

Relationship of Labor Productivity, Foreign Direct Investment and Economic Growth: Evidence from OECD Countries

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Abstract The aim of this study is to have an insight into the causality relationships between economic growth and two of its key determinants, foreign direct investment and labor productivity. Error correction mechanism, through the implementation of generalized method of moments (GMM), is used to study the causalities between the three variables. This study encompasses data from nineteen (19) OECD member countries over a period of 1980-2009. Short-term causalities have been observed running from foreign direct investment to economic growth, labor productivity to economic growth and foreign direct investment to labor productivity. In the long-run, bi-directional causalities exist between economic growth and labor productivity, foreign direct investment and labor productivity. Also, foreign direct investment is observed to cause economic growth in the long-run.

Keywords: *economic growth, foreign direct investment, labor productivity, labor economics, generalized method of moments (GMM) estimator, panel causality analysis*

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1. Introduction

Economic growth has always been a key concern for economic policymakers. Researchers have also realized the importance of the topic and have extensively studied economic growth, along with its determinants [1-9]. Literature contains numerous studies, cross-sectional as well as panel, estimating causalities between economic growth and its key determinants.

Foreign direct investment and its role in the development of an economy are undeniable. For example, economic growth and ongoing investment levels impact the technological changes taking place in an economy [10]. However, it is argued that foreign direct investment not only impacts economic growth directly, but also through its interaction with human capital [11]. Developing economies are generally low on capital and need substantial inflow of funds from foreign investors to avoid the potential problems of low growth and squat savings [12]. Generally, growing-countries and the governments look forward to foreign direct investments; as these warrant new technological advancements, improved skills, more capital into the system and expertise. Foreign investment not only satisfies the capital needs of the economy but also brings in technological advancements which motivate the productivity of the labor force in the long run. Another positive impact of foreign capital inflow is in the shape of competition that

crop ups in the domestic firms in order to cope up with the foreign firms. These characteristics of foreign investment differentiate and signify its contribution in the economic development, compared to other forms of investment like foreign aid and portfolio investment.

A productive labor force possesses obligatory as well as additional dexterity and has the ability to improve the overall the economic growth of a nation. However, foreign direct investment fits in the relationship between labor productivity and economic growth in the sense that labor productivity is enhanced by the inflow of capital from foreign investors. Hence, labor productivity and foreign direct investment have significant roles to play in the development of the economy.

The above discussed notion that labor productivity, foreign direct investment and economic growth are correlated; structures the motivation of this study. We believe that foreign direct investment boosts up the economic growth but through its positive interaction with labor productivity i.e., increased foreign investment triggers up productivity and in turn, economic growth augments and vice versa. Analyzing the data from a panel of nineteen OECD member countries over a period of thirty years, this paper looks into the short and long-run causality relationships between labor productivity, foreign direct investment and economic growth.

2. Literature Review

Technological development has been a key construct in enhancing the growth capabilities of a country [13,14]. Most of the technological transmissions enter a country through MNCs which invest in a country and transfer their technological skills and advancements into the host country. So, foreign direct investment evolves as a key source of technological diffusion [15]; which in the long-run, boosts up the country's economic growth [16,17].

Labor productivity refers to the amount of goods and services produced (specifically, the amount of real GDP produced) by one hour of labor. Foreign direct investment in a country contributes to the enhancement of the labor productivity [18,19]. Human capital and international trade is expected to improve technology adoption and innovation [20] which leads us to the statement that labor productivity improves through foreign direct investments in the country.

It has been widely postulated that the foreign firms, while investing in the host economy, transfer knowledge and technology into the country. There is a contagion effect due to which technology and novel management practices of the foreign firms are introduced into investing country; which in turn, boosts up the technical development of the host economy [15].

Researchers have argued that foreign investment is handy as compared to domestic investment. For a panel of 12 Latin American economies, it has been shown that foreign direct investment is three (3) times more resourceful than its domestic counterpart [21]. Domestic firms may have the advantage of information symmetry and cultural knowledge of the industry but the technological innovations and managerial expertise that foreign capital introduces into the economy has major advantages for the host country.

Sector-wise foreign direct investment in Chile during the eighties and nineties was analyzed and it was found that foreign investment was comparatively higher than the local investment; although the major chunk of the foreign investment was harbored in the agriculture and mining sector [22]. The problem with investment in these sectors is based on the fact that the technology used in these sectors is more or less standardized across the nations, with less chances of innovation; also the productivity in these sectors is relatively on the lower side. This substantially bars the major influences of FDI, i.e., technological advancement and increase in labor productivity. On the empirical front, the analysis reported a positive impact of foreign direct investment on labor productivity growth. Although the results suggested that the influence of FDI on labor productivity was significant during the period of 1960-2000 but it gained substantial strength during the 1996-2000¹.

The most fundamental advantage of foreign direct investment over foreign aid and portfolio investment etc. is the ability to transfer production-related knowledge and managerial expertise/skills to the host country [23]. But a

line of researchers have argued that it is not the FDI in isolation; others factors, like human capital, also act as mediators in this relationship [24].

Foreign direct investment is bound to impact the labor productivity of the host economy. The impact of foreign direct investment on the labor productivity for several countries was studied and the results validate the fact that foreign direct investment yields to the technological transfer and managerial competence of the local firms and hence their labor productivity is boosted [25]. The local firms strive hard to compete with the foreign firms in terms of productivity, labor wages and skilled workers; failing to do so gives rise to wage and skill differences in the country. So, FDI has positives (technology transfer, managerial expertise, job creation, regional development and labor productivity) along with the negatives (wage inequality and skill differences) for the host country.

The positive impact of foreign direct investment on the labor productivity of host industries is achieved through the establishment of technology, management skills and techniques, capital and spillover effects on the local firms [26]. The overall effect of FDI on 41 sub-sectors of the Chinese electronic industry was examined and it was suggested, through empirical examination, that the presence of foreign firms in the industry enhances labor productivity. Similar results of positive impact of FDI on labor productivity have been reported in other studies [27-31]. For a Canadian sample, it has been shown that the labor productivity of local firms was positively correlated to the FDI [32]. The benefits of foreign direct investment are dependent on the technological aptitude of the local firms such that in order to receive more benefits from FDI, the domestic firms must possess greater technological abilities [31].

However, it is not only the story of one-sided positive impact of foreign direct investment on labor productivity. Foreign direct investment leads to labor productivity of the domestic firms in some cases [33,34,35,36], whereas, it can have a negative impact in other cases [17]. For a sample of seventeen (17) non-OECD and fifteen (15) OECD countries, it was shown that the impact of FDI on productivity growth was negative [17]. He argued that the reason for this negative relation may be the inability of the host countries to adapt to the technological advancements dived by the foreign firms or the rationale may be that the host countries are already developed enough to assume these technological advancements. Foreign direct investment can have negative impact on the local firms' productivity in the sense that the introduction of foreign firms would force the local firms to draw back some of their production due to the higher demand for the foreign products [37]. This can have negative impact on the net productivity of the domestic firms. The notion that foreign firms had no influence on the labor productivity of local Mexican firms has also been investigated and shown to be valid [38].

Table 1. Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Minimum	Maximum
Economic Growth (<i>EG</i>)	570	22.2644	1.7925	18.0084	29.5062
Foreign Direct Investment (<i>FDI</i>)	570	2.6167	6.0156	-15.0483	92.4989
Labor Productivity (<i>LP</i>)	570	4.3788	0.2062	3.6163	4.6977

Foreign direct investment in an economy is considered as a vital ingredient in boosting up the economic development of the host country. This impact may be due to various spillover effects of the foreign investment and many factors may mediate the relationship between FDI and economic growth. The impact of foreign direct investment (FDI) on the economic growth of sixty nine (69) developing countries was studied and the empirical analyses suggested that FDI had an influence on the technology transmission and FDI contributed to growth more than the domestic investment [16]. However, they pointed out that the contribution of the FDI to economic growth was dependent upon the fact that the host economy has a sufficient room for absorption of advanced technologies.

Numerous researches [39,40,41] have been carried out for China to validate the fact that, along with many other factors, inward foreign direct investment has been a fundamental factor in the sustainability of Chinese economic growth. China, being one of the strongly growing economies, attracts huge foreign capital and therefore signifies the relative importance of FDI for the host economy.

The techniques of co-integration and error correction mechanism have been used for Indian sample to study the relationship between foreign direct investment and economic growth [42]. It was found that economic growth (EG) had impact on inward FDI (EG→FDI) for India. Bi-directional causality has been estimated between FDI and growth (EG↔FDI), but it was insisted by the researcher that the effects were more evident from growth to FDI [43].

3. Data and Methodology

3.1. Data

The study utilizes panel data consisting of 19 OECD member countries for the period 1980 – 2009. In (Real GDP) was used to represent economic growth (EG); foreign direct investment (FDI) and labor productivity (LP) were the other variables used in the study. GDP and FDI data was obtained from World Bank World Development Indicators (WDI) online database. Labor productivity data was taken from the OECD statistics database. Summary statistics for the variables are given in Table 1.

3.2. Panel Unit Root Test

Panel data unit root tests [44,45,46] are employed to check the stationarity properties of the three variables. The specification for the LLC unit root test [44] is given as:

$$\Delta y_{it} = \alpha_i + \gamma_i y_{it-1} + \sum_{k=1}^{p_i} p_i \Delta y_{it-k} + \varepsilon_{it} \quad (1)$$

Where, Δ represents first difference operator; y_{it} represents the dependent variable representing observation for country i at time t ; ε_{it} represents the error term which is independently distributed normal for all i, t . The null hypothesis for the test is $\gamma_x = \gamma = 0$ for all i ; against the alternative of $\gamma_x = \gamma < 0$ for all i .

IPS unit root test [45] relaxes the assumption of common autoregressive parameter and allows for the heterogeneity of the value of γ .

3.3. Panel Co-integration Test

If all the three series economic growth (EG), foreign direct investment (FDI) and labor productivity (LP) are stationary at $I(1)$, panel co-integration tests are applied in order to check the long-run relationship between the three variables. Pedroni co-integration test [47] is used in this regard. It is specified as follow:

$$EG_{it} = \alpha_i + \delta_t + \beta_i FDI_{it} + \gamma_i LP_{it} + \eta_{it} \quad (2)$$

$$FDI_{it} = \alpha_i + \delta_t + \beta_i EG_{it} + \gamma_i LP_{it} + \mu_{it} \quad (3)$$

$$LP_{it} = \alpha_i + \delta_t + \beta_i EG_{it} + \gamma_i FDI_{it} + \nu_{it} \quad (4)$$

Where, EG_{it} , FDI_{it} and LP_{it} represent Economic Growth, Foreign Direct Investment and Labor productivity respectively. i and t represent the countries in the panel and the time respectively. α_i indicates the country specific effects and δ_t represents the deterministic time trends. η_{it} , μ_{it} and ν_{it} represent the estimated residuals from equations (2), (3) and (4) respectively.

3.4. Panel Causality Tests

Short and long-run causalities are then investigated for the variables under study. Long-run causality is checked by implementing a two-step process. Residuals are first estimated from equations (2), (3) and (4). In the next step, the residuals are used in the error correction model as below:

$$\Delta EG_{i,t} = \alpha_{1i} + \sum_{k=1}^h \delta_{11i,k} \Delta EG_{i,t-k} + \sum_{k=1}^h \delta_{12i,k} \Delta FDI_{i,t-k} \quad (5)$$

$$+ \sum_{k=1}^h \delta_{13i,k} \Delta LP_{i,t-k} + \gamma_{1i} \eta_{i,t-1} + \theta_{1i,t}$$

$$\Delta FDI_{i,t} = \alpha_{2i} + \sum_{k=1}^h \delta_{21i,k} \Delta EG_{i,t-k} + \sum_{k=1}^h \delta_{22i,k} \Delta FDI_{i,t-k} \quad (6)$$

$$+ \sum_{k=1}^h \delta_{23i,k} \Delta LP_{i,t-k} + \gamma_{2i} \mu_{i,t-1} + \theta_{2i,t}$$

$$\Delta LP_{i,t} = \alpha_{3i} + \sum_{k=1}^h \delta_{31i,k} \Delta EG_{i,t-k} + \sum_{k=1}^h \delta_{32i,k} \Delta FDI_{i,t-k} \quad (7)$$

$$+ \sum_{k=1}^h \delta_{33i,k} \Delta LP_{i,t-k} + \gamma_{3i} \nu_{i,t-1} + \theta_{3i,t}$$

Where, Δ represents the difference operator. $EG_{i,t}$, $FDI_{i,t}$ and $LP_{i,t}$ represent Economic Growth, Foreign Direct Investment and Labor Productivity respectively, for country i at time t . θ represents the error term which is serially uncorrelated and having zero mean. γ_i measures the adjustment speed and h represents the lag length.

The significance of the coefficients of error correction terms, in equations (5), (6) and (7), is used to test the long-run causality. Generalized method of moments (GMM) estimator [48] is used for the three equations (5), (6) and (7). The hypotheses used to check short-term causalities are as follow:

$(H_0 : \delta_{12i,k} = 0 \text{ and } H_0 : \delta_{13i,k} = 0 \text{ for } \forall i,k)$ for equation (5);
 $(H_0 : \delta_{21i,k} = 0 \text{ and } H_0 : \delta_{23i,k} = 0 \text{ for } \forall i,k)$ for equation (6);
 $(H_0 : \delta_{31i,k} = 0 \text{ and } H_0 : \delta_{32i,k} = 0 \text{ for } \forall i,k)$ for equation (7).

Significance of the adjustment speed is, then, checked by noting if the coefficient of the respective error correction term (γ) is zero. This is done in order to test long-run causalities between the variables.

To determine strong causalities, joint tests are applied on the equations (5), (6) and (7) for checking the coefficients of explanatory and error correction terms, as follow:

FDI and LP each with η for equation (5)
 EG and LP each with μ for equation (6)
 EG and FDI each with v for equation (7)

4. Empirical Results and Discussion

4.1. Panel Unit Root Test

Results of the panel unit root tests are reported in Table 2. The statistics show that the three series (economic growth, foreign direct investment and labor productivity) are integrated of order $I(1)$.

Table 2. Panel Unit Root Test Results

Variables	Trend	Levin, Lin and Chu	Im, Pesaran and Shin	Fisher-ADF	Fisher-PP
<i>EG</i>	Individual Effects	-1.9695	-3.1754	-3.0595	-7.8949
	Individual Effects and Linear Trends	-2.4491***	-3.1745	-2.9057	-5.9240
<i>FDI</i>	Individual Effects	-6.3505***	-4.6915	-4.3860	-6.6517
	Individual Effects and Linear Trends	-8.4184***	-7.9951	-7.1841	-7.9376
<i>LP</i>	Individual Effects	-6.4725***	-0.3284	-0.3336	-0.5024
	Individual Effects and Linear Trends	4.6094	5.4710	5.3902	8.0566
ΔEG	Individual Effects	-4.9772***	-6.4298***	-6.4533***	-6.1629***
	Individual Effects and Linear Trends	-4.6168***	-6.9159***	-6.8583***	-6.5156***
ΔFDI	Individual Effects	-18.2860***	-20.0519***	-15.9733***	-18.9972***
	Individual Effects and Linear Trends	-11.5985***	-14.6767***	-11.9741***	-37.5946***
ΔLP	Individual Effects	-9.0488***	-9.2356***	-5.9105***	-8.9673***
	Individual Effects and Linear Trends	-9.3220***	-8.9739***	-5.6800***	-8.0892***

*** indicates significance at 1% level.

Table 3. Panel Co-integration Test Results

Variables	Trend	Panel v	Panel Rho	Panel PP	Panel ADF	Group Rho	Group PP	Group ADF
<i>EG</i>	No Deterministic Trend	0.57	-0.22	-3.01***	-2.50**	1.29	-3.08***	-2.68**
	Deterministic Intercept and Trend	-0.003	0.3350	-3.30***	-3.03***	2.08**	-2.26**	-1.51
<i>FDI</i>	No Deterministic Trend	-0.77	-4.10***	-8.30***	-9.04***	-1.80*	-11.3***	-9.24***
	Deterministic Intercept and Trend	-3.52***	-1.69*	-9.42***	-11.06***	0.37	-11.8***	-12.09***
<i>LP</i>	No Deterministic Trend	-3.05***	2.18**	1.71*	2.89***	3.22***	1.99*	3.12***
	Deterministic Intercept and Trend	20.41***	3.04***	3.52***	2.81***	3.74***	4.01***	2.96***

***, **, *indicates significance at 1%, 5% and 10% levels; respectively.

4.2. Panel Co-integration Test

Pedroni panel co-integration test [47] was applied on the basis of the unit root tests which indicated that all the three variables were stationary at $I(1)$. Table 3 mentions the co-integration statistics.

At 10% significance level, the null hypothesis of no co-integration between the three series is rejected. Hence the

three series *EG*, *FDI* and *LP* exhibit a long-run relationship for the panel of this study.

4.3. Panel Causality Test

Results of the generalized method of moments (GMM) estimation for the equations (5), (6) and (7) are presented in Table 4.

Table 4. Panel Causality Test Results

Dependent Variable	Sources of Causation (Independent Variables)						
	Short Run			Long Run		Strong Causality	
	ΔEG	ΔFDI	ΔLP	<i>ECT</i>	$\Delta EG, ECT$	$\Delta FDI, ECT$	$\Delta LP, ECT$
ΔEG	-	4.1670**	8.6140***	0.0010	-	3.4699**	5.7516***
ΔFDI	1.6923	-	2.0980	1.5823	1.1574	-	2.3218*
ΔLP	1.2523	14.5345***	-	6.1617**	4.1164***	10.4234***	-

**, *represent significance at 5% and 10% level. *ECT* represents the coefficient of the error correction terms η , μ and v . Wald *F*-statistics are reported.

Our analysis indicates that foreign direct investment and labor productivity cause economic growth in the short

and long-run. This supports the hypothesis that higher levels of foreign investment and increased labor

productivity enhance the economic growth of the host economy. Our results for the causality between foreign direct investment and economic growth were consistent with the findings of researchers [39,40,41] who found that, for Chinese economy, foreign direct investment has contributed towards the sustainability of economic growth. Only labor productivity was observed to affect the foreign direct investment in a country in the long-run, as more investors would make decisions to invest in the host economy with the knowledge that the labor is high on productivity.

Foreign direct investment caused labor productivity in both the short and the long-run. This confirms the notion that foreign direct investment in the country causes technological advancement and managerial skills enhancement [23], which have direct influence on the productivity of the labor force. This result validates the empirics of the prior studies [18,19,26-31] which presented the results that foreign direct investment enhances the labor productivity of the economy. Economic growth also caused labor productivity in the long run; indicating the fact that, in an economically stable economy, labor force will have high productivity levels as compared to the economies having low growth rates.

The significance of the *ECT* coefficient for labor productivity equation indicates that the economic growth, foreign direct investment and labor productivity interact in order to establish the long-run stability; in the case when labor productivity diverges from the equilibrium position.

5. Conclusion

The rationale of this research was to study the causality relationships between economic growth, foreign direct investment and labor productivity for a panel of 19 OECD member countries over a period of 1980-2009. Causalities were estimated, both in the short and long run, using error correction mechanism.

Through the empirical results of this study, we establish that short-run causalities exist between foreign direct investment and economic growth (FDI→EG), labor productivity and economic growth (LP→EG), foreign direct investment and labor productivity (FDI→LP). Bi-directional causalities, in the long run, were observed between economic growth and labor productivity (EG↔LP), foreign direct investment and labor productivity (FDI↔LP). Also, long-run causality was observed between foreign direct investment and economic growth. This led us to the conclusion that foreign direct investment impacts economic growth through its interaction with labor productivity (FDI↔LP↔EG).

This study has a number of policy implications. In order to enhance the economic growth of a country, policies must be made to induce foreign direct investment in the economy. Foreign direct investment is observed to improve the labor productivity of the host country; which causes a positive impact on the economic growth of the country, both in the short and the long-run. Other means of enhancing the labor productivity must be adopted, as it has a strong bi-directional relationship with both foreign direct investment and economic growth. The relation FDI→LP→EG indicates major inclination of policy shifts, validating the fact that increased foreign direct investment

in an economy enhances the labor productivity; which in turn, boosts up the economic growth of the country. In order to maintain long-run sustainable labor productivity, foreign direct investment and economic growth must be enhanced and should play their due roles to enforce high levels of labor productivity.

End Notes

1. After 1995, policies were made to shift the foreign investment towards manufacturing and other sectors where technological spillover chances are greater.

2. Australia, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Turkey, United Kingdom, United States.

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