FDI & Growth: What Causes What?

By

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Abstract

The paper examines the causal relationship between FDI and economic growth by using an innovative econometric methodology to study the direction of causality between the two variables. We apply our methodology, based on the Toda-Yamamoto test for causality, to time-series data covering the period 1969-2000 for three developing countries, namely Chile, Malaysia and Thailand, all of them major recipients of FDI with a different history of macroeconomic episodes, policy regimes and growth patterns. Our empirical findings clearly suggest that it is GDP that causes FDI in the case of Chile and not *vice versa*, while for both Malaysia and Thailand, there is a strong evidence of a bi-directional causality between the two variables. The robustness of the above findings is confirmed by the use of a bootstrap test employed to test the validity of our results.

Keywords: FDI, economic growth, causality, Toda-Yamamoto test.

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1. Introduction

The relationship between Foreign Direct Investment (FDI) and economic growth has motivated a voluminous empirical literature focusing on both industrial and developing countries. Neoclassical models of growth as well as endogenous growth models provide the basis for most of the empirical work on the FDI-growth relationship. The relationship has been studied through four main channels: (i) by looking at the determinants of growth, (ii) by exploring the determinants of FDI, (iii) by examining the role of multinational firms in host countries and (iv) by studying the direction of causality between the two variables.

Empirical work on the role of FDI in host countries seems to suggest that FDI is an important source of capital, complements domestic private investment, is usually associated with new job opportunities, in most of the cases is related to the enhancement of technology transfer and overall boosts economic growth in host countries.[1]

Regarding developing countries in particular, macro-empirical work on the FDI-growth relationship overall suggests that FDI has a positive impact on economic growth, but this also depends on other crucial factors, such as the human capital base in the host country, the trade regime and the degree of openness in the economy.[2] See Balasubramanyam *et al.* (1996 & 1999) and Borensztein *et al.* (1998) among others and Niar-Reichert and Weinhold (2001) for a critical assessment of the empirical literature; Baliamoune (2002)

[1] It is clearly beyond the scope of the present paper to review the vast literature on the FDI-growth relationship and the determinants of FDI. The interested reader should refer to de Mello (1997 & 1999) for a comprehensive survey of the nexus between FDI and growth as well as for further evidence on the FDI-growth relationship, Mody and Murshid (2002) for a recent assessment of the relationship between domestic investment and FDI, Blomstrom and Kokko (1998) for a critical review of the role of FDI in technology transfer, Asiedu (2002), Chakrabarti (2001) and Tsai (1994) on the determinants of FDI and Asiedu (2003) for an excellent discussion of the relationship between policy reforms and FDI in the case of Africa.

[2] The ratio of FDI to GDP is frequently employed in empirical work to capture the degree of integration (and globalization in certain cases) in world markets. It has also been extensively used as a measure of openness of the economy in the voluminous growth literature.

provides a comprehensive discussion of the above literature and further evidence on Africa within the context of panel data analysis. Another strand of literature is related to micro studies at the firm level to examine the impact of FDI on growth in developing countries - see Aitken and Harrison (1999) and Harrison (1994) regarding recent assessments.

FDI is now becoming quite crucial for many developing countries in view of the increasing need for additional foreign capital to achieve the MDGs by the year 2015. This is becoming a hot issue particularly in the case of sub-Saharan Africa with a very small share of FDI inflows relatively to other developing regions (Asiedu, 2003). It is also notable that FDI has potentially desirable features that affect the quality of growth with significant implications for poverty reduction. It may reduce adverse shocks to the poor stemming from financial instability and helps improve corporate governance. Furthermore, FDI generates revenues that may support the development of a safety net for the poor (Klein *et al.*, 2001). A vast literature on the determinants of FDI in developing countries clearly suggests the centrality of infrastructure, skills, macroeconomic stability and sound institutions for attracting FDI flows. The importance of ICT has also been documented in recent empirical work (Addison and Heshmati, 2003).[3]

FDI to developing countries, after a decline of about 4 percent in the early 1980s, increased substantially (by about 17 percent on annual basis) in the second half of the 1980s to reach $70 billion in 1993 (Nair-Reichert and Weinhold, 2001) and almost $180 billion in 1999 (GDF, 2003). Estimates from the recently released Global Development Finance report (GDF, 2003) clearly suggest that though FDI has slipped from a 1999 peak of $179 billion to $143 billion in 2002, it remains a dominant source of external financing for developing countries.

[3] See Addison and Mavrotas (2003) for a recent critical assessment of the relationship between FDI and infrastructure with particular reference to Africa.

FDI is concentrated in a small group of countries most of them in East Asia and Latin America who receive more than 70 percent of the total FDI directed to developing countries, with China alone receiving almost one fifth of the total (GDF, 2002 & 2003). Africa's share of FDI to developing countries has been declining over time, from about 19 percent in the 1970s to 9 percent in the 1980s and to almost 3 percent in the 1990s. This has been recently attributed to relatively mediocre reforms (in institutions, infrastructure and FDI regulatory framework) undertaken in many African countries in recent years as compared to reforms implemented in other developing countries (Asiedu, 2003).

In this paper our focus is on the causal relationship between FDI and economic growth. The paper seeks to contribute significantly to the above literature by using an innovative econometric methodology to study the direction of causality between the two variables which, (to the best of our knowledge) goes clearly beyond the existing literature on the subject. More precisely, existing empirical work on the direction of causality between FDI and growth uses standard Granger-causality-type tests to detect the direction of causality in the above important relationship. Our paper adopts a different methodological approach, namely the Toda-Yamamoto test for causality (Toda & Yamamoto, 1995), which allows us to derive much more robust conclusions regarding the above relationship.

We use data covering the period 1969-2000 for three developing countries, namely Chile, Malaysia and Thailand, all of them major recipients of FDI for many years (top 10 recipients of FDI) but at the same time with a different history of macroeconomic episodes, policy regimes and growth patterns, thus making them an interesting group for a comparative analysis.[4]

[4] It has not been possible to include a representative country from the African region due to lack of enough observations for time-series analysis.

The trends regarding the share of FDI in GDP for the above countries are shown in **Figure 1**. Chile has been widely recognized for its success in attracting FDI. Between 1969 and 2000, materialized foreign investment exceeded US$60 billion. Of this amount, about three-fourths entered the country after 1990. During the 1990s, FDI measured about 6 percent of GDP in Chile, rising to about 8 percent between 1997 and 2000. Both Malaysia and Thailand performed extremely well among developing countries in attracting foreign investment. All three countries showed a significant increase in FDI flow as well as its variability in the 1990s. During the early sample period, the FDI/GDP ratio was higher in Malaysia and Thailand relative to Chile. Since 1997, however, FDI inflow in Chile has surpassed the other two countries. This can be attributed to the increasing uncertainty among foreign investors following the Asian currency crisis which affected both Malaysia and Thailand.

INSERT **FIGURE 1** ABOUT HERE

The rest of the paper is organised as follows: section 2 discusses in detail the Toda-Yamamoto approach to test for causality as well as data issues related to our empirical work; empirical findings based on the above methodology are presented in section 3; finally, section 4 concludes the paper.

2. Methodology and Data Issues

The use of Granger causality tests to trace the direction of causality between two economic variables is not uncommon in empirical work. Testing the direction of causality has generally been performed using either the Granger or Sims tests (see Granger, 1969 and Sims, 1972). However, as econometric research has shown, such tests focus on time-precedence, rather than causality in the usual sense. Therefore, they are particularly weak for establishing the relation between forward-looking variables - taken literally, they can lead us to conclude that Christmas cards "cause" Christmas. Having said this, Granger

tests can still yield some valuable information in terms of time patterns, and can be particularly interesting in a cross-country comparative framework.

These tests are based on null hypotheses formulated as zero restrictions on the coefficients of the lags of a subset of the variables. However, such tests are grounded in asymptotic theory; yet, it must be borne in mind that asymptotic theory is only valid for stationary variables, thus if a series is known to be non-stationary, I(1), then such inferences can only be made if the VAR is estimated in first differences, and therefore stationary. This causes problems because the unit root tests to test the null hypothesis of stationarity have low power against the alternative hypothesis of trend stationarity. Similarly, the tests for cointegrating rank in Johansen's tests are sensitive to the values of trend and constant terms in finite samples and thus not very reliable for typical time-series sample sizes. In other words, it is possible that incorrect inferences could be made about the issue of causality simply due to the sensitivity of stationarity or cointegration tests.

In this paper we use the Toda and Yamamoto's (1995) methodology for testing for causality in the FDI-Growth relationship. Toda and Yamamoto avoid the problems outlined above by ignoring any possible non-stationarity or cointegration between series when testing for causality, and fitting a standard VAR in the *levels* of the variables (rather than first differences, as is the case with the Granger and Sims causality tests), thereby minimising the risks associated with possibly wrongly identifying the orders of integration of the series, or the presence of cointegration, and minimises the distortion of the tests' sizes as a result of pretesting (Giles, 1997; Mavrotas & Kelly, 2001).

We use the Augmented Dickey Fuller (ADF) test (Dickey and Fuller, 1981) to test for unit roots. In order to model the variable in a manner that captures the inherent characteristics of its time-series, we use the Akaike information criterion (AIC) to determine the lag structure of the series. Blough (1992) discusses the trade-off between the size and power of unit root tests, namely that they must have either a high probability of falsely rejecting the null of non-stationarity when the DGP is a nearly stationary

process, or low power against a stationary alternative. This is because in finite samples it has been found that some unit root processes display behaviour closer to stationary white noise than to a non-stationary random walk, while some trend-stationary processes behave more like random walks (Harris, 1995). Thus, as pointed out by Blough (1992), unit root tests with high power against any stationary alternative will have a high probability of a false rejection of the unit root when applied to near stationary processes. These problems, occurring when there is near equivalence of non-stationary and stationary processes in finite samples, is partly due to using critical values based on the DF asymptotic distribution. Bearing in mind all these potential problems in testing for unit roots, we also employed the KPSS test described in Kwiatkowski *et al.* (1992) in order to confirm the validity of the ADF test results.

Data from three countries – Chile, Malaysia and Thailand - are used in estimation. The significance of including them is evident from the share of FDI flows in these countries and the record of their moderate to strong growth performance over the sample period. The sample period runs from 1969 to 2000. The data on FDI are taken from the *Global Development Finance* and the *World Development Indicators* published by the World Bank, while data on GDP are taken from the *International Financial Statistics* published by the International Monetary Fund.

3. Estimation Results

The empirical results are reported in four steps. First, we test for the order of integration for both GDP and FDI in the three countries. In the second step, we find out the optimum lag structure using the Akaike's final prediction error (FPE) criterion. Third, we conduct diagnostic tests to find out the presence of any misspecification in the results. Finally, we conduct a bootstrap simulation to investigate the performance of the Toda-Yamamoto test.

To set the stage for the Toda-Yamamoto test, the order of integration of the variables is initially determined using the Augmented Dickey-Fuller (ADF) test with four lagged

differences. The results are given in **Table 1**. The variables are given in column 1. GDP and FDI are the logarithm of gross domestic product and foreign direct investment, respectively. The unit root tests are performed sequentially. The results of the ADF tests for one and two unit roots are given in columns 2 and 3 respectively. The results show that the GDP and the FDI series in each of the three countries are I(1) series. The null hypothesis of a unit root is not rejected. However, similar tests for the presence of two unit roots reject the hypothesis at least at the 5 percent significance level. To check for the robustness of the ADF test results, the KPSS test described in Kwiatkowski *et al*. (1992) is also reported. Here the null hypothesis of stationarity around a level and around a deterministic linear trend is tested. The results, shown in the last two columns in **Table 1**, indicate that the null hypothesis of both level stationarity and trend stationarity can be rejected for all variables. Given the results of the ADF and the KPSS tests, it is concluded that all variables included in this study are integrated of order one.

Next, we specify the model for each country by determining the optimal lag length of the levels of own and other variables in the model. Akaike's minimum final prediction error criterion is used to select the optimum lag. The results are presented in **Table 2**. In Chile, the optimal lag length of FDI in the GDP equation is zero suggesting that FDI does not influence GDP. On the other hand, the optimal lag length of GDP in the FDI equation is 2. This indicates the presence of a unidirectional causality running from economic growth to foreign direct investment. The results in Malaysia and Thailand are quite similar. In both countries, GDP has a non-zero optimal lag in the FDI equation; while FDI also has a non-zero lag in the GDP equation. This suggests the presence of a feedback between these two variables.

The next step involves the test to see if the data supports the model assumptions. Following Giles (1997) and Mavrotas and Kelly (2001), a battery of misspecification tests are performed. In particular, the Ramsey RESET (RR, Ramsey 1969) test is used to see if the coefficients of higher order terms added to the regression are zero. The Lagrange multiplier test (LM1-LM3,) is also used to test whether the error terms are serially uncorrelated. Finally, the Jarque-Bera (JB, Bera & Jarque 1981) test is performed. The results are reported

in **Table 3**. In general, the tests show that the model specification used in estimation is appropriate without any of the assumptions of the econometric model being rejected.

The Toda-Yamamoto test involves the addition of one extra lag of each of the variables to each equation and the use of a standard *Wald* test to see if the coefficients of the lagged 'other' variables (excluding the additional one) are jointly zero in the equation. The results of the *Wald* test are given in column one in **Table 3**. In case of Chile, the assumption of non-causality from GDP to FDI is rejected at least at the 5 percent level; however, we cannot reject the non-causality assumption from FDI to GDP. Hence GDP causes FDI in Chile. In case of both Malaysia and Thailand, there is a strong evidence of a bi-directional causality between GDP and FDI.

It is notable that, given the small sample size employed in this paper, the Toda-Yamamoto test may suffer from size distortion and low power (Giles, 1997; Mavrotas and Kelly, 2001). In view of this, we check for the robustness of the causality test results by recalculating the p-values obtained in the initial *Wald* test using a bootstrap test with 1000 replications. The idea behind a bootstrap test is to use the estimation residuals to artificially generate additional observations, which have the same distribution as the original observations, via a Monte-Carlo type process. Using the additional observations, a more robust estimation can be undertaken (see Greene 1997, for more details). The results are given in **Table 4** below. Given the nature of the test, both the *Wald* test statistics and the *p* values would be different from those obtained and reported in **Table 3**. The p-values in **Table 4** show the probability that the independent variable in regression is equal to zero. The results confirm the findings reported in **Table 3** i.e. GDP causes FDI in Chile while there is a feedback between these two variables in both Malaysia and Thailand. This confirms the robustness of the tests performed in this paper.

4. Concluding Remarks

The present paper has employed an innovative methodology to test the direction of causality between FDI and growth for three major FDI recipients in the developing world, namely

Chile, Malaysia and Thailand with different macroeconomic episodes, policy regimes and growth patterns over the period 1969-2000. Our empirical findings based on the Toda-Yamamoto causality test seem to suggest that it is GDP that causes FDI in Chile and not *vice versa*. In the case of both Malaysia and Thailand, there is a strong evidence of a bi-directional causality between GDP and FDI.

The above findings have important policy implications. Understanding the direction of causality between the two variables is crucial for formulating policies to encourage private investors in developing countries, particularly in the aftermath of the Asian financial crisis of 1997/98 and the recent Argentinean crisis. In view of our findings, the conventional view which seems to suggest that the direction of causality runs from FDI to economic growth is not confirmed in the case of Chile, while in the case of both Malaysia and Thailand the causality is bi-directional. Consequently, this casts some doubts on the validity of policy guidelines which emphasize the importance of FDI for growth and stability in developing countries under the assumption that "FDI causes growth". Increased attention needs also to be given to the overall role of growth (and the quality of growth) as a crucial determinant of FDI along with the quality of human capital, infrastructure, institutions, governance, legal framework, ICT and tax systems among others in host countries.

At the same time, our results clearly suggest the need for more individual country studies on the above relationship since causality between the two variables is also country-specific. This is in line with recent empirical work in this area which by testing causality within a panel of 24 developing countries over a period of 25 years suggests that the causal relationship between FDI and growth is characterized by a considerable degree of heterogeneity (Nair-Reichert and Weinhold, 2001). Adopting the above improved time-series methodology to detect causality for a large group (data permitting) of developing countries may provide us with more robust conclusions regarding policy guidelines in this significant research area. This remains an important challenge for future research.

FIGURE 1: Foreign Direct Investment in Chile, Malaysia & Thailand (% of GDP)

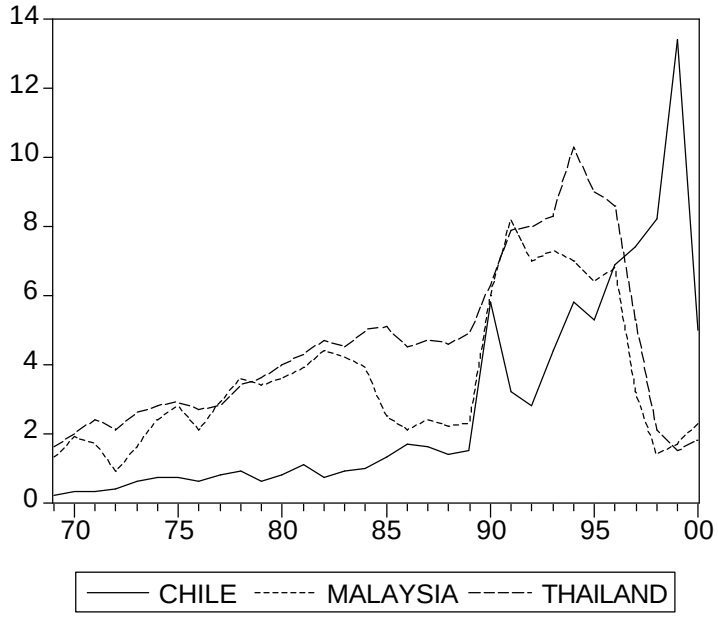

Table 1: Stationarity Test Results[a]

		Augmented Dickey Fuller Test		Kwiatkowski Test[b] H_0: I(0)	
Country	Variable	H_0: I(1)	H_0: I(2	level	trend
Chile	GDP	-0.81	-6.13*	0.324	0.224
	FDI	-1.66	-7.18*	0.510	0.317
Malaysia	GDP	-1.27	-4.28*	0.316	0.156
	FDI	-0.91	-8.52*	0.181	0.082
Thailand	GDP	-2.33	-7.12*	0.447	0.316
	FDI	-1.80	-11.44*	0.245	0.065

Notes:

a/ GDP and FDI are the logarithm of gross domestic product and foreign direct investment, respectively.

b/ Following Kwiatkowski *et al* (1992), the null hypothesis of stationarity around a level and around a deterministic linear trend is tested.
The 5 percent critical value for the Augmented Dickey Fuller statistic is -3.45 [Fuller (1976)].
The 5 percent critical value for stationarity around a level and around a deterministic linear trend are 0.463 and 0.146, respectively.

Table 2: Optimum lag structure using Akaike's FPE Criterion

	Own Lags				
	0	1	2	3	4
Chile					
Dependent Variable					
GDP	0.0677	0.0674	0.0663	0.0711	0.0705
FDI	0.0083	0.0081	0.0079	0.0076	0.0084
Other Variable Lags					
GDP (FDI)	0.0817	0.0856	0.0910	0.0872	0.0838
FDI (GDP)	0.0083	0.0080	0.0074	0.0089	0.0095
Malaysia					
Dependent Variable					
GDP	0.0241	0.0236	0.0229	0.0256	0.0298
FDI (GDP)	0.0566	0.0542	0.0610	0.0607	0.0594
Other Variable Lags					
GDP (FDI)	0.0242	0.0228	0.0230	0.0293	0.0277
FDI (GDP)	0.0585	0.0569	0.0532	0.0577	0.0564
Thailand					
Dependent Variable					
GDP	0.0044	0.0037	0.0048	0.0051	0.0046
FDI	0.1366	0.1320	0.1319	0.1377	0.1368
Other Variable Lags					
GDP (FDI)	0.0039	0.0036	0.0040	0.0043	0.0041
FDI (GDP)	0.1377	0.1310	0.1420	0.1364	0.1390

Table 3: Toda-Yamamoto Test Results & Misspecificaiton Diagnostics

Equation	Wald	JB	LM1	LM2	LM3	RR
Chile						
GDP	0.714	0.673	0.866	1.041	1.289	0.009
	(0.530)	(0.874)	(0.773)	(0.649)	(0.552)	
FDI	11.383	0.833	0.677	0.719	0.736	0.034
	(0.013)	(0.820)	(0.244)	(0.230)	(0.197)	
Malaysia						
GDP	19.041	1.049	2.044	2.709	2.933	0.163
	(0.003)	(0.340)	(0.378)	(0.314)	(0.362)	
FDI	16.383	0.875	1.985	2.066	2.843	0.199
	(0.011)	(0.477)	(0.442)	0.343)	(0.267)	
Thailand						
GDP	9.838	0.704	3.020	3.085	3.128	0.075
	(0.008)	(0.552)	(0.744)	(0.689)	(0.640)	
FDI	11.120	0.533	1.642	1.744	2.104	0.144
	(0.007)	(0.694)	(0.381)	(0.363)	(0.224)	

Note: The figures in parentheses are the p-values.

Table 4: Bootstrap Test Results

	Wald Statistics
Chile	
GDP causes FDI	0.0941 (0.011)
FDI causes GDP	0.0654 (0.373)
Malaysia	
GDP causes FDI	0.0811 (0.015)
FDI causes GDP	0.0373 (0.009)
Thailand	
GDP causes FDI	0.2236 (0.007)
FDI causes GDP	0.0134 (0.003)

Note: The figures in parentheses are the p-values.

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