Descriptive analysis of manufacturing production and international trade

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Abstract: International trade plays an important role in the economy of each individual country. It allows to satisfy the needs of the population; stimulates the internal development of the country. International trade is the exchange of goods and services between countries. The paper studies specialisation patterns in manufacturing production and international trade to (1980-2013). It investigates whether specialisation has increased in the international trade and analyses whether these patterns are consistent with three different strands of trade theories: the classical Heckscher-Ohlin theory, the 'new' trade theories based on increasing returns to scale, and the economic geography' theories based on vertical linkages between industries. I find that there is evidence of increasing specialisation in the international trade and there is some support for all three strands of trade theories.

Key words: International trade, specialisation, Economic Geography, Trade Theories.

1.1 INTRODUCTION

In this section, we provide a descriptive statistical account of manufacturing production and trade pattern during the reference period. The analysis is based on simple statistical tools such as annual growth rates and average shares. For brevity, the entire period is sub-divided as follows: Period I (1980 to 1990), Period II (1991 to 2000), Period III (2001 to 2007) and Period IV (2008 to 2013). The first period covers the period of initial liberalisation in terms of import deregulations in the 1980s. The second period marks the beginning of the comprehensive liberlaisation regime of the 1990s. The third period covers further expansion of trade liberalisation until the external demand shock from the global economic crisis in 2008. Period IV corresponds to an environment with considerable external uncertainty and demand shock due to the onset of global financial Crisis.

Table provides the growth of India's manufacturing production, in terms of real value added at 2004–05 prices, at sectoral level. Figures in parenthesis are the respective sectoral shares in overall manufacturing for a given period. For the entire period (i.e., 1980 to 2013), the average growth rate of organised manufacturing output is around 8 per cent per annum. The manufacturing production grew at this rate during the 1980s (period I) but declined to 6 per cent per annum during the 1990s (period II). However, production witnessed considerable improvement in the following period as it registered double-digit

growth rate of 15 per cent per annum during 2007–08. Thereafter, the growth rate declined to the level witnessed in the nineties.

Trend of manufacturing sector (1980-2013) % per annum

Description (2digit)	*1980-90*	*1991-00*	*2001-07*	*2008-13*	*1980-2013*
Food products & beverages (15)	11.5 (10.3)	5.8 (10.6)	9.1 (8.8)	7.0 (8.7)	8.4 (9.8)
Tobacco products (16)	13.7 (1.8)	8.9 (2.1)	1.3 (2.1)	3.0 (1.5)	7.7 (1.9)
Textiles, wearing apparel (17+18)	7.4 (14.9)	8.7 (11.7)	8.4 (8.1)	10.4 (7.4)	8.6 (10.5)
Tanning & dressing of leather (19)	14.9 (0.9)	3.4 (0.9)	11.6 (0.7)	14.7 (0.8)	10.7 (0.9)
Wood products (20)	7.6 (0.5)	-2.4 (0.3)	20.8 (0.2)	14.0 (0.2)	8.6 (0.3)
Paper & paper products (21)	9.2 (1.9)	7.1 (1.9)	6.2 (1.6)	9.3 (1.2)	7.9 (1.7)
Publishing & printing (22)	0.6 (1.9)	1.9 (1.7)	11.1 (1.4)	-1.6 (0.9)	2.8 (1.5)
Coke, refined petroleum & nuclear fuel (23)	29.2 (4.2)	13.5 (4.7)	33.1 (11.8)	7.3 (11.9)	21.3 (7.9)
Chemicals & chemical products (24)	10.9 (14.6)	9.5 (19.9)	7.4 (17.1)	10.5 (16.6)	9.7 (17.4)
Rubber & plastics products (25)	13.1 (3.0)	10.7 (3.2)	11.9 (2.9)	18.2 (3.9)	13.1 (3.3)
Non-metallic mineral products (26)	10.8 (4.9)	9.1 (4.7)	17.1 (5.1)	0.0 (6.0)	9.7 (5.1)
Basic metals (27)	8.4 (12.4)	6.4 (11.7)	21.4 (14.8)	2.3 (12.9)	9.4 (12.7)
Fabricated metal products (28)	4.6 (2.9)	8.2 (2.9)	18.1 (3.0)	2.2 (4.1)	8.1 (3.1)
Machinery & equipments (29+30)	6.1 (9.4)	5.7 (7.6)	12.4 (6.5)	8.4 (7.6)	7.7 (7.7)
Electrical machinery & apparatus (31+32)	12.4 (6.8)	7.0 (7.2)	15.7 (5.8)	2.6 (4.8)	9.7 (6.4)
Medical, precision & optical instruments (33)	9.5 (1.2)	18.5 (0.9)	20.1 (1.0)	36.9 (2.5)	19.4 (1.3)
Motor vehicles & trailers (34+35)	9.4 (8.6)	5.1 (7.9)	20.4 (9.0)	9.3 (9.0)	10.4 (8.5)
Manufacturing sector	**8.1 (100)**	**5.9 (100)**	**14.9 (100)**	**5.7 (100)**	**8.4 (100)**

Note: Figures in parenthesis are the average share of individual sector in total manufacturing. The growth rates are the simple average of annual growth over the respective periods. Production data is based on real net value added, base 2004-05=100

Source: Author's calculation based on data collected from ASI (CSO), various issues.

Even though there is considerable variation in sectoral growth rates, the general trend is similar to the pattern observed at the aggregate level. For instance, we can notice that relative to period II, the growth rates of 13 sectors are relatively higher during period I.

During period III, the growth rates improved substantially, as 12 sectors witnessed double-digit growth rates. However, the growth resurgence did not persist for long as 10 sectors witnessed sharp deceleration in the final period. For the entire period, nine manufacturing sectors registered double-digit growth rates, namely leather (11%), coke & petroleum (21%), chemicals (10%), rubber and plastics (13%), non-metallic minerals (10%), electrical machinery (10%), medical, precision and optical instruments (19%) and transport equipment (10%). The distribution of manufacturing sector in terms of value added share reveals that the chemicals sector, with 17 per cent share, is the largest contributor followed by

machinery, including electrical & non-electrical (14%), basic metals (13%), and textile segments (10%). The share of non-traditional technology-intensive industries such as chemicals, coke & petroleum and transport equipment has witnessed a consistent increase during the reference period. On the other hand, the share of traditional and less-technologyintensive sectors such as food & beverage, tobacco, textiles, wood & paper products and rubber & plastics, has either declined or remained stagnant during the entire period. This indicates the changing nature of sectoral specialisation from traditional segment of manufacturing to more advanced or knowledge-intensive manufacturing activities. Overall, in terms of robust growth rates and size distribution, the chemicals and capital goods segments have been the leading sectors in organised manufacturing in recent decades.

In *Table 3*, the pattern of manufacturing trade by selected industrial sectors is given. In terms of manufacturing exports share, textiles (20%), chemicals (15%), food & beverage (14%), coke & refined petroleum (10%) and machinery (9%), constitute the largest share during the entire period of study. The share of non-traditional export sectors such as chemicals, machinery, coke & petroleum, transport equipment, etc., have expanded and sustained their relative sizes. In contrast, most of the traditional export sectors such as food & beverage, textiles, leather, etc., have witnessed a sustained decline in relative export share during the same period. Similarly, import composition reveals a heavy dependence on technology-intensive products during this period. Some of the major import sectors are coke & petroleum, chemicals, basic metals and machinery equipment.

The growth profile of manufacturing exports reveals that most of the sectors have witnessed double-digit growth rates during various sub-periods. The growth is relatively less impressive during the 1990s as most of them witnessed considerable deceleration. However, similar to the production case, the exports of almost all sectors have revived during the third period. However, the contraction in world demand in period IV seems to have affected the export prospects, as there was deceleration across sectors, except in food & beverage, textiles, leather and paper products. Overall, manufacturing exports grew at 18 per cent per annum during the entire period. In case of

Figure Trend in manufacturing trade (1980-2013) % per annum

Description (2-digit)	*Exports*					*Imports*				
	1980-90	*1991-00*	*2001-07*	*2008-13*	*1980-2013*	*1980-90*	*1991-00*	*2001-07*	*2008-13*	*1980-2013*
Food products & Beverages (15)	44.8 (13.5)	10.8 (18.4)	14.7 (10.7)	22.7 (9.0)	24.1 (13.6)	-0.6 (9.7)	38.0 (5.0)	10.9 (4.9)	25.8 (4.3)	18.3 (6.4)
Tobacco Products (16)	13.2 (0.9)	6.3 (0.2)	16.9 (0.1)	12.8 (0.1)	11.8 (0.4)	38.6 (0.0)	23.3 (0.0)	66.0 (0.0)	24.6 (0.0)	37.2 (0.0)
Textiles, wearing Apparel (17+18)	24.0 (24.1)	9.7 (25.7)	7.9 (17.0)	11.0 (8.9)	13.9 (20.4)	55.3 (1.2)	10.1 (2.0)	21.7 (2.3)	9.5 (1.5)	26.2 (1.7)
Tanning & dressing Of leather (19)	25.9 (14.4)	3.0 (7.4)	11.1 (4.2)	11.6 (2.2)	13.2 (8.1)	148.7 (0.2)	8.2 (0.5)	19.1 (0.5)	14.9 (0.4)	54.3 (0.4)
Wood products (20)	3.6 (0.4)	20.3 (0.2)	27.5 (0.1)	15.9 (0.1)	16.0 (0.2)	109.1 (0.1)	17.8 (0.1)	29.5 (0.1)	22.9 (0.2)	48.9 (0.1)
Paper & paper Products (21)	41.1 (0.1)	33.6 (0.4)	15.8 (0.5)	19.7 (0.4)	29.6 (0.3)	16.8 (3.2)	6.3 (2.3)	15.7 (1.6)	15.1 (1.3)	13.1 (2.3)
Publishing & Printing (22)	70.1 (0.3)	27.8 (1.0)	11.3 (0.8)	0.0 (0.3)	32.1 (0.6)	120.6 (0.4)	28.8 (0.9)	20.3 (1.9)	-11.6 (0.3)	47.5 (0.9)
Coke, refined petroleum & nuclear fuel (23)	64.7 (6.6)	12.5 (2.8)	51.2 (13.7)	23.8 2(5.0)	38.6 (10.2)	21.5 (17.4)	1.8 (15.9)	33.4 (7.4)	7.6 (6.1)	15.5 (12.9)
Chemicals & chemical Products (24)	27.7 (11.6)	13.4 (15.2)	21.2 (17.7)	17.1 (16.6)	20.0 (14.8)	152.7 (17.5)	6.7 (24.3)	21.5 (18.5)	16.4 (19.5)	55.8 (20.1)
Rubber & plastics Products (25)	22.7 (2.0)	14.8 (3.1)	20.9 (2.7)	17.8 (2.3)	19.0 (2.5)	70.2 (0.6)	15.0 (1.0)	25.6 (1.3)	14.6 (1.4)	33.9 (1.0)
Non-metallic mineral Products (26)	38.8 (1.0)	21.8 (1.9)	17.0 (2.1)	10.2 (1.3)	23.8 (1.5)	6.4 (1.3)	7.3 (0.7)	28.1 (0.9)	13.7 (0.9)	12.6 (1.0)
Basic metals (27)	34.9 (3.5)	17.2 (6.4)	35.0 (10.1)	14.2 (9.6)	25.8 (6.8)	29.6 (13.7)	16.7 (16.2)	28.4 (21.6)	13.7 (26.0)	22.5 (18.2)
Fabricated metal Products (28)	34.5 (4.0)	12.6 (4.1)	17.6 (4.3)	16.0 (3.2)	20.9 (4.0)	50.0 (1.7)	9.9 (1.3)	32.3 (1.5)	12.1 (1.9)	27.2 (1.6)
Machinery & Equipments (29+30)	26.9 (6.6)	8.2 (4.7)	26.0 (5.7)	14.7 (5.4)	18.8 (5.7)	25.9 (17.5)	8.9 (15.0)	27.4 (15.3)	7.6 (14.1)	17.7 (15.7)
Electrical machinery & apparatus (31+32)	21.2 (3.6)	12.8 (2.8)	27.3 (3.7)	20.0 (5.4)	19.7 (3.7)	35.4 (6.6)	12.5 (6.4)	34.0 (11.9)	10.3 (11.6)	23.6 (8.5)
Medical, precision & Optical instruments (33)	123.4 (0.6)	17.1 (0.7)	18.1 (1.2)	17.3 (1.0)	49.6 (0.8)	42.7 (2.8)	8.2 (3.2)	23.4 (3.5)	10.1 (2.9)	22.2 (3.1)
Motor vehicles & trailers (34+35)	9.8 (6.8)	9.7 (4.9)	29.9 (5.3)	26.7 (9.2)	17.1 (6.3)	55.9 (6.2)	12.9 (5.2)	37.7 (6.6)	19.9 (7.5)	32.5 (6.2)
Manufacturing Sector	**24.4 (100.0)**	**10.3 (100.0)**	**20.5 (100.0)**	**17.1 (100.0)**	**18.0 (100.0)**	**13.0 (100.0)**	**8.1 (100.0)**	**25.9 (100.0)**	**11.3 (100.0)**	**13.9 (100.0)**

Note: Ex= Exports, Im =Imports. The growth is based on simple average annual rates of trade volumes in US $. Figures in parenthesis are the average shares, in percentage, computed yearly. *Source*: Author's calculation based on data collected from DGCIS and UN Comtrade.

1.2 MATERIALS AND METHODS

Econometric Methodology

We propose to assess the impact of international trade on organised manufacturing sector productivity using an econometric methodology. We hypothesise that a relatively greater international exposure to trade will lead to greater productivity in Indian manufacturing. The econometric framework15 relates productivity growth (*P*) in manufacturing to the relative import price (*RP*), import penetration ratio (*IMP*), export intensity (*EXI*), capital intensity (*CI*) and capacity utilisation (*CU*). That is,

$$P_{j,t} = f(RP, IMP, EXI, CI, CU) \quad ---(1)$$

Where, *j* refers to manufacturing sector and *t* refers to year, 1980–2013. The first three trade-related variables are intended to provide evidences of the theoretical channels. In addition, we include both *CI* and *CU* as additional explanatory (control) variables. The level of capital per worker is an important determinant of productivity growth. The capacity utilisation variable is expected to control the procyclical nature of productivity in manufacturing.

The empirical analysis is based on 17 cross-section manufacturing sectors identified at 2- digit level observed through 1980–81 to 2013–14. The panel is balanced and the statistical inferences are based on standard panel regression estimation methodology. Panel regression provides robust inference of parameters by blending the inter-sectoral differences with intra-sectoral dynamics and helps to control the issue of omitted variable biases arising from unobserved heterogeneity in the regression model (Hsiao, 2003).

1.3 RESULTS

To study the trade-productivity growth nexus, we use a panel econometric estimation technique outlined in the methodology. We use the standard longitudinal regression tools on 17 cross-section units observed during 33 years. For all variables, the "within" variation is found to be larger than the "between" variation. The relative import price variable has the largest overall variance while the lowest mean deviation is found in export intensity and import penetration variables. The overall trend of relative import prices, import penetration, export intensity and capacity utilisation. Since the impact of trade exposure on productivity can last for more than one period, the trade related variables are also assigned a lag structure of one to two periods. The econometric model is estimated using the random effect technique40, based on Hausman specification tests41. Standard errors are calculated using the Huber-White standard errors technique, which is found to be robust in the presence of panel level heteroscedasticity and autocorrelation of the unknown form42. The econometric results are discussed in two sub-parts. Part (a) shows the results based on TFP and part (b) the estimation results for LP. In all estimates, the coefficient of capacity utilisation (ΔCU) is positive and highly significant at 1 per cent level. This confirms our assumption of pro-cyclical nature of productivity in the manufacturing sector. Similarly, the coefficient of capital intensity (ΔCI) is found to have a positive and statistically significant impact on LP— contemporaneously and with lags. For TFP, the coefficient is positive but statistically not significant. The results provide robust evidence for the positive impact of increased mechanisation on labour efficiency.

Econometric Results of Trade and Productivity Growth: 2-digit Manufacturing Sector Sample

The random panel estimation results for TFP and LP are given in *Table*. The results are given in three columns corresponding to the lag length. In the first period (no lag), we have 561 observations. In the

second period (1-year lag), we have 544 observations and for the last period (2-year lag), we have 527 observations.

Panel Regression of productivity growth (1980-2013)

Dependent variable: TFPG based value added framework (Random Effects)

Explanatory Variables	*(a) No Lag*	*(b) 1-year Lag*	*(c) 2-Year Lag*
ΔRP	0.006** (0.023)	-0.021*** (0.003)	-0.010*** (0.004)
ΔIMP	-0.175 (0.175)	0.673** (0.273)	-0.486*** (0.014)
ΔEXI	0.050* (0.108)	0.006 (0.263)	0.326 (0.432)
ΔCI	0.063 (0.151)	0.054 (0.136)	0.048 (0.145)
ΔCU	1.089*** (0.0329)	1.090*** (0.321)	1.092*** (0.320)
constant	1.171 (1.00)	0.095 (0.887)	1.047 (0.751)
R^2	0.21	0.23	0.57
Wald test	30.21 (0.0000)***	272.09 (0.0000)***	52.73 (0.0000)***
Hausman	0.13 (0.997)	0.13 (0.997)	0.16 (0.995)
No of observations	561	544	527
No of industry sectors	17	17	17

CONCLUSIONS

The purpose of the present study is to examine the impact of international trade on productivity growth of the organised manufacturing sector in India. The rationale of the study is based on the various theoretical propositions which predict that participating in international trade could augment productivity growth through competition effects, reallocation effects, economies of scale effects and spill over effects. In contrast to the existing empirical studies on India, we tried to assess the relative merits of these channels thorough several trade related variables such as relative import prices, import penetration and export intensity. The empirical assessment is based on a panel econometric estimation of 17 2-digit sectors during the period 1980 to 2013, a period of considerable trade openness in the economy.

The descriptive analysis reveals that organised manufacturing has witnessed noticeable dynamism in terms of growth in production, productivity and trade pattern. There is evidence of a change in the pattern of specialisation—from less technologyintensive/ traditional manufacturing such as food & beverage, tobacco, wood, etc., to highly technology-/skill-intensive modern activities such as chemicals and engineering sectors. The compositional shift is relatively higher in domestic production. The growth in production is accompanied by an expansion in productivity, both TFP and LP, especially during the

2000s. Trade composition has also shifted towards skill-intensive manufacturing, although some traditionally competitive and labour-intensive segments such as textiles still dominate the export basket. The panel econometric results for both TFP and LP reveal evidences of trade-induced productivity gains in manufacturing. In the short period, there is some evidence of negative economies of scale dominating from increased competition. However, we find strong evidence of trade-induced productivity gains operating through imports, especially by intensifying the competitive channels. Apparently, the positive impact of competition, reallocation and spillover channels from imports is unambiguously robust after 1 year. On the other side, there is less evidence of a sustained productivity improvement from reallocation, economies of scale and spillovers effects through exports as it was found to be significant only during the short period. The contemporaneous correlation may be because of the entry of relatively high productivity firms in the exports business with the expectation of recovering initial sunk costs rather than pure learning effects after entry. Finally, the empirical analysis reveals that the impact of international trade on productivity growth in the Indian manufacturing is not static but dynamic in nature.

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