



A Further Investigation of Product Specialization in International Trade

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Abstract

According to the two empirical observations about U.S. imports, endowments-driven 'within-product specialization' has been increasing. From the data analysis, both these observations are shown extending to the imports of Brazil, India and Japan. However, in this paper, our finding is focused on that two factors driving the classical observations. First, China is the dominant low-wage exporter of multiple-sourced products. Second, the most developed countries remain the primary exporters of multiple-sourced products. When China is deleted from the U.S. import data, there is no trend in across-product specialization; also, rich exporters are increasing their trade share of multiple-sourced products. This paper builds on the method pioneered by Schott. Since without consideration of China data has no theoretical justification, these results should be viewed as a way of deepening our understanding of Schott's his empirical results.

Keywords: Product specialization, Heckscher–Ohlin Model, International trade, Multiple sourcing

1. Introduction

Schott (2004, pp.647-678) makes two fundamental observations about highly disaggregated U.S. imports as follows: (1) the United States increasingly imports the same products from low-wage, middle-wage and high-wage countries. Further, the number of products it imports exclusively from low-wage or middle-wage countries is insignificant. He refers to this as a lack of 'across-product specialization.' (2) Within each product but across exporters, unit values vary systematically with exporter factor endowments and exporter capital–labor production techniques. He refers to the variation in unit values as 'within-product specialization.' Schott concludes that factor proportions theory can explain within-product specialization, but not the lack of across-product specialization.

In this paper, we provide further evidence on the pattern of product specialization in U.S. import data. Moreover, in order to look for patterns that characterize product specialization in world trade in general, we also examine the imports of Brazil, India and Japan. This paper builds on the method pioneered by Schott. Using Schott's product-level focus, we show that the phenomenon of multiple sourcing (i.e., lack of across-product specialization) is driven almost exclusively by two features of the data. First, China is the dominant low-wage exporter of multiple-sourced products. Second, the most developed countries remain the primary exporters of multiple-sourced products. These factors are most pronounced in the U.S. case (as opposed to Brazil, India and Japan). When China is deleted from the U.S. import data, there is no trend in across-product specialization and rich exporters are increasing their trade share of multiple-sourced products.

Schott (2004, pp.647-678) was aware that China might be an issue and indeed deleted China from his analysis. See his sensitivity analysis of Table 3. However, his table does not adequately convey the importance of China for his result. Interestingly, Rodrik (2006, pp.245-251) have returned to this theme of the uniqueness of China.

The exact interpretation of these results is not completely clear. For one, an earlier version of this paper showed that Schott's results about U.S. within-product specialization hold equally well for Brazil, India and Japan. This buttresses what is arguably Schott's most important conclusion. For another, there is no theoretical justification for excluding China when re-examining Schott's across-product specialization result. For example, it is possible that in the absence of China, other low-wage countries would have picked up the slack and started exporting to the United States, Brazil, India and Japan. Our result is instead best interpreted as deepening our understanding of the underlying data upon which Schott based his conclusions.

2. Analytical framework and results

2.1 Analytical framework

The theoretical foundation of our analytical framework is a standard Heckscher–Ohlin model (Dornbush, Fisher &

Sammuelson, 1980, pp.203-224; Zhu, 2004, pp.1042-1060, Zhu & Trefler, 2005, pp.21-48) in which there are three cones of diversification associated with three groups of countries: low-wage, middle-wage and high-wage countries. With complete specialization, low-wage countries have a comparative advantage in the least capital-intensive products while countries of middle-wage and high-wage groups completely specialize in the production of medium and high capital-intensive products, respectively.

Empirically, three cohorts of low-wage, middle-wage and high-wage U.S. trading partners are defined according to whether their GDP per capita is in the 0th to 30th, or the 30th to 70th, or the 70th to 100th percentiles of the world GDP per capita distribution respectively. For trading partners of Brazil, Indian and Japan the cutoffs are the 40th and 80th percentiles.

We then define six types of “products” from the data. L, M, and H products are those that originate exclusively from low-wage, middle-wage, and high-wage countries, respectively. LM products are those imported simultaneously from both low-wage and high-wage countries and MH products from both middle-wage and high-wage countries. Finally, LMH products originate simultaneously from at least one low-wage and one high-wage country. As Schott points out, the logic of the Heckscher–Ohlin model holds if the unit values of LMH products that are produced by high-wage countries are systematically and significantly higher than the unit values of LMH products produced by middle-wage and low-wage countries.

U.S. product-level import data which we use from 1972 to 1994 are compiled from Feenstra (1996). Brazilian, Indian and Japanese product-level import data are available from the United Nations Commodity Statistics Trade Database (UN Comtrade). These data are available from 1989 to 2004 and grouped according to six-digit classifications of the Harmonized Commodity Coding System — Revision 2. All the data correspond to SITC (Revision 2) manufacturing industries.

2.2 Decreasing across-product specialization: the role of China and high-wage countries

According to the two empirical observations given by Schott (2004, pp.655):

Observation (1): There are an increasing number of products imported by the U.S. simultaneously from low-wage, middle-wage and high-wage countries. Re-stated, there is decreasing across-product specialization.

Observation (2): The unit values of these products are positively and significantly correlated with exporter relative capital and skill abundance and with exporter production techniques (capital–labor ratios).

We can find robust evidence of *observation (2)* for products imported by Brazil, India and Japan. This was reported in an earlier version of the paper. The focus of the analysis in this paper is about what explains *observation (1)*.

Fig. 1A displays the evolution of shares of U.S. imported products by source of importers. Since the shares of L, M and LM products are extremely small we choose to combine them in the graph. Fig. 1A presents exactly the same trends for H, MH and LMH products as in Schott (2004). Two important features of the data stand out. First, the percent of MH and H products is in steady decline. Second, the share of LMH products is increasing over time and becomes the most important type of product exported to the U.S.

The evidence above, at first sight, is clearly not consistent with the established fact that most of world trade takes place among developed countries. Given China's status as a low-wage exporter and the exceptionally high growth rate of its exports for the last three decades we now investigate whether Chinese exports drive the trend in LMH products. Further disaggregation of the data by source shows that this is indeed the case. Fig. 1A also presents an additional curve, LMH 2, which represents the shares of LMH products for which China is the only low-wage exporter to the U.S. market. It is graphically clear that the evolution of LMH products originating from low-wage countries and the evolution of those LMH products having China as the only low-wage exporter follow a similar upward trend, which indicates that the number of LMH products that other low-wage countries export to the U.S. remains the same throughout the 1972–1994 period.

To confirm the finding above, Fig. 1B depicts the shares of H, MH, LMH and L+M+LM products when we remove China from the sample and accordingly redefine all six types of products. The numbers of LMH, MH and H products now follow similar trends over time and are almost equally important in the first and last year of the sample. From 1972 to 1994 there is no evidence of a steady upward trend for LMH products and no evidence of a steady downward trend for MH and H products. It is important to point out that to be consistent with the Heckscher–Ohlin framework China must be included in the analysis as a low-wage exporting country. We exclude China from the sample in our analysis as a way of looking into the importance of China in shaping across-product specialization in world trade.

China's increasing ability to penetrate the U.S. market in products that high-wage countries also export is seen in trade data from Brazil, India and Japan. Fig. 2A and B clearly shows that removing China from the sample substantially reduces the share of LMH and increases the share of MH and H products imported by Brazil. We also see from Fig. 3A and B that this is exactly the case for Indian imports. While declining over time the share of H products remains

noticeably important for both Brazil and India in 2004. When China is excluded the share of H products remains the most important component of Brazilian imports for the whole 1989–2004 period. Since Brazil and India are representative middle-wage country and low-wage the evidence shows that across-product specialization is present. It is only for Japanese imports that the trend toward greater within-product specialization remains graphically strong independent of the presence of China in the sample (Fig. 4).

Turning now to investigate which groups of countries are major actors of within-product specialization in LMH products, Table 1 presents the average number of low-wage, middle-wage and high-wage exporters in a LMH product and the breakdown of the value of LMH imports. Columns 1, 3 and 4 show that, for all four countries, the average number of low-wage countries in an LMH product is much smaller than that of middle-wage and especially high-wage countries. For example, a LMH product is on average exported to the U.S. market by 2.3 low-wage, 4.6 middle-wage and 10.5 high-wage countries in 1972. Also, in 1992 the average number of high-wage exporters of an LMH product imported by Brazil, India and Japan is approximately 2 to 4 times higher than the average number of low-wage exporters. More importantly, column 2 shows that the presence of high-wage exporters in LMH products increases over time while that of low-wage exporters remains essentially the same when China is excluded. In 1994 a LMH product is on average imported by the United States from 2.1 low-wage, 4.9 middle-wage and 14.1 high-wage countries. Also, the number of high-wage exporters of a LMH product imported by Brazil, India, and Japan increases to 7.7, 8.2, and 9.3 in 2004, respectively.

Columns 5, 7 and 8 of Table 1 also show that high-wage countries export a much larger share of the value of LMH products to the United States than the group of low-wage countries. In 1972, for example, 7%, 26% and 67% of the total value of exports of LMH products to the United States originated from low-wage, middle-wage, and high-wage countries, respectively. The same numbers are 11%, 14% and 75% in 1994. The share of low-wage country exports in LMH imports by Japan exhibits the highest increase: from 18 % in 1992 to 37 % in 2004. Yet, this increase is due to Chinese exports. Column 6 shows that when China is excluded the share of low-wage countries in the value of LMH products imported by Japan drops to 9.0 % in 2004, just 3 percentage points higher than the share in 1992. In sum, our analysis above shows that it is China and high-wage countries that are the major players in the trend towards greater within-product specialization.

3. Conclusion

This paper provides an empirical analysis of multiple sourcing (i.e., across-product specialization) in the imports of the United States, Brazil, India and Japan. We find that the phenomenon of increasing multiple sourcing, as documented by Schott, applies to the imports not only of the United States but also of Brazil, India and Japan. Our analysis shows that two important features characterize this phenomenon. First, China is the dominant low-wage exporter of multiple-sources products imported by the United States, Brazil, India and Japan. Second, it is China and the high-wage countries that are the driving forces of increasing multiple sourcing in imports of all those four countries.

These findings are of independent interest and deepen our understanding of the data underlying Schott's results. What they mean for Schott's conclusions is not entirely clear. First, Schott's most important finding — about the role of factor endowments for within-product specialization — also holds for Brazil, India and Japan. Thus, we are only reporting on his across-product specialization finding. Second, it is unclear conceptually what it means to remove China. Had China not entered the global economy would other low-wage countries have taken up the slack in a way that would reduce across-product specialization? Such a complex general equilibrium counterfactual is worth making further researches.

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Table 1. Presence of countries and their share in LMH products by importer

Year	Number of countries				Share			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Low	Low*	Middle	High	Low	Low*	Middle	High
U.S. import data								
1972	2.3	1.6	4.6	10.5	0.07	0.09	0.26	0.67
1982	2.8	1.9	5.7	11.6	0.08	0.06	0.32	0.60
1994	2.1	1.1	4.9	14.1	0.11	0.03	0.14	0.75
Brazilian import data								
1992	1.2	1.2	1.1	3.2	0.04	0.03	0.19	0.77
1998	1.4	1.3	3.3	7.9	0.04	0.02	0.22	0.74
2004	1.6	1.3	3.4	7.7	0.10	0.02	0.16	0.74
Indian import data								
1992	1.1	1.1	1.3	4.3	0.08	0.04	0.10	0.82
1998	1.3	1.2	2.5	8.4	0.06	0.03	0.13	0.81
2004	1.7	1.6	3.7	8.2	0.15	0.03	0.20	0.65
Japanese import data								
1992	1.8	2.3	2.9	6.8	0.18	0.06	0.25	0.57
1998	2.2	2.7	3.5	9.1	0.22	0.07	0.19	0.59
2004	2.6	3.0	4.3	9.3	0.37	0.09	0.22	0.41

*Notes: denotes the average number of low-wage in a LMH product and the share of low-wage countries of the total value of LMH products when China is excluded from the sample.

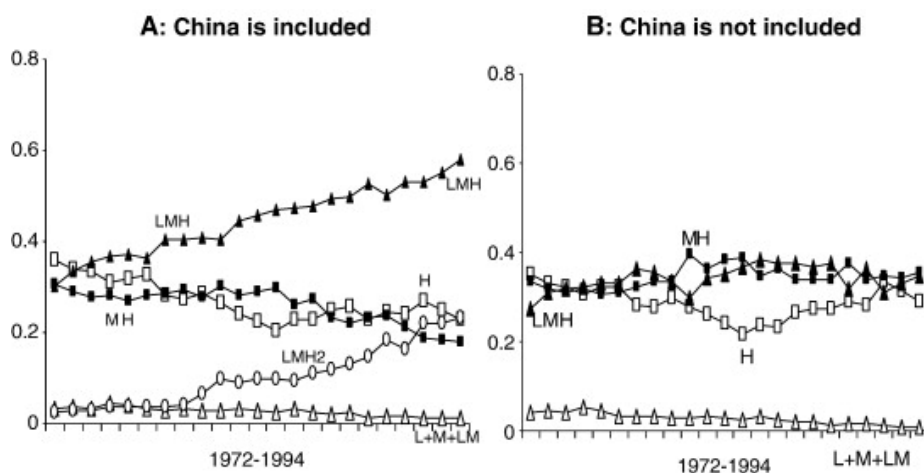


Figure 1. Shares of U.S. imported products by source.

A: China is included B: China is not included.

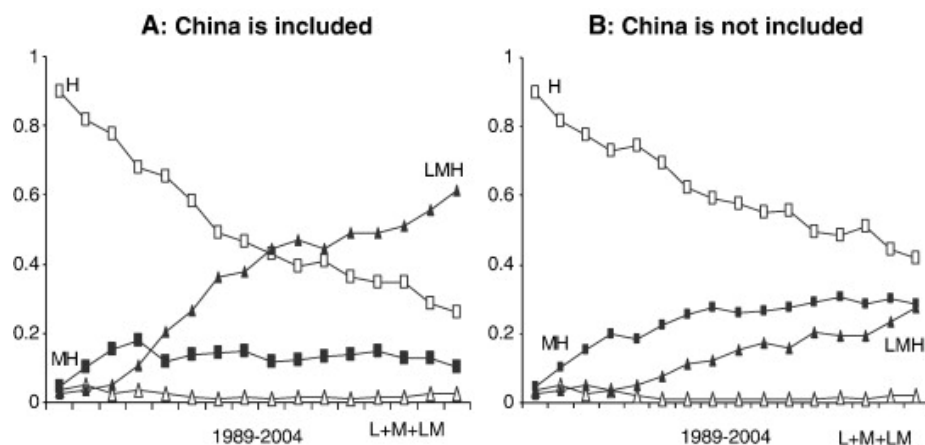


Figure 2. Shares of Brazilian imported products by source.

A: China is included B: China is not included.

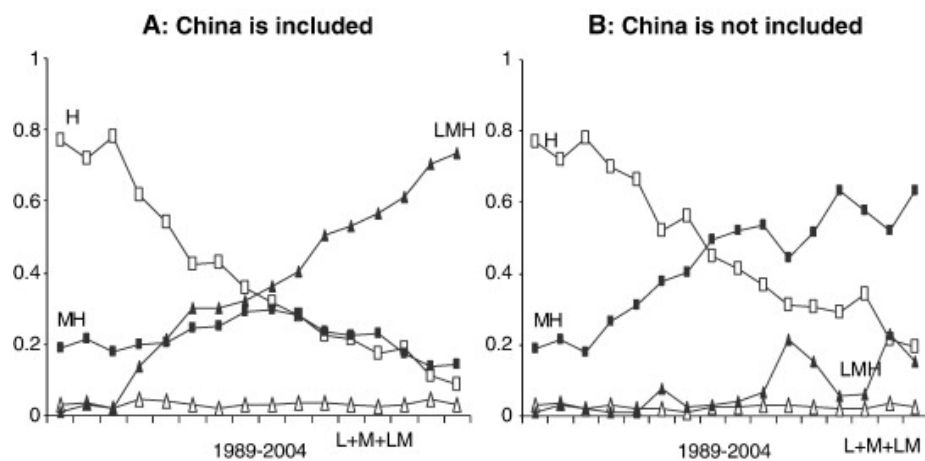


Figure 3. Shares of Indian imported products by source.

A: China is included B: China is not included.

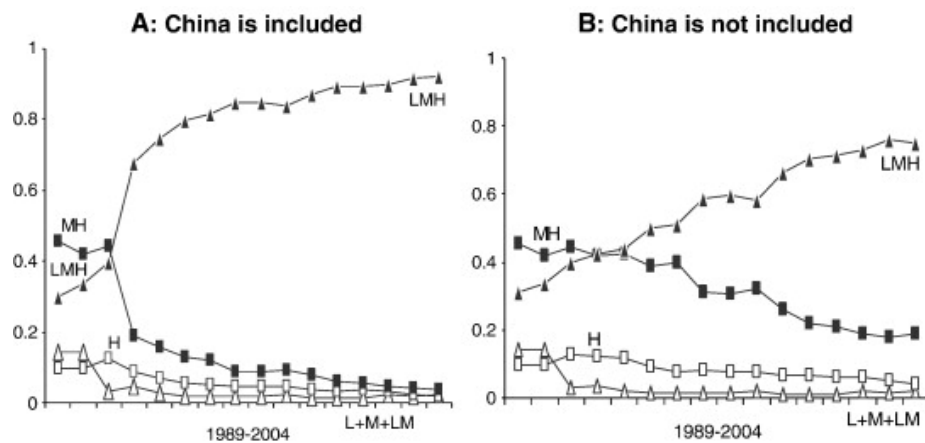


Figure 4. Shares of Japanese imported products by source.

A: China is included B: China is not included.