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Impact of Intellectual Property Rights on International Trade: Evidence from India

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This paper analyzed the effect of intellectual property rights (IPR) on Indian trade by employing Johansen's Co-integration test, VECM and Granger Causality approach. Annual time series data on variables viz. trade, patents, copyrights, trademark for Indian economy, stemming from 1996-97 to 2013-14 have been used in analysis. The empirical result shows that there exists significant long run relationship between Indian trade and export as well as import of patent related commodities It also suggests that all the series are found to be co-integrated of order one. It means export as well as import of patent related commodities are significantly contributing towards Indian trade. The short run Vector Error Correction Model (VECM) reveals that Indian Trade (LNTRADE) respond significantly to re-establish the equilibrium relationship whenever there is any disturbance in the system in long run. Further Granger causality test exhibits that there exists unidirectional causality running from Indian trade to export and import of patent related commodities, export of trademark related commodities whereas causality runs from export and import of copyright related commodities to Indian trade.

Keywords: TRIPS Agreement, intellectual property rights, patents, copyrights, trademark, Johansen Co-integration, VECM, Granger Causality Test

The Intellectual Property Rights have economic value when put into use in the marketplace.[1] Ownership right to intellectual asset covers those ideas, inventions and creative expression on which there is public willingness to bestow the status of property.[2] Intellectual property is a creation of human mind and intellect. The underlying objectives of intellectual property rights (IPRs) is to protect the creator's right to be appropriately acknowledged for his or her work, be it in the form of an invention, a manuscript, a suite of software, or a business name. The IPRs put in place a mechanism that provides the creator a means as to how their protected work is exploited, thereby ensuring that they are properly rewarded for their creative endeavors. It is argued that effective and easily enforceable IPR encourages and stimulates the creation of fresh creative works.

India being a growing country, has taken massive steps to be in conformity with Trade Related Intellectual Property Rights (TRIPS) Agreement and in fulfillment of US and European intellectual property right arrangements. The nation's capacity to absorb the existing knowledge and create new one will be the indicators of its future prosperity. Thus, efforts have been made by mankind to generate knowledge which leads to prosperity. The subjects of production, assessment, fortification and utilization of IP would become significantly essential all over the world.

The relation between IPR and trade is very significant as it has received an increasing attention in the arena of international economic policy. International trade in goods embodying IPR's has increased substantially in recent decades as the allocation of manufactures and share of high technology goods in total merchandise has increased. As a result, developing nations like India argue that expansion of IPR's would damage their self-developed technical advancement and they should continue to be free to opt out partial system of international IPR's provided by current conventions.

Table 1 and 2 show that percentage share of export of patent related commodities has increased from 3.2% in 1996-97 to 6.1% in 2013-14. Also at the same time, percentage share of import of patent related commodities has shown rise from 5.46% in 1996-97 to 11.50% in 2013-14. Further, percentage share of export and import of copyright related commodities is very less and has almost remained stagnant. Export of

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Table 1 — Percentage share of export of IPR related commodities

Patent related commodities	1996-97	2001-02	2007-08	2013-14
Aerospace	0.004	0.007	0.073	2.416
Computer office machines	1.515	0.231	0.237	0.181
Electronic telecommunications	0.154	0.566	0.782	2.389
Pharmacy	0.315	0.518	1.413	1.544
Scientific instruments	0.045	0.252	0.415	0.294
Chemistry	1.076	0.949	1.046	1.621
Electrical machinery	0.03	0.491	0.041	0.092
Non-electrical machinery	0.091	0.156	0.166	0.051
Armament	0.003	0.017	0.002	0.007
Total	3.229	3.18	4.102	6.179
Copyright related commodities				
Printed books, newspapers, journals, periodicals	0.079	0.069	0.121	0.065
Sound recording or reproducing operators operated by coins, bankcards, etc.	0.000	0.000	0.000	0.000
Video operators	0.004	0.005	0.002	0.001
Total	0.083	0.074	0.123	0.066
Trademark related commodities				
Alcoholic beverages	0.012	0.010	0.048	0.069
Perfumes and cosmetics	0.208	0.332	0.261	0.206
Glassware	0.016	0.041	0.173	0.144
Motor vehicles parts	0.463	0.620	1.330	1.349
Furniture	0.023	0.094	0.448	0.316
Travel goods and handbags	0.649	0.625	0.601	0.394
Watches	0.044	0.112	0.019	0.013
Toys	0.106	0.084	0.095	0.084
Clothes	4.578	3.354	8.516	8.490
Total	6.099	5.272	11.491	11.065

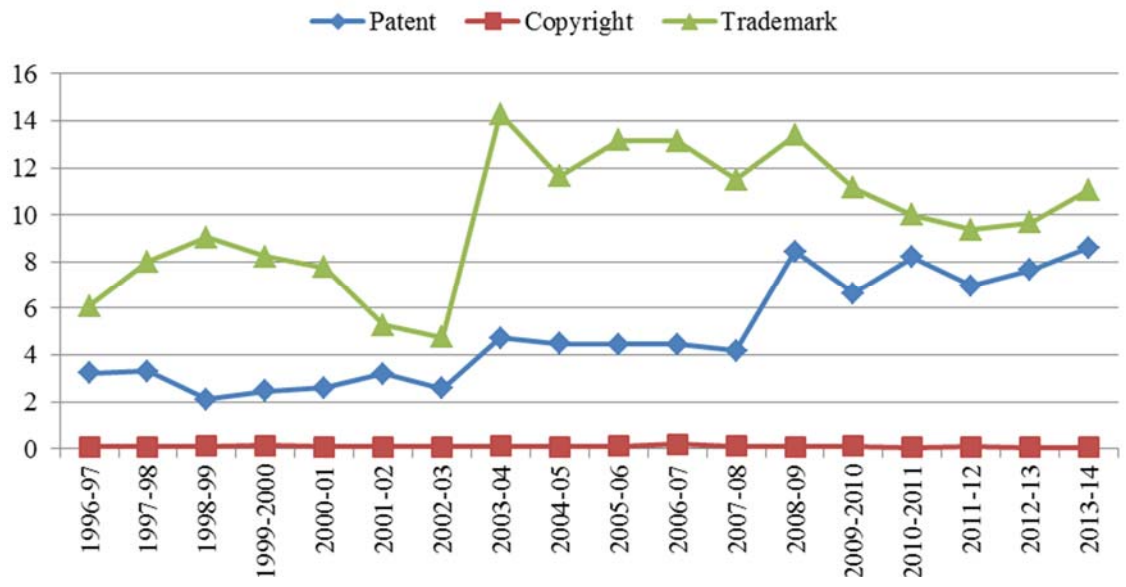

Fig. 1 — Percentage Share of Export of IPR Related Commodities

Table 2 — Percentage share of import of IPR related commodities

Patent related commodities	1996-97	2001-02	2007-08	2013-14
Aerospace	1.080	0.300	7.560	0.930
Computer office machines	1.610	4.080	3.130	3.830
Electronics telecommunications	1.190	6.270	2.510	3.060
Pharmacy	0.070	0.110	0.520	0.810
Scientific instruments	0.550	0.530	0.920	1.330
Chemistry	0.170	0.160	0.200	0.480
Electrical machinery	0.360	0.150	0.350	0.490
Non-electrical machinery	0.430	0.360	0.530	0.560
Armaments	0.000	0.000	0.000	0.010
Total	5.460	11.960	15.720	11.500
Copyright related commodities				
Printed books, newspapers, journals, periodicals	0.060	0.040	0.020	0.020
Sound recording or reproducing operators operated by coins, bank cards, etc.	0.000	0.000	0.000	0.000
Video operators	0.000	0.010	0.060	0.020
Total	0.06	0.05	0.08	0.04
Trademark related commodities				
Alcoholic beverages	0.000	0.010	0.060	0.110
Perfumes and cosmetics	0.020	0.120	0.060	0.130
Glassware	1.620	1.310	0.060	0.090
Motor vehicles parts	1.940	0.480	0.730	1.330
Furniture	0.840	0.670	0.180	0.280
Travel goods and handbags	0.000	0.010	0.030	0.090
Watches	0.000	0.010	0.040	0.090
Toys	0.880	0.660	0.040	0.170
Clothes	0.010	0.040	0.070	0.200
Total	10.630	6.600	2.540	4.980

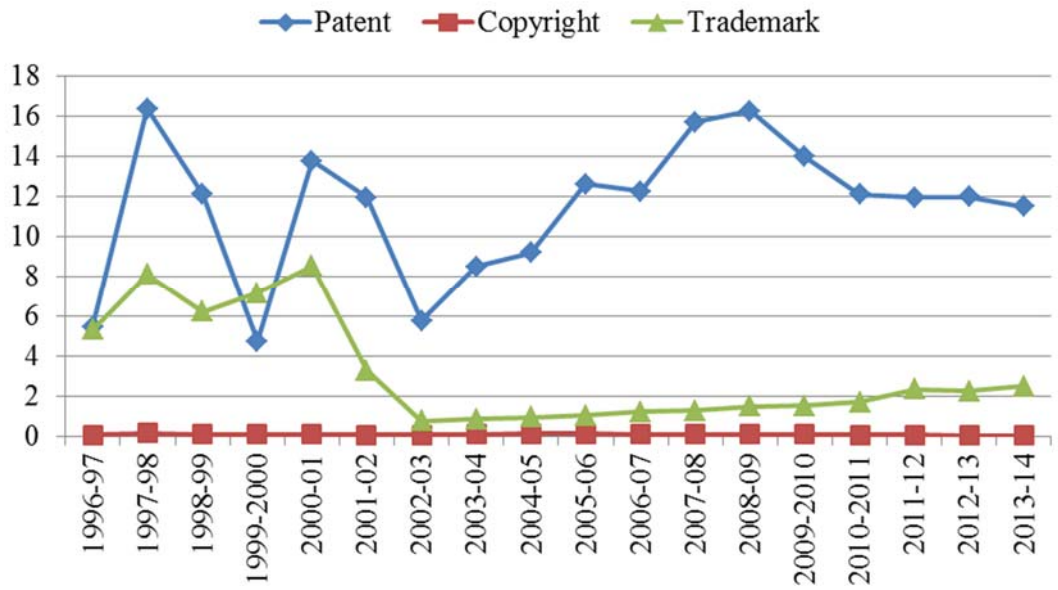

Fig. 2 — Percentage share of import of IPR related commodities

trademark related commodities has increased from 6.09% in 1996-97 to 11.06% in 2013-14 while import of trademark related commodities has decreased from 5.31% in 1996-97 to 2.49% in 2013-14.

It is clear from table and graph that strong patent rights have increased imports of patent sensitive industries (high technology industries) because of weak imitation abilities in such industries. While IPR protection has negative impact on copyright and trademark sensitive industries (low technology industries) since imports of both have shown declining trend. The industries covered under these categories, India provides less efficient IPR protection in terms of minimal punishment and poses very strong ability of imitation. The ongoing analysis suggests the enforcement of different IPR's policies. Thus, there is a need for a detailed analysis for causal linkages between trade and IPR's in India. Although there is some theoretical and descriptive work on the impact of intellectual property rights on trade. However scant attention seems to have been paid to empirically test the causal linkage between trade of India and IPRs.

Objectives

The main purpose of the study is to detect the causal linkage, if any between intellectual property rights (Patent, Copyright, Trademark) and Indian trade, which would be helpful for formulating suitable policies. Johansen Co-integration techniques along with Granger Causality have been used to test short run and long run relationship.

Several studies have attempted to estimate the impact of intellectual property rights on trade; however, the results show that the impact of IPR on trade remains ambiguous. Maskus and Penubarti (1995) used an augmented version of the Helpman-Krugman model of monopolistic competition to estimate the effect of patent protection on international trade flows. Their results, based on 1984 bilateral trade data, show that the market expansion effect dominate the market power effect as they found that higher levels of patent protection have a positive impact on manufacturing exports of OECD nations to developing countries.[3] Maskus and Penubarti (1997) found that the impact on trade volumes depend on patent amendments, market size and reduction in imitation threats. Studies found that stronger IPR enforcement increased US-export to nations with strong imitative abilities (market expansion effect) but reduced US exports to countries with weak imitative abilities (market power effect).[4] Smith (1999) further extends this line of inquiry by exploring the effect of the threat of imitation in the importing countries and reveals that the threat of imitation is weakest in countries with weak imitative abilities and strong patent laws and is strongest in countries with strong imitative abilities and weak patent laws. The market expansion effect is expected to be more pronounced in the market with high threat of imitation.[5] Using US manufacturing exports data, Smith (2001) showed that the link between patent rights protection and international trade depends on the ability of the importer to imitate the exporter's technology.[6] In addition, Fink and Braga (1999) examined the IPR and trade nexus using 1992 data for a cross-section of 89 countries and found that stronger patent rights increase bilateral flows of manufactured non-fuel imports. They noted that the positive link is weaker for trade in the high-technology sectors.[7] Other studies (Lesser, 2001; Rafiquzzaman (2002); Park and Lippoldt, 2003) on the relationship between patent rights and trade flows to developing countries draw similar conclusions.[8-10] Al-Mawali (2005), and Liu and Lin (2005) found that stronger IPR protection increased exports to those nations that posed a strong threat of imitation and reduced exports to nations that posed weak threat of imitation.[11,12] Yang and Huang (2009) revealed that the market expansion effect prevailed over the market power effect on Taiwan's exports to developed and developing countries. Particularly, this effect was stronger for high-tech exports than that for non-high-tech exports.[13] Delgado *et al*. (2013) concluded that the increase in imports by developing countries was driven by the exchange with high-income countries, which was concentrated in the information and communications technology sector. These findings suggest that the effect of TRIPS in promoting knowledge diffusion from high-income countries to developing countries varied from sector to sector.[14]

Existing studies deal mainly with two impacts. One, the market expansion effect, IPR protection reduces imitation in importing countries which leads to increase in exports while slowing down the technological acquisition and development in importing country. Two, market power effect causes the countries that receives IPR protection to reduce bilateral exchange by ensuring temporary monopoly over protected knowledge. Hence firms with strong patent rights in foreign market can exercise their market power by restricting quantity and increasing the

unit price of bilateral exchange to that market. These studies focused on advanced or developed nations as exporters and importers. Little empirical research has been undertaken from the perspective of developing countries as exporters and importers.

Database

The present study is based on secondary data. The data for patent, copyright, trademark related products have been taken from Foreign Trade Statistics of India for the period 1996-97 to 2013-14. Furthermore, all the series are transformed into log form. Those product groups have been selected which are vulnerable to patent, copyright or trademark. The commodities selected are based on *Standard International Trade Classification (SITC- Rev IV)*.

We estimated trade by applying following formula:

Trade = Exports + Imports

Furthermore, all the series have been deflated into real terms to minimize price effect and expressed in natural logarithm. Log alteration can lessen the difficulty of heteroscedasticity because it compresses the scale in which the variables are calculated, thereby reducing a ten times dissimilarity among two values to a twofold differentiation (Gujarati, 1995). The following time series are analyzed in this study:

LNPTX = Log of export of patent related commodities

LNCRX = Log of export of copyright related commodities

LNTRX = Log of export of trademark related commodities

Table 3 — Standard International Trade Classification (SITC-Rev IV)

Patent related products	
Product name	SITC Revision IV codes
Aerospace	(714-714.89-714.99)+, 792.1+, 792.2+, 792.3+, 792.4+, 792.5+, 792.91+, 792.93+, 874.11
Computers office machines	751.94+, 751.95+, 752+, 759.97
Electronics telecommunications	763.31+, 763.8+, (764-764.93-764.99)+, 772.2+, 772.61+, 773.18+, 776.25+, 776.27+, 776.3+, 776.4+, 776.8+, 898.44+, 898.46
Pharmacy	541.3+, 541.5+, 541.6+, 542.1+, 542.2
Scientific instruments	774+, 871+, 872.11+, (874-874.11-874.2)+, 881.11+, 881.21+, 884.11+, 884.19+, (899.6-899.65-899.69)
Chemistry	522.22+, 522.23+, 522.29+, 522.69+, 525+, 531+, 574.33+, 591
Electrical machinery	(778.6-778.61-778.66-778.69)+, 778.7+, 778.84
Non-electrical machinery	714.89+, 714.99+, 718.7+, 728.47+, 731.1+, 731.31+, 731.35+, 731.42+, 731.44+, 731.51+, 731.53+, 731.61+, 731.63+, 731.65+, 733.12+, 733.14+, 733.16+, 735.9+, 737.33+, 737.35
Armaments	891
Copyright related products	
Product name	SITC Revision IV codes
Printed books, newspaper, journals, periodicals	892.2+
Sound and audio-visual recording	763+
Trademark related products	
Product name	SITC Revision IV codes
Alcoholic beverages	112+
Perfumes and cosmetics	553+
Glassware	665+
Motor vehicles parts	784+
Furniture	821+
Travel good, handbags	831+
Watches	885.3+, 885.4+, 8885.5 +
Toys	894.2+, 894.3+, 894.4+, 894.6+
Clothes	841+, 842+, 843+, 844+, 845+, 846+, 848+

The trade data has been sourced from *Handbook of Statistics on Indian Economy*

LNPT1 = Log of import of patent related commodities

LNCRI = Log of import of copyright related commodities

LNTRI = Log of import of trademark related commodities

LNTRADE = Log of total Indian trade

All the econometric assessments in this paper are carried out by means of Eviews 6.

Unit Root Test

To examine whether the data are stationary or not, the Augmented Dicky Fuller (ADF) and Phillip-Perron tests were conducted. For each of ADF and PP tests, the null hypothesis was that the variable under study has a unit root, whereas the alternative hypothesis was that it does not have it. That is,

H_0: Time series possess a unit root (*i.e.,* it is Non-stationary)

H_1: Time series does not possess a unit root (*i.e.,* it is stationary)

The model for ADF is specified below:

$$\Delta Y_t = \alpha + \beta T + \delta Y_{t-1} + \sum_{i=1}^{p} d_t \Delta Y_{t-1} + \varepsilon_t$$

where, Y_t is variable considered, T is the time based value and $\varepsilon_t$is an error term. The coefficients, α, β and δ represent unknowns of the model to be estimated from the available data.

Phillip and Perron used non- parametric statistical method to take care of the serial association in the error term without adding lagged difference terms. The asymptotic distribution of PP test is the same as ADF test statistic.[15]

Co-integration Test

The study used Johansen and Juselious (1990)[16] co-integration method for examining long-run relationship among the variables. This method can be used for testing co-integration of I (1) time series data. The test permits more than one co-integrating relationship and is thus most extensively used compared to the other approaches. This approach is explained on the basis of two test statistics*, viz.,* the Trace Test Statistic and the Maximum Eigen Value Test Statistic as indicated below:

Trace Test Statistic

The hypothesis of trace statistics is as follows:

H_0:Number of CI ≤ r

H_1:Number of CI > r

where CI refers to co-integrating relations and r refers to the number of co-integrating vectors.

The trace test is specified as:

$$\lambda_{trace}(r) = -N \sum_{i=r+1}^{k} \log(1-\lambda_i)$$

where 'N' is the number of observations, r is the numeric value of co-integrating vectors, k is the numeric value of variables, and λs are the *eigen values*.

Maximum Eigen Value Test

The hypothesis of Maximum Eigen Value Test Statistic is as follows:

H_0:Number of CI = r

H_1:Number of CI = r+1

Where, again, CI refers to co-integrating relations and r refers to the number of co-integrating vectors.

Maximum Eigen Value Test is specified as:

$$\lambda_m(r, r+1) = -N \log(1-\lambda_{r+1})$$

where 'N' is the number of observations, r is the number of co-integrating vectors, and □s are the *eigen values*.

Vector Error Correction Model

After obtaining co-integration among variables, we then estimate error correction model for growth. It can be expressed as:

$$\Delta Y_t = \beta_0 + \beta_1 \Delta X_t + \gamma(X_{t-1} - Y_{t-1}) + \mu_t$$

Where $\Delta X_t = X_t - X_{t-1}$

This is characteristic error correction specification where change in one variable is related to change in another variable as well as gap between variables in previous period. The ordinary least square method is used which is a prominent one in most of the estimation techniques.

The Granger Causality Test

Granger's analysis was used to identify the leading and lagging variables. As per the test procedure, if previous values of a variable X_t is a significant factor to estimate the value of another variable Y_{t+1} then X_t is said to Granger cause Y_t and *vice versa*.

The null and alternative hypothesis of Granger's causality is as follows:

H_0: X_t does not *Granger cause* Y_t

H_1 : X_t *Granger causes* Y_t

Suppose the variable X_t andY_t are stationary; then the following model holds:

$$Y_t = \alpha + \beta Y_{t-1} + \gamma X_{t-1} + \varepsilon_t$$

This model shows that last period's value of X (along with last period's value of Y) has a significant explanatory power for explaining current period's value of Y. The co-efficient $\gamma$is a measure of influence of X_{t-1} on Y. If $\gamma = 0$, then past values of X do not have any significant effect on Y. In other words, X does not *Granger cause* Y. The same process was then repeated after interchanging the series X_t and Y_t.

Results and Discussion

The results of ADF test, as presented in Table 4 indicates that time series data on all the variables is non-stationary at levels, but the series have been found stationary at first difference *i.e.* integrated of order one I (1). Hence, we move forward towards second step, which requires that whether there exists any long run affiliation among the variables or not. In other words, time series is co-integrated or not.

Co-integration

Since stationary results confirmed that all the variables are integrated of order1 *i.e.* I (1), therefore, variables might have long run relationships and to test the long run connection among variables bivariate co-integration has been applied. Before identifying number of co-integration vectors, we first used VAR test in order to decide the most favorable lag length. The Akaike information measure, Schwarz Information criterion, Hannan-Quinin Information criterion indicated that one year lag is the most favorable lag length for Johansen co-integration test. Table 5 shows the results obtained through trace statistic and maximum eigen value statistic. Specifically, the trace statistic and maximum eigen value statistic were used to examine number of co-integrating vectors among the group of variables considered. The Trace Test indicated three co-integrating equations and the Maximum Eigen value statistic identified one co-integrating equation (Table 5). The results have thus pointed towards the presence of co-integration among variables, which amounts to saying that there existed long-run equilibrium relationship between Indian trade (LNTRADE) and export as well as import of IPR

Table 4 — Stationarity (unit root) Test for Variables (ADF test)

Part A: Export of IPR related commodities							
Variables		Test statistics	1%	5%	10%	p-value	Result
LNPTX	At levels	-0.02	-3.92	-3.06	-2.67	0.942	Reject Null Hypothesis
	At difference	-5.97*	-3.92	-3.06	-2.57	0.002	
LNTRX	At levels	-1.24	-3.88	-3.05	-2.66	0.6305	Reject Null Hypothesis
	At difference	-4.66*	-3.92	-3.06	-2.67	0.0024	
LNCRX	At levels	-1.97	-4.61	-3.71	-3.29	0.5705	Reject Null Hypothesis
	At difference	-5.03*	-4.72	-3.75	-3.32	0.0060	
Part B: Import of IPR Related Commodities							
Variables		Test statistics	1%	5%	10%	p-value	Result
LNPTI	At levels	-2.29	-3.88	-3.05	2.66	0.1849	Reject Null Hypothesis
	At difference	-5.70*	-3.92	-3.06	-2.67	0.0003	
LNTRI	At levels	-1.95	-3.92	-3.06	-2.67	0.2998	Reject Null Hypothesis
	At difference	-2.87***	-3.92	-3.06	-2.67	0.0708	
LNCRI	At levels	-1.52	-4.66	-3.73	-3.31	0.7760	Reject Null Hypothesis
	At difference	-2.94***	-4.72	-3.75	-3.32	0.0776	
Part C: Dependent variable: Indian trade							
Variables		Test statistics	1%	5%	10%	p-value	Result
LNTRADE	At levels	-1.55	-3.88	-3.05	-2.66	0.4826	Reject Null Hypothesis
	At difference	-3.29**	-3.92	-3.06	-2.67	0.0317	

*Note: *,** and *** denote statistical significance at 1%, 5%and 10% levels of significance respectively.*

related commodities (LNPTX, LNTRX, LNCRX, LPTI, LNTRI, LNCRI).

After having examined long-run equilibrium relationship between study variables, an attempt was made to study short- run dynamics among the variables as well. For this purpose, Vector Error Correction Modelling was adopted (Table 6).

Assuming one co-integration vector, the long run and short run relationship between the given variables has been estimated based on Vector Error Correction Model (VECM) which is based on Johansen co-integration methodology. The results of Part A of Table 6 i.e. export of IPR related commodities shows that there exists long run relationship between export of IPR related commodities (LNPTX, LNTRX, LNCRX) and Indian Trade (LNTRADE). It may be mentioned that the estimated co-integrating co-efficient for Indian trade based on first normalized Eigen vector represent long term elasticity co-efficient. The co-integration relationship could be re-expressed in equation form, as follows:

LNTRADE=-10.693+(-0.5670) * LNPTX+0.0931 LNTRX + (-0.0670) LNCRX … 6.1

Table 5 — Results of Johansen's Co-integration test

Part A: Export of IPR related commodities

Hypothesized No. of C.E(s)	Eigen Value	Trace Statistic	0.05 Critical Value	p-value#	Max-Eigen Statistic	0.05 Critical Value	p-value#
None*	0.8676	74.340	47.856	0.0000	32.3556	27.584	0.0112
At most 1*	0.7643	41.984	29.797	0.0012	23.3301	21.131	0.0241
At most 2*	0.6434	18.654	15.494	0.0161	16.5017	14.264	0.0218
At most 3	0.1258	2.152	3.841	0.1423	2.1527	3.841	0.1423

Part B: Import of IPR related commodities

Hypothesized No. of C.E(s)	Eigen Value	Trace Statistic	0.05 Critical Value	p-value#	Max-Eigen Statistic	0.05 Critical Value	p-value#
None*	0.8315	52.391	47.856	0.0176	28.4999	27.584	0.0381
At most 1	0.5615	23.891	29.797	0.2051	13.1925	21.131	0.4347
At most 2	0.3293	10.699	15.494	0.2307	6.3910	14.264	0.5636
At most 3*	0.2360	4.308	3.841	0.0379	4.3080	3.841	0.0376

* denotes rejection of the hypothesis at the 0.05 level. # Mackinnon- Haug- Michelis (1999)

Table 6 — Results of Vector Error Correction Model

Part A: Export of IPR Related Commodities

Normalized Co-integration Co-efficient

LNTRADE (-1)	LNPTX (-1)	LNTRX (-1)	LNCRX (-1)	Constant
1.0000	-0.567075	0.093188	-0.067067	-10.69386
Standard errors	0.04528	0.07399	0.06728	
t-statistics	-12.5226	1.25939	-0.99686	

Co-efficient of Error Correction Term

Error correction	D(LNTRADE)	D(LNPTX)	D(LNTRX)	D(LNCRX)
Co-integration Eq 1	-0.17987	2.09212	-0.50490	-1.70901
Standard errors	0.23291	0.77616	1.21792	1.0727
t-statistics	-0.77229	2.71647	-0.41456	-1.59386
p-value	0.4445	0.0097	0.6807	0.1188

Part B: Import of IPR Related Commodities

Normalized Co-integration Co-efficient

LNTRADE (-1)	LNPTI (-1)	LNTRI (-1)	LNCRI (-1)	Constant
1.0000	-0.86609	0.43800	0.129008	-12.0972
Standard error	0.22718	0.13486	0.15582	
t-statistics	-3.81237	3.24786	0.82794	

Co-efficient of Error Correction Term

Error correction	D(LNTRADE)	D(LNPTI)	D(LNTRI)	D(LNCRI)
Co-integration Eq 1	-0.28063	0.495052	-0.7772	-0.53956
Standard errors	0.05802	0.47941	0.52288	0.41390
t-statistics	-483717	1.03264	-1.48641	-1.30361
p-value	0.0000	0.3080	0.1450	0.1998

Equation 6.1 shows that export of patent related commodities (LNPTX) and export of copyright related commodities (LNCRX) had a positive short-run relationship with Indian Trade (LNTRADE) whereas export of trademark related commodities (LNTRX) had a negative relationship with the Indian Trade (LNTRADE). All the explanatory variables were statistically significant in explaining variations in Indian Trade, since their t-values (in absolute terms) happened to exceed 2. The sign of error correction co-efficient in determination of Indian Trade was negative (-0.17987) and the corresponding t-value and p-value were -0.77229and 0.445 respectively. This indicates that in case of any disturbance in the long run nearly 18% corrections to disequilibrium would take place in every short period.

Further Part B of Table-6 indicates that there exists long run relationship between import of IPR related commodities (LNPTI, LNTRI, LNCRI) and Indian Trade (LNTRADE). Thus, the co-integration relationship can be re-expressed in equation from is as follows:

LNTRADE = - 12.097 + (-0.8666) *
LNPTI + 0.438 LNTRI + 0.129 LNCRI … 6.2

Equation 6.2 shows that import of patent related commodities (LNPTX) had a positive short-run relationship with Indian Trade (LNTRADE) whereas import of trademark related commodities (LNTRX) and import of copyright related commodities (LNCRX) had a negative relationship with the Indian Trade (LNTRADE). All the explanatory variables were statistically significant in explaining variations in Indian Trade, since their t-values (in absolute terms) happened to exceed 2. The sign of error correction co-efficient in determination of Indian Trade was negative (-0.28063) and the corresponding t-value and p-value were -4.8371and 0.000 respectively. This indicates that in case of any disturbance in the long run nearly 28% corrections to disequilibrium would take place in every short period.

Before going in for the Causality Analysis, the error terms obtained from the VECM specification were subjected to three diagnostic tests, namely of (a) absence of serial correlation, (b) normality (c) absence of heteroscedasticity. These diagnostic tests were performed *via* Langrangian Multiplier Test (for Serial Auto-correlation), Jarque- Bera Test (for Normality) and Chi-square test (for Heteroscedasticity), respectively (Table 7). Non significance of each of the test statistics (as assessed through corresponding p-value) indicated that export as well as import of IPRrelated commodities passed each of the three tests. That is, there are no problems of (a) Auto-correlation (b) Non-normality (c) Heteroscedasticity.

Subsequently, an attempt was made to carry out pairwise Granger's Causality Analysis between import of Patent Related Commodities and Indian Trade, the results of which have been put in Table 8.

Granger Causality Test

Results of Pairwise Granger Causality Test are presented in Table 8.

The results shows that there exists causal relationship between Indian Trade (LNTRADE) and IPR related commodities such as Export and Import of Patented goods (LNPTX, LNPTI), Export and Import of Copyright Goods (LNCRX, LNCRI) and Export and (LNTRX). LNTRADE is a dominant variable as far as Export and Import of Patented goods (LNPTX, LNPTI) and export of trademark related commodities (LNTRX) are concerned. All the three variables LNPTX, LNPTI & LNTRX are being influenced by LNTRADE. Equivalently, Indian Trade has a significant and stable long run impact on export as well as import of patent related commodities and export of trademark related commodities. Further, it also shows that due to increase in trade volumes there will be

Table 7 — Diagnostic Test Results

Part A: Export of IPR related commodities			Result
Test Statistics	Null Hypothesis (H_0)	p-value	
(LM-Stat) (8.62)	No serial correlation	0.9282	Cannot Reject H_0
Jarque Bera (9.30)	There is normal distribution	0.1913	Cannot Reject H_0
χ^2 (88.85)	No Heteroscedasticity	0.7798	Cannot Reject H_0
Part B: Import of IPR Related Commodities			
LM-Stat (23.20)	No serial correlation	0.1083	Cannot Reject H_0
Jarque Bera (6.52)	There is normal distribution	0.5886	Cannot Reject H_0
χ^2 (111.14)	No Heteroscedasticity	0.2098	Cannot Reject H_0

Table 8 — Pairwise Granger Causality Test Results

Null Hypothesis	F-Statistic	p-value	Causality	Relationship
LNPTX *does not Granger Cause* LNTRADE	1.8716	0.1928	-	Uni-directional
LNTRADE *does not Granger Cause* LNPTX	15.6717	0.0014	LNTRADE→LNPTX	
LNPTI *does not Granger Cause* LNTRADE	0.8572	0.3702	-	Uni-directional
LNTRADE *does not Granger Cause* LNPTI	10.238	0.0064	LNTRADE→LNPTI	
LNCRX *does not Granger Cause* LNTRADE	9.9019	0.0071	LNCRX→LNTRADE	Uni-directional
LNTRADE *does not Granger Cause* LNCRX	1.7967	0.2014	-	
LNCRI *does not Granger Cause* LNTRADE	5.5850	0.0331	LNCRI→LNTRADE	Uni-directional
LNTRADE *does not Granger Cause* LNCRI	0.7592	0.3983	-	
LNTRX *does not Granger Cause* LNTRADE	1.9061	0.1890	-	Uni-directional
LNTRADE *does not Granger Cause* LNTRX	3.4938	0.0827	LNTRADE→LNTRX	
LNTRI *does not Granger Cause* LNTRADE	2.1765	0.1623	-	No
LNTRADE *does not Granger Cause* LNTRI	0.5572	0.4677	-	

increase in Export as well as Import of Patented goods and export of trademark related commodities. But LNTRADE is not being influenced by movements in these three commodity groups. Thus, there is a uni-directional causal relationship from LNTRADE towards Export and Import of Patented goods (LNPTX, LNPTI) and export of trademark related commodities (LNTRX). On the other hand, Export and Import of Copyright Goods (LNCRX, LNCRI) both are driving Indian Trade (LNTRADE) whereas LNCRX & LNCRI are not being affected by shocks of Indian Trade. Thus, this commodity group (LNCRX, LNCRI) is active enough to predict direction of trade and not influenced by rise or decline of trade volumes of India. No causal linkage could however be detected between each of import of trademark related commodities (LNTRI) with Indian Trade.

Conclusion

The Augmented Dickey Fuller Test confirms that all the series are found to be non-stationary at levels but stationary at first difference. Thus, all the series considered for estimating the model is integrated of same order i.e. I (1).

The co-integration test confirms that there exists stable long run equilibrium between Indian Trade and export as well as import of IPR related commodities. It also suggests that all the series are found to be co-integrated of order one. The short run Vector Error Correction Model exhibited that the speed of adjustment towards long run equilibrium is low. That means, in case of any disturbance in the system in long run, only 18% correction to dis-equilibrium would take place in every short period by export of IPR related commodities. On the other hand, 28% correction to dis-equilibrium would take place in every short period by import of IPR related commodities.

Further Granger Causality Test reveals that trade is a dominant variable and is driving export-import of patent related commodities as well as export of trademark related commodities Thus, there is a uni-directional relationship running from Indian trade to both export as well as import of patent related commodities and export of trademark related commodities. On the other hand, both export as well as import of copyright related commodities are driving Indian trade. This shows that strong patent rights has increased imports to India in patent sensitive industries (high technology industries) since India has weak imitation abilities in such industries while IPR protection has negative impact on Copyright and Trademark sensitive industries (low technology industries) since the imports of both the industries have shown declining trend. In both industries, India provides less efficient IPR protection in terms of minimal punishment and meanwhile poses very strong ability of imitation. Thus, to have favorable impact on Indian economy, Patent Law, Copyright Law and Trademark law should be made more stringent which will make India an attractive destination for technology transfers and Foreign Direct Investments. In nutshell, it can be said that to have favorable impact upon and further uptrend in India's economic growth, in addition to stronger IPR protection, other complementary factors such as high level of research and development expenditure, quality legal institutions and improved physical infrastructure are also needed for narrowing down technology gap between India and developed

nations. This will contribute towards India's economic growth.

Policy Implications

In the light of the findings of Granger's causality analysis, it is imperative that government should adopt trade-promoting policies which expectedly will give a boost to export as well as import of patent related commodities.

Exports as well as imports of Copyright related commodities were observed to have played a very important role in economic growth in India. Hence, there is a need to give further impetus to trade of copyright commodities for the growth of Indian economy.

Exports as well as imports of Trademark related commodities and Indian trade relationship analysis has shown that Indian trade has grown enough to support trade- led growth hypothesis in the Indian context. Thus, there is a need for more trademark amendments to ensure some sort of stability in exports as well as well as imports of item like glassware, watches and toys.

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