Trade productivity upgrading, trade fragmentation, and FDI in manufacturing

The Asian development experience

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Abstract

Purpose – This paper aims to examine the experience of ten Asian countries with respect to growth, trade and FDI. It seeks to explore relationships between the nature of exports and imports and growth, as well as the relevance of FDI as a channel for these relationships.

Design/methodology/approach – The paper opted for an empirical approach. It included collecting standardize data on international trade, GDP per capita, and FDI inflows. The trade data and GDP data were used in creating the productivity level for exports and imports for all of the relevant countries. The paper analyses how these productivity levels compare to GDP per capita, change over time, and relate to FDI inflows.

Findings – The authors find that FDI is positively correlated with higher productivity levels in exports and imports for many of the countries in their sample. The effect for imports is particularly apparent for imported intermediate goods, reflecting the emergence of greater trade fragmentation. In turn, both imported intermediates and exports that are associated with higher productivity levels are positively correlated with per capita GDP.

Research limitations/implications – There are a couple of research limitations. First, the work does not determine causality; future econometric work should help to identify the causality mechanism. Second, trade fragmentation might lead to an overestimation of "productivity" levels; future work should try to identify the extent of the bias and a way to fix the issue.

Practical implications – This work may have implications for how policymakers view trade and FDI policies, and the possible links between them, in the context of promoting growth.

Social implications – This work may have implications for understanding the links between growth and structural change in the economy, which is in turn linked to societal change.

Originality/value – This paper brings together empirical evidence that integrates discussions of FDI, trade fragmentation and improvements in the productivity of traded goods.

Keywords International trade, Trade policy, Product upgrading, Trade fragmentation, Vertical specialization, FDI and economic development, Trade, Manufacturing industries

Paper type Research paper

I. Introduction

From nineteenth century arguments about infant industry protection to recent exercises such as the World Bank's well-known "East Asian Miracle" study, the various aspects of globalization in economic development have been endlessly analyzed and debated. Studies typically focus on different aspects of globalization, such as exports alone,

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or foreign direct investment (FDI) alone, and use different empirical methodologies. For example, Rodrik (2006) stresses the role of exports that exceed (in a precise manner that we will define later) their "expected" productivity level, in explaining China's growth success. While there is a specific and precise measure of export productivity in Rodrik's analysis, his discussion of the positive role of FDI is brief and informal. On the other hand, Borensztein *et al.* (1998), for example, examine the impact of FDI on growth through cross-country regressions, finding that a positive impact depends on factors such as having sufficient levels of human capital in the recipient countries. But they have no role for trade in their empirical specifications.

Of course, there are many studies that examine trade and FDI together. In theoretical modeling, the two are bound together, either as substitutes or as complements, depending on the nature of production networks and the associated FDI. Even in these cases, however, empirical examinations based on this theoretical modeling do not seem to treat trade and FDI in an integrated manner. This comes out in the literature reviews of Saggi (2002) and Keller (2009), for example. This problem cannot be solved completely, because trade and FDI data are available at very different levels of granularity. Nevertheless, our analysis makes some progress in providing a more coherent and consistent empirical examination of trade and FDI in relation to economic development.

Examinations of trade and productivity have recently begun to focus on imported intermediate goods, in contrast to the earlier emphasis on exporting as a driver of productivity and growth (Goldberg *et al.*, 2010). Clearly, the nature of this trade is partly related to patterns of FDI, to the extent that it is driven by trade fragmentation or vertical specialization (though it need not be). These studies are typically micro-level analyses, using plant or firm level data, and do not consider the role of FDI. Again, our approach allows us to explore the possible linkages between FDI and trade fragmentation in an empirically consistent manner[1].

Our central empirical tool is the Hausmann *et al.* (2007) index of export productivity (also used by Rodrik, 2006), called EXPY[2]. The precise index is described in Section III. This index measures the extent to which the export pattern of a country reflects the export of goods that have productivity levels that can be associated with higher income countries. We follow Hausmann *et al.* (2007) in examining the behavior of this index over time, and its relationship to per capita gross domestic product (GDP). Our contribution here is to extend their approach to a longer time period for a specific set of countries.

We go on to adapt the EXPY index to measure the productivity level of imports. This is an innovation that allows us to examine how the other side of trade flows can matter, and also connects more directly to the role and impact of inward FDI. We are able to divide imports into intermediates and other goods, allowing us to distinguish their different possible roles in development, as well as different possible relationships to FDI. In sum, our approach allows us to examine the productivity patterns of exports and imports in relation to income levels and FDI flows.

Our empirical contribution can be viewed in the light of the ongoing debate about the role of trade (and government policy toward trade and industry) in the East Asian miracle:

> *The East Asian Miracle* (World Bank, 1993a) [. . .] study puts strong emphasis on the importance of performance in manufactured goods exports. The study goes beyond simply arguing that rapid export growth played an important role in permitting East Asian economies

> to avoid foreign exchange constraints. It suggests that exports and export policies played a crucial role in stimulating growth. The authors challenge the view that simply striving for a neutral incentive structure was adequate. Instead, they advocate broad government support for exports as a "highly effective way of enhancing absorption of international best practice technology [and] thus boosting productivity and output growth." [...] Although the study emphasizes exports as a channel for learning and technological advancement, conspicuously absent is a discussion of the role of imports and import competition in providing similar benefits (Lawrence and Weinstein, 2001, pp. 379-380).

In their study, Lawrence and Weinstein (2001) examine aggregate time-series data for Japan and Korea to make the case for the importance of imports in the two countries' growth experience. Again, our contribution differs in that we are able to take a more disaggregated view of trade, examine its productivity level and patterns of fragmentation, and correlate it with FDI flows. We also consider a larger sample of countries, giving a sense of patterns more in keeping with the intent of the East Asian miracle study.

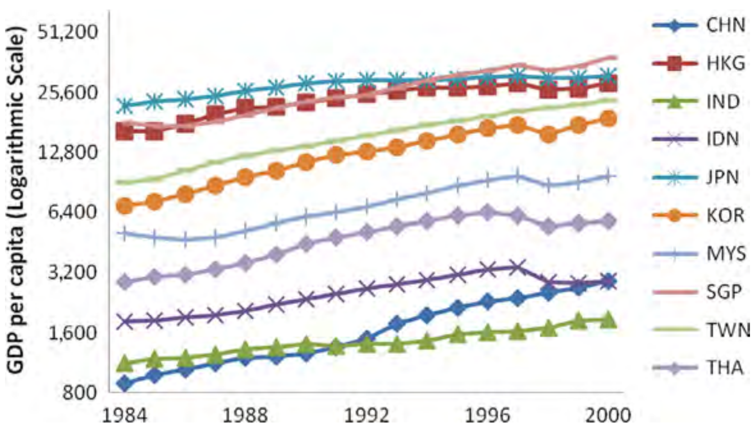
The scope of our study is the eight economies considered in the World Bank (1993) study, augmented by the two emerging giants, China and India. Data limitations dictate the period that we use, 1984-2000 (with a couple of exceptions). This period captures the latter part of the East Asian miracle, as well as significant portions of the transitions of China and India toward being more open to foreign trade and capital, as well as domestically more market-oriented. In Section II, we provide an overview of some aspects of these economies' experience during the period in question. Section III describes our data and methodology in some detail. Since we use data from several sources, necessitated by our conceptual scope as well as changes in data categories over the period in question, preparing the data requires some care. We also explain our indices of trade "quality," based on Hausmann *et al.* (2007), or based on extensions of those ideas. We focus on trade in manufactures in our analysis, rather than all commodity trade as in Hausmann *et al.* (2007), but results for all trade are similar to those presented below.

Section IV describes our results. We find that the Asian countries in our sample have been relatively successful at upgrading the productivity level of their trade, consistent with the analysis of Hausmann *et al.* (2007), but for a different time period. By extending the Hausmann *et al.* (2007) approach to different types of exports (intermediate and other), and to imports, which are not considered by those authors, we find that productivity levels in intermediate exports, other goods exports, and intermediate imports are highly correlated with GDP per capita; the three have a clear positive trend for most countries. Furthermore, the correlation between intermediate imports (respectively, intermediate and other goods exports) productivity levels and FDI inflows tends to be higher for more developed (respectively, less developed) Asian countries in our sample (where the terms "more" and "less" are used in the context of this particular sample of countries). We also estimate panel regressions, finding evidence that the complexity of non-intermediate exports and of intermediate exports is each positively associated with GDP per capita for this period and sample of countries. Section V provides a summary conclusion.

II. Historical overview

The well documented East Asian economic "miracle" is probably best appreciated by observing the growth in GDP per capita in the region. The countries examined all saw impressive growth in GDP per capita (Figure 1)[3]. PPP converted GDP per capita increased at an average annual growth rate (AAGR) of 4.2 percent in the 1984-2000 period. There was significant convergence in the region, a result of Japan's stagnation and the high growth experienced by the Asian Tigers (Hong Kong, South Korea, Singapore, and Taiwan) and China. In terms of GDP per capita, the fastest growing countries were China (7.6 percent), South Korea (6.5 percent), and Taiwan (6.1 percent); the slowest growing countries were Japan (2.1 percent), Indonesia (3.0 percent), and India (3.2 percent). The Asian financial crisis had a significant effect on these economies, but China and the Asian Tigers were able to recover fairly quickly. This pattern continued and, even, accelerated in the post-2000 period, though we do not analyze that more recent experience in this paper (Table I).

Trade, especially trade in manufacturing, appears to have played significant role in this growth. We focus on manufactured goods because it allows us to exclude commodities, which have a different role to play in development and industrialization. In all cases, total exports and imports grew at much faster rates than that of the GDP per capita. China experienced the fastest growth in both exports and imports (19 and 21 percent, respectively) and the countries with slowest growing exports and imports



Note: Constant 2005 US$
Source: Author's calculations using data from Penn World Tables

Figure 1.
PPP converted GDP per capita, 1984-2000

Table I.
Country ISO three-letter code by country

Country	Code
China	CHN
Hong Kong	HKG
India	IND
Indonesia	IDN
Japan	JPN
Korea Rep.	KOR
Malaysia	MYS
Singapore	SGP
Taiwan	TWN
Thailand	THA

were Japan (7 percent each, respectively) and Indonesia (7 and 6 percent, respectively). Manufacturing trade, especially for exports, played a crucial role in this growth (Table II). Manufactures grew at faster rates than overall trade. As can be seen in Table II, most of the countries in the sample experienced significant increases in the share of manufactures in overall merchandise trade. The only decreases were minor (Hong Kong, − 1.0 percent, and Japan − 0.4 percent), and occurred in countries that had very high shares in manufacturing at the beginning of the period.

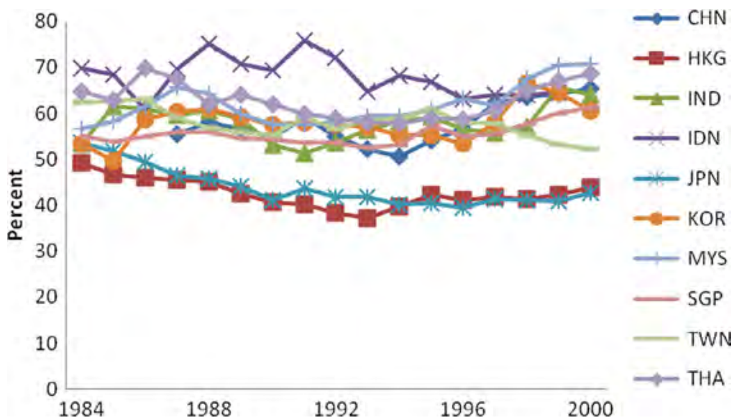
There were a few noticeable drops in the share of manufacturing in imports over the period of analysis. For example, the share of manufactures in imports decreased in India (because of the increased importance of uncut/un-mounted diamonds, which the UNCTAD classification does not consider to be manufacturing), China (because of the increase in petroleum imports), and Indonesia (also because of the large increase in petroleum imports). Manufacturing exports in China, Hong Kong, Japan, Korea, and Taiwan accounted for more than 90 percent of all exports by 2000. Indonesia had the lowest share (56 percent) and Japan had the highest share (96 percent). On the import side, only Indonesia (61 percent), India (35 percent), Japan (56 percent), and Korea (61 percent) had shares lower than 75 percent. Although the share of manufacturing is not as high on the import side, the growth in share was in the double digits for most of the countries. Japan had the largest increase in the share of imported manufactures (33 percent points), but it had the smallest share at the beginning of the period (23 percent).

When splitting trade into intermediates and other goods, we see that intermediate trade patterns are not uniform across countries (Figures 2 and 3 and Table III)[4]. For imports, the importance of intermediates in manufacturing decreased from 1984 until about the mid-1990s. They subsequently increased in importance, but, in many cases, had not recovered by 2000, or were at about the same level, as in the early 1980s. The largest decrease was of less than 11 percent points (Japan). The only countries to increase the share of intermediates in imports over the period were India, Korea, Malaysia, Singapore, and Thailand. Intermediate imports were, nevertheless, important and account for over 40 percent of all imports for all of the Asian countries in our sample. Characterizing the changes in intermediates in manufacturing exports is more difficult to generalize about, because some countries saw the percentage share of intermediates decrease by double

		Exports			Imports	
Code	1984	2000	Difference	1984	2000	Difference
CHN	62	91	29	82	75	(6)
HKG	92	91	(1)	75	86	11
IDN	8	56	48	64	61	(4)
IND	38	61	22	43	35	(8)
JPN	96	96	(0)	23	56	33
KOR	90	90	0	55	61	6
MYS	26	83	56	73	84	11
SGP	50	82	32	53	81	28
THA	29	76	47	59	75	16
TWN	90	95	5	57	79	22

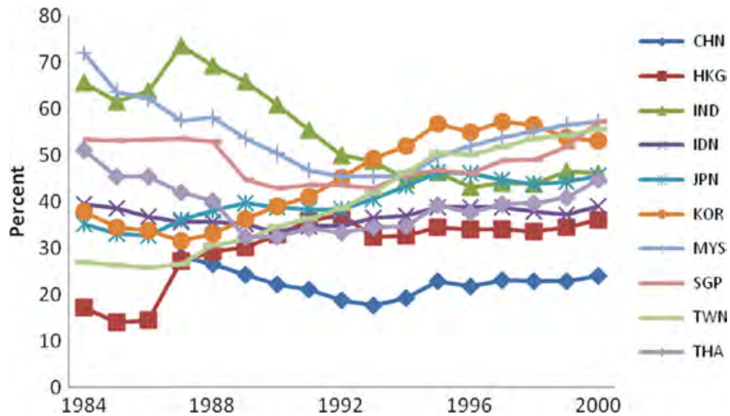
Notes: Data for China starts in 1987 and data for India ends in 1999
Source: Authors' calculations using data from Feenstra *et al.* (2005)

Table II.
Share of manufacturing in total exports and imports



Note: Share of total imports
Source: Author's calculations using data from Feenstra *et al*. (2005)

Figure 2.
Intermediate imports in manufacturing



Note: Share of total imports
Source: Author's calculations using data from Feenstra *et al*. (2005)

Figure 3.
Intermediate exports in manufacturing

digits, while for other countries the share increased by double digits. The largest drop in intermediates' exports share was almost 20 percent (India) and the highest increase was 29 percent (Taiwan). Interestingly, Japan and the Asian Tigers increased their share, while the rests of the countries (including China) saw decreases. This is consistent with several studies that looked at intermediates and found that the share of intermediates in trade has decreased (Hummels *et al.*, 2001). However, looking at the share of intermediate manufactures trade ignores the fact that not all intermediates are the same. The drop in the share of intermediates in the 1980s was a result of a drop in the importance of relatively low-tech intermediates (such as fabrics), while the increase in the 1990s was a result of increases in the importance of relatively higher-tech intermediates (such as electronic microcircuits). We quantify this difference in relative technological level embodied in each country's imports and exports in the next section[5].

Code	1984	Exports 2000	Difference	1984	Imports 2000	Difference
CHN	28	24	(4)	55	65	10
HKG	17	36	19	49	44	(5)
IDN	40	39	(0)	70	64	(5)
IND	66	46	(20)	53	64	11
JPN	35	46	10	54	43	(11)
KOR	38	53	15	53	61	7
MYS	72	57	(15)	57	71	14
SGP	53	57	4	55	61	6
THA	51	45	(7)	65	69	4
TWN	27	56	29	63	52	(10)

Note: Data for China starts in 1987 and data for India ends in 1999
Source: Authors' calculations using data from Feenstra *et al.* (2005)

Table III.
Share of intermediates in manufacturing exports and imports

III. Data and methodology

The trade, GDP, and FDI data each comes from a separate source. We use trade data compiled and standardized by Feenstra *et al.* (2005). The data contain bilateral trade data for 1962-2000, classified as standard international trade classification, revision 2 (SITC, Rev. 2) and disaggregated at the four-digit level. The bilateral data is aggregated to create multilateral data, which is what we use in our analysis[6]. The pre-1984 data were originally classified by SITC Rev.1 and had to be converted to SITC Rev. 2 by the authors; to avoid any concordance issues, we will only focus on the data beginning in 1984 and ending in 2000[7]. We should note that the data excludes SITC four-digit categories that did not exceed $100,000 per year for both imports and exports. The PPP adjusted GDP per capita data are from the Penn World Tables and are in constant 2005 US dollars. For FDI we use UNCTAD's data on utilized FDI inflows as a percent of GDP for the same period as the trade data. The only exception is for Indonesia, which did not report FDI inflows as a percent of GDP during the period in question, and is excluded from the analysis of FDI.

The calculations required two concordances: SITC to manufacturing and SITC to broad economic categories (BEC). First, to determine which SITC products are classified as manufacturing, we used UCTAD's definition for manufacturing[8]. Second, to determine which SITC goods were intermediates and which were "other goods", we used the UN's classification by BEC, which allows us to separate the data into intermediates, consumption, capital, and not classified (Table IV). The BEC concordance is in SITC Rev. 3, while the trade data is in SITC Rev. 2. As a result we ended up with three trade categories: intermediate, others, and mixed. "Mixed" refers to categories that include both intermediate and other goods in the different SITC revisions, and it tends to be a fairly small and consistent category (the data can be provided upon request). The share of goods classified as mixed varied significantly, but was between 8 (Malaysia) and 25 (China) percent of total exports and between 16 (Singapore) and 23 (Taiwan) percent of total imports. Including mixed as intermediates or as "others" did not change our results much and we chose to leave the "mixed" trade data out of the current analysis. Based on its trade share of total trade (2.1 percent), the top excluded product was "Children's toys, etc."; for a list of the top ten mixed/excluded products see Table V.

Classification by BEC	Basic classes of goods in SNA
1. *Food and beverages*	
1.1 Primary	
1.1.1. Mainly for industry intermediate	Intermediate
1.1.2. Mainly for household consumption	Consumption
1.2 Processed	
1.2.1. Mainly for industry intermediate	Intermediate
1.2.2. Mainly for household consumption	Consumption
2. *Industrial supplies not elsewhere specified*	
2.1. Primary intermediate	Intermediate
2.2. Processed intermediate	Intermediate
3. *Fuels and lubricants*	
3.1. Primary intermediate	Intermediate
3.2. Processed	
3.2.1. Motor spirit not classified	Not classified
3.2.2. Other intermediate	Intermediate
4. *Capital goods (except transport equipment), and parts and accessories thereof*	
4.1. Capital goods (except transport equipment) capital	Capital
4.2. Parts and accessories intermediate	Intermediate
5. *Transport equipment and parts and accessories thereof*	
5.1. Passenger motor cars not classified	Not classified
5.2. Other	
5.2.1. Industrial capital	Capital
5.2.2. Non-industrial consumption	Consumption
5.3. Parts and accessories intermediate	Intermediate
6. *Consumer goods not elsewhere specified*	
6.1. Durable consumption	Consumption
6.2. Semi-durable consumption	Consumption
6.3. Non-durable consumption	Consumption
7. *Goods not elsewhere specified not classified*	Not classified

Table IV.
Current BEC and SNA classes of goods

No	SITC2	Description	Share
1	8942	Children toys, indoor games, etc.	2.1
2	7788	Other elect. machinery and equipment	1.5
3	7284	Mach. and appliances for specialized particular ind.	1.4
4	7712	Other electric power machinery, parts of 771	0.9
5	8939	Miscellaneous art. of materials of div. 58	0.9
6	8851	Watches, watch movements and cases	0.6
7	7781	Batteries and accumulators and parts	0.5
8	8710	Optical instruments and apparatus	0.5
9	5417	Medicaments (including veterinary medicaments)	0.5
10	8811	Photographic, cameras, parts and accessories	0.4

Note: Share of imports and exports during the period
Source: Authors' calculations using data from Feenstra *et al.* (2005)

Table V.
Top excluded items

The trade in the categories used in our analysis still accounts for at a minimum of three-fourths of aggregate trade.

To analyze the role of different aspects of trade in the Asian development success, we make use of Hausmann's *et al.* (2007) framework to establish a hierarchy in goods in terms of their implied productivity (for a sample of the highest and lowest ranked SITC four-digit products see Table VI). The quantitative index requires two steps. Step 1 is to rank the traded goods in terms of their implied productivity. Hausmann *et al.* (2007) refer to this measure as PRODY and it is calculated by taking a weighted average of the per capita GDP of a product's exporters. The weights used are the revealed comparative advantage of each country in that commodity. As PRODY gives the "income/productivity level" of a commodity, the higher the PRODY, the higher the average income level of its exporters. We define good i's share of total exports by country j as $EXP_{ji} = x_{ji}/\sum_i x_{ji}$ and good i's share of total imports by country j as $IMP_{ji} = m_{ji}/\sum_i m_{ji}$, where x_{ji} is the value of export i by country j and m_{ji} is the value of import i by country j. Thus, $\sum_i x_{ji}$ and $\sum_i m_{ji}$ are total manufacturing exports and imports, respectively. The formula for PRODY is:

$$PRODY_i = \sum_j \frac{EXP_{ji}}{\sum_j EXP_{ji}} (Per\ Capita\ GDP_j)$$

Step 2 is to calculate the average "income/productivity level" for each country's trade basket. Hausmann *et al.* (2007) refer to this measurement for exports as EXPY and note that it measures "[. . .] the productivity level associated with a country's specialization pattern." Since we are also looking at the import side we calculate two productivity level variables EXPY and IMPY. They are the weighted sum of the PRODY for each country. The weights are, respectively, the share of each good in country j's total exports and total imports in manufacturing. Therefore, in our analysis, we have introduced IMPY as the import analog of EXPY. The two measures are calculated using the following formulas:

$$EXPY_j = \sum_i EXP_{ji}(PRODY_i)$$

No	SITC2	Description	Class	PRODY
1	5148	Other nitrogen-function compounds	I	30,242
2	8744	Instr. and app. for physical or chemical analysis	O	29,822
3	5332	Printing ink	I	29,558
4	7928	Aircraft, n.e.s. balloons, gliders, etc. and equipment	O	29,230
5	8813	Photographic and cinematographic apparatus n.e.s	M	28,889
493	6116	Leather of other hides or skins	I	2,506
494	6593	Kelem, schumacks and karamanie rugs and the like	O	1,621
495	6592	Carpets, carpeting and rugs, knotted	O	1,536
496	6545	Fabrics, woven, of jute or of other textile bast fib	I	1,503
497	5513	Essential oils, concretes and absolutes: resinoids	I	1,464

Source: Authors' calculations using data from Penn World Tables and Feenstra *et al.* (2005)

Table VI. The lowest and highest ranked products

$$IMPY_j = \sum_i IMP_{ji}(PRODY_i)$$

We calculated EXPY and IMPY for each country using only intermediates and using only "other goods". For some summary statistics see Table VII. Note that, since we are using PRODY as a measurement for the productivity level, we use PRODY created from exporters to calculate both EXPY for exports and IMPY for imports. Using importers to calculate IMPY results in lower levels for both "other goods" and intermediates for all countries, except Hong Kong. This ranking of products is less likely to correlate with technological upgrading and may conceivably have a negative correlation if rich countries import less technologically advanced goods. We find that the correlation between the two calculations of IMPY, within country, is significant in only half the cases; and in all these cases the correlation is positive.

Hausmann *et al.* (2007) chose to compare the implied productivity at a point in time across different countries (with varying GDP per capita). For example, Hausmann *et al.* (2007) find that "EXPY is a strong robust predictor of subsequent economic growth, controlling for standard covariates." They also find that, compared to the world average, India and China are outliers. We, on the other hand, examine a relatively small number of countries and see how trade patterns in these countries have evolved over time, compared to each other. We also examine different types of exports, imports, and FDI inflows in tracing the evolution of these trade patterns.

		Intermediates				Other goods			
Var	Country	First year	Last year	Diff	AAGR (%)	First year	Last year	Diff	AAGR (%)
EXPY	CHN	11,247	14,031	2,784	1.72	7,154	10,281	3,126	2.83
	HKG	13,306	15,085	1,778	0.79	8,327	9,134	808	0.58
	IND	9,563	14,104	4,541	2.62	7,321	7,272	(49)	(0.04)
	IDN	9,711	13,998	4,287	2.31	6,700	10,253	3,553	2.69
	JPN	15,382	16,656	1,274	0.50	16,076	16,721	645	0.25
	KOR	12,954	15,279	2,325	1.04	8,915	15,268	6,353	3.42
	MYS	15,176	15,473	297	0.12	9,742	15,496	5,753	2.94
	SGP	15,563	16,503	939	0.37	11,889	17,342	5,453	2.39
	TWN	13,894	15,494	1,600	0.68	9,528	17,694	8,167	3.94
	THA	13,072	15,348	2,276	1.01	6,430	12,675	6,246	4.33
IMPY	CHN	13,534	15,391	1,856	0.99	16,198	17,067	869	0.40
	HKG	13,921	15,217	1,296	0.56	12,310	11,840	(470)	(0.24)
	IND	14,116	14,795	679	0.31	16,733	17,243	510	0.20
	IDN	15,198	16,644	1,446	0.57	15,966	15,439	(527)	(0.21)
	JPN	14,564	15,986	1,422	0.58	13,547	13,670	123	0.06
	KOR	15,483	15,945	462	0.18	14,585	17,026	2,440	0.97
	MYS	15,144	15,792	648	0.26	15,395	16,649	1,254	0.49
	SGP	15,123	16,213	1,091	0.44	14,295	15,739	1,445	0.60
	TWN	15,776	16,313	537	0.21	17,363	16,843	(521)	(0.19)
	THA	15,486	15,533	47	0.02	17,354	16,739	(615)	(0.23)

Notes: AAGR refers to average annual growth rate; first and last year refers to 1984 and 2000, respectively, for most countries; the only exceptions are China (first is 1987) and India (last is 1999)
Source: Authors' calculations using data from Penn World Tables and Feenstra *et al.* (2005)

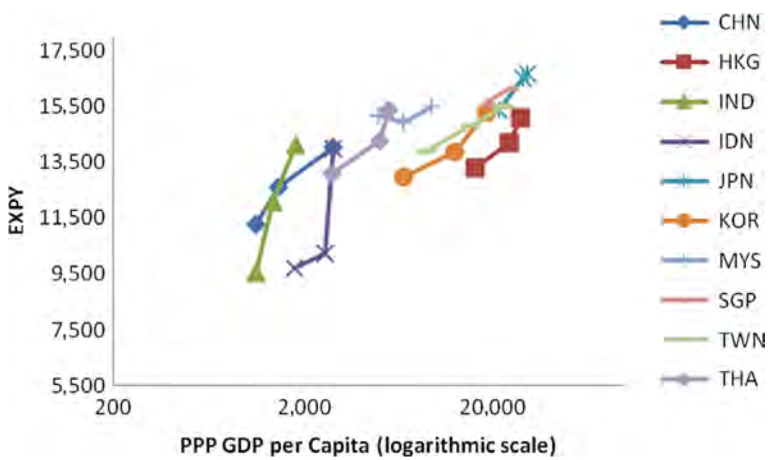
Table VII.
IMPY and EXPY in manufacturing summary statistics

IV. Results

In this section we analyze and compare the EXPY and IMPY in manufacturing for the Asian countries with GDP per capita, growth over time, and FDI inflows. First, we follow Hausmann *et al.* (2007) in comparing EXPY for exports (and IMPY for imports) relative to GDP per capita. We find that the less developed Asian countries in the sample are somewhat distinct, relative to the average trend of the other Asian economies in this group. This is consistent with Hausmann *et al.* (2007) finding. Second, we see how the IMPY and EXPY for imports and exports have changed over time. We find that when we look across time, China and some of the other Asian countries have achieved significant increases in their EXPY and IMPY, but Japan and the Asian Tigers are the ones who stand out as having the highest EXPY (this pattern is not as pronounced for IMPY). Finally, we look at the connection between EXPY or IMPY on the one hand, and FDI inflows on the other; we find that, in almost every case, both EXPY and IMPY are significantly and positively correlated with FDI inflows. The correlation appears to be stronger among intermediate products than among other products.

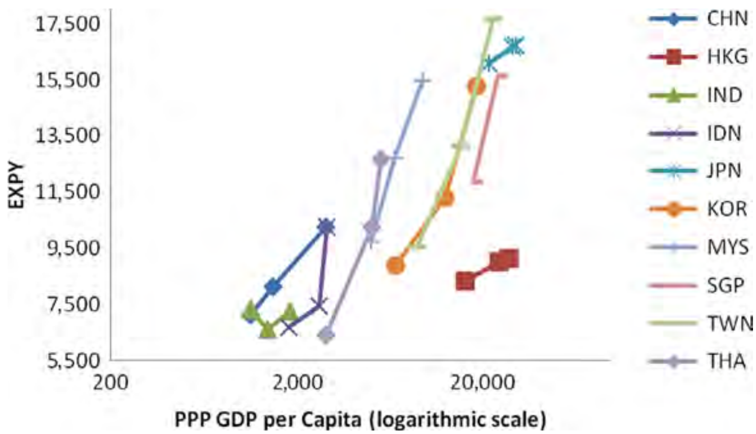
We begin with Figures 4 through 7, which show patterns of relationships between EXPY and IMPY on the one hand (for each of the two categories of goods – intermediate and other) and GDP per capita on the other. Both categories of exports display a strong positive relationship between EXPY and per capita GDP. On the other hand, this positive relationship only appears for intermediate imports when comparing IMPY with per capita GDP[9].

It is interesting to note that China, India, Thailand, Malaysia, and, to a lesser extent, Indonesia appear to be in a different group when comparing EXPY and IMPY with GDP per capita (Figures 4-7)[10]. That is, for their per capita GDP, these countries appear to be at EXPY levels higher than their Asian counterparts (Japan and the Asian Tigers) were at the same GDP per capita level. Does that mean these countries found a way to increase EXPY/IMPY for a given GDP per capita or that the technological barriers to trade have gone down over time allowing these lesser developed countries



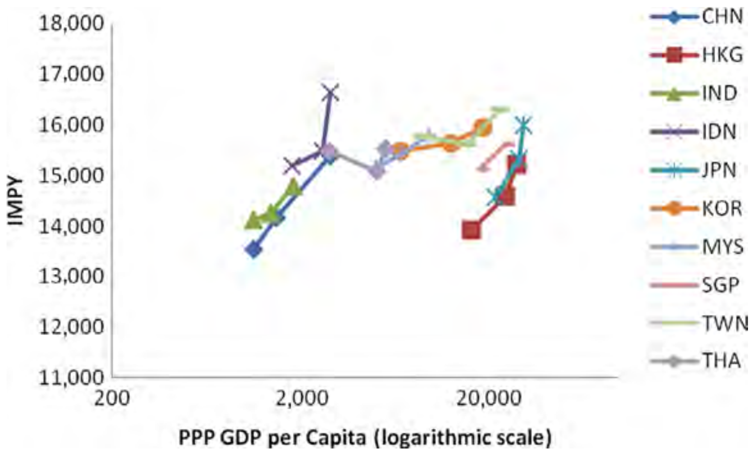
Source: Authors' calculations using data from Penn World Tables and Feenstra *et al.* (2005)

Figure 4.
EXPY for intermediate exports vs GDP per capita (1984, 1992, and 2000)



Source: Authors' calculations using data from Penn World Tables and Feenstra *et al*. (2005)

Figure 5.
EXPY for other exports vs GDP per capita (1984, 1992, and 2000)

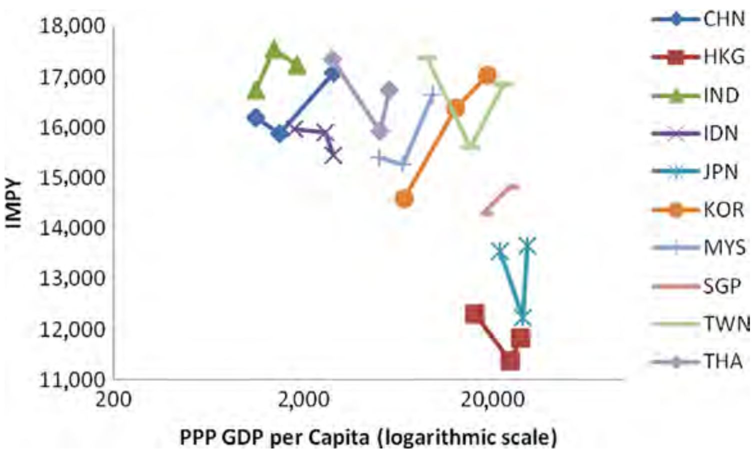


Source: Authors' calculations using data from Penn World Tables and Feenstra *et al*. (2005)

Figure 6.
IMPY for intermediate imports vs GDP per capita (1984, 1992, and 2000)

to export more sophisticated products? Hausmann *et al.* (2007) suggest that it is first, but the literature on trade fragmentation would favor the latter explanation.

We conjecture that the observed pattern is a combination of the two explanations, with the key link being FDI. During the period being analyzed, these Asian countries have been more receptive to FDI, have opened up their markets, and demanded more technology transfer (Swenson, 2011). At the same time, lower tariffs, lower transportation costs, and lower communication costs have allowed intermediate goods to increase substantially in trade.



Source: Authors' calculations using data from Penn World Tables and Feenstra *et al*. (2005)

Figure 7.
IMPY for other imports vs GDP per capita (1984, 1992, and 2000)

Since intermediates have not increased as fast as other goods for several of the countries in the sample (Section II, and Table III), the fact that EXPY and IMPY have increased means than the composition of intermediates has changed substantially. Since the changes in composition have tended towards more high-tech intermediates, these products are the ones that have tended to benefit from the lower trade costs and the various government policies. Finally, with trade fragmentation, it is conceivable that some of the increases in EXPY are due to increased IMPY, since export upgrading is based on importing more complex intermediate goods. The iPod, a product "made" in China, is a clear example of this (Linden *et al.*, 2011).

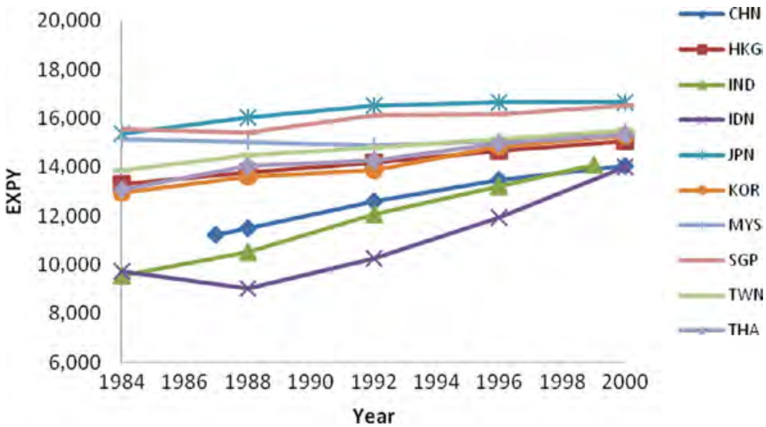
The patterns in Figures 4-7 can be more clearly investigated through examining the correlations between the variables, reported in Table VIII. We find that GDP per capita and EXPY are highly correlated (this is consistent with Hausmann *et al.* (2007)). In fact, the EXPY for both intermediate and other exports are highly correlated with GDP per capita. The correlation is positive and significant in every case, with the sole exception of "other goods" for Hong Kong. Interestingly, the correlation between the IMPY for intermediate imports and GDP per capita is also strong, positive, and significant in many cases. There are, however, a few exceptions; the correlation is not significant for India, Malaysia, Taiwan, and Thailand. The correlation between the IMPY for other imports and GDP per capita is not significant in most cases. The only exceptions are Malaysia, Singapore and Taiwan. The correlation is actually negative and significant for Taiwan. It is interesting to note that for both Malaysia and Taiwan the correlation is not significant for intermediate imports, but it is for other imports. For Malaysia, the reason may be the country's increased reliance on non-intermediate imports. For Taiwan, the negative sign on the correlation of IMPY for other goods imports is perplexing.

To see if part of the reason that the less developed countries in the sample stand out from the others is shifts in the technological frontier, we examine how EXPY and IMPY change over time (Figures 8 through 11). Looking at the data in this dimension, it becomes quite clear that for EXPY the less developed countries (including China) are

Table VIII.
Correlation coefficient between GDP per capita and EXPY/IMPY in manufacturing

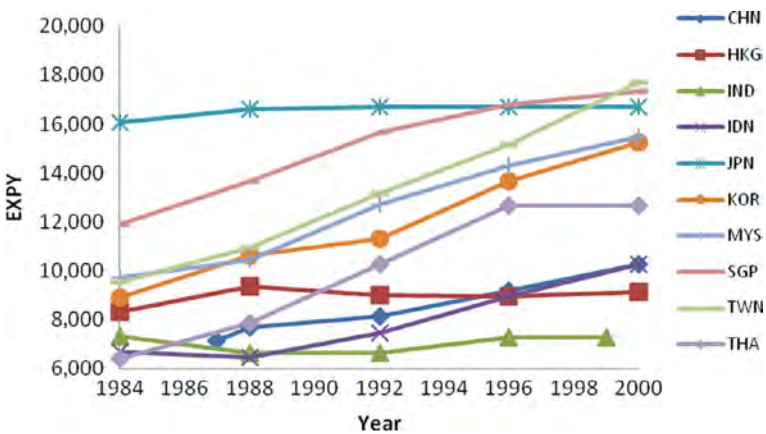
Flow	Class	CHN	HKG	IDN	IND	JPN	KOR	MYS	SGP	TWN	THA
EXP	I	0.9727*	0.9025*	0.7675*	0.9622*	0.9769*	0.9778*	0.2758	0.9128*	0.9802*	0.9160*
	O	0.9697*	0.3693	0.8475*	0.6002*	0.9033*	0.9726*	0.9756*	0.9368*	0.9941*	0.9755*
IMP	I	0.8999*	0.9533*	0.7096*	0.3862	0.7433*	0.5795*	0.2013	0.9572*	0.4053	−0.0929
	O	0.5013	−0.0032	0.4814	0.1582	−0.1912	0.4661	0.4936*	0.8721*	−0.6412*	−0.2575

Note: Significant at: *5 percent level
Source: Authors' calculations using data from Penn World Tables and Feenstra *et al.* (2005)



Source: Authors' calculations using data from Penn World Tables and Feenstra *et al*. (2005)

Figure 8.
EXPY for intermediate exports



Source: Authors' calculations using data from Penn World Tables and Feenstra *et al*. (2005)

Figure 9.
EXPY for other exports

not outliers, but are, in fact, below the East Asian average. A major reason might be that the less developed economies in the sample have not reached development levels required to export more technologically advanced products. The fact that EXPY and IMPY are so high relative to GDP per capita may be a result of the breakup of the production chain (trade fragmentation), lower production costs (better, more inexpensive technology), or lower trade costs (transportation costs, high tariffs, and non-tariff barriers).

Nonetheless, it is also clear that the EXPY has increased at impressive rates for exports (Figures 8 and 9). This applies to both intermediates and others. As shown in Figure 8, the EXPY for all of the countries in this study appear to converge towards one point for intermediates. China, India, and Indonesia have the lowest EXPY in intermediates at the end of the period, but these were also the countries with the fastest

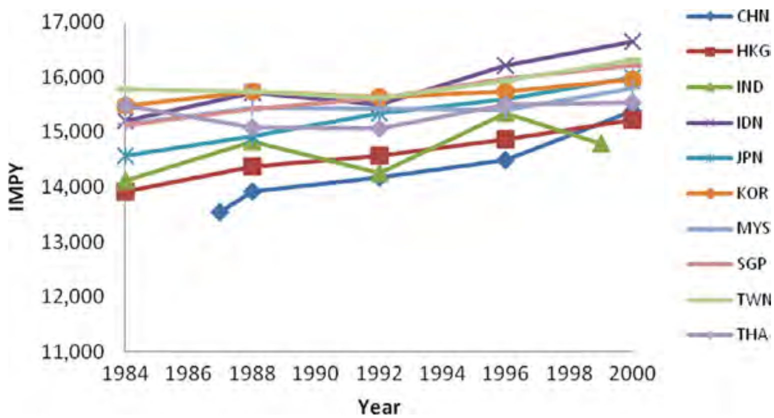


Figure 10.
IMPY for intermediate imports

Source: Authors' calculations using data from Penn World Tables and Feenstra *et al*. (2005)

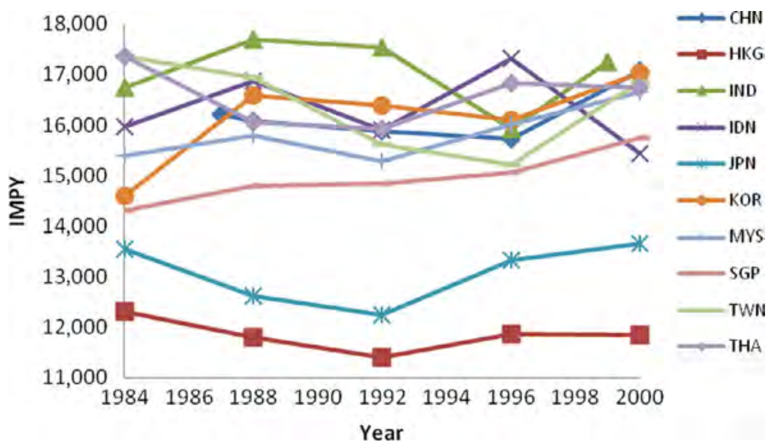


Figure 11.
IMPY for other imports

Source: Authors' calculations using data from Penn World Tables and Feenstra *et al*. (2005)

growing EXPY. The increase in EXPY for "other goods" exports is even larger than that of intermediate exports (five countries increased EXPY by at least US$ 5,000). It is no wonder that this increase in productivity level has been noticed, even in the popular press[11]. There are some exceptions; China, Indonesia, Hong Kong, and Japan had relatively little or no growth in EXPY for non-intermediates. However, the reasons for this lack of growth are very different among this subgroup. In particular, Japan, which experienced almost not EXPY growth in the period, had the largest EXPY at the beginning of the period, and was still in the top three by the end of the period. Interestingly, even though China, Indonesia, and Hong Kong may not have increased non-intermediate EXPY as much as the other countries, they have managed to match the rest of the sample countries in their EXPY for intermediate exports.

How is it that the EXPY for “other goods” exports increased by such large amounts? It is conceivable, with trade fragmentation, that part of the large increase in the EXPY for exports was led by the increase in the IMPY for imports. Several studies find that foreign content in some countries’ exports has increased over time (for examples of this phenomenon, see Hummels *et al.*, 2001; Dean *et al.*, 2008). Our results also show that the imported intermediates have also increased in productivity level, as measured by IMPY, something that has received little attention in the literature (Figure 10). India is the only country where IMPY does not have a strong positive trend during the period (which may be related to its poor performance in the EXPY for “other goods” exports). By the end of the period, the countries with the lowest IMPY for intermediate imports were India, Hong Kong, and China. China, however, began to experience a large increase in IMPY toward the end of the 1990s. For the most part, it appears that the IMPY for other imports is fairly constant (Figure 11). It is noteworthy that most of the Asian countries in the sample had IMPY levels for imports that were at the same technological level during the whole period and that “other goods” imports into Hong Kong and Japan were significantly less technologically advanced that those of the other countries.

What role has FDI played in this technological upgrading? FDI is arguably a key driver of trade fragmentation. In China, for example, foreign invested enterprises perform the majority of processing trade (trade that uses imported intermediates) and do very little in regular trade (Dean *et al.*, 2009). There are case studies, such as the iPod example, that find examples of FDI leading to technological upgrading in imports and exports. However, rigorous econometric analysis rarely looks at the link between technological upgrading and FDI, focusing more on increases in exports or imports. To see if there is a connection between FDI and upgrading we compare the respective correlations between EXPY and IMPY and FDI inflows (as a percent of GDP). The EXPY and IMPY correlations with FDI inflows (Table IX) are smaller than their correlations with GDP per capita. They are, nonetheless, statistically significant in many cases, and fairly high in magnitude. In general, for both intermediate and other goods exports, the correlation between EXPY and FDI inflows is strongest for the less developed economies in the sample (especially for China and India). The correlations, although positive, are not significant for Japan, Singapore, and Taiwan; South Korea has a strong positive and significant correlation for both intermediates and other goods exports; and Hong Kong has a strong positive and significant correlation for the intermediates EXPY and a positive, but not significant, correlation for other goods EXPY. The correlation appears to be higher for intermediate exports than for other goods exports. Malaysia, again, has a negative and significant correlation between the EXPY for intermediate exports in manufacturing and FDI inflows.

Flow	Class	CHN	HKG	IND	JPN	KOR	MYS	SGP	TWN	THA
EXP	I	0.7857*	0.5085*	0.8133*	0.3735	0.6485*	−0.4826*	0.3934	0.3451	0.5159*
	O	0.6644*	0.1755	0.7942*	0.2351	0.6952*	0.5416*	0.4444	0.35	0.5457*
IMP	I	0.4428	0.5229*	0.4812	0.6982*	0.7729*	−0.4194	0.5753*	0.4705	−0.3866
	O	0.0896	0.1316	0.1874	0.3964	0.3737	0.0236	0.6643*	0.1566	−0.4973*

Notes: Significant at *5 percent level; data on FDI inflows for Indonesia is missing
Source: Authors’ calculations using data from Penn World Tables, UNCTAD, and Feenstra *et al.* (2005)

Table IX. Correlation coefficient between FDI inflows (as a percent of GDP) and EXPY/IMPY in manufacturing

The correlation between IMPY and FDI inflows (as a percent of GDP) is not as strong, nor as significant, as the correlation between EXPY and FDI inflows. It is interesting to note that, in contrast to the findings for EXPY, the correlation is not significant for the less developed Asian economies of our sample. The correlation for intermediate imports is fairly strong, positive, and significant for Hong Kong, Japan, Korea, and Singapore. The correlation between IMPY for "other goods" imports and FDI inflows is only significant in two cases: Singapore and Thailand, and it is negative in the latter case. The fact that the correlation is negative and significant for Thailand is perplexing (especially because the correlations were strong, positive, and significant for EXPY).

The heterogeneity of the correlations among the sample of countries is presumably a result of how important FDI is to each country and the sectors targeted by the FDI inflows. For example, FDI may be complementary to certain types of trade, and a substitute for others. The latter happens when FDI is motivated by the desire to reduce trade costs of exporting to the host country. On the other hand, if FDI is motivated by setting up production for exporting, then FDI and exports can move together[12]. In these kinds of models or empirical exercises, trade effects are measured in terms of quantitative impacts on the amount of trade. On the other hand, the focus of the analysis here is on the complexity or productivity of trade. The correlations in Table IX indicate that the higher income countries in the sample tend to have higher FDI being associated with more complex intermediate goods imports: these might be sophisticated engineering equipment, for example. For the lower income countries in the sample, the export impacts are more pronounced. In both cases, however, there is still unexplained variation across countries with similar income levels.

While we have chosen to focus on trends and correlations in presenting the patterns in the data, it is also possible to perform some simple regression analysis. Accordingly, Table X displays regression results for several different specifications of a possible relationship between per capita GDP and the different measures of trade complexity that we have developed in the paper[13]. The first column reports a basic OLS

Variable	OLS	Random effect	Fixed effects	IV	Developing	Developed
Log (EXPY_int)	1.38***	0.21	0.16	−0.052	0.16	2.88***
	(0.40)	(0.17)	(0.15)	(0.20)	(0.18)	(0.41)
Log (EXPY_other)	1.35***	1.32***	1.31***	1.26***	1.15***	1.08***
	(0.20)	(0.08)	(0.07)	(0.11)	(0.10)	(0.10)
Log (IMPY_int)	6.64***	2.46***	2.44***	3.79***	1.78***	1.26**
	(0.92)	(0.46)	(0.42)	(1.24)	(0.57)	(0.51)
Log (IMPY_other)	−4.80***	−0.0095	0.24	−0.43	0.72*	0.0080
	(0.31)	(0.24)	(0.23)	(0.92)	(0.39)	(0.19)
Cons	−34.5***	−28.9***	−30.5***	−34.7***	−28.1***	−40.3***
	(8.45)	(4.02)	(3.70)	(5.73)	(5.66)	(3.58)
Country FE	No	No	Yes	Yes	Yes	Yes
N	166	166	166	148	81	85
Adj. R^2	0.86		0.82		0.79	0.93

Table X.
Regression results for various models

Notes: Significant at: $^{*}p < 0.10$, $^{**}p < 0.05$ and $^{***}p < 0.01$; dependent variable: log (GDP per capita); standard errors in parentheses
Source: Authors' calculations using data from Penn World Tables and Feenstra *et al.* (2005)

regression, and it is followed by results of a random effects estimation, fixed effects, and fixed effects with instrumental variables for the right hand side variables[14], since they are endogenous in a cross-sectional relationship. The final two columns report results for fixed effects regressions for two subsamples of countries, divided by per capita GDP, with the "developing" economies being China, India, Indonesia, Malaysia and Thailand, while the others (Hong Kong, Japan, Korea, Singapore and Taiwan) are in the "developed" group.

There are two robust results, both of which fit with the earlier analysis of trends and patterns. First, the coefficient of non-intermediate export complexity is always positive and statistically significant. The magnitude does not vary much across the different specifications. In fact, the coefficient is an elasticity, and its magnitude suggests that a 1 percent increase in the complexity of non-intermediate exports translates into slightly more than a 1 percent increase in GDP per capita. Of course, even in the case of the IV regression, the causal interpretation of the regression results should not be pushed too far. The second robust result is that the coefficient of intermediate import complexity is also positive and significant across all the specifications. In this case, the estimated magnitudes do differ substantially across cases. There is some evidence that the elasticity in this case is greater than 1, and greater than in the case of non-intermediate exports.

V. Conclusion

In reviewing the development experience of several Asian economies, specifically with respect to their FDI, trade fragmentation and trade upgrading, we find that these countries have been relatively successful at upgrading the productivity level of their exports and their intermediate imports. Although we do not precisely identify the causal relationship, it is clear that export and import productivity levels are highly correlated with GDP per capita. This result is particularly strong for intermediate imports, and for non-intermediate exports. Whatever the causal link may be, we find that, for the Asian economies in our sample, intermediate export productivity levels are converging; there are many successful cases of improved final goods export productivity levels; and there are strong positive trends for intermediate import productivity levels.

FDI may arguably be a driver for the upgrading of trade productivity levels, but the role varies by country. In general, for the less developed Asian economies in our sample, we find that FDI is highly correlated with the increases in productivity growth in exports. For the more developed Asian economies, however, this correlation tends to be higher for increases in productivity of intermediate imports.

Our findings have potential policy implications. First, FDI may play a significant role in technological upgrading and the sectors receiving this FDI may determine whether intermediate goods or other goods increase in productivity levels. Second, trade costs (especially tariffs and non-tariff barriers) may stunt the productivity levels of exports by increasing the costs of intermediates used by local producers or by discouraging FDI that seeks to take advantage of vertical specialization. Policymakers should take these possibilities into account when setting trade policies.

Future research can focus on several areas. For example, detailed econometric studies are needed to identify the causal link between FDI and technological upgrading of both imports and exports. This would involve identifying the specific sectors receiving

FDI and to see if this FDI is indeed driving some of the patterns we identify in our analysis. Finally, it would also be interesting to disaggregate the data by trading partner. For example, in the case of exports, are higher-technology goods destined for countries in the north or the south? Is this pattern different for intermediates vs other goods? And in the case of imports, what is the origin of the higher-tech intermediate goods imports? Has trade fragmentation opened up new opportunities or new challenges for developing countries? These are all questions worth exploring.

Notes

1. For an overview of the evolution and role of FDI in East Asia, see Urata (2001).
2. We should note that the definition of productivity used in this paper is different than that of most firm-level studies. Following Hausmann *et al.* (2007), we refer to increases in productivity as increases in the aggregate implied productivity level of a country's trade basket.
3. The figure uses ISO three-letter codes for each country. For a country-code concordance see Table I.
4. We should note that the data is of a lower bound for intermediates, for more information see the data and methodology section.
5. To provide a concrete sense of the major exports and imports of the sample countries, we provide "top ten" tables for each in the Appendix.
6. The Feenstra *et al.* (2005) trade data are bilateral. They use multiple sources for this base data (e.g. they believe importer data is more accurate) to avoid issues such as re-exports. We aggregate the bilateral data into multilateral data (i.e. getting world totals by SITC sector).
7. There are two exceptions to this: (1) China; which starts in 1987 because a significant amount of data were not disaggregate before that date; and (2) India, which ends in 1999 because India data for imports were not separated in 2000.
8. SITC 5 (chemicals and related products), 6 (manufactured goods), 7 (machinery and transport equipment), and 8 (miscellaneous manufactured articles), less 667 (pearls, precious and semi-precious stones) and 68 (non-ferrous metals).
9. Our results with respect to intermediate imports may also be seen as complementing analyses of the development impacts of trade in capital goods, such as Eaton and Kortum (2001) and Alfaro and Hammel (2007).
10. In order to make the figures intelligible, we do not display the data for every year, but only for the first, middle and last years of the sample.
11. For example, see *The New York Times* (2012), which reflects the combination of FDI, trade fragmentation and export productivity upgrading in the context of China's role as a base for iPhone production (www.nytimes.com/2012/01/22/business/apple-america-and-a-squeezed-middle-class.html).
12. Blonigen (2001) finds evidence of substitution as well as complementarity between affiliate production and exports of Japanese automobile parts for the US market.
13. Given the small sample size, and the aggregate nature of the FDI data used in this analysis, we chose not to include FDI in the regressions, focusing only on the trade complexity measures.
14. For instruments, we used first and second lags of the right hand side variables.

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Further reading

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Appendix

Country	Class	SITC2	Description	Value	PRODY
China	M	8942	Childrens toys, indoor games, etc.	24,590,510	13,995
	O	8510	Footwear	18,749,789	6,470
	I	7599	Parts of and accessories suitable for 751.2-, 752-	10,296,961	14,434
	O	8310	Travel goods, handbags, brief-cases, purses, sheaths	9,490,894	8,162
	O	8451	Jerseys, pull-overs, twinsets, cardigans, knitted	7,697,577	4,012
	O	7525	Peripheral units, incl. control and adapting units	7,297,261	14,228
	M	8939	Miscellaneous art. of materials of div. 58	5,559,173	18,789
	O	8439	Other outer garments of textile fabrics	5,554,139	4,881
	I	7649	Parts of apparatus of division 76-	5,283,397	15,621
	M	7712	Other electric power machinery, parts of 771-	4,936,128	13,050
China HK SAR	I	7764	Electronic microcircuits	4,275,384	17,052
	I	7599	Parts of and accessories suitable for 751.2-, 752-	2,969,879	14,434
	O	8451	Jerseys, pull-overs, twinsets, cardigans, knitted	2,712,731	4,012
	O	8439	Other outer garments of textile fabrics	1,676,353	4,881
	M	8851	Watches, watch movements and cases	1,519,618	22,093
	M	8942	Childrens toys, indoor games, etc.	1,504,373	13,995
	O	8973	Jewellery of gold, silver or platinum	1,381,675	7,939
	O	8462	Under garments, knitted of cotton	1,086,441	4,521
	M	7788	Other elect. machinery and equipment	1,032,287	13,171
	I	6522	Cotton fabrics, woven, bleach. merceriz. dyed, printed	936,002	8,098
India	M	6513	Cotton yarn	1,422,014	3,743
	O	8973	Jewellery of gold, silver or platinum	1,044,606	7,939
	O	6584	Bed linen, table linen, toilet and kitchen linen, etc.	768,543	5,950
	O	8462	Under garments, knitted of cotton	755,072	4,521
	O	8441	Shirts, mens, of textile fabrics	676,076	3,080
	O	8435	Blouses of textile fabrics	643,912	4,518
	O	8439	Other outer garments of textile fabrics	571,569	4,881
	O	8481	Art. of apparel and clothing accessories, of leather	509,505	5,374
	M	5417	Medicaments (including veterinary medicaments)	506,859	20,926
	I	6522	Cotton fabrics, woven, bleach. merceriz. dyed, printed	502,823	8,098

Table AI.
Top ten exports in 1999

(*continued*)

Country	Class	SITC2	Description	Value	PRODY
Indonesia	I	6342	Plywood consisting of sheets of wood	2,735,111	6,861
	O	8510	Footwear	1,865,958	6,470
	O	8219	Other furniture and parts	1,108,464	12,395
	I	7599	Parts of and accessories suitable for 751.2-, 752-	912,272	14,434
	I	6412	Printing paper and writing paper, in rolls or sheets	887,605	22,352
	O	7525	Peripheral units, incl. control and adapting units	865,212	14,228
	O	7638	Other sound recorders and reproducers	811,759	15,030
	I	6415	Paper and paperboard, in rolls or sheets, n.e.s.	774,986	20,324
	I	7649	Parts of apparatus of division 76-	749,020	15,621
	O	8439	Other outer garments of textile fabrics	730,930	4,881
Japan	O	7810	Passenger motor cars, for transport of pass. and good	57,271,654	16,660
	I	7764	Electronic microcircuits	24,731,586	17,052
	I	7849	Other parts and accessories of motor vehicles	14,698,404	19,647
	I	7599	Parts of and accessories suitable for 751.2-, 752-	13,130,106	14,434
	M	7284	Mach. and appliances for specialized particular ind.	10,948,210	19,017
	I	7649	Parts of apparatus of division 76-	10,225,946	15,621
	M	7788	Other elect. machinery and equipment	9,713,834	13,171
	O	7638	Other sound recorders and reproducers	9,475,341	15,030
	O	7932	Ships, boats and other vessels	9,467,473	11,211
	O	7525	Peripheral units, incl. control and adapting units	8,991,797	14,228
Korea Rep.	I	7764	Electronic microcircuits	17,875,244	17,052
	O	7810	Passenger motor cars, for transport of pass. and good	9,372,667	16,660
	O	7643	Radiotelegraphic and radiotelephonic transmitters	4,772,204	20,363
	O	7932	Ships, boats and other vessels	4,640,971	11,211
	I	7599	Parts of and accessories suitable for 751.2-, 752-	4,516,730	14,434
	O	7525	Peripheral units, incl. control and adapting units	4,477,254	14,228
	I	6531	Fabrics, woven of continuous synth. textil. materials	3,166,282	10,051
	O	7524	Digital central storage units, separately consigned	3,140,025	16,289
	I	7649	Parts of apparatus of division 76-	2,399,884	15,621
	I	6552	Knitted/crocheted fabrics of fibres oth. than synth	1,992,552	9,384
Malaysia	I	7764	Electronic microcircuits	16,619,652	17,052
	I	7599	Parts of and accessories suitable for 751.2-, 752-	9,396,094	14,434
	O	7524	Digital central storage units, separately consigned	4,986,819	16,289

(*continued*)

Table AI.

Country	Class	SITC2	Description	Value	PRODY
	O	7525	Peripheral units, incl. control and adapting units	2,553,217	14,228
	O	7638	Other sound recorders and reproducers	2,182,045	15,030
	I	7763	Diodes, transistors and sim. semi-conductor devices	2,138,164	12,103
	O	7628	Other radio-broadcast receivers	1,964,173	12,516
	O	7523	Complete digital central processing units	1,893,200	24,163
	I	7649	Parts of apparatus of division 76-	1,837,646	15,621
	O	7611	Television receivers, colour	1,582,574	14,250
Singapore	O	7524	Digital central storage units, separately consigned	12,363,981	16,289
	I	7764	Electronic microcircuits	11,771,117	17,052
	I	7599	Parts of and accessories suitable for 751.2-, 752-	8,273,697	14,434
	O	7523	Complete digital central processing units	2,551,731	24,163
	O	7525	Peripheral units, incl. control and adapting units	2,452,324	14,228
	I	7768	Piezo-electric crystals, mounted, parts of 776-	1,490,692	15,380
	O	7528	Off-line data processing equipment. n.e.s.	1,405,417	23,176
	I	7649	Parts of apparatus of division 76-	1,285,399	15,621
	M	7788	Other elect. machinery and equipment	1,238,413	13,171
	O	8983	Gramophone records and sim. sound recordings	1,205,298	25,318
Taiwan	I	7599	Parts of and accessories suitable for 751.2-, 752-	13,294,784	14,434
	I	7764	Electronic microcircuits	13,201,899	17,052
	O	7522	Complete digital data processing machines	4,288,036	24,050
	O	7525	Peripheral units, incl. control and adapting units	4,266,756	14,228
	O	7523	Complete digital central processing units	3,878,125	24,163
	I	7722	Printed circuits and parts thereof	2,295,402	13,784
	I	6552	Knitted/crocheted fabrics of fibres oth. than synth	2,101,460	9,384
	I	6531	Fabrics, woven of continuous synth. textil. materials	1,965,487	10,051
	M	7788	Other elect. machinery and equipment	1,889,128	13,171
	M	8939	Miscellaneous art. of materials of div. 58	1,833,581	18,789
Thailand	O	7524	Digital central storage units, separately consigned	4,211,867	16,289
	I	7764	Electronic microcircuits	3,510,486	17,052
	I	7599	Parts of and accessories suitable for 751.2-, 752-	3,205,052	14,434
	O	7525	Peripheral units, incl. control and adapting units	2,338,450	14,228
	O	7821	Motor vehicles for transport of goods/materials	1,107,166	16,254
	I	7649	Parts of apparatus of division 76-	1,057,604	15,621
	O	8973	Jewellery of gold, silver or platinum	1,030,814	7,939
	M	7415	Air conditioning mach. self-contained and parts	1,020,753	16,787
	O	7611	Television receivers, colour	968,940	14,250
	O	8510	Footwear	911,503	6,470

Table AI.

Country	Class	SITC2	Description	Value	PRODY
China	I	7764	Electronic microcircuits	7,532,605	17,052
	I	7649	Parts of apparatus of division 76-	5,363,549	15,621
	M	7284	Mach. and appliances for specialized particular ind.	4,048,955	19,017
	I	7599	Parts of and accessories suitable for 751.2-, 752-	3,788,179	14,434
	I	5833	Polystyrene and its copolymers	2,583,205	19,903
	I	7721	Elect. app. such as switches, relays, fuses, pwgs, etc.	2,283,884	14,682
	I	6531	Fabrics, woven of continuous synth. textil. materials	2,247,753	10,051
	O	7924	Aircraft exceeding an unladen weight of 15,000 kg	2,240,222	12,637
	M	7788	Other elect. machinery and equipment	2,184,398	13,171
	I	6746	Sheets and plates, rolled; thickness of less than 3 mm	2,180,581	12,025
China HK SAR	I	7764	Electronic microcircuits	9,197,478	17,052
	I	7599	Parts of and accessories suitable for 751.2-, 752-	6,878,303	14,434
	M	8942	Childrens toys, indoor games, etc.	6,136,434	13,995
	I	7649	Parts of apparatus of division 76-	5,010,606	15,621
	O	8510	Footwear	4,960,661	6,470
	O	8310	Travel goods, handbags, brief-cases, purses, sheaths	3,532,912	8,162
	M	8851	Watches, watch movements and cases	2,866,234	22,093
	O	7643	Radiotelegraphic and radiotelephonic transmitters	2,755,613	20,363
	O	8451	Jerseys, pull-overs, twinsets, cardigans, knitted	2,664,494	4,012
	M	7712	Other electric power machinery, parts of 771-	2,225,244	13,050
India	I	5222	Inorganic acids and oxygen compounds of non-metal	924,435	4,738
	I	5629	Fertilizers, n.e.s.	660,715	7,131
	I	7599	Parts of and accessories suitable for 751.2-, 752-	432,886	14,434
	I	7849	Other parts and accessories of motor vehicles	356,810	19,647
	I	5623	Mineral or chemical fertilizers. potassic	339,131	6,173
	I	5112	Cyclic hydrocarbons	318,569	17,291
	O	8983	Gramophone records and sim. sound recordings	318,389	25,318
	O	7932	Ships, boats and other vessels	297,038	11,211
	O	7938	Tugs, special purpose vessels, floating structures	268,552	9,027
	I	7649	Parts of apparatus of division 76-	256,785	15,621
Indonesia	I	5112	Cyclic hydrocarbons	474,619	17,291
	I	5111	Acyclic hydrocarbons	306,753	17,334
	I	7849	Other parts and accessories of motor vehicles	296,772	19,647
	I	5989	Chemical products and preparations, n.e.s.	283,198	18,135
	I	5121	Acyclic alcohols and their halogenated, derivatives	245,741	15,580
	M	7284	Mach. and appliances for specialized particular ind.	222,606	19,017
	O	7938	Tugs, special purpose vessels, floating structures	217,835	9,027

(*continued*)

Table AII.
Top ten imports in 1999

Country	Class	SITC2	Description	Value	PRODY
	O	7821	Motor vehicles for transport of goods/materials	210,690	16,254
	I	6782	Seamless tubes and pipes; blanks for tubes and pipes	196,176	7,611
	O	7234	Construction and mining machinery, n.e.s.	195,787	15,514
Japan	I	7764	Electronic microcircuits	11,926,291	17,052
	I	7599	Parts of and accessories suitable for 751.2-, 752-	6,881,834	14,434
	O	7810	Passenger motor cars, for transport of pass. and good	6,213,942	16,660
	O	7924	Aircraft exceeding an unladen weight of 15,000 kg	4,220,178	12,637
	O	7523	Complete digital central processing units	4,072,387	24,163
	I	7649	Parts of apparatus of division 76-	3,444,135	15,621
	O	7524	Digital central storage units, separately consigned	3,394,213	16,289
	O	8451	Jerseys, pull-overs, twinsets, cardigans, knitted	3,047,889	4,012
	O	8310	Travel goods, handbags, brief-cases, purses, sheaths	2,664,623	8,162
	O	8510	Footwear	2,581,682	6,470
Korea Rep.	I	7764	Electronic microcircuits	13,540,410	17,052
	M	7284	Mach. and appliances for specialized particular ind.	2,154,851	19,017
	I	7599	Parts of and accessories suitable for 751.2-, 752-	1,815,882	14,434
	I	7649	Parts of apparatus of division 76-	1,794,350	15,621
	I	5989	Chemical products and preparations, n.e.s.	1,382,362	18,135
	M	7788	Other elect. machinery and equipment	1,341,709	13,171
	I	7763	Diodes, transistors and sim. semi-conductor devices	1,339,290	12,103
	I	7721	Elect. app. such as switches, relays, fuses, pwgs, etc.	1,319,443	14,682
	I	7768	Piezo-electric crystals, mounted, parts of 776-	1,212,723	15,380
	M	8710	Optical instruments and apparatus	1,058,776	16,677
Malaysia	I	7768	Piezo-electric crystals, mounted, parts of 776-	9,191,687	15,380
	I	7764	Electronic microcircuits	8,325,827	17,052
	I	7599	Parts of and accessories suitable for 751.2-, 752-	2,519,590	14,434
	I	7649	Parts of apparatus of division 76-	1,690,317	15,621
	M	7788	Other elect. machinery and equipment	1,298,959	13,171
	I	7722	Printed circuits and parts thereof	1,216,008	13,784
	I	7721	Elect. app. such as switches, relays, fuses, pwgs, etc.	1,143,346	14,682
	M	7284	Mach. and appliances for specialized particular ind.	1,140,345	19,017
	I	7763	Diodes, transistors and sim. semi-conductor devices	999,865	12,103
	O	7810	Passenger motor cars, for transport of pass. and good	886,831	16,660
Singapore	I	7764	Electronic microcircuits	17,784,221	17,052
	I	7599	Parts of and accessories suitable for 751.2-, 752-	9,063,500	14,434
	O	7524	Digital central storage units, separately consigned	3,258,148	16,289
	I	7649	Parts of apparatus of division 76-	2,822,151	15,621

Table AII.

(*continued*)

Country	Class	SITC2	Description	Value	PRODY
	I	7768	Piezo-electric crystals, mounted, parts of 776-	2,289,477	15,380
	M	7788	Other elect. machinery and equipment	2,274,292	13,171
	I	7721	Elect. app. such as switches, relays, fuses, pwgs, etc.	1,931,954	14,682
	M	7284	Mach. and appliances for spezialized particular ind.	1,870,827	19,017
	I	7763	Diodes, transistors and sim. semi-conductor devices	1,659,250	12,103
	O	8983	Gramophone records and sim. sound recordings	1,602,773	25,318
Taiwan	I	7764	Electronic microcircuits	14,275,299	17,052
	O	7524	Digital central storage units, separately consigned	6,301,691	16,289
	M	7284	Mach. and appliances for specialized particular ind.	4,671,837	19,017
	I	7599	Parts of and accessories suitable for 751.2-, 752-	2,184,552	14,434
	M	7416	Mach. plant and sim. lab. equip. involv. a temp. change	1,840,257	13,071
	I	7721	Elect. app. such as switches, relays, fuses, pwgs, etc.	1,730,691	14,682
	I	5989	Chemical products and preparations, n.e.s.	1,706,517	18,135
	I	7763	Diodes, transistors and sim. semi-conductor devices	1,691,680	12,103
	I	6725	Blooms, billets, slabs and sheet bars of iron or steel	1,609,921	7,648
	M	7788	Other elect. machinery and equipment	1,493,057	13,171
Thailand	I	7768	Piezo-electric crystals, mounted, parts of 776-	2,664,272	15,380
	I	7599	Parts of and accessories suitable for 751.2-, 752-	2,239,371	14,434
	I	7764	Electronic microcircuits	2,202,747	17,052
	O	7924	Aircraft exceeding an unladen weight of 15,000 kg	1,611,338	12,637
	I	6997	Articles of iron or steel, n.e.s.	1,329,656	14,589
	I	7721	Elect. app. such as switches, relays, fuses, pwgs, etc.	1,003,479	14,682
	M	7788	Other elect. machinery and equipment	872,248	13,171
	M	8939	Miscellaneous art. of materials of div. 58	811,267	18,789
	I	7761	Television picture tubes, cathode ray	803,673	12,841
	I	7849	Other parts and accessories of motor vehicles	679,681	19,647

Table AII.

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