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An Overview of Indian Economy based on the influence of trade openness and liberalisation on India's Economic Growth.

Certified that this paper entitled as "An Overview of Indian Economy based on the influence of trade openness and liberalisation on India's Economic Growth" submitted by me as a part of my B.Sc, Part-III Economics (Honours) Examination, following 2009 regulations (1+1+1 system), over syllabus 2010-2011 examination, **ECOA Paper VIIIB (Term Paper)** section. This paper is original and is based on my work and research.

Neither the content nor the parts have been submitted before for any degree/ diploma.

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ABSTRACT

Trade Liberalisation in general sense refers to a circumstance which involves activities which concerns with lessening of government regulations and restrictions in an economy in exchange for greater participation by Private entities.

In broader view we can justify trade liberalisation as the removal or reduction of restrictions or barriers on the free exchange of goods between nations. These barriers include tariffs, such as duties and surcharges and non tariff barriers, such as licensing rules and quotas.

Trade liberalisation enables a particular country to compete with other countries. However this paper makes an enquiry whether openness to trade has contributed towards the growth of Indian economy. To do so, we take the data on National Income, NNP growth rate and weighted average of import duty for the period 1991-92 to 2015-16 and the average import duty rate. The coefficient is significant at 5%level of significance. Thus it shows that trade liberalisation has been beneficial for India as it contributed to the economic growth.

*Key Words: Liberalisation, Tariff.

INTRODUCTION

The essence of liberalisation is that economic management should be left to marketing conditions. The prices determined by interactions of demand and supply forces, whether they are for commodities, labour power, capital, land, or foreign exchange, should be flexible in either direction and should be capable of clearing the market. In order to ensure that markets are allowed to undertake their jobs, all directives and remedies also measures that constitute barriers to entry, should be done away with and eliminated.

Thus liberalisation follows from this that the state should take a back seat in economic matters. Any intervention by state in the form of controls, subsidies, selective protection, etc. would distort prices and make the resulting allocation inefficient, thus hindering economic growth.

Trade helps to transfer resource endowments, technology, taste and preferences among countries by allowing them i.e. (the involved countries) to specialize in things that the countries does the best and thus helps to reduce the cost of production through increasing efficiency in the system. From a narrow perspective it can be said that trade enables each person to consume a large number of commodities which either they cannot produce by themselves or can produce only at a higher cost, on the contrary in autarky the person can only consume what he can produce. In broader sense, trade helps a country to grow by increasing the market for country's producers, opening up the opportunities for adopting better technology from the country inventing it and by allowing countries to specialise in things they have comparative advantage.

Post Independence, the Government of India admitted its approach towards the Development of industrial sector in the Industrial Policy Resolution 1948 which was followed by another policy resolution on 1956. In between, the government introduced the Industries Act (1951)

to regulate and control the development of private sector and also the Monopolies and Restrictive Trade Practices Act (1969) was adopted to prevent concentration of economic power and control monopolies. Another legislation that had considerable implications for industrial policy (as far as the participation of foreign companies in Indian industrial sector is concerned) was the Foreign Exchange Regulation Act (1973). However, all these measured which guided and determined the State intervention in the field of industrial development failed in achieving the objectives laid down for them. Therefore, the government started liberalising the industrial policy in 1970s and 80s with the announcement of the New Industrial Policy in 1991.

In the light of above scenario, the aim of the present paper is to examine the relationship among import duty rate, National income and trade openness for India during the New Economic Policy of 1991covering period from (1991-2015) on the basis of secondary data. Trade openness has been an important element of economic development strategy adopted by the Indian government during the post reforms period. It is pertinent to mention that trade openness leads to efficient allocation of resources through comparative advantage; allows the diffusion of knowledge and technological progress and promote competition in domestic and international markets. Moreover, the present study is an attempt to analyze the association between trade openness and economic growth.

LITERATURE REVIEW

The literature survey on the impact of trade liberalisation on the growth rate of Indian Economy is plentiful. Let us consider few of the committed works which are relevant to our purpose.

- Petia Topalova (2007): Examined the effects of India's trade reforms in the early 1990s on firm productivity in the manufacturing sector, focusing on the interaction between this trade reform policy shock and industry, firm and environment characteristics. Also stated there is strong suggestive evidence of complementarities between trade liberalization and industrial policies that encourage domestic competition and economic growth.

- Prabirjit Sarkar(2005): Defined the two concepts of 'trade liberalisation' and 'trade openness' as closely related but not identical. Thus with relevance to the literature, country's trade openness is considered in the sense of an expansion in the size of trade sector in relation to total production as an acceptable factor for trade liberalisation.

- Hammouda(2011): Examined the relationship between liberalization and growth alone, but can be enriched by comparing the development experiences of Africa and Asia. Future thinking should turn towards a search for optimal combinations between liberalization and control in order to promote growth and strengthen the competitiveness of developing economies.

- Bela Balassa (1978) & (1982): Directed two major comparative studies on trade liberalisation. The first dealt with the need to distinguish between nominal and effective tarrifs. However the second study tackled the relationship between trade regimes and economic

growth where he founded that countries with faster export growth had experienced a faster growth of GDP rate.

- Gershon Feder (1983): His work relied on alternative methodologies, including detailed comparative studies and cross-country econometric analysis. He generally supported the view that more liberal trade regimes are conducive to better economic performance by illustrating the two sector model of a small economy which included exports and non-exports. Here export entered as input to production function of non-exports by indicating that policies that encourage exports by opening trade, have appositive effect on overall growth.

- Dominick Salvatore (1991): His work generally utilised the classification of developing countries in accordance to their trade orientation. He examined the effect of trade on economic development of the countries within each group, the efficiency of investment and the industrialisation process under alternative trade strategies.

- Thomas Hatcher(1991) : He generally hypothesised that international trade benefits most developing countries and that an outward orientation leads to a more efficient use of resources where growth is partially supported by the econometric results. He also established methodologies to give rise to some estimation problems which exposed some hesitating and doubting results which were obtained in cross-section studies.

- Michaely (1977): Used the spearman's rank correlation to examine a sample of 41 LDCs to detect the association between export growth and

economic growth. His study found that there is a positive relationship between export growth and economic growth and the economic growth tended to be affected significantly by exports only when countries achieve some minimum level of development.

- Tyler (1981): Empirically analyzed the relationship between export expansion and economic growth of middle income developing countries using the inter-country cross section analysis. The study found that there is a strong positive association between export expansion and economic growth and export expansion significantly enhances gross national product growth. The higher rates of economic performance have been associated with the higher rates of export growth.

OBJECTIVE

To address this issue we have attempted to explain the hypothesis of trade liberalisation based on a theoretical framework that links international trade and economic growth, a careful examination of empirical evidences is required to find out relationship between trade and growth on the basis of macro level studies. In light of this, the present paper is an attempt to examine causal relationship between the three variables, namely, National Income i.e. (NNP at factor cost), Import duty rate, and Trade Openness of India during the Post- Liberalization period as defined above.

In the Indian context, in early 1950's, planners ignored trade option as a major source of economic growth. As India was then primarily an agricultural exporter, trade would have been detrimental to growth. The planners were pessimistic, and this led them to concentrate on a policy of import substitution or an inward oriented development strategy, giving little importance to export promotion. However, that caused inefficiency, as firms started to gain market

power. License and Quota raaj became rampant. Restricting policies like FERA slowed down the growth in manufacturing sector. Social vices like corruption and smuggling became prevalent.

Finally in 1991 India went for trade liberalization. Rules and regulations were relaxed to make Indian economy competitive. It refers removal of control in foreign trade, leaving companies to the market forces etc.

The motive of this paper is to enquire whether openness to trade has contributed significantly towards the growth of the Indian economy. For that we take the data on national income and import duty rate from 1991-92 to 2015-16 to show the following results:

- How trade liberalization has significantly helped in the improvement of national income of India during the post reform, in the form of cut in the import duty rates
- And how this increase in National Income growth rate of India had significantly raised over a long period of time.

For the purpose of the data & methodology and analysis, this paper is organized by empirical results and analysis of data findings as well as the paper proceeds in five halves:

- Section 1 shows various reviews given by Economist and policy makers on trade liberalisation.
- Section 2 represents data and the methodology of this paper.
- Section 3 deals with the thorough analysis of the trade liberalisation framework and also displays the model in graphical and mathematical terms.
- Section 4 consists of conclusion and references.
- Section 5 includes all the calculations and data obtained from a viable source.

DATA AND METHODOLOGY

The adopted Methodology in the research study is outlined below. The entire procedure of methodology elaborates the type of data used, the span of investigation the technique of statistical tool used to intercept the study. The study uses the data from secondary source for period of 1991-2015 from the Reserve Bank database on the Indian economy.

- Type of data: The main source of data for this study is taken from secondary source. For this purpose, journals, books, periodicals & reports have been referred to collect data & information on Net National Income on Factor Cost and Import Duty.
- Span of Investigation: The period for the present study covers 26 years of data analysis. During this period the government has embarked upon liberalisation and globalization since the New Economic Policy of 1991 which makes this particular period significant and necessitates to evaluate the performance of India's foreign trade particularly during post reform era.
- Technique of statistical tools: The statistical tool used to analyse the trend patterns of growth with trade openness include regression analysis and the neo classical growth model.

ANALYSIS

Several Economists have argued against the “Free trade” or “Foreign Trade” on the ground that it benefits exporting countries and impoverishes importing countries whether or not these regions or “Nations” or “Countries” benefit indirectly. After independence, many changes have taken place in almost all the sectors of the Indian economy, especially after the liberalization period of the Indian economy. During the period 1947-1991, Government of India was following a mixed economy combining the features of capitalism and socialism. This resulted in the interventions by the Govt., i.e. encouraging the exports and controlling or substituting the imports. Followed by that in 1991, India adopted liberal and free market oriented policy and liberalized its economy to international arena. With the Liberalization, Privatization and Globalization of the Indian economy and the government policies on exports and imports also changed. Many of the foreign countries which were members of the trading blocs like SAARC, WTO entered into for doing in the international trade and made many, trade agreements with its neighbours. The services sector was playing a major role in the development of the Indian economy with this (after the Liberalization, Privatization, Globalization) the total shape of the Indian economy has changed along with the changes in polices of the government. The government policies like the EXIM policy put some products earlier in the restricted trade list now came into the open general list and more over the number of products in the restricted list has now brought down to somewhere around two hundred and placed in the open general list. With the liberalization in the licensing policy, many of the Indian firms entered into business with individual or with joint ventures to do export and imports business. Many of the foreign countries which were members of the trading blocs like SAARC, WTO entered into India to do export and imports business. In this regard, an attempt is made to find out the impact of India’s International trade on India’s growth performance during this period.

In relation to foreign trade policy, the aim was to liberalise the regime with respect to imports and try to bring about a closer link between exports and imports. The tariff rates were reduced. The import licensing system was dismantled. The 8th plan, overtaken by the economic crisis of 1991, represented the first effort of planning for a market oriented economy. According to Dreze and Sen, four decades of allegedly 'interventionist" planning did little to make country literate, provide a wide- based health service, achieve comprehensive land reforms or end the social inequalities. There were a strong imperative for changes in the role of planning. The new economic policy is built on this experience.

The NEP comprises the various policy measures and changes introduced since July 1991. The objective is simple and that is to improve the efficiency of the system, and creating a more competitive environment in the economy as a means to improving the productivity. This is to be achieved by removing the barriers to the entry and the restriction on the growth of firms. While the industrial policy seeks to bring about a greater competitive environment domestically, the trade policy seeks to improve international competitiveness subject to the protection offered by tariffs. The private sector is being given a large space to operate in, as some of the areas reserved exclusively for the public sector will have to compete with the private sector, even though the public sector continues to play the dominant role. What is sought to be achieved is an improvement in the functioning of the various entities whether they are in the private or public sector by injecting the element of competition.

DATA ANALYSIS AND FINDINGS.

The model is presented in three sections. The first section explains the methodology and the second section introduces the theoretical background of regression analysis. The final section deals with the regression using the current data.

We have data on NNP at factor cost, and weighted average of import duty rates for the years 1991-92 to 2015-16. The NNP at factor cost is evaluated at current prices (2011-12 as base year).

1) NNP at factor cost on weighted average of import duty rates and estimate the coefficient of weighted average of import duty rates.

2) Again, NNP growth rate on weighted average import duty rates and estimate the coefficient.

Finally, we check the significance test of the estimated coefficient.

THEORETICAL BACKGROUND OF LINEAR REGRESSION

Suppose we have 'n' paired observation (Xi , yi) on two variables X and Y. This gives a scatter of 'n' points justifying the presence of randomness at the level of observations. So, we write the 'observed relation' as following:

$Y_i = \alpha + \beta X_i + u_i$

Where u_i represents the stochastic disturbance terms of random errors and this error term is included in the model due to:

1. Omission of other explanatory variables, some of which may not be qualified or even identifiable.
2. Unpredictable elements of randomness in human responses.
3. Imperfect specification of the mathematical form of model.
4. Errors in recording and processing of the data.

u_i is distributed normally with the following properties:

i. $E(u_i) = 0 \ \forall_i = 1,2,.....,n$
ii. $Var(u_i) = \sigma_u^2 \ \forall_i = 1,2,.....,n$
iii. $Cov\ (x_i , u_j) = 0 \ \forall$ i,j

Let the estimated regression equation be:

$\hat{Y}_i = \alpha + \hat{\beta} X_i$

Where $\hat{\alpha}$ & $\hat{\beta}$ are the estimates of the parameters α & β respectively and $\hat{Y}_i$ is the estimated value of Y for any given value of $X=x_i$.
We cannot expect all observations to fall on the estimated regression line. This implies the true value Y_i and the estimated value $\hat{Y}_i$ will defer and this difference is denoted by:

$e_i = Y_i - \hat{Y}_i$
$= Y_i - \hat{\alpha} - \hat{\beta}X_i$

Note that, e_i 's can be positive, negative or zero.

We choose such values $\hat{\alpha}$ and $\hat{\beta}$ which minimize the sum of squares of the error terms i.e. we have to minimize $\sum e_i^2 = \sum(Y_i - \hat{\alpha} - \hat{\beta}X_i)^2$.

The first order condition for maximization require :
$\frac{\partial \sum e_i^2}{\partial \hat{\alpha}} = 0$ and $\frac{\partial \sum e_i^2}{\partial \hat{\beta}} = 0$ which respectively yield the following two normal equations:

$\sum Y_i = n\,\hat{\alpha} + \hat{\beta} \sum X_i$ ..... (1)

$\sum X_i Y_i = \hat{\alpha} \sum X_i + \hat{\beta} \sum X_i^2$ ..... (2)

Solving equation (1) and (2) we obtain:

$\hat{\beta} = \frac{COV(x,y)}{var\,(x)}$ and $\hat{\alpha} = \bar{Y} - \hat{\beta}\bar{X}$
After estimating the values of α and β we have to test their significance. If the values of a parameter is significant ε% level then it implies that the parameter resembles the true population characteristics in (1- ε%) of the cases. For the purpose of the paper we would concentrate on the significance test of β.

Let us construct the null hypothesis, H_0: β=0 and we take the alternative hypothesis H_1: β < 0
We know, $\hat{\beta} \sim N[\beta, \frac{\sigma_u^2}{\sum X_I^2}]$ Where, $x_i = X_i - \bar{X}$

Therefore, $\frac{\widehat{\beta}-\beta}{\frac{\sigma_u}{\sqrt{\sum X_i^2}}} \sim N(0,1)$

Under H_0 , $\tau_0 = \frac{\widehat{\beta}}{\frac{\sigma_u}{\sqrt{\sum X_i^2}}}$

Since σ_u^2 is not known, the above test statistic cannot be calculated numerically. We may use s_u^2 in the place of σ_u^2.

We know that $\frac{RSS}{\sigma_u^2} \sim \chi_{n-2}^2$

If equation (3) and (4) are independent, then by combining them we may define a t-value.

$t = \frac{\tau}{\sqrt{\chi_n^2/_n}}$

Now from equation (3) we have $\tau_0^2 = \frac{\widehat{\beta}^2 \sum X_i^2}{\sigma_u^2} = \frac{ESS}{\sigma_u^2} \sim \chi_1^2$

We also have TSS = ESS + RSS

Or, $\frac{TSS}{\sigma_u^2} = \frac{ESS}{\sigma_u^2} = \frac{RSS}{\sigma_u^2}$

So, $\frac{TSS}{\sigma_u^2} \sim \chi_{n-1}^2$

Now, $\frac{ESS}{\sigma_u^2} \sim \chi_1^2$ and $\frac{RSS}{\sigma_u^2} \sim \chi_{n-2}^2$

Again, as cov($\widehat{Y}$, e) = 0, so ESS and RSS are independent. It implies equation (3) & (4) are independent. Therefore, we may construct the following test statistic:

$$t = \frac{\hat{\beta}\sqrt{\sum X_i^2 / \sigma_u}}{\frac{\sqrt{\frac{RSS}{\sigma_u^2}}}{n-2}} \sim t_{n-2}$$

Now, $t = \frac{\hat{\beta}}{s_u / \sqrt{\sum X_i^2}} \left[s_u^2 = \frac{RSS}{n-2} \right]$

Since σ_u^2 is unknown so s_u^2 is an unbiased estimator of σ_u^2.

Estimated variance V $(\hat{\beta}) = \frac{s_u^2}{\sum X_i^2}$

Hence, estimated Standard Error $(\hat{\beta}) = \frac{s_u}{\sqrt{\sum X_i^2}}$

So we can write $t = \frac{\hat{\beta}}{Estimated\ S.E(\hat{\beta})} = \frac{\hat{\beta}\sqrt{\sum X_i^2}}{s_u} \sim t_{n-2}$

H_0 is rejected at 5% level of significance if calculated value of $t > -t_{0.05,n-2}$.

Graphical Approach

1. REGRESSION ANALYSIS OF NATIONAL INCOME & WEIGHTED AVERAGE IMPORT DUTY.

In the present data, national income is the dependent variable and the average import duty rate is the independent variable. Let us call national income as Y and average import duty rate as X. Then the regression equation is taken as the following.

Y (N.I.) = α + β*X* (Average import duty rate)

ESTIMATION OF THE REGRESSION EQUATION

In the scatter diagram shown below we plot the values of average import duty rates on horizontal axis and the values of national income on the vertical axis. The diagram confirms the linearity of the relationship between the two variables. We, therefore, use the theoretical knowledge described in the part which involves many carefully arranged details about the linear regression analysis, where we to estimate the regression coefficient.

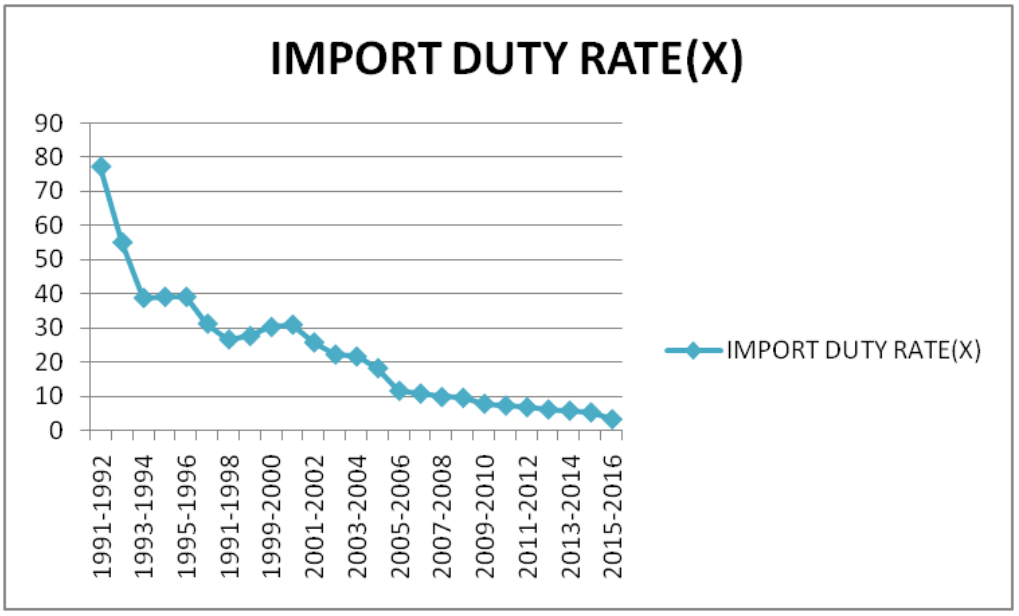

CHART -1: SHOWS THE REDUCTION IN IMPORT DUTY RATES.

So the equation regression equation of Y (NNP) on X (average import duty rates) is Y=69459.868-1389.32X
The regression coefficient of X is also significant at 5% level
Proof: Refer to appendix.(pg -25) ★

Observation 1:
The gradual trade liberalization in the form of cut in import duty rates has significantly helped in improving the national income of the India in the post-reform period.

We observe a negative correlation between reduction in import duty rate and national income of the country. It means that as the import duty rate

was reduced it led to the increase in national income of India. Thus the fifth principle of economics as pointed out by Mankiw that "Trade makes everyone better-off" holds for the Indian economy. The above observation also shows that the Indian planners really made a mistake in underestimating the growth potential of India through trade in the pre-reform period. This observation is in contrast to Jin (2003). In Korea, trade liberalisation reduced economic growth rate in the pre-crisis period (1997-98). The reason stated was the crowding out of domestic investment. The Indian experience has been completely different. We observe that trade liberalisation has increased the National Income. The reason behind such contrast in two country's experience is that in India, with the opening up of the economy, foreign investment came in which resulted in an increase in private domestic investment also. In the past, the economy could not reap the benefit of private investment due to the control regime. But since liberalisation, there has been a crowding in of domestic investment with foreign investment.

REGRESSION ANALYSIS OF NNP GROWTH RATE & IMPORT DUTY.

In the present data, NNP growth rate is the dependent variable & the average Import duty rate is the independent variable. Let us call NNP growth rate as Y and average Import duty rate as X. Then the regression equation is taken as the following:

Y (NNP growth rate) = $\alpha + \beta X$ (Average import duty rate)

In the scatter diagram we plot the values of average import duty rates on horizontal axis and the values of NNP growth rate on the vertical axis. The diagram confirms the linearity of the relationship between the two variables. We, therefore, use the theoretical knowledge describes in sections 3.1 to estimate the regression coefficient.

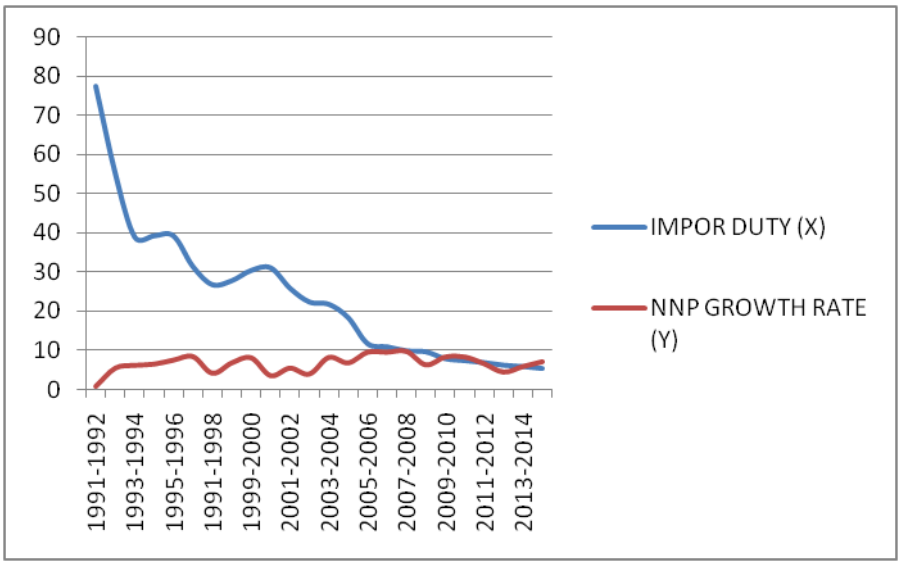

CHART -2 SHOWS THE LINEARITY BETWEEN NNP GROWTH & IMPORT DUTY

In the present data, NNP growth rate is the dependent variable & the average Import duty rate is the independent variable. Let us call total trade as Y and average Import duty rate as X. Then the regression equation is taken as the following:

Y (NNP at growth rate) = $\alpha + \beta X$ (Average import duty rate)
The estimated equation becomes:

Y=8.51-0.08X
The regression coefficient of X is also significant at 5% level.
Proof: Refer to appendix.(pg-28) ☆
Observation 2:
A cut in import duty rate increases the National Income growth rate of India not only marginally but significantly.

Again, we observe a negative regression coefficient between reduction in import duty rate and NNP growth rate of the country. It means that as the import duty rate was reduced it led to the increase in NNP growth rate of India. So the trade liberalization in the form of cut in import duty rate has helped in improving the NNP growth rate of India in the post-reform period.

This observation is in line with observation 1. As expected we find the same contrast with Jin (2003). Although there are controversies at the theoretical level whether trade liberalisation positively impacts the growth of a developing country or not, yet our result matches with the empirical finding of Hammouda (2011). But our primary concern remains with the marginal positive impact that trade liberalisation in India had on its National Income growth rate. We conjecture that the other factors, which are not considered in the paper, might have played the dominating role in accelerating India's economic growth rate. Further, as mentioned by Bella Ballasa (1978 & 1982) while comparing the development experiences of Africa and Asia, an optimal combination of liberalisation and control could also have a much favourable impact on the economic growth rate of India.

CONCLUSION

The paper estimates the impact of the gradual trade liberalization process that started since the initiation of economic reforms in India in 1991 on its NNP and NNP growth rate. This analysis is important as we find two opposing strands in economic theories. While most theories suggest that trade benefits a nation irrespective of whether it is a developed country or a developing country, some say it can be harmful for the latter.

Different trade models have provided useful insights into how international trade increases 2 human welfare . Therefore, the testing of the hypothesis that trade have positive influence on economic growth had remained a crucial issue in the present times. As trade and growth depend on many other economic, social, and political factors, therefore, the study of relationship between trade and economic growth is a complex. Thus the study has attempted to analyse the relation between import duty rate & National income within the framework of econometrics model and regression model.

Using the data on NNP, NNP growth rate and average import duty rates for India for the period 1991-92 to 2015-16 we find a significant

negative regression coefficient of NNP and NNP growth rate on average import duty rates. This study confirmed that cut in import duty rates has significantly helped in improving NNP and NNP growth rate after trade liberalization. Although the impact has been substantial in absolute terms i.e. increasing the National Income, but only to a marginal extent in relative terms i.e. increasing the National Income growth rate.

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APPENDIX

Table1: Calculations for regression NNP & weighted average Import duty rate.

INDIA'S WEIGHTED AVERAGE IMPORT DUTY & NNP(CURRENT PRICE)	AMOUNT IN BILLION
BASE YEAR 2004-2005	

OBS	YEAR	IMPORT DUTY RATE(X)	NATIONAL INCOME(Y)	X2	Y2	XY
1	1991-1992	77.2	5388.24	5959.84	29033130.3	415972.1
2	1992-1993	55.1	6179.4	3036.01	38184984.36	340484.9
3	1993-1994	38.9	7230.24	1513.21	52276370.46	281256.3
4	1994-1995	39.2	8455.54	1536.64	71496156.69	331457.2
5	1995-1996	39.2	9925.16	1536.64	98508801.03	389066.3
6	1996-1997	31.4	11588.58	985.96	134295186.4	363881.4
7	1991-1998	26.8	12871.41	718.24	165673195.4	344953.8
8	1998-1999	27.8	14900.3	772.84	222018940.1	414228.3
9	1999-2000	30.4	16563.02	924.16	274333631.5	503515.8
10	2000-2001	31.1	17711.18	967.21	313685897	550817.7
11	2001-2002	25.9	19263.43	670.81	371079735.4	498922.8
12	2002-2003	22.4	20809.93	501.76	433053186.6	466142.4
13	2003-2004	21.8	23329.56	475.24	544268369.8	508584.4
14	2004-2005	18.4	26291.98	338.56	691268212.3	483772.4
15	2005-2006	11.8	30006.66	139.24	900399644.4	354078.6
16	2006-2007	11	35013.13	121	1225919272	385144.4
17	2007-2008	10	40768.78	100	1662093423	407687.8
18	2008-2009	9.74	47054.47	94.8676	2214123147	458310.5
19	2009-2010	8	54111.04	64	2928004650	432888.3
20	2010-2011	7.5	64068.34	56.25	4104752190	480512.6
21	2011-2012	7	74349.65	49	5527870455	520447.6
22	2012-2013	6.34	82559.78	40.1956	6816117274	523429
23	2013-2014	6	91710.45	36	8410806639	550262.7
24	2014-2015	5.5	101266.5	30.25	10254897946	556965.6
25	2015-2016	3.5	106727.5	12.25	11390765660	373546.4
TOTAL		$\sum X = 571.98$	$\sum Y = 941111.02$	$\sum X^2 = 20680.1732$	$\sum Y^2 = 61810881100$	$\sum XY = 10981713.05$

Source: Hand Book of Statistics on the Indian Economy, Reserve Bank of India 2016-2017

Calculation of regression between Import duty rate & NNP at factor cost.

$\bar{X} = \frac{\sum X_i}{n}$ = 571.98/25 = 22.9

$\overline{\mathrm{Y}} = \frac{\sum \mathrm{Y_i}}{\mathrm{n}} = \frac{941111.02}{25} = 37644.44$

$$\hat{\beta} = \frac{(25 * 10981713.05) - (571.98 * 941111.02)}{(25 * 20680.1732) - (571.98)^2}$$

$$= \frac{-263753.855}{189843.2096}$$

= -1389.32

$\hat{\alpha} = \bar{Y} - (\hat{\beta} * \bar{X})$

= 37644.44 + 1389.32*22.9

=69459.868

Y(N.I.) = α + βX (Average import duty rate)

So, the regression equation of Y(NNP) on X (Average import duty rates) is,

Y = 69459.868 – 1389.32

Now,

$S_{xx} = \sum X_i^2 - n\bar{X}^2$

= 206680.1732 – 25*(22.9)²

=7569.92

$S_{yy} = \sum Y_i^2 - n\bar{Y}^2$

= 61810881100 – 25*(37644.44)²

= 47199345340

RSS = $S_{yy} - \hat{\beta}^2 S_{XX}$

=47199345340 – (-1389.32)² (7569.92)

=32581498680

$$S_U^2 = \frac{RSS}{n-2}$$

=32581498680/(25-2) = 1416586899

Or, $S_u = \sqrt{1416586899} = 37637.573$

$$\widehat{S.E} = \frac{S_U}{\sqrt{S_{XX}}}$$

$$=\frac{37637.573}{\sqrt{7569.92}} = 432.59$$

Therefore, $t = \frac{\widehat{\beta}}{S.E}$

$$=\frac{-1389.32}{432.59}$$

= - 3.21

The tabulated value of $t_{0.05,23} = 1.714$

In this case calculated value of $|t| = 5.34 > -t_{0.05,23}$

So, H_0 is rejected at 5% level of significance and we accept the alternative hypothesis. It confirms the claim that reduction in import duty rates has significantly increased the national income for India.

The estimation equation becomes:

Y = 69459.868 – 1389.32X

The regression coefficient of X is also significant at 5% level.

TABLE2: CALCULATION OF REGRESSION BETWEEN NNP GROWTH RATE AND WEIGHTED AVERAGE IMPORT DUTY RATE.

Year	IMPOR DUTY (X)	NNP GROWTH RATE (Y)	X^2	Y^2	XY
1991-1992	77.2	0.8	5959.84	0.64	61.76
1992-1993	55.1	5.4	3036.01	29	297.54
1993-1994	38.9	6.1	1513.21	37.21	237.29
1994-1995	39.2	6.4	1536.64	40.96	250.88
1995-1996	39.2	7.4	1536.64	54.76	290.08
1996-1997	31.4	8.3	985.96	68.89	260.62
1991-1998	26.8	4.1	718.24	16.81	109.88
1998-1999	27.8	6.7	772.84	44.89	186.26
1999-2000	30.4	8	924.16	64	243.2
2000-2001	31.1	3.5	967.21	12.25	108.85
2001-2002	25.9	5.4	670.81	29.16	139.86
2002-2003	22.4	3.9	501.76	15.21	87.36
2003-2004	21.8	8.1	475.24	65.61	176.58
2004-2005	18.4	6.7	338.56	44.89	123.28
2005-2006	11.8	9.4	139.24	88.36	110.92
2006-2007	11	9.4	121	88.36	103.4
2007-2008	10	9.6	100	92.16	96
2008-2009	9.74	6.2	94.8676	38.44	60.388
2009-2010	8	8.2	64	67.24	65.6
2010-2011	7.5	8.2	56.25	67.24	61.5
2011-2012	7	6.5	49	42.25	45.5
2012-2013	6.34	4.4	40.1956	19.36	27.896
2013-2014	6	5.8	36	33.64	34.8
2014-2015	5.5	7	30.25	49	38.5
TOTAL	ΣX=568.48	ΣY=167	ΣX^2=20680.1732	ΣY^2=1207.7	ΣXY=3196

Source: Hand Book of Statistics on the Indian Economy, Reserve Bank of India 2016-2017

Calculation of regression between import duty and NNP growth rate.

$$\overline{X} = \frac{\sum X_i}{n} = 571.98$$

$$\bar{Y} = \frac{\sum Y_i}{n} = 6.68$$

$$\hat{\beta} = (25 * 3196.2) - (571.98 * 167)$$

$$= \frac{\_15615.66}{189843.2096}$$

= - 0.08

$$\hat{\alpha} = \bar{Y} - (\hat{\beta} * \bar{X})$$

= 6.68 + 22.9*0.08

=8.51

Y (NNP growth rate) = α + βX (Average import duty)

So, the regression equation of Y (NNP growth rate) on X (Average import duty rates) is,

Y = 8.51 – 0.08X

$S_{XX} = \sum X_i^2 - n\bar{X}^2$

=7569.92

$S_{YY} = \sum Y_i^2 - n\bar{Y}^2$

= 1207.7 – 25*(6.68)^2

= 92.14

RSS = $S_{YY} - \hat{\beta}^2 S_{XX}$

= 92.14 – (- 0.08)^2 (7569.92)

= 43.69

$$S_U^2 = \frac{RSS}{n-2}$$

= 43.69/23

=1.899

Or, s_u = 1.378

$$\widehat{S.E} = \frac{s_u}{\sqrt{s_{XX}}}$$

=0.016

Therefore, t = $\frac{\widehat{\beta}}{S.E}$

= -0.08/0.016

= -5

The tabulated case calculated value of $|t| = 5 > -t_{0.05,23}$

So, H_0 is rejected at 5% level of significance and we accept the alternative hypothesis. It confirms the assertion that cut or decline in import duty rates has proliferated the NNP growth rate for India.