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Trade Liberalization and Industrial Growth in India: A Cointegration Analysis

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ABSTRACT.

India adopted a liberal economic regime, particularly in the areas of trade, since 1991. This study seeks to evaluate the impact of liberalization on the country's industrial growth by analyzing the 1970-2010 data with the help of cointegration and error correction methods. The empirical results suggest that long-run industrial growth in India is largely explained by its major determinants of the real capital stock, the labour force, real exports, the tariff collection rate and the secondary school enrolment ratio.

The short -term dynamic behavior of India growth function of industrial value added has been investigated by estimating an error correction model in which the error correction term has been found to be correctly signed and Statistically significant.

KEYWORDS:

liberalization, Industrial growth, cointegration

INTRODUCTION:

In the year 1991, India opted for a major breakaway from past strategies of economic developing. It opened its market for foreigner investors and companies as opposed to a regular regime characterized by high tariff rate and export and import restrictions. In fact, India chose a state- led industrialization strategy which involved economic planning, high protectionism, and regulation of economic activity (Bajpai & Sachs, 1997, P.137; Mishra& Kumar, 2005). The early plans have emphasized on industrialization and import substitution strategy that followed a Harrod- domar model incorporated for a closed economy (Bhagwati & Chakravarty, 1969, P.4; Narayana &Parikh, 1999).

In during different strategies of development and eleven development plans, industrial growth has been concentrated by policy makers in India. In this article empirically investigates the effect of trade liberalization in 1991 year on industrial growth. It covers a wide time period of 41 years from 1970 to 2010 with using an endogenous growth model and dependent variable as industrial value added and

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independent variables such as export, import, labor force, physical capital, import tariff rate and human capital.

1. Review of Previous Research Finding

Ynikkaya (2003) estimated the effect of trade liberalization on per capita income growth for 120 countries for the period 1970 to 1997. He used two types of trade openness measures. The first openness measure was estimated by using trade volumes which include different ratios of trade variables (exports, imports, exports plus imports and trade with developed countries) with GDP. Another measure based on trade restrictiveness estimated by calculating restrictions on foreign exchange on bilateral payments and current transactions. The results of the GMM (Generalize Method of Movement) estimates showed that first group of openness, based on trade volumes were significant and positively related with per capita growth. However, for developing countries openness based on trade restrictions were also significant and positively related with per capita growth. He therefore concluded that trade restrictions in developing countries may cause faster GDP growth.

Afonso (2001) examined the studies, since Adam Smith, on the impact of international trade on economic growth. He remarked that the theory of economic growth and the theory of international trade, during the 'classic period', constituted two inseparable branches of economics. Also in this period, it was believed that international trade has a positive effect on the economic growth. Later, during the 'neoclassic period', these two theories of the economic thought became autonomous relatively to each other. He got result studying that the importance of international trade was neglected in the context of economic growth, especially until the 1960's. He mentions with the introduction of models of endogenous growth, both theories have merged again. He believes that the new models have allowed us to obtain a better understanding of the relation between economic growth and international trade.

Edwards (1992) used a cross country data set to analyze the relations between trade openness (trade intervention and distortions) and GDP growth of 30 developing countries over the period 1970 to 1982. In his model he used two basic sets of trade policy indicators, constructed by Leamer (1988). The first set refers to openness and measures of trade policy (tariff and Non Tariff Barriers - NTB) which restrict imports. The second set measures trade intervention and captured the extent to which trade policy distorted trade. The results of the model, estimated by OLS, showed that all the four openness indicators were positively related with real per capita GDP growth, while trade intervention indexes were found significantly negatively associated with GDP growth. These studies support the hypothesis that countries with a more open trade regime have tended to grow faster, and a more distorted trade regime will tend to grow slower.

Paulino (2002) examined the impact of trade liberalization on export growth for a sample of 22 developing economies between1972 to1998. He used a typical export growth function, which postulate that exports volume depends upon real exchange rate and world income. Trade openness is measured in

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two ways. First by the ratio of export duties to total export, as indicator of the degree of anti-export bias and second by a dummy variable of timing of the introduction of trade liberalization measures. The results of OLS estimate showed export duty significant with negative sign and the dummy variable is also significant with a positive sign. Therefore it was concluded that exports grow faster in open economies.

Kumari (2005) attempted to analyze the effect of economic liberalizations on pattern of sources of growth of output of Indian manufacturing industry from a demand side perspective. He considers the output growth into its four sources: domestic demand expansion, export expansion, import substitution and intermediate demand expansion due to change in input-output coefficient. The basic data used for this study has been the input-output tables for 1983-84, 1989-90 and 1997-98. The analysis has been done separately for the pre-liberalization period, 1983-84 to 1989-90, and the post-liberalization period, 1989-90 to 1997-98, to examine the changing pattern in the sources of growth of output as a result of policy liberalization and structural reforms during the 1990's. The nominal values of the variables have been deflated. The study found that output growth in manufacturing industry has been mainly driven by domestic demand expansion followed by contribution of export expansion during both pre-liberalization as well as post-liberalization period, but after liberalization the contribution of both domestic demand expansion and export expansion has increased.

Sultan (2008) considers industry value added as a possible source of economic growth in additional to export and import. The key research questions of this study are: to what extent trade and industry value added contribute to the economic growth of Bangladesh? Are there any causal and long run relationship among export, import, industrial value added and gross domestic product in Bangladesh? The regression results show that the growth rate of industrial value added can contribute more than the growth rate of export and import to increasing the growth rate of GDP for Bangladesh also this research find that there is cointegration and a long run relationship between GDP and industry value added in the bivariate cointegration test. The result clearly show that only that only import and /or export cannot contribute to the economic growth unless industrial sector is taken into account.

Dutta and Ahmed (2006) analyze the relationship between trade policies and industrial growth in Pakistan during the period 1973 -1995. The cointegration and error correction modelling approaches have been applied. The empirical results suggest that there exists a unique long-run relationship among the aggregate growth function of industrial value added and its major determinants of the real capital stock, the labour force, real exports, the import tariff collection rate and the secondary school enrolment ratio. The short -term dynamic behaviour of Pakistan's growth function of industrial value added has been investigated by estimating an error correction model in which the error correction term has been found to be correctly signed and statistically significant.

Ellahi, Mehmood,& Ahmed(2010) attempted to investigate the empirical relationship among the trade openness, industrial value added and economic growth of Pakistan. Annual time series data set (1980 to 2009) was utilized to observe the connections amongst the indicators of interest. Moreover, unit

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root test was applied to determine the time series properties while OLS technique of estimation and Granger causality tests were employed to find out direction of causality. The results inferred from the econometric model articulated that imports and exports affect positively to economic growth till the industrial value added are taken into account. It is concluded and recommended from the outcomes of the study that the developing countries must adopt and pursue trade openness and liberalization to strengthen their economies and consequently enhance the living standards of their population.

2. Conceptual clarification

Trade liberalization

Free trade is a policy by which a government does not discriminate against imports or interfere with exports by applying tariffs (to imports) or subsidies (to exports) or quotas. According to the law of comparative advantage, the policy permits trading partners' mutual gains from trade of goods and services.

Under a free trade policy, prices emerge from supply and demand, and are the sole determinant of resource allocation. 'Free' trade differs from other forms of trade policy where the allocation of goods and services among trading countries are determined by price strategies that may differ from those that would emerge under deregulation. These governed prices are the result of government intervention in the market through price adjustments or supply restrictions, including protectionist policies. Such government interventions can increase as well as decrease the cost of goods and services to both consumers and producers. Since the mid-20th century, nations have increasingly reduced tariff barriers and currency restrictions on international trade. Other barriers, however, that may be equally effective in hindering trade include import quotas, taxes, and diverse means of subsidizing domestic industries. Interventions include subsidies, taxes and tariffs, non-tariff barriers, such as regulatory legislation and import quotas, and even inter-government managed trade agreements such as the North American Free Trade Agreement (NAFTA) and Central America Free Trade Agreement (CAFTA) (contrary to their formal titles) and any governmental market intervention resulting in artificial prices.

In fact, trade liberalization policy is defined the removal or reduction of restrictions or barriers on the free exchange of goods between nations. This includes the removal or reduction of both tariff (duties and surcharges) and non-tariff obstacles (like licensing rules, quotas and other requirements). In general, liberalization refers to a relaxation of previous government restrictions, usually in areas of social or economic policy.

Endogenous Growth Model

Much of the recent literature distinguishes between exogenous and endogenous growth models. The endogenous growth model was developed by Solow (1956) and Swan (1956). It shows that if there

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were no technological progress, then diminishing returns would eventually cause economic growth to cease (Aghion & Howitt, 1998). According to Lucas (1998), the 'engine' of growth is human capital and the human capital accumulation raise has positive effect on productivity of both labour and physical capital. This is the main feature of the Lucas model that provided the first human capital approach to endogenous growth. The basic idea of the model is that people divide their time between work and training. So, there is a trade-off, since when taking on training people give up part of their work income, but raise their future productivity, and therefore their future wages.

According to Dutta and Ahmed (2006) 'endogenous growth theory has provided a more convincing and rigorous conceptual framework for the analysis of the relationship between trade policies and economic growth'.

Let L_t be the number of workers, q_t be a measure of the average quality of workers and u be the fraction of working hours workers spend on production of goods, such that uq_tL_t is the total effective workforce used to produce output, Y_t ,. In the Lucas model, Y_t depends on the physical capital stock K, K_t, the effective work force, uq_tL_t, and the average skill level of human capital (workers), q_a, : (See Equation 1)

$$Y_t = A_t K_t^b (uq_t L_t)^{1-b} q_a^{\gamma} \qquad (1)$$

Where the term q_a^{γ} a represents externalities from average human capital (AHC), and A_t stands for the technology level which is assumed to be constant.

Based on above state, relation between trade liberalization and endogenous growth model is more acceptable than exogenous growth model. The theoretical framework of the study derives from the 'human capital model of endogenous growth' developed by Lucas (1988).

3. Methodology and Data

The secondary data, time series 1970 to 2010, will be used for estimating the above equation. Also linkage between trade liberalization and the growth rate of industrial production is verified by using an aggregate production function framework. Following Lucas model we specify an industrial production function for India in equation 2 as follows:

$$Y = f(K, L, H, TL) \qquad (2)$$

Where Y is the industrial value added; K, L, H and TL represent, respectively, capital and labour inputs, human capital and an index of trade liberalization. In this research will apply the ratio of exports plus imports to GDP (OPEN), exports shares in GDP (XGDP), import tariff rate and D, per & post trade liberalization equal zero and one presently, to measure trade liberalization index (TL). To examine the

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relationship among variables will use the cointegration and error correction modeling approaches as follows: (See Equation 3)

$$INDUSVA = F(RCAPITAL, LABORP, OPEN, XGDP, TARIFF, EDU, D) \qquad (3)$$

Summary of data are shown in Table 1.

Table1: Summary of Variables

VARIABLE	DISCRIPTION
INDUSVA	Industrial value added
RCAPITAL	Gross fixed capital
LABORP	Labor force as % of population
OPEN	The ratio of exports plus imports to GDP , Export
XGDP	Exports shares in GDP
TARIFF	Import tariff collection rate
EDU	Secondary school enrolment ratio
D	Before 1991 D=0 After 1991 D=1

Specifying the production function in log-linear form (with an error term, ut), the following equation 4 may be written:

$$LINDUSVA_T = \alpha_0 + \alpha_1 LRCAPITAL_T + \alpha_2 LLABOURP_T + \alpha_3 LOPEN_T + \alpha_4 LXGDP_T + \alpha_5 LTARIFF_T + \alpha_6 LEDU_T + \alpha_7 D_T + U_T \qquad (4)$$

It is expected that the elasticity parameters$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_6, \alpha_7 > 0 \; and \; \alpha_5 < 0$

This leads to the specification of a general error correction model (ECM) of the industrial production function of the following form: (See Equation 5)

$$\Delta LINDUSVA_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta LINDUSVA_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta LRCAPITAL_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta LLABORP_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta LOPEN_{t-i} + \sum_{i=0}^{n} \beta_{5i} \Delta LXGDP_{t-i} + \sum_{i=0}^{n} \beta_{6i} \Delta LTARIFF_{t-i} + \beta_7 D + \beta_8 LEDU_{t-1} + \beta_9 EC_{t-1} + \varepsilon_t \qquad (5)$$

Where ECt-1 = error-correction term lagged one period

4. Empirical Result

Data on INDUSVA, RCAPITAL, LABOURP, REXPORT, TARIFF and EDU for the 1970-2010 period are shown in Table 2 as their mean, standard deviation (SD), coefficient of variation (CV), and annual compound growth rate.

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Table 2: Summary Statistics of Variables

Variable	Description	Mean	SD	CV (%)	Growth Rate (%)
INDUSVA	Industrial value added(constant 2000us $)	82,174,907,067	58,750,936,853	0.72	6
CAPITAL	Gross fixed capital formation(constant 2000us $)	85,484,096,679	76,179,935,176	0.89	6.9
LABOURP	Labour force as % of population	0.359	0.0077	0.021	0.002
EXPORT	Export(constant 2000us $)	48,438,878,856	59,465,776,811	1.22	10
IMPORT	Import(Constant 2000us$)	51,863,498,759	63,627,414,198	1.22	0.11
Trade Liberalization	(Export+Import)/GDP	0.213	0.122	0.571	0.04
TARIFF	Import tariff collection rate	0.616	0.340	0.552	-0.04
EDU	Secondary school enrolment ratio	39.06	11.3	0.28	0.03

Unit-Root Tests

The data used in the empirical investigation cover the period from 1970 to 2010. In this section we perform unit root tests for stationary on the levels and the first differences of all variables. The Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) unit-root tests (*Table 3*) show the existence of unit roots, and therefore non-stationary, in the levels of all variables (LINDUSVA, LCAPITAL, LLABOURP, LEXPORT, LIMPORT, LTRADE LIBERALIZATION, LTARIFF and LEDU). However, the first differences of eight variables (LINDUSVA, LCAPITAL, LLABOURP, LEXPORT, LIMPORT, LTRADE LIBERALIZATION, LTARIFF and LEDU) are stationary under the DF/ADF tests. The Phillips –Perron (PP) unit-root test does confirm stationary for all the eight variables in differencing stages (*Table4*). Hence we conclude that these variables are integrated of order 1.

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Table 3: DF-ADF Unit Root Tests for Stationary

Variable	Level / First Difference	Dickey-Fuller Test Statistic		Augmented Dickey-Fuller Test Statistic		Conclusion
		Without Trend	With Trend	Without Trend	With Trend	
LINDUSVA	Level	0.824(2)	-1.351(2)	2.7(2)	-1.327(3)	I(1)
	First Difference	-4.103(3)*	-5.195(3)*	-4.502(2)*	-5.082(4)*	
LCAPITAL	Level	1.274(2)	-0.789(2)	2.329(2)	-0.817(2)	I(1)
	First Difference	-4.876(2)*	-5.516(2)*	-4.814(3)	-5.468(4)	
LLABOURP	Level	2.246(2)	-0.499(2)	1.608(2)	0.148(2)	I(1)
	First Difference	-3.795(2)*	-4.893(2)*	-4.707(2)*	-5.213(3)*	
LEXPORT	Level	0.062(2)	-1.0134(2)	1.497(2)	-1.210(4)	I(1)
	First Difference	-4.742(2)*	-5.736(2)*	-5.425(2)*	-5.651(4)*	
LIMPORT	Level	0.503(2)	-1.532(2)	1.271(2)	-1.814(3)	I(1)
	First Difference	-6.011(2)*	-6.734(2)*	-6.493(2)*	-7.070(3)*	
LTRADE LIBERALIZATION	Level	1.234(2)	-1.578(2)	0.181(2)	-1.649(2)	I(1)
	First Difference	-6.139(2)*	-6.201(2)*	-6.219(3)*	-6.261(3)*	
LTARIFF	Level	1.734(2)	-1.150(2)	1.343(2)	-1.454(3)	I(1)
	First Difference	-4.583(2)*	-5.103(2)*	-4.728(2)*	-5.056(3)*	
LEDU	Level	1.019(2)	-1.855(2)	-0.426(2)	-1.838(2)	I(1)
	First Difference	-5.064(2)*	-5.329(2)*	-5.328(2)*	-5.244(3)*	

Notes:
(i) Unit root tests are performed using Eviews 7
(ii) 95% critical values for DF & ADF statistics (variables in level) = -1.949 & -2.936 (without trend) and -3.19 & -3.526 (with trend).
(iii) 95% critical values for DF & ADF statistics (variables in first dif.) = -1.949 & -2.938 (without trend)

and -3.19 & -3.529 (with trend).

(iv) In ADF tests, optimum lag lengths, shown in parentheses in the test statistic column, have been determined
using Schwartz Bayesian Criterion (SBC).

(v) * denotes significant at 5 percent level

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Table 4: Phillips -Perron (PP) unit root test for stationary

Variable	Level / First Difference	Phillips-Perron (PP) Test Statistic		Conclusion
		Without Trend	With Trend	
LINDUSVA	Level	5.131	-1.186	
	First Difference	-4.437	-5.757	I(1)
LCAPITAL	Level	4.581	-0.714	
	First Difference	-4.825	-6.161	I(1)
LLABOURP	Level	1.430	-0.061	
	First Difference	-4.736	-5.213	I(1)
LEXPORT	Level	1.450	-1.210	
	First Difference	-5.420	-5.656	I(1)
LIMPORT	Level	1.403	-1.814	
	First Difference	-6.501	-7.070	I(1)
LTrade Liberalization	Level	0.205	-1.669	
	First Difference	-6.220	-6.262	I(1)
LTARIFF	Level	1.062	-1.593	
	First Difference	-4.779	-5.074	I(1)
LEDU	Level	-0.457	-2.194	
	First Difference	-5.356	-5.275	I(1)

Notes : (i) PP test was performed using Ewievs7.
(ii) The critical values for PP statistic at 95 per cent level are –2.93 (for constant and no trend) and –3.52 (for constant and trend).

Cointegration Tests

Having found that all the six variables (LINDUSVA, LCAPITAL, LLABOURP, LEXPORT, LTARIFF and LEDU) are integrated of order one, our next step is to determine whether any combinations of the variables are cointegrated. Before undertaking the cointegration tests, we first specify the relevant order of lags (*p*) of the *vector* auto regressions (VAR) model. Since the sample size is relatively small, we select 1 for the order of the VAR (Pesaran and Pesaran, 1997). The results obtained from the Johansen Juselius (JJ) method are presented in Table 5.

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Table 5: Johansen -Juselius Maximum Likelihood Cointegration Tests

Null	Alternative	Statistic	95% Critical Value
Maximal Eigenvalue Test			
r=0	r=1	48.003	40.077
r<=1	r=2	20.337	33.876
r<=2	r=3	14.218	27.584
r<=3	r=4	8.344	21.131
r<=4	r=5	6.054	14.264
Trace Test			
r=0	r>=1	97.14	95.75
r<=1	r>=2	49.137	69.818
r<=2	r>=3	28.8	47.856
r<=3	r>=4	14.581	29.797
r<=4	r>=5	6.237	15.494

Notes: (i) The test was performed using Ewievs 7.
(ii) *r* stands for the number of cointegrating vectors

Not only the maximal eigenvalue test suggests r = 1 but also the trace statistic shows r =1. So, we can take r = 1. Therefore, our annual data from 1970 to 2010 appear to support the proposition that in India there exist a long-run relation between level of industrial value added and its determinants of the real capital stock, the labour force, real exports, the tariff rate and the secondary school enrolment ratio. Estimates of long-run co integrating vectors are given in Table 6.

Table 6: Estimates of Long-Run Co integrating Vectors (Linearised)

INDUSVA	LCAPITAL	LABOURP	LEXPORT	LTARIFF	LEDU
1.00	0.897	-2.714	-1.109	-0.364	-1.371
	(-0.23)	(-2.149)	(-0.147)	(-0.075)	(-0.193)

Notes: 1. The long-run equilibrium relation is:
LINDUSVA = 0.897LCAPITAL – 2.71 LLABOURP -1.109 LEXPORT - 0.364 LTARIFF - 1.37 LEDU

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2. Figures in parentheses indicate standard errors.

Estimation of an Error-Correction Model

In this section we estimate an *error-correction* model (ECM). The ECM shown in *Table 7* is found to fit the data best.

Table 7: Estimated Error-Correction Model

Dependent Variable =ΔLINDUVA			
Regressor	Parameter Estimate	T-Ratio	P-Values
Intercept	0.022	3.147	0.003
ΔLCAPITAL	0.451	6.297	0.000
ΔLABOURP	-1.133	-1.703	0.97
ΔLEXPORT	0.039	0.898	0.375
ΔLTARIFF	-0.026	-0.836	0.409
ΔLEDU	0.047	0.413	0.682
ECM(-1)	-0.265	-2.574	0.014
Adj R^2 = 60 D.W=2.058 Serial Correlation =1.70(0.635) Reset=0.77(0.442) Normality=0.465(0.792)			

Note : Figures in bracket indicate p -values.

The error correction coefficient estimated at -0.265 is statistically significant at the 5 per cent level, has the correct sign, and suggests a moderate speed of convergence to equilibrium. The diagnostic test statistics show no evidence of misspecification, no serial correlation, nor any problem of heteroscedasticity and no problem of non normality in the residuals.

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5. Conclusion

This paper studies the relation between trade policies and economic growth in India. The 'human capital model of endogenous growth' developed by Lucas (1988) is taken as the theoretical framework for undertaking empirical work on the relation between trade liberalization and industrial growth in India.

In the empirical investigation of the aggregate growth function of industrial value added in India, cointegration and error correction modeling approaches have been applied. A unique co integral relation between the industrial value added function and its major determinants of the real capital formation, the labour force, real exports, the import tariff collection rate and the secondary school enrolment ratio is found.

In order to determine the short-term dynamics around the equilibrium relationship, we estimated an error correction model (ECM). The study shows that real capital formation has emerged as significant determinants of industrial value added function in India. The results, however, do not provide evidence of the importance of human capital in the India economy.

It is quite clear that a big country such as India would not be able to benefit substantially from any comprehensive set of liberalization measures unless the preconditions such as basic infrastructure and good governance are in place.

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