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Comparative Advantage for the World's Major Economies

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Résumé de l'article

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Analysing International Trade Patterns: Comparative Advantage for the World's Major Economies

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Using disaggregate product data classified by the Harmonized System code, this paper computes the revealed comparative advantage (RCA) for seven major economies that, when combined, contributed more than 80% of global manufacturing exports in 1996-97 and 2006-07. Results show that in the last decade, Canada, the US, and Japan have lost their share of global exports, while China has increased its share three-fold. These losses occurred mainly for low-tech products for the US, but medium and high-tech (MHT) products for Canada and Japan. However, MHT products comprise the highest share of Japanese exports (70%) compared to Canada (which has the lowest share, approximately half of Japan's). Canada is the only economy whose contribution to global MHT exports is lower than that of global total exports. Japan also has the highest share of RCA-based MHT exports of other East Asian countries (OEACs) and the US. China has the highest share of non-RCA- based MHT exports. Finally, the trade patterns for OEACs and Mexico did not change greatly in any dimension in the last decade. However, products with RCA have changed substantially in all economies, with the highest in Mexico.

1. Introduction

Comparative advantage is the single most widely used indicator for measuring a country's international trade performance. A country is considered to have a comparative advantage in the production of certain goods if it has low relative cost in the production of that good compared to other countries. The use of both "relative" and "compared" means that there are two comparisons to be made. Relative cost means the production cost compared to the cost of other goods produced within the same country. The cost ratio is then compared across trading partner countries (Deardorff, 1998). Hence, a country can have a comparative advantage in the production of a good, even if it is not the lowest cost producer. In the latter case, the country is said to have an absolute advantage (i.e. absolute advantage does not necessarily imply a comparative advantage). The standard trade model implies that an improvement in absolute advantage (i.e. an economy-wide fall in production costs in all sectors) will show up in higher real income for the whole economy, but will have little or no effect on resource allocation or trade patterns.

In business, however, much emphasis is given to competitive advantage, a concept that is closer to absolute advantage than to comparative advantage.[1] According to business literature, a country's standard of living and a firm's profit depend on competitive advantage. On the other hand, economics literature suggests that while it may be desirable to have an absolute advantage in the production of goods, it is the comparative advantage that is vital in explaining trade patterns. There are two theories to explain patterns of trade: comparative advantage and increasing returns to scale.[2] Comparative advantage occurs due to differences across countries in factor endowment or technology, whereas returns to scale is related to a country's size (returns to scale), market structure (with imperfect competition), and location (with trade costs). Thus, some countries export more in certain industries than others because of endowment-driven or productivity driven comparative advantages. Yet this theory cannot explain intra-industry trade, which results from firm-level horizontal product differentiation combined with increasing returns to scale. A larger country produces more variety and export as costs fall with the level of production.

Despite the different theoretical explanations for why countries engage in trade, in most cases the trade gravitas that arises due to increasing returns to scale also translates into cost differences between two countries. Hence, a country's measure of comparative advantage should reflect its performance vis-à-vis other competitor countries in foreign markets. While several studies have estimated comparative advantage, most have focused only on one country or on a small number of products and industries. They also fail to take the world market as a reference point, instead focusing on selected regional markets. Furthermore, while estimation of comparative advantage at a single point in time is important, a deeper understanding of trade dynamics requires the knowledge of how these advantages are changing over time.

To fill a gap in the literature, this paper computes the comparative advantage for major trading economies in the world (Canada, the US, EU-27, China, Japan, other East Asian countries (OEACs), and Mexico) in order to provide a global perspective on trade performance.[3] These sample countries/regions represent more than 80% of global manufacturing exports. I estimate the comparative advantage for two time periods using average export data for the years 1996-97 and 2006-07.

The most important factor that influences a country's comparative advantage is innovation. In this context, I evaluate the performance of these economies in more R&D-intensive products, called medium- and high-tech (MHT) products. A country's strong performance in this group of products is treated as an economic success, as it reflects increasing innovation and potential positive externalities to other sectors of the economy. At the conclusion of this paper I showcase a world class success story, the Massachusetts life science super cluster, in order to highlight the importance of R&D (and associated factors like innovation, government programs, talent, institutions, and capital markets) in sustaining comparative advantage.

I found that Canada, the US, and Japan have lost their share of global exports, while China has increased its share three-times in the last decade. As a result, China is as large a supplier of global manufacturing as the US. The latter's loss has occurred mainly in low-tech products. In Canada and Japan, the loss has occurred in medium and high-tech (MHT) products. Canada's comparative advantage is dominated by resources and resource-based manufactured products, which have increased in recent years. For example, for every five dollars Canada earned in exports, one dollar came from mineral fuels and oil, compared to only fifty cents a decade ago. On the other hand, Canada's shares of MHT products (e.g. motor vehicles, machinery, and electrical machinery) from 1997-2007 declined. The combined export share of these three products declined from 36% to 28% in Canada in the last decade, while their share in global exports declined only marginally (from 38 to 37%) over the same period. Canada is the only economy whose contribution to global MHT exports is lower than that of global total exports. Despite its losses, Japan still has the highest share of MHT products in its exports (70%), double that of Canada. Japan also has the highest share of exports in products with RCA. This is followed by OEACs and the US. The country with the highest share of MHT export in products without RCA is China. The changes in trade patterns for EU-27, OEACs, and Mexico were not substantive in any dimension, except that RCA products have changed substantially in all economies, with highest in Mexico. For example, 81% of Mexico's RCA products during 2006-07 were those that Mexico did not have RCA in during 1996-97.

The rest of this paper is organized as follows: I briefly describe the data in Section 2 and outline a methodology for computing comparative advantage in Section 3. Discussion of product composition of global trade is carried out in Section 4. Results on comparative advantage for all products at an aggregate level are presented in Section 5. Results on comparative advantage in MHT products using data at a disaggregate level are presented in Section 6. The success story of the Massachusetts life sciences super-cluster is presented in Section 7, followed by the conclusion section.

2. Measuring Revealed Comparative Advantage

A country takes advantage of international trade by specializing in the production of those goods that have a lower opportunity cost, and by importing those that have a higher opportunity cost. In other words, trade allows countries to produce and export those products where it has a comparative advantage, and import those where it does not have a comparative advantage. Hence, it is likely that one could establish the link between exports and comparative advantage by looking at the trade data of a country. In a strict sense, a country's comparative advantage vis-à-vis its trading partners should be evaluated by comparing the autarky level production costs (goods price) ratio of two countries. Since no production cost data for autarky are available, one cannot follow that route. However, using the assumption that trade flows are more or less free of policy induced trade costs, the export share of a country reveals its comparative advantage position relative to its trading partners - hence called the revealed comparative advantage (RCA).

One concern with the computation of RCA is that while the concept is straightforward in the case of 2-products and 2-countries, in theory it becomes far more complex in a multi-country, multi-commodity settings. Balassa's (1979) export share index of RCA is not flawless, but it is often used as a first approximation. The export-share measure of RCA for country i in product j is:

1) $$\text{RCA of country i in product j} = \frac{\text{share of product j in country i's total exports}}{\text{share of product j in world total exports}}$$

A country/region i has a comparative advantage in product j if the following relation holds:

2) $$\frac{\text{share of product j in country i's total exports}}{\text{share of product j in world total exports}} > 1$$

For a country/region for products for which this relation holds, it can then be said that the country/region has a comparative advantage on those products.

The index of RCA given in equation 2 is sensitive to a number of variables. For example, the measure depends on how broadly the products are defined and on how reference exporters are defined. The measure of RCAs at different levels of aggregation could lead to different conclusions. For example, a country may not have a RCA in a more aggregate level product but could have RCA at a more disaggregate level with the same aggregate product, and vice versa. As far as knowing what area a country has a comparative advantage, it would be best to use data at the highest level of disaggregation. Similarly, reference exporters could be all the exporters in the world or a subset of countries, and the export market may be the whole world or a specific region such as the US or EU markets.

Mindful of these limitations, this paper will accommodate major economies and global trade flows. I will also use data at quite a disaggregate level to minimize the aggregation bias, while keeping the analysis tractable. As a result of incorporating economies that represent more than 80% of global exports in the numerator of equation 2, and capturing global exports in the denominator, the RCA assigned to a country/region based on the result of equation 2 can be interpreted as global RCA. Any country/region that has the value for equation 2 greater than 1 can be safely said to have a global comparative advantage.

3. Data

In the paper, I use World Trade Atlas and UN Commodity Trade databases on products based on Harmonized System (HS) code rather than on industries.[4] The HS system (established by the World Customs Organization) has 21 Sections (1-digit), 96 Chapters (2-digit), more than 1200 products at 4-digit level and many more at HS 6-digit, which is the most disaggregate level of data for cross country/ region studies. The WCO assigns up to 6-digit codes for general categories common to all trading countries, and countries adopting the system can have their own codes to capture commodities at more detailed levels.

In a first attempt, I compute RCA for 2-digit 96 products for Canada, the US, EU, China, Japan, OEACs, and Mexico. For some of the chapters, especially for MHT products, I use data at HS 4-digit level. Since exports data for the world is not available in the database, I computed "world exports" by aggregating data for all countries that are recorded in the database. Although one cannot rule out missing a few very small countries from the database, in that case, their share of global trade is negligible and should not bias the results.

This is a relatively data-intensive work since we need exports of seven economies by 96 products as HS 2-digit, for some of them at HS-4 digit, and also for the world. One could potentially use data on further disaggregation (HS 6-digit) level, but I have not done so for two reasons. First, I could gain little additional insight either for a particular product or for a country/region by going from 4-digit to 6-digit data. Second, the focus of the paper is to look at the overall RCA position of the major trading economies in the world rather than focus on one particular country with a very disaggregate level of data. Hence, a balance must be maintained between the number of economies and product coverage in order to have the discussion tractable.

4. Product Composition of Global Trade

Before embarking on RCA computation, I look at the share of world manufacturing trade by countries/regions that are our unit of analysis. Table 1 shows that the sample includes more than 80% of global manufacturing trade, however, their share has fallen by approximately three percentage-points over the last decade. The major share loss occurred for the US, EU, and Japan. Canada has also lost its share of global manufacturing exports by one percentage-point. The major global export share gain is captured by China, whose share in 2006-07 rose six percentage-points to make it the largest supplier of the world's manufacturing.

Table 1. Country share of global manufacturing exports (%)

	Canada	US	EU 27	China	Japan	OEACs	Mexico	Total
1996-1997	4.5	14.1	41.1	3.6	9.0	10.2	2.2	84.7
2006-2007	3.5	9.6	39.7	9.5	5.9	11.1	2.3	81.6

Source: UN Commodity Trade database

The empirical analysis starts by examining the product composition of global exports. Using data at HS 2-digit (96 products) for two time periods with average of two years each (1996-97 and 2006-07), the product composition (product share in a country's total manufacturing exports) of each sample economy and the world is given in Appendix A Table A1 (Mexico, the smallest trading nation in the sample, is not reported in this table for the sake of brevity). At this level of aggregation, as shown in Table 2, the top 10 world export products (sorted based on year 2006-07 shares) contribute about two-thirds of total trade. The share of these ten products is high in all sample economies' exports, ranging from 58% in China to 79% in Japan. The top ten products of global export are also the top nine export products in the US and the EU-27. Similarly, these top 10 products include seven top export products for Japan and six top export products for Canada and China. The top 20 global export products constitute about 80% of the world's total exports, and adding another 10 products would constitute more than 90% of world's exports. Hence, based on product category, the world's trade is dominated by few products, and the contribution of these products is somewhat symmetrical across major trading nations.

The main points of the data in Table 2 are the following: First, the trade pattern is not very different (looking at product composition) whether examining 5, 10, or 20 products. For example, the share of 20 products with an average of 77% at the world scale ranges from 76% for the EU-27 to 86% for Japan. Second, the products that dominate the world's trade have increased their share over time: the share of the top 10 products increased by 6% and that of top 20 by 5% over one decade. This increase was across the board for all sample economies except for Japan, in which case the share of the world's top ten export products in Japan's exports fell by 2%.

Table 2. Commodity composition of world manufacturing exports for selected countries, 2006-07

HS-2	Commodities	Canada	US	EU-27	China	Japan	OEAC	World
84	Machinery	7.9	17.3	15.5	19.0	19.5	15.6	13.9
85	Electrical machinery	4.6	13.4	10.2	24.1	19.3	31.8	13.6
27	Mineral fuel, oil etc	20.4	3.5	5.5	1.7	1.1	7.2	11.6
87	Vehicles other than railway	15.9	9.1	11.5	2.5	22.2	4.9	9.0
39	Plastic	3.1	4.1	4.2	2.2	3.1	3.9	3.3
90	OPTM etc apparatus	1.2	5.8	3.1	3.2	5.0	3.6	3.1
72	Iron and Steel	1.4	1.4	3.5	3.0	4.1	1.9	2.9
30	Pharmaceutical products	1.3	2.5	4.7	0.2	0.4	0.5	2.7
29	Organic chemicals	1.2	3.2	3.2	1.7	2.9	2.7	2.6
71	Precious stones, metals	2.1	3.3	1.3	0.7	0.9	2.4	2.0
	Total	**59.4**	**63.5**	**62.5**	**58.2**	**78.5**	**74.5**	**64.6**
Increase in the share of top 10 products in 1996-97		**5.3**	**2.4**	**5.4**	**22.5**	**-2.0**	**17.2**	**6.0**

Source: Global Trade Atlas and UN Commodity Trade Databases
nes: not elsewhere specified; OPTM: optical photo, technical, medical

5. Empirical Results: All Products

Using equation 2, I compute RCA for all countries/regions and products. The results for all 96 products are presented in Appendix Table A2. RCAs for Canada are presented for both periods (1996-97 and 2006-07), but presented only for the latter period for other countries.[5] Similar RCA computations were performed for all economies for 1996-97 (the summary of that computation will be presented in a future work).[6]

I have listed products where Canada had a clear RCA in 2006-07 in Table 3 in descending order of the RCA index. The first six columns are for six economies' RCA measurements, and the last column shows the share of these products in Canada's manufacturing exports in 2006-2007. Out of these 96 products, there are 29 products where Canada has a clear RCA.[7] Among these, the US also has RCA in 11 products (those with value in greater than unity). Similarly, the EU-27 has RCA in 13 of these products, followed by eight for China, three for Japan, and one for OEACs. For all the products where Canada has a RCA, there is at least one competitor country/region that has a RCA except for in fish and seafood (a product that contributes only 0.8% of Canada's manufacturing exports). In this case, the competitors could be countries that are not included in the sample.

Comparing values for RCA in each product across countries, and if we assume that the country with the highest RCA value in a product is the most competitive one, then Canada is the most competitive country for the first six and eleven other products, with total of 17 products (reported in bold face). As shown in the last row, the products where Canada has a comparative advantage in global exports contribute to 68.1% of Canada's exports. The 29 products where Canada has a comparative advantage constitute 34% of US exports, 33% of EU-27 exports, 40% of Mexico's exports, 14% of China's exports, 19% of OEAC's exports, and 32% of Japan's exports. I have opted not to prepare a similar table for each sample country/region as was done for Canada (Table 3) because it would be unnecessary for this paper.

To summarize, Canada has RCA in a limited number of products. Most are related to primary industries and resource-based manufacturing products, except for vehicles other than railway, inorganic chemicals, and aircraft and spacecraft. It appears that among the six countries/regions presented in Table 3, Canada's close competitors are the US, EU-27, and Mexico. The two products, "minerals" and "vehicles other than railway" contribute more than one-third of Canada's manufacturing exports.[8]

Since the factors that shape trade patterns evolve over time, comparative advantage is not static. Knowing RCA at a point in time is important, but equally important is how changes are taking place across countries/regions. A change in comparative advantage could arise from government policies, either deliberately from direct policies, such as industrial strategies, or inadvertently from indirect policies, such as military spending, R&D spending, and innovation support. For the remainder of this section, I concentrate on these RCA dynamics by presenting results for the year 1996-97 and comparing them with those of 2006-07. Instead of preparing tables for all sample economies for products that have RCA in 1996-97, I use a shortcut: providing information on the number of products these economies have with RCA and any changes that have occurred over one decade (Table 4).

Table 3. Products where Canada has revealed comparative advantage, 2006-07

HS	Description	Canada	US	EU 27	China	Japan	OEACs	Share in exports (Canada)
75	Nickel & articles thereof	**6.2**	0.5	0.7	0.2	0.3	0.3	1.8
47	Wood pulp etc.	**5.9**	2.2	0.8	0.0	0.4	0.1	1.6
01	Live animals	**4.1**	0.6	1.5	0.3	0.0	0.1	0.5
44	Wood	**3.8**	0.7	1.1	0.9	0.0	0.6	3.5
31	Fertilizers	**3.2**	1.2	0.7	0.8	0.1	0.2	0.9
79	Zinc and articles thereof	**2.9**	0.2	1.0	0.8	0.3	1.0	0.5
12	Misc grain, seed, fruit	2.5	3.3	0.5	0.4	0.1	0.1	0.8
10	Cereals	2.4	3.3	0.6	0.3	0.0	0.5	1.2
48	Paper, paperboard	2.4	1.0	1.5	0.4	0.3	0.4	3.0
76	Aluminum and articles thereof	2.3	0.8	1.1	0.8	0.3	0.4	2.7
78	Lead and articles thereof	**2.2**	0.3	0.9	1.4	0.2	0.7	0.1
87	Vehicles other than railway	**1.8**	1.0	1.3	0.3	2.5	0.6	15.9
27	Mineral fuel, oil etc	**1.8**	0.3	0.5	0.1	0.1	0.6	20.4
28	Inorganic chemicals, isotopes	**1.7**	1.4	0.9	1.1	0.8	0.3	1.2
03	Fish and seafood	**1.7**	0.8	0.7	0.9	0.3	0.7	0.8
07	Vegetables	**1.7**	0.8	1.2	1.1	0.0	0.2	0.5
19	Baking related	1.6	0.7	1.6	0.3	0.1	0.5	0.5
43	Fur skins & artificial fur	1.6	0.5	1.1	1.7	0.0	1.7	0.1
26	Ores, slag, ash	**1.6**	0.7	0.2	0.1	0.0	0.0	1.1
11	Milling; malt; starch	**1.5**	1.1	1.3	0.4	0.1	0.6	0.1
88	Aircraft, spacecraft	1.5	4.1	1.1	0.1	0.2	0.3	2.3
25	Salt; sulfur; earth, stone	**1.5**	0.8	1.0	1.1	0.3	0.5	0.3
02	Meat	**1.4**	1.1	1.2	0.1	0.0	0.1	0.9
99	Commodities nes	1.4	1.0	0.9	0.1	1.6	0.5	4.1
36	Explosives	1.3	2.2	0.8	2.0	0.1	0.2	0.0
94	Furniture and bedding	1.3	0.6	1.3	2.4	0.1	0.4	1.6
49	Book and Newspapers	1.1	1.5	1.4	0.5	0.3	0.9	0.4
81	Other base metals, etc.	1.1	1.7	0.8	2.1	1.6	0.3	0.2
74	Copper and articles thereof	1.1	0.6	1.0	0.5	1.1	0.8	1.1
	Export share in 2006-07	**68.1**	**33.9**	**33.2**	**13.8**	**31.9**	**19.0**	**68.1**

Source: World Trade Atlas and UN Commodity Trade databases
OEACs: Other East Asian countries; nes: not elsewhere specified

Table 4. Dynamics of comparative advantage, 1996-97 and 2006-07

	Canada	US	EU 27	China	Japan	OEACs	Mexico
Number of products with RCA							
In 2006-2007	29	34	46	45	18	25	21
Increase from 1996-97 (+)	+6	+13	+5	+5	+5	+3	+7
Decrease from 1996-97 (-)	-1	-3	-4	-6	0	-11	-10
Share of new number of products	24.1	47.1	19.6	24.4	27.8	56.0	81.0
Share of RCA products in country's exports							
2006-07 (%)	68.1	53.6	66.2	77.0	86.7	68.7	70.2
1996-97 (%)	64.3	64.8	65.0	54.8	83.8	65.1	56.2
Share of RCA products in world's exports							
2006-07 (%)	36.6	34.7	52.5	41.7	54.9	42.6	43.5
1996-97 (%)	29.0	46.1	55.1	17.9	50.2	37.0	34.2

Source: UN Commodity Trade Database
Note: RCA stands for revealed comparative advantage

There has been a substantial change in the number of products with RCA for all economies. Interestingly, the number of RCA products that these countries/ regions have has increased in 2006-07 compared to a decade ago. For example, Canada's 29 RCA products in 2006-07 (row 1) were the result of six new products (row 2) that Canada did not have in 1996-97, and the loss of one RCA product (row 3) in 1996-97. In 1996-97 Canada had 24 RCA products (= 29 – 6 + 1). Canada's seven new RCA products (out of 24) in 1996-97 caused a change in RCA products by 24%. The percentage change was smallest for the EU-27 (about 20%). For Mexico, the products changed by 81%. For the US, almost half of the products that had RCA in 1996-97 did not exist in 2006-07.

In terms of product counts, compared to Canada (which has 29 RCA products), Japan, OEACs, and Mexico have RCA for fewer products, while the US, the EU-27, and China have RCA for more products. However, since all products are not of the same export value, and different countries/regions have RCA in different products, one should not draw conclusions based on mere comparisons of the number of products with RCA across countries/regions.

In Table 4, I also present the product shares of country/region exports that have RCA in two time periods. Except for the US, the share of exports covered by RCA products increased in the latter decade for all economies. Hence, both the number of products and the share of exports with RCA increased in 2006-07 for all countries compared to a decade ago; however, in the US these two indicators moved in the opposite direction. This implies that US RCA is going towards products that have a smaller share in US exports.

One could argue that the larger share of trade being covered by RCA products is an indicator of more specialization. In that case, the benefits of trade are largely harnessed. In the sample, Japan stands out as one of the best performers in terms of exports coverage by RCA products. In 2006-07, most of Japan's exports (87%) were for products that had RCA, an increase of three percentage points from the situation a decade ago. China and Mexico have also been rapidly moving towards attaining a higher share of exports in RCA products over the last decade.

The last two rows show the share of products for each country/region's RCA in global total exports. For example, Canada's RCA products in 2006-07 make up 36.6% of global exports. Again, Japan leads this category – its RCA products constitute about 55% of world exports. China has doubled the share of world exports of its RCA products in 2006-07 compared to the situation in 1996-97.

6. Empirical Results: Medium- and High-Tech Products

In today's world of rapid globalization and increased inter-dependence among economies we are at the "knife-edge" of specialization. A country that has RCA today could easily lose it to a rival tomorrow (Bhagwati, 2006). The rapid diffusion of knowledge globally is quickly eroding the Schumpeterian monopoly advantages from innovation. In this new world economy the only way to survive and prosper is to continually innovate. The most important factor that influences the comparative advantage of a country is innovation. Effective innovation is the only way to cope with the rapid pace of globalization and raise living standards.

Against this backdrop, I would like to evaluate the relative performance of sample economies in the foreign markets for innovative products. Since there are no data to examine which products are more innovative than others, I followed a different route. A product or an industry can be defined in innovation or technology space by evaluating its skill-intensity (share of university graduates in total employment), capital-intensity (physical capital per worker), and R&D-intensity (R&D expenditure to output ratio). In general, the higher these intensities, the higher their products in the technology ladder. Since these intensities correlate very highly, and R&D is the input for innovation, looking only at the R&D intensity suffices to distinguish the product in the technology space.

Literature shows that domestic R&D not only raises the productivity of the investing firms, but also creates positive externalities to other firms in the country. Furthermore, for a country to be able to reap the positive spillover of other countries' R&D, it should develop its own absorptive capacity by investing in its own R&D (on the role of domestic and foreign R&D and their spillover, see Acharya and Keller, 2007 and 2008). A paper by Braunerhjelm and Thulin (2006), using data for 19 OECD countries, shows that an increase in R&D expenditure by one percentage-point results in a three percentage-point increase in high-technology exports. Hence, a country with a larger share of high R&D-intensity products in their trade component can be considered as moving towards more innovative activities, and will likely capture a larger market share in the future.

From an R&D-intensity perspective, among the 96 products at HS 2-digit, there are seven products that can be considered MHT. Using industry data for OECD countries from 1973 to 2002, Acharya (2007) showed that the industries that produced these seven products represented only 9% of value-added products but receive 77% of R&D expenditure among OECD countries. The R&D intensities for industries that produce these products range from 4-38%, whereas the economy-wide R&D intensity is only 1.7%. Hence, these seven products are produced by industries that are very R&D intensive and can be considered MHT products.

In Table 5, the first seven rows show the share of each of the seven MHT products in a country/industry's exports in 2006-07, with their aggregate shares given in the row that follows. As a point of comparison, the respective sum of all seven products' shares in 1996-97 is given in the last row. These products contribute to almost half (46.4%) of global exports, a slight decline from 47.5% a decade ago. In 2006-07, Japan continued to lead in terms of the highest share of these products in exports, despite the fact that Japan's share of these products fell by about five percentage points over a decade (74.7% in 1996-97 versus 69.6% in 2006-07).

Table 5. Medium and high-tech product shares in countries' exports, 2006-07

HS	Description	Canada	US	EU-27	China	Japan	OEACs	Mexico	World
29	Organic chemicals	1.2	3.2	3.2	1.7	2.9	2.7	0.7	2.6
30	Pharmaceutical products	1.3	2.5	4.7	0.2	0.4	0.5	0.5	2.7
84	Machinery	7.9	17.3	15.5	19.0	19.5	15.6	12.8	13.9
85	Electrical machinery	4.6	13.4	10.2	24.1	19.3	31.8	25.3	13.6
87	Vehicles other than railway	15.9	9.1	11.5	2.5	22.2	4.9	15.6	9.0
88	Aircraft, spacecraft	2.3	6.5	1.7	0.1	0.3	0.4	0.2	1.6
90	OPTM, etc apparatus	1.2	5.8	3.1	3.2	5.0	3.6	3.3	3.1
	TOTAL (2006-07)	**34.6**	**57.8**	**49.8**	**50.7**	**69.6**	**59.6**	**58.3**	**46.4**
	TOTAL (1996-97)	**40.3**	**58.9**	**47.5**	**26.5**	**74.7**	**43.9**	**57.3**	**47.5**

Source: UN Commodity Trade Database
Note: OPTM stands for optical, photo, technical, medical

The biggest loss in product share to total exports occurred in Canada, which declined from 40% in the first period to 35% in the second period. This drop was mostly due to a fall in export shares of three products; machinery, electrical machinery, and vehicles other than railway. The combined share of these three products was 37.3% in the first period, and it declined by almost 10 percentage-points (to 27.8%) in the second period. Comparing the share of these products by country/region with share of these products in the world, only Canada saw the share of these products smaller than that in the world. The country/region that saw the largest increase in the share of these products is China. Only one-quarter of China's exports was in MHT products in 1996-97, but a decade later, more than half of China's exports are MHT products. OACEs have also made impressive gains in their share of MHT products, and slight gains have been made by EU-27 and Mexico in the latter period compared to a decade ago. The share of these products declined slightly over time for the US.

Table 5 examines how much each of these products contribute to their own country/region's exports. The next interesting issue is which country/region is the biggest world supplier for each of these products. This data is presented in Table 6. For all of these products, except aircraft and spacecraft, the largest supplier is the EU-27. The dominant role that the EU-27 has is partly due to the fact that this region supplies about 40% of all global exports. The other noteworthy result is that the US supplies 42% of global aircraft and spacecraft exports, Japan supplies 15% of world vehicle exports, and OEACs contribute more than half of the world's exports on electrical machinery.

Table 6. Country shares of world exports in medium- and high-tech products, 2006-07

	Products	Canada	US	EU 27	China	Japan	OEACs	Mexico
29	Organic chemicals	1.7	12.2	48.6	6.2	6.7	11.9	0.6
30	Pharmaceutical products	1.8	8.9	71.4	0.6	0.8	2.2	0.4
84	Machinery	2.0	11.9	45.0	13.5	8.3	12.7	2.0
85	Electrical machinery	1.2	9.5	30.7	16.6	8.5	26.2	4.1
87	Vehicles other than railway	6.3	9.7	52.2	2.6	14.7	6.1	3.9
88	Aircraft, spacecraft	5.6	42.2	39.1	0.8	1.4	3.4	0.3
90	OPTM etc apparatus	1.4	18.0	40.8	10.6	9.6	13.0	2.4
	Total of seven products	**2.6**	**12.0**	**41.1**	**10.5**	**8.9**	**14.4**	**2.8**
	Aggregate	**3.5**	**9.6**	**39.7**	**9.5**	**5.9**	**11.1**	**2.3**

Source: UN Commodity Trade Database
Note: OPTM stands for optical, photo, technical, medical

Comparing the last two rows, it is clear that Canada is the only country whose share of total exports in global exports (3.5%) is less than its share of global exports in MHT products (2.6%). This is a further indication that Canada's trade pattern occurs more in relatively low-tech products. Using the information in Table 6, one can deduce the RCA of each of the seven products. The ratio of the share of each product to the aggregate share is the measure of RCA as given in equation 2. Therefore, countries/regions that have higher shares in specific product than at the "aggregate" will have RCA in that product. In this way, Canada has a RCA only in HS-87 "vehicle other than railway" and HS-88 "aircraft and spacecraft" (as was also shown in Table 2), whereas OEACs and Mexico have on three, the US has on four, and EU-27 and Japan have on five.

So far the analysis is based on HS 2-digit (96 products) level. These results are interesting but could be sensitive to the level of aggregation. It is common for a country to have the RCA for a product defined at a more aggregate level, but not for all of the products at a disaggregate level that belong to this aggregate category. From the policy perspective, for measuring RCA by country, one would like to choose the most detailed level of data disaggregation. Here, I use HS 4-digit level data to study RCA for MHT products.

At the 4-digit level, there are a total of 234 products (in these seven HS 2-digit products), ranging from a lowest of five products in "aircraft, spacecraft" to a highest of 85 products in "machinery" (Table 7). I compute RCA for each of these products, and the number of the products that each country has with RCA is presented in Table 7.[9] Note that even though an economy may not have RCA at HS 2-digit product, it could have products at HS 4-digit that have RCA. For example, Canada does not have RCA in 2-digit "machinery" but it has RCA in 15 products that belong to 4-digit level of "machinery".

Table 7. Number of products that the country has comparative advantage, 2006-07

HS	Description	Total # of products	Number of products that country has comparative advantage						
			Canada	US	EU-27	China	Japan	OEACs	Mexico
29	Organic chemicals	42	2	26	26	21	15	10	3
30	Pharmaceutical products	6	0	5	5	2	0	1	0
84	Machinery	85	15	34	68	24	43	14	12
85	Electrical machinery	47	2	20	20	30	28	32	24
87	Vehicles other than railway	16	7	7	8	5	7	1	5
88	Aircraft, spacecraft	5	2	5	2	0	1	1	0
90	OPTM etc apparatus	33	3	23	23	11	16	10	10
	Total	**234**	**31**	**120**	**152**	**93**	**110**	**69**	**54**

Source: UN Commodity Trade Database
Note: Since more than one country/region could have RCA for the same products, the sum of products across countries/regions may be larger than the total number of products.

Table 7 shows that, first, the larger the country's trade value, the larger the number of RCA products it has. Second, RCA in pharmaceutical products is dominated by the US and the EU-27. Third, Japan's position in terms of number of RCA products in "machinery" is much stronger than other countries/regions.

Fourth, RCA product count for electrical machinery is dominated by China and Japan. Fifth, the US has RCA in all five aircraft and spacecraft products.

Even though a country may not have measured RCA in a product, it may still be exporting that product. I present the share of exports of RCA products in Table 8 (the rest is for products that have no RCA). The contribution of products that have RCA varies substantially both by economy and by product. For example, in Canada the share of exports of RCA products varies from 0 for "pharmaceutical" to 96% for "vehicle other than railway". This means that none of the products at the 4-digit level "pharmaceutical" has RCA, and whatever Canada exports in this category is entirely from those products that have no RCA. On the other hand, almost all of Canada's exports in "vehicles other than railway" are supported by products with RCA. Japan's standing is remarkable in this product category; 98% of its exports are contributed by seven RCA products (Table 7).

Table 8. Export shares of products with RCA in total product exports, 2006-07

		Canada	US	EU-27	China	Japan	OEACs	Mexico
29	Organic chemicals	54.2	75.0	68.8	52.9	55.2	77.8	42.9
30	Pharmaceutical products	0	88.0	97.9	0	0	8.0	0
84	Machinery	36.7	68.2	68.4	88.9	75.4	73.7	60.9
85	Electrical machinery	26.1	67.9	36.3	13.3	87.6	92.5	83.0
87	Vehicles other than railway	95.6	56.0	88.7	32.0	98.2	2.0	71.8
88	Aircraft, spacecraft	82.6	76.9	5.9	0	3.3	2.5	0
90	OPTM etc apparatus	16.7	93.1	87.1	81.3	84.0	72.2	84.8
	Total	**63.9**	**70.9**	**68.5**	**48.1**	**85.1**	**76.8**	**73.9**

Source: UN Commodity Trade Database

The country that has the highest share of exports supported by RCA products is Japan; 85% of its exports (last row) are for products for which Japan has a comparative advantage at the global level. On the other hand, less than half of China's exports are for products that have RCA. This raises the question, what explains the part of trade that is not supported by RCA? As explained above, not all the determinants of trade patterns can be captured by comparative advantage. For example, trade due to increasing returns to scale (a combination of market size and market structure) may not be fully translated into an RCA measure. But since the objective of this paper is not to identify the determinants of trade patterns, I have not further analyzed the other factors that could explain the exports not supported by an RCA measure.

Innovation appears to be the only factor that helps a country retain and expand its comparative advantage. Countries should implement innovation policies if they hope to become successful at capturing foreign markets, raise the standard of living, and realize desired outcomes. However, innovation policies should be supplemented by a combination of framework policies and activities. The importance of supplemental policies, skills, talents, resources, and facilities in making an industry successful is nowhere more vivid than in Massachusetts' pharmaceutical industry, which has been more than 200 years in the making. The next section will showcase the Massachusetts life science super-cluster.

7. Massachusetts Life Science Super-Cluster

Massachusetts remains a worldwide leader in healthcare. As the largest life science cluster in the world it is referred to as a super-cluster. Massachusetts has the world largest concentration of life sciences assets; researchers and academic medical centers, entrepreneurs, venture capitalists, and biotechnology, medical device and pharmaceutical companies. On a per capita basis, the state of Massachusetts receives more patents and funding from associated federal agencies and venture capitalists, and has more PhDs and Nobel Prize winners, than anywhere else in the US. More than 30 Massachusetts scientists have won the Nobel Prize.

On a per capita basis, Massachusetts has also led the nation in producing patent-worthy inventions. In 2006, Massachusetts had 15.5 life science patents per 100,000 people, well above 8.5 in second-place New Jersey. The combined employment share of healthcare and life sciences in Massachusetts is 17.6, almost double that of manufacturing. The average annual salary in the state is slightly more than $52,000, whereas the highest paid sector in life sciences/pharmaceuticals has an average annual salary of almost $100,000 (PricewaterhouseCoopers, 2008).

Porter (2003) reports that despite being a profound success, the Massachusetts life science super-cluster was developed without an overarching strategy or structure. He reports that it did not follow the traditional model whereby government provides economic development through policy and initiatives. Rather than a deliberate government attempt, it was to some extent a path-dependent outcome: one event leading to, and building on, another. It began with the establishment of two prestigious universities. Then came the collaboration of stakeholders' outside government, the availability of venture capital, a strong science base of leading researchers and leading academic research centers, frequent technology and knowledge transfer from research to industry, and a high availability of capital and federal research funding.

Nevertheless, government policies have been very important in shaping the cluster. Although there does not appear to be state- or sector-focused policies in life sciences at the Federal level, companies benefit from an enormous amount of funding from the National Institutes of Health (NIH), which is distributed through competition. The NIH is an agency of the U.S. Department of Health and Human Services focusing mainly in conducting and supporting medical research. The NIH invests over $28 billion annually. More than 83% of the NIH's funding is awarded through approximately 50,000 competitive grants to over 325,000 researchers at thousands of universities, medical schools, and other research institutions (NIH, 2008). In the last 10 years, Massachusetts has received NIH grants amounting to $18.8 billion out of $164.6 billion of the total NIH grants disbursed in the US (i.e. approximately 11.5% of the total). In 2007, Massachusetts won grants of $2.24 billion (NIH, 2008). In 2006 and 2007, Massachusetts was the second largest NIH grantee state after California. On a per capita basis, Massachusetts was the number one recipient of NIH funding with US $353, followed by Maryland with US $316 (NIH, 2008).

This public funding of life sciences research in Massachusetts has resulted in numerous biomedical breakthroughs over the past three decades. A history of scientific excellence, evidenced by multiple Nobel Prize winners, is a key reason why Massachusetts receives more NIH funding per capita than any other state. The timeline of seminal discoveries in Massachusetts shows that future researchers will be standing on the shoulders of giants.

8. Conclusion

A country's comparative position is largely dependent on technology, factor endowments, and market size. Since these factors change over time, so too, will a country's comparative advantage. The only way to be competitive is to innovate. Only an innovative economy can ensure robust growth and a higher standard of living. Innovation - the development and adoption of new products, processes and services - is the only sustatinable way to remain competitive. Thus, future research should focus the role of domestic R&D and innovation in capturing larger foreign market shares. Research should also examine the structural adjustments developed economies must undergo as a result of China's emergence in the international market. An equally important topic is the role of inward and outward foreign direct investment in promoting/contracting the competitive position of a nation.

End Notes

[1]Competitive advantage may be explained in one of two ways. First, lower barriers to entry or a larger number of firms in an industry may be considered a competitive advantage. Second, some natural or policy induced mechanisms (such as lower taxes or greater labor-market flexibility) are synonyms for absolute advantage because they reduce costs for all sectors in the economy (see Neary, 2002).
[2]For the relative importance of these two theories in explaining production and trade, see David and Weinstein (2003) and Acharya (2006). The first paper looks at data for OECD countries, and the latter at data on Canada, the US, and Mexico.
[3]EU-27 includes: Austria, Belgium, Bulgaria, Czech Republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the U.K. Other East Asia countries are Hong Kong, Singapore, South Korea, the Philippines, Malaysia, Indonesia, and Thailand.
[4]In an earlier study, I computed Canada's RCA in the US market using industry level data (Acharya, Sharma and Rao, 2003).
[5]The detailed RCA calculation for 96 products for the year 1996-97 for all sample countries/regions is available upon request.
[6]The detail RCA calculation for 96 products for the year 1996-97 for sample countries/regions is available upon request.
[7] There were a few products whose ratios were slightly higher than 1, but I have not included them in Table 2 because these borderline cases are not worth pursuing due to questions related to data quality when working at the global level.

[8]The high share of minerals in 2006-07 is partly due to higher international mineral prices during that period.
[9]RCA by all 234 products for all countries/regions in the sample can be obtained upon request.

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Appendix A

Table A1. Product composition of exports in the world and of selected economies, 2006-07

HS 2-digit Code	Commodities	Canada	US	EU 27	China	Japan	OEAC	World
01	Live animals	0.5	0.1	0.2	0.0	0.0	0.0	0.1
02	Meat	0.9	0.7	0.8	0.1	0.0	0.1	0.6
03	Fish and seafood	0.8	0.4	0.3	0.4	0.2	0.3	0.5
04	Dairy, eggs, honey, etc	0.1	0.2	0.8	0.0	0.0	0.1	0.5
05	Other of animal origin	0.0	0.1	0.0	0.1	0.0	0.0	0.0
06	Live trees and plants	0.1	0.0	0.2	0.0	0.0	0.0	0.1
07	Vegetables	0.5	0.3	0.4	0.4	0.0	0.1	0.3
08	Edible fruit and nuts	0.1	0.6	0.4	0.1	0.0	0.1	0.4
09	Spices, coffee and tea	0.1	0.1	0.1	0.1	0.0	0.0	0.2
10	Cereals	1.2	1.6	0.3	0.1	0.0	0.2	0.5
11	Milling; malt; starch	0.1	0.1	0.1	0.0	0.0	0.1	0.1
12	Misc grain, seed, fruit	0.8	1.0	0.2	0.1	0.0	0.0	0.3
13	Lac, vegetable sap, extract	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	Other vegetable	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	Fats and oils	0.3	0.2	0.3	0.0	0.0	0.8	0.3
16	Prepared meat, fish, etc	0.2	0.1	0.2	0.5	0.1	0.4	0.2
17	Sugars	0.2	0.1	0.2	0.0	0.0	0.1	0.2
18	Cocoa	0.2	0.1	0.3	0.0	0.0	0.1	0.2
19	Baking related	0.5	0.2	0.5	0.1	0.0	0.1	0.3
20	Preserved food	0.3	0.3	0.4	0.4	0.0	0.1	0.3
21	Miscellaneous food	0.3	0.4	0.4	0.1	0.1	0.2	0.3
22	Beverages	0.2	0.3	1.1	0.1	0.0	0.2	0.6
23	Food waste; animal feed	0.2	0.4	0.3	0.1	0.0	0.1	0.3
24	Tobacco	0.1	0.2	0.3	0.1	0.0	0.1	0.2
25	Salt; sulfur; earth, stone	0.3	0.2	0.2	0.2	0.1	0.1	0.2
26	Ores, slag, ash	1.1	0.5	0.2	0.1	0.0	0.0	0.7
27	Mineral fuel, oil etc	20.4	3.5	5.5	1.7	1.1	7.2	11.6
28	Inorganic chemicals, isotopes	1.2	1.0	0.7	0.8	0.6	0.2	0.7
29	Organic chemicals	1.2	3.2	3.2	1.7	2.9	2.7	2.6
30	Pharmaceutical products	1.3	2.5	4.7	0.2	0.4	0.5	2.7
31	Fertilizers	0.9	0.3	0.2	0.2	0.0	0.1	0.3
32	Tanning, dye, paint, putty	0.2	0.5	0.7	0.3	0.5	0.3	0.5
33	Perfumery, cosmetic, etc	0.3	0.7	1.0	0.1	0.2	0.3	0.6
34	Soap, wax; dental prep	0.2	0.4	0.5	0.1	0.2	0.1	0.3
35	Albumins; mod starch; glue	0.1	0.2	0.2	0.1	0.1	0.1	0.2
36	Explosives	0.0	0.1	0.0	0.1	0.0	0.0	0.0
37	Photographic goods	0.1	0.3	0.2	0.1	0.7	0.1	0.2
38	Misc. chemical products	0.4	1.5	1.2	0.5	1.5	0.6	1.0
39	Plastic	3.1	4.1	4.2	2.2	3.1	3.9	3.3
40	Rubber	0.8	0.9	1.1	0.8	1.4	1.6	1.0
41	Hides and skins	0.1	0.3	0.2	0.1	0.0	0.4	0.2
42	Leather articles, travel goods	0.0	0.1	0.3	1.2	0.0	0.5	0.3
43	Fur skins & artificial fur	0.1	0.0	0.1	0.1	0.0	0.1	0.1
44	Wood	3.5	0.6	1.0	0.8	0.0	0.5	0.9
45	Cork	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	Plaiting material & basketwork	0.0	0.0	0.0	0.1	0.0	0.0	0.0
47	Wood pulp etc.	1.6	0.6	0.2	0.0	0.1	0.0	0.3
48	Paper, paperboard	3.0	1.3	2.0	0.6	0.4	0.5	1.3
49	Book and Newspapers	0.4	0.5	0.5	0.2	0.1	0.3	0.3
50	Silk; silk yarn, fabric	0.0	0.0	0.0	0.1	0.0	0.0	0.0
51	Animal hair, yarn, & fabric	0.0	0.0	0.1	0.2	0.0	0.1	0.1
52	Cotton, yarn, & fabric	0.0	0.6	0.2	0.8	0.1	0.5	0.4
53	Other vegetable textile fiber	0.0	0.0	0.0	0.1	0.0	0.0	0.0
54	Manmade filament, fabric	0.2	0.2	0.3	0.7	0.3	0.5	0.3
55	Manmade staple fibers	0.0	0.2	0.2	0.5	0.2	0.3	0.2
56	Wadding, felt, twine, rope	0.0	0.2	0.2	0.1	0.1	0.1	0.1
57	Textile floor coverings	0.1	0.1	0.1	0.1	0.0	0.0	0.1
58	Special woven fabric etc	0.0	0.1	0.1	0.4	0.0	0.1	0.1
59	Impregnated text fabrics	0.1	0.1	0.2	0.2	0.1	0.2	0.1
60	Knit, crocheted fabrics	0.0	0.2	0.1	0.5	0.1	0.5	0.2
61	Knit apparel	0.2	0.2	0.8	4.9	0.0	1.5	1.2
62	Woven apparel	0.2	0.1	1.1	4.2	0.0	1.3	1.2
63	Misc textile articles	0.1	0.1	0.2	1.2	0.0	0.1	0.3
64	Footwear	0.1	0.1	0.6	2.2	0.0	0.6	0.6
65	Headgear	0.0	0.0	0.0	0.2	0.0	0.0	0.0

65	Headgear	0.0	0.0	0.0	0.2	0.0	0.0	0.0
66	Umbrella, walking sticks, etc	0.0	0.0	0.0	0.1	0.0	0.0	0.0
67	Artificial flowers, feathers	0.0	0.0	0.0	0.2	0.0	0.1	0.0
68	Stone, plaster, cement etc	0.3	0.2	0.4	0.4	0.2	0.1	0.3
69	Ceramic products	0.0	0.1	0.4	0.6	0.2	0.1	0.3
70	Glass and glassware	0.2	0.4	0.6	0.6	0.6	0.2	0.5
71	Precious stones, metals	2.1	3.3	1.3	0.7	0.9	2.4	2.0
72	Iron and Steel	1.4	1.4	3.5	3.0	4.1	1.9	2.9
73	Articles of iron or steel	1.4	1.3	2.4	2.9	1.7	1.2	1.8
74	Copper and articles thereof	1.1	0.6	1.0	0.5	1.1	0.8	1.0
75	Nickel & articles thereof	1.8	0.2	0.2	0.1	0.1	0.1	0.3
76	Aluminum and articles thereof	2.7	1.0	1.3	1.0	0.4	0.5	1.2
78	Lead and articles thereof	0.1	0.0	0.0	0.1	0.0	0.0	0.0
79	Zinc and articles thereof	0.5	0.0	0.2	0.1	0.0	0.2	0.2
80	Tin and articles thereof	0.0	0.0	0.0	0.0	0.0	0.1	0.0
81	Other base metals, etc.	0.2	0.2	0.1	0.3	0.2	0.0	0.1
82	Tool, cutlery of base metal	0.2	0.4	0.4	0.6	0.4	0.3	0.4
83	Misc art of base metal	0.3	0.3	0.5	0.7	0.2	0.2	0.4
84	Machinery	7.9	17.3	15.5	19.0	19.5	15.6	13.9
85	Electrical machinery	4.6	13.4	10.2	24.1	19.3	31.8	13.6
86	Railway and loco. equip.	0.2	0.2	0.2	0.7	0.1	0.0	0.2
87	Vehicles other than railway	15.9	9.1	11.5	2.5	22.2	4.9	9.0
88	Aircraft, spacecraft	2.3	6.5	1.7	0.1	0.3	0.4	1.6
89	Ships and boats	0.2	0.3	0.6	0.9	2.2	2.0	0.8
90	OPTM etc. apparatus	1.2	5.8	3.1	3.2	5.0	3.6	3.1
91	Clocks and watches	0.0	0.1	0.1	0.2	0.1	0.6	0.3
92	Musical instruments	0.0	0.1	0.0	0.1	0.1	0.0	0.0
93	Arms and ammunition	0.1	0.3	0.1	0.0	0.0	0.0	0.1
94	Furniture and bedding	1.6	0.7	1.5	2.9	0.2	0.5	1.2
95	Toys and sports equip.	0.3	0.6	0.4	2.3	0.5	1.1	0.6
96	Miscellaneous manufactured	0.0	0.1	0.2	0.5	0.2	0.2	0.2
97	Art and antiques	0.1	0.6	0.2	0.0	0.0	0.1	0.2
	Commodities nes	4.1	2.9	2.6	0.2	4.8	1.5	3.0
	TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table A2. Revealed comparative advantage for Canada and other economies, 1996-97 and 2006-07

HS 2-digit		Canada 1996-97	Canada 2006-07	US	EU 27	China	Japan	OEAC	Mexico
01	Live animals	3.5	4.1	0.6	1.5	0.3	0.0	0.1	1.8
02	Meat	0.9	1.4	1.1	1.2	0.1	0.0	0.1	0.2
03	Fish and seafood	1.6	1.7	0.8	0.7	0.9	0.3	0.7	0.5
04	Dairy, eggs, honey, etc	0.2	0.2	0.4	1.7	0.1	0.0	0.1	0.1
05	Other of animal origin	0.6	0.9	1.6	0.9	2.1	0.1	0.3	0.1
06	Live trees and plants	0.6	0.6	0.3	1.8	0.1	0.0	0.2	0.2
07	Vegetables	0.9	1.7	0.8	1.2	1.1	0.0	0.2	4.5
08	Edible fruit and nuts	0.1	0.3	1.6	1.0	0.3	0.0	0.2	1.8
09	Spices, coffee and tea	0.1	0.3	0.3	0.7	0.6	0.0	0.2	0.8
10	Cereals	2.6	2.4	3.3	0.6	0.3	0.0	0.5	0.1
11	Milling; malt; starch	1.1	1.5	1.1	1.3	0.4	0.1	0.6	0.3
12	Misc grain, seed, fruit	1.8	2.5	3.3	0.5	0.4	0.1	0.1	0.1
13	Lac, vegetable sap,	0.2	0.3	1.3	1.4	0.6	0.2	0.4	1.0
14	Other vegetable	0.1	0.1	0.5	0.6	1.3	0.0	0.6	2.9
15	Fats and oils	0.7	0.9	0.7	0.9	0.1	0.0	2.2	0.1

16	Prepared meat, fish, etc	0.8	0.6	0.5	0.9	2.1	0.3	1.5	0.2
17	Sugars	0.5	0.8	0.5	1.0	0.2	0.0	0.6	1.2
18	Cocoa	0.6	1.0	0.5	1.5	0.1	0.0	0.5	0.3
19	Baking related	0.9	1.6	0.7	1.6	0.3	0.1	0.5	0.9
20	Preserved food	0.5	0.9	0.8	1.2	1.3	0.0	0.4	0.7
21	Miscellaneous food	0.5	1.1	1.3	1.4	0.3	0.3	0.6	0.8
22	Beverages	0.6	0.4	0.5	1.7	0.1	0.0	0.3	1.8
23	Food waste; animal feed	0.7	0.5	1.4	1.0	0.2	0.0	0.3	0.1
24	Tobacco	0.2	0.3	1.0	1.3	0.2	0.2	0.6	0.4
25	Salt; sulfur; earth, stone	1.6	1.5	0.8	1.0	1.1	0.3	0.5	0.7
26	Ores, slag, ash	2.5	1.6	0.7	0.2	0.1	0.0	0.0	0.6
27	Mineral fuel, oil etc	1.9	1.8	0.3	0.5	0.1	0.1	0.6	1.3
28	Inorganic chemicals	1.4	1.7	1.4	0.9	1.1	0.8	0.3	0.4
29	Organic chemicals	0.4	0.5	1.2	1.2	0.6	1.1	1.0	0.3
30	Pharmaceutical products	0.3	0.5	0.9	1.8	0.1	0.1	0.2	0.2
31	Fertilizers	3.0	3.2	1.2	0.7	0.8	0.1	0.2	0.1
32	Tanning, dye, paint, putty	0.3	0.5	1.1	1.4	0.6	1.0	0.6	0.4
33	Perfumery, cosmetic, etc	0.3	0.5	1.1	1.6	0.3	0.3	0.5	0.7
34	Soap, wax; dental prep	0.5	0.5	1.3	1.5	0.4	0.7	0.5	0.7
35	Albumins; mod starch;	0.3	0.4	1.3	1.4	0.5	0.7	0.6	0.2
36	Explosives	1.0	1.3	2.2	0.8	2.0	0.1	0.2	1.6
37	Photographic goods	0.4	0.5	1.6	1.1	0.4	4.0	0.6	1.1
38	Misc. chemical products	0.3	0.4	1.6	1.3	0.5	1.6	0.7	0.3
39	Plastic	0.8	0.9	1.2	1.2	0.7	0.9	1.2	0.6
40	Rubber	1.0	0.9	0.9	1.1	0.8	1.5	1.6	0.5
41	Hides and skins	0.3	0.3	1.2	0.9	0.6	0.1	1.5	0.5
42	Leather articles, travel goods	0.1	0.1	0.3	0.9	3.6	0.0	1.6	0.3
43	Fur skins & artificial fur	1.1	1.6	0.5	1.1	1.7	0.0	1.7	0.0
44	Wood	4.8	3.8	0.7	1.1	0.9	0.0	0.6	0.2
45	Cork	0.0	0.1	0.4	2.2	0.1	0.0	0.0	0.4
46	Plaiting material & basketwork	0.0	0.2	0.2	0.3	7.9	0.0	0.2	0.1
47	Wood pulp etc.	7.0	5.9	2.2	0.8	0.0	0.4	0.1	0.1
48	Paper, paperboard	2.6	2.4	1.0	1.5	0.4	0.3	0.4	0.4
49	Book and Newspapers	0.8	1.1	1.5	1.4	0.5	0.3	0.9	0.6
50	Silk; silk yarn, fabric	0.0	0.0	0.2	0.7	4.8	0.6	1.0	0.0
51	Animal hair, yarn, & fabric	0.1	0.1	0.1	1.1	1.6	0.4	0.5	0.2

52	Cotton, yarn, & fabric	0.1	0.0	1.6	0.5	2.3	0.4	1.4	0.2
53	Other vegetable textile fiber	0.2	0.2	0.1	1.3	2.3	0.2	0.9	0.0
54	Manmade filament, fabric	0.4	0.5	0.5	0.9	2.3	1.1	1.6	0.5
55	Manmade staple fibers	0.3	0.2	0.8	0.9	2.4	1.0	1.4	0.3
56	Wadding, felt, twine, rope	0.2	0.3	1.2	1.4	0.8	1.0	0.8	0.6
57	Textile floor coverings	0.4	0.5	0.9	1.3	1.1	0.0	0.2	0.2
58	Special woven fabric etc	0.3	0.2	0.6	0.8	3.6	0.4	1.4	0.5
59	Impregnated text fabrics	0.6	1.0	1.0	1.2	1.6	0.8	1.1	0.5
60	Knit, crocheted fabrics	0.3	0.2	0.9	0.6	2.7	0.5	2.9	0.2
61	Knit apparel	0.2	0.1	0.2	0.7	4.1	0.0	1.3	0.7
62	Woven apparel	0.2	0.2	0.1	0.9	3.4	0.0	1.0	1.1
63	Misc textile articles	0.3	0.3	0.4	0.7	3.9	0.1	0.4	1.1
64	Footwear	0.1	0.1	0.1	1.0	3.6	0.0	1.0	0.2
65	Headgear	0.5	0.5	0.4	0.8	4.2	0.5	1.1	0.5
66	Umbrella, walking sticks, etc	0.1	0.1	0.1	0.5	7.0	0.0	1.0	0.0
67	Artificial flowers, feathers	0.1	0.2	0.2	0.3	5.9	0.0	2.4	0.1
68	Stone, plaster, cement etc	0.9	0.9	0.8	1.3	1.3	0.8	0.3	0.8
69	Ceramic products	0.1	0.1	0.4	1.4	2.1	0.8	0.4	1.3
70	Glass and glassware	0.6	0.5	0.9	1.3	1.3	1.3	0.5	1.1
71	Precious stones, metals	0.7	1.0	1.6	0.6	0.3	0.4	1.2	0.6
72	Iron and Steel	0.6	0.5	0.5	1.2	1.0	1.4	0.7	0.4
73	Articles of iron or steel	0.8	0.8	0.7	1.3	1.6	0.9	0.6	0.8
74	Copper and articles thereof	1.3	1.1	0.6	1.0	0.5	1.1	0.8	0.8
75	Nickel & articles thereof	5.5	6.2	0.5	0.7	0.2	0.3	0.3	0.1
76	Aluminum and articles thereof	2.1	2.3	0.8	1.1	0.8	0.3	0.4	0.4
78	Lead and articles thereof	2.3	2.2	0.3	0.9	1.4	0.2	0.7	0.7
79	Zinc and articles thereof	3.4	2.9	0.2	1.0	0.8	0.3	1.0	1.6
80	Tin and articles thereof	0.3	0.2	0.5	0.5	1.1	0.6	3.7	0.4
81	Other base metals, etc.	2.1	1.1	1.7	0.8	2.1	1.6	0.3	0.2
82	Tool, cutlery of base metal	0.4	0.5	1.0	1.1	1.7	1.2	0.8	0.5
83	Misc art of base metal	0.9	0.8	0.9	1.3	1.8	0.4	0.6	2.1
84	Machinery	0.6	0.6	1.2	1.1	1.4	1.4	1.1	0.9
85	Electrical machinery	0.4	0.3	1.0	0.7	1.8	1.4	2.3	1.9
86	Railway and locomotive equip.	2.5	0.8	1.1	1.0	3.2	0.5	0.1	1.7
87	Vehicles other than railway	2.1	1.8	1.0	1.3	0.3	2.5	0.6	1.7
88	Aircraft, spacecraft	1.0	1.5	4.1	1.1	0.1	0.2	0.3	0.1

89	Ships and boats	0.4	0.2	0.3	0.7	1.2	2.8	2.6	0.1
90	OPTM, etc apparatus	0.3	0.4	1.9	1.0	1.0	1.6	1.2	1.1
91	Clocks and watches	0.0	0.0	0.3	0.4	0.8	0.5	2.4	0.3
92	Musical instruments	0.2	0.5	1.4	0.9	2.5	2.3	0.8	0.5
93	Arms and ammunition	0.3	0.9	4.1	1.0	0.1	0.2	0.2	0.1
94	Furniture and bedding	1.5	1.3	0.6	1.3	2.4	0.1	0.4	1.8
95	Toys and sports equip.	0.5	0.4	0.9	0.7	3.6	0.8	1.8	0.7
96	Miscellaneous manufactured	0.2	0.2	0.7	0.9	2.6	1.3	1.1	1.4
97	Art and antiques	0.4	0.8	3.6	1.2	0.0	0.1	0.4	0.0
99	Commodities nes	1.8	1.4	1.0	0.9	0.1	1.6	0.5	0.1