IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Impact of FDI on innovation in the Indian subcontinent

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Abstract

The expansion of innovation capabilities more specifically indigenous innovation, is a prerequisite for late industrializers, or so-called developing countries, for instance those of the Indian subcontinent, to achieve economic dominance in today's globalized world. The existing economic literature almost universally agrees that innovation has a positive impact on a country's economic growth and development. The impact of FDI inflows on the impact of innovation in developing countries and how the influx of foreign capital in various forms impacts the innovation capabilities in such countries are, however, quite hotly debated in the economic literature and the literature is largely murky on this subject. There is a wealth of research that shows how FDI helps some developing countries innovate, while a similar quantum of research demonstrates how FDI inflows actually hinder the ability of some other developing countries to innovate. Additionally, research has shown that FDI inflows for some developing nations have little to no effect on their capacity for innovation in either direction. Therefore, it is important to specify the precise effects of FDI inflows on innovation for the particular countries. This paper claims to make such an attempt, namely to determine for the Indian subcontinent, the impact of FDI inflows on innovation using empirical data that has been collected over the previous three decades. For FDI inflows into the various countries of Indian subcontinent, data provided by World Bank has been utilised. Patents and trademarks have been used as proxies for Innovation, and the data for patents and trademarks has been obtained from the World Bank Database. Simple statistical tools have been used to gauge the impact of FDI inflows on innovation in Indian subcontinent over the years and appropriate conclusions regarding policy has been drawn from the same.

Keywords: FDI, INNOVATION, PATENTS, TRADEMARKS, DEVELOPING COUNTRIES.

INTRODUCTION

Some authors believe that the entire economic history from the late 18th century to the present is the result of relatively permanent changes brought about in the global economic structure by the enormous technological changes wrought about by the Industrial Revolution, which accelerated the pace of economic development first in western Europe and then the rest of the world. Technology advancements and subsequent innovations—both quantitative and qualitative—are considered to be the main forces behind not only economic changes but also the relationships that different nations develop with or against one another. (1988, Hobsbawm). Additionally, according to Kuznets (1967), the technological divide between developing and developed nations is the main cause of the economic gap between them. According to Erdal and Gocer (2015), R&D and innovations, rather than factor endowments and natural resources, primarily determine global market competitiveness. The late entrants in the race of industrialization and growth had to try to adopt better technologies and innovate accordingly if they wanted to keep up with the developed nations. The development theories identify capital and technical change as the main drivers of an economic system, while economic growth also reaches a constant value in steady state equilibrium in the absence of technical change (e.g. Solow, 1966 and Romer, 1987). Innovation inevitably leads to development, according to economic literature (e.g., Aghion and Howitt, 1992; Romer, 1990). Growth is modeled in growth models by Romer (1990), Grossman and Helpman (1991), and others as a function of the generation of new ideas, also known as innovation. These theoretical claims about how innovation fosters growth, development, productivity gains, etc. have strong empirical support (e.g., Geroski, 1989; Fagerberg et al., 2007). Both theoretical and empirical research has shown the significance of innovation in a country's economic growth and development. We will examine the expansion of innovation capabilities in the Indian subcontinent over the past 20 years with this perspective of innovation as a critical component of development in mind. This would aid us in gaining an objective understanding of India's progress toward becoming an economic superpower by 2047 and the challenges it still faces in order to speed up this process.

In the era of globalization, Foreign Direct Investment (FDI) flows have a significant impact on both the global economy and developing economies. The economic literature has focused on examining the influence of FDI inflows on the innovation capabilities of developing countries, as capital flows have become increasingly important. However, the literature on the impact of FDI inflows is not straightforward and can be seen as ambiguous. Three main research perspectives have emerged regarding the effects of FDI inflows on developing and host countries.

The first perspective argues that FDI inflows positively affect the innovation capabilities of developing/host countries. It suggests that the influx of capital not only provides the necessary funding for advanced innovations but also fosters competition in the domestic market, creating an environment conducive to innovation.

In contrast, the second perspective suggests that FDI inflows hinder the innovation capabilities of developing/host countries. It posits that foreign capital influx suppresses domestic firms through increased foreign competition, ultimately diminishing their ability to innovate. This perspective claims that foreign capital leads to the establishment of foreign monopolies, which stifle competition and, consequently, innovation.

The third perspective maintains that the impact of FDI inflows on innovation capabilities cannot be predetermined and may be neutral. According to this view, a country's economic conditions primarily determine its innovation capabilities, with FDI inflows having an effect but not necessarily a decisive one.

Therefore, it is essential to analyse the specific context of different countries to determine the concrete impact of FDI inflows on innovation, a crucial driver of growth and development. This paper aims to explore this relationship in the Indian subcontinent in the past three decades.

REVIEW OF LITERATURE

Grossman and Helpman (1991) presented a theoretical model in their paper that demonstrates how economic growth is influenced by Research and Development (R&D) and why it is crucial for the government to prioritize attaining an optimal level of research spending.

Bertschek (1995) conducted an analysis on the impact of Foreign Direct Investment (FDI) on domestic innovation. Using a random effects probit model and data from 1,270 firms in the German manufacturing industry, the study concluded that FDI has a positive effect on the host country's innovation capabilities.

In contrast to Bertschek's view, Dunning (1996) argued in his paper that the relationship between FDI and innovation is determined endogenously and not by a universal connection between the two.

Osorio and Pose (2004) analyzed the impact of R&D expenditure on innovation and economic growth in peripheral regions of Europe. Their study employed a two-fold process, first examining the influence of R&D expenditure on innovation (measured by patent applications per million) and then investigating the impact of innovation on economic growth. The results revealed that the extent of the impact of R&D expenditure on innovation, as well as the impact of innovation on economic growth, depended on the absorptive capacity of the nation.

Fagerberg et al. (2010) attempted to challenge the erroneous view in economic literature that innovation is more important for developed countries and high-tech firms than for developing countries. The paper concluded that although there are qualitative differences in innovation between developing and developed countries, innovation plays a vital role in the development of developing countries as well. The study emphasized the need for theoretical and practical research on innovation, recognizing it as a crucial factor for the growth and development of developing countries.

Bradley et al. (2012) disputed the perspective that poverty and lack of development in developing economies can be solely attributed to resource allocation problems and a lack of capital. Based on a case study of Nairobi, Kenya, the paper concluded that alongside resource allocation, the issue of development should also be viewed as a matter of innovating and generating new ideas. The study demonstrated that innovation had a positive impact on the performance of firms that adopted innovative methods, compared to those that did not.

In their empirical research conducted in Turkey, Temiz and Gokmen (2014) reached the conclusion that while there appears to be a positive association between Foreign Direct Investment (FDI) inflows and innovation, the correlation between the two is not robust. The study suggested that the main reason for this is that the FDI inflows primarily involved mergers and acquisitions rather than the establishment of new manufacturing facilities. As a result, outdated technology was being utilized in production, which hindered the potential for innovation.

In their research, Sivalogathasan and Wu (2014) investigated the correlation between Foreign Direct Investment (FDI) and innovation using panel data from South Asian countries spanning from 2000 to 2011. The study findings indicated that FDI has a significant positive influence on innovation within the host country's firms. However, this positive impact is contingent upon the

absorptive capacities of the host firms and other complementary attributes. In the absence of these factors, FDI would not have a positive effect on innovation.

Pece et al. (2015) analyzed the impact of innovation on long-term economic growth in three Central and Eastern European countries: Poland, Hungary, and the Czech Republic. Multiple regression models were used in the analysis, and the results demonstrated a positive relationship between economic growth and innovation. The study recommended investing in workforce education, increasing R&D expenditure, and investing in technology to propel an economy on the path of growth.

Barsa et al. (2018) conducted a study based on data from sub-Saharan Africa, and their findings suggested that Foreign Direct Investment (FDI) inflows have a negative or regressive effect on the innovation capabilities of developing economies. The argument was made that FDI inflows often bring foreign technologies that are not well-suited for the domestic environment.

METHODOLOGY

Simple correlation analysis has been used to test the impact of Foreign Direct investment (FDI) inflows on innovation in the various economies of the Indian Subcontinent in a time frame of three decades. The number of patents and trademarks has been used as a proxy for innovation in the nation, following economic literature. According to model economic literature on the subject, the effect of FDI inflows on the number of patents and trademarks has been taken into account with a two-year time lag.

Data for FDI inflows to for the time period considered has been taken from statistics provided by the World Bank whereas the data for no. of patents and no. of trademarks has been sourced from the World Intellectual Property Organisation's (WIPO) website.

RESULTS AND DISCUSSIONS

Correlations

		patents	fdi
Pearson Correlation	Trademarks	1.000	.704
	Fdi	.704	1.000
Sig. (1-tailed)	Trademarks	.	<.001
	Fdi	.000	.
N	trademarks	29	29
	fdi	29	29

Fig 1. Correlation between FDI inflows and trademarks for Pakistan

Fig 1 clearly shows that a high positive correlation (0.704) exists between the FDI inflows and trademarks in Pakistan. We additionally assess the model's goodness of fit to determine the extent to which the independent variable (FDI inflows) can account for the variation in the dependent variable (trademarks).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.704a	.496	.477	6012.008

a. Predictors: (Constant), fdi

b. Dependent Variable: trademarks

Fig 2. Goodness of fit

The estimate of goodness of fit (R squared) reveals that only 49.6% of the fluctuations in the dependent variable (trademarks) can be accounted for by the variations observed in the independent variable (FDI inflows). This suggests that over 50% of the fluctuations in the dependent variable are likely influenced by other factors. As a result, the strong correlation observed between FDI inflows and trademarks in Pakistan is likely coincidental, and the growth in patents is not necessarily dependent on the increase in FDI inflows.

We conduct the same tests to check the relationship between FDI inflows and patents in Pakistan over the past thirty years. The summary of the tests is given below.

Correlations

		patents	fdi
Pearson Correlation	patents	1.000	.616
	fdi	.616	1.000
Sig. (1-tailed)	patents	.	<.001
	fdi	.000	.
N	patents	32	32
	fdi	32	32

Fig 3. Correlation between FDI inflows and patents for Pakistan

Fig 3 clearly shows that a medium high positive correlation (0.616) exists between the FDI inflows and patents in Pakistan. We additionally assess the model's goodness of fit to determine the extent to which the independent variable (FDI inflows) can account for the variation in the dependent variable (patents).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.616a	.379	.358	237.156

a. Predictors: (Constant), fdi

b. Dependent Variable: patents

Fig 4. Goodness of Fit

The estimate of goodness of fit (R squared) reveals that only 37.9% of the fluctuations in the dependent variable (patents) can be accounted for by the variations observed in the independent variable (FDI inflows). This suggests that over 62% of the fluctuations in the dependent variable are likely influenced by other factors. As a result, the correlation observed between FDI inflows and patents in Pakistan is only coincidental, and the growth in patents is not necessarily dependent on the increase in FDI inflows.

We now conduct the same analysis for some other countries in the Indian subcontinent for which adequate data is available over the last three decades. Next, we take up the case of Bangladesh.

Correlations

		Trademarks	FDI
Pearson Correlation	Trademarks	1.000	.900
	FDI	.900	1.000
Sig. (1-tailed)	Trademarks	.	<.001
	FDI	.000	.
N	Trademarks	32	32
	FDI	32	32

Fig 5. Correlation between FDI inflows and trademarks for Bangladesh

Fig 5 clearly shows that a high positive correlation (0.900) exists between the FDI inflows and trademarks in Bangladesh. We additionally assess the model's goodness of fit to determine the extent to which the independent variable (FDI inflows) can account for the variation in the dependent variable (trademarks).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.900[a]	.810	.804	1707.742

a. Predictors: (Constant), FDI

Fig 6. Goodness of Fit

The estimate of goodness of fit (R squared) reveals that 81% of the fluctuations in the dependent variable (trademarks) can be accounted for by the variations observed in the independent variable (FDI inflows). This suggests that only about 19% of the fluctuations in the dependent variable are likely influenced by other factors. As a result, the strong correlation observed between FDI inflows and trademarks in the case of Bangladesh is not coincidental.

We conduct the same tests to check the relationship between FDI inflows and patents in Bangladesh over the past thirty years. The summary of the tests is given below.

Correlations

		Patents	FDI
Pearson Correlation	Patents	1.000	.663
	FDI	.663	1.000
Sig. (1-tailed)	Patents	.	<.001
	FDI	.000	.
N	Patents	32	32
	FDI	32	32

Fig 7: Correlation between FDI inflows and patents for Bangladesh

Fig 7 clearly shows that a medium high positive correlation (0.663) exists between the FDI inflows and patents in Bangladesh. We additionally assess the model's goodness of fit to determine the extent to which the independent variable (FDI inflows) can account for the variation in the dependent variable (patents).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.663[a]	.440	.421	70.312

a. Predictors: (Constant), FDI

Fig 8: Goodness of fit

The estimate of goodness of fit (R squared) reveals that only 44% of the fluctuations in the dependent variable (patents) can be accounted for by the variations observed in the independent variable (FDI inflows). This means that 56%, i.e., more than half of the fluctuations in the dependent variable are likely influenced by other factors. As a result, the correlation observed between FDI inflows and patents in Bangladesh is only coincidental, and the growth in patents is not necessarily dependent on the increase in FDI inflows.

Next we undertake the same tests for Sri Lanka.

Correlations

		Trademarks	FDI
Pearson Correlation	Trademarks	1.000	.838
	FDI	.838	1.000
Sig. (1-tailed)	Trademarks	.	<.001
	FDI	.000	.
N	Trademarks	32	32
	FDI	32	32

Fig 9: Correlation between FDI inflows and trademarks for Sri Lanka

Fig 9 clearly shows that a high positive correlation (0.838) exists between the FDI inflows and trademarks in Sri Lanka. We additionally assess the model's goodness of fit to determine the extent to which the independent variable (FDI inflows) can account for the variation in the dependent variable (trademarks).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.838[a]	.702	.692	1518.135

a. Predictors: (Constant), FDI

Fig 10: Goodness of Fit

The estimate of goodness of fit (R squared) reveals that 70% of the fluctuations in the dependent variable (trademarks) can be accounted for by the variations observed in the independent variable (FDI inflows). This suggests that about 30% of the fluctuations in the dependent variable are likely influenced by other factors. As a result, the strong correlation observed between FDI inflows and trademarks in the case of Sri Lanka is unlikely to be coincidental.

Correlations

		Patents	FDI
Pearson Correlation	Patents	1.000	.793
	FDI	.793	1.000
Sig. (1-tailed)	Patents	.	<.001
	FDI	.000	.
N	Patents	32	32
	FDI	32	32

Fig 11: Correlation between FDI inflows and patents for Sri Lanka

Fig 11 clearly shows that a high positive correlation (0.793) exists between the FDI inflows and patents in Sri Lanka. We additionally assess the model's goodness of fit to determine the extent to which the independent variable (FDI inflows) can account for the variation in the dependent variable (patents).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.793[a]	.629	.616	101.258

a. Predictors: (Constant), FDI

Fig 12: Goodness of fit

The estimate of goodness of fit (R squared) reveals that 62.9% of the fluctuations in the dependent variable (patents) can be accounted for by the variations observed in the independent variable (FDI inflows). This suggests that about 37% of the fluctuations in the dependent variable are likely influenced by other factors. As a result, the strong correlation observed between FDI inflows and patents in the case of Sri Lanka may or may not be coincidental.

Moving on the final case, that of India.

		trademarks	Fdi
Pearson Correlation	trademarks	1.000	.743
	Fdi	.743	1.000
Sig. (1-tailed)	trademarks	.	<.001
	Fdi	.000	.
N	trademarks	29	29
	Fdi	29	29

Fig 13. Correlations between FDI inflows and Trademarks

Fig. 13 makes it abundantly clear that there is a strong positive correlation (0.743) between FDI inflows and trademarks in India during the chosen time period. We further examine the model's goodness of fit to see if the independent variable (FDI inflows) can account for the majority of the variance in the values of the dependent variable (trademarks).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.743[a]	.552	.536	70073.013

a. Predictors: (Constant), FDI

Fig 14. Goodness of fit

Only about 55% of the variations in the dependent variable (trademarks) can be accounted for by variations in the independent variable (FDI inflows), according to the goodness of fit estimate (R squared), whereas 45% of the observed variations in the dependent variables are probably due to other factors. Therefore, it is likely that the strong correlation between FDI inflows and trademarks in India observed during the study period was an accident and that the rise in trademarks during the study period was independent of the rise in FDI inflows.

We conduct the same tests to check the relationship between FDI inflows and patents in India. The summary of the tests is given below.

		patents	Fdi
Pearson Correlation	patents	1.000	.704
	fdi	.704	1.000
Sig. (1-tailed)	patents	.	<.001
	fdi	.000	.
N	patents	29	29
	fdi	29	29

Fig 15. Correlations between FDI inflows and patents

Figure 15 makes it abundantly clear that there is a strong positive correlation (0.704) between FDI inflows and patents in India during the chosen time period. We also examine the model's goodness of fit to determine whether the independent variable, FDI inflows, can account for the majority of the variance in the values of the dependent variable, patents, or if the high correlation between these two variables is merely coincidental, as it was in the case of FDI inflows and trademarks.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.704[a]	.496	.477	6012.008

a. Predictors: (Constant), FDI

Fig 16. Goodness of fit

According to Fig. 16, the R square estimate for this model is 0.496. Only about 50% of the variations in the dependent variable (Patents) can be accounted for by variations in the independent variable (FDI inflows), according to the goodness of fit estimate (R squared), whereas more than 50% of the variations in the dependent variables are probably due to other factors. As a result, it is very likely that the strong correlation between FDI inflows and patents observed in India is coincidental, as is the case with correlation.

CONCLUSIONS AND POLICY IMPLICATIONS

- From the results given above it can be concluded that in the four countries considered in the Indian subcontinent, in the past 30 years FDI inflows had dissimilar effects on the various countries. For India and Pakistan, it can be concluded that the FDI inflows had no direct substantial bearing on the innovation indicators. For Sri Lanka and Bangladesh, the impact of FDI inflows on trademarks was clearly positive but in the case of patents, FDI inflows had little to no impact in the case of Bangladesh and its impact on Sri Lanka's patents was ambiguous.
- Thus, the policy implications regarding increasing innovation in India and Pakistan thus should target the furtherance and expansion of innovation activities directly, rather than in the roundabout way of focusing on creating policies that attract foreign investment.
- For Sri Lanka and Bangladesh, it looks as if they stand to benefit (especially in the case of trademarks) by attracting FDI, it would be wise to also take steps for the direct furtherance of innovation activities.

The following steps look to directly encourage innovation activities in the various countries of the Indian subcontinent

- The apparatus of technical education in Indian subcontinent by the respected governments should be expanded and modernized along the lines of the developed countries. A key part of this would be to increase the amount of funds allocated not only to technical education but also education as a whole on part of the government.
- The curriculum of the technical institutes should be linked up with the actual demands of economy so as to link up the general technical know-how with the particular innovation demands of the various branches of the economy.
- The tie-ups with foreign companies, especially those from the developed economies should be on the basis of technical know-how sharing.
- The system of patents and trademarks registering should be made more robust in order to further incentivize the innovator.

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