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Trade Productivity Upgrading, Trade Fragmentation, and FDI in Manufacturing: The Asian Development Experience

Jesse Mora and Nirvikar Singh

University of California, Santa Cruz

NIPFP Macro-Finance 9th Research Meeting

New Delhi, March 15-16, 2012

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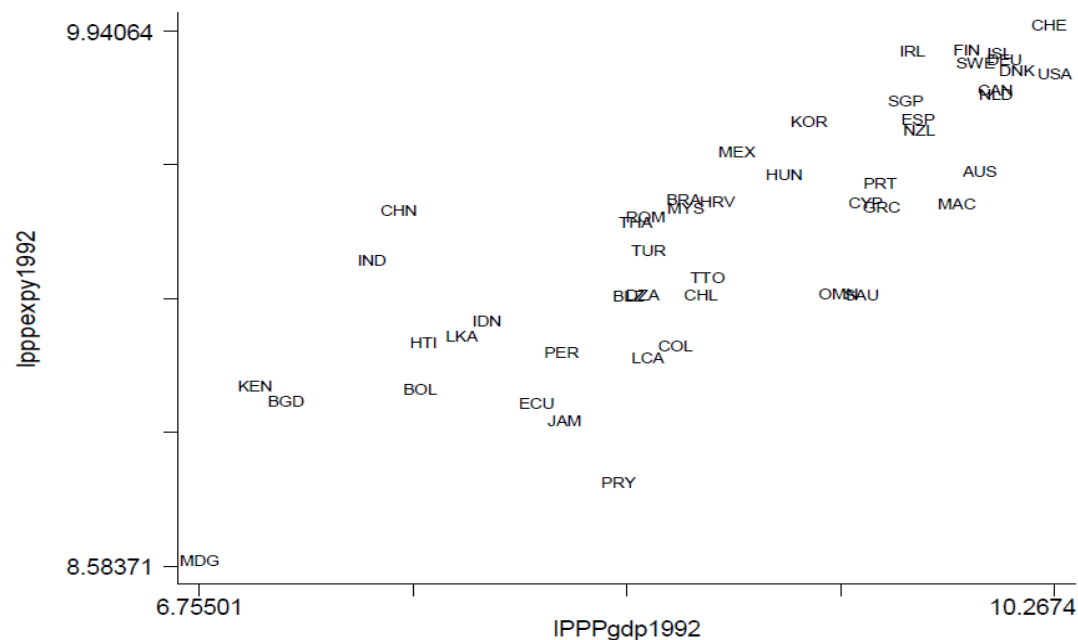III. Data and Methodology

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I. Introduction

- ## Asian economic growth
  - ❑ China (and other Asian economies) export technologically advanced products beyond their "expected" productivity level (Rodrik 2006)

Figure 3: Relationship between *EXPY* and per-capita incomes in 1992

I. Introduction

- **What accounts for this technological upgrading? Trade Fragmentation? FDI?**

    - Few empirical studies measuring technological upgrading (of exports and imports) and FDI

    - Imported intermediates: iPod case (Linden et al. 2011).

    - China processing: FIE perform the majority of processing trade (exports using imported intermediates) and do very little in regular trade (Dean, Lovely, and Mora 2009)

    - Vertical specialization: The foreign content of China's 2002 aggregate merchandise exports ranges between 25% and 46%, with some individual sectors as high as 52%-95% (Dean, Fung, and Wang 2008)

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I. Introduction

- In the paper we use the HHR (Hausmann, Hwang, and Rodrik, 2007) measure of export productivity level and focus on 10 Asian countries

- We extend this measure to imports

- To examine trade fragmentation, we split the trade data into intermediates and other goods.

- We analyze how trade productivity levels:

    - compare to GDP per capita,

    - change over time, and

    - relate to FDI inflows

II. Historical Background

Figure II.1: PPP Converted GDP per capita, 1984-2000 (constant 2005 US$)
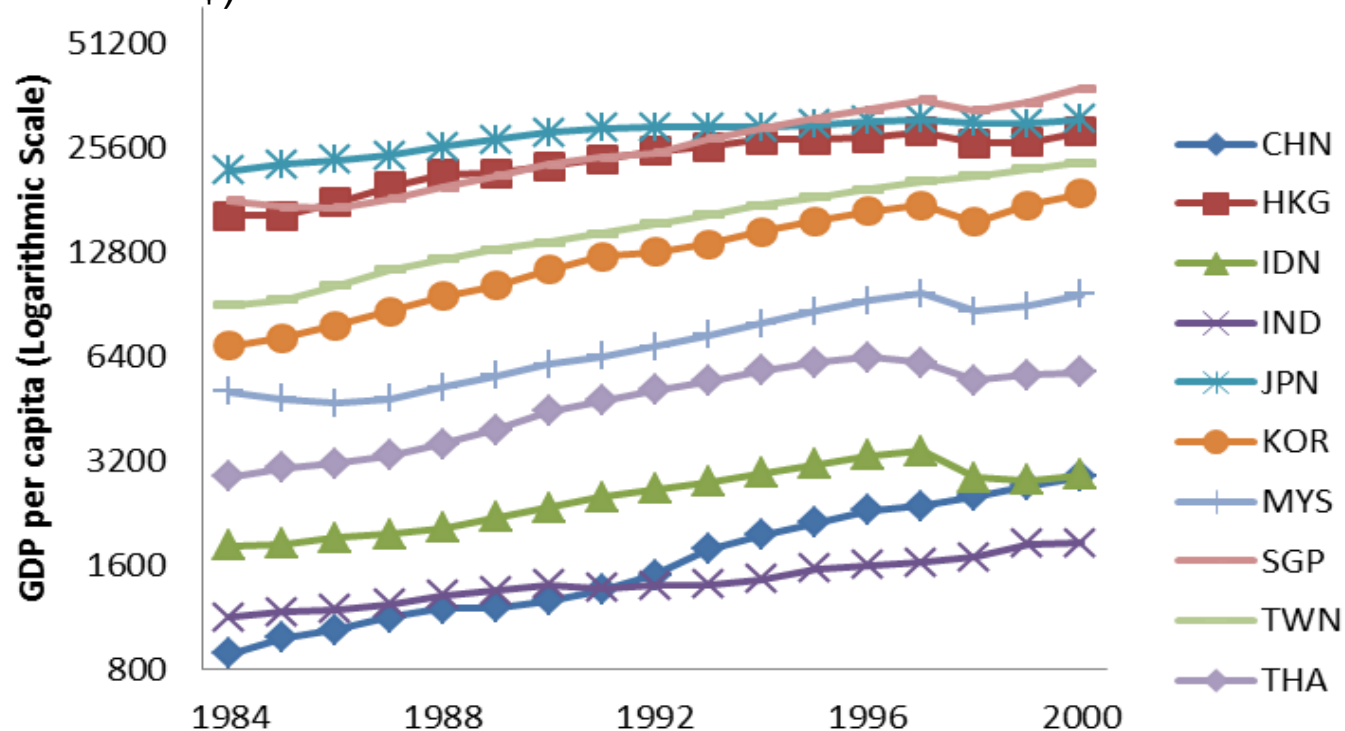
Observation: Impressive GDP per capita growth (AAGR 4.2 % in region). The fastest growing countries were China (7.6 percent), South Korea (6.5 percent), and Taiwan (6.1 percent); the slowest growing countries were Japan (2.1 percent), Indonesia (3.0 percent), and India (3.2 percent).

**Table II.1. Share of Manufacturing in Total Exports and Imports**

Code	Exports			Imports		
	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

Note: Data for China starts in 1987 and data for India ends in from 1999
Negative numbers are in (*)

Observation: Manufactures grew at faster rates than overall trade. Most of the countries in the sample experienced significant increases in the share of manufactures in overall merchandise trade.

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Figure II.3. Intermediate Exports in Manufacturing (share of Total Exports)
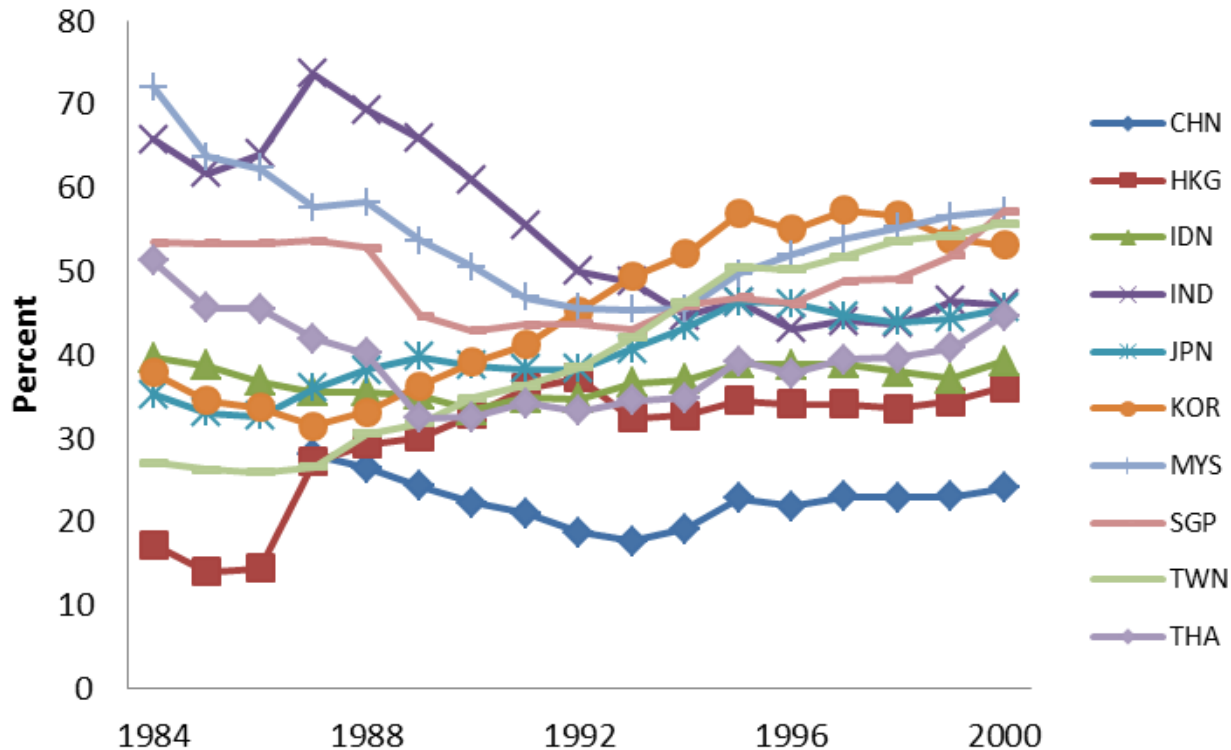
Observation: Difficult to generalize for the region as a whole. Japan and the Asian Tigers increased their share of intermediates in manufacturing exports, while the rest of the countries (including China) saw decreases.

Figure II.2. Intermediate Imports in Manufacturing (share of Total Imports)
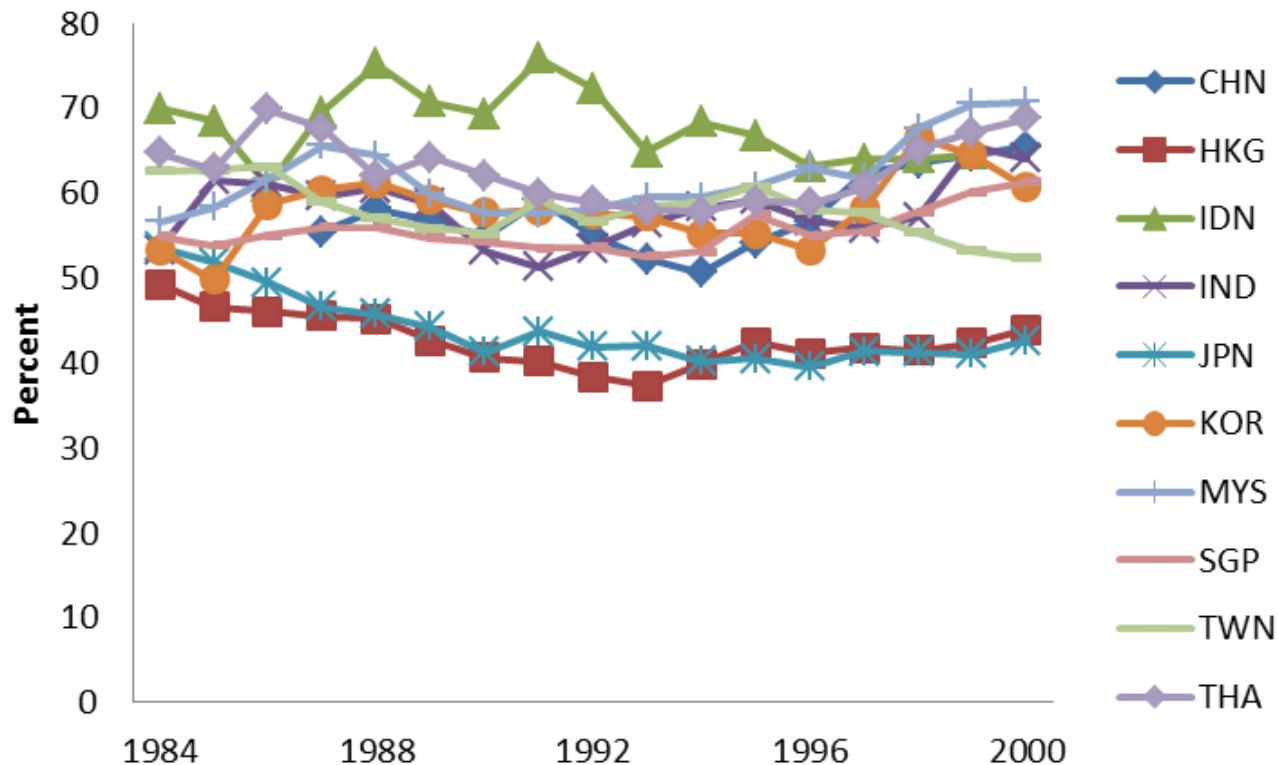
Observation: The importance of intermediates in manufacturing imports decreased from 1984 until about the mid-1990s. They subsequently increased in share, but, in many cases, had not recovered by 2000, or were at about the same level, as in the early 1980s.

Table II.2. Share of Intermediates in Manufacturing Exports and Imports

	Exports			Imports		
Code	1984	2000	Difference	1984	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 from 1999
Negative numbers are in (*)

1. Intermediates account for a significant amount of trade (this is a lower bound).
2. 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).

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III. Data and Methodology

- ## Data Sources

  - ❑ Trade data compiled and standardized by Feenstra, Lipsey, Deng, Ma, and Mo (2005)

  - ❑ GDP per capita (PPP adjusted, constant 2005 USD) data from the Penn World Tables

  - ❑ FDI inflows (as a percent of GDP) data from UNCTAD

III. Data and Methodology

- ## Data Concordances
  - ❑ UNCTAD's definition for manufacturing

  - ❑ The UN's classification by Broad Economic Categories (BEC), which allows us to separate the data into intermediates, consumption, capital, and not classified

  - ❑ 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 (consumption, capital, and not classified), and Mixed (intermediates and others)
    - ■ We drop "Mixed" (but results change little if left in)

Table III.1. Current BEC and SNA classes of goods

Classification by Broad Economic Categories	Basic classes of goods in SNA
1 Food and beverages	
11 Primary	
111 Mainly for industry Intermediate	Intermediate
112 Mainly for household consumption Consumption	Consumption
12 – Processed	
121 Mainly for industry Intermediate	Intermediate
122 Mainly for household consumption Consumption	Consumption
2 Industrial supplies not elsewhere specified	
21 Primary Intermediate	Intermediate
22 Processed Intermediate	Intermediate
3 Fuels and lubricants	
31 Primary Intermediate	Intermediate
32 Processed	
321 Motor spirit Not classified	Not classified
322 Other Intermediate	Intermediate
4 Capital goods (except transport equipment), and parts and accessories thereof	
41 Capital goods (except transport equipment) Capital	Capital
42 Parts and accessories Intermediate	Intermediate
5 - Transport equipment and parts and accessories thereof	
51 Passenger motor cars Not classified	Not classified
52 Other	
521 Industrial Capital	Capital
522 Non-industrial Consumption	Consumption
53 Parts and accessories Intermediate	Intermediate
6 Consumer goods not elsewhere specified	
61 Durable Consumption	Consumption
62 Semi-durable Consumption	Consumption
63 Non-durable Consumption	Consumption
7 - Goods not elsewhere specified Not classified	Not classified

III. Data and Methodology

- **Definitions**
  - ❑ Step 1

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

$$EXP_{ji} = x_{ji} / \sum_i x_{ji} \qquad IMP_{ji} = m_{ji} / \sum_i m_{ji}$$

  - ❑ Step 2

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

SITC Sectors with Highest and Lowest PRODY

No	SITC2	PRODY	Description	Classif.
1	5148	30,242	OTHER NITROGEN-FUNCTION COMPOUNDS	I
2	8744	29,822	INSTR.& APP.FOR PHYSICAL OR CHEMICAL ANALYSIS	O
3	5332	29,558	PRINTING INK	I
4	7928	29,230	AIRCRAFT,N.E.S.BALLOONS,GLIDERS ETC AND EQUIPMENT	O
5	8813	28,889	PHOTOGRAPHIC & CINEMATOGRAPHIC APPARATUS N.E.S	M
…	…	…	…	…
493	6116	2,506	LEATHER OF OTHER HIDES OR SKINS	I
494	6593	1,621	KELEM,SCHUMACKS AND KARAMANIE RUGS AND THE LIKE	O
495	6592	1,536	CARPETS,CARPETING AND RUGS,KNOTTED	O
496	6545	1,503	FABRICS,WOVEN,OF JUTE OR OF OTHER TEXTILE BAST FIB	I
497	5513	1,464	ESSENTIAL OILS,CONCRETES & ABSOLUTES:RESINOIDS	I

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IV. Results

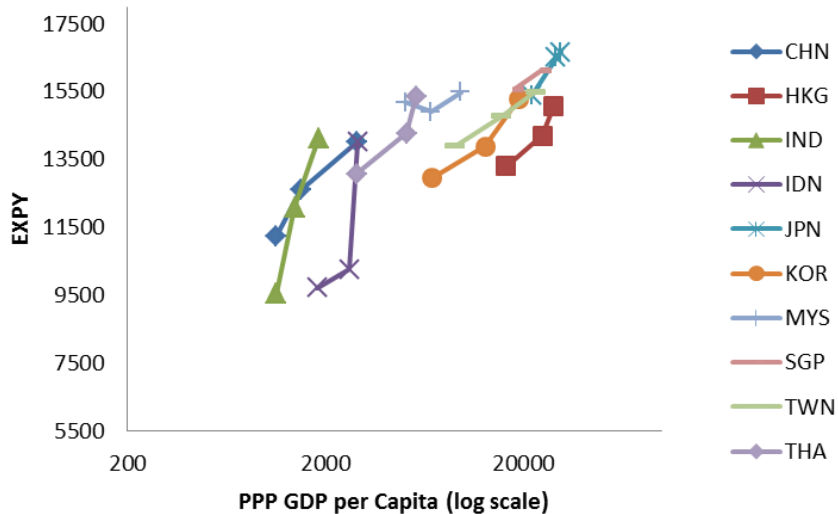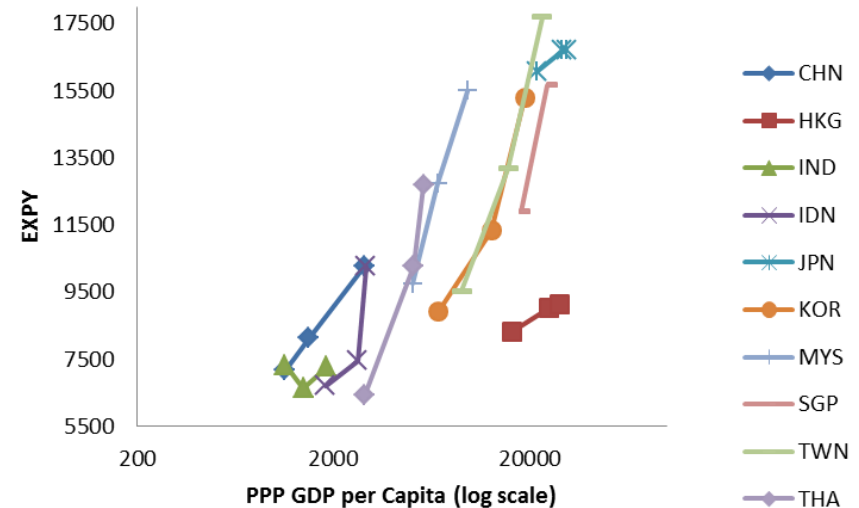Figure IV.1. EXPY for Intermediate Exp. Vs. GDP per capita

Figure IV.2. EXPY for Other Exports Vs. GDP per capita

Main Findings:
China, India, Thailand, Malaysia, and, to a lesser extent, Indonesia appear to be at EXPY levels higher than their Asian counterparts (Japan and the Asian Tigers) were at the same GDP per capita level.

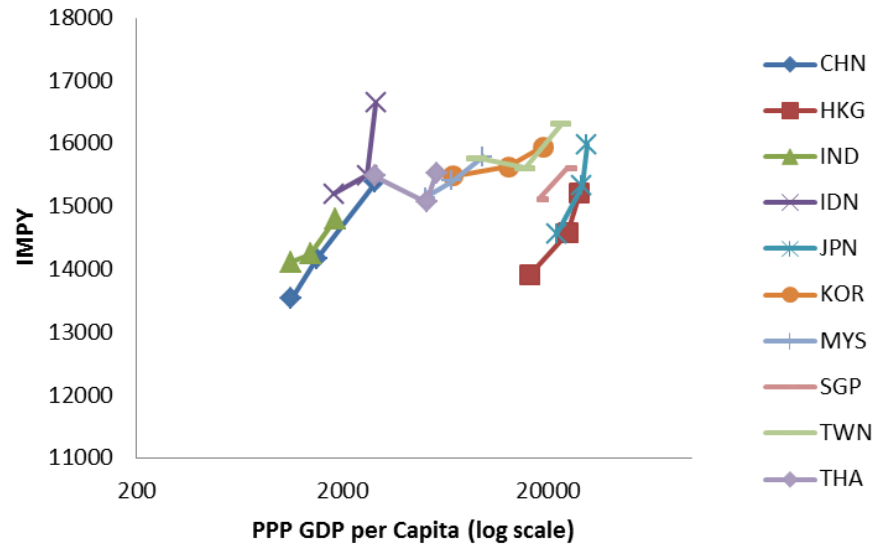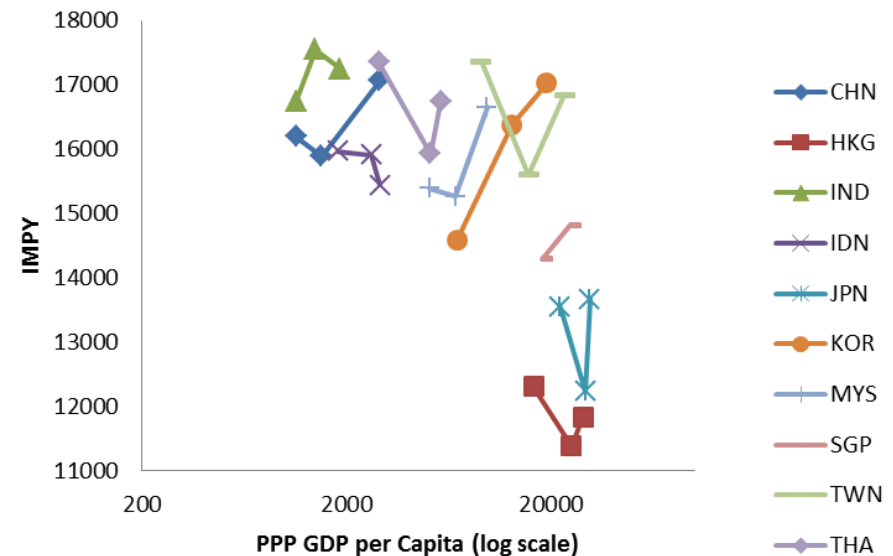Figure IV.3. IMPY for Intermediate Imp. Vs. GDP per capita

Figure IV.4. IMPY for Other Imports Vs. GDP per capita

Main Finding:

No pattern for "other" imports. Intermediate imports have a positive relationship between productivity level and GDP per capita.

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Table IV.1. 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

* 5% significance level

Main Findings:

1) 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.

2) The correlation between the IMPY for intermediate imports and GDP per capita is also strong, positive, and significant in many cases.

3) The correlation between the IMPY for other imports and GDP per capita is not significant in most cases.
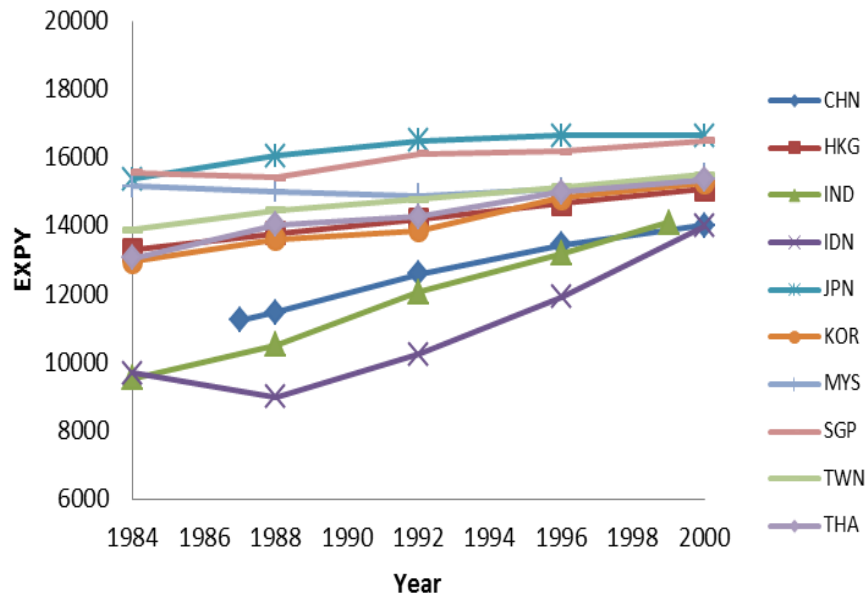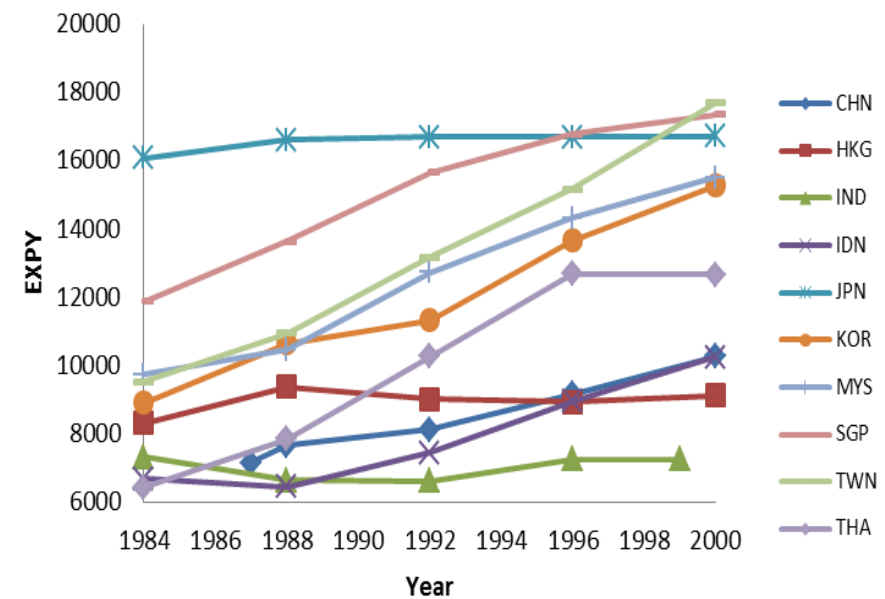
Figure IV.5 EXPY for Intermediate Exports

Figure IV.6. EXPY for Other Exports

Main findings:
1) EXPY increased at impressive rates for both intermediates and other exports.
2) These figures appear to show that all the countries are converging towards similar EXPY levels for intermediates.
3) The increase in EXPY for "other goods" exports is quite large (five countries increased EXPY by at least 5,000 US$).
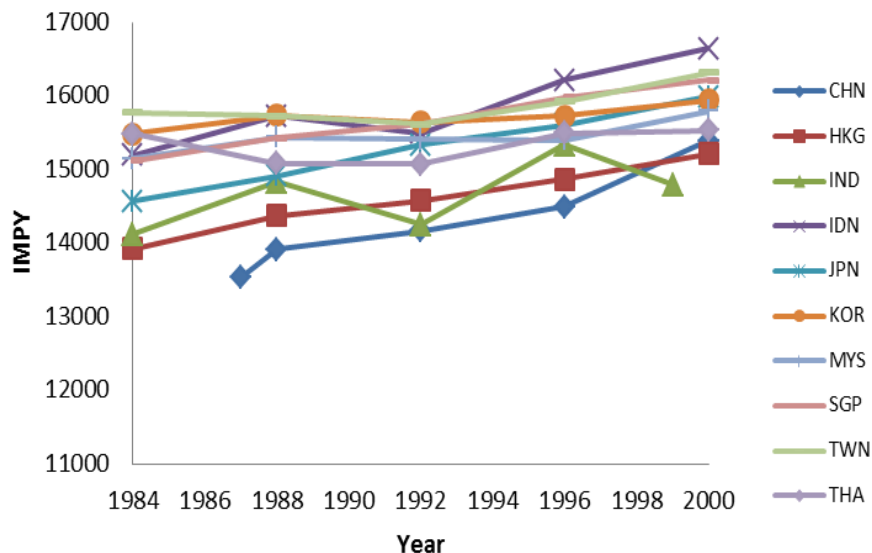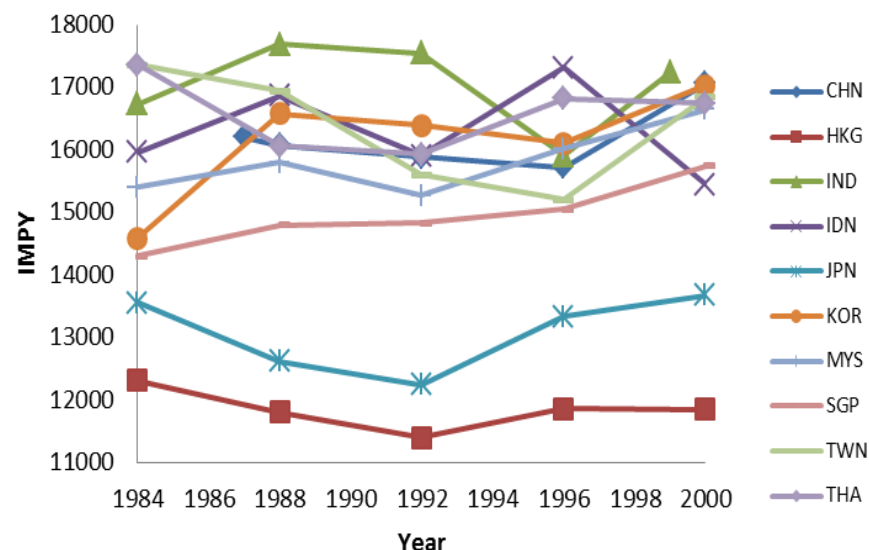
Figure IV.7. IMPY for Intermediate Imports

Figure IV.8. IMPY for Other Imports

Main finding:
1) Imported intermediates have also increased in productivity level. 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.
2)   For the most part, it appears that the IMPY for other imports is fairly constant

Table IV.2. Correlation Coefficient between FDI inflows (as a % of GDP) and EXPY/IMPY in Manufacturing

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*

* 5% significance level
Note: Data on FDI inflows for Indonesia is missing.

Main Findings:

1. The EXPY and IMPY correlations with FDI inflows are smaller than their correlations with GDP per capita.

2. The correlation between *intermediate and other goods exports* productivity levels and FDI inflows are highly correlated *for less developed* Asian countries in the sample.

3. The correlation between *intermediate import* productivity levels and FDI inflows are highly correlated for the *more developed* Asian countries.

4. For the most part, there is no significant correlation between *other goods import* productivity levels and FDI inflows.

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V. Conclusions

❑ The countries in our sample have been relatively successful at upgrading the productivity level of their exports and their intermediate imports.

❑ EXPY and IMPY are highly correlated with GDP per capita

❑ FDI is highly correlated with the increases in productivity growth in exports and intermediate imports

V. Conclusions

- ❑ Policy implications: Trade policy settings
  - ■ FDI play a significant role
  - ■ Trade costs
- ❑ Future work
  - ■ Econometric work to establish causality
  - ■ Bilateral trade productivity levels (South-South trade vs. North-South trade)
  - ■ How to address issues with estimating trade productivity levels because of fragmentation
    - ❑ Exports/imports may be less high-tech (eg. iPod)
    - ❑ Exports/Imports may be more high-tech (eg. technology)
  - ■ How to address quality differences

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