than its production issues (Borini, de Miranda Oliveira, Silveira, & de Oliveira Concer, 2012; Costa & de Queiroz, 2002).

Among the various initiatives of the World Bank, one of them is the measurement of adjusted net saving and with it gross savings generated by the country suffers discounts for damages and emissions of pollutants and generates an indicator of wellbeing. This variable can be used in conjunction with a vector autoregressive model and thus verify the existence of relationship between FDI and the damage caused by it in the invested country. There are currently few studies associating FDI to sustainable development (Narula, 2012; Wang, Gu, Tse, & Yim, 2012). The proposal of this work is to help to clarify some of the complex influences of FDI in the Brazilian economy and initiate, in a simple way, the discussion of the following research problem: Does the increase in Foreign Direct Investment result in an increase in adjusted net saving of Brazil?

This paper is structured as follows: a brief literature review considering Foreign Direct Investment and Sustainable Development in Brazil, presenting theoretical model, presentation of findings, conclusions and references.

2. LITERATURE REVIEW

1.1 Adjusted Net Saving

The indicator of adjusted net saving (ANS), also known as genuine savings, is an indicator of sustainability built upon the concepts of green accounting and it does not evaluate sustainability by the consumption, production or income streams, but the capacity of the country to store wealth (World Bank, 2006). According to Veiga (2010), the theoretical root is in the idea that sustainability requires constant maintenance of extended wealth. This stock aggregates natural resources, physical/productive capital and human capital.

Despite not having a definition or consensual concept regarding sustainable development (Atkinson and Hamilton, 2007), there are studies confirming the validity of sustainable development indicators including ANS. Some contributions are Pillarisetti (2005) that are based in correlation analysis and Ferreira and Vincent (2005) and Ferreira, Hamilton and Vincent (2008) having consumption as a social utility. In the study by Gnègnè (2009) a positive and significant influence is found between the measure of social welfare, HDI and infant mortality, but it is below the desired in econometric relationship. One of the assumptions is the short period of existence of the indicator, and the relation can be more consistent with the theory in a longer period of time. The author claims that ANS can be used as a weak sustainability indicator but demonstrates a huge step in the valuable measure of sustainability.

It cannot be affirmed, for instance, that a particular indicator or method provides useful signals to prospect development unless there is a solid conceptual basis for this claim (Atkinson and Hamilton, 2007). Veiga (2010) states that in ANS the idea of total possibility of substitution among natural resources, physical/productive capital and human capital can be controversial. However the practical instincts of these researchers who sought the pioneering of the construction of indicators claim that unless sustainable development is measurable it probably will not be representative.

Insert Figure 1 here

Unlike traditional accounting, education expenditures are added to net saving, and they are seen as an investment in human capital and not as expenditures. The next step is to discount the estimates of consumption of natural resources, reflecting all the decline of assets associated with the extraction and harvesting. The World Bank cites the difficulty in estimating the damage caused by pollution, mainly due to regional and specific condition of each local. In the calculation of adjusted net savings the damage associated to health are based on urban air pollution and global pollution estimated from the damage caused by the emission of carbon dioxide. (Bolt, Matete, & Clemens, 2002).

1.2 Sustainable Investing

Foreign direct investment is an important factor in the economy of a country. To Narula (2012) FDI acts as a catalyst for emerging economies, generating acceleration in economic growth rates. However, in many cases this growth results in degradation of the environment in which it operates. Pathak, Laplume and Xavier-Oliveira (2012) emphasize that the benefits of FDI depend on the level of economic development that the nation is, as well as the level of interaction between institutions. FDI affects most developing countries with a focus on efficiency than emerging countries with focus on innovation.

With the focus on increasing the Gross Domestic Product (GDP) and attracting investment, countries have become price takers in the short term rather than long-term. This led to the growth of only one dimension of sustainability and hence externalities like environmental degradation and inequality grew in conjunction to the economic aspects (Narula, 2012). The survey by the World Wildlife Fund (WWF) reveals that in a large number of cases, there is a high correlation between FDI and environment, especially in sectors such as mining and others based on natural resources that form an important part of investment flows in developed countries.

To make better use of FDI, policymakers first need to improve institutions, such as infrastructure, legal systems, intermediaries and market development in order to stimulate and absorb the positive impacts of FDI, and at the same time, control and reduce negative impacts (Narula, 2012; Wang et al., 2012).

3. METHOD

A linear model was specified to investigate the interference of foreign direct investment in the country's sustainable development:

$$\begin{aligned} \ln(ANS_t) &= \alpha + \beta_0 t + \beta_1 \ln(ANS_{t-1}) + \beta_2 \ln(GNI_{t-j}) + \beta_3 \ln(FDI_{t-1}) + \beta_4 \ln(EDU_{t-1}) + \beta_5 \Delta \ln(INF_{t-1}) \\ &+ \varepsilon_t \end{aligned} \quad (1)$$

Where ANS is adjusted net saving of the country; GNI is gross national income; FDI is the foreign direct investment; EDU are the expenses with education in the country; INF is the inflation in the period in Brazil in its first difference. The summary of the variables is found in Table 1:

Insert Table 1 here

The objective of this work is to verify the response to the impulse of FDI on sustainable development in Brazil. However, VAR methodology is not able to identify the variance of each structural shocks. Sims (1980) proposed a solution assigning common arbitrary effects among variables and found that a shock affects all endogenous variables of dynamic structure and not only itself (Lutkepohl, 1991). As an alternative to the assignment of common arbitrary effects, Pesaran and Shin (1998) applied specific values for each variable, thus measuring the importance of each random perturbation to the variables of VAR system. In this study, the impulse response function will allow to verify how foreign direct investment spreads on the sustainability of the country, allowing the visualization of the magnitude of this impact.

4. RESULTS

Insert Table 2 here

To check the stability of the time series the Dickey-Fuller unit root test was chosen, analyzing for each equation the existence of an intercept (c) or a trend (t). The results show that all variables are I(0) trend stationary, that is, they do not present unit roots in level, except for the inflation that presents unit root also presenting a trend stationary in its first difference. This verification is needed to estimate VAR model in which the variable not being stationary affects the variance of the estimator (FULLER, 1999).

Insert Table 3 here

After checking the unit roots there is a need for estimating the lag p VAR (p) used. Therefore, the study used the criterion BIC (Schwarz Bayesian Criterion) due to the fact this method is important to have not only stationary variables but also stationary waste (MARGARIDO, 2004).

Insert Table 4 here

Thus, the model set for the autoregressive regression was the VAR (1) and we can now concern about checking if the variables have a long-run equilibrium according to Johansen and Juselius (1990).

Insert Table 5 here

The Johansen cointegration test consists in comparing the trace test with Lmax test. If the trace test is greater than or equal in all orders of integration, the variables can be adjusted in level. If all orders have value of the trace test lower than the amounts of Lmax test, the variables can be adjusted on the first difference. In all other cases there is a need for correction of the model by cointegration vectors and thus instead of using VAR we should have used vector error correction (VEC).

The regression performed (Table 6) found significance in the variables chosen, except inflation that was not significant. The R^2 was high (0.79), and the variables can explain most of the variation in adjusted net savings. The increase in gross national income generates a greater accumulation of wealth in the country, as it was expected.

Insert Table 6 here

FDI was significant ($p < 0.10$) and showed a negative relationship with ANS, as well as studies in developed countries of WWF Brazil also has this characteristic. Investments in education also were significant ($p < 0.05$) and present a negative relationship with ANS, a strong indication that investment in education in the country is used in order to solve problems and not as a lasting investment.

4.1 Granger Causality

The test result confirms that the causal relationship between FDI and ANS does not exist. Thus, the existence of the input of FDI in the country does not necessarily precede changes in ANS and hence the changes of ANS do not precede changes of FDI. In practice, this may be due to the small number of observations involved or because of the knowledge of investors that foreign capital inflows in the country does not change its internal policies as well as these changes aimed at welfare they do not affect the decision making of foreign investors. Some other interesting results are the causality between FDI and Education, indicating that investment causes a demand for training, as well as most capable the country attracts more international investment.

Insert Table 7 here

4.2 Impulse response function

The dynamics structure of VAR can be seen through the impulse response function. It is possible to see the long-term relationship between the variables in a time horizon. The impulse response function represents what happens to a variable in the long term when there is a shock in another variable of the dynamics structure. The following figures show this behavior for variable ANS:

Insert Figure 2 here

By obtaining the response of ANS, the variation of the FDI is negative, suggesting that the country loses net saving or generates more natural resource consumption with the introduction of more external capital. However, over time the net saving gets back to where it was before the shock. For education and gross national income, the same behavior is found, which is consistent with the studies conducted by WWF and in accordance with what the authors Narula (2012) and Wang et al., (2012) report.

5. CONCLUSION

The vector autoregression model can be of great help to verify the sustainable impact of certain variables, especially when using the concept of impulse response function. The major problem is often to achieve a sustainable metric that can be acceptable among the vast majority of those who seek to measure sustainability (Veiga, 2010). By using the adjusted net saving, one of the measures of sustainability of the World Bank, it was found that the behavior of foreign direct investment in the country and its entrance represents mostly a drop in the country's sustainable development. There is the production of wealth, but also the use of resources in higher proportions in the beginning, which will be adjusted over time. According to the adjusted net saving FDI does not help to promote sustainable development. As a suggestion for future studies, surveys can be developed to verify whether national policies have created efficient mechanisms of regulation for the use and consumption of natural resources by foreign investors.

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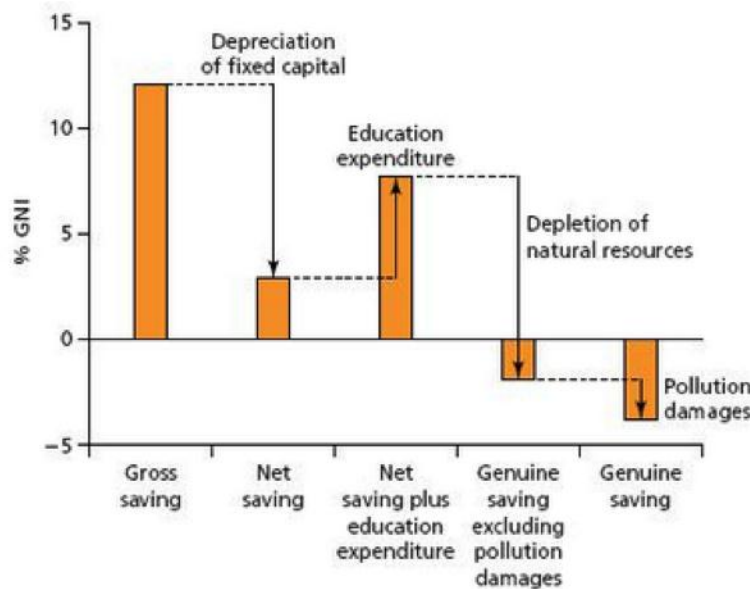


Figure 1 – Adjusted net saving. Source: World Bank (2010).

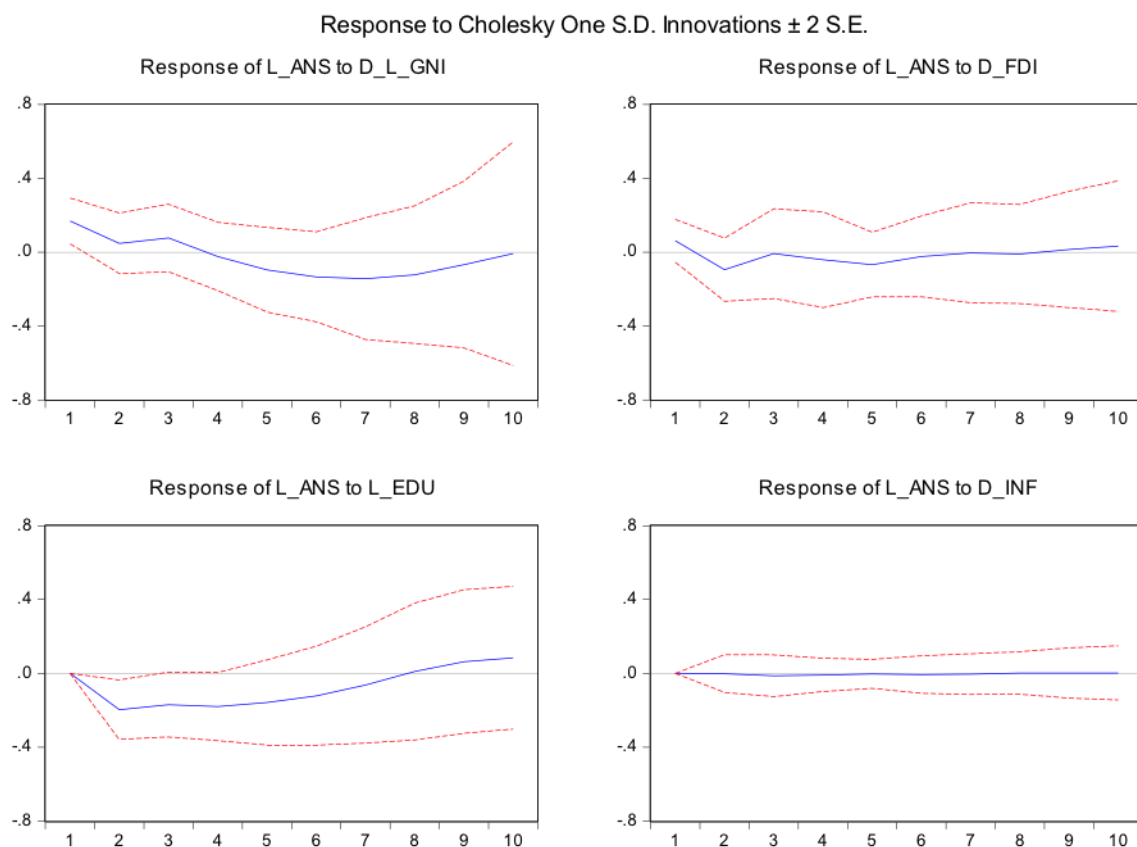


Figure 2 – Response to FDI

Table 1- Variables of linear model

Variable	Symbol	Description
Adjusted net saving	ANS	Measurement of the variation in value of a particular set of goods, excluding capital gains. When it is positive suggests a gain in social welfare, when it is negative indicates that the economy is on an unsustainable path.
Gross national income	GNI	Value added in dollar per capita of all producers in the country plus taxes on products (excluding subsidies). Property and payment of employees working abroad are not included.
Foreign direct investment	FDI	All money invested (US\$) in the country in acquiring a lasting participation (participation of 10% or more).
Expenses with education	EDU	Money invested in education in the country, including wages and maturities and excluding capital investments in buildings and equipment.
Inflation	INF	Inflation (in % of GDP) in the period.

Table 2 – Descriptive statistics of variables used to analyze FDI in Brazil

	Observations	Average	Standard deviation	Sample variance	Interval	Minimum
□□□	36	3347.222	1957.733	3832718	8370	1170
<i>EDU</i>	36	2.6E+10	2.4E+10	5.77E+20	1.01E+11	4.39E+09
<i>ANS</i>	36	4.75E+10	3.17E+10	1.01E+21	1.18E+11	1.02E+10
<i>INF</i>	36	330.8679	672.8238	452691.8	2731.255	4.233373
<i>IDI</i>	36	1.16E+10	1.38E+10	1.91E+20	4.82E+10	3.45E+08

Source: World Bank (2012).

Table 3 – Unit Root Test

	LAG	Statistics	Critical Value			p-value
			10%	5%	1%	
GNI	2	-3.4501	-2.89	-3.19	-3.77	0.0450
ΔGNI	3	-4.4065				0.0021
FDI	5	-1.4224	-2.89	-3.19	-3.77	0.8548
ΔFDI	4	-3.2753				0.0703
EDU	9	-3.4874	-2.89	-3.19	-3.77	0.0407
ΔEDU	5	-3.2221				0.0800
INF	4	-1.9046	-2.89	-3.19	-3.77	0.6520
ΔINF	2	-5.4131				0.0000

Table 4 – Schwarz Bayesian Criterion

Lag	BIC
1	62.903823*
2	63.694759
3	64.341921

Table 5 – Johansen Cointegration Test

Order	Autovalue	trace test	p-value	Lmax Test	p-value
0	0.69164	113.09	[0.0000]	40.001	[0.0057]
1	0.64976	73.093	[0.0000]	35.671	[0.0024]
2	0.54548	37.422	[0.0048]	26.809	[0.0056]
3	0.24019	10.613	[0.2406]	9.3394	[0.2648]
4	0.036765	1.2736	[0.2591]	1.2736	[0.2591]

Table 6 – VAR Regression

	Coefficient	Standard Deviation	t-ratio	p-value
Constant	17.9582	4.71556	3.8083	0.00073***
$\ln(ANS)_{t-1}$	0.800218	0.216085	3.7033	0.00097***
$\Delta \ln(GNI)_{t-1}$	1.72133	0.741756	2.3206	0.02810**
ΔFDI_{t-1}	-1.90E-11	9.70E-12	-1.9562	0.06086*
$\ln(EDU)_{t-1}$	-0.596478	0.264028	-2.2591	0.03216**
ΔINF_{t-1}	6.09E-05	9.19E-05	0.6631	0.51291
Trend	0.0500312	0.0154139	3.2458	0.00312***
Mean dependent var	24.42662		S.D. dependent var	0.632847
Sum squared resid	2.701047		S.E. of regression	0.316289
R-squared	0.795628		Adjusted R-Squared	0.750212
F(6, 27)	17.51868		Prob (F-Statistic)	3.62E-08
rho	-0.238574		Durbin-Watson	2.456488

Table 7 – Granger Causality

Null Hypothesis:	Obs	F-Statistic	Prob.
FDI does not Granger Cause EDU	34	4.14568	0.0261
EDU does not Granger Cause FDI		9.00228	0.0009
GNI does not Granger Cause EDU	34	3.46862	0.0446
EDU does not Granger Cause GNI		8.83954	0.0010
INF does not Granger Cause EDU	34	0.22254	0.8018
EDU does not Granger Cause INF		0.31846	0.7298
ANS does not Granger Cause EDU	34	0.38523	0.6837
EDU does not Granger Cause ANS		0.88921	0.4219
GNI does not Granger Cause FDI	34	9.05809	0.0009
FDI does not Granger Cause GNI		5.34362	0.0106
INF does not Granger Cause FDI	34	0.18693	0.8305
FDI does not Granger Cause INF		0.81163	0.4540
ANS does not Granger Cause FDI	34	1.96615	0.1582
FDI does not Granger Cause ANS		0.77506	0.4700
INF does not Granger Cause GNI	34	0.37252	0.6922
GNI does not Granger Cause INF		0.35291	0.7056
ANS does not Granger Cause GNI	34	1.08647	0.3507
GNI does not Granger Cause ANS		0.98745	0.3847
ANS does not Granger Cause INF	34	5.15812	0.0121
INF does not Granger Cause ANS		0.66962	0.5196

Notes: Sample period 1975-2012. 2 lags.