E C O N O M I C S B U L L E T I N

Foreign direct investment and profit outflows: a causality analysis for the Brazilian economy

Fernando Seabra
Federal University of Santa Catarina

Lisandra Flach
Universität Stuttgart

Abstract

Most empirical works have focused on the effects of foreign direct investment (FDI) to exports and other economic performance indicators, whereas its impacts to profit outflows has been relatively neglected. This paper investigates the nature of the causal relationship between FDI and profit remittance in Brazil using the Granger causality test procedure developed by Toda and Yamamoto (1995). The findings in this paper indicate that FDI causes profit remittance and emphasize significant adverse long−run effects of FDI attraction policies for the Brazilian economy.

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1. Introduction

Foreign direct investment (FDI) has been argued to play a key role in accelerating growth of developing countries. Apart from FDI as a source of private external finance, the most important ways a developing nation may benefit from such investments is through (a) transfer of technology and (b) technological spillover effects. Despite those positive effects of FDI[1], one of the major costs is the potential remittance of a large share of the profits. Indeed, Jansen (1995) has argued that the impact of FDI on the current account is further complicated by the investment income payments that arise from FDI. According to UNCTAD (2002), unregulated FDI flows can bring about serious difficulties to balance of payments owing to high import content and profit outflows related to multinational capital.

The objective of this paper is, therefore, to test for causality between inflows of foreign direct investment and profit outflows for the Brazilian economy. Brazil experienced a significant financial liberalization[2] during the 1990s, becoming one of the main recipients of FDI among emerging markets. In terms of the methodology, we basically follow the Granger causality procedure extended by Toda and Yamamoto (1995), which enables us to examine the long-run effects of foreign direct investment on profit repatriation. The rest of the paper is organized as follows. Section 2 contains a brief description of the methodological procedure and data definitions. Section 3 presents the empirical results. Concluding remarks are given in section 4.

2. Data and methodology

Both series examined in this paper – foreign direct investment and profit repatriation – are denominated in US$. All data sources are the Brazilian Central Bank (http://www.bcb.gov.br). The sample range is 1979Q1 up to 2003Q4, which comprises 96 observations. The variables are expressed in their logarithmic transformation.

A preliminary issue regarding the methodological procedure is related to the fact that the data generating process for most of the economic series exhibits a unit root. Time series properties, namely order of integration and cointegration, have been examined by applying the full information multivariate procedure proposed by Johansen (1988).

The cointegration methodology basically characterizes the existence of a long-run relationship. In order to establish a causal relationship between profit repatriation and foreign direct investment, we have employed a modified version of the Granger causality test, which is robust for the cointegration features of the process. This procedure was suggested by Toda and Yamamoto (1995) with the objective to overcome the problem of invalid asymptotic critical values when causality tests are performed in the presence of nonstationary series. According to these authors, even if the series are nonstationay, a level vector autoregressive (VAR) model can be estimated and a standard Wald test can be applied. The Toda and Yamamoto (1995) procedure essentially suggests the determination of the *d-max*, i.e., the maximal order of integration of the series in the model, and to intentionally over-fit the causality test underlying model with additional *d-max* lags – so that the VAR order is now $p = k + d$, where k is the optimal lag order).

The Toda and Yamamoto (1995) augmented Granger causality test has been obtained in the present study by estimating a two-equation system using the seemingly

[1] For a viewpoint emphasizing those positive effects, see Athukorala and Menon (1995). For a critical perspective of FDI impacts, especially in terms of spillover effects, see Agosin and Mayer (2000).
[2] For an assessment of the impacts of Brazilian repatriation restrictions and the abolishment of such measures, see Ihrig (2000).

unrelated regressions (SUR) technique. It has been shown that Wald tests experience efficiency improvement when SUR models are used in the estimation[3]. Therefore, the model can be specified as follows:

$$lpro_t = \sum_{i=1}^{k+d} \alpha_{1i} lpro_{t-i} + \sum_{i=1}^{k+d} \beta_{1i} lfdi_{t-i} + u_{1t} \quad (1)$$

$$lfdi_t = \sum_{i=1}^{k+d} \alpha_{2i} lfdi_{t-i} + \sum_{i=1}^{k+d} \beta_{2i} lpro_{t-i} + u_{2t} \quad (2)$$

where *lpro* and *lfdi* are, respectively, the logarithm of profit outflows and of foreign direct investment, k is the optimal lag order, d is the maximal order of integration of the series in the system and μ_1 and μ_2 are error terms that are assumed to be white noise. Conventional Wald tests were then applied to the first k coefficient matrices using the standard χ^2-statistics. The main hypothesis set can be drawn as follows: (a) in equation (1), foreign direct investment "Granger-causes" profit outflows if it is not true that $\beta_i = 0 \ \forall \ i \leq k$; (b) analogously, in equation (2), profit outflows "Granger-causes" foreign direct investment if it is not true that $\beta_i = 0 \ \forall \ i \leq k$.

As pointed out by Yamada and Toda (1998), the lag selection procedure is a crucial step for the augmented Granger causality test, especially when theory and statistical results indicate a small number of lags in the VAR component. For the present case a long lag structure is expected due to the time to investment maturity. To choose the optimum lag length (k), the Schwarz selection criterion was implemented. A series of diagnostic tests were also conducted to ensure the standard properties of the test.

3. Estimation results

The results regarding the order of integration of the series, given by the augmented Dickey-Fuller (ADF) unit roots tests, are presented in Table 1. The results indicate that the logarithm of foreign domestic investment and the logarithm of profit outflows are not stationary in their levels. On the other hand, after first differencing the variables, the null hypothesis of no unit root can be rejected at the 5% significance level for both series.

Table 1 - Augmented Dickey Fuller unit root tests

Variable	I(0)	Lags	I(1)	Lags
lfdi	-2.28	1	-7.87	1
	-2.45	2*	-6.97	2*
	-2.21	4	-5.54	4
lpro	-4.11	1	-10.79	1
	-2.96	4	-4.17	4
	-3.26	8*	-5.14	6*

Optimal lag order (denoted by *) in the autoregressive component was found according to the *Schwarz Criterion*. Model includes constant and time trend.

Given that both series were found to be integrated of order one, the cointegration hypothesis between the variables is examined by the Johansen multivariate test (Table 2). Using the maximal eigenvalue test, the null hypothesis of no cointegrating vector ($r = 0$)

[3] See, for instance, Rambaldi and Doran (1996).

can be rejected at 1% significance level, whereas the null hypothesis of at most one cointegrating vector ($r \leq 1$) cannot be rejected, indicating one cointegrating vector. Therefore, the results support the hypothesis of cointegration between profit outflows and foreign direct investment. At the bottom of Table 2, the estimated cointegrating vector shows a positive long-run elasticity (equal to 0.759) for FDI with respect to profit outflows.

Table 2 - Johansen cointegration test (maximal eigenvalue)

Null hypothesis	Likelihood ratio	5 percent critical value	1 percent critical value
$r = 0$	36.88	15.41	20.04
$r \leq 1$	2.36	3.76	6.65
Cointegrating Equation (normalized to *lpro*)			
lpro = 0.897 + 0.759 *lfdi*			

The lag order in the VAR process is 30.

The next step is, then, to estimate a Granger-causality test by using the Toda-Yamamoto procedure. The optimum lag length (k), chosen by the Schwarz criterion, was found to be 30 (i.e., 7.5 years). Before examining the causality test, a series of diagnostic tests were implemented to assure that the underlying assumptions hold. Autocorrelation and autoregressive conditional heteroskedasticity (ARCH) could be ruled out[4], based on the long lag structure. We also conducted the Breusch-Pagan Lagrange Multiplier (LM) test to verify the suitability of the SUR estimation versus the standard VAR estimation. The LM test – which verifies the null hypothesis of a non-diagonal error covariance matrix – gives support to our use of the SUR estimation ($\chi^2_{31} = 48.8$).

The results of the causality Wald test, obtained from the SUR estimation of the level VAR model outlined in equations (1) and (2), are in Table 3. The null hypothesis that profit outflows do not Granger cause foreign domestic investment cannot be rejected at the 5% significance level. On the other hand, the hypothesis that FDI do not Granger cause profit outflows can be rejected at the 1% significance level. Therefore, we find evidence that there is a unidirectional causality from foreign direct investment to profit remittance in the case of the Brazilian economy.

Table 3 - Test for Granger-causality applying Toda and Yamamoto modified Wald test

Null hypothesis	χ^2	p-value
lfdi does not Granger cause *lpro*	90.37	0.000
lpro does not Granger cause *lfdi*	30.39	0.497

The underlying model for the two-equation system is a SUR model; the lag order (k) is 30 (based on the Schwarz Criterion) for the two variables in both equations.

Intuitively, the clear evidence of causality from FDI on profit outflows poses an interesting dilemma regarding FDI attraction. Despite all short-run positive effects of FDI inflows, the causality results indicate long-run adverse effects of foreign direct investment

[4] The results for these diagnostic tests are available on request from the authors.

on profit remittance. Indeed, the sum of the coefficients on lagged FDI in the profit outflows equation (equation 1) was estimated to be 3.13. Besides, there is an absolute predominance of positive coefficients estimated in equation (1) after lag 20 (5 years) – which indicates that it takes time for new capital to be built, to become profitable and, then, to generate profit outflows.

4. Concluding remarks

The main objective of this paper was to test causality between foreign direct investment (FDI) and profit outflows for the Brazilian economy. The literature has basically focused on the relationship between FDI and economic performance (such as GDP growth and exports), while the relationship between FDI and profit remittance has been neglected by empirical studies. To search for the nature of the relationship between FDI and profit outflows, we have implemented the Toda-Yamamoto extended causality test. Our results indicate unidirectional causality from FDI to profit outflows. This result not only ratifies the assumption that previous inflows of FDI are a driving force of current profit outflows, but also shows that the Brazilian economy – according to estimation results - will be facing a remarkable increase in profits remittance considering the vast capital inflows registered during the late 1990s. The lag-order structure estimated in the VAR model indicates that the influence of lagged FDI to profit outflows becomes consistently positive for higher lag orders (greater than 20 quarters).

Therefore, as a policy implication, we should stress the fact that the significant effects that FDI inflows may cause to the deterioration of the balance of payments in the long run (due to profit remittance) should be taken into account when policy makers decide to implement policies to attract foreign investors.

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