Globalisation and Patents: A Study of Patents filed by India

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ABSTRACT

This paper studies the impact of globalisation on Indian patents. An attempt is made to analyse the impact of globalisation on patent filings by Indian citizens from 1993 to 2011. Using semi-log and double-log regression models, we study the impact of FDI, GDP and R&D expenditure on patent filings by Indians. Our results show that real GDP per capita is a significant determinant of FDI; an increase in GDP per capita by 1% leads to an increase in patents filed by 0.72%. FDI is not a significant determinant of patents filed, implying that the notion that globalisation leads to increase in patent filing does not hold good in the Indian case.

Keywords: FDI, GDP per capita, R&D expenditure, Patent life, Cold Shower effect, Accelerator effect

1.0 Introduction

The entire world has witnessed the rapid growth of globalisation in the past few decades which involves the spread and diffusion of ideas, practices, knowledge and technologies across the nations. India liberalised its economy by undertaking economic reforms in 1991. This boosted the growth of the economy and was a strong precursor to globalisation. Prior to globalisation, the technological divide between the developed and developing countries was large and was attributable to the presence of giant multinationals corporations (MNCs) in the developed countries. However, the process of liberalisation and globalisation has led to possibility of technology transfer to developing countries.

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Patents are referred to as rights that are granted to the innovator or creator of an invention or process for a limited period of time that enables him to make, use and sell that invention/innovation for a set period of time. As per Abott (1997), patents recognise improvements and technological advances rather than existing knowledge stock. Patents are one of the tools of protecting the intellectual property in the TRIPs Agreement that comes under the WTO that was established as a result of globalisation. India is also a member of WTO and is a signatory to the WTO agreements. Consequently, India is also obliged to comply with TRIPs regulations related to IPRs in which there is an agreement on patents as well.

2.0 Conceptual Issues

2.1 Economics of patents

As mentioned above, patents are meant to be an incentive for the creator of ideas, products or processes. The benefit or remuneration to the innovators is in the form of supernatural profits which can be reaped by the innovator. In its implementation, a patent is defined for a given period during which the innovator has the absolute right over his creation, invention or innovation. This period is known as the life of patent. It is in this context that a conflict arises between the interest of the innovator and that of society. The loss to the consumer is the welfare loss to the consumer surplus being transferred from the consumer to the producer. In the absence of a patent the competitive price would prevail. Therefore, any price is an incentive to innovator and loss to the society. Figure 1 shows that total benefit to the society is more after the life of patent as well as consumer surplus also increases after patent life but there is no surplus to the producer after the expiry of patent.

Patent markets should operate and regulate in a manner such that there is an optimum life of patent for which neither does the entire benefit goes to the innovator nor does it go to the society. Therefore, there is a notion of sharing of the gains from the process of innovation and creation. This is the zest of the theory of optimum patent life. While the above theory has been in existence for a long period of time, from the point of view of international business, globalisation has changed the context of innovation of patents, particularly due to WTO provisions. Secondly, FDI flow has increased and in great part due to patents. FDI is a phenomenon, which has grown not only out of the need for imported capital, but also as a transferor of technology and the basis of technology is patent. The import of capital through FDI is directed towards new technology most of which is promoted through patents.
2.2 Cold Shower Effect

Cold shower effect takes place when restrictions on trade are being removed. As a result of liberalisation and globalisation, there has been a trend towards removal of such restrictions. Cold shower effect is ordinarily seen in the form of greater efficiency in terms of reduction in cost. We can relate it to import of technology and FDI. In the Indian context, one possibility is that in face of imported technology, the Indian technology may fade out. On the other hand, due to competition, it may actually promote “local technologies” leading to a cold shower effect. In general cold shower effect is positive, i.e. increased efficiency and if it is so then, it would also have a general effect on economy which could lead to increase in the GDP.

2.3 Effect of globalisation

Globalisation has been responsible for setting up international institutions like WTO for liberalising and promoting international trade. In WTO, two important agreements of our concern are the TRIPs and TRIMs. TRIMs promote free flow of capital and investments. So, with TRIMs, there would be inflow of capital in country like
India. Therefore, there is a possibility that TRIMs would lead to promotion of FDI and FDI comes along with capital and technology. On the other hand, with TRIPS there would be more stringent IPR laws. Before the IPR regime, duplication and imitation was very prevalent, but with the introduction of IPR laws, such duplication and imitation of patented products or processes is not permissible.

3.0 Rationale

In order to understand the rationale of this study we have to start with the basic principle of globalisation that involves establishment of a common economic and trading environment, which is facilitated by the free movement of capital, resources and technology. The main agent of change is FDI which is international relocation of production. Capital and technology act as a complimentary input to other resources. The legal and organisational framework which goes along with the process of globalisation or facilitates the process of globalisation is WTO. The inception of WTO arose from the prime concern of intellectual property rights. In this sense, when globalisation takes place technology becomes an integral dimension of this process. Technology flows accompanying FDI can have three different effects:
1. Transfer of technology where imported technology is adopted without any change.
2. Adaptation of technology to the local conditions in the host country in accordance with the host country factor endowment. This would involve technological progress and innovation.
3. Evolution of new technology in the host country.

The main instrument that links the global policy framework in respect of IPRs with either of the processes is through the host country patent regime. One of the prime implications of globalisation is that IPR regimes have to be adopted uniformly so that it facilitates the level playing field. It is known that patents are a means to establish, evolve and encourage innovation and technology. One source of technological progress would be through the import of foreign technology. The other would be through MNC’s adapting their technology to host country conditions. The third possibility is that there is a spill-over effect flowing from FDI to the domestic firms, that is due to globalisation, liberalisation and competition the cold shower effect is expected and this would lead to the possibility of spill-overs from MNC’s to domestic firms in form of technology and innovation which would have implication for Indian patents.

Our enquiry is into the impact of FDI on Indian patents. Since our dependent variable is patents filed by Indian citizens (PF), that is why it does not capture situation where the MNC is adapting the technology to the host country conditions. Since FDI
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involves relocation of production and transfer of capital along with technology, therefore the expectation is that there would be technological progress in the host country (India). The MNCs come from developed countries which are labour deficient and therefore their technology is expected to be capital intensive.

4.0 Data and Methodology

4.1 Data
This study includes data on patents filed by Indians in the country and in order to study the impact of globalisation on Indian patents, data on FDI has been taken. The other independent variables taken to assess the impact on patent filing include GDP per capita and R&D expenditure as a percentage of GDP. FDI and GDP per capita have been deflated to convert them into real terms. (Whole Sale Price Index with base year 2005 is used to deflate the variables). Data collected is mainly from secondary and tertiary sources. There are 18 data points starting from the year 1993 till 2011. So, in this empirical study, patents filed would constitute dependent variable and rest of the variables including FDI(real), GDP per capita(real) and R&D expenditure as a % of GDP would constitute independent variables.

4.2 Objectives
The study has the following objectives:
➢ To analyse trends of Indian patents filed
➢ To measure and analyse the determinants of Indian patents
➢ To study the impact of globalisation on Indian patents

Regression is the main tool used in the analysis to measure the impact of different variables as mentioned above.

4.3 Hypothesis
Primary hypothesis-
(A) Null Hypothesis($H_0$) : There is no change in trends of Indian patents i.e. $\beta = 0$
Alternate Hypothesis($H_a$): There is an increase in the number of Indian patents, i.e. $\beta > 0$

Secondary Hypothesis-
(B) Null Hypothesis($H_{01}$): FDI does not affect Indian patents, i.e. $\beta_1 = 0$
Alternate Hypothesis($H_{a1}$): FDI leads to increase in Indian patents, i.e. $\beta_1 > 0$
(C) Null Hypothesis($H_{02}$): There is no accelerator effect on Indian patents, i.e. $\beta_2 = 0$
Alternate Hypothesis($H_{a2}$): There is accelerator effect that leads to increase in Indian patents, i.e. $\beta_2 > 0$
(D) Null Hypothesis ($H_{03}$): R&D Expenditure does not affect Indian Patents, i.e. $\beta_3 = 0$
Alternate Hypothesis ($H_{a3}$): R&D Expenditure leads to increase in Indian Patents, i.e. $\beta_3 > 0$

4.4. Methodology
Regression is used as a primary tool in this study. The entire methodology here is being laid out in three steps:
I. Linear trend
II. Semi-log equation
III. Double-log equation

I. Linear Trend: This would show the linear trend of different variables from 1993 to 2011.

II. Semi-log Model: This model is like any other model in which the parameters $\beta_1$ and $\beta_2$ are linear, it is used to measure the growth rate and is also known as log-lin model. This model is being used to find out the growth rate of different variables in this study.

\[ Y_t = Y_0(1 + r)^t \]  
\[ \ln Y_t = \ln Y_0 + t\ln(1 + r) + U_t \]

Taking natural log on both the sides of the equation and adding error term:

\[ \ln Y_t = \beta_1 + \beta_2 t + U_t \]

Both the parameters $\beta_1$ and $\beta_2$ are linear. Model is called semi-log because only one variable i.e. dependent variable appears in the logarithmic form.

In this model, the slope coefficient measures the relative change in $Y$ for a given absolute change in the value of the regressor, in this case it is the variable $t$, that is,

\[ \beta_2 = \frac{(\text{relative change in regressand})}{(\text{absolute change in regressor})} \]

Using differential calculus we can show that $\beta_2 = \frac{\partial (\ln Y)}{\partial X} = \left( \frac{1}{Y} \right) \left( \frac{dY}{dX} \right) = \left( \frac{dy}{Y} \right) dX$

For small changes in $Y$ and $X$ this relation may be approximated by

\[ \frac{(Y_t - Y_{t-1})}{(X_t - X_{t-1})} \]

Multiplying the relative change in $Y$ by 100, equation (4) will then give the % change, or the growth rate, in $Y$ for an absolute change in $X$, the regressor. That is, 100 times $\beta_2$ is known in the literature as the semielasticity of $Y$ w.r.t. $X$. 
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So here, \( \beta_2 \) measures the instantaneous growth rate i.e. growth rate at a point of time, and

\( 'r' \) measures annual compound growth rate:

\[ \beta_2 = \ln(1 + r) \]

\[ r = \text{Antilog} \beta_2 - 1 \]

In this study the above equation/model would be used to find out the growth of different variables which includes patents filed (PF), Real FDI, GDP per capita and R&D expenditure as a percentage of GDP. So our semi-log equations would be:

\[
\begin{align*}
\ln PF_t &= \beta_1 + \beta_2 t + U_t & \text{(for patents filed)} \\
\ln FDI_t &= \beta_1 + \beta_2 t + U_t & \text{(for Real FDI)} \\
\ln GDP_t &= \beta_1 + \beta_2 t + U_t & \text{(for GDP per capita)} \\
\ln R&D_t &= \beta_1 + \beta_2 t + U_t & \text{(for R&D expenditure)}
\end{align*}
\]

III. Double-log Model: This model is used to measure the elasticity of dependent variable say ‘Y’ with respect to independent variable say ‘X’. In other words, we can measure that if independent variable changes by say 1% then how much is the change in dependent variable and in what direction.

We start with exponential regression model equation:

\[ Y_t = e^{\alpha + \beta_1 X_t + \beta_2 X_{2t} + \beta_3 X_{3t} + \beta_4 X_{4t}} \]

Taking natural log on both the sides of the equation and adding error term:

\[
\begin{align*}
\ln Y_t &= \ln \alpha + \beta_1 \ln X_{1t} + \beta_2 \ln X_{2t} + \beta_3 \ln X_{3t} + \beta_4 \ln X_{4t} + U_t & \text{(6)} \\
\ln Y_t &= \alpha + \beta_2 \ln X_{2t} + \beta_3 \ln X_{3t} + \beta_4 \ln X_{4t} + U_t & \text{(7)}
\end{align*}
\]

where \( \alpha = \ln \beta_1 \)

Here, the slope coefficient \( \beta_2 \) measures the elasticity of \( Y \) with respect to \( X \), that is the % change in \( Y \) for a given % change in \( X \). Thus, if \( Y \) represents the quantity of a commodity demanded and \( X \) its unit price, \( \beta_2 \) measures the price elasticity of demand, a parameter of considerable economic interest.

General regression equation based on variables in the study:

Patents Filed =f (Real FDI, Real GDP per capita, R&D Ex.(% of GDP) and time variable)

\[ PF_t = e^{\alpha + \beta_1 t + \beta_2 \ln FDI + \beta_3 \ln GDP + \beta_4 \ln RDEX} \]

Taking log on both sides and adding error term (Estimating Equation):

\[ \ln PF = \alpha + \beta_1 t + \beta_2 \ln FDI + \beta_3 \ln GDP + \beta_4 \ln RDEX + U_t \]
5.0 Results and Analysis

5.1 Trend analysis

(a) Patents Filed - In the year 1993 only 1228 patents applications were filed which rose to 1741 in 1995 then declined to 1606 in 1996. Again, it showed a declining trend till 2000 and the number rose to 2247 thereafter. There was a decline for two consecutive years but from the year 2002 the number kept increasing till 2011 and went up to 8062 in the same year (Figure 2).

Figure 2: Trends of Patents filed

Source: www.ipindia.nic.in

(b) FDI in real terms (US$ million) - Starting from the year 1993 total FDI flow in real terms was only US$1072.01 that increased manifold to US$ 3454.68 in 1995. Such rapid increase can be attributed to the major economic reforms of 1990s that includes liberalisation of the economy and initiation of the process of globalisation. This trend continued till 1997; then there was decline for two consecutive years and the figure came to US$ 2929.73 million in 1999 from US$ 5278.63 million in 1997. Thereafter, FDI flow improved in next year and showed increasing trend till 2002; FDI inflow was US$ 6619.65 million in 2002. It declined sharply to US$ 4824.5 million in the next year. Again it bounced back and came up to US$ 6043.88 million in 2004 and kept increasing.
till 2009 to US$ 291173.26, but there was a sudden and very sharp fall in the very next year that is 2010 and the figure came down to US$ 19795.34 million. The main reason behind such a rapid fall was the economic recession of 2009 that shook the whole world with US as its centre. However, there was sign of recovery in the next year and the inflow increased from US$ 19795.34 million in 2010 to US$ 22081.22 million in 2011. Therefore, it is very clear that were lot of fluctuations in FDI inflow in the past 19 years (Figure 3).

![Figure 3: Trends of Foreign Direct Investment](image)

*Source: Authors’ calculations using data from www.tradingeconomics.com*

(c) **GDP per capita in real terms (US$ million)**- Starting from the year 1993 our GDP per capita in real terms was only US$ 596.03 million. The figure kept fluctuating in the range of 590 to 630 till 2003 then it rose to US$ 673.37 million in 2004 and showed an increasing trend till the year 2007 where it reached the figure of US$ 960.4 million. There was a sharp fall in the subsequent year and the figure came down to US$ 861.04 million then it kept increasing for the two years and came up to US$ 1043.47 million in 2010 but there was again a marginal fall in 2011 and the figure came down to US$ 1035.12 million (Figure 4).
(d) **R&D Expenditure as a percentage of GDP** - R&D expenditure as a percentage of GDP kept fluctuating in the range of 0.7 percent to 0.9 percent for the entire period of study of 19 years starting from the year 1993 till 2011 (Figure 5).
5.2 Semi-log Model
(a) For Patents Filed (PF):
Estimating equation: \( \ln PF_t = \beta_1 + \beta_2 t \)
Estimated equation: \( \ln PF_t = -199.58 + 0.1036t \)
p-values: (1.3361E-13) (7.0235E-14)
\( r = 0.1092 \) i.e. 10.92%
The annual compound growth rate, that is, ‘\( r \)’ is coming out to be 10.92%. So, the Patents filed in India grew quite rapidly at an average of 10.92% annually over the past 18 years that is from 1993 to 2011 (Figure 6).

![Figure 6](source: www.data.worldbank.org)

(b) For FDI in real term (RFDI):
Estimating equation: \( \ln FDI_t = \beta_1 + \beta_2 t \)
Estimated equation: \( \ln FDI_t = -371.82 + 0.1902t \)
p-value: (8.65E-06) (6.467E-06)
\( r = 0.2094 \) i.e. 20.95%
The CAGR that is compound annual growth rate is coming out to be 20.95%. So it is evident that FDI in the past 18 years has grown rapidly at a pace of 20.95% annually (Figure 7).
(c) For Real GDP per capita (RGDP):
Estimated equation: \( \ln GDP_t = \beta_1 + \beta_2 t \)
Estimating equation: \( \ln GDP_t = -57.53 + 0.032t \)
\( p\)-value: \( (3.356E-05) \) \( (9.525E-06) \)
\( r = 0.0325 \) i.e. 3.25%

In case of GDP per capita, the compound annual growth rate (CAGR) is coming out to be 3.25%. GDP per capita has grown steadily at a pace of 3.25% (Figure 8) annually which is not bad, but still it's not up to the mark what Indian economy should achieve.
(d) For R&D Expenditure as a % of GDP (RDEX):
Estimating equation:  \( \ln R&D_t = \beta_1 + \beta_2 t = \)
Estimated equation:  \( \ln R&D_t = -20.87 + 0.0103 \)
p-value:  (0.000235)  (0.00026)
r = 0.01037  i.e.  1.037%
R&D Expenditure for the past 18 years has remained mostly steady and fluctuated within a range without a significant increase in growth rate; it showed annual compound growth rate of only 1.04% (Figure 9). So, its trend shows a mild increase over this period of time.

**Figure 9**

Source: Authors’ calculations

### 5.3 Double-log Model

In the previous section we arrived at the following estimating equation (double-log equation):

\[
\ln PF = \alpha + \beta_1 t + \beta_2 \ln RFDI + \beta_3 \ln RGDP + \beta_4 \ln RDEX + U_t
\]

The results of multiple regression are shown in Table 1.
The estimated equation is coming out to be:

\[
\ln PF = -152.79 + 0.078t + 0.014\ln RFDI + 0.72\ln RGDP - 0.009\ln RDEX
\]

p-values  (5.676E-08)  (0.588)  (0.0002)  (0.979)
So, the results are as follows:  \( \alpha = -152.79; \quad \beta_1 = 0.078; \quad \beta_2 = 0.014; \)
\[ \beta_3 = 0.72; \quad \beta_4 = 0.009 \]

From the results it is found that \( \alpha \) is coming out to be negative which indicates that to start with patents applied were very low. F-statistic is also coming out to be statistically significant indicating that the equation is well specified containing the sufficient number of variables.

One can find the elasticity by looking at the \( \beta \) coefficients which is coming out to be 0.014 in case of FDI, 0.72 in case of GDP and -0.009 in case of R&D expenditure. It means that an increase in FDI by 1% it leads to an increase in number of patents filed by 0.014%. Therefore, the degree of elasticity is low between FDI inflow and patents filed. In case of GDP, if there is an increase in GDP by 1% there will be an increase in patents filed by 0.72%. So, the degree of elasticity is quite high as compared to FDI. But in case of R&D expenditure elasticity is coming out to be negative indicating that if there is an increase in R&D expenditure by 1%, it would lead to reduction in patents filed by .009%. So, a negative or inverse relationship is appearing in case of R&D expenditure but the degree of elasticity is very low.

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<th>Table 1: Results of Multiple Regression</th>
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| Multiple R | 0.994115496 |
| R Square | 0.988265619 |
| Adjusted R Square | 0.984912939 |
| Standard Error | 0.072924668 |
| Observations | 19 |
From Table 1, p-values of FDI and R&D expenditure as % of GDP are coming out to be insignificant, since their p-values are 0.588 and 0.979 respectively which are much higher than the 0.05. The values could have been significant if these were any way near to 0.05. But if we look at the p-value of real GDP, it is coming out to be highly significant which is only 0.0002. Therefore, real GDP is the only significant determinant among the three in our study.

**FDI:** The p-value is not significant; this implies that the ‘cold shower’ effect does not play a role here. Cold shower effect may be taking place through its impact on operational costs by better efficiency, but it certainly does not have a direct impact on patents filed. The motivation for patents might be coming from domestic growth.

**GDP:** GDP is coming out to be the significant factor as the p-value is 0.0002. It is quite possible that GDP growth acts as an accelerator. According to the accelerator principle, when GDP grows at a certain rate, investment demand grows at a faster rate, and investment is directly related to technology and innovation.

**R&D Expenditure:** Like FDI, the p-value is coming out to be insignificant at 0.979. It is possible that R&D expenditure is mainly being done on technology input. One more possibility is that R&D in government laboratories leading to new patents may be doubtful or may be in private institutes. A lot of R&D expenditure could be reflected in import of technologies from abroad in high tech areas and therefore, it would form royalties paid from home countries and it is not really directed towards patent applications.

**Testing Hypothesis**

(A) $H_0$: There is no change in Indian Patents; \[ \beta = 0 \]

$H_A$: There is an increase in Indian Patents; \[ \beta > 0 \]

The $t$-statistic is represented as:

\[
t = \frac{\text{estimator} - \text{parameter}}{\text{estimated standard error of estimator}}
\]

\[
t_{(\alpha, n-k)} = \frac{\hat{\beta} - \beta_{H_0}}{\text{s.e.}(\hat{\beta})}
\]

**Test Criterion:** If $\text{Cal} t_{(\alpha, n-k)} > \text{Tab} t_{(\alpha, n-k)}$, then reject null hypothesis

The computed $t$ value is:

\[
t = \frac{0.10367}{0.004745}
\]
\[ t = 21.8486 \]

Since, the computed t value (21.8486) does exceed the critical t value (1.761) at 5% level of significance with 14 degrees of freedom, therefore, we would reject the null hypothesis. Therefore, \( \beta_1 > 0 \)

In the semi-log equation of regression it is also found that the annual compound growth rate of Indian patents coming out to be 10.92% from 1993 to 2011. So, it became clear that there is an increase in Indian patents being filed.

(B) \( H_{01} \): There is no accelerator affect on Indian patents; \( \beta_1 = 0 \) 
\( H_{a1} \): There is an accelerator effect which leads to increase in Indian Patents; \( \beta_1 > 0 \) We will be testing this hypothesis with respect to GDP. So, the t-values are as follows:
\[ t_{\text{cal.}} = 4.82; \quad t_{\text{tab.}} = 1.761 \]
Since, \( t_{\text{cal.}} > t_{\text{tab.}} \) the null hypothesis is rejected. Therefore, we accept the alternate hypothesis\( (H_{a1}) \) that there is an accelerator effect which leads to increase in Indian Patents. Hence, \( \beta_1 > 0 \)

(C) \( H_{02} \): FDI does not affect Indian Patents; \( \beta_2 = 0 \) 
\( H_{a2} \): FDI leads to an increase in Indian Patents; \( \beta_2 > 0 \)
\[ t_{\text{cal.}} = 0.55; \quad t_{\text{tab.}} = 1.761 \]
Since, \( t_{\text{cal.}} < t_{\text{tab.}} \) the null hypothesis is accepted. So, it implies that FDI does not affect Indian patents. Hence, \( \beta_2 = 0 \)

(D) \( H_{03} \): R&D Expenditure does not affect Indian Patents; \( \beta_3 = 0 \) 
\( H_{a3} \): R&D Expenditure leads to an increase in Indian Patents; \( \beta_3 > 0 \)
\[ t_{\text{cal.}} = -0.26; \quad t_{\text{tab.}} = 1.761 \]
Since, \( t_{\text{cal.}} > t_{\text{tab.}} \) the null hypothesis is accepted. Therefore, it implies that R&D expenditure does not affect Indian patents. Hence, \( \beta_3 = 0 \)

6.0 Conclusion

This study was carried out to find out the impact of globalisation on Indian patents. The factor representing globalisation, i.e. FDI was found to have no significant impact on Indian patents. Therefore, one of the major finding is that the notion that globalisation is leading to increased Indian patents does not hold good. It may be
possible that technology policy is still not very clear and there are not enough incentives for foreign firms or individual for getting Indian patents. It may be possible that as we are taking Indian patents, FDI is not influencing the dependent variable (i.e. patents filed); this means that MNCs may actually be applying for foreign patents but not for Indian patents. Hence, the spill-over effect from FDI is not leading to any gains to the host country in terms of patents. The gain may be going to the home country or third country.

Apart from this technological push i.e. R&D expenditure was also found to have no connection with the increasing Indian patents. Some incentives should be given to foreign firms to encourage them for having Indian patents or in order to prompt them to acquire Indian patents.

Further, it was found that it is the domestic factor, i.e., GDP which is affecting Indian patents the most. The economy’s domestic factors and accelerator affect represented by GDP has shown significant impact on Indian patents that has led to an increase in Indian patents. Hence, it is not globalisation but domestic factors/growth i.e. GDP which is actually leading to increase in Indian patents.

7.0 Limitations and Suggestions for Future Research

One of the limitation of the study is that it incorporates the impact of liberalisation-globalisation, domestic factors in form of GDP and technological push in the form of R&D expenditure only and does not take in to the other factors like political-legal environment for patents in the country that could also have an important bearing on the system.

The study is an aggregate analysis or macro level analysis meant for the whole economy. In future, study at micro level could be undertaken to assess the impact of globalisation-liberalisation on different industries and sectors. It would also be interesting to examine the indirect effect of FDI on GDP which would in turn lead to patents. In order to study the indirect impact of FDI on GDP and then on patents, a model of simultaneous equations would be required. In future studies for the purpose of refining the impact of globalisation and liberalisation on Indian patents, data on patent filings by foreign nationals/institutions can be taken into account.

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**Weblinks**

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