Characterising India's Exports to the U.S.: The Post Liberalisation Dynamics

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Abstract: - India has experienced significant export growth over the past two decades and presently stands as the 10th biggest trading partner of the U.S. Using the U.S. trade data compiled by Robert Feenstra, the U.S. CPI data, and the NBER Manufacturing Productivity database, this empirical paper attempts to understand the anatomy of India's exports to the U.S. between 1991 and 2006. In particular, we analyse how the allocation of industries in the export sector, skill intensity of products, product diversification, and contributions of new products have changed as India's exports to the U.S. have grown. Our findings suggest that India has moved from traditional agricultural and raw material products toward exports of sophisticated manufaturing products that require greater skill to produce. Furthermore, our study finds that India has diversified in the range of products it is exporting to the U.S., with new products gaining an increased share in India's export basket.

Key-Words: - specialization, diversification, trade, extensive margin, intensive margin, skill intensity.

1. Introduction

In the span of 15 years post liberalisation, India's real exports to the world have increased by 304 percent. India has experienced significant export growth over the past two decades. In 2013, India was the 17th largest exporter in the world and was ranked 8th biggest importer in the world. The recent release from the U.S. Census Bureau for the month of April 2013 showed India as the U.S.'s 10th largest trading partner, contributing about 2.8 percent of the U.S. total trade with its top ten trading partners. This paper attempts to understand the anatomy of India's exports to the U.S. between 1991 and 2006. In particular, this paper attempts to observe how India's export structure changed as the country's export expanded. We do this by analysing how the allocation of industries in the export sector, skill intensity of products, product diversification, and contributions of new products have changed as India's exports to the U.S. have grown. The paper decomposes India's export growth along variuos dimensions to see: (i) whether India's export basket to the U.S. has undergone significant redistribution; (ii) whether India's exports have become more skill intensive; (iii) how the degree of specialisation has changed in India's export sector; (iv) the contribution of new export varities towards India's exports to the U.S. Post liberalisation, India has experienced phenomenal export growth in general, and with the U.S. in particular. This remarkable export growth draws attention to understand the nature of the growth. This is of particular importance because the analysis would help us better understand the shift in India's competitive advantage in international trade and would have policy implications toward India's further export oriented growth strategies. The major contribution of this analysis would be to understand the global welfare consequences of India's export expansion and the future growth trajectory of India's export sector.

This research provides valuable insights into the existing literature on trade theory by characterising the Indo-U.S. bilateral trade data. There is a considerable debate in trade literature on understanding the growth pattern of emerging economies and the factors driving that growth. For instance, Hummels and Klenow (2005)

concluded that the extensive margin contributes relatively more in export growth, while Helpman, Melitz, and Rubinstein (2008) argued that growth in the export of existing products (intensive margin) plays the dominant role. In his study on the liberalisation of trade in India in the 1990s, Mukherji (2009) found growth in the extensive margin in both Indian exports and imports. According to his study, the least-traded commodities grew from 10 percent to 33.8 percent of total imports and from 10 percent to 26.5 percent of total exports. A more recent study by Besedes and Prusa (2011) suggested that developing countries would experience significantly higher export growth if they were able to improve their performances at the intensive margin. On the other hand, Aldan and Culha (2013) reported that the export share of the least exported goods increased dramatically for countries such as India, the Czech Republic, and China.

Previous trade literature also argued that developing countries could meet the challenges of unemployment and low growth through diversification of their export bundles. Agosin (2009) attributed export diversification to be an important factor for economic growth across countries. Furthermore, Aditya and Roy (2007) found a U-shaped relationship between economic growth and specialisation of exports. Their findings suggested that export diversification increases economic growth until a critical level of export concentration is reached. Beyond this point increased specialisation leads to higher growth. Given that China is the leading exporter in the world, these findings may explain why we observe increased specialisation in China's exports over the past few years.

Kowalski and Dihel (2009) reported the skill intensity evolution of India's export mix. Their study found that although India managed to secure rapid growth in trade flows, not much development happened in the high-technology export sector. In fact, the skill requirements in India's exports remained stable between 1996 and 2005. Hamburg Institute of International Economics reveals that India's export growth of high-technology manufactured goods has increased less than 5 percent since 1996. On the other hand, India has evolved dramatically as a major exporter of services, and in some cases the export orientation has shifted toward skill intensive services (Kowalski and Dihel, 2009).

This study contributes to the existing literature on trade of emerging economies by particularly focusing on India's export sector to gauge the relation between the country's growth and the changes in its export basket. In relation to the questions posed in this paper, our findings suggest that India has moved from traditional agricultural and raw material products toward exports of sophisticated manufaturing products such as heavy machinery, chemicals, and transportation equipment that require greater skill to produce. The contribution of relatively less skilled industries to India's export growth fell by 30 percentage between 1991 and 2006. Furthermore, our study finds that India's export sector has become relatively more diversified, meaning a variety of products within each product category have contributed to India's export growth. Also new products gaining an increased share in India's export basket.

The rest of the paper is organised as follows: Section 2 describes the data, Section 3 examines the reallocation of exports across industries, Sections 4 and 5 discuss the skill intensity and product diversification in India's export sector, Section 6 examines the contribution of new varities (extensive margin) versus existing varities (intensive margin) in India's export growth, Section 7 compares India's export prices to the U.S. to those from the rest of the world, and Section 8 concludes the paper and discusses future research avenues.

2. Data

The Indo-U.S. trade data used in this paper is obtained from the U.S. import and export data compiled by Robert Feenstra (Feenstra, 1994). The most disaggregated trade data is available at HS 10-digit, which includes 14918 unique product codes. Following Feenstra (1994), we generate cost, insurance, and freight (c.i.f) by adding customs value and charges of imports for consumption. As c.i.f., trade value of the U.S. import from India, is in nominal terms, we use the year 2000 as the base period to deflate c.i.f by the U.S. CPI to generate real values. HS 6-digit data, which includes 4657 unique product codes, is used to measure the industry skill intensity, degree of specialisation, and intensive and extensive margins of India's exports to the U.S. Following Zhu and Trefler (2005), industry skill intensity is measured using the National Bureau of Economic Research (NBER) Manufacturing Productivity Database. We use both SITC1-digit and 2-digit codes in our analysis. The SITC1-digit code data is used to examine the export pattern across nine major industries, while the SITC 2-digit classification is used to analyse the changes within the manufacturing sector.

Table 1 shows both India's total export and export to the U.S. India's real export to the world increased by 304 percent bewteen 1991 and 2006. The share of its exports to the U.S. increased from 16.6 percent in 1991

to 18.5 percent in 2006. Although India's exports to the U.S. increased in absolute terms between 1991 and 2006, the percentage of India's export to the U.S. out of total exports was stagnant between 1994 and 1997 and in fact declined after 2000.

Table 1 - Summary statistics of India's export

| Year	1991	1994	1997	2000	2003	2006
India's Exports to the U.S. (Real Value)	4.33	6.56	8.24	11.3	12.9	19.5
India's Total Exports (Real Value)	26.04	33.12	43.35	41.20	53.57	105.23

All Export figures are in US billion dollars.

Source: own contribution

3. Reallocation across Industries

India's export composition underwent a significant redistribution between 1991 and 2006. It has moved from the first stage of agricultural, raw materials, and manufacturing materials (SITC0, SITC2, SITC3, SITC4, SITC6) to heavy machinery, chemicals, and transportation equipment (SITC5, SITC7, SITC8). This is depicted in figure 1, which plots the export share of each 1-digit SITC sector in 1991 and 2006. It can be observed that the percentage of total exports declined in less sophisticated sectors, while the percentage of total exports in more sophisticated sectors rose. Among the more sophisticated manufacturing sectors, SITC7 (Industrial machinery, office machinery, telecommunications equipment, electrical machinery, transportation equipment) experienced a sharp increase in export shares (358 percent), followed by 133 percent and 8 percent for SITC5 and SITC8, respectively.

Fig. 1 – Reallocation of exports across SITC 1-digit industries
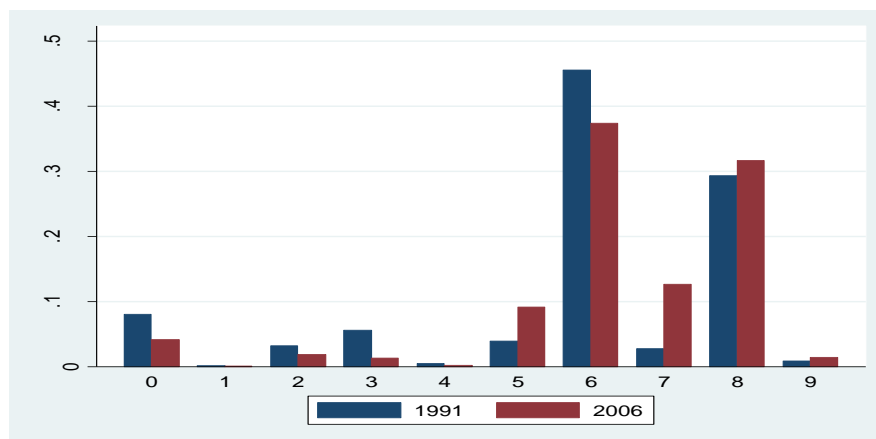
Source: own contribution

Figure 2 focuses on changes within the manufacturing sector in particular. Here we look at changes in trade share in all major 2-digit SITC sectors. Figure 2 confirms what we observed in figure 1. Within manufacturing there has been a shift in export shares from apparel and textiles to electric machinery, arms and amuniations, printed matter, toys, games, musical instrument, office and stationary suppliers, jewellery, and iron and steel. For instance, export shares increased significantly in SITC67, SITC77, and SITC89 (by 315 percent, 645 percent, and 210 percent respectively), while SITC65, SITC66, SITC69, and SITC64 experienced a fall in export shares by 12 percent, 37 percent, 15 percent, and 26 percent respectively.

**Fig. 2** – The reallocation of manufacturing exports across major 2-digit sectors*
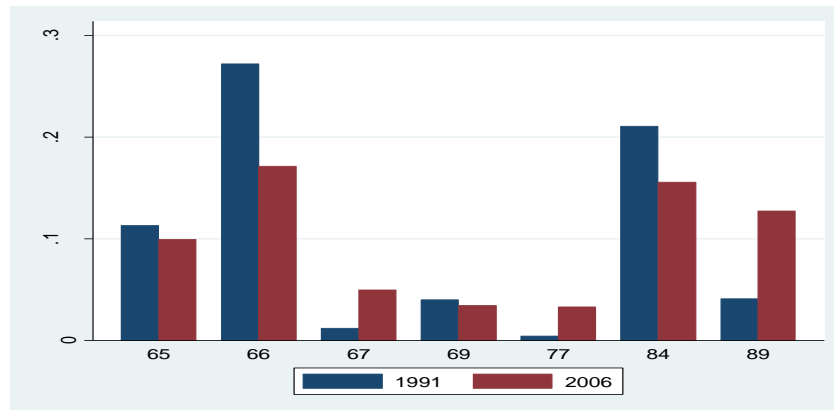
* Major is defined as accounting for at least 3 percent of exports in 1991 and/or 2006

Source: own contribution

Figure 3 depicts the movement of export shares for all the years in the sample across the 1-digit SITC sectors. As it can be seen from the figure, the change in export shares from 1991 to 2006 has not been smooth. There has been a subtantial amount of fluctuation in export shares during the intervening years. This is particulary true for the industries in which export shares declined between 1991 and 2006. For example, SITC6 reported an 18 percent decline in export shares from 1991 to 2006. However, this decline is accompanied by a series of increases in export share in this time frame. Similar trends are observed in other sectors such as SITC0, SITC2, and SITC4. The sectors which have reported an increase in export shares between 1991 and 2006 have more or less experinced a smooth upward trend over the years, with a notable exception being SITC8. Although the export share in SITC8 grew by about 8 percent from 1991 to 2006, it shows an average downward trend. Overall, what we can see from figure 3 is that the shift of India's export composition from agricultural to manufacturing and heavy industries (as infered from figure 1) has not been smooth with frequent ups and downs in agriculutiral export shares.

Fig. 3 – Trend in export shares of SITC 1-digit industries
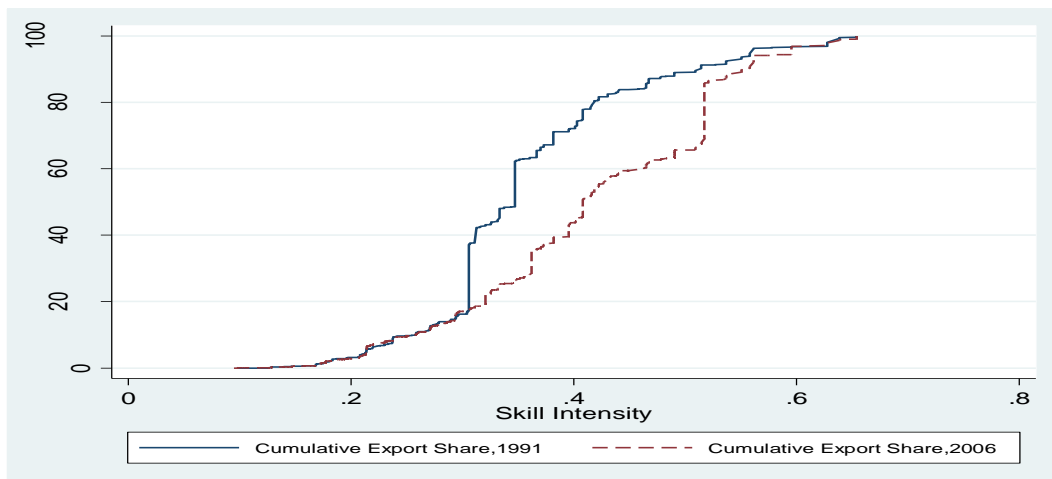

Source: own contribution

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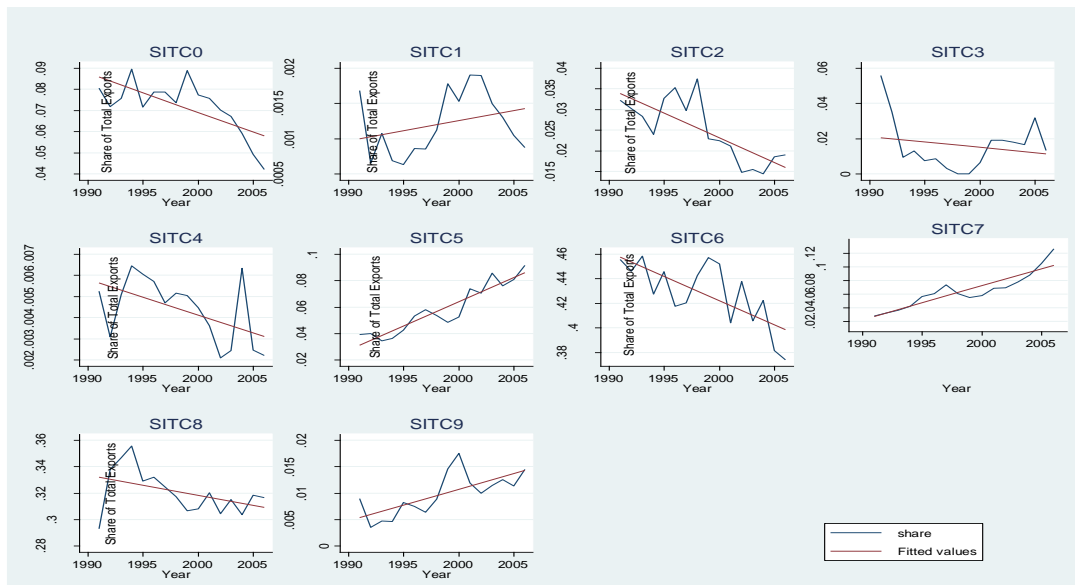
4. Skill Content of Export Growth

So far we have seen that India's export bundle experienced a shift from agricultural products to manufacturing industries between 1991 and 2006. In light of India's growing economy, this transformation is not surprising. However, it is worth analysing whether the growth of manufacturing's share of export has also brought in increased sophistication to India's exports.

As increased sophistication may be reflected in the overall skill content of India's exports, figure 4 plots skill intensity and cumulative export share. We rank industries from low to high skill intensity on the horizontal axis of figure 4 and plot the cumulative export share on the vertical axis. The skill intensity is measured as the ratio of non-production workers to total employment for manufacturing industries. In figure 4 the shift of the curve to the right indicates that the skill content of India's exports to the U.S. increased over the sample period. For example, in 1991, 40 percent of the least skill-intensive industries produced 70 percent of India's export share. By 2006, the export share that these industries produced fell to 40 percent. However, this increase in skill intensity may be due to processing trade. Due to unavailability of processing trade data for India, this analysis cannot be extended to see whether the observed increase in skill intensity actually happened in non-processing manufacturing exports or if India is importing intermediate inputs with high skill content and then assembling them for export.

**Fig. 4** – Skill intensity of India's manufacturing exports

Source: own contribution

5. Diversification versus Specialisation

So far we have seen that India's export sector has undergone a significant transformation, with increased churning from agricultural and manufacturing materials into machinery, transportation equipment, and chemicals. As traditional trade theory suggests, a higher standard of living is achieved through more specialised trading. The next step would be to see the extent to which specailisation has changed as a result of this transformation. Imbs and Warziarg (2003), however, found that countries tend to diversify production as they grow from low levels of income and that they only begin to specialise once they reach a relatively high level of income. This is consistent with countries moving from exploiting natural resources to developing new industrial sectors as they grow. Hausmann and Rodrik (2003) argued that in the early stage of development, more entrepreneurship and potentially greater diversification may help producers identify the sectors in which they have a competitive advantage.

To see whether India's exports show increased or decreased specialisation between 1991 and 2006, we plot the inverse cumulative export shares for all products at the HS 6-digit level with the rank of the product in figure 5. A shift of the curve to the right indicates that India experienced a decrease in specialisation from 1991 to 2006, particularly in the first 1000 product categories. Lesser ranked products have undergone no significant change in the degree of specialisation.

Fig. 5 – Cumulative share of exports by rank using HS 6-digit classifications
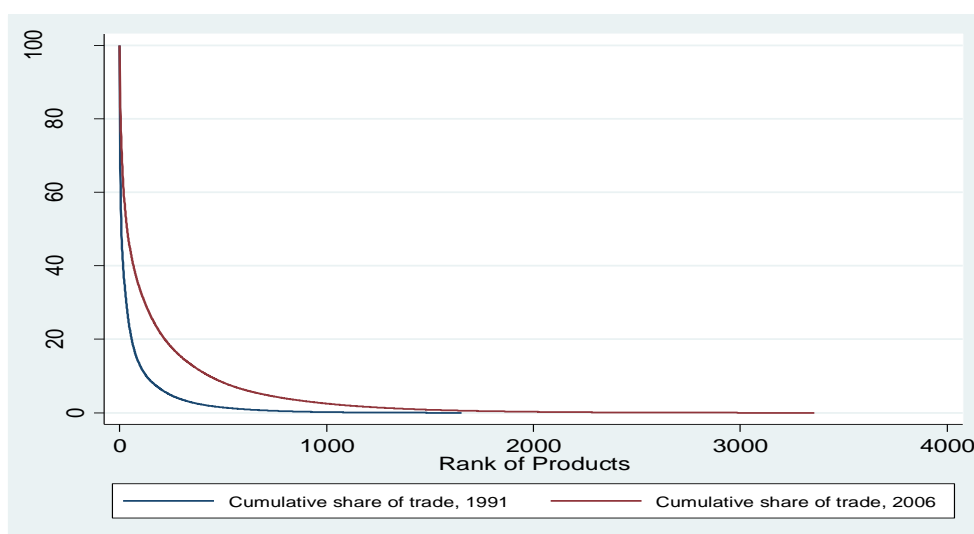
Source: own contribution

Using the Gini Coefficient to measure the export equality in each period can be an alternative way to measure the changes in specialisation. Here, the Gini Coefficient can be defined as

$$Gini \equiv 1 - \frac{1}{n}\sum_i (cshare_{i-1} + cshare_i),$$

where n is the number of products, i is the product's rank (1 is the smallest and n is the largest), and $cshare_i$ denotes the cumulative share of exports of the ith product. The Gini Coefficient, by definition, lies between 0 and 1. A value of zero indicates that export shares are equally distributed, while an increase in the coefficient implies an increase in specialisation.

The values of the Gini Coefficient for 1991 and 2006 for all, top 90 percent, and top 100 products are reported in table 2. Values close to one when all products are included indicate high degree of specialisation, meaning that most of the export is happening from a specified range of products. However, these values are substantially less for the top 90 percent and the top 100 product categories.

Table 2 – Gini coefficient for India's export

Period	All	Top 90%	Top 100
1991	0.90	0.54	0.25
2006	0.90	0.51	0.05

Source: own contribution

Comparing the two sample periods, we see that between 1991 and 2006, there was a drop in the value of the Gini Coefficient, especially for the top 100 product categories. This indicates that over the sample period, India experienced decreased specialisation, meaning that India's export growth is not driven by an increase in the export of particular products within each product category. Rather the export of many products within each product category is contributing to the export growth, and we see more export equality between 1991 and 2006.

6. Intensive and Extensive Margins

It has been observed so far that post liberalisation India has experienced large export growth with a shift of export share from agricultural to manufacturing. However, a question that remains is whether or not this large export growth mainly happened due to introduction of new products. Extensive margin, or growth in new product varieties, is defined as the export of products with new product codes. For new product codes, export figures will be positive in a particular period but will be zero in the preceding period.

One major problem in measuring export growth from new products is the issue of trade data reclassification. Due to major reclassification in the trade data in 1996 and 2002 at the HS 6-digit level, many existing products were identified as new just because they got a new product code or previous codes were split.

6.1. Export Shares

To see whether or not India's export growth actually happened in the extensive margin, we follow Kehoe and Rhul (2013) by splitting exports into deciles by value in 1991 and calculating their shares of exports in 2006. If export growth is attributable to the introdution of new products, then the bottom deciles, which had negligible growth in 1991, would show up with high export figures in 2006. Figure 6 depicts the share of exports in 2006 for products falling into each decile by value in 1991. Export shares of products in decile 1, which accounted for the bottom 10 percent export share in 1991, is observed to have more than tripled in 2006, meaning that there was a substantial increase in export shares in 2006 of the products that were least traded in 1991. This indicates that extensive margin significantly contributed to India's export growth between 1991 and 2006.

Fig. 6 – Reallocation of exports by value using HS 6-digit classifications
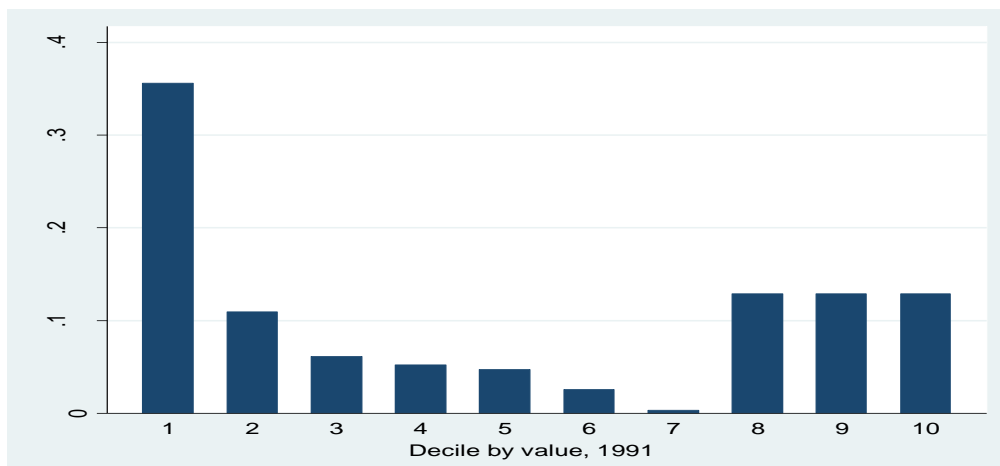
Source: own contribution

As exports may tend to concentrate in a smaller number of categories, we divide exports into deciles according to the number of categories of trade that there were in 1991. For instance, the tenth decile is the top ten percent of product categories when products are ranked by value. Figure 7 depicts the share of total value of exports for each such decile for 1991 and 2006. As we can see from the figure, the distribution of export share is highly skewed for both 1991and 2006. For both the years 1991and 2006, 10 percent of the category accounted for more than 80 percent of India's import from the U.S. while the bottom 5 deciles do not even show up in the figure. Also, there has been no gain in the export shares between 1991 and 2006 for the other deciles. Figure 7 thus indicates that there was no sizeable reallocation of trade, especially for the bottom deciles which show almost no change in export shares between 1991 and 2006.

Fig. 7 – Reallocation of exports by product shares using HS 6-digit classifications
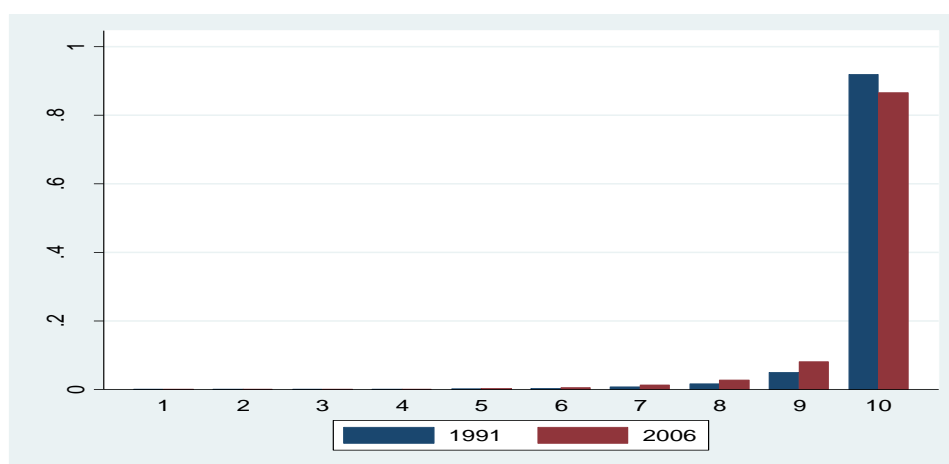
Source: own contribution

6.2. Variety growth

In this section, we extend our analysis on the contribution of new varieties to export growth by utilising more disaggregated trade data at the HS 10-digit level. We use two complementary methods: first is the Feenstra index, and second is a decomposition of export growth into new, disappearing, and existing varieties.

The Feenestra index provides an indication of the importance of new varieties in trade. A positive value of the index would indicate that the number of varieties has grown relative to the base period while a zero value would indicate no growth. However, the significance of new products in export growth may be understated by the Feenstra Index if there is a lot of churning of export varieties. We refer to Feenstra (1994) for a detailed analysis.

The second measure gives more information on the magnitude of export creation and destruction. In order to get an idea of how important churning is in Indo-U.S. trade, we follow Amiti and Fruend (2010) to decompose trade growth into new, disappearing, and existing goods. The intensive margin accounts for the growth in export shares of products that were exported in both periods. Whereas, the extensive margin can be defined as the net share of trade growth attributed to the growth of new product share less the share of disappearing goods.

Figure 8 plots the Feenstra Index of net variety growth and the share of trade growth attributed to the extensive margin for U.S. imports from India at the 10-digit level from 1991 to 2006. Both measures show a similar pattern in the growth of extensive margin between 1991 and 2006, with considerable variation in the intervening years. In particular, the years 1996, 2000, and 2003 experienced a sharp increase in variety growth followed by a big fall in the subsequent years. This may be explained with the major reclassifications in trade data that happened in 1996 and 2002. The sudden rise and fall in export figures may reflect the fact that while new classifications were used in 1996, old classifications were not removed until the following year. What figure 8 indicates is that there is a possibility that major reclassifications with creation and destruction of export varieties contributed toward the rises and falls of export varieties in between 1991 and 2006.

Fig. 8 – Growth in extensive margin of India imports from US using HS 10-digit classifications, 1991-2006
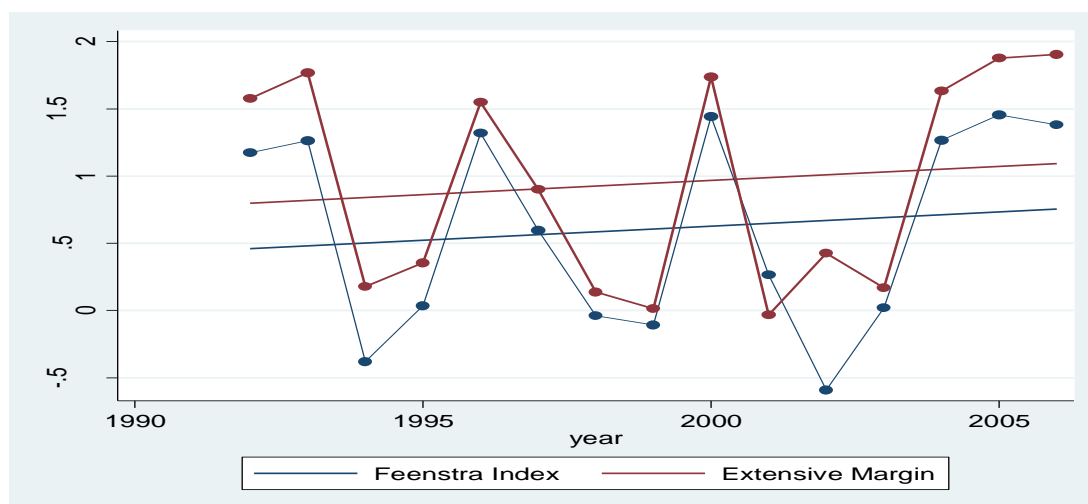
Source: own contribution

Table 3, however, weakens the possibility of the growth of export varieties due to reclassification of trade data. Table 3 reports the average values of the Feenstra index, intensive and extensive margins, and India's total export growth from 1991-2006 and from 1997-2006. If increases in net export variety and share of trade, which are attributable to extensive margin happened due to trade reclassification in 1996, then the average values of the Feenstra and extensive margin indexes from 1997-2006 should be larger than those from 1991-2006. However, table 3 suggests that reclassification did not affect Indo-U.S. trade. The average values of the Feenstra index and the extensive margin calculated using the post reclassification years are the same as the ones obtained from the entire sample period. Positive values of the Feenstra index and the extensive margin indicates that new export varieties have in fact contributed towards India's total export growth to the U.S. However, we see an upward trend in both the Feenstra index and the measure of extensive margin, although it is relatively flat.

Table 3 - Variety growth in India's export: extensive margin using 10-Digit US data

Year	Feenstra	Intensive	Extensive	Growth
1991-2006	.01	.91	.09	108%
1997-2006	.01	.92	.08	109%

Source: own contribution

8. Conclusion

This paper analyses Indo-U.S. bilateral trade along various dimensions between 1991 and 2006. The primary contribution of this paper to the existing literature is to identify the key structural changes that characterise India's export growth during this period. The major findings of the paper may be summarized as follows:

(1) As India's export grew over time, data reveals that the manufacturing sector has gained an increasing share in India's export mix while the share of traditional agricultural products has declined. Within the manufacturing sector, growth in the export of products related to industrial machinery, office machinery, telecommunications equipment, electrical machinery, and transportation equipment has been the highest.

(2) The skill content of India's manufacturing exports has increased.

(3) India's export sector has become relatively more diversified. New export varieties have contributed towards India's export to the U.S.

The above findings lead to some observations. First, the finding that the skill content of India's manufacturing exports has increased is consistent with the fact that India has moved toward the export of sophisticated manufacturing products. However, this finding must be interpreted with a little caution. The data for exports are aggregated and include processing trade. If processing trade plays an important role in

manufacturing export, then this finding may be incorrect, as it would mean that India is importing intermediate inputs with higher skill content to assemble them for exporting. We could not test this hypothesis due to the unavailability of processing trade data for India. Second, diversification of India's export is consistent with the previous literature which claims export diversification as an important factor for export growth. This finding is consistent with the more recent trade theories that emphasise the gains from trade as importing countries access new product varieties. On the other hand, traditional trade theory suggests specialisation in relatively cost advantage sectors as a key to growth. Amiti and Freund (2010) find China to exhibit increased specialisation in its export. It seems that the volume of trade matters—countries at initial level of export growth may find it more beneficial to diversify export than counties at a later stage of export growth.

Overall the study finds that the growth of an emerging economy is typically associated with sophistication and diversification of export products. As skill intensive manufacturing products may give India favorable terms of trade as compared to the traditional agricultural commodities, policies should be directed towards improving the terms of trade of those product categories.

Future research may be directed towards using more recent data and also working with Indian trade and manufacturing data. Analysing recent data would build on the existing literature by observing the current trends in bilateral trade dynamics, especially for the years after the great recession of 2008. Furthermore, a detailed data on India's trade and manufacturing would allow us to get a better understanding of the role that processing trade might play in India's trade growth. If manufacturing technologies used in developing nations such as India is different than those in the U.S., then Indian manufacturing data would be more reliable in measuring skill intensity of India's exports.

Acknowledgements

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