Patenting, Licensing, Trade, Foreign Direct Investment and Economic Growth: A Panel Data Analysis of Middle and Low Income Countries

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Transfer of technology through various channels like patenting, licensing, trade and foreign direct investment is considered as an integral component of economic growth both in developed and developing economies. The study investigates the impact of different technology transfer channels such as patenting, licensing, trade and foreign direct investment on economic growth for a balanced panel of 28 middle and low income countries over a period of 1975–2010 through fixed effect methods and the empirical results show that each channel affects differently in the sample countries. For full sample of middle income countries, only licensing and foreign direct investment are the most effective channels for the transfer of technology, while this is true for patenting and licensing in case of upper middle income countries. In lower middle income countries, licensing and foreign direct investment and in low income countries, only foreign direct investment have been found to be the effective channels for the transfer of technology.

Keywords: Intellectual property rights, patent, licensing, trade, foreign direct investment, research and development, economic growth

Transfer of technology through different channels such as patenting, licensing, trade and foreign direct investment are considered as integral components of economic growth and development, raising living standards through production and provision of better quality goods and services in various developed and developing countries. Moreover, technological development, obtained through different research and development (R&D) activities is also responsible for various changes in production and processing techniques, carried out through structural reforms in various organizations, which enhance productivity and economic growth. In general, knowledge is a science and application of science is known as technology, which is an intangible asset and hence has difficulties in its measurements.

When the technology is transferred through patenting (inventions), the evidences suggest that the country’s market size or its economic structure is quite important, determining the impact of a patent right on productivity and economic growth process. If, on the other hand, technology is transferred through trade (in the form of technology embodied imports), the protection of intellectual property rights (IPRs), especially in the developing countries reduces imitation and encourages more innovative activities in developed countries. If, foreign direct investment (FDI) is considered as a source of technology, then the innovators of developed countries may shift their production processes to developing countries, so as to avoid the competition of available resources in developed countries under existing IPRs protection regime. If, however, IPRs are well protected in developing countries, it encourages FDI and further innovations, which would be essential for productivity and growth process in these countries. Finally, if, licensing is considered as a channel for transfer of technology, the protection of IPRs in developing countries will enhance the transfer of technology.

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countries may result in greater innovations in developed countries, which increases licensing towards the developing countries. In this study, the authors estimated and analysed the relative effectiveness of different technology transfer channels such as, patenting, licensing, trade and FDI on economic growth in middle and low income countries, using fixed effect methods. For this purpose, a balanced panel of 28 countries (17 middle income and 11 low income countries) for a period of 1975–2010 was identified. The empirical results reveal that for full sample of middle income countries, licensing and foreign direct investment are the effective channels for the transfer of technology. While patenting and licensing are more appropriate channels for the transfer of technology in upper middle income countries; licensing and FDI are found to be more effective in lower middle income countries. On the other hand, in low income countries, only FDI is an effective channel for the transfer of technology.

In this paper, after a brief introduction, the existing literature on the subject is reviewed followed by empirical methodology and data description. Then are discussed the empirical results followed by summary of findings and concluding remarks.

**Review of Literature**

In order to raise productivity and economic growth, need and importance of technological development has been considered both in developed and developing countries. In general, technological progress takes into account different changes in production processes; structural changes in organization or firms; and improvement in management techniques, which can raise productivity and economic growth during the short run and long run, along with the requisite skills and other necessary infrastructures. Resources for various inventions and innovative activities tend to be highly concentrated in developed countries due to which various research oriented institutions and firms generally remain engaged in various innovative activities in these countries.

**Intellectual Property Rights and Patenting**

Generally, most of the R&D activities take place in developed countries and due to protection and enforcement of IPRs, the innovators register bulk of the inventions for which the patent rights are granted to the potential innovators and creators for a specific period of time (20 years) in order to earn returns over their inventions, which in turn helps to raise productivity and growth in these countries. These inventions can be transferred as technology from developed countries to developing countries (usually middle and low income countries) in order to benefit their economic growth process. If, however, there is protection of IPRs in developing countries then this flow of technology will continue to enhance their economic growth and development and vice versa. Hence the inventions, being made and developed in high income countries benefit the middle and low income countries, if and only if, there is certain level of protection of IPRs in developing countries.

Under certain level of protection of IPRs, the innovators are allowed to obtain the appropriate share of their profits from their inventions, which are produced through various R&D activities and these inventions facilitate future stock of knowledge and various other innovative activities, which help in the long run growth. In this regard, the patent applications are considered as a measure of output of different R&D activities and granting of patent rights are identified as the innovations, which are protected for a period of 20 years. Kanwar and Evenson investigated a panel of 32 countries over a period of 1981–1995, to find out whether strong protection of IPRs, increases R&D expenditure and concluded a positive and significant impact in terms of R&D spending as a share of GDP in these countries.

Chen and Puttitanun developed a model to identify the relationship between IPR protection and innovations for 64 developing countries over a period of 1975–2000 and showed that IPR protection and innovations are positively linked with each other in developing countries. They also suggested that in a country, the domestic innovations increase the level of development with the increasing level of IPR protection.

Schneider investigated the valuation and significance of IPRs, high-technology imports and foreign direct investment on innovations and per capita GDP growth for 47 developed and developing countries over 1970–1990 through the use of number of patent applications by the residents of United States and concluded that the innovations responded positively to IPR protection in these countries. Moreover, it also concluded that in developed countries, protection of IPRs has positive impact on innovations and negative impact in developing countries. For 19 OECD countries, Eaton and Kortum examined whether to patent abroad and concluded that
the countries, which provide strong protection to IPRs, are more attractive destinations for foreign patenting as compared to those destinations which are providing weaker level of protection of IPRs, concluding that growth is significantly related to foreign patenting.

Xu and Chiang\(^8\) conducted an exercise for different technology transfer channels like trade, foreign patenting and disembodied spillovers for 48 countries over the period of 1980–2000 and concluded, with few exceptions that, productivity and growth are positively and significantly related to these technology transfer channels, suggesting that total factor productivity and growth are positively associated with the protection of IPRs and foreign patenting.

**Intellectual Property Rights and Licensing**

Under different level of protection of IPRs, licensing has sometimes opposing influences on the productivity and economic growth in various countries. In developed countries, due to protection of IPRs, more licences are issued to meet the production purposes as compared to middle and low income countries, as these countries have low level of IPR protection. Within firms, licensing and technological development are associated with each other for the sharing of information, knowledge and other procedural assistances.\(^9\) In this way different firms modify their production techniques in order to obtain productivity and growth performance. On granting a licence, the licensee has to pay some fee in the form of royalty payments or initiate profit sharing for a given period of time.

Yang and Maskus\(^10\) empirically examined the effectiveness of international variations of IPR protection in terms of royalty payments and licensing fees, which were paid to US firms from a panel of 23 developed countries over the periods of 1985, 1990 and 1995, suggesting that stronger protection of IPRs enhanced licensing levels among willing partners. Maskus is of the view that ‘flow of investment and licensing do not necessarily increase with the strength of IPRs’ in different countries. Despite this fact, the developing countries with their low technical capabilities preferred global competition for capital and technology; they strengthened their intellectual property regime.\(^11\)

Arshad and Samad\(^12\) examined that the enforcement level of IPRs in developing countries discourages net FDI investment and encourages royalty payments and licence fees. If the patent protection is stronger, then licensing is preferred to that of commodity trade, as it reduces imitation, uncertainty and transaction costs.

**Intellectual Property Rights and Trade**

In general, trade in the form of ‘technology embodied imports’ improves the welfare level of their residents via the provision of better quality goods and services of willing trading partners. This flow of technology may vary among developed–developed and developed–developing countries on the basis of protection levels of IPRs, economic structure and available factor endowments. Since, among developed–developed countries, there is strong protection and strict enforcement of IPRs, more flow of technology will take place through trade and hence these countries have higher productivity and economic growth. On the other hand, among developed–developing countries, due to low level of protection of IPRs in developing countries, transfer of technology through trade would be low and hence lower the productivity and economic growth in these countries.

Generally, most of the studies consider trade (in the form of technology embodied imports) as a technology transfer channel and its effectiveness in economic growth. But these studies do not comprehensively identify any suitable procedures through which trade promotes and encourages the transfer of technology and economic growth.\(^13\)–\(^16\) Different R&D activities help to increase innovations, which are responsible for productivity and economic growth in open and closed economies differently, depending upon the protection of IPRs. For a panel of 22 developed countries, Coe and Helpman\(^13\) concluded that the domestic and foreign R&D capital stocks both have significant impact on total factor productivity of a country, which is more vibrant for open economies as compared to closed economies.

Eaton and Kortum\(^7\) investigated the significant role and importance of trade in order to obtain different benefits from various innovations. In their analysis, they concluded that trade can be considered as a critical technology transfer channel in order to get benefits among OECD countries. Coe et al.,\(^14\) improved and used an approach, already developed by Coe and Helpman\(^13\) for 77 developing countries. In this analysis, they utilized foreign stocks of R&D expenditures and found that total factor productivity increases over a period of time in these countries with the increasing level of R&D spending. They recognized that the knowledge spillovers (in the form of imports) from the Northern (developed countries) towards the Southern (developing countries) are also important sources of productivity and economic growth.
The foreign direct investment has two major forms: (i) inward FDI, meaning the investment made by the foreign sector into the domestic economy; and (ii) outward FDI in which the domestic capital and resources are used for investment purposes into other foreign economies in order to meet their industrial purposes. In other words, foreign direct investment is carried out in those industries where both knowledge and technology are important for productivity and economic growth.

Xu and Wang\(^\text{17}\) examined for 21 OECD countries over a period of 1971–1990 and deduced few evidences of spillovers for inward FDI with a few for outward FDI. Through the utilization of patent applications by Swedish Transnational Corporations and Non-transnational Corporations, Globermann \textit{et al.}, concluded and suggest that among corporations, outward FDI is a better source of technology than inward FDI. Besides, as subsidiary, FDI helps transfer of technology in transnational corporations through learning of advanced technologies.\(^\text{18-21}\)

Mansfield\(^\text{22}\) investigated how protection of IPRs is associated with the sales distribution in various localities by selecting 100 major firms from the US economy in six different industries. The result revealed that the protection of IPRs is marginally associated with distribution outlets in different locations. It also revealed that some firms are concerned about IPR protection for sale of manufactured components and some in terms of their completely manufactured products.\(^\text{23}\)

Lee and Mansfield\(^\text{24}\) used the same survey data, which is used by Mansfield\(^\text{22}\) to examine an empirical relationship for IPR protection and investment into those industries. The analysis concluded that very few investments have been made into these firms. In their analysis, they suggested that the countries with poor protection of IPRs and R&D facilities have low level of foreign direct investment.

In order to analyse the importance of FDI to raise firm level productivity, some studies examined and reported some mixed findings that FDI has positive, negative and insignificant impacts on economic growth in different economies.\(^\text{2,25}\) Arshad and Samad’s\(^\text{12}\) empirical findings are optimistic about the strong IPR protection in that it increases FDI in production sector and distribution networks. They also emphasized that weak institutions, corrupt bureaucracy, weak capital concentration and employment protection are detrimental to FDI.

Empirical Methodology

The transfer of technology through different channels like patenting, trade, FDI and licensing affect the economic growth differently in developed and developing economies, which depends upon the structure and various stages of development of the concerned economies; either these economies are innovative and/or imitative. If the economies are innovative, then all these channels positively affect productivity and economic growth. On the other hand, if economies depend upon pirated and imitated technologies then the effectiveness of these channels on growth vary differently in these countries.

The concept of convergence implies that poor economies grow faster than richer ones based on their initial level of per capita GDP, was examined by Barro\(^\text{26}\) and negative coefficient for this level of GDP was obtained, which confirms that convergence has been achieved in the system. Trade openness and human capital stock contribute to economic growth.\(^\text{26,27}\) In many countries, a fundamental objective of different economic policies is to obtain a high growth rate by lowering the inflation rate. High inflation is associated with increasing price variability, which leads to uncertainty for future profitability and investment in various projects and hence low level of productivity and economic growth. Inflation may also lessen the international competitiveness of domestic products by increasing their prices and affects the balance of payments.

Population growth may also affect the productivity and growth differently in developed and developing countries. In developed countries, the impact of population growth appears to be positive, as determined by their absorption capacity. But in developing countries, population growth leads to less capital per worker, decreasing per capita output and consumption. When businesses are investing to raise their production level in physical capital and the government invests in construction of roads, railways, schools and hospitals, it reflects optimism for productivity and economic growth.

Generally, protection of IPRs affects domestic innovation differently in different countries. For instance, when technology is transferred through trade, then protection of IPRs in developing countries lessens the imitative abilities and encourages for more innovative activities in the short run, since the innovations have become more profitable. In the long run, however, innovations may fall in the developed countries, as fewer resources are available for
innovations there. But this happens only if there is weak protection of IPRs in developing countries.

The innovators in developed countries shift their innovative and productive resources towards developing countries if technology is transferred through FDI and productive resources may lessen in the source country. In this process, IPR protection encourages FDI, which increases innovations and economic growth. Licensing is used as a technology transfer channel, resulting into more innovation under IPRs protection regime. If there is protection and enforcement of IPRs in developing countries then more licences are granted by developed countries towards developing countries, as this protection level reduces the imitative abilities in these countries. In other words, transfer of technology through patenting, trade, FDI and licensing affect economic growth differently in different countries.

The brief review of literature above suggests that economic growth depends upon initial level of per capita GDP, inflation, population growth rate, trade openness, rate of investment, patenting, trade, licensing and FDI. Among these variables, initial level of per capita GDP predicts various stages of development; investment rate shows production of new goods and services; population growth determines that how per capita GDP growth is affected over a period of time; inflation determines the stability of the country; and trade openness elaborates sum of the exports plus imports to GDP ratio. In order to examine the relationship between different technology transfer channels and economic growth, the following estimated growth equation was used:

\[ y_i = \beta_0 + \beta_1 y_n + \beta_2 \pi_n + \beta_3 gn_n + \beta_4 to_n + \beta_5 inv_n + \beta_6 \log(Patent_n) + \beta_7 RP_n + \beta_8 HITIMP_n + \beta_9 FDI_n + \epsilon_i \]

In the above equation, lower case letters show the growth rates of the selected variables. For \( t \)th country in \( i \)th time period, \( y \) indicates growth rate of GDP per capita; \( y_n \) shows initial level of per capita GDP at the beginning of each five year period (a measure of convergence); \( \pi \) is the inflation rate (for the measurement of economic stability); \( gn \) indicates population growth; \( to \) is trade openness; \( inv \) exhibits investment to GDP ratio; patent is the number of patents being granted; RP stands for royalty payments in response to licensing; HITIMP denotes high technology imports, used as a trade channel; FDI is foreign direct investment; and \( \epsilon \) is the error term.

In this analysis, the study uses growth rate of GDP per capita, as a dependent variable (\( y \)) and the explanatory variables include: logged level of per capita GDP at the beginning of each five year period, denoted as log(INIGDPPC); inflation rate, denoted as INF; population growth, denoted as GPOP; trade openness, denoted as TRADEOPEN; investment to GDP, denoted as INV; patenting, denoted as log(PATENT); licensing, denoted as royalty payments (RP); high technology imports, denoted as HITIMP; and foreign direct investment, denoted as FDI.

In empirical analysis, both fixed and random effect methods conclude their outcome differently. Generally, for a balanced panel, one might expect that the fixed effects method works better. On the other hand, when sample contains limited number of observations then random effects method would be more appropriate. In empirical analysis, in order to determine the validity of fixed and random effect methods, Hausman test was used. If value of Hausman statistics was large, null hypothesis was rejected and fixed effects method was used. On the other hand, the small value of the statistics suggested that the random effects estimator was more appropriate.

Data Description

In this study, the data set covers 28 countries28 with 17 middle income countries (including 9 upper middle income and 8 lower middle income countries); and 11 low income countries. Table 1 describes the list of all the sample countries. The time period covered is 1975–2010. Instead of using data for each year, averages of all variables over a period of five years

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<th>Table 1—List of countries</th>
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<td>Upper middle income countries</td>
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<tr>
<td>Argentina</td>
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<td>Brazil</td>
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<td>China</td>
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have been taken. Data on growth rate of GDP per capita, initial level of per capita GDP, population growth, investment rate, trade openness, inflation, royalty payments, patenting, FDI and high technology imports have been taken from the World Development Indicators (2012) and Penn World Table (PWT 7). The licensing has been measured in terms of royalty payments, which the licensees have to pay in response to having a licence from the licensor. Similarly, trade is measured in terms of high technology imports from developed to developing countries.

**Results and Discussion**

Table 2 reports the results regarding the effectiveness of different technology transfer channels on economic growth is such a way that column 1 defines explanatory variables and columns 2, 3, 4 and 5 indicate the empirical outcomes for full sample of middle income countries, upper middle income countries, lower middle income countries, and low income countries respectively.

Column 2 shows the empirical results for sample middle income countries, revealing that most of the variables have their expected signs and are significant at conventional level, except for openness and patenting, which are insignificantly affecting the growth. Further, it has been observed that the level of initial GDP per capita negatively and significantly affects the economic growth, which is significant at 5 percent, suggesting that convergence has been achieved in these countries in terms of the growth. The study measured stability of the economy through inflation and the coefficient associated with inflation negatively and significantly affected the economic growth, depending upon the structure of the concerned economies.

In middle income countries, due to scarcity of R&D activities, very few inventions are introduced in the markets and mostly these economies rely on pirated and imitated technologies for their production processes. Therefore, in these countries patenting has negative effect on economic growth. The study shows that patenting (invention) being considered as a technology transfer channel has negative and insignificant impact on growth in the sample middle income countries, suggesting that these countries enjoy foreign patenting and imported capital goods. In order to measure the impact of licensing on growth in these middle income countries, the study included royalty payment indicator for its empirical analysis and shows that its impact on growth is positive and significant in middle income countries.

In general, developed and high income countries produce and introduce technological products in the international markets that can be transferred towards developing countries, raising their productivity and economic growth. If, however, there is strong protection of IPRs then more technologies would be imported from developed to developing countries and if there exists weak protection of IPRs then it will reduce the flow of technology from developed to developing nations. These imports may include intermediate capital goods, production methods, imitated and new technologies. The study measured the trade channel in the form of high technology imports and concludes that high technology imports have negative impact on growth in middle income countries, that is, high-technology imports are not suitable for these countries due to differences in their trade balances.

The benefits from FDI can be obtained through labour training and their turnovers and provision of high quality intermediate inputs made available for

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<th>Variable</th>
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<th>Lower middle income countries</th>
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<td></td>
<td>C</td>
<td>(4.70)**</td>
<td>(6.80)**</td>
<td>(2.30)**</td>
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<td></td>
<td>log(PATENT)</td>
<td>(1.97)**</td>
<td>(1.05)**</td>
<td>(1.96)**</td>
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<tr>
<td></td>
<td>HITIMP</td>
<td>(-1.98)**</td>
<td>(-1.10)**</td>
<td>(-0.82)**</td>
</tr>
<tr>
<td></td>
<td>FDI</td>
<td>0.62</td>
<td>-0.19</td>
<td>0.52</td>
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<tr>
<td></td>
<td>R-squared</td>
<td>0.56</td>
<td>0.78</td>
<td>0.62</td>
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<td></td>
<td>F-statistic</td>
<td>5.43**</td>
<td>9.02**</td>
<td>4.14**</td>
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|            | Hausman statistic           | 30.76                         | 26.35                         | 13.05              | 22.30

** indicates significance at 5 percent level respectively, t-statistics are reported in brackets.
The study concluded that FDI positively and significantly affects the economic growth in middle income countries. However, it concluded that in these countries few inventions and more imitations are made due to weaker protection and enforcement of IPRs. The most suitable and appropriate channels for the transfer of technology with their impact on growth are licensing and FDI in middle income countries.

The study concludes that in middle income countries, licensing and FDI are the appropriate channels for the transfer of technology. But Xu and Chiang ⁷ showed that middle income countries rely on foreign patenting and imported capital goods to raise productivity and economic growth. In order to empirically examine relative effectiveness of each technology transfer channel on growth, all middle income countries were further classified into upper middle income and lower middle income countries.

In upper middle income countries there is relatively stronger protection of IPRs than lower middle income countries. Therefore, in upper middle income countries, the impact of IPRs on growth is relatively significant compared to lower middle income countries. Moreover, due to different level of protection of IPRs, technology transfer channels affect these countries differently, which also depends upon the structure of the concerned economies.

Column 3 of Table 2 shows the required empirical results for upper middle income countries in such a way that most of the variables are significant at the conventional level. In upper middle income countries, very few R&D activities take place that result into inventions, which increase productivity and economic growth in these countries. In these countries, therefore, both domestic and foreign patenting have positive and significant effect on economic growth. The coefficient associated with patenting (invention) which is considered as a technology transfer channel has positive and significant impact on economic growth in these countries.

Similarly licensing has also positive and significant impact on growth in these countries. Finally, the result shows that in upper middle income countries, high technology imports and FDI negatively but significantly affect their economic growth. It is concluded that in upper middle income countries, few inventions and more imitations are made due to weak protection and enforcement of IPRs. Depending upon the structure of the economy, the most suitable and appropriate channels for the transfer of technology with their impact on growth are patenting and licensing.

In lower middle countries, due to weak level of protection of IPRs, very little innovative activities take place and mostly products are produced through imitated technologies. In these countries due to weak level of protection of IPRs, both domestic and foreign patenting do not impact their productivity and economic growth. Moreover, these countries do not import high-technology imports, therefore, it does not have any significant impact on growth and these countries use imitated technologies for their production processes.

Column 4 of Table 2 describes empirical results in relation to lower middle income countries in which some variables are significant at conventional level. In lower middle income countries due to lack of proper protection of IPRs, very few R&D activities take place, resulting in scarcity of inventions and hence have low productivity and economic growth. The coefficient associated with patenting negatively affects the economic growth. Licensing has a positive and significant impact on growth in these countries, which is significant at 5 percent level of significance. In lower middle income countries, high technology imports negatively impact upon economic growth, which means that these countries use the imitated technologies due to weaker level of protection of IPRs. Finally, the result shows that in these countries FDI positively and significantly affects the growth, which is significant at 5 per cent level of significance. The study concludes that in lower middle income countries, due to weak protection of IPRs, very little invention occurs and these economies use imitated technologies. Depending upon the structure of the economy, the most suitable and appropriate channels for the transfer of technology with their impact on growth are licensing and foreign direct investment.

The empirical results for transfer of technology and economic growth in low income countries are shown in column 5 of Table 2 in which most of the variables have their expected signs and are significant at conventional level. Inflation has been included in the analysis to measure stability of the economy and the coefficient associated with inflation negatively and significantly affects the economic growth in these countries. Similarly, investment also positively and significantly affects the growth in these countries. In developing countries, population growth is negatively
related to economic growth due to reduction in capital labour ratio. This analysis also shows that in low income countries, population growth negatively and significantly affects the economic growth. Since these are small economies therefore, trade openness positively but insignificantly affects their growth rate, showing that these countries are not getting the potential benefits from international trade, which reduces the welfare level of their residents.

In low income countries, very little R&D activities take place that result into scarcity of inventions and hence have low productivity and economic growth and the coefficient associated with patenting negatively affects the economic growth, suggesting that these countries benefit from foreign patenting. Similarly licensing and trade (in the form of high technology imports) negatively affects the economic growth rate in low income countries. But in developing countries like India, Pakistan and Bangladesh, the enforcement level of IPRs discourages net FDI and encourages royalty and licensing, depending upon the nature and form of the technology. The study concludes that in low income countries depending upon the structure of the economy, the most suitable and appropriate channel for the transfer of technology with its impact on growth is foreign direct investment.

Developing countries are apparently placed in a disadvantageous position in terms of innovations, inventions and protection of IPRs and most of the R&D activities in these countries are adaptive, rather than creative in nature. However, in these countries the process of industrialization in particular and growth process in general involves substantial technical changes. In technological capability literature, it has been argued that the developing countries must invest in R&D to acquire technical capability, make use of the public domain knowledge to enhance productivity and international R&D spillovers do not contribute to productivity, until the developing countries invest in R&D activities. In developing countries, these R&D activities have been encouraged to produce inventions under various level of protection of IPRs.

The transfer of technology and international differences for the effectiveness of IPRs are insensitive for various products, being produced through labour intensive techniques rather than technology intensive techniques in developed and developing countries. Under strict protection of IPRs, the transfer of technology may be enhanced through licensing, which would replace the foreign direct investment by reducing the licensing cost and the transfer of technology can be raised irrespective of these channels. In order to measure the impact of licensing on growth, the study includes royalty payment indicator for empirical analysis. The advocates of stronger protection of IPRs in developing countries suggest that it can increase exports, FDI transfer of technology and inventions over a period of time.

The enforcement of IPRs and import of technology depends upon the level of development and technological nature of economic activities. The knowledge produced in one country can be transferred to the other countries through (i) import of intermediate and capital goods to enhance productivity; (ii) cross-border learning of production methods, product design and organizational structures, which can result in a more efficient allocation of domestic resources; (iii) imitation of new products; and (iv) development of new technologies or the imitation of foreign technology.

Foreign direct investment is a process of investment of foreign investors into the domestic economic structure in the forms of inward investment in which the investment of foreign capital occurs in the domestic resources; and outward investment during which the local capital is being invested in some foreign resource. Both these inward and outward FDI have different impact in different economies. FDI can be an important channel for transfer of technology, when firm-specific technology is transferred from one destination to another destination. One more important advantage of FDI relative to licensing or joint ventures is that it keeps the technology internal to the firm, which may increase the benefits for the domestic firms. The benefits from FDI can be obtained through labour training and their turnovers and through the provision of high quality intermediate inputs, which are available for the domestic firms for their production process.

Summary of Findings and Concluding Remarks

In this study, the authors empirically investigated impact of different technology transfer channels like patenting, trade, licensing and foreign direct investment on the economic growth for a panel of 28 countries over a period of 1975–2010. The results revealed that for full sample of middle income countries, licensing and foreign direct investment are the effective channels
for the transfer of technology. But due to lack of protection of IPRs and fewer innovative activities, patenting and high technology imports are unable to play their role on economic growth in these countries. Moreover, patenting and licensing are more effective channels for the transfer of technology in upper middle income countries, while in lower middle income countries, licensing and foreign direct investment have more prominent role. Finally, in low income countries, only foreign direct investment is a suitable channel for the transfer of technology, which positively and significantly affects economic growth. In such countries, due to poor protection of IPRs with very few innovative activities, other channels like patenting, trade and licensing are ineffective for the transfer of technology.

The transfer of technology is a phenomenon in which a technology produced or introduced in one country is transferred and deployed in another country, which may take place through different channels like patenting, trade, licensing and foreign direct investment, which should be encouraged to enhance productivity and economic growth among the trading partners. Under the protection of IPRs these channels encourage technology transfer and this flow of technology varies in middle and low income countries. In middle and low income countries, these technology transfer channels should be made effective through the protection and enforcement of IPRs. Therefore, the focus of the policies should be to improve the economic structure, which will be helpful for the transfer of technologies through various channels under protection of IPRs.

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These countries are selected on the basis of their different economic structure and level of development (defined by the World Bank), in order to specifically examining the objectives of the study. Moreover, for a balanced panel analysis, all these countries have all required data and information, necessary for empirical analysis. So inclusion of large number of countries, with missing observations on some variables does not support balanced data analysis.


