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INTEGRATION THROUGH INTERMEDIATE GOODS: A COMPARISON OF G-7 OPENNESS TO DEVELOPING COUNTRY EXPORTS

ABSTRACT

The fragmentation of manufacturing in G7 economies has substantially altered the way in which developing countries participate in world trade and production. Commodity chains and intertwined production networks have become increasingly important as vectors for the diffusion of technology and integration of developing countries into the world economy. We establish a set of simple and transparent benchmarks to compare and contrast the speed and extent to which production networks have integrated each of the G7 with developing economies through the importation of intermediate goods and examine these comparative indicators of G7 integration at both regional and global levels. We examine both total and intermediate goods trade flows and calculate the income-expenditure elasticity of developing-country sourced imports with respect to G7 incomes and also the elasticity of imported intermediate goods with respect to manufactured output. Within the G7, we find three tiers of openness to intermediate goods produced by developing countries, led by Germany and the US. Regional integration exhibits a clear pattern in which Central Europe appears to be integrating with developed Europe, Mexico with North America, and only East Asia is simultaneously integrating with North America, Europe and Japan.

Key Words: economic integration, international linkages to development, intermediate goods, vertical specialization

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ECONOMIC INTEGRATION AND VERTICAL SPECIALIZATION

The precipitous decline in international trade during the 2008-2009 recession has highlighted the international fragmentation of the value chain. According to the traditional Heckscher-Ohlin-Samuelson trade model countries specialize in, and export, products in which they have a comparative advantage based on factor endowments. These traded products are produced entirely within one country. A great deal of trade today, however, involves countries specializing in processes, or different stages in production (Feenstra, 1998, Sanyal and Jones, 1982). A product, therefore, can cross borders several times before reaching its final user (Trefler, 1995), and the recorded value of such trade can be considerably greater than the value of the final product. Thus, world trade in goods, which grew considerably faster than GDP in almost every year during the period 1990-2007, appeared to collapse during the great recession of 2009, falling by 12 percent when world output fell by just under 1 percent[1].

The relationship between trade and standards of living has been of interest to economists from the time of Adam Smith. While a large number of statistical studies have found a positive association between trade and growth[2], endogeneity problems made it difficult to identify the direction of causation. However, Frankel and Romer (1999), using an instrumental variables approach derived from a gravity model including all countries with available data, demonstrated quite clearly that there is a large and robust causal link from trade to growth. Extending the work of Frankel and Romer, Romalis (2007) showed that trade liberalization in developed countries led to trade expansion and an acceleration in growth in developing countries. Romalis, however, does not distinguish between different developed countries, and uses US "most favored nation" tariff rates as a proxy for trade barriers in the developed world as a whole. In this paper, we examine the openness of each of the G-7 countries to imports from developing countries, and specifically to imports of intermediate goods which are especially important indicators of economic integration, to obtain a comparative perspective of their potential contribution to economic growth in developing countries.

[1] IMF, World Economic Outlook Update, Jan. 26, 2010.
[2] There is an extensive literature on this. Good examples are found in (Dollar, 1992, Edwards, 1998, Panagariya, 2004).

THE NEW LITERATURE ON INTERMEDIATE GOODS

The rapid rise of international trade in the 1990's was accompanied by a wide-ranging resurgence of empirical work on trade's role in regional as well as global economic integration (Rogoff, 2005). During this period, both the volume and the variety of goods traded rose (both absolutely and relative to most national incomes). One area where trade grew particularly rapidly was trade in intermediate goods, creating new export opportunities that appeared to be directly related to the fragmentation of manufacturing into an internationally dispersed network of activities.[3]

Theoretically, the fragmentation of manufacturing allows firms and nations to specialize in specific manufacturing activities—the production, processing, or assembly of newly distinct components –which are potentially better suited to their factor endowments than the previously integrated product. This matters for development because activities can be selected so as to avoid a locality's inhibitory bottlenecks, e.g. the scarcity of particular skills or institutional competencies. While fragmentation is not without its own set of factor and infrastructural requirements, it has gained increasing theoretical as well as empirical attention as an important pathway for economic growth and technological development. Sanyal and Jones (1982) have pointed out that locating trade in the middle of a country's productive spectrum, instead of the end, enriches the availabilities of inputs; this should enhance productivity. Romer (1990) provided an influential theoretical framework in which trade in capital good increases both the level and rate of change of productivity: trade in capital goods actually integrates developing economies with the full range of global human capital. Santacreu (2008) models national output as a function of the range of intermediate goods used in final goods production, with trade as a primary driver of the growth of productivity of domestic factors of production. In her model the farther a country is from the technological frontier the greater is the productivity gain from an increase in the number of intermediate goods imported. Lüthje (2003) presents an alternative formulation in which access to a greater variety of intermediate goods allows producers to select that particular differentiated intermediate good that best suits their production process.

The empirical literature has explored several intertwined mechanisms through which international trade in intermediate goods might raise productivity and/or speed the growth of productivity. These effects may obtain at either the national or global level.

[3] For recent surveys see Karras and Submitter (2008), and Andersen and Babula (2008).

Feenstra pioneered the application to international trade and intermediate goods of Romer's (1990) production function (Feenstra, 1998, Feenstra et al., 1997, Feenstra and Markusen, 1992). Vertical specialization may be an effective mechanism for the diffusion of best practice technologies between nations.[4] Kaminski and Ng (2005) find considerable technological diffusion in Central Europe where simple assembly led to the production and (net) export of components, as well as a progressive integration into European Union networks of production and distribution. Kasahara and Rodrigue (2008) find that importing intermediate goods improves productivity in a panel study of Chilean manufacturing plants. Vertical specialization and the import and export of intermediate goods has been posited as a vector for the diffusion of existing best practice technique as well as a potent factor behind the development of genuinely autonomous innovative capacity (Connolly, 1997).

While a large number of variations of these 'new' growth theory connections between trade, productivity and technical change could be mentioned, the rise of trade in intermediate goods between 'north' and 'south' also has clear implications for the traditional Singer-Prebisch concern regarding the ability of developing nations to successfully enter the world economy. Fragmentation of production and trade in intermediate or middle goods allow newly industrializing economies to enter a far wider range of products, hence the specter of deteriorating terms of trade (and the attendant threat to export earnings) is greatly attenuated.[5] Moreover, modest reductions in trade barriers can lead to large increases in exports of intermediate goods (Yi, 2003).

ANALYTICS OF VERTICAL SPECIALIZATION

The analytics of specialization in processes as opposed to products have been clearly demonstrated by Arndt (1997)[6] and Deardorff (2001). Figure 1 shows the standard 2 factor-2 product diagram for international trade, with the production of each good taking place entirely in its country of origin. Labor and capital are the two factors, and X and Y are the two products, whose expansion paths at a given ratio of the price of labor to the

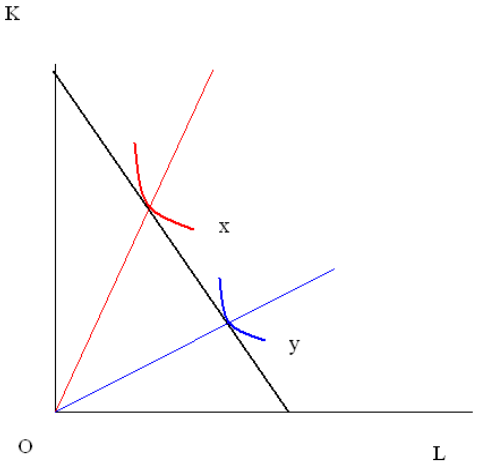
[4] We use the term vertical specialization in the general sense of a country specializing in part of a production process. The term is used more narrowly by Amador and Cabral (2009) who refer to vertical specialization as the use of imported inputs to produce goods which are afterwards exported.

[5] There is a large literature related to Bhagwati's (1968) concept of "immiserizing growth". However, as Krueger (1997) noted more than a decade ago, developing countries integrating with the international economy through manufacturing have been able to grow rapidly.

[6] Arndt's objective was to show that unlike in the Heckscher-Ohlin model, where specialization in a product leads to a loss in income for the scarce factor, specialization in a process could lead to increases in income for labor in both the capital abundant and the capital scarce country.

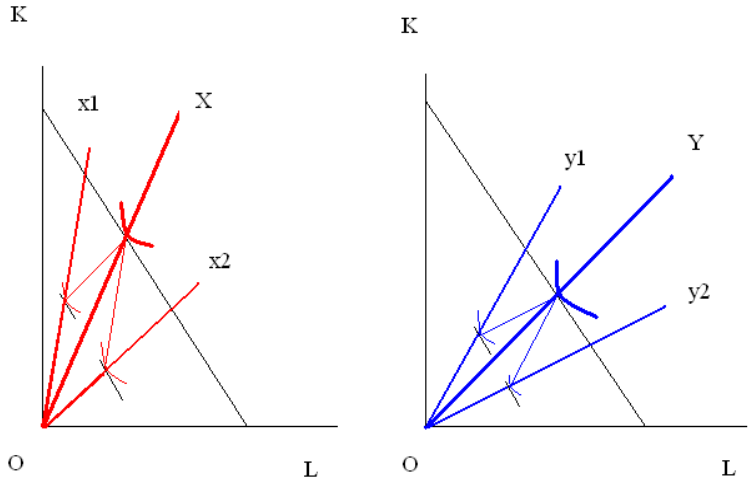
price of capital (set by country A's factor endowments) are shown by the upward sloping dotted lines from the origin. The isoquants x and y represent outputs of X and Y at the same cost; X is clearly the capital-intensive product, and Y the labor-intensive one. If A is a capital-abundant country, it will specialize in and export X, and import Y. Figure 2 shows the case of specializing in a process, or intra-product specialization. The left panel shows production of X is now fragmented into two stages, x1, which is relatively capital-intensive, and x2, which is relatively labor intensive[7]. The thin upward sloping lines from the origin, x1 and x2, show the expansion paths of the two processes at the given factor price ratio. The heavier line OX is the expansion path of X. The capital-labor ratio for X is a weighted average of the ratios for x1 and x2. Similarly, the right panel shows the production of Y fragmented into a capital intensive process y1, and a labor intensive process y2[8]. It is quite possible now that the capital abundant country A will specialize in the processes x1 and y1, while a labor abundant country will specialize in processes x2 and y2. Production fragmentation has led to both the capital and labor abundant countries being involved in the production of the capital intensive as well as the labor intensive products, and international trade is now as much about intermediate goods as it is about final goods.

Figure 1: Standard Diagram for Trade in Goods



[7] It may be helpful to think of X as a product like a tractor, with x1 representing assembly (capital intensive) and x2 components (labor intensive).
[8] Y may be a shirt, with y1 representing capital intensive yarn and fabric production, and y2 labor intensive cutting and stitching.

Figure 2: Two-stage production of X and Y



INTERMEDIATE GOODS IN REGIONAL PERSPECTIVE

The growth of trade relative to national incomes has been accompanied by a proliferation of regional trade agreements. The NAFTA was negotiated and implemented in the early to mid 1990s, in Europe bilateral free trade and accession agreements with Central European partners presaged European Enlargement (Caporale et al., 2009), and there was much concern about a regional bloc forming in East Asia (Frankel, 1993). Similar questions hovered over each region. Would the rise of regional trade be a complement or a substitute for multilateral trade? Did regional arrangements bode well or ill for the integration and development of lower and middle income economies overall? Jacob Viner's (1950) famous distinction between 'trade creation' and 'trade diversion' was widely invoked: a regional free trade area will create trade to the extent that its members switch from high cost domestic goods to those produced at lower cost in partner countries. But it will divert trade when members switch from low cost non-partners to higher cost partners. In an earlier paper we (Berdell and Ghoshal, 2007) found that the US economy became considerably more open to non-Mexican imports from the developing world over the 1990s. Rather than diverting trade, the NAFTA was associated with clear evidence of increased import penetration into the US economy by non-member developing countries. Our objective here is to place the US experience of the 1990s in comparative perspective by examining changes in the openness of each of the G7 economies to imports from developing countries in general, as well as from the different

regions in which countries are newly industrializing. More importantly we give particular attention to the changes in G7 openness to intermediate goods flows because of the growing recognition that they indicate the integration of industrializing economies into the productive structure of high income economies.

The regional structure and nature of intra industry trade has attracted attention for some time now. East Asia's pronounced orientation towards intermediate goods trade and vertical specialization is well established (Wakasugi, 2007) and a considerable amount of comparative work has been done on the labor market impacts and implications of trade linkages between OECD economies and NIEs (Molnar et al., 2007). Our concern here is somewhat different. We view flows of intermediate goods as an important indicator of the economic integration of newly industrializing regions into the productive structure of the world economy, and are interested in establishing whether there is an emerging set of trans-regional relationships in which the G7 economies are integrating with different newly industrializing regions.

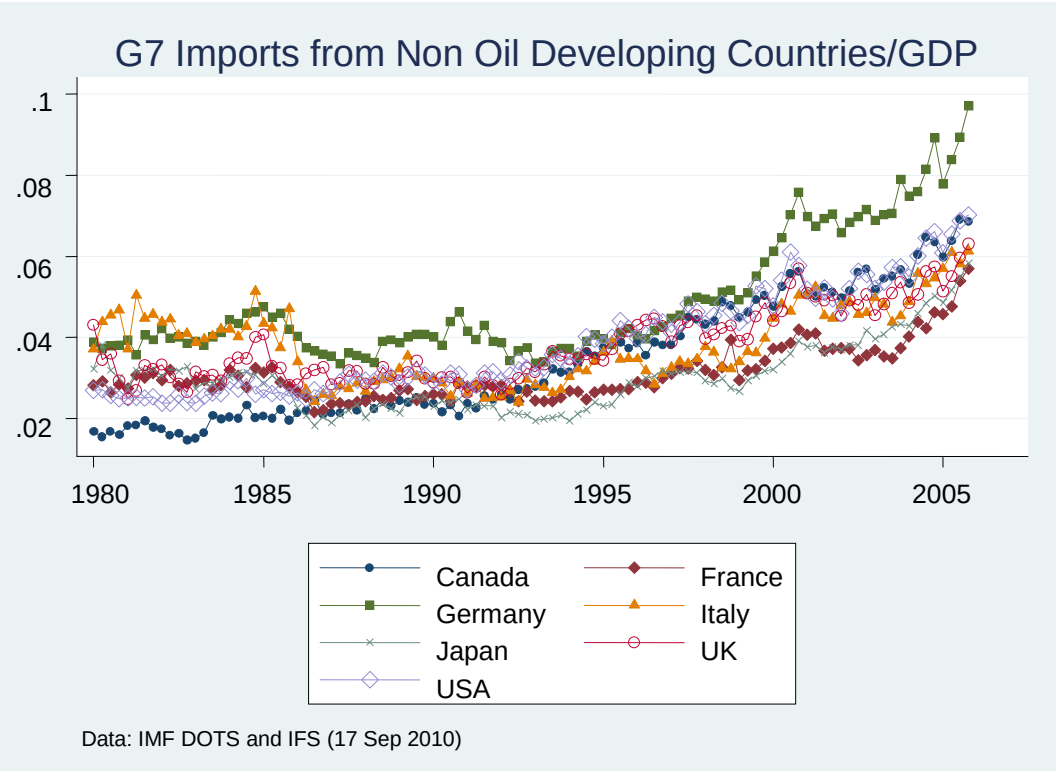
G7 IMPORTS OF ALL GOODS

Arora and Vamvakadis (2006) have made a strong case for the importance of export linkages in the growth process. They find that when developing countries trade more with wealthy countries their income rises faster. As our objective is to examine the strength of linkages of each of the G-7 countries to developing countries, we start with a simple means of assessing these linkages: import penetration, or the value of exports from a country or group of countries to a G7 importer as a proportion of the importer's national income. An increasing share is a crude but fairly comprehensive indicator of economic integration as it indicates that export goods from the region are becoming more important in the importer's consumer basket or more prominent (as inputs) with its productive process.

Movements in a region's exports expressed as a share in the importer's GDP are directly related to what we refer to as the 'income elasticity of expenditure' on imports from that area. For example if the US income elasticity of expenditure on imports from East Asia is greater than one, then an increase in US income is accompanied by faster growth in the value of imports from East Asia and a rising East Asian import to US GDP ratio. Following upon the implementation of the NAFTA the US income elasticity of expenditure on Mexican imports increased substantially (Berdell and Ghoshal, 2007), but

so did US income elasticity for imports from non-oil developing countries as a group (excluding Mexico). This suggests that trade patterns indicated greater openness to developing country imports during the 1990's. Here we look at all G7 members and calculate the income elasticity for total imports from developing countries.

Figure 3: Imports from Developing Countries as shares of GDP



We first look at long term trends in imports of Canada, France, Germany, Italy, Japan, the UK, and the US from developing countries. We delineate the latter as those listed in the International Monetary Fund's classification as Group 201—non-oil developing countries.[9] Figure 3 shows quarterly values for the ratio of developing country imports to GDP for the period 1980-2005. Import figures are from the IMF's Direction of Trade Statistics, and GDP figures from International Financial Statistics. While there has been a good deal of variation among the G-7 economies in import penetration by developing

[9] The IMF has a broader Group 202—all developing countries, which includes a dozen countries listed as oil exporters, as well as the 201 countries.

countries, the overall trend has an increasing one for all seven. By this measure, Germany appears to have the highest degree of openness, followed by the US and Canada.

It is useful to supplement the broad picture given by trends in import penetration with elasticity figures. As noted earlier, the income elasticity of expenditure on imports is a good measure of the degree to which an economy becomes more open to imports as its income rises. Using the same data, and OLS regression methods, we calculate elasticities for the entire period 1980-2005, as well as two sub-periods 1980-1992 and 1993-2005.

The import elasticity is calculated by the OLS regression of the log of the value of imports v_i, i.e. imports from particular location (i), upon the log of GDP from a member of the G7 (y_j):

$$v_i = \alpha + \beta y_j \quad (1)$$

The estimates of β and its standard error for each of the G7 countries are shown in Table 1. [10] Most regressions generate highly significant figures for elasticity. For the entire 1980-2005 period all the G-7 countries have elasticities greater than one with the exception of Italy which was marginally below one, indicating that imports from developing countries grew faster than income. Moreover, the elasticity increased in the second period for all except Japan. These results indicate an increasing openness to imports from developing countries.

Caution should be exercised when comparing our results to the literature. Our results are conceptually quite different from traditional estimates of trade elasticities as we do not intend to correct for changes in prices and exchange rates, nor do we include a term capturing changes in the income of the exporting country as a gravity equation would. Our estimates are intentionally *pari passu* rather than *ceteris paribus* estimates, that is we capture how trade expenditures have varied with income as prices, exchange rates and other incomes have varied as well. [11] Nevertheless our finding of large income-expenditure elasticities for the G7 is consistent with Hooper et al. (2000) who find that income elasticities are generally between one and two, except for Japan, which is slightly below one. Similarly a more recent paper (Crane et al., 2007) finds income elasticites

[10] In log form, the coefficient β is the elasticity of expenditure on imports with respect to income.
[11] In our parsimonious model, when an income-expenditure elasticity is greater than one the value of imports is necessarily rising relative to national income. In the case of an income elasticity that was estimated along with price and other variables this relative change would also depend upon the movement of those other variables.

between one and two with Germany a larger outlier. Like us they find that income elasticites have been growing over time.

Table 1: Income Elasticity of Expenditure on Imports from Non-Oil Developing Countries by G7 Countries

	80-05	80-92	93-05
	ALL	EARLY	LATE
USA	1.684***	1.281***	1.980***
	(0.024)	(0.031)	(0.047)
UK	1.337***	0.854***	1.562***
	(0.032)	(0.041)	(0.050)
France	1.193***	0.841***	1.821***
	(0.043)	(0.034)	(0.182)
Germany	1.258***	0.932***	1.531***
	(0.046)	(0.028)	(0.317)
Italy	0.992***	0.539***	1.863***
	(0.051)	(0.037)	(0.138)
Canada	2.089***	1.487***	1.936***
	(0.049)	(0.047)	(0.075)
Japan	1.038***	0.686***	0.42
	(0.048)	(0.029)	(0.431)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Intercepts omitted; Data: DOTS and IFS

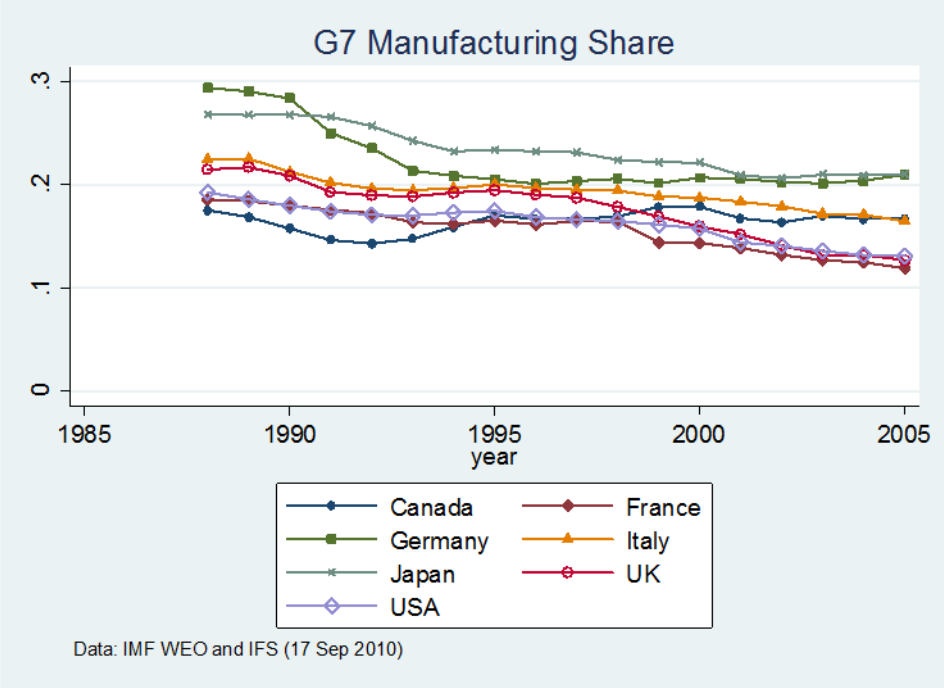
In some respects our concerns go back to a neglected result of Houthakker and Magee who examined annual data from 1951 to 1966. They found that the income elasticity for each of the G7 countries for all imports was greater than one. Examining US imports in more detail, they found the elasticity higher for imports from developed than underdeveloped countries, implying that the "share of industrial countries in US imports is likely to increase over time" (1969: 122). To our knowledge their results have not been revisited and we find that matters have changed considerably: imports from developing countries have been rising more quickly than those from the developed world, and our calculations indicate higher expenditure-elasticities for imports from developing countries.

G7 IMPORTS OF INTERMEDIATE OR MIDDLE GOODS

Intermediate or middle goods are manufactured parts or components used in the production of other goods. While conceptually they are quite distinct from final goods, empirically it has not been easy to separate them in international trade statistics, until Revision 3 of the United Nations' Standard International Trade Classification. The UN's COMTRADE database now separates intermediate goods in the SITC 7 (machinery and

transport equipment) and SITC 8 (miscellaneous goods) categories. This is what we focus on in this section. An illustration of the kinds of products included is shown in Appendix Table 2, along with a complete list of the relevant five digit codes in Appendix Table 3.

Figure 4: Declining Share of Manufacturing in GDP of G-7



It should be noted that we are able to identify only a segment of the range of intermediate goods traded internationally. As pointed out by Athukorala and Yamashita (2006), while COMTRADE provides a fairly complete list of parts and components in the machinery and components sector, many items which should be recorded as parts in the miscellaneous goods sector are not. In addition, intermediate goods are not separated out in pharmaceutical and chemical products and metal products, two industries where there has been considerable international fragmentation of production.

We are interested in examining the integration of manufacturing in G-7 countries with developing countries through imports of parts and components from the latter. This export oriented (from the perspective of developing countries) measure of emerging market production integration complements the more widely investigated importation of

intermediate goods into developing countries To measure the strength of this linkage between G-7 and developing countries we again start with import penetration. Since these imports of parts and components go into manufacturing, and manufacturing has had an unstable and declining share of GDP in all the G-7 economies, (as shown in Figure 4) it is more appropriate to compare intermediate goods imports to manufacturing output rather than to GDP. It should be noted that we do not use value added in manufacturing—the common measure of manufacturing output—since value added in manufactures is by definition domestically produced. Instead, we take the gross output (by value) of manufacturing in the G7 economies. This, of course, makes the ratio of imports to manufacturing output much smaller than if we had used the value added figures. Our measure of manufacturing gross output is chosen from the STAN database (OECD, 2010) to correspond as closely as possible to the SITC 7 and 8 trade classifications of traded intermediate goods. A list of the relevant manufacturing sectors appears in the Appendix Table 4.

Figure 5: Imported Intermediates as Shares of Manufacturing Output

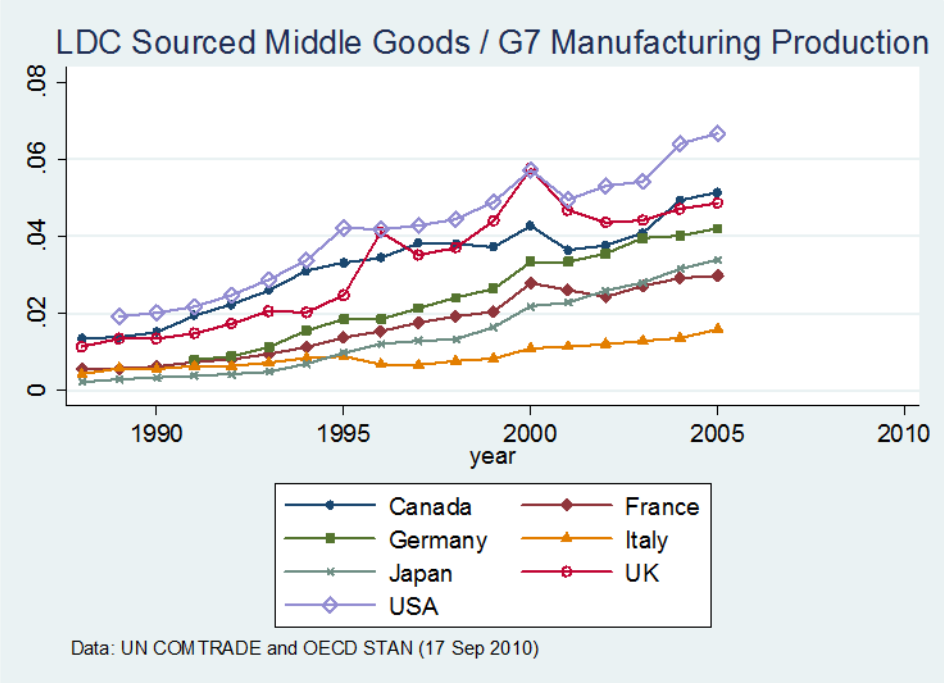


Figure 5 shows imports of intermediate goods as a share of relevant manufacturing output in each of the G7 countries for the period 1988-2005.[12] It is seen that the share rises for all seven countries though there seem to be three groups among them. The US has the highest levels of openness, with import penetration reaching 6 percent by 2005. Italy lags at less than 2 percent. The others lie between 2 ½ and 4 ½ percent.

Table 2: Import Elasticity of Intermediate Goods with respect to Manufacturing Output

	World	Industrial	201	202	Africa	America	Asia	Europe	Mid East
Canada	1.056***	0.957***	2.313***	2.317***	4.679***	2.113***	2.386***	3.654***	3.246***
	(0.0078)	(0.0075)	(0.0169)	(0.0169)	(0.0262)	(0.0226)	(0.0224)	(0.0245)	(0.0226)
France	1.858***	1.666***	3.828***	3.825***	3.760***	3.504***	3.292***	6.171***	2.772***
	(0.0123)	(0.0101)	(0.0398)	(0.0401)	(0.0299)	(0.0393)	(0.0417)	(0.0730)	(0.0408)
Germany	1.798***	1.320***	3.276***	3.276***	5.157***	2.731***	2.656***	4.378***	2.090***
	(0.0253)	(0.0186)	(0.0678)	(0.0680)	(0.1670)	(0.0437)	(0.0536)	(0.0985)	(0.0584)
Italy	1.127***	0.982***	2.256***	2.245***	2.876***	1.168***	2.232***	4.012***	1.886***
	(0.0076)	(0.0074)	(0.0237)	(0.0236)	(0.0673)	(0.0258)	(0.0248)	(0.0436)	(0.0400)
Japan	2.507***	1.648***	3.822***	3.836***	4.488***	2.276***	3.857***	4.401***	2.603***
	(0.1120)	(0.0654)	(0.1730)	(0.1740)	(0.4580)	(0.2210)	(0.1740)	(0.3600)	(0.1720)
UK	1.508***	1.227***	3.614***	3.562***	3.142***	5.190***	3.340***	5.530***	2.045***
	(0.0100)	(0.0083)	(0.0327)	(0.0315)	(0.0993)	(0.0778)	(0.0328)	(0.0798)	(0.0262)
USA	1.974***	1.310***	3.003***	3.016***	5.246***	2.994***	3.021***	4.296***	1.917***
	(0.0112)	(0.0072)	(0.0182)	(0.0181)	(0.0847)	(0.0310)	(0.0165)	(0.0568)	(0.0292)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; 201 represents non-oil developing countries as classified by the IMF; 202 represents all developing countries

As in the previous section, we supplement import penetration trends with elasticity calculations, and regress imports of intermediate goods on manufacturing output (in logs). The results are shown in Table 2. Here we go beyond Table 1 and calculate elasticities for imports from several groups of countries. We show figures for the world as a whole, for industrial, non-oil developing, and all developing countries (as classified by the IMF). Moreover, we separate developing countries into five geographic groups—Africa, Americas, Asia, Europe (transitional countries) and Middle East. Each of the G-7 countries is seen to have an elasticity of greater than one for imports of middle goods from the developing countries, indicating closer integration as manufacturing output increases. For each of the G-7, the elasticity figure is greater for developing countries than

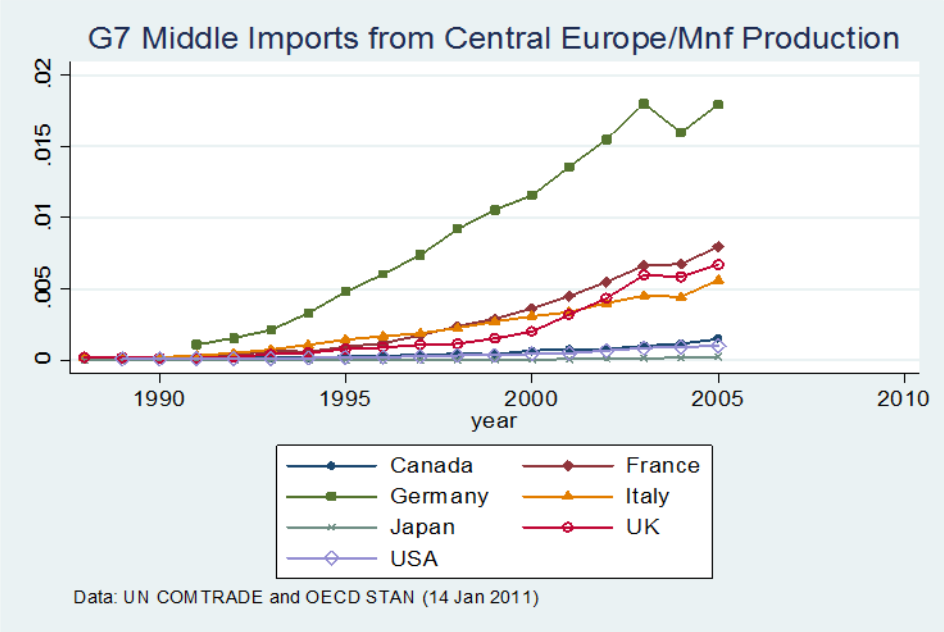
[12] Unlike total trade, shown in Figure 3, COMTRADE data are available only since 1988, and on an annual rather than a quarterly basis.

for industrial countries[13]. Among the groups of developing countries we see a great deal of variation in the elasticites which require a more detailed discussion.

A CLOSER LOOK AT EAST ASIA, CENTRAL EUROPE AND MEXICO

Three areas have attracted a lot of attention in the discussion of outsourcing part of the production process to developing countries. East Asia, due to its favorable business climate and relatively low labor costs has for a long time been a favorite location for manufacturing affiliates of multinational corporations. Since 1989, Central Europe has attracted a great deal of manufacturing investment from firms based in Western Europe. With the implementation of NAFTA in 1994, removing trade barriers and providing investment security, American and Canadian firms have greatly expanded their presence in Mexico (as have Asian and European firms), to take advantage of an integrated North American market). We focus on these three areas, and their exports of intermediate goods to the G-7 countries.

Figure 6: Central Europe: Exports of Intermediate Goods to G-7



[13] This should be treated with some caution, since industrial countries account for most of component exports, though the share of developing countries has been increasing.

Figure 7: East Asia: Exports of Intermediate Goods to G-7

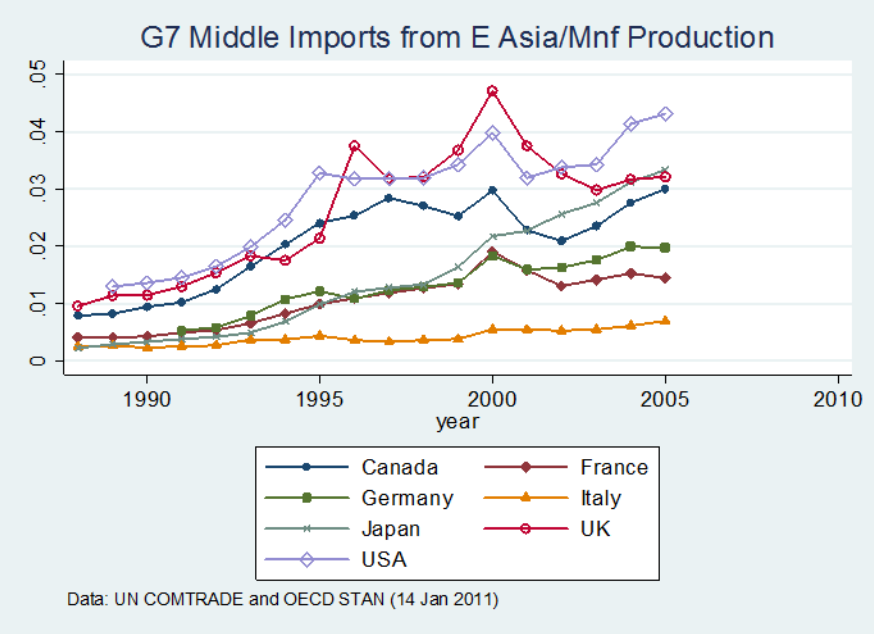


Figure 8: Mexico: Exports of Intermediate Goods to G-7

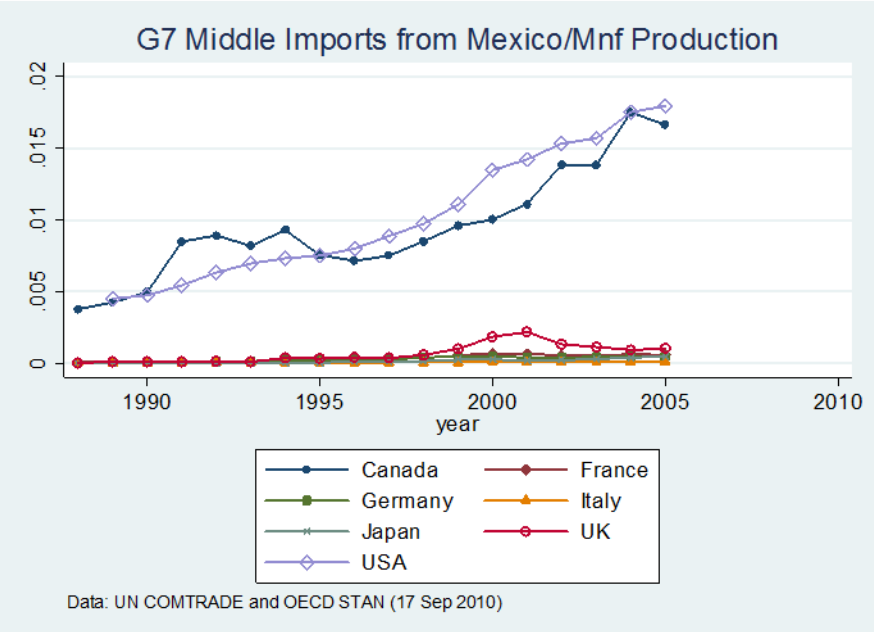


Figure 6 shows imports from Central Europe [14] as a share of the relevant manufacturing output of each of the G-7 economies. We see that import penetration into Germany has risen rapidly, followed by France, Italy and the UK; shares in Canada, the US and Japan have remained very low. Figure 7 shows similar measures for East Asia. Here we see a rising trend for all the G-7 countries, though considerably less for Italy than the others. In Figure 8, we see sharply rising penetration of Mexican intermediate goods into the US and Canada, and with negligible shares for the other G-7 members.

We also calculate elasticities for intermediate imports from the three areas of interest. These are seen in Table 3. In all cases, the elasticities are considerably greater than one, suggesting that the integration of the three regions with the G-7 through trade in intermediate goods will continue to increase with economic growth.

Table 3: Import Elasticity of Intermediate Goods from Three Areas of Interest

	Central Europe	East Asia	Mexico
Canada	3.919***	2.377***	2.124***
	(0.0265)	(0.0225)	(0.0248)
France	8.120***	3.272***	4.714***
	(0.1020)	(0.0417)	(0.0606)
Germany	4.692***	2.640***	3.009***
	(0.1180)	(0.0535)	(0.0734)
Italy	5.492***	2.171***	2.781***
	(0.0689)	(0.0243)	(0.0519)
Japan	4.742***	3.854***	2.950***
	(0.4160)	(0.1730)	(0.2430)
UK	7.175***	3.333***	6.243***
	(0.1030)	(0.0334)	(0.0914)
USA	4.900***	3.011***	3.056***
	(0.0639)	(0.0163)	(0.0327)

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Intercepts omitted.

This broad conclusion is consistent with that of Yeats (1998) who finds that imports of parts and components have been rising relative to value added in manufacturing in Europe, Japan and North America. While he does not distinguish the developing vs. developed country sources of the imports he notes that exports of parts and components have become more that 40% of total manufacturing exports for some developing countries. Kimura et al. (2007) also find a rising share of parts and components relative to final goods in international trade. In their estimates of gravity equations for bilateral flows

[14] We define Central Europe as the European parts of the former Soviet Union less Russia, other former Warsaw Pact countries, and the former Yugoslavia.

of parts and components the elasticity with respect to the importer's GDP is significantly larger than one. They find that the growth of parts and components exports from Asia has been considerably faster than that from Europe, which is consistent with our finding that East Asia has been successfully integrating with each of the G7 economies. [15]

CONCLUSIONS

Our study shows unambiguous evidence of increasing integration and globalization. All seven of the G-7 economies saw greater opening to imports from developing countries, with rising trade shares and (with the exception of Japan), income elasticity of expenditure on imports greater than one for total imports. For intermediate goods, we have rising shares and high elasticities for all seven, as well as higher elasticity figures for imports from developing economies than from industrial countries.

There are, however, some interesting variations within the overall trend of increasing integration. Among the G7 economies, the US is the most integrated with developing countries in its manufacturing production, while Italy is much less so. We also see clear regional patterns. Central Europe appears to be integrating successfully with Germany and the other European members of the G-7, Mexico with the US and Canada, while East Asia has been successfully integrating with all of the G7.

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[15] The Secretary-General of UNCTAD (Panitchpakdi, 2010) very recently referred to the importance of intermediate goods for Asian integration into the world economy: "UNCTAD estimates that the share of intermediate products was about 48% of non-fuel merchandise trade in 2008. This is largely due to the integration of East and Southeast Asia in global supply chains since 1990.....Despite an increased vulnerability to external crisis, integration into global production chains enables these countries to benefit from specialization.....This provides an important lesson for other developing countries to elaborate strategies for strengthening participation in global value chains and in diversifying their export structures"

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APPENDIX

Table 1: Regional Aggregates

Name: 201 as per IMF classification **Countries**: Afghanistan, Albania, Angola, Anguilla, Antigua and Barbuda, Argentina, Armenia, Aruba, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belize, Benin, Bermuda, Bhutan, Bolivia (Plurinational State of), Bosnia Herzegovina, Botswana, Br. Virgin Isds, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Cayman Isds, Central African Rep., Chad, Chile, China, China, Hong Kong SAR, China, Macao SAR, Colombia, Comoros, Congo, Cook Isds, Costa Rica, Côte d'Ivoire, Croatia, Cuba, Cyprus, Czech Rep., Czechoslovakia, Dem. People's Rep. of Korea, Dem. Rep. of the Congo, Djibouti, Dominica, Dominican Rep., Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Falkland Isds (Malvinas), Fiji, Fmr Panama, excl.Canal Zone, Fmr Panama-Canal-Zone, Fmr USSR, Fmr Yugoslavia, French Guiana, French Polynesia, FS Micronesia, Gabon, Gambia, Georgia, Ghana, Grenada, Guadeloupe, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, India, Israel, Jamaica, Jordan, Kazakhstan, Kenya, Kiribati, Kyrgyzstan, Lao People's Dem. Rep., Latvia, Lebanon, Lesotho, Liberia, Lithuania, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Marshall Isds, Martinique, Mauritania, Mauritius, Mayotte, Mexico, Mongolia, Montenegro, Montserrat, Morocco, Mozambique, Myanmar, N. Mariana Isds, Namibia, Nepal, Neth. Antilles, New Caledonia, Nicaragua, Niger, North America and Central America, nes, Occ. Palestinian Terr., Oceania, nes, Other Africa, nes, Other Asia, nes, Other Europe, nes, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Rep. of Korea, Rep. of Moldova, Réunion, Romania, Russian Federation, Rwanda, Saint Helena, Saint Kitts and Nevis, Saint Kitts, Nevis and Anguilla, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Sarawak, Senegal, Serbia and Montenegro, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia, Solomon Isds, Somalia, South Africa, Sri Lanka, Sudan, Suriname, Swaziland, Syria, Tajikistan, TFYR of Macedonia, Thailand, Timor-Leste, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Turks and Caicos Isds, Tuvalu, Uganda, Ukraine, United Rep. of Tanzania, Uruguay, US Virgin Isds, Uzbekistan, Vanuatu, Viet Nam, Wallis and Futuna Isds, Yemen, Zambia, Zimbabwe

Name: 202 as per IMF classification **Countries**: 201 group plus Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia, United Arab Emirates, Venezuela

Name: East Asia **Countries**: Brunei Darussalam, Cambodia, China, China, Hong Kong SAR, China, Macao SAR, Indonesia, Lao People's Dem. Rep., Malaysia, Mongolia, Myanmar, Other Asia, nes, Philippines, Rep. of Korea, Singapore, Thailand, Viet Nam

Name: Central Europe **Countries**: Bulgaria, Czech Rep., Czechoslovakia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia

Name: Africa **Countries**: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Rep., Chad, Comoros, Congo, Côte d'Ivoire, Dem. Rep. of the Congo, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mayotte, Morocco, Mozambique, Namibia, Niger, Nigeria, Other Africa, nes, Réunion, Rwanda, Saint Helena, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Togo, Tunisia, Uganda, United Rep. of Tanzania, Zambia, Zimbabwe

Name: Americas **Countries**: Anguilla, Antigua and Barbuda, Argentina, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia (Plurinational State of), Br. Virgin Isds, Brazil, Cayman Isds, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Rep., Ecuador, El Salvador, Falkland Isds (Malvinas), Fmr Panama, excl.Canal Zone, Fmr Panama-Canal-Zone, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Neth. Antilles, Nicaragua, North America and Central America, nes, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Kitts, Nevis and Anguilla, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Turks and Caicos Isds, Uruguay, US Virgin Isds, Venezuela

Name: Asia **Countries**: Afghanistan, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, China, Hong Kong SAR, China, Macao SAR, Cook Isds, Dem. People's Rep. of Korea, Fiji, French Polynesia, FS Micronesia, India, Indonesia, Kiribati, Lao People's Dem. Rep., Malaysia, Maldives, Marshall Isds, Mongolia, Myanmar, N. Mariana Isds, Nepal, New Caledonia, Oceania, nes, Other Asia, nes, Pakistan, Palau, Papua New Guinea, Philippines, Rep. of Korea, Samoa, Sarawak, Singapore, Solomon Isds, Sri Lanka, Thailand, Timor-Leste, Tonga, Tuvalu, Vanuatu, Viet Nam, Wallis and Futuna Isds

Name: Europe **Countries**: Albania, Armenia, Azerbaijan, Belarus, Bosnia Herzegovina, Bulgaria, Croatia, Cyprus, Czech Rep., Czechoslovakia, Estonia, Fmr USSR, Fmr Yugoslavia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Montenegro, Other Europe, nes, Poland, Rep. of Moldova, Romania, Russian Federation, Serbia and Montenegro, Slovakia, Slovenia, Tajikistan, TFYR of Macedonia, Turkey, Turkmenistan, Ukraine, Uzbekistan

Name: Industrial **Countries**: Andorra, Australia, Austria, Belgium, Belgium-Luxembourg, Canada, Denmark, Finland, Fmr Dem. Rep. of Germany, Fmr Fed. Rep. of Germany, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Ryukyu Isd, San Marino, Spain, Sweden, Switzerland, United Kingdom, USA

Name: Middle Eastern **Countries**: Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Occ. Palestinian Terr., Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates, Yemen

Table 2: Illustrative Intermediate Goods

SITC7	Machinery and Transport Equipment
71191	Parts for steam generating or other vapour generating boilers
71192	Parts for auxiliary plants used with boilers; parts of condensers for steamers and other vapour power units
71280	Parts for steam turbines and other vapour turbines
71319	Parts, n.e.s., of spark-ignition reciprocating or rotary combustion piston engines for aircraft
71331	Outboard motors
71332	Spark-ignition reciprocating or rotary marine propulsion engines, n.e.s.
71391	Parts, n.e.s, suitable for use solely or principally with spark-ignition internal combustion piston engines
71392	Parts, n.e.s., suitable for use solely or principally with compression-ignition internal combustion piston engines
71491	Parts for turbojets or turbo propellers
71499	Parts for gas turbines, n.e.s.
71690	Parts n.e.s. for use solely or principally with electric motors, electric generators, electric generating sets and rotary converters
71819	Parts, including regulators, of hydraulic turbines and water wheels

Table 3: SITC Codes for Intermediate Goods

SITC 7: 71191 71192 71280 71319 71331 71332 71391 71392 71491 71499 71690 71819 71878 71899 72119 72129 72139 72198 72199 72392 72393 72399 72439 72449 72467 72468 72488 72491 72492 72591 72599 72689 72691 72699 72719 72729 72819 72839 72851 72852 72853 72855 73591 73595 73719 73729 73739 73749 74128 74135 74139 74149 74159 74172 74190 74291 74295 74380 74391 74395 74419 74491 74492 74493 74494 74519 74529 74539 74568 74591 74593 74595 74597 74699 74790 74839 74890 74991 74999 75910 75991 75993 75995 75997 75999 76491 76492 76493 76499 77129 77220 77231 77232 77233 77235 77238 77241 77242 77243 77244 77245 77249 77251 77252 77253 77254 77255 77257 77258 77259 77261 77262 77281 77282 77429 77549 77579 77589 77611 77612 77621 77623 77625 77627 77629 77631 77632 77633 77635 77637 77639 77641 77643 77645 77649 77681 77688 77689 77811 77812 77817 77819 77829 77833 77835 77848 77869 77883 77885 77889 78421 78425 78431 78432 78433 78434 78435 78436 78439 78535 78536 78537 78689 79199 79291 79293 79295 79297

SITC 8: 81211 81219 81380 81391 81392 81399 82119 82180 84699 84848 85190 87119 87149 87240 87319 87329 87412 87414 87424 87426 87439 87449 87454 87456 87469 87479 87490 88114 88115 88123 88124 88134 88136 88422 88431 88432 88433 88439 88591 88592 88593 88597 88599 89124 89129 89191 89195 89199 89410 89935 89937 89949 89966 89984 89986 89996 89997

Table 4: OECD STAN Select Manufacturing Sectors

C30T33 Electrical and optical equipment

C30 Office, accounting and computing machinery

C31 Electrical machinery and apparatus, n.e.c.

C32 Radio, television and communication equipment

C33 Medical, precision and optical instruments

C34T35 Transport equipment

C34 Motor vehicles, trailers and semi-trailers

C35 Other transport equipment

C351 Building and repairing of ships and boats

C353 Aircraft and spacecraft

C352A9 Railroad equipment and transport equipment n.e.c.

C36T37 Manufacturing n.e.c. and recycling

C36 Manufacturing n.e.c.

C37 Recycling