

Article

Does FDI Really Matter to Economic Growth in India?

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Abstract: The main contribution of this article is to examine the productivity spillover effects from India's inward foreign direct investment (FDI), controlling for trade, in the framework of the cointegrated vector autoregression (CVAR). For this purpose, using the Solow residual approach the aggregate total factor productivity (TFP) in India is estimated to measure FDI-induced spillovers. The results show that the inflow of FDI to India indeed improves TFP growth through positive spillover effects. We also find that trade appears to have a detrimental effect on TFP growth in India.

Keywords: cointegrated VAR; FDI; India; total factor productivity

JEL Classification: C22; F14

1. Introduction

Since the implementation of economic liberalization policies in the early 1990s, India has recorded one of the most rapid growth economies in the world. Between 1992 and 2010, for example, India has grown on average by approximately seven percent annually. During the same period, the influx of foreign direct investment (FDI) to India has increased rapidly. Between 2001 and 2010, for example, the average annual inflows of FDI into India have reached \$18.5 billion, more than six times the amount for the 1995–2000 period, thereby becoming one of the fastest growing FDI recipients (in terms of annual FDI inflows) among developing countries during the 2001–2010 period. Accordingly, an interesting research question would be certain to arise regarding India's economy: what is the effect of the influx of FDI on economic growth in India?

The relationship between the inflow of FDI and economic growth in developing countries has been studied extensively. Examples include, but are not limited to, [Tsai \(1991\)](#); [Wang and Swain \(1997\)](#); [Liu et al. \(1997\)](#); [Borensztein Eduardo and Lee \(1998\)](#); [Zhang \(2001\)](#); [Sun and Parikh \(2001\)](#); [Bende-Nabende et al. \(2001\)](#); [Liu et al. \(2002\)](#); [Shan \(2002\)](#); [Hansen and Rand \(2005\)](#); [Yao \(2006\)](#); and [Chang \(2007\)](#). They generally report a beneficial effect of FDI on economic growth. However, despite increasing flows of FDI especially in recent years, the FDI-growth nexus in India has not yet been intensively investigated. To the best of our knowledge, only a handful of studies to date—such as [Pradhan \(2002\)](#); [Chakraborty and Basu \(2002\)](#); [Sahoo and Mathiyazhagan \(2003\)](#); [Agrawal \(2005\)](#); [Chakraborty and Nunnenkamp \(2008\)](#); [Agrawal and Khan \(2011\)](#); and [Dash and Parida \(2013\)](#)—have attempted to tackle the issue and have provided mixed conclusions. For example, [Pradhan \(2002\)](#) employs a production function analysis to analyze the effect of inward FDI on economic growth in India; he finds that FDI does not have significant positive growth impacts. [Agrawal \(2005\)](#) confirms the findings of [Pradhan \(2002\)](#) in that FDI has had little to do with economic growth in India. On the other hand, [Chakraborty and Nunnenkamp \(2008\)](#) use a panel cointegration method to explore the dynamic relationship between FDI and economic growth; they find that the influx of

FDI contributes to economic growth for the Indian economy. Dash and Parida (2013) utilize a vector error-correction (VEC) model in examining the issue; they report in passing a beneficial effect of FDI on growth, after controlling for trade. Notably, these studies have concentrated mostly on whether the inflows of FDI to India have had any significant effects on the level and/or growth rate of gross domestic product (GDP) (as a proxy for economic growth). Considering the pivotal role that technology spillovers via FDI play in enhancing productivity and hence overall growth in developing countries (Aghion and Howitt 1998; Grossman and Helpman 2002; Alfaro 2003; Yao 2006), it may be more appropriate to use a growth variable that is able to capture the FDI-induced spillover impacts when estimating the FDI-growth nexus in India. This can have a substantive impact on estimated results, but has been largely ignored by early studies on the topic. For example, Grossman and Helpman (1992) and Aghion and Howitt (1998) emphasize that the major benefits of FDI for the host country's economic growth would be as a vehicle for the transmission of ideas, technological knowledge, organizational knowledge, and business knowledge.

The main contribution of this article is thus to re-examine the FDI-growth nexus in India by emphasizing productivity spillover effects from FDI. Given that total factor productivity (TFP) growth obtained by the Solow residual approach is widely used to measure FDI spillovers and the growth effect of FDI is considered to be a long-run phenomenon, empirical focus in this article is on assessing the long-run effects of FDI on TFP of India, controlling for trade, in the cointegrated vector autoregression (CVAR) framework.¹ It should be noted that our article is part of a larger literature; since the seminal work by Findlay (1978), many scholars have sought to isolate the independent effect of FDI on TFP (e.g., Gorg and Greenway 2004; Alfaro et al. 2009; Woo 2009; Baltabaev 2014; Ashraf Ayesha and Nunnenkamp 2016; Kannen et al. 2017). For example, Alfaro et al. (2009) study the FDI-TFP nexus by focusing on the complementarities between FDI and financial markets and report in passing a beneficial effect of FDI on TFP only if the host country has well-developed financial institutions; however, the existing literature has not yet examined the FDI-TFP nexus in India. The remaining sections present empirical framework, empirical methodology, data, estimation results, and conclusions.

2. The Model

2.1. The Link between Total Factor Productivity and FDI

In examining the spillover effects of FDI on total factor productivity (TFP), researchers generally rely on a theoretical framework developed by Coe and Helpman (1995) and Park and Lee (2003). In this model, the TFP of the individual economy is obtained using the aggregate production function as follows:

$$Y = f(A, L, K) \quad (1)$$

where Y is gross domestic product (GDP); L is labor input; and K is capital input. The variable A represents the level (index) of TFP in output, not accounting for an increase in factor inputs such as K and L . In this article, the TFP of India is estimated using the following translog production function approach with time series data method:

$$\ln Y = \alpha_0 + \alpha_L \ln L + \alpha_K \ln K + (1/2)\alpha_{LL}(\ln L)^2 + (1/2)\alpha_{KK}(\ln K)^2 + \alpha_{LK} \ln L \ln K + u_t \quad (2)$$

¹ However, it should be admitted at the onset that the difference between analyzing the FDI-GDP nexus or FDI-TFP nexus is more technical than conceptual; that is, the spillover effects are implicit in the former and explicit in the latter. When estimating the effect of FDI on GDP, for example, the effects of the inputs such as labor and capital on outputs could change in response to FDI. On the other hand, concentrating on TFP in a two-step procedure adopted here may give rise to different results by removing those input effects and then looking at the effect of FDI on TFP, holding the contribution from inputs being fixed. For completeness, therefore, we also analyze the FDI-GDP nexus in India using the same data set. The results show that FDI plays little role in boosting economic growth. Interested readers can contact the authors for more details of the analysis. The authors thank a referee for raising the issue discussed here.

The translog function is a generalization of the Cobb-Douglas function and enables us to capture decreasing or increasing marginal input effects via a second-order approximation, as well as to identify the substitution or complementary effects of inputs via an interaction term. The TFP is measured as the residual obtained from the estimated Equation (2).

Since the effect of FDI on TFP also depends on the trade policy regime, following other studies (e.g., De Mello 1997; Zhang 2001; Urata 2001), in the empirical model adopted here we extend the standard model of the TFP-FDI nexus to include exports (*EX*) as a proxy for India's trade regime as follows:

$$TFP = f(FDI, EX) \quad (3)$$

The expected sign of FDI is ambiguous and uncertain. For example, if India's FDI inflows lead to an increase in TFP through transfer of advanced technology and managerial skills to domestic firms, it could be hypothesized that FDI has a positive relation with TFP ($\partial TFP/\partial FDI > 0$). However, if an increase in inward FDI leads to substantial reverse flows of profits/dividends, transfer of inappropriate technology, and/or elimination of domestic firms through intense competition (i.e., multinational corporations' monopoly over state-of-the-art technology), thereby resulting in a decrease in TFP, FDI is expected to have a negative relation with TFP ($\partial TFP/\partial FDI < 0$). To the extent that TFP increases with more exports, it could be hypothesized that exports are expected to have a positive effect on TFP ($\partial TFP/\partial EX > 0$).

2.2. The Cointegrated Vector Autoregression (CVAR) Approach

The CVAR approach is employed to examine the long-run effects of FDI and exports on TFP in Equation (3). The CVAR is a very convenient method for determining the long-run dynamic effects when the selected variables in Equation (3) are nonstationary and cointegrated as seen in the empirical results section. The cointegration approach used in this article is the maximum likelihood estimation method developed by Johansen (1988). To impose the identified cointegration constraint, the CVAR is generally reformulated into a vector error-error correction model (VECM) as follows:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta y_{t-i} + u_t \quad (4)$$

where y_t is a (3×1) vector of endogenous variables—in this article $y_t = [TFP_t, FDI_t, T_t]$; Π is the matrix of long-run coefficients; Γ_i is the matrix of short-run coefficients; and u_t is the white noise. The number of cointegrating relations among the components of the vector y_t is represented by the rank of Π . If Π has rank $r < k$, then there exist $k \times r$ matrices, α and β , each with rank r such that $\Pi = \alpha\beta'$. Here, r is also called the cointegrating ranks, β is the cointegrating vector and the components of α are the adjustment parameters. In the Johansen methodology, the number of cointegration vectors, the rank of Π , in the model is determined by the likelihood ratio test (Johansen 1988).

3. Data

The gross domestic product (measured at 2000 constant prices), labor (measured in million persons) and capital (measured in billion U.S. dollars) taken from the Reserve Bank of India (RBI) are used to estimate the total factor productivity (TFP) as specified in Equation (2). The values of FDI for India are measured as the inward FDI flows (measured in million U.S. dollars) and are taken from the Secretariat for Industrial Assistance (SIA) Newsletter (various issues), published periodically by the Department of Industrial Policy and Promotion, Ministry of Commerce and Industry, Government of India. Since exporting firms and firms engaged in FDI are generally more productive than their purely domestic counterparts, FDI and exports are known to be highly correlated in developing countries like India (De Mello 1997); hence, the values of exports are used as a proxy for representing India's trade regime and are obtained from the RBI. India's inward FDI, exports and capital are deflated using the GDP deflator (2000=100) taken from the RBI. The data set contains annual observations for the period

1978 to 2010. All variables are in natural logarithms. Simple plots of our variables used in Equation (3) are portrayed in Figure 1.

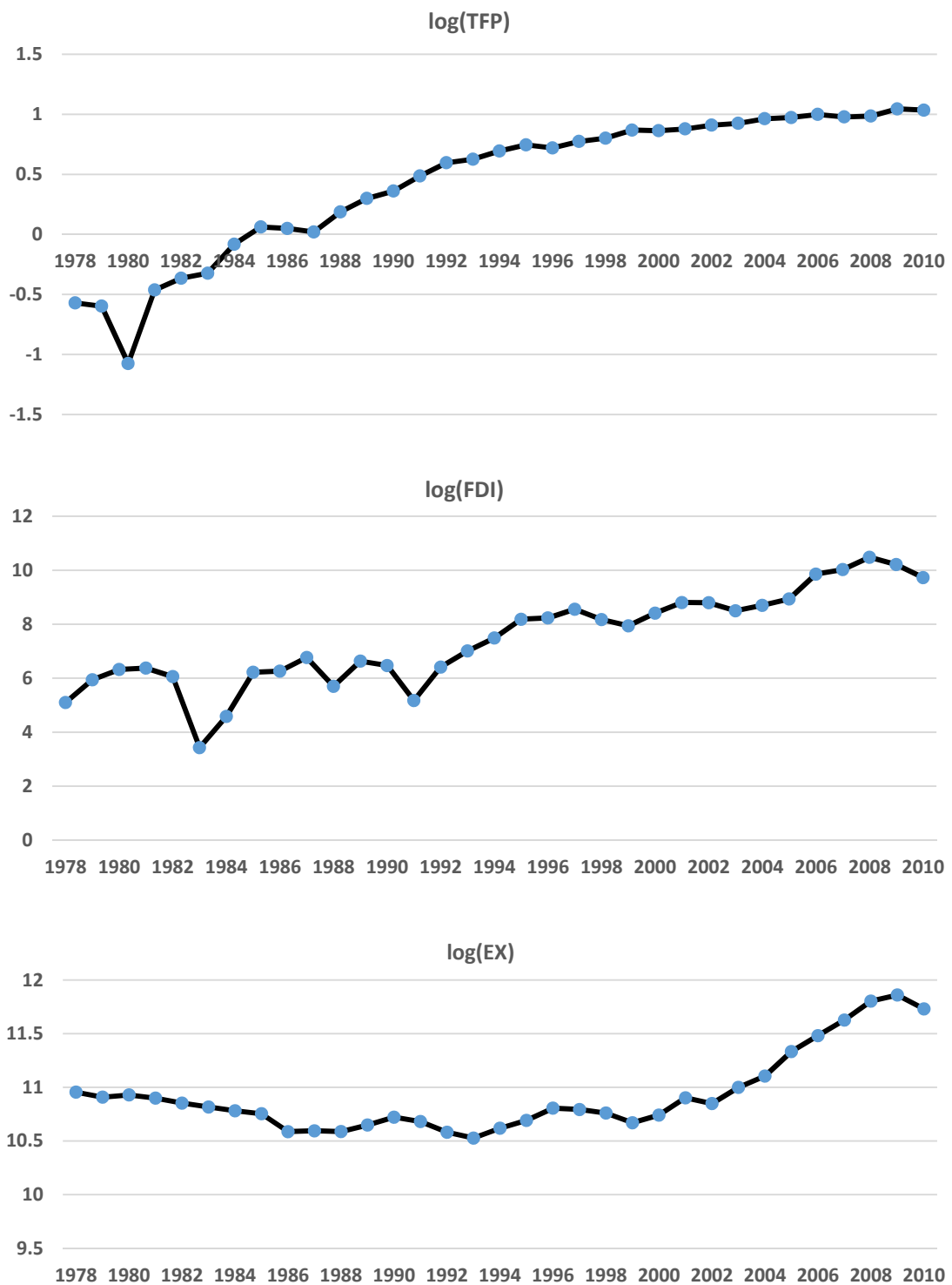


Figure 1. Plots of total factor productivity, foreign direct investment (FDI) and trade in India over 1978–2010.

4. Empirical Results

4.1. Measuring the Total Factor Productivity

Table 1 reports the estimation results of the translog production function in Equation (2) using ordinary least squares (OLS).² The estimated effects of labor and capital on output are both positive, suggesting that an increase in labor and capital results in improved output in India. Statistically, it is highly significant for labor and moderately so for capital. Of greater interest is the relationship with the squared terms of labor and capital. The estimated coefficients of both the squared terms are positive and highly significant, indicating that both inputs show increasing returns to scale and adding a unit of inputs continues to increase output in India. Another interest is the coefficient on the interaction term. The OLS estimate is positive and highly significant, providing evidence that labor and capital are complementary in India. Finally, the derived TFP growth in India shows a constant upward trend over the sample period (Figure 1).

Table 1. Estimated coefficients of India's translog production function.

Variable	ln (Gross Domestic Product)	
	Coefficient	t-Statistic
ln (Labor)	5.382	2.206 **
ln (Capital)	1.094	1.111
[ln (Labor)] ²	1.306	3.576 **
[ln (Capital)] ²	0.249	2.213 **
ln (Labor) * ln (Capital)	0.506	2.634 **
Constant	18.663	2.467 **

Note: ** and * denote significance at the 1% and 5% levels, respectively.

4.2. The CVAR Approach: Does FDI Matter to the Total Factor Productivity?

The first step in the CVAR approach is to identify if the selected variables in Equation (3) are nonstationary. The existence of a unit root is determined using an augmented Dickey-Fuller (ADF) test. The Schwarz Information Criterion (SIC) is used to determine the appropriate lag-length truncation in each variable that includes either a constant or a constant and a linear time trend. The results show that with and without a time trend, the null hypothesis of a unit root cannot be rejected for all level series at least at the 5% significance level (Table 2). For the first differences, on the other hand, the unit root hypothesis can be rejected for all the series in both models because the test statistics are below the 5% critical value. From these findings, it is concluded that all the three variables are nonstationary and integrated of order one, or $I(1)$; hence, cointegration analysis can be pursued on them.

The second step in the CVAR is to determine the number of cointegrating vectors among the three variables using the Johansen cointegration method. The null hypothesis that there are at most r cointegrating vectors is tested using the trace test and maximum eigenvalue test. Doornik and Hendry (1994) show that the trace test provides a consistent test procedure, but the maximum eigenvalue test does not. Hence, Table 3 contains the results from using the Johansen test on the basis of the trace statistics. The results show that the trace tests can reject the hypothesis of no cointegrating vector ($r = 0$), but cannot reject the null of one cointegrating vector ($r = 1$) at the 5% significance level, indicating that there is one cointegrating relationship in the system. In other words, it suggests that there is a stable, long-run equilibrium relationship among the three variables. The system specification tests based on F -tests show that an intercept and a linear trend are necessary.

² It should be noted that the presence of unit roots in the variables in Equation (2) is tested using the augmented Dickey-Fuller (ADF) test. The results show that all the variables appear to be stationary and integrated of order one; hence, OLS can be safely used to estimate Equation (2) without worrying about spurious regression problem.

Table 2. Results of Unit Root Test.

Variable	Level	First Difference	Decision
<i>ADF test with no trend</i>			
Total Factor Productivity	−1.765 (0)	−3.676 * (0)	I(1)
FDI	−1.076 (0)	−5.686 ** (0)	I(1)
Exports	0.978 (0)	−8.992 ** (0)	I(1)
<i>ADF test with trend</i>			
Total Factor Productivity	−1.257 (0)	−5.868 ** (0)	I(1)
FDI	−3.251 (0)	−5.838 ** (0)	I(1)
Exports	−2.234 (0)	−5.458 ** (0)	I(1)

Note: ** and * indicate rejection of the null hypothesis at the 1% and 5% levels, respectively. The 1% and 5% critical values for the augmented Dickey-Fuller (ADF), including a constant (a constant and trend), are −3.70 and −2.97 (−3.59 and −4.34), respectively. Numbers inside parentheses are lag lengths, which are selected by the Schwarz Information Criterion (SIC).

Table 3. Results of Johansen Cointegration Rank Tests.

Null Hypothesis	Eigenvalue	Trace Statistics	5% Critical Value
$H_0: r = 0$	0.731	53.822 *	35.193
$H_0: r \leq 1$	0.239	14.430	20.262
$H_0: r \leq 2$	0.187	6.208	9.165

Note: * denotes rejection of the null hypothesis at the 5% significance level.

With one cointegrating vector being identified, the test for the long-run exclusion is conducted to examine whether any of the three variables can be excluded from a cointegrating vector. The null hypothesis is formulated by restricting the matrix of long-run coefficients to zero ($\beta_i = 0$) (Johansen and Juselius 1990). The results show that the null hypothesis can be rejected for all variables at least at the 5% level, indicating that the three variables are statistically relevant to the cointegrating space and cannot be excluded from the long-run relationship (Table 4). Then, a parameter in speed-of-adjustment is restricted to zero ($\alpha_i = 0$) to test long-run weak exogeneity (Johansen and Juselius 1990). The results show that the null hypothesis of weak exogeneity cannot be rejected for FDI and exports, suggesting that the two variables are the driving variables in the system and significantly influence the long-run movements of the TFP in India, but are not influenced by the TFP. In other words, the FDI and exports are the determining factors and the India's TFP is the adjusting variable of the long-run relationships in the model.

Table 4. Exclusion and Weak Exogeneity Tests.

Variable	Exclusion $H_0: \beta_i = 0$ (LR Test Statistic)	Weak Exogeneity $H_0: \alpha_i = 0$ (LR Test Statistic)
Total Factor Productivity	7.777 [0.000] **	27.461 [0.000] **
FDI	31.096 [0.000] **	1.396 [0.238]
Exports	4.815 [0.028] *	0.001 [0.977]

Note: ** and * indicate rejection of the null hypothesis at the 1% and 5% levels, respectively. β_i and α_i represent a matrix of long-run coefficients and the speed of adjustment to equilibrium, respectively. Long-run (LR) test statistic is based on the χ^2 distribution and parentheses are p -values.

Finally, the long-run equilibrium relationship among the three variables using the relevant long-run coefficients (β_1) and normalizing the coefficient of TFP is obtained as follows:

$$TFP_t = 0.364FDI_t - 0.426EX_t \quad (5)$$

(7.237) (4.113)

where the t -statistics are in parentheses. Equation (5) shows that the coefficients of both variables are statistically significant at the 5% level.³ More specifically, the total factor productivity (TFP) has a positive long-run relationship with FDI. This suggests that India's inward FDI leads to an increase in TFP growth through positive spillover effects of stimulating technological improvements and transferring advanced managerial skills to domestic firms. One of plausible explanations for this finding is that, since the inflow of FDI to India is mainly concentrated on such sectors as finance, telecommunications and computer software where the technological gap between local and foreign-owned firms is not very large, FDI is more likely to be a significant catalyst to TFP growth and overall growth in India. To our knowledge, this is a finding that has not been documented yet in the literature. In addition, the TFP has a negative long-run relationship with exports, indicating that an increase in India's exports reduces TFP and GDP growth. This result puts us at odds with other scholars, who find a strong, positive effect of exports on TFP in developing countries. One possible explanation for this finding is that, since the major export products of India is still dominated by the primary industries—such as unrefined (15% of total exports), gems and jewelry (13%), agricultural products (10%), cotton (10%), and cotton-based ready-made garment and accessories (6%), export growth may have a detrimental effect on raising TFP growth, which is mainly driven by technological progress.

5. Concluding Remarks

Despite the recent rise in inward FDI in India, empirical studies on the FDI spillover impacts are relatively scarce and have provided mixed results. The main contribution of this article is thus to examine the productivity spillover effects from India's inward FDI, controlling for trade, using the cointegrated vector autoregression (CVAR). For this purpose, the aggregate total factor productivity (TFP) for the Indian economy is estimated to measure FDI spillovers. We have found that the inflow of FDI to India indeed has a beneficial effect on TFP growth through positive spillover effects. We also find that exports appear to have a detrimental effect on TFP growth.

A clear implication from this finding is that, since FDI is found to be an engine of economic growth in India, adopting a more active and open policy to attract FDI inflows in selected sectors (i.e., finance, telecommunication and computer software) would be likely to facilitate technology transfer and economic growth. Another important implication is that, given that growth generally goes hand in hand with FDI-induced productivity growth and exports in host countries, government policy directed at undertaking industry transfer to advance industrial structure (e.g., high-tech industries) in India can have positive effects on both FDI and exports, thereby boosting TFP growth.

Finally, it should be admitted that, although we conjecture that more disaggregated data such as sector and industry data would produce more robust results, this article is not able to explore industrial/sectoral heterogeneity. This issue should be addressed in future research.

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³ It is worth mentioning that interpreting the coefficients in Equation (5) as long-run elasticities may ignore the dynamics of the system (Lütkepohl 2005). For example, a 1% increase in FDI may not cause a long-run change of India's TFP by 0.364%, since a change in FDI is likely to have an impact on exports as well that may interact in the long-run.

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