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Impact of Growth on Factor Endowment and Structure of India's Trade

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Abstract: *The paper aims at empirically validating the inter relations between changing factor endowment, structure of trade and Indian economy. Heckscher-Ohlin theory of international trade envisages that a country specialises in the production and export of such goods as conform to its factor endowment. It generally imports goods, the production of which does not conform to its factor endowment. The theory, like the classical comparative cost theory, uses static analytical framework. Among others, an assumption of the theory is that the factor endowment does not change, and therefore, the pattern and composition of its trade remains stable. Classical and neo classical theories also assumed that such factors of production as land, labour and capital are immobile between countries but mobile within countries. Goods are, however, assumed to be totally mobile both within and between countries. An implication of the assumption is that the relative supply of labour and capital cannot be altered by imports and exports of these factors. This assumption also implicitly rules out the pattern of growth to alter factor endowment of the economy. Economic growth, however, leads to the transformation of not only the pattern and structure of production but it also transforms factor endowment. It brings about drastic changes in the quantum, pattern and structure of international trade of an economy. Even if the pattern of trade and factor endowment were initially consistent with each other, these will diverge with each other as a consequence of growth. Factor endowment also changes with growth and developing economies focus mainly on industrialisation. Imports of goods in the early stages of growth are replaced by domestic production and some of these goods enter even export basket thus initial factor endowment will guide the import of capital intensive goods, special capital goods and export of labour intensive goods in the initial phase of growth . This argument forms the basis of this paper. The main hypothesis of investigation in this paper is that there exists an interrelation between changing factor endowment, changing pattern of trade and the production structure of a developing economy like India. The past factor endowment governs the current exports structure and the current exports structure governs the future factor endowment of the country and hence it's production structure.*

Keywords: *Heckscher-Ohlin Theorem, Factor endowment, Indian exports, Labour Capital ratio*

I. Introduction

This paper focuses on the impact of growth on factor endowment and structure Indian trade. Heckscher-Ohlin theory of international trade envisages the countries to specialize in the production and export of goods which conform to their factor endowment, while the goods which do not conform to factor endowment are imported. This theory, like classical comparative advantage/cost theory, *uses assumptions which make its analytical framework static*. The theory assumes that factor endowment and production function are given and fixed. Consequently, pattern of production, and hence, composition of trade remains stable through time. The theory also assumes that goods are mobile while land, labour and capital are immobile between the countries. Consequently, inter-country factor immobility and trade leave factor endowment unaltered. The implied fixity of production function rules out the growth to alter factor endowment, and hence, factor reversibility (substitution of one for another factor) in production.

Historical observations, however, show that economic growth based on factor transformation involves upward shift in the production function (Barewald, 1972); this represents shift from less to more advance technology and use of higher quality and lower amount of inputs in production (Cf. P. N. Mathur, 1962). Growth based on technological transformation results in the rising factor productivity, change in pattern and transformation of structure of production and alterations in factor endowment. Technological change revolves round accumulation of physical/financial capital and acquisition of human capital of better quality for the adoption of more advance technology than before. Such changes bring about drastic changes in volume, pattern and structure of international trade of an economy.

Consequently, at each higher stage of growth, factor endowment differs from those of lower stages. Domination of capital over labour tends to rise at each higher stage of growth. Even if the pattern of trade and factor endowment were initially consistent with each other, these will differ from initial state in the process of growth. As developing economies focus mainly on industrialization which is more capital than labour intensive,

structure of production and trade tends to diverge more and more from factor endowment at each successive stage of growth. Developing economies' imports are dominated by capital and intermediate goods during the period of initiation and nurturing of industrialization. These imports continuously push down the proportion of imports of industrial consumer goods in the import baskets. Savings, and hence, domestic capital formation as a proportion of GDP rises continuously. Imports of capital goods in the early stages of growth and industrialization are generally replaced by domestic production and some of these goods enter even export basket as the economy moves to mature stages of growth. Thus initial factor endowment, characterized by scarcity of capital and abundance of labour tends to change in the process of growth. In the earlier phases of growth, export of labour intensive primary goods dominate export basket. The main hypothesis of investigation is that there exists an interrelation between economic growth, changing factor endowment and changing pattern of trade of a developing economy like that of India. The past factor endowment governs the current exports stricture and the current exports structure governs the future factor endowment of the country and hence it's production structure.

Impact of Growth on Factor Endowment and Trade Structure

Growth of income leads to growth of both consumption and saving*s/investment*, though the rates of growth of income, consumption and investment differ in unbalanced growth. If the structure of production is diversified to fill up the observed gaps, composition of output will also change. This is especially so in the case of a countrie*s* like India, which assigned pivotal role to the growth of heavy and basic goods industries to replace imports of capital goods by domestic production to attain self reliance. This strategy not only raise investment but it also radically changes production structure which requires not only more capital per unit of output but more educated and better skilled human capital is also required for production(Sharma, Amit, 2012, Prakash and Balakrishnan, 2008, Prakash, 1977). Heavy and basic goods are used for investment which raises productive capacity and future capital formation; it accelerates industrialization. Growth of income stimulates savings and investment slowly but steadily, which mitigates initial capital scarcity in a labour abundant and capital *scarce* developing economy and change in production structure affects structure of trade.

Impact of Structure of Trade on Production and Factor Endowment

Just as structure of production and growth affect structure of trade, structure of trade, especially capital and labour movements also influences growth and economic structure. Export of particular set of goods continuously over a period of time enables an economy to acquire specialized skills, knowledge and expertise for their production. It also facilitates accumulation of the accumulation of requisite type of capital. Similarly, continuous import of specific capital goods and technology alters capital-labour ratio in the long run. As the economy reaches relatively mature stage of growth and/or adoption of LPG in the current era, import substitution strategy is replaced by export led growth. This warrants the exporting countries to have a cutting edge in quality and cost in international markets which keeps the emerging market economies on their toes to face increasing competition both in domestic and foreign markets. Many erstwhile imported goods will be domestically produced and several goods, imports of which were disallowed earlier, will now be imported. Under export led growth strategy, the country acquires specialization in the production of both traditional and new export goods. Continuous growth of exports transforms production structure in favour of export sectors. *Thus, structure of trade and economic structure are mutually related; they act and react to changes in each other in the dynamic process of growth. Such inter-relations between economic and trade structure make factor endowment also change in the process of growth.* Both consumption multiplier and accelerator reinforce each other to propel growth in such a state(See, Shri Prakash and Ritu Sharma, 2013, Shri Prakash and Sonia Anand, 2013, Shri Prakash, Amit Sharma and Sonia Anand, 2012).

Acceleration of growth creates more job opportunities in the economy, though the state of job market differs between sectors and occupations. Fast growing sectors of the economy lead not only the growth but these sectors also lead in the creation of job opportunities. Technological transformation of production leads to the obliteration of some existing occupations and create new jobs in newly emerged occupations. Skill and knowledge requirements of information and knowledge based economies are different from and higher than those of the older sectors of mortar and bricks economies (See, Prakash, S. 1977, 1996, 1997, Sharma, Amit, 2010, 2012). If education grows ahead of population and economy, erstwhile scarcity of educated workforce may be transformed into surplus of educated manpower which results in the substitution of less by more educated and general by professional education (Sharma, Amit, 2012). In the mature stage, economy grows ahead of population, training and in some cases even education. Hence, current general and educated labour surplus is transformed into scarcity of specific skills and education. Consequently, factor endowment is subject to change both from demand and supply sides of capital and human resources. Indian economy is no exception to this. The rapid growth of the economy has transformed production structure as well as structure of trade and

factor endowment. It may be surmised that factor reversals are an essential feature of rapid growth (Cf. B.S.Minhas, **1979).**

Brief Recapitulation of Selected Studies

Very few studies have estimated the factor contents of India's foreign trade. R.N. Bharadwaj (1962) estimated the factor intensities of India's export and competitive import of 1953-54 when investigated the structural basis of India's foreign trade. His study revealed that India's export absorbs more labour than its competitive imports. However, when Bhardwaj (1962) conducted a similar test on India's bilateral trade with the US which showed India to be capital abundant relative to the United States; this refuted the prediction of factor endowment theory of trade. Sengupta (1989) tested factor contents of India's foreign trade for 1979-80 and 1984-85, he confirmed India's export being more labour intensive relative to imports. Chakraborty (2006) tested the gains from free trade between India and Bangladesh and found research in this field to be scanty recent years. More recently, Chakraborty (2011) also used Leontief-Leamer's framework to analyze factor contents of bilateral trade between India and Sri Lanka and found Indian exports to Sri Lanka capital intensive and imports labour intensive. These results lend some evidence to support Leontief paradox for India. But these results probably suggest that bilateral trade between trade partners may be guided by the partners' factor endowment. Relatively capital abundant trade partner may export capital intensive and import labour in tensive goods, though the same country may not be capital abundant in general terms. ***Such results may be treated as special cases of factor endowment theory.***

Leontief Paradox inspired economists across the globe to examine the validity of factor endowment theory with country specific data. Bharadwaj, R. (1953), and Bharadwaj, R. and Bhagwati, J. N. (1969) found no evidence to support Leontief-paradox for Indian economy. Prasad, K. N. (1976) extended the theme to include natural resources also as a factor in addition to labour and capital to evaluate the pattern of India's foreign trade. Prakash, S. (1995) also did not find India's factor endowment and trade to differ from each other.

Economic Development and Changing Factor Endowment of India

Technological base of production and supply of labour per unit of capital have changed in the course of development of Indian economy. In 1951, saving rate was around 3 to 3.5% of GDP, which has increased to slightly more than 32.5% in 2008 *and 36.48% in 2009-10 (Economic Survey, 2011) of GDP in 2009 and 2010.* This has decidedly raised the capital base of production. The question is has it altered the scarcity of capital relative to labor in the production processes? Does labour-capital ratio differ between sectors?

Human Capital Base of Production

Only less than 5% of total population have had an access to education and only .01% of the people had an access to higher education in 1951 (Prakash, S., 1977). Average completed school years of workforce rose from less than 0.5 in 1961 to 0.85 years of education in 1981 (Prakash, S. and Buragohain, Taru Jyoti, 1985) and it has further increased substantially over the years since then. (For evidence, see Sharma, Amit, 2010). Consequently, *Indian workforce was largely dominated by illiterate and uneducated workers even three decades after independence and human capital base was low. But basic education was universalized in 2011, and more than 20% population has had an access to higher education, including professional and technical education. There has been continuous substitution of illiterate by literate, less by more educated workers, and general education graduates and above by professional and technical graduates and above in production* (Sharma, Amit, 2010, 2012). This has transformed the human capital base of the country both quantitatively and qualitatively. Nearly 20% of senior secondary graduates go for higher education. Besides, education, including higher professional and technical education, has grown exponentially during last 60 years. As a consequence of economic growth and educational development, there is economy wide substitution of educated/literate (studied up to primary) for uneducated/illiterate, secondary and above for below secondary/matriculation, graduate for under graduate, and technical and professional for general education graduate manpower in Indian economy (Sharma, Amit, 2010, 2012).

Changing Structure of Production

Long term growth at an average annual rate of 3.5% of GDP was dominated initially by agriculture and related activities, which accounted for 59% of GDP and absorbed more than 80 % work force in 1951. Agriculture continued to dominate growth of Indian economy till seventies, rapid industrialization notwithstanding. If growth of agriculture accelerated, entire economy was buoyant and vibrant. In agriculture also, growth of output of food grains dominated growth, while food prices dominated general prices (Prakash, S. and Rajan, P., 1977, Prakash, S., 1981, 1987, Sharma, Shalini, 2004). Seventies, eighties, nineties and first decade of the millennium witnessed rapid industrialization and tertiary growth in Indian economy (See, Prakash, S., Gautam Negi and Sudhi Sharma, 2013). Technological up-gradation of production has also taken place. *In*

2009, tertiary sector accounted for 59% of GDP, while agriculture and allied activities produced around 20% of GDP, but employed 55% of the total workforce. Manufacturing activities accounted for remaining 21% of GDP. Thus, structure of production, capital base and human capital has changed concurrently with growth.
New Economic Policy (NEP) of liberalization, privatization and globalization has converted the semi closed Indian economy in to an open economy. India has emerged as an important destination for foreign investment, including FDI, though foreign investment accounted for about 0.5% of total investment, yet it is large in absolute terms. The absolute and relative share of trade in GDP, an indicator of openness of an economy, has also increased several times from 1951 to 2009-10. Rising degree of openness of Indian economy may be gauged from the following table*:*

Table I-Trade as Proportion of GNP

Year	1950-1	1980-1	1990-1	2000-01	2009-10
Trade % of GNP	12.54	14.50	14.93	22.83	30.31
Increase	---	1.96	0.43	7.9	7.48

Total trade (exports + imports) has risen from 12.54 in 1950-51 to 30.31 per cent of GNP in current prices in 2009-10. This shows an increase of approximately 2.5 times of base value. The table also reveals that percentage of GNP accounted by trade increased only marginally during the first three decades of planning era, and it remained almost stagnant in eighties. But the proportion of GNP accounted by trade increased by 7.9 and 7.5 percentage points during the first two decades of LPG, an almost 2.5 fold increase over the base year. As a consequence of growth and structural change during the era of globalization radical transformation in factor endowment and economic structure has taken place. These changes put international trade in goods and services and capital movements in the center stage of Indian economy. Besides the above, substitution of imports by domestic production as growth strategy has raised the domestic supply of basic and heavy goods, including machinery, equipment and plants. Several other new goods also entered the production basket. All above changes have contributed to the transformation of production and trade structure.

Natural resources, especially such minerals as coal, coke, lignite, mica, iron ore, zinc, lime, gas, oil, etc., have been used more extensively for exports and to nurture the growth of minerals based Indian industries. Heavy and basic and consumer goods industries have been established or expanded and diversified. Some minerals or new source of thorium, uranium, gas, oil etc. have been discovered by extensive exploration for production. Such developments are expected to have changed the requirement of labour per unit of capital, natural resources per unit of labour, and natural resources per unit of capital used in production. Such changes are expected to reflect the changes in factor endowment.

II. Research Questions

Research questions posed in the paper are 'has India's factor endowment remained the same as it was till end of eighties? Has the labour and capital intensity of Indian exports remained the same since 1980s? Does structure of exports affect economic structure; or does economic structure determine the structure of trade? Then, what is the growth effect of exports? These questions are attempted to be answered by empirical analysis. Answers to above questions are based on the determination of temporal changes in labour-output, capital-output and labour-capital ratios in Indian economy since 1981. Both econometric and input output models are used for data analysis.

Data Base

All data are secondary; data are taken from official sources such as publications of CSO, Reports of Ministry of Commerce and Economic Survey.

III. Methods And Models

As time series data are involved in the analysis, different versions of Random Walk Model have been used to evaluate whether series are stationary. Total requirements of labour and capital are estimated by input output models at the given point in time. Total labour and capital requirements are determined as follows:

$N= L'(I-A)^{-1}$ and $K=B\ (I-A)^{-1}$

N is vector of sector-wise employment and K is sector-wise stock of capital, $(I-A)^{-1}$ is Leontief Inverse; L'= (a_{0j}), and B=(b_{ij}), i, j=1,2,..n. a_{0j} is labour employed in j-th sector per unit of output, and b_{ij} shows amount of i-th capital good needed to produce one unit of j-th good.
Growth effect of exports is determined as follows:

$X= (I-A)^{-1} C$

X is vector of sector wise gross output and C is specially constructed final demand vector in which sector wise value of exports are the only non-zero elements. Final demand for non-export goods is entered as zero. This facilitates the isolation and determination of pure output/growth effect of exports on Indian economy.

IV. Empirical Results

Empirical results are presented systematically in different sections.

Section -I

Results of descriptive statistics, reported in table I, capture the basic facets of changing profile of labor-output, capital-output and labor-capital ratios from 1980-81 to 2010-11. Constancy of mean, variance and independence of covariance from the point of calculation are also the features of a stationary time series. Nature of distribution of the ratios is also highlighted by summary statistics. For evaluating the constancy of mean and variance, the series is split into almost two equal parts of 15 and 16 observations for the sub-periods:1980-81 to 1994-95 and 1996-2011. The reason for this partition is that first few years of adoption of NEP were not expected to bring about drastic change in the economy.

Table II- Summary Statistics

Ratio	Labor-Output	Capital-Output	Labor-Capital
Mean – I	0.00049	0.2293	0.000108
Mean – II	6.555E-05	0.2915	1.7826E-05
Variance – I	8.304E-08	0.00031	3.058E-09
Variance – II	1.302E-09	0.00168	7.389E-11
T	5.6963	-5.2352	6.2770
F	1.302E-09	0.1882	41.3858

t-statistics of mean differences for labour-output, capital output and labour –capital ratios show that the means of these ratios differ significantly between the two sub-periods. However, the variances of only labor-capital ratios for sub-periods differ significantly. Thus, the evidence is not conclusive to infer that time series of these ratios are non-stationary. Therefore, the data are subjected to more rigorous test of Random Walk Model.

Results of Random Walk Model

All three versions of random walk model-RWM without drift, with drift, and with drift and stochastic trend were applied to the data relating to Economic Structure-ES, Trade Structure-TS, Labor-Output Ratio-LOR, Capital-Output Ratio-COR, and Labor-Capital Ratio-LCR. But results of only relevant version of the model are reported for each case in table II. A perusal of the table reveals that (i) the coefficient of drift for ES alone is statistically significant, which imply that the current value tends to drift away from its lagged value and the first order difference of economic structure is not influenced by some systematic factor rather than only by random factors; (ii) Coefficients of drift of lagged TS, LOR, COR and LCR are not significant statistically, hence, the first order differences of these ratios may be influenced mainly by random factors. This may suggest that all these series are non-stationary, provided that the coefficients of the corresponding lagged values of these ratios are positive and statistically significant. In this case, the roots of these regression equations will not be less than unity; (iii) The coefficients of lagged value of ES, LOR and LCR are negative and statistically significant. It means that these three time series are stationary. Therefore, the regression models of these variables are likely to furnish non-spurious results; (iv) However, the coefficients of lagged TS and COR are negative but not statistically significant; it means that these coefficients are as good as zero and the root of these equations of two series lies in the Unit circle. Hence, it may be inferred that these data series are not stationary. Therefore, the regression models of these two variables will be subjected to Engel-Granger test of unit root of their residuals.

Table-III- Estimates of Random Walk Model

VARIABLE	α_0	α_1	R^2	F	F*	t_1	t_2
ΔES_t	0.0578	- 0.2402	0.1274	4.091	0.052	2.026	-2.022
ΔTS	6.651	- 0.0895	0.0835	2.552	0.1213	1.688	-1.597
ΔLCR	-	- 0.1269	0.966	829.818	2.37E-22		-28.806
	7.21E-07	- 0.1281	0.937	423.513	1.92E-18	0.286	-20.579
ΔCOR	0.0074	- 0.0101	0.0041	0.0324	0.8582	0.5034	-0.1802
ΔLOR	-	- 0.1107	0.968	894.171	8.58E-23		-29.902
	6.59E-08	-0.1112	0.935	404.134	3.54E-18	0.137	-20.103

Section II

Factor Endowment of Indian Economy

This section deals with the changes in economic structure and factor endowment of Indian economy during the course of development. Labor-Capital ratios are treated as a proxy of factor endowment. Changes in proportions of manufactures in total output are used as an indicator of changing economic structure of Indian economy from 1980-81 to 2010-11. Directly observed values of the labor-capital ratios for the economy taken as whole (*not sector wise*) are used in regression modeling. We have the values of sector wise ratios of total labor and capital required per unit of final demand only for limited number of years IO tables). Alternative models have been fitted to the data as a part of experiment. The OLS estimate of the regression functions showing factor endowment, FE as dependent on economic structure, ES is reported in table III given below:

Table:IV: Step-wise Aggregate Regression Functions of Economic Structure and Factor Endowment

Function	α_0	α_1	α_2	R^2	F	F*	t_1	t_2	t_3
(1)	0.245	-20.536		0.365	16.672	0.0003	122.664	-4.083	
(2)	0.2456	– 19.876		0.346	14.832	0.00062	117.759	-3.851	
(3)	0.0847	0.6542	–5.73	0.611	21.213	2.9E-06	2.255	4.287	-1.09
(4)	0.0872	0.644	-7.17	0.6614	21.510	2.59E-06	2.329	4.235	-1.20

Functions in the table are: 1. $FE_t = f(ES_t)$; 2. $FE_t = f(ES_{t-1})$; 3. $FE_t = f(FE_{t-1}, ES_{t-1})$; 4. $FE_t = f(FE_{t-1}, ES_t)$.

Different models formulated for experimentation shows that (i) Both current and lagged economic structure emerges as significant determinant of current factor endowment separately; (ii) Introduction of lagged factor endowment as second explanatory variable both in function 1 and 2 respectively improves the explanatory power of the functions considerably; (iii) But the distributed lag model with current economic structure as determinant of current factor endowment furnishes the best fit to the data; (iv) Current as well as lagged economic structure emerge as inversely related to factor endowment in all the four functions. As the relation between factor endowment and economic structure, both current and lagged, is found to be inversely related even in bi-variate regression functions, inverse relation is not explained by multi-collinearity; (v) Inverse relation between factor endowment and economic structure is explained by the fact that, whereas share of manufactures has been consistently rising in total output, labor per unit of capital, the index of factor endowment, is declining through time. It is accounted by consistent rise in capital per unit of labor resulting in decline of LCR; (vi) DLM shows that an increase of 1 per cent manufactures in total output results in decline of 7.2 units of labor per unit of capital employed in production; (vii) Distributed Lag Model (DLM) of factor endowment with economic structure as the determinant highlights that adjustment of factor endowment to changing economic structure is spread over several periods, coefficient of adjustment being 0.356. Actual adjustment realized over three years is as follows:

Table: V-Proportion of Completed and Residual Adjustment to Change

Period	1	2	3	Remaining Adjustment
	0.356	-	-	0.644
	0.356	0.717	-	0.283
	0.356	0.717	0.818	0.182

Approximately 82% of total desired change in economic structure in response to inter-temporal changes in factor endowment is accomplished in 3 years. The long period of adjustment is explained by involvement of time in (i) acquisition and utilization of new machinery and equipment in which investment is

made; (ii) conversion of savings into investment/capital, (iii) Relatively sluggish growth of employment and replacement of old by new workforce. But the short run impact of change in current factor endowment on economic structure is 7.17. Thus, the factor endowment of the economy changes with the changes in economic structure. *This refutes the implicit assumption of fixity of factor endowment of the conventional theory*. *This also highlights the fact that a country exports what it produces and its production is embodied in its economic structure which determines factor endowment, especially in case of planned developing economies which adopt industrialization as an instrument of development despite the scarcity of capital.* The traditional labor intensive production structure tends to gradually become capital intensive under the impact of industrialization based growth. Changing pattern and structure of production is reflected in changes in factor endowment. This is an outcome of policy of industrialization followed since 1951. This lends credence to our *a priori reasoning* that change in economic structure in the course of economic growth changes factor endowment.

Economic Structure, Factor Endowment and Structure of Trade

Modified Factor Endowment theory postulates that economic structure and factor endowment together govern and guide the changes in trade structure and vice versa. One version stipulates that preceding period's economic structure, ES_{t-1} and factor endowment, FE_{t-1} together determine current structure of exports, $EXPRT_t$. This takes lags involved in production of export goods into consideration. The thesis complementary to the above stipulates current economic structure, ES_t to depend on lagged export structure, $EXPRT_{t-1}$ and lagged factor endowment, FE_{t-1}.

First the regression functions are tested for auto-correlation (Functions are not reported). Auto-correlation coefficient is statistically significant for regression functions of both export structure and economic structure (second) function. Calculated values of Durban-Watson d statistics are respectively 0.586 and 0.938, which are lower than the table values of d_l. The data for both export and economic structures and their determinants are adjusted for first order auto-regression. The functions are re-estimated from adjusted data; OLS estimates of functions of export and economic structures are shown in the table below:

Table-VI: Estimates of Functions 1 ad 2 of Export Structure and Economic Structure

α_0	α_1	α_2	R^2	F	P*	t_1	t_2	t_3
0.1118	0.000102	– 24.62	0.1688	2.7431	0.0823	19.301	0.6169	- 2.038
36.6059	– 197.54	–33543	0.2853	5.1982	0.0126	5.5492	- 2.196	-2.97

First function does not fit the data well, since the explained proportion of variation is as low as about 17% of total change in economic structure and the coefficient of determination is significant only at 0.0823 probability level. Besides, the coefficient of export structure is not significant statistically. The non-significance of the coefficient of export structure may be attributable to multi-collinearity. But factor endowment is inversely related with economic structure. This is explained by the fact that capital base of production relative to labor is being increasingly deepened through time. Besides, the function further substantiates the inverse relation between economic structure and factor endowment revealed by earlier results.

Second function shows that current structure of exports is determined jointly as well as separately by previous period's factor endowment and economic structure. However, the relation with both pre-determined variables of structure of exports is inverse. Inverse relation between these variables is explained partly by the method of measurement of structure of the economy and factor endowment which runs counter to each other.

Above results furnish empirical evidence to support the twin hypotheses of this study that (i) economic / production structure determine structure of trade, (ii) dynamic growth of economy leads to reversal of factor intensities of traded goods, and (iii) it is preceding rather than current period's factor endowment which influence structure of trade.

A priori reasoning in the study stipulates bidirectional relationship between economic structure, factor endowment and structure of trade. The other direction of inter-relations of these variables is examined by the following regression functions: 1. $ES_t=f(TRS_{t-1})$; 2. $ES_t = f(FE_{t-1},IMPRT_{t-1})$; 3. $TRS_t = f(FE_{t-1})$; 4. $ES_t=f(TRS_{t-1},FE_{t-1})$; 5. $FE_t = f(TRS_{t-1})$

TableVII: Relations among Economic Structure, Trade Structure and Factor Endowment

	α_0	α_1	α_2	R^2	F	F*	t_1	t_2	t_3
(1)	0.1994	0.0004	-	0.124	3.996*	0.055	9.761*	1.999*	-
(2)	0.2458	-19.834	– 1.9E-05	0.346	7.154*	0.0032	80.385*	-3.747*	-0.066
(3)	103.598	– 14369.8	-	0.2992	11.954*	0.0017	61.659*	-3.457*	-
(4)	0.2556	– 9.6E-05	-21.754	0.3499	7.267*	0.0029	9.951*	0.3901	3.0574
(5)	0.0022	– 2 E-05	-	0.465	24.343*	3.32E-05	5.511*	-4.933*	-

*Significant at 0.05 probability level.

Equation 1 shows that (i) trade structure significantly influences economic structure of the economy as has been hypothesized in the study; (ii) But introduction of factor endowment as an a determinant and replacement of trade structure by import index as second determinant in equation 2 improves the explanatory power of the function tremendously relative to equation 1. But the coefficient of import index is not significant; it loses significance in equation 2 due to multi-collinearity; (iii) Equation 4 lends support to the thesis that structure of trade is dependent on factor endowment; (iv) Replacement of import structure in relation 4 by trade structure in function 2 as the second determinant of economic structure along with factor endowment not only improves the explanatory power of the function but the coefficients of both trade structure and factor endowment emerge as significant explanatory variables of economic structure. This lend credence to on of the theses proposed in the study; (v) Trade structure inversely influences the factor endowment of the Indian economy as has been emphasized in the study. **These findings run counter to the predictions of the conventional theory that the pattern and structure of international trade among countries are determined by factor endowment.**

Section III

Relation between Exports, Economic Structure and Factor Endowment (I-O Model based)

Impact of economic structure and factor endowment, measured by sector-wise labor-capital ratios, on exports is evaluated by the OLS estimate of the regression model at 4 points in time. I-O tables are available for 1993-94, 1998-88, 2003-04, and 2006-07. As cross section data of sectors constitute the base of these functions, one each for one year, estimated functions are tested for heteroscedasticity by Park Test: $EXPRT_t = \alpha_0 + \alpha_1 ES_t + \alpha_2 LCR_t$. (These 4 estimated regressions, used for derivation of error variances, **are not reported due to heteroscedastic error variances,** which are required for adjustment of data for heteroscedasticity**).** $EXPRT_t$ = Exports, ES_t = Economic Structure, LCR_t = Labor- capital ratio.

Park Test

Results of Park test based on the equation given below are reported for all four years in table VI:
$\ln U_t^2 = \alpha_0 + \alpha_1 \ln ES_t + \alpha_2 \ln LCR_t + \varepsilon_t$

Table VIII-Results of Park Test of Heteroscedasticity-Regression of Export Structure

Year	α_0	α_1	α_2	R^2	F	F*	t_1	t_2	t_3
2006-07	12.637	0.252	0.137	0.0724	4.293*	0.0160	23.264*	2.1*	1.606
2003-04	12.217	0.597	-0.113	0.209	14.55*	2.48E-06	38.819*	5.05*	-1.368
1998-99	12.878	1.309	0.052	0.458	46.55*	2.25E-15	33.130*	9.44*	0.501
1993-94	11.93	1.17	0.19	0.32	26.06*	5.42E-10	24.29*	6.63*	1.29

The above results indicate the presence of heteroscedasticity in the function in all four years. Heteroscedasticity arises from diversity of economic structure the coefficient of which is significant and the coefficient of labor-capital ratio (factor endowment) is not significant in any of these equations. Data adjusted by error variances are used for re-estimating the function of export structure: $EXPRT^*_t = \alpha_0 + \alpha_1 ES^*_t + \alpha_2 LCR^*_t + \varepsilon_t$

OLS estimates of the functions are reported in the table below for 2006-07, 2003-04, 1998-99, 1993-94 respectively.

Table IX: Export Structure* as Function of ES * and LCR*.

Year	α_0	α_1	α_2	R^2	F	F*	t_1	t_2	t_3
2006-07	0.3349	85901596	0	0.911*	1142.43	2.61E-74	1.523	33.80*	0.65535
2003-04	0.652	42106814	-826.385	0.911*	564.64	1.42E-58	7.54*	32.85*	-1.794
1998-99	0.789	53297512	0.1347	0.984*	3281.6	8.7E-99	1.71	80.98*	1.001
1993-94	0.47	1357432	1.41	0.99*	598847.3	92.E-21	6.04*	46.23*	0.16

- Denotes adjustment of data by error variances of the original function.

Above table shows that (i) Explanatory power of the function is raised substantially by the adjustment of data for heteroscedastic error variances; (ii) Current economic structure greatly influences structure of exports independently of the influence of LCR/factor endowment in all 4 years; (iii) Factor endowment inversely but not significantly affects export structure in 2003-04 but its influence on export structure independently of economic structure in all other years is positive. But the positive coefficient of factor endowment is not significant in any

of the 3 years of observation; and, (iv) Non significance of the coefficient of factor endowment appears to arise *partly from multi-collinearity; (v)* Non significant influence of factor endowment may also be attributed, besides multicollinearity, to the fact that exports depend upon demand in international markets and availability of exportable surpluses in the exporting countries. If international demand is taken as given, then exportable surplus jointly with commercial policy of the country govern and guide exports. The incentives in-built in the policy will induce exporters' to explore new markets and expand their share of exports in existing markets for their products. This inference is supported *by significance of the intercept in 2003-04 and 1993-94, which indicates that export structure is significantly influenced by factors other than economic structure and factor endowment in these two years*.

Above results lend further credence to the thesis of this paper that factor endowment loses importance as a determinant of structure of trade in a dynamically growing economy in a state of flux.

Input Output Analysis of Factor Intensity Reversal

An important question arising from results of this study is whether the growth of Indian economy has resulted in factor intensity reversal in production processes in the Indian economy. Number of sectors depicting factor intensity reversal is estimated from I-O model. The factor intensities at the given point in time are determined by the following model:

$A_{0t}\,(I-A_t)^{-1} / B_t\,(I-A_t)^{-1} = Z_t$

$(I-A_t)^{-1}$ cannot be cancelled since A_0 vector of labor coefficients of sectors, and B, the matrix of capital coefficients have different dimensions. Resultant pre-multiples of numerator and denominator will differ from each other for sectors. Inter-temporal differences are derived from the following ratio: $\mathbf{Z_{t+1}}/\mathbf{Z_t}$. . Table-X shows sectors undergoing factor intensity reversals.

Table X: Export and Non-Export Sectors showing Factor Intensity Reversal

Export sectors with Factor Intensity Reversal	**Export sectors without Factor Intensity Reversal**	**Non Export sectors with Factor Intensity Reversal**	**Non Export sectors without Factor Intensity Reversal**
Maize , Groundnut, Coconut, Jute, Rubber, Tobacco, Milk and milk products, Other liv.st. produ. & Gobar Gas, Forestry and Lnging, Coal and lignite, Lime stone, Mica, Other non metallic minerals, Sugar, Tea and coffee processing, Beverages, Khadi, cotton textiles handlooms, Cotton textiles, Woolen textiles, Silk textiles, Art silk, synthetic fiber textiles, Carpet weaving, Furniture and fixtures-wooden, Wood and wood products, Printing and publishing, Leather footwear, Inorganic heavy chemicals, Organic heavy chemicals, Fertilizers, Pesticides, Drugs and medicines, Other chemicals, Structural clay products, Iron and steel casting & forging, Hand tools, hardware, Tractors and agri. Implements, Industrial machinery(F & T), Machine tools, Ships and boats, Rail equipments, Motor cycles and scooters, Bicycles, cycle-rickshaw	Paddy, Wheat, Pulses, Other Crops, Poultry & Eggs, Fishing, Crude Petroleum and Natural Gas, Iron ore, Manganese ore, Bauxite, Other metallic minerals, Readymade garments, Miscellaneous textile products, Paper, paper prods. & newsprint, Leather and leather products, Rubber products, Plastic products, Petroleum products, Coal tar products, Paints, varnishes and lacquers, Edible oils other than vanaspati, Miscellaneous food products, Tobacco products, Jute, hemp, mesta textiles, Soaps, cosmetics & glycerin, Synthetic fibers, resin, Cement, Other non-metallic mineral prods., Iron, steel and ferro alloys, Iron and steel foundries, Non-ferrous basic metals, Miscellaneous metal products, Industrial machinery(others), Other non-electrical machinery, Electrical industrial Machinery, Electrical wires & cables, Batteries, Electrical appliances, Communication equipments, Other electrical Machinery, Electronic equipments(incl.TV), Motor vehicles, Other transport equipments, Miscellaneous Manuf., Railway transport services, Supporting and Aux. Activities	Jowar, Bajra, Gram, Sugarcane, Cotton, Tea, Coffee, Animal services(agricultural), Khandsari, boora, Hydrogenated oil(vanaspati), Construction, Electricity, Communication, Trade, Hotels and restaurants, Banking, Insurance, Other Services, Water supply, Storage and warehousing	Copper ore, Ownership of dwellings, Medical and health, Public administration

Two broad inferences may be drawn from sector specific total labor-capital ratios during one and a half decades covered by I-O tables: (i) Total labor-capital ratios differ sharply between the sectors at each point of observation; (ii) Total labor-capital ratios differ for each sector between all 4 points of observations; (iii) There exists discernible **trend of decline in total labor-capital ratios both between sectors and inter-temporally for the same sector** between 1993-94, 1998-99, 2003-04 and 2006-07; (iv) **Pattern of changes in these ratios** displays the following facets (For identification of sectors, See table-8 above):

(1)Forty two manufacturing and non-manufacturing export sectors depict continuous and considerable decline in total labor per unit of capital used in production to satisfy one unit of international final demand. This **highlights the substitution of labor by capital intensity in production of these export** goods. This lends credence to the thesis of factor reversibility in these sectors under the impact of growth;
(2) Out of 42 export sectors subject to factor reversal process, 29 **are manufacturing and 13 sectors are agricultural in nature and orientation**;
(3) Only **6 export sectors** subject to factor reversal process fall in other services/categories;
(4) As against this, **46 export sectors** do not exhibit significant factor intensity reversal in production. It is inferred that these 46 export sectors have not experienced substantial change in technology over a period of nearly 2 decades covered by the study.

The above findings lend credible empirical support to the following theses of this study:
(1) Technology based modern economic growth involves substitution of capital for labor in most of the sectors, including export sectors of the economy;
(2) Factor contents of production change with technology, which results I in factor reversibility in the long run;
(3) Factor intensities in production vary between sectors at given point in time and between sectors through time;
(4) Macro level factor endowment hardly matters in the determination of pattern of international trade as factor contents generally differ between traded and non-traded goods;
(5) Factor contents have always been subject to factor reversibility in long run growth;
(6) It is note-worthy that regression models, including those based on conventional macro production functions, cannot reveal the sector wise reversal or invariance of factor intensities of production;
(7) 21 *non export sectors* in Indian economy show reversal of factor intensity; and
(8) Only 4 non export sectors do not exhibit any factor intensity reversal. These sectors have been using stagnant technology.

Above findings lend substantial empirical evidence in support of the thesis that modern growth radically influences factor endowment, economic structure and pattern and structure of trade.

Section-IV

Cobb Douglas Production Function

Several studies have used production function approach to evaluate the individual and joint effect of variations of labor and capital on output either through time or across sectors. Changes in output in response to changes in capital and labor facilitate imputation of growth of productivity to alteration in factor endowment, shown by labor and capital in Cobb Douglas production function, which is estimated from aggregate time series data from 1980-81 to 2010-11 and cross section data of total and direct requirements of labor and capital derived from I-O analysis for 1993-94, 1998-99, 2003-04 and 2006-07 separately. The Cobb-Douglas function is tested for autocorrelation (in case of time series data base) and heteroscdasticity (in case of cross section data base) respectively.

Aggregate Cobb-Douglas Production Function (Time Series)-I

The calculated value of d statistic for the original Cobb-Douglas production function (results not reported) is 0.86. This indicates significant autocorrelation. So, the data are adjusted for first order auto-correlation. OLS estimates of Cobb Douglas Production Function, *based on auto-correlation adjusted data*, are as follows:

$\ln O^*_t = -0.370+2.048 \ln K^*_t+ 0.676 \ln L^*_t,\ R^2 = 0.9942,\ F= 2321.57>F^*- 6.13E-31$
t: (-1.51) (3.72) (12.04)

O_t=output, K_t=Capital, L_t=Labor, and t= time. * Sign indicates use of auto-correlation adjusted data base. The function explains 99.42% of total change in output over the years. The coefficients of determination

and both output elasticity with respect to capital and labour are statistically significant. But the growth of output seems to have been dominated more by capital than labor. The function shows that one percent increase in investment/capital increases output by 2.05% which is approximately 3 times greater than the labor's output elasticity which shows that 1% increase in employment raises output only by only 0.68%. The negative but not significant intercept implies that such variables as organization structure, techniques of management at micro level and quality of intermediate inputs have remained more or less invariant. Non-significance and negative sign of intercept indicate constancy of technology above mentioned variables which are generally associated with the change in technology (See, Prakash and Balakrishnan, 2008). *The function highlights the fact that the production process has become much more capital intensive than before.* This also *lends credence to the thesis of reversal of factor intensities in production in Indian economy. This evidence supports the thesis that growth brings about significant change in factor endowment*.

Cobb-Douglas Production Function II (Cross Section) I-O Model Based Total Capital and Labor Requirements of Sectors

Total labor, TL_t and total capital, TK_t used in production are derived from I-O model to estimate Cobb-Douglas production function for1993-94, 1998-99, 2003-04 and 2006-07 from data of 113 sectors of the Indian economy. The function was tested for heteroscedasticity by Park Test. OLS estimates for Park Test are reported below:

Table XI:$\ln U_t^2 = \alpha_0 + \alpha_1 \ln TK_{Tt} + \alpha_2 \ln TL_{Tt}$

Year	α_0	α_1	α_2	R^2	F	F*	t_1	t_2	t_3
2006-07	-1.161	0.149	0.098	0.020	1.168	0.314	-7.40	1.294	0.842
2003-04	-1.300	-0.008	-0.087	0.006	0.358	0.699	-8.844	-0.063	-0.593
1998-99	-1.748	-0.251	0.115	0.058	3.403	0.036	-12.43	-2.470	0.740
1993-4	-1.722	0.0031	-0.224	0.051	2.990	0.054	-12.71	0.019	-1.916

The coefficient of determination has very low value for all 4 years, though it is significant for 1994 and 1999 only. The function for 1993-04, 2003-04 and 2006-07 shows that the error variances are not influenced by changes in total labor and total capital. Therefore, the function is free from heteroscedasticity for these 3 years. But the error variances are significantly but negatively influenced by the changes in capital stock in 1998-99; this function is adversely affected by heteroscedasticity.

OLS estimates of the Cobb-Douglas production function, based on total capital and labor requirements (estimated from I-O model) are given below:

Table XII: $\ln O_t = \alpha_0 + \alpha_1 \ln TK_t + \alpha_2 \ln TL_t + U_t$

Year	α_0	α_1	α_2	R^2	F	F*	t_1	t_2	t_3
2006-07	6.657	-0.144	0.557	0.239	17.295	2.94E-07	50.59	-1.48	5.65
2003-04	6.290	-0.081	0.645	0.275	20.872	2.06E-08	51.445	-0.712	5.350
1998-9*	3.857	-1.281	2.062	0.156	10.196	8.66E-05	10.972	-3.864	4.002
1993-4*	5.794	0.869	-0.11	0.712	136.017	1.82E-30	112.409	14.245	-2.47

- Depicts adjustment of data for heteroscedasticity.

A perusal of above results show that (i) Cobb-Douglas function does not fit well to the data of last 3 of the 4 years, if explained proportion of total variation is considered which ranges from 15.6 to only 27.5%, though the coefficient of determination is statistically significant in all 4 cases; (ii) Coefficient of total capital is not only negative but it is not significant for 2003-04 and 2008-07. This may imply low variation of total capital used in production between sectors in these years; (iii) Explanatory power of the function for 1998-99 is the lowest and the coefficient of capital is significant but negative. Negative sign may probably be attributed to multi-collinearity; (iv) The function fits the data fully well only to the cross section data of 1993-94. The coefficient of labor is negative but significant. It implies that employment in 1993-94 remained more or less stagnant; (v) Coefficient of labor for other 3 years is positive and significant. It may be noted that empirical production function is mostly subject to multi-collinearity.

Production Function III (Cross Section) based on Direct Requirement of Capital and Labor

$\ln O_t = \alpha_0 + \alpha_1 \ln DK_t + \alpha_2 \ln DL_t + U_t$; DK_t = Direct Capital Requirement, DL_t = Direct Labor Requirement. The function was again tested for heteroscedasticity by Park Test. OLS estimates of Park Test are reported in the table given below:

Table XIII: $\ln U^2_t = \alpha_0 + \alpha_1 \ln DK_t + \alpha_2 \ln DL_t + e_t$

Year	α_0	α_1	α_2	R^2	F	F*	t_1	t_2	t_3
2006-07	-1.090	0.024	-0.107	0.0099	0.555	0.575	-4.142	0.208	-0.911
2003-04	1.551	-0.265	-0.033	0.867	358.765	6.29E-49	94.974	-21.18*	-2.31*
1998-99	-1.478	0.313	-0.189	0.104	6.414	0.002	-12.34	2.83*	-2.45*
1993-94	-1.275	0.399	0.185	0.119	7.481	0.00089	-9.225	3.24*	2.04*

The above results indicate the presence of heteroscedasticity in the function for 1993-94, 1998-99 and 2003-04. The data have been adjusted for heteroscedasticity and the OLS estimates from data adjusted by error variances are presented below:

Table IVX: OLS Estimates of C-D Production Function from Directly Labor and Capital Required Data Adjusted by Error Variances

Year	α_0	α_1	α_2	R^2	F	F*	t_1	t_2	t_3
2006-07	6.894	-0.025	0.296	0.273	20.688	2.36E-08	46.833	-0.383	6.131*
2003-04	5.986	0.552	-0.107	0.649	102.084	8.56E-26	69.790	12.22*	-2.01*
1998-99	4.457	-0.8001	2.305	0.093	5.657	0.0045	14.292	-2.204*	3.17*
1993-94	4.411	-0.282	2.186	0.099	6.071	0.0031	14.898	-0.620	3.37*

Fit of this function is poor by and large in terms of explanatory power and sign and significance of elasticity coefficients. Reason underlying these results appear to be multicollinearity. This is remedied by dividing both output and employment by capital to obtain OLS estimate of Solow production function. These re-estimated functions are reported hereunder.

Solow Production Function-I

Production function estimates are always affected by multicollinearity as both labor and capital are used together in production. In an optimum combination of labor and capital there is no possibility of substitution of labour for capital and vice versa. But sub-optimum combination, which generally exists in practice, always warrants substitution of one factor for another. Solow, therefore, modified Cobb Douglas production function by elimination of capital as a distinct factor and used labor per unit of capital to determine output per unit of capital:

$\ln(O_t/K_t)=\alpha_0+\alpha_1 \ln(L_t/K_t)+U$. The function is applied to data of direct labor-capital ratio and output per unit of direct capital. OLS estimates of these functions are reported in table XV.

Table XV:OLS Estimates of Solow Production Function-I

Year	α_0	α_1	R^2	F	F*	t_1	t_2
2006-07	4.78	1.49	0.14	17.26	6.42E-05	14.4	4.15*
2003-04	4.62	-0.22	0.01	1.19	0.28	11.93	-1.08
1998-99	3.03	1.77	0.25	37.66	1.33E-08	9.5	6.14*
1993-94	3.67	1.84	0.25	38.23	1.07E-08	12.07	6.18*

*Significant at 0.05 probability level.

The function treats productivity of capital as function of factor endowment, shown as the ratio of direct labour to direct capital requirement. The table shows that the coefficient of determination declines over the years from 1993-04 to 2006-07. The factor endowment significantly affects the capital productivity in all years except 2003-04. Sign of 3 out of 4 significant coefficients of labor-capital ratio is positive, which supports the thesis of multi-collinearity affecting the results of Cobb-Douglas production function.

Solow Production Function-II

The function is now applied to total labor-capital ratio on productivity and total capital (I-O model based): $\ln (O_t/TK_t) = \alpha_0+\alpha_1 n (TL_t/TK_t)+U$; results are shown in table XVI.

Table XVI: Estimate of Solow Production Function-II

Year	α_0	α_1	R^2	F	F*	t_1	t_2
2006-07	6.21	1.13	0.41	75.96	3.18E-14	44.02	8.72*
2003-04	6.76	0.77	0.31	50.55	1.2E-10	57.85	7.10*
1998-99	5.87	1.18	0.61	171.08	3.19E-24	48.17	13.08*
1993-94	5.67	1.22	0.55	138.08	3.32E-21	49.45	11.75*

Interestingly, the explained proportion of variation for this function is much higher than that of earlier function in all 4 years. Explained proportion of variation ranges from 31% in 2003-04 to te the maximum 61%

in 1998-99. This may probably be accounted by the bunching of heavy investment in the economy in 1998-99. However, the onset of recession in US economy seems to have affected the investment, especially foreign investment in Indian economy. Ration of total labor to total capital calculated from I-O model, significantly impacts the capital productivity in all 4 years. Increase in capital productivity with deepening of capital base is in consonance with the earlier results of regression of direct capital productivity on direct labor-capital ratio. It thus shows that productivity of capital increases with rise in capital as a proportion of total factors in use. Above results may imply that economic structure has still not reached the optimum combination of labor and capital in production. Hence there is scope for further substitution of labor by capital.

Above results raise the question whether there has been a shift in production function due to change in technology. This is examined by two factors ANOVA: sectors and 4 points in time are treated as two factors of classification. Each year is associated with the use of different technology matrix which is the base of estimation of total labor and total capital required per unit of final demand..

Change in Technology

Results of two factors ANOVA relating to total capital used in production over the years are reported in the table XVII:

Table XVII: Two Factors VII-Two Factor ANOVA of Total Capital Employed in 113 Sectors

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Rows	1.16E+16	112	1.04E+14	5.17346	8.5E-32	1.277989
Columns	1E+15	3	3.34E+14	16.63681	4.22E-10	2.631489
Error	6.75E+15	336	2.01E+13			
Total	1.94E+16	451				

Physical capital is the carrier of technology while manpower is the carrier of human capital. Above results show that total capital used in production per unit of final demand has changed significantly not only between the years but also within the sectors of the economy in any given year.

Results of two factor ANOVA for total workforce employed in different sectors for production in different years are shown in the table XVIII.

Table XVIII:Two Factors ANOVA of Total Manpower Employed in 113 Sectors

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Rows	242722	112	2167.16	7.737237	1.23E-48	1.277989
Columns	1318.465	3	439.4882	1.569069	0.196663	2.631489
Error	94111.87	336	280.0949			
Total	338152.3	451				

Section V

Main Findings

The above results indicate that total labour requirement has changed among the sectors of the economy significantly. But the impact of technology on total manpower employed per unit of final demand has not been so rapid as the capital accumulation. The variation between the columns inter-temporally is not significant. These results also support the thesis of factor reversal dominated by capital rather than manpower.

The above findings lend credible empirical support to the following theses of this study:

(1) Technology based modern economic growth involves substitution of capital for labor in most of the sectors, including export sectors of the economy;

(2) Factor contents of production change with technology, which results I in factor reversibility in the long run;

(3) Factor intensities in production vary between sectors at given point in time and between sectors through time;

(4) Macro level factor endowment hardly matters in the determination of pattern of international trade as factor contents generally differ between traded and non-traded goods;

(5) Factor contents have always been subject to factor reversibility in long run growth;

(6) It is note-worthy that regression models, including those based on conventional macro production functions, cannot reveal the sector wise reversal or invariance of factor intensities of production;

(7) 21 *non export sectors* in Indian economy show reversal of factor intensity; and

(8) Only 4 non export sectors do not exhibit any factor intensity reversal. These sectors have been using stagnant technology.

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