# The Impact of Trade Liberalization on Industrial Growth of India: An Empirical Investigation

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## Abstract
This paper examines impact of trade liberalization on industrial growth of India. The research problem is expressed as "To what extent does trade liberalization or openness of the economy influence industrial growth of India?" To identify the impacts of trade liberalization, total time period, 1970-2010, is divided into two sub periods of before trade liberalization i.e. (1970 to 1990) and after trade liberalization i.e. (1991 to 2010). The variables identified in the main objective of the study are tested hypothetically, and quantitative analytical methods are applied to make accurate and reliable conclusions. Graphical presentations and regression analyses are used to assess the degree of relationships among variables concerned. Further to test the structural changes in the country, the Chow test is applied. Findings of the study confirm that there is no evidence that the structural changes in industrial growth rates have been happened during the last four decades due to trade liberalization in India.

**Keywords:** Trade Liberalization, Industrial Growth, Trade Policies, Structural Changes.

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## 1. Introduction

Trade liberalization of economies via the reduction or complete elimination of trade barriers has become the most popular economic policy of developed and developing countries today. Import and export tariffs, quotas, export subsidies, technical barriers are the popular trade barriers which have been used during the last few decades. However with globalization of world economies all most all the counties in the world are actively involved with reducing trade barriers among their trade partners. Major objective of moving towards free trade is to achieve macroeconomic goals of their economies. Basically to achieve high economic growth developing economies are implementing free trade policies during the last few decades. As a result of that trade openness has been widening up in these economies.

India is not exception of this process although India chose a state- led industrialization strategy which involved economic planning, high protectionism, and regulation of economic activity (Bajpai & Sachs, 1997). The early plans of India have emphasized on industrialization and import substitution strategy that followed a Harrod-Domar model incorporated for a closed economy (Bhagwati & Chakravarty, 1969) but Trade liberalization in 1991 was a major breakaway from India's strategy in the past. At that time, the policy of trade liberalization has been strongly supported by economic scientists and it has often been argued that trade free results in overall economic growth, which was what, India required at that time (Dollar & kraay, 2002, 2004). Based on, Indian economy declined the high restriction on foreign investors, export, import and tariff. Although, Agarwal (2007) argued that India forced to choose international trade policy because, in 1991, reserves were only sufficient for two weeks of imports and the government deficit had increased to US$10 billion. Inflation was high at 13%, the currency was overvalued due to which export suffered, and remittances from abroad had been withdrawn.

With this background in mind, this paper empirically analyses the relationship between trade liberalization and industrial growth in India during the period 1970-2010.

Researchers have investigated to answer the question of how the trade liberalization is linked with industrial growth of a country. However, the researches carried out on this field have produced a mixed bag of results all over the world. These results have made the issue more complex in the world. In fact, the problem statement is expressed as "to what extent does trade liberalization influence industrial growth of India. More specifically following research questions will be addressed by the study.

What has been the effect of trade liberalization on industrial growth, export and import growth in India?

The primary objective of the study is to investigate the relationships between the trade liberalization and industrial growth of India. Therefore, the study investigates more specifically the contribution made by the trade liberalization to industrial growth, exports and imports of India. According to the said specific objectives, the study has been carried out with the use of hypotheses as follows.

Hypothesis One (H1): There is a positive relationship between trade liberalization and industrial growth.

Hypothesis two (H2): The trade liberalization has increased the total exports of India.

Hypothesis Three (H3): The trade liberalization has increased the total import of India.

The relevant literature is reviewed in Section 2, while Section 3 discusses policies of trade liberalization. Section 4 presents the methodology of our research. Sections 5 reports and analyzes the empirical results obtained by the model estimation. Section 6 concludes related remarks.

## 2. Literature Review

Based on different empirical evidence, the effects of trade liberalization on industrial growth have been mixed. Some of researchers found out positive relationship between trade liberalization and growth. For example Dutta and Ahmed (2006) showed that trade liberalization has positive effect on industrial value added in Pakistan. Also Dutta and Ahmed (2006) cited that there are number of empirical studies linking economic growth to the openness of the trade regime (Little, Scitovsky and Scott, 1970; Balassa, 1971 and 1982; Bhagwati, 1978; Krueger, 1978; Heitger 1987; World Bank 1987; Romer 1989; Quah and Rauch 1990; Michaely, Papageorgiou and Choksi, 1991; Thomas, Nash and Associates, 1991; Dollar, 1992; Edwards, 1992; Harrison, 1995; Savvides, 1995; Bakht, 1998; Onafowora and Owoye, 1998).

On the other hand some empirical studies show there is not statistically significant link between trade liberalization and economic growth according to Dutta and Ahmed (2006) (Sachs, 1987; UNCTAD, 1989; Agosin, 1991;

Taylor, 1991; Shafaeddin, 1994; Clarke and Kirkpatrick, 1992; Greenaway and Sapsford, 1994; Karunaratne, 1994; Jenkins, 1996; Greenaway, Morgan and Wright, 1997).

New growth theories, however, do not predict that trade will unambiguously raise economic growth. Increased competition could discourage innovation by lowering expected profits. Grossman, G. and E. Helpman (1991) point out that intervention in trade could raise long run growth if protection encourages investment in research – intensive sectors for countries with an international advantage in these kinds of goods. Since the theoretical literature does not provide a clear answer, empirical work is needed to help resolve the debate. (Ann Harrison, 1995)

To study more about previous empirical studies and earning knowledge about them, we summarize a few articles based on data, sample, variables, and methodology in Table 1.

**Table 1: Summary of literature review on trade liberalization and growth**

| Authors | Methodology | Finding |
|---|---|---|
| Yusuf and Emmanuel (2000) | They used export plus import growth rate as proxy of openness | The Johansan estimation results rejected the hypothesis that there is no cointegration between economic (GDP) growth and openness while the hypothesis that error correction term is significant and could not be rejected. This Vector Error Correction estimates showed bi-direction causality. |
| Barua-Debashis Chakraborty (2006) | In this research the period after trade liberalization has been examined. Also HOS model is used | The share of export and import remain more or less same in most cases even after trade liberalization and total trade as a percentage of GDP has gone up significant. While a fall in industrial concentration is good in the sense that it may increase welfare consumer, it may lead to a fall in producer's surplus. Similarly, a rise in the price-cost margins while may be considered beneficial for producers it is clearly the welfare reducing from the view point of consumers. |
| Bosworth & Collins (2007) | In this research, two periods consider before 1980 and after that then compare different index in agriculture, industrial and service sections | The results show that India will need to broaden its current expansion to provide manufactured goods for the world market and jobs for its large pool of low-skilled workers. Increased public saving, as well as a rise in foreign saving -- particularly FDI -- could augment the rising household saving and support the increased investment necessary to sustain rapid growth. |
| Dutta & Ahmed (2006) | Time series data for 1973-1995 for Pakistan economy: cointegration analysis | The results show that real capital, labor force and real export have emerged as significant determinants of industrial value added function also don't provide evidence of the importance of human capital in Pakistan. The results of this study show that comprehensive trade liberalization accelerates economic growth. |
| Ghani (2011) | t-test between five years per & post trade liberalization | The results show that the trade liberalization process has improved the country's GDP per capita in the medium term. Unlike the effect on GDP, the ratio of import, export and trade over GDP did not improve after trade liberalization |
| Salinas (2006) | Endogenous model based on Cobb-Duglas production | The results show that trade liberalization has been followed by acceleration in investment; exports of goods and services, and manufacturing exports, and as opposed to common belief, outward orientation did not lead to significant deindustrialization and actually seems to have increased export diversification. |

*Source*: Authors

## 3. Trade Liberalization Policies

The process of trade liberalization and market-oriented economic reform that has started in many developing countries in early 1980s intensified in the 1990s. The reform undertaken varied in ownership and contents in different countries. The reforming countries can be classified into three groups. The first group consists of a number of countries in East Asia which continued their own dynamic industrial and trade policies initiated in 1960s. The second group includes a large number of countries, mostly in Africa, which have gone through the reform programs designed and dictated by the

international financial institutions (IFIs). The third group comprises a number of Latin American countries that undertook economic reform since early 1980s, initially under the pressure from IFIs. Nevertheless, in 1990s they intensified their reform process without having been necessarily under pressure of those institutions in all cases.

The contents and philosophy of their reform programs were, however, similar to those designed by the IFIs which in turn have been referred to as the "Washington Consensus" since the early 1990s.

Trade liberalization measures, in particular, are believed to be a reaction to the failure of traditional import substitution (IS) policies of the 1950s–1970s. The philosophy behind the reform programs was that the role of government in making decisions on resource allocation should be minimized and the incentive structure should change in favor of exports through import liberalization in order to follow an export promotion (EP) path instead of IS. It was argued that private agents, guided by the operation of market forces, would better achieve the objectives of growth and diversification of exports and output structure in favor of manufactured goods. Such objectives would in turn be attained through the expansion of investment, better channelling of resources and allocation of investment outlays to productive sectors. The change in the structure of incentives would not only lead to growth and diversification but also to the upgrading of the production structure, facilitated by imported technology and improved skills enhanced by trade.

## 4. Methodology

The study is mainly based on secondary data. In identifying the impacts of trade liberalization on industrial growth data were collected on a specific time interval before and after the liberalization of international trade in India. The time period selected is from 1970 to 2010. Further to identify the impacts of trade liberalization, total time period is divided into two sub periods of pre trade liberalization i.e. (1970 to 1990) and post trade liberalization i.e. (1991 to 2010).

The variables identified in the main objective of the study are tested hypothetically, and quantitative analytical methods are applied to make accurate and reliable conclusions. Therefore, simple statistical techniques as well as advanced statistical methods are applied in the study. Descriptive statistical techniques, simple and multiple regression analysis are used

to assess the degree of relationships among variables concerned. Further to test the structural changes in pre liberalized and post liberalized periods of international trade in the country, the Chow test is applied.

The study uses linear log model in measuring growth rate of industrial value added, export and import of India. Growth rate of a certain economic variable can be measured by applying simple regression technique. Suppose that it is required to measure the growth rate of variable Y (see equation 1). According to the compound interest formula (see equations 2-6), it can be written down as follows.

$$Y_t = Y_0(1 + r)^t \tag{1}$$
$$\ln Y_t = \ln Y_0 + t\ln(1 + r) \tag{2}$$
$$\beta_1 = \ln Y_0 \tag{3}$$
$$\beta_2 = \ln(1 + r) \tag{4}$$
$$\ln Y_t = \beta_1 + \beta_2 t + u_t \tag{5}$$
$$\beta_2 = \frac{\Delta \ln Y_t}{\Delta t} = \frac{Y_t - Y_{t-1}}{Y_t} \tag{6}$$

In Equation (6), if numerator is multiplied by 100 it will give the growth rate of dependent variable (*Y*).

The study is mainly based on secondary data of 4 decades from the World Bank reports from 1970 to 2010. As the study is based on time series data, price effects of variables are removed by using constant 2000 US$ deflator of respective years.

### 4.1. Behavior of Major Variables

It is very much important to get a clear picture on general behavior of major variables concerned in the study. Basically long term trend and oscillations of variables mainly in industrial growth, export growth (EXG) and import growth (IMG) variables are essential to study during the pre and post liberalization period.

Industrial growth in India has, in terms of long run trend, remained aligned with the growth rate of gross domestic product (GDP). The long-term average annual growth of industries comprising mining, manufacturing, and electricity, during the post-reform period between 1991-2 and 2010, averaged 6.7 per cent as against GDP growth of 6.6 per cent. The share of industry in GDP remained generally stable at around 24 per cent in the post-reform period. The share of manufacturing, which is the most dominant sector within industry, also remained in the 14-16 per cent range during this period. The share is modest when compared to that of China (above 40 per cent) and some of the East Asian countries (above 30 per cent) (Table 2).

**Table 2: Industry Value Added (IVA) and GDP Pre and Post Trade Liberalization**

| Variable | Average Amount ( constant 2000 US$ ) | | Average growth (%) | | The share of industry in GDP (%) | |
|---|---|---|---|---|---|---|
| | Pre(1970-90) | Post(1991-2010) | Pre | post | pre | post |
| IVA | 38,510,328,420 | 128,022,714,647 | 5 | 6.7 | 22.4 | 24.3 |
| GDP | 171,615,390,561 | 525,951,467,684 | 4.4 | 6.6 | | |

*Source:* World Bank Report

**Table 3: India's Imports, Import Growth and Share in GDP**

| Variable | Average Amount ( constant 2000 US$ ) | | Average Growth (%) | | The Share of Import in GDP (%) | |
|---|---|---|---|---|---|---|
| | Pre(1970-90) | Post(1991-2010) | Pre | post | Pre | post |
| Import | 11,286,091,824 | 94,469,776,041 | 8 | 14 | 6.5 | 17.9 |
| GDP | 171,615,390,561 | 525,951,467,684 | 4.4 | 6.6 | | |

*Source:* World Bank Report

### 4.2. Import Growth and Export Growth in India

Import growth rates over the last four decades show quite irregular pattern. India has experienced a low average import growth rates, 8 percent, during the period pre trade liberalization from 1970 – 1990. After trade liberalization (1991) import growth rates have shown more than before trade liberalization about 14 percent. This period is especially well known as policy makers decided decrease restriction on trade international In fact, trade liberalization, 1991, was accepted and it shows significant effect on import growth rates. Also, the share of import in GDP increased significantly of 6.5 to 17.9 percent. (Table3).

In the 1970s, average of India's exports grew by 11 per cent per annum, which was quite impressive compared to its performance in the past. However, it declined sharply in 1980's. The average of exports grew by 5 per cent per annum.

Export growth rates over the last four decades show quite irregular pattern. India has experienced a low average export growth rates, 8 percent, during the period pre trade liberalization from 1970 – 1990. After trade liberalization (1991) export growth rates have shown more than before trade liberalization about 13 percent. This period is especially well known as policy makers decided decrease restriction on trade international. In fact, trade liberalization, 1991, was accepted and it shows significant effect on export growth rates. Also, the share of export in GDP increased significantly of 6.2 to 16.7 percent pre and post trade liberalization respectively. (Table4)

**Table 4: India's Export, Export Growth and Share in GDP**

| Variable | Average Amount ( constant 2000 US$ ) | | Average Growth (%) | | The Share of Export in GDP (%) | |
|---|---|---|---|---|---|---|
| | Pre(1970-90) | Post(1991-2010) | pre | post | pre | post |
| Export | 10,761,320,260 | 88,000,315,38 | 7.83 | 12.9 | 6.2 | 16.7 |
| GDP | 171,615,390,561 | 525,951,467,684 | 4.4 | 6.6 | | |

*Source***:** Authors

## 5. Empirical Results

To measure the impact of trade liberalization on industrial growth of India, simple regression analysis is applied. Firstly, to measure the impacts of trade liberalization on industrial growth simple regression model is applied for two different policy regimes, before and after trade liberalization. To measure the growth rate of dependent variables such as industrial value added, trade balance and current account balance the Log-Linear Model of regression is used. In Simple regression analysis direct relationship between dependent and one independent variable is measured. In this

research, simple regression model is constructed with use of ordinary Least Square (OLS) method. One of the major objectives of the study is to assess the degree of relationship between industrial growth and trade liberalization of India. Hence to find out the direct relationship, a simple regression is applied between these two variables for the period from 1970 to 2010. In this context, simple regression is applied using industrial growth as the dependent variable and trade liberalization as the independent variable. The regression model is formed by using industrial growth as an interval level measurement and

trade liberalization as a categorical variable. Hence trade liberalization is used in the regression as a dummy variable.

- ***Industrial Growth (IG) versus Trade Liberalization (TL):***

$IG = 3.28 + 3.95TL + 0.47\,MA\,(1)$       (7)
$SE$: (1.67) (1.40)    (0.16)
$T\text{-}S$: 1.96   2.05     2.79
$R\text{-}Squared = 0.22$     D.W = 1.71
$TL = 0$ for (1970-1990) & $TL = 1$ for (1991-2010)

Equation 7 shows the causal relationship between industrial growth and trade liberalization. Correlation coefficient of industrial growth and trade liberalization is 0.47 and shows a moderate positive relationship between two variables. Goodness of fit can be interpreted by using the value of coefficient of determinant (R-Squared) of this regression model and shows a low value which is equal to 0.124. Individual regression parameters (intercept and slope) are significant at 5 percent level. Also overall model is significant at 5 percent level of significance. Durbin Watson (DW) statistic shows 1.71 then regression model is free from autocorrelation. According to the regression result, the intercept of the regression model is 3.28 and slope coefficient is 3.95. The intercept of the model describes the average industrial growth of the country during closed economic period from the period 1970 – 1990. Average growth during the closed economic period is 3.28 percent. The slope coefficient of the model explains the impact of trade liberalization on industrial growth and it shows that trade liberalization has accelerated the industrial growth by 3.95 percent. Hence with trade liberalization, industry has achieved on average 7.23 percent industrial growth during the1991 – 2010 period (See Equation A-1 in Appendix A)

- ***Industrial Value Added (IVA) versus Trend (T):***

$LINVA = -112.41 + 0.068TREND + 0.90AR1$ (8)
$S.E.$:     (20.59) (.010)        (0.068)
$T\text{-}S.$:    -5.46    6.73       13.36
$TREND = (1970\text{-}2010)$
$R\text{-}Squared = 0.998$, $D.W = 1.595$,
*Chow Forecast Test*: F-statistic = 1.052
P.>F (20,17) = 0.46

Equation 8 shows the causal relationship between industrial value added and trend (pre & post trade liberalization). Correlation coefficient of industrial value added and trend

is 0.99 and shows a high positive relationship between two variables. Goodness of fit can be interpreted by using the value of coefficient of determinant (R-Squared) of this regression model and shows a high value which is equal to 0.99. Individual regression parameters (intercept and slope) are significant at 1 percent level. Also overall model is significant at 1 percent level of significance. Durbin Watson (DW) statistic shows 1.59 then regression model is free from autocorrelation. According to the regression model, slope coefficient describes INVA growth rates for pre & post trade liberalization. The slope coefficient for two time periods, 1970-2010, is 0.068. Therefore during the period from 1970-2010, INVA of India has grown at a rate of 6.8 percent. The chow test shows there is no evidence that the structural changes in industrial growth rates have been happened during the last four decades due to trade liberalization in India (See Equations B-1, B-2 and B-3 in Appendix B).

***I.  Pre-liberalization***

$LINVAI = -83.28 + 0.054TREND + 0.68AR1$   (9)
$S.E.$:       (10.52)   (0.005)     (0.189)
$T\text{-}S.$:       -7.91     10.24       3.615
$R\text{-}Squared = 0.992$ $D.W = 1.8221$
$TREND = (1970 - 1990)$

***II.  Post-liberalization***
$LINVAII = -108.7 + .067TREND + 0.932MA1$ (10)
$S.E.$: (4.55)      (.002)      (0.098)
$T\text{-}S.$:   -23.84    29.43       9.44
$R\text{-}Squared = 0.994$ (R = 0.997)
$TREND = (1991\text{-}2010)$    $D.W. = 1.402$

The rate of growth of industrial value added (INVA) over pre and post liberalization period is estimated using log-linear regression model. To identify the growth rate effect of INVA in different policy regimes, total time period (1970-2010) is divided into two sub periods. The first period is from 1970 to 1990 and the second period is from 1991-2010. According to the equation 9 and 10, correlation coefficients (R) for regression models are higher than 0.99. They show a strong positive relationship between INVA and time variable. Simple regression models derived for two different time periods depict higher coefficient of determination values. Coefficients of Determination (R-square) for regressions estimated for periods 1970-90 and 1991-2010 are 0.992, 0.994 respectively. Therefore it is

clear that more than 99 percent of total variation of INVA is explained by each regression model. Individual and overall significance of regression coefficients are fulfilled at 1 percent level of significance. Also Durbin Watson (DW) statistics show 1.82, 1.40 respectively then the regression models is free from autocorrelation.

According to the each equation, slope coefficients of two regressions describe INVA growth rates for two different time periods. The slope coefficients for two time periods, 1970-1990 and 1990 -2010 are 0.054 and 0.067 respectively. Therefore during the period from 1970-1990, INVA of India has grown at a rate of 5.4 percent. With trade liberalization in 1991 growth rate of Industrial Value Added has climbed to 6.7 percent in India. As a whole it is proved that country has achieved higher industrial growth after 1991 with trade liberalization.

- ***Exports (EX) Versus Trend (T)***

$LEX = -218.24 + 0.121 TREND + 0.935 AR1$ (11)
*S.E.*: (60.61)    (.030)    (0.053)
*T-S.*: -3.600    4.039    17.455
*TREND*= (1970-2010)
*R-Squared*=0.995,    *D.W.*=1.825
*Chow Forecast Test*: *F-statistic*=2.255
*Prob*. *F* (20, 17) =0.047

Equation 11 shows the causal relationship between export and trend (pre & post trade liberalization). Correlation coefficient of export and trend is 0.99 and shows a high positive relationship between two variables. Goodness of fit can be interpreted by using the value of coefficient of determinant (R-Squared) of this regression model and shows a high value which is equal to 0.99. Individual regression parameters (intercept and slope) are significant at 1 percent level. Also overall model is significant at 1 percent level of significance. Durbin Watson (DW) statistic shows 1.82 so the regression model is free from autocorrelation. Heteroscedasticity test of Glejser shows: *Glejser F-statistic* =2.956, *Prob. F(1,38)*=0.0937, so the model is homoscedastic. According to the regression model, slope coefficient describes export growth rates for pre & post trade liberalization. The slope coefficient for two time periods, 1970-2010, is 0.121. Therefore during the period from 1970-2010, export of India has

grown at a rate of 12.1 percent. The chow test shows that there is evidence that the trade liberalization increased export growth in India (See Equations C-1, C-2 and C-3 in Appendix C)

**I.** *Pre-liberalization*

$LEXI = -90.389 + .057 TREND + 0.739 AR1$ (12)
*S.E.*: (17.91)    (.009)    (0.163)
*T-S.*: -5.046    6.344    4.512
*R-Squared*=0.972,   D.W=1.685
*TREND*= (1970-1990)

**II.** *Post-liberalization*

$LEXII = -234.93 + .129 TREND + 0.540 AR1$ (13)
*S.E.*: (14.458)   (.0072)   (0.215)
*T-S.*: -16.248   17.980   2.502
*R-Squared*=0.989, D.W.=1.638
*TREND*= (1991-2010)

The rate of growth of export (EX) over pre and post liberalization period is estimated using log-linear regression model. To identify the growth rate effect of EX in different policy regimes, total time period (1970-2010) is divided into two sub periods. The first period is from 1970 to 1990 and the second period is from 1991 - 2010. According to the equation 12 and 13, correlation coefficients (R) for regression models are higher than 0.98. They show a strong positive relationship between EX and time variable. Simple regression models derived for two different time periods depict higher coefficient of determination values. Coefficients of Determination (R-square) for regressions estimated for periods 1970-90 and 1991-2010 are 0.97, 0.98 respectively. Therefore it is clear that more than 98 percent of total variation of EX is explained by each regression model. Individual and overall significance of regression coefficients are fulfilled at 1 percent level of significance. Also Durbin Watson (*DW*) statistics are 1.68 and 1.63 respectively so the regression models are free from autocorrelation.

According to the each equation, slope coefficients of two regressions describe EX growth rates for two different time periods. Slope coefficients for two time periods, 1970-1990 and 1990 -2010 are 0.057 and 0.129 respectively. Therefore during the period from 1970-1990, EX of India has grown at a rate of 5.7 percent.  With trade liberalization in 1991

growth rate of EX has climbed to 12.9 percent in India. As a whole it is proved that country has achieved higher EX growth after 1991 with trade liberalization.

- ***Import (IM) Versus Trend (T)***

$LIM=-195.267+.110TREND+0.855AR1$     (14)
*S.E.*     (25.32)     (0.012)     (0.079)
*T-S.*     -7.71     8.696     10.771
*R-Squared*=0.993, *D.W.*=2.12
*TREND*= (1970-2010)
*Chow Forecast Test*:  *F-statistic*=1.0956
*Prob. F* (20, 17) =0.4285

Equation 14 shows the causal relationship between import and trend (pre & post trade liberalization). Correlation coefficient of industrial value added and trend is 0.99 and shows a high positive relationship between two variables. Goodness of fit can be interpreted by using the value of coefficient of determinant (R-Squared) of this regression model and shows a high value which is equal to 0.99. Individual regression parameters (intercept and slope) are significant at 1 percent level. Also overall model is significant at 1 percent level of significance. Durbin Watson (DW) statistic shows 2.12 so the regression model is free from autocorrelation. According to the regression model, slope coefficient describes import growth rates for pre & post trade liberalization.  The slope coefficient for two time periods, 1970-2010, is 0.11. Therefore during the period from 1970-2010, import of India has grown at a rate of 11 percent. The chow test shows that there is no evidence that the trade liberalization increased import growth in India (See Equations D-1, D-2 and D-3 Appendix D)

***I. Pre-liberalization***

$LIMI=-116.85+.070TREND+0.50AR1$     (15)
*S.E.:* (14.955)     (.0075)     (0.207)
*T-S:*  -7.813     9.361     2.447
*R-Squared*=0.955, D.W=2.05
*TREND*= (1970-1990)

***II. Post-liberalization***

$LIMII=-226.66+.125TREND+0.59AR1$     (16)
*S.E* (17.127)     (.0085)     (0.196)
*T-S*:  -13.233     14.704     3.016
*R-Squared*=0.987, *D.W*=1.612
*TREND*= (1991-2010)

The rate of growth of import (IM) over pre and post liberalization period is estimated using log-linear regression model. To identify the growth rate effect of IM in different policy regimes, total time period (1970-2010) is divided into two sub periods. The first period is from 1970 to 1990 and the second period is from 1991 - 2010. According to the equation 15 and 16, correlation coefficients (R) for regression models are higher than 0.95. They show a strong positive relationship between IM and time variable. Simple regression models derived for two different time periods depict higher coefficient of determination values. Coefficients of Determination (R-square) for regressions estimated for periods 1970-90 and 1991-2010 are 0.95, 0.98 respectively. Therefore it is clear that more than 95 percent of total variation of IM is explained by each regression model. Individual and overall significance of regression coefficients are fulfilled at 1 percent level of significance. Also Durbin Watson (DW) statistics show near to tow so the regression models are free from autocorrelation (See Appendix D).  According to the each equation, slope coefficients of two regressions describe IM growth rates for two different time periods. Slope coefficients for two time periods, 1970-1990 and 1990 -2010 are 0.07 and 0.125 respectively. Therefore during the period from 1970-1990, IM of India has grown at a rate of 7 percent.  With trade liberalization in 1991 growth rate of IM has climbed to 12.5 percent in India. As a whole it is proved that country has achieved higher IM growth after 1991 with trade liberalization.

1): Hypotheses Testing for Structural Changes by Trade Liberalization are as follows:

Hypothesis One (H1): There is a positive relationship between trade liberalization and industrial growth.

According to the regression result, equation 7, average growth during the closed economic period is 3.28 percent and the slope coefficient of the model explains the impact of trade liberalization on industrial growth and it shows that trade liberalization has accelerated the industrial growth by 3.95 percent. Although with trade liberalization, industry has achieved on average 7.23 percent industrial growth during the1991 – 2010 period. But According to the regression model, equation 8, the Chow test shows there is no evidence that the structural changes in industrial growth rates have been happened during the last four decades due to trade liberalization in India.

Hypothesis two (H2): Trade liberalization has increased the total exports of India.

According to the regression models, equation 12&13, the slope coefficients of two regressions describe EX growth rates for two different time periods. The Slope coefficients for two time periods, 1970-1990 and 1990 - 2010 are 0.057 and 0.129 respectively. Therefore during the period from 1970-1990, EX of India has grown at a rate of 5.7 percent. With trade liberalization in 1991 growth rate of EX has climbed to 12.9 percent in India. As a whole it is proved that country has achieved higher EX growth after 1991 with trade liberalization also the Chow test shows that the structural changes in export growth rates have been happened during the last four decades due to trade liberalization in India.

2) Hypothesis Three (H3): Trade liberalization has increased the total import of India.

According to the regression models, equation 15&16, the slope coefficients of two regressions describe import growth rates for two different time periods. The Slope coefficients for two time periods, 1970-1990 and 1990 -2010 are 0.07 and 0.125 respectively. Therefore during the period from 1970-1990, import of India has grown at a rate of 7 percent. With trade liberalization in 1991 growth rate of import has climbed to 12.5 percent in India. As a whole it is proved that the country has achieved higher import growth after 1991 with trade liberalization but the Chow test shows that that there is no evidence that the structural changes in import growth rates have been happened during the last four decades due to trade liberalization in India.

## 6. Conclusion

The study encompassed four decades which belong to two trade regimes, pre and post liberalization period in India. Findings of the present study are on the relationships between trade liberalization and industrial growth of India. And also other factors affecting these relationships are taken into consideration in the study. One of the major hypotheses of the study is to test the relationship between trade liberalization and the India's industrial growth during the pre and post liberalization era. The result of Chow test proves the structural changes in industrial growth rates have not been happened during the last four decades due to trade liberalization in India. In fact, there is no difference statistically on industrial growth during pre and post trade liberalization in India.

The study shows that the liberalization has increased the export growth of the country by 12.9 percent. During the closed economic period the export growth has been 5.7 percent and this average export growth further has been improved by trade liberalization. As a result India has achieved a 7.2 percent average export growth after trade liberalization of the country. Also the Chow test shows that the structural changes in export growth rates have been happened during the last four decades due to trade liberalization in India. In fact, there is difference statistically on export growth pre and post trade liberalization in India.

The Chow test shows that there is no evidence that the structural changes in import growth have been happened during the last four decades due to trade liberalization in India.

Though the economic reforms of 1991 created a turnaround for the India with the world economy – seem to have paid off as opposed to the results obtain on some economic variables. There is a very mixed picture is seen rather the analysis is titled more toward liberalization having a very weak impact on macroeconomic variables such as industrial growth an balance of trade.

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## Appendix A

$IG = 3.28 + 3.95\ TL + 0.47\ MA1$ (A-1)

*S.E.*: (1.67)   (1.40)      (0.16)
*T.S.*: 1.96      2.05           2.79
*R-Squared* = 0.22, *D.W*=1.71
*F.S* =5.43   (P-value=.008)
P-value      0.05   0.04   0.00

Observations = 41(1970-2010)
*TL*=0 for (1970-1990) & *TL*=1 for (1991-2010)
*Het. Test: Glejser F-statistic* =0.339751
Prob. F(4,36)=0.849

## Appendix B

$LINVAI = -112.41 + 0.068TREND + 0.90AR1$ (B-1)
S.E.:      (20.59) (.010)          (0.068)
*T.S.*:      -5.46         6.73                 13.36
*R-Squared*=0.998, *D.W*=1.595
F.S. 11348.12
P-value      0.000      0.000           0.000
Observations= 41(1970-2010)
*TREND* = (1970-2010)
*Het. Test: Glejser   F-statistic* =0.3719
Prob. F(1,38)=0.5456
*Chow Forecast Test  F-statistic*=1.052
Prob. F(20,17)=0.46

### I.  Pre liberalization

$LINVAI = -83.28 + 0.054TREND + 0.68AR(1)$(B-2)
*S.E.*:          (10.52)      (.005)      (0.189)
*T.S.*:          -7.91         10.24         3.615
*R-Squared*=0.992, *D.W*=1.8
*F-S.:* 1080.78, P-value= 0.000
Observations=20(1970-1990)
*TREND* = (1970-1990)   221
*Het. Test: Glejser   F-statistic* =0.1165
Prob. F(1,18)=0.736

### II.  Post liberalization

$LINVAII = -108.70 + 0.067TREND + 0.932MA1$ (B-3)
*S.E.:*      (4.55)     (.002)         (0.098)
*T.S.*:      -23.84    29.43            9.44
*R-Squared* = 0.994, D.W=1.402
FS. 1464.901, P-value= 0.000
Observations=20(1991-2010)
*TREND* = (1991-2010)
Het. *Test: Glejser   F-statistic* =1.166370
Prob. F(1,18)=0.2944

## Appendix C

$LEX = -218.24 + 0.121TREND + 0.935AR1$   (C-1)
S.E.:      (60.61)      (.030)         (0.053)
T-S.:      -3.600         4.039         17.455
*R-Squared*=0.995, *D.W*=1.825
F.S. 349.49, P-value= 0.000
Observations=41(1970-2010)
*TREND*= (1970-2010)
*Het. Test: Glejser   F-statistic* =2.956
Prob. F(1,38)=0.0937
*Chow Forecast Test F-statistic* =2.255
Prob. F(20,17)=0.047

### I.  Pre-liberalization

$LEXI = -90.389 + 0.057TEND + 0.739AR1$   (C-2)
*S.E*:   (17.91)   (.009)         (0.163)

*T.S.:* -5.046 6.344 4.512
*R-Squared*=0.972, *D.W*=1.685
*F-S.*=305.07, P-value=0.000
Observations=21(1970-1990)
*TREND*= (1970-1990)
*Het. Test: Glejser F-statistic* =0.130
Prob. F(1,18)=0.721

**II. Post liberalization**
*LEXII*=-234.93+0.129*TREND*+0.540*AR1*(C-3)
*S.E.*: (14.458) (.0072) (0.215)
*T.S.:* -16.248 17.980 2.502
*R-Squared*=0.989, *D.W*=1.638
*F-S.:* 786.987, P-value=0.000
Observations =20(1991-2010)
*TREND*= (1991-2010)
*Het. Test: Glejser F-statistic* =3.8199
Prob. F(1,18)=0.0664

**Appendix D**
*LIM*=-195.267+0.110*TREND*+0.855*AR1* (D-1)
*S.E.*: (25.32) (0.012) (0.079)
*T.S.:* -7.71 8.696 10.771
*R-Squared*=0.993, *D.W*=2.12
F-S.= 2655.35, P-value=0.000
Observations=41(1970-2010)
*TREND*= (1970-2010)
*Het. Test: Glejser F-statistic* =0.4649
Prob. F(1,38)=0.499
*Chow Forecast Test F-S*=1.0956
Prob. F(20,17)=0.4285

**I. Pre-liberalization**
*LIMI*=-116.85+0.070*TREND*+0.50AR1 (D-2)
*S.E.*: (14.955) (0.0075) (0.207)
T.S.: -7.813 9.361 2.447
*R-Squared*=0.955, *D.W*=2.05
*F-S.*= 183.71, P-value=0.000
Observations=21(1970-1990)
*TREND*= (1970-1990)
*He. Test: Glejser F-statistic* =2.1523
Prob. F(1,18)=0.159

**II. Post-liberalization**
*LIMII*=-226.66+0.*125TREND*+0.59AR1 (D-3)
*S.E.:* (17.127) (0.0085) (0.196)
*T.S.:* -13.233 14.704 3.016
*R-Squared*=0.987, D.W=1.612
*F-statistic*=670.99, P-value=0.000
Observations=20(1991-2010)
*TREND*= (1991-2010)
*Het. Test: Glejser F-statistic* =0.0108
Prob. F(1,18)=0.9183