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ARTICLES AND TESTIMONIES

Intellectual Property Rights and Technology Transfer A Panel Study of Pakistan, India and Bangladesh

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Abstract In theory, the strong protection of Intellectual Property Protection (IPRs) would encourage technology transfer from North to South. This study examines the association between IPRs protection in developing countries like India, Pakistan and Bangladesh and technology transfers for the period 1990-2005. Using royalty and license fees as indicator for technology transfer, the study concludes that IPRs protection does encourage technology transfer to these countries. Furthermore, the results indicate positive impact of economic freedom and GDP on technology transfer. However, the impact of Diasporas on technology transfer is found negative in this study.

Keywords Intellectual Property Rights - Licensing fee - Technology transfer - Diasporas

JEL Classification O34 - F19 - L24

Introduction

The implication of the multilateral trade agreement on Trade Related Intellectual Property Rights (TRIPS) and its seven important components namely Patents, Trademarks, Copyrights, Geographical indications, Industrial designs, Layout designs and Basic principles has been exclusively discussed within the World Trade Organization (WTO) context. The Intellectual Property Rights (IPRs) regime is gaining strength in developing countries. The developed and developing countries have their own contrasting views regarding the stronger protection of IPRs. The advocates of stronger IPRs regime in developing countries argue that such regime would results in more exports, more foreign investment, technology transfer, and increase in innovation. The opponents are of the view that it is detrimental to the development process through the loss of jobs, creation of monopoly power, which ultimately leads to increase in prices, and most importantly to the technology needed for development.

The adequate enforcement of Intellectual Property Rights (IPRs) is strengthening in multilateral trade negotiations. It mostly remained one of the main concerns in North-South trade dialogues. It is hard to find the empirical literature on enforcement of IPRs and technology transfer, but theoretically this issued has been addressed. The enforcement of IPRs

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and technology transfer depends on the level of development and technological nature of economic activities. At early stage of economic development the stronger protection of IPRs would discourage the technology transfer and ultimately the industrialization (Kim, 2003, Falvey, 2006). The discourse of IPRs protection and technology transfers engender conflicting views in the context of developing countries, as is mentioned earlier, and therefore, requires empirical examination for specific developing region such as South Asia.

In addition, Diaspora is considered to be another source of technology transfer. It is argued that people settled in developed countries would invest in their home countries and thereby bring in new technology to these countries. Whether or not this is the case in South Asia has yet to be tested empirically and this paper serves this purpose as well. Likewise, remittance is also believed to invigorate technology transfer to developing world as remittances would enable people to pay the licensing and royalty fees. Once again, the matter requires empirical investigation for specific countries and region.

In light of above discussion about IPRs protection and technology transfer, this paper inspects the relationship between the IPRs and technology transfer in the presence of other control variables such as economic freedom of the world, GDP, Diasporas and remittances for a panel of three South Asian Countries namely, Pakistan, India and Bangladesh for the period 1990-2005. For this purpose, the panel Fixed Effect specification is used for analysis.

Rest of the paper is organized as follows: section 2 reviews the relevant literature; section 3 exhibits graphical representations. Data and variables and methodology are discussed in section 4. The results are presented and discussed in section 5 and conclusion and policy recommendations are provided in section 6.

1. Literature review

Technological development under the auspices of Trade Related Intellectual Property Rights (TRIPS) agreement is a contentious issue. The structure of the economy and its developmental level is the important for technology development and ultimately for technology transfers. Examining the impact of TRIPS agreement on building technology capabilities in East and South Asian economies [Rasiah (2002)] demonstrate Japan and to less extent Asian and China are will developed IPRs regime and can maintain technological development, while China is lacking the high-tech infrastructure to sustain the technological development. India, Pakistan, Sri Lanka and Vietnam overall infrastructure is too weak for technological development and weak to ensure TRIPS compliance.

Fink *et al* (2005) explains investment and licensing flows are not necessarily increases with the strengthening of IPR. Despite this fact, the developing countries with their low technical capabilities preferred global competition for capital and technology, they strengthen their IPRs regime. Branstetter *et al* (2006) examine for the US firm level data the royalty payments for technology transfer has been increase by 30% to the affiliate at the time of IPRs reforms in 16 countries. The stunning debate of North-South technology transfer and its welfare implications are still questionable. Sinha (2006) examines the weak protection of IPRs in South would flourish innovation in North, which would leads to more licensing contracts in North. This would result in more subsidiaries production or exports to South and ultimately the welfare would increase in South. Similarly, the strong patent protection in South may lead to enormous licensing and less subsidiaries production or exports.

The argument in favour of protecting the IPRs and technology transfer has been extending by Naghavi (2007), for his comprehensive analysis of welfare implication of protecting the IPR

in South through its impact on innovation, market structure and technology transfer. A strong IPR regime in South facilitates technology transfer by FDI in less R&D intensive industries. It further indigenizes innovation and deterring the Multinational Corporations (MNCs) in high technology sectors. In most of the economies the service sectors contribute enormously into the country GDP, with the growing importance of the service sectors in the economies, the protection of services sector is considerably becoming important. Maskus (2008) review the interrelationship of importance of service sectors (information technology, the internet, digital entertainment, and financial sectors) and protection of IPRs and suggest that protections of IPRs are of increasing importance in service sectors of the economies.

Wakasugi and Ito (2009) using firm level data for Japanese MNCs investigate theoretically and empirically that stronger protection of Intellectual Property Rights (IPRs) while controlling for both market specific factor in host countries as well as for parent subsidiary firm specific factors has positive effect on technology transfer from parents firm to its subsidiaries in foreign countries. Exploring the structure of the out-licensing of the Japanese firm for the destination countries [Nagaoka (2009)] examines the stronger patent protection in the recipient countries would decline the know-how licensing (pure or in bundled form) relative to that of pure patent licensing. The result visibly represents the minimal role of the patent protection in attracting the know-how licensing. In contrary, the strong patent protections in the recipient countries would declines the strength of ownership of licensor, indicating a facilitating role of technology transfer. Arshad and Samad (2010) empirical findings are optimistic about the stronger protection of IPRs increase FDI in production sector and in distribution networks. Further they emphasize that weaker institutions, corrupt bureaucracy, weaker capital concentration and employment protection are detrimental to FDI.

In contrary to the importance of IPRs protection and technological development, strengthening the IPR system for SMEs and technology transfer is ambiguous in practice. It is the business strategies of SMEs not the IPRs enforcement [Turpin and Macdonald (2007)]. Langinier and Crampes (2009) extend the argument that IPRs are legal constrains, which limit the entry in industries. It would stop the positive externalities of these new entrants for the incumbents. The IPRs protection is effective only in pharmaceutical industries and at some extent in chemical industries which represents only apart of the economy not the whole economy. Similarly, the copyrights are effective in audiovisual industry. It's not the TRIPS that widen the technology gap between the North and South but it's the absorptive capacity in the recipient countries. In nutshell [Archibugi *et al* (2010)] deter the IPR regime for technology transfer as a sufficient condition.

2. An overview of IPRs and technology transfer

In this section we give an overview of the IPR protection level and technology transfer over time in the three South Asian countries. To begin with, Figure 1 exhibits the Intellectual Property Rights (IPRs) index for the three countries for three different periods. The IPRs enforcement level index range from 0 to 5 where 5 is the maximum enforcement level. It is evident form the figure that India has a growth in IPRs index almost 66 % in 2005 which was 84 % in 2000. Pakistan growth rate is 9 % in 2005 and almost 60% in 2000. Bangladesh, however, has shown no growth.

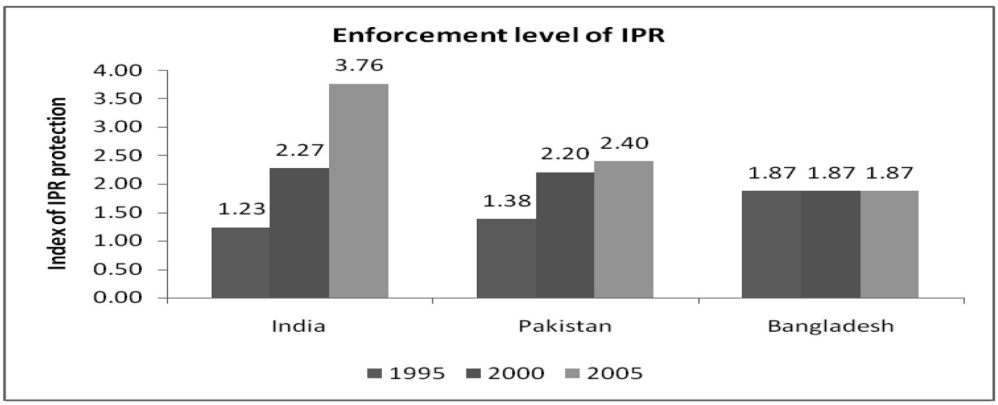

Fig. 1 Intellectual Property Rights (IPRs) Index: India, Pakistan and Bangladesh

Another important component to technology exposure is royalty and license fees. Figure 2 clearly demarcate that there has been a tremendous increase in royalty and licensing fee (technology transfer) in India over time. Similarly, Pakistan has also observed an increase in technology transfer although at a lower rate compared to India. Bangladesh growth in this regards has, nonetheless, been negligible. From these two figures, it can be seen that there is an apparent positive relationship between IPRs and technology transfer at least in Pakistan and India. Even the case of Bangladesh may be used to support this positive relationship in the sense that no increase in IPRs protection level restricts growth in technology transfer in Bangladesh.

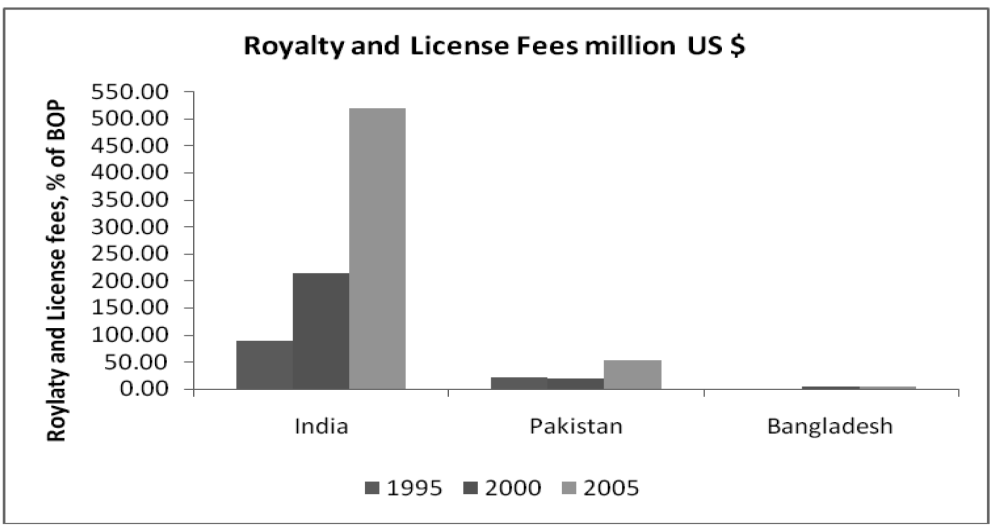

Fig. 2 Royalty and License Fees Payment: India, Pakistan and Bangladesh

3. Model specification, methodology and data

The technology progress in a country is achieved through its own technology creation or the adoption and adaption of technology created somewhere else. Technology creation and dissemination depends on the extent of a country exposition to foreign technologies by fostering foreign direct investment, imports of high technological products and intermediate including a country strong absorptive capacity in the form of macroeconomic stability and political environment and the existence of its Diasporas (Burns 2009).

Direct measuring of technological progress or achievements is difficult. Subsequently, the literature employs indirect methods such as Total Factor Productivity (TFP), scientific innovation and invention, penetration of older technologies, exposure to external technology for the measurement. The current study uses royalty and license fees payments to measure technological achievements. The remaining other three, which are imports of high-technology goods, imports of capital goods, and imports of intermediary goods are not incorporated in this paper. In order to find out the relationship between technological progress and IPRs, we estimate the following Fixed Effect Model of panel data for the three countries mention earlier.

$$RLF_{it} = \beta i + \beta_1 IPR_{it} + \beta_2 EFW_{IT} + \beta_3 GDP_{IT} + \beta_4 Diasporait + \beta_5 \text{Re}\, mit\ tan\ ces + V_{it} \ldots\ldots(A)$$

Where $V_{it} = \mu_i + \epsilon_{it}$: μ_i is the unobservable individual country specific effects and $\epsilon_{it,}$ represents other disturbances. In equation (A) RLF_{it} is the royalty and license fees used to show technological achievements; IPR is the intellectual property rights index indicating the respective enforcement level; Economic Freedom of World (EFW) depicts the economic scenarios like trade openness and economic regulations etc; GDP per capita demonstrate the absorptive capacity of the economy; Diasporas are the level of international out migration measured in number of migrated people and lastly remittances show the amount of foreign currency flown into the country.

This study uses panel data, which is useful in many ways. It controls for individual heterogeneity, give more informative data, study the dynamics of adjustment, bitterly able to indentify and measure the effects which are not simply measured in cross section and time series data (Baltagi 2005). The panel data is not the panacea for all the problems; it has certain shortcomings like designing and data collection, selectivity problems, short time series dimensions and cross section dependence. To examine the relationship between the technology transfer and IPRs enforcement level, this study applies the Pooled Least Square estimation technique to control for country specific effects.

This panel study includes three South Asian countries India, Pakistan and Bangladesh. The main reasons of this sample include the same structure of these economies, almost same developmental level, and existence of large Diasporas. The reason for excluding other countries of the region from this sample is the unavailability of data on some important variables for the same period of analysis used in this study. The five years average data is use to control the short term cyclical fluctuations and to embed the medium term economic policy era which is considered five years. The data on Royalty and License Fees Real GDP per capita and Remittances are taken form World Development Indicator (WDI, 2011). Furthermore, the data for IPRs index and Economic Freedom World (EFW) are obtained from Ginarte and Park (1997) index, which latter extended for the year (2005) and Gwartney *et al* (2010) respectively. Data on Diaspora is acquired from data bank of South Asia Migration Resource Network (SAMReN)[1] based in Bangladesh. The descriptive statistics of the variables are given in Table 1.

[1] http://www.samren.net/

Table 1 Panel Descriptive Statistics

	RLF	IPR	EFW	GDP	DP	REMT
Mean	94.38	1.84	5.49	422.58	0.10	3.15
Median	18.50	1.87	5.58	428.04	0.09	2.93
Maximum	672.00	3.76	6.68	594.76	0.21	7.15
Minimum	3.00	1.03	4.17	280.17	0.01	0.75
Std. Dev.	162.07	0.58	0.54	89.01	0.06	1.40
Skewness	2.28	1.15	-0.28	0.03	0.24	0.85
Kurtosis	7.47	4.63	3.09	1.83	1.75	3.60
Jarque-Bera	81.83	16.02	0.67	2.70	3.56	6.57
Probability	0.00	0.00	0.71	0.25	0.16	0.03
Sum	4530.26	88.48	263.97	20284.25	5.03	151.49
Sum Sq. Dev.	123460	16.19	13.84	372426.9	0.17	92.59
Observations	48	48	48	48	48	48
Cross sections	3	3	3	3	3	3

Note: RLF= Royalty and License Fee; IPR= Intellectual Property Rights; EFW= Economic Freedom of World; GDP= Gross Domestic Product; DP= Diaspora; REMT= Remittances

4. Empirical findings and discussion

We have estimated four models for the selected South Asian countries using the panel data Fixed Effect Model. The fixed effect model has been checked and corrected for Hetroscedasticity and cross section weights are applied to account for cross-section heterogeneity. The key purpose of this analysis is to check for association, if any, between IPRs protection and technology transfer in Pakistan, India and Bangladesh in the period 1990-2005. Furthermore, the study also intends to find out the nature of relationships between Diaspora and remittances, and technology transfer.

It can be observed from the first model that the coefficient of IPRs variable is positive and highly significant. This indicates that IPRs protection does encourage technology transfer to developing countries. The high significance of this variable may be interpreted in the sense that in developing countries, where IPRs enforcement is dreadfully weak, a small increase in IPRs enforcement works as a sign of encouragement to firms in developed countries and motivate them to invest in and bring technology to developing countries. Since cheap labor and low cost production are always there in developing countries to attract foreign firms, the threat of technology being plagiarized (low IPRs protection) is the only major concern for them. Hence, when they see a little improvement in IPRs enforcement, it induces to invest in these countries, which in turns become a source of technology transfer. This interpretation also validates from what we observe in section 3, which shows growth in IPRs enforcement in these countries as a whole.

The results in Table 2 further show that the economic freedom of the world is also important for technology transfer to developing world. The higher the economic freedom, the higher will be investment and trade between countries and the more will be technology transfer from

developed to developing countries. On the reverse side, if there restriction on investment in developing countries, it will reduce the transfer of technology even in the presence of intellectual property rights in these countries. Hence, economic freedom of the world is an important determinant of technology transfer.

Table 2 Estimation Results of Fixed Effect Models

Variables	Model 1	Model 2	Model 3	Model 4
Constant	-1205.60 (-17.70)***	-1250.87 (-18.71)***	-1255.687 (-15.96)***	-1268.25 (-16.91)***
IPRs	179.52 (13.47)***	183.61 (14.78)***	171.13 (12.90)***	179.70 (13.29)***
EFW	60.50 (2.30)**	91.94 (3.22)***	76.39 (2.48)**	96.00 (3.14)***
GDP	1.50 (4.67)***	1.27 (4.01)***	1.50 (4.73)***	1.29 (4.06)***
Diaspora	---	-376.28 (-2.61)**	---	-344.09 (-2.14)**
Remittances	---	---	-6.92 (-1.31)	-2.93 (-0.53)
Bangladesh	58.72***	76.26***	69.95***	79.52***
India	121.74***	86.13***	111.45***	84.81***
Pakistan	-180.47***	-162.39***	-181.40***	-164.34***
R^2	0.98	0.98	0.98	0.98
F-Stats	195.37***	222.30***	191.05***	206.52***

Note: t-stats are given in parenthesis. ***, ** and * show significance at 10%, 5% and 1% levels respectively.

It is also evident from the result in model 1 that the coefficient of GDP is positive and highly significant. This insinuates that higher GDP attracts technology to these developing countries. This result can be justified on the grounds that GDP is also an indicator of income of a country. With higher income, there will be more amounts available for licensing fee. Similarly, higher GDP will enable a country to develop its infrastructure and other facilities to create conducive environment for foreign investment. This in turns will bring in investment and with it the technology to the respective country. Since, GDPs of these three South Asian countries has been on the rise in the period under analysis, the positive relationship between GDP and technology transfer in these countries should not be astonishing.

We have also included country dummies in the analysis. These country dummies represent country-specific effects, other than those included as explanatory variables in the model. It is observable that all these country dummies are statistically significant. The positive signs of the coefficients of Bangladesh and India suggest that other country specific characteristics are conducive for technology transfer. In case of Pakistan, however, these other features of the economy are not helpful in transfer of technology. We also tested for time dummies but almost all of them were insignificant and hence were not included due to space limitation. Both the R-square and F-stats demonstrate the overall of significance of the model.

Theoretically, it is believed that the presence of Diaspora of a country is beneficial for transfer of technology to respective country. In order to examine this empirically, we included this variable in our second model. One can see that the coefficients of all the three explanatory variables as well as those of the country dummies of the previous model are robust in terms of sign, significance and magnitude. The coefficient of Diaspora, although statistically significant, has negative sign contrary to the popular belief. This may not be surprising if one look at the

role of Diaspora in technology transfer. The people who come under the Diaspora definition are actually the people who can truly be called the brain-drain. These people who are skilled and wealthy enough to bring in technology to their respective country are settled in foreign countries. Had they been in their own countries, they would have been able to play role in technology transfer by using their wealth and skills to start business in their respective country. In this sense, they are the people who can potentially play a role in technology transfer but only when they reside in their own countries. Subsequently, their becoming a Diaspora is in fact detrimental for technology transfer and that is why the sign of coefficient of this variable is negative. The more people become Diaspora, the lesser are the chances of technology transfer to these countries. the importance of this variable is in the model is evident from the F-stats whose value is higher compared to the previous model.

Although the presence of Diaspora is not beneficial in technology transfer directly, but their indirect role can still be of significance in transferring technology to their countries. This Diaspora sends remittances to their respective countries, which can be used to start business and then for paying licensing fee to transfer technology. This notion also required empirical investigation. Consequently, we included remittance as an explanatory variable in model 3. The robustness of other explanatory variables and country dummies is validated once more in model 3. Interestingly, the variable "remittances" is found insignificant in this model. Nonetheless, the result can be validated by looking at the use of remittance in these countries. Most of the remittances are used for consumption purpose including both non-durable consumption and durable consumption in the form of building houses. Likewise, they are also used for human capital accumulation through education [see, for example, Nasir *et al.* (2011)]. Although some people use these amounts for physical investment, however, these investments are largely in very small scale businesses which do not require technology transfer from other countries. Hence, the remittances received from foreign countries including those from Diaspora does not play significant role in transfer of technology as is evident from the result. The overall significance of the model is shown by F-stats. However, its value is less compare to the previous models which further imply the irrelevance of the variable "remittances".

In order to further validate the robustness of these results, both Diaspora and remittances are included in model 4. The results of this model confirm the robustness of the previous models. The coefficients of all the variables including Diaspora and remittances as well as the country dummies are robust in terms of sign, significance and magnitude. Both R-square and F-stats authenticate the model fit. However, the value of F-stats is less than model 2. This is due to the inclusion of the variable "remittances". If the F-stats criterion is used, then the best model 2 is the best model, which does not include remittances as explanatory variable. However, the reason for inclusion of this variable in model 4 is its value of t-stats in model 3 which is greater than 1. Nevertheless, putting together Diaspora and remittances in model 4 reduces the value of t-stats of remittances to less than 1. Hence, one can now safely conclude that model 2 is best model and remittance is an irrelevant variable.

5. Conclusion and policy implications

The main focus of this paper is to examine the impact of protection of intellectual property rights (IPRs) on technology transfer in selected South Asian countries namely, Pakistan, India and Bangladesh for the period 1990-2005. For this purpose, royalty and license fee payments has been used as proxy for technology transfer. The Fixed Effect Model results indicate that the enforcement level of IPRs in these developing countries encourages the royalty and license

fees and thereby technology transfers. Strong patent protection encourages licensing because it would reduce imitation risk, uncertainty and transaction cost. These results are also compatible with Javorcik (2005) findings that strong IPRs level of protection makes licensing a viable alternative to FDI.

The results further show that economic freedom of the world and greater GDP of the recipient countries also encourages transfer of technology. However, Diaspora discourages technology transfer while "remittances" has no impact on it at all. The country-specific features of Bangladesh and India are also conducive for technology transfer whereas those of Pakistan and not favorable for such transfer.

These results suggest that in order to encourage technology transfer, these developing countries will have to enforce and enhance the protection level of Intellectual Property Rights in order to give confidence to foreign firms to transfer the technology and not just do the investment. Secondly, these countries need to attract their wealthy and skilled Diaspora from the world to making them a source of transfer of technology. Thirdly, the governments should make policies and programs to educate and encourage people receiving foreign remittances to invest in businesses that could ultimately result in arriving of new technologies to these countries.

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