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KOREA ECONOMIC RESEARCH INSTITUTE

Future of Factory Asia

co-edited by Choi Byung-il and Changyong Rhee

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6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
Tel +63 2 632 4444
Fax +63 2 636 2444
www.adb.org

45th Fl. FKI Tower, 24 Yeoui-daero, Yeongdeungpo-gu
Seoul 150-756, Republic of Korea
Tel +82 2 3771 0001
Fax +82 2 785 0270
www.keri.org

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For orders, please contact:

Public Information Center
Fax +63 2 636 2584
adbpub@adb.org

Division of Planning and Coordination
Korea Economic Research Institute
Tel +82 2 3771 0011
Fax +82 2 785 0270
ehkim@keri.org

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Contributors

Ramesh Subramaniam has been with the Asian Development Bank (ADB) since April 1997. At present, he is the Deputy Director General at the Southeast Asia Department (SERD) from July 2013. Prior to SERD, he was the Senior Director at the ADB's Office of Regional Economic Integration from October 2011; he was in Central and West Asian regional operations of ADB from April 2007; and between 2003 and 2007, he was the deputy country director for ADB in Indonesia. He was ADB's coordinator for APEC Finance Ministers' Process (1998–2000), and co-team leader for the ASEAN Infrastructure Fund, established in late 2011. His research and operational work over the last 22 years has focused on policy and institutional change in developing Asia. He has a Master's Degree in Econometrics from University of Madras in India; and a PhD in Econometrics and Development Economics from McMaster University, Canada.

Thiam Hee Ng is Senior Economist with the Asian Development Bank (ADB) where he works on financial integration, macroeconomic surveillance and early warning systems in the Office for Regional Economic Integration. He manages the *AsianBondsOnline* web portal and the Asia Bond Monitor, a quarterly report on local currency bond market developments in Asia. He also contributes to Asian Economic Integration Monitor and writes on capital flows, economic integration and financial markets. He has extensive experience working on economic issues in developing countries in Africa and Asia. Prior to joining ADB, he has worked for the United Nations Industrial Development Organization and the Central Bank of Malaysia. He was awarded his PhD and MSc in Economics from the University of Wisconsin-Madison in the USA; and his Bachelor in Economics from the University of Cambridge in the United Kingdom. He has been a CFA charter holder since 1999.

Jayant Menon is Lead Economist of the Office of Regional Economic Integration (OREI), Asian Development Bank (ADB) where he works on a range of trade, international finance, and development issues. Prior to his current post, he has worked on ADB's India Desk, the Regional Economic Monitoring Unit, the Southeast Asia Department, and the ADB Institute in Tokyo, Japan. Before joining ADB, he was Senior Research Fellow at the Centre of Policy Studies at Monash University in Melbourne, Australia working on economic modeling and trade and investment issues. He also worked at the University of Melbourne and Victoria University, and at the American University in Washington DC. He holds adjuncts appointments with the Australian National University, University of Nottingham, United Kingdom, and Cambodia Institute for Cooperation and Peace. He is a member of the Advisory Board of the University of Nottingham, Malaysia campus and has served as a Board Director of the Cambodia Development Resource Institute. Mr. Menon serves as co-editor of the ASEAN Economic Bulletin and is on the editorial boards of several academic journals. He has authored over 100 academic publications, mostly on trade and development in Asia. He obtained his PhD in International Economics from the University of Melbourne.

Namsuk Choi is Research Fellow at the Division of Macroeconomic Policy Research at Korea Economic Research Institute (KERI). His major fields of expertise include economic growth and development, international trade and investment and macroeconomics. Currently he is undertaking a research on global supply chain and how this affects job market growth of the Republic of Korea. He earned his MA and PhD in Economics from University of Colorado, Boulder where he also served as an instructor, before moving to become Assistant Professor of Economics at Dordt College prior to joining KERI.

Hea Jung Hyun is Assistant Professor of College of International Studies at Kyung Hee University since 2012. Prior to joining Kyung Hee, she served as Assistant Professor at Dankook University and as Head of WTO team of the Korea Institute for International Economic Policy. Some of her recent publications include, *Who Goes Where and How? Firm Heterogeneity in the Choice of FDI Type and Location* (2013), and *The Strategy of Korean Multinational Enterprices-Multiple vs. Single Plant* (2013). She received her PhD as well as a Master's Degree in Economics from Indiana University.

Shujiro Urata holds position as Professor of Economics at Waseda University of Japan and Research Fellow of Japan Center for Economic Research. Previously he worked for the Brookings Institution and the World Bank before joining as a lecturer at Waseda University in 1986. His field of specialization includes international economic and development economics. He is a co-author or editor of books on international economic issues and numerous articles in professional journals including, *Free Trade Agreements in the Asia-Pacific* (World Scientific, co-edited, 2010) and *Economic Consequences of Globalization: Evidence from East Asia* (Routledge, co-edited, 2012). He received his PhD as well as Master's Degree in Economics from Stanford University. He is also a Senior Research Advisor to Executive Director at the Economic Research Institute for ASEAN and East Asia (ERIA).

Shintaro Hamanaka is Economist at the Office of Regional Economic Integration of the Asian Development Bank (ADB). He also holds the position of Honorary Research Fellow at White Rose East Asia Centre in the United Kingdom. Before joining ADB in 2008, he worked as a service negotiator of Doha Round at the Japanese Mission to the World Trade Organization (WTO). Prior to this, he was a central bank economist at the Bank of Japan. His research interests include international political economy, international relations, regional economic integration, and free trade agreements, particularly regional services and investment agreements. He authors several books and numerous academic journal articles in the field of political science, economics and international economic law. His most recent book is *Asian Free Trade Agreements and WTO Compatibility* (World Scientific, 2014, single-authored).

Federico Foders received his PhD and Master's Degree from the University of Hamburg, Germany. He is Senior Fellow at the Kiel Institute for the World Economy and an Honorary Professor of Economics at the University of Cologne; he also teaches at the University of Kiel. His publications include books and articles on regional integration in developing and developed countries, economic policy in Latin America and the German education system. Recently, he wrote an article on the Monetary Union of the EU, Zur Vollendung der Europäischen Währungsunion (2011) and co-edited a book on Labor Mobility and the World Economy (with Langhammer, R. 2006). His research interests include trade, growth, education, natural resources and globalization. He advised governments in Europe, Asia, Latin America and Africa.

Manuel Molina Vogelsang holds a Master's Degree in Latin American Studies from the University of Cologne, Germany. In his master's thesis he analysed technology policy in Brazil and Mexico and technological specialisation in foreign trade and international patent applications. In 2009 he joined the department for International Business Development at Fraunhofer Gesellschaft headquarters. Since 2012 he contributed to the project European Union – Mexico Innovation Initiative in the framework of the Agreement for Scientific and Technological Cooperation between the EU and Mexico. Recently, he finished a study on the Fraunhofer's business operation model on behalf of the Korean Research Council for Industrial Science and Technology (ISTK).

Foreword

The dynamic evolution of manufacturing in Asia surpassed the imagination of the skeptics. The tremendous development of the Asian economy has helped millions of Asians out of poverty, but has not yet generated the rate of job growth that gives other Asians a sense of economic and personal security for the future.

Despite this impressive track record, no one has a crystal ball for the smooth navigation of Asian manufacturing in this stormy sea, against a strong headwind. The amazing past and the uncertain future of manufacturing in Asia is how this book began.

The origin of this book goes back to a meeting in Manila in November 2012, when a group of Korea Economic Research Institute (KERI) scholars held engaging discussions with Changyong Rhee, then Chief Economist at the Economics and Research Department of the Asian Development Bank (ADB), to search for ways to sustain the growth momentum of manufacturing in Asia. More specifically, the scholars asked whether Asia as a manufacturing center of the world could be reformed in a way that would make it viable for postcrisis development. They quickly agreed that a new Asian development model must now turn its gaze inward to cater to the demand of a growing middle-class, and that economic cooperation within Asia is indispensable in regaining precrisis vitality and competitiveness for sustainable growth.

To find a new Asian development model that could adapt to the political and economic changes taking place in Asia, ADB and KERI joined together to organize a conference in Seoul on 2 October 2013, to explore promising ideas and proposals to enhance the effectiveness and the depth of the supply chain in Asia. The conference brought together economists, policymakers, business executives and other interested parties. This volume is based on the Seoul conference and co-published by ADB and KERI, and is organized in three parts, which broadly correspond to the thematic sessions of the conference:

- Beyond *Factory Asia*
- Outsourcing Risks of Asian Manufacturing and Services
- Source of Germany's Competitiveness in Manufacturing

Upon completing this project, we would like to extend particular thanks to Wongun Song, Senior Research Fellow and Director of Division of Public Policy Research of KERI, who was instrumental in the inception of the project. Thiam Hee Ng, Senior Economist at ADB and Taekyu Lee, Director of Division of Planning and Coordination at KERI, shared their ideas with us on a number of occasions and their coordinating efforts have been crucial in the making of this volume.

No project of this magnitude can work without research and logistical support, and we would like to thank Eunhae Kim, Research Associate at KERI, for her meticulous work over the course of this project. We would also like to thank Mitzirose Legal, Economics Officer at ADB for her splendid logistical support for the publication of this volume.

Finally, ADB and KERI hope that this book will serve as catalyst for officials, experts and industries to facilitate a larger public dialogue in and out of Asia, and help generate momentum for the transformation of Asia into a more inclusive and sustainable platform for the future of *Factory Asia*.

Choi Byung-il
President
Korea Economic Research Institute

Changyong Rhee
Chief Economist
Asian Development Bank

Executive Summary

The deepening integration of Asia into the global markets has been instrumental in its phenomenal growth. During the past two decades, the world has witnessed the rise of *Factory Asia*. Fueled by cheap and abundant labor, Asia has supplied many of the manufactured consumer goods the world needs, particularly final goods destined for the United States and eurozone economies. This model, i.e., "supply from the East, consume in the West", has driven global economic prosperity to unprecedented heights. Such a pattern has resulted in a win-win situation: Western consumers enjoyed an increase in their purchasing power, and Eastern workers found their incomes rising. The *Factory Asia* model has helped lift millions of Asians out of poverty.

The People's Republic of China (PRC), Japan and the Republic of Korea have been the main drivers of *Factory Asia*. For some time, the PRC has been the main recipient of investment from the Republic of Korea and Japan, with products being assembled in the PRC using key intermediary inputs from the Republic of Korea and Japan. This early pattern of a regional supply chain has further evolved, now with more participating economies, as wages in the PRC rose steadily due to its rapid economic growth. As a result, more and more foreign firms are exiting from the PRC and moving into other Asian countries. Currently, *Factory Asia* maps a vast regional production network with the Republic of Korea and Japan as major outsourcing countries, and the PRC and most South-East Asian economies as assemblers of parts and components into final products.

Recently, questions have been mounting on the sustainability of *Factory Asia*. Since the onset of the global financial crisis, demand from advanced economies has remained subdued. Political pressure to protect Western manufacturers has always been strong, giving rise to various forms of both visible and hidden barriers. Furthermore, the Western public perception of *Factory Asia* has turned sour: *Factory Asia* has been seen as one of the main causes of the financial crisis through its contribution to a global imbalance. Unless Asia effectively addresses these concerns, the future of *Factory Asia* looks nebulous. This book has been initiated to assess the challenges

confronting the *Factory Asia* model and provide suggestions and strategies to effectively handle such challenges.

Finding ways to establish a new *Factory Asia* is not an easy task. The value chain is crucial to understanding economic growth and integration in Asia. Throughout this book, our discussion is directed at examining how countries that are already part of *Factory Asia* can move up the value chain, and how economies that currently stand outside the parameters of *Factory Asia* can find ways to join the global network production system. In an attempt to answer such questions, we assess changes in the regional value chain and the level of current regional integration, and attempt to provide effective strategies for moving up the value chain and expanding regional economic integration.

Countries that currently participate in value chains are losing their competitiveness in the labor-intensive, low-technology manufacturing sector. One way to restore waning competitiveness is to target new and high technologies, and more customer-oriented goods and services. Rising wages and rapid economic growth in Asia have created a growing middle-class in the region, a large market with increasing purchasing power but which remains untapped. With weaker demand from the West, the new *Factory Asia* must nurture new sources of growth within the region. By upgrading its manufacturing sector and developing its service sectors, Asia can cater to the growing demands of its regional customers. Spawning regional economic integration is also an integral part of the new *Factory Asia* strategy.

Chapter 1, "Beyond *Factory Asia*: Fuelling Growth in a Changing World" written by Ramesh Subramaniam and Thiam Hee Ng aims to explore how Asian economies can move beyond *Factory Asia*. Subramaniam and Ng examine several strategic options that Asian economies can pursue to meet these challenges. Options are classified for different country categories. For countries within *Factory Asia*, Subramaniam and Ng propose to move up the value chain and shift from production to knowledge economy,

invest in R&D, education, and improve investment climate. For countries outside *Factory Asia* such as India and the Central Asian economies, they recommend using the large domestic market potential to attract manufacturing investment by improving the investment climate and identify constraints to joining production networks. They emphasize that regional cooperation resulting in trade liberalization is vital to the continued success and evolution of *Factory Asia*. They also provide 12 key issues in moving beyond *Factory Asia* and propose policy recommendations for each issue. Subramaniam and Ng contend that policymakers have to change their mindset and view other developing Asian economies as potential customers. Thus, governments may help manufacturers build connections in fast-growing markets and making regional trade freer should be among the priority government efforts in the region. They argue that Asia needs to enhance cooperation at various levels to maintain its overall competitiveness.

Trade liberalization within the region is supposed to be crucial for the Asian economy to move beyond *Factory Asia*. In Chapter 2 of this book, "Can FTAs Support the Growth or Spread of International Production Networks in Asia?" Jayant Menon examines the effectiveness of Free Trade Agreements (FTA) in Asia. Previous empirical studies have produced mixed results. Menon examines the characteristics of both product fragmentation trade and FTAs in Asia to ascertain possible linkages by employing a qualitative approach. The share of product fragmentation trade based on regional production networks is much higher in East and Southeast Asia than in any other region in the world. Menon finds that most product fragmentation trade takes place within the electronic parts and components sector. Since the Information Technology Agreement (ITA) eliminates tariffs on Information and Communications Technology (ICT) products covered under the agreement, FTAs have little to offer. Various duty-drawback schemes and the location of most multinationals in duty-exempt export processing zones also contribute to the weak linkages between product fragmentation trade and FTAs in Asia. Menon argues that since most FTAs in Asia are relatively shallow

focusing on tariff reductions rather than addressing trade facilitation and other non-tariff barriers that could have a greater impact on promoting production networks, intra-regional FTAs appear to have had little effect on either the growth or spread of production networks. He claims that if FTA preferences were multi-lateralized and other accords offered to all on a "most favoured nation" basis, it would be the best way to support the growth of production networks in current participants and their spread to new ones.

The outsourcing of the manufacturing sector, especially of the labor-intensive sector might incur negative effects such as an increase in unemployment and stagnant SMEs. Thus, the effects of outsourcing on jobs and SMEs should be scrutinized and measures should be provided for job growth and development of SMEs in the Republic of Korea. Chapter 3, "The Effect of International Outsourcing on Job Growth in the Republic of Korea" written by Namsuk Choi investigates the effect of international outsourcing on employment in manufacturing in the Republic of Korea. Using the joint OECD-WTO statistics on trade in value added and Korean firm-level employment data, Choi shows that international outsourcing has negative and statistically significant effects on job growth in the Korean manufacturing sector. But he also shows the differences of employment effects between labor-intensive industries and high-technology industries in the Republic of Korea. An increase of foreign value added content share of gross exports in the labor-intensive industries by 1% decreases firm employment level by 0.27% while it increases 0.31% in the high-technology industries. Overall the effect of international outsourcing on job growth in the manufacturing sector decreases firm employment by 0.13%, implying the net displacement effects in the labor-intensive industries dominate the net productivity effects in the high-technology industries. In addition Choi finds that Korean firms' increasing participation in global value chains throughout the Association of Southeast Asian Nations (ASEAN) has a positive and significant impact on increasing firm-level employment. In particular, the positive effect of value added exports and imports of the Republic of Korea with ASEAN associated with declining international

outsourcing costs on firm-level employment in the technology intensive industries is positive and statistically significant over the past 10 years. The empirical evidence of Choi's work suggests that the interdependence between job growth in the Republic of Korea and its position on the value chain in Asia is recently increasing and it is quite plausible that Korean firms continually expand outsourcing in *Factory Asia* to improve its global competitiveness in the manufacturing sector.

Chapter 4, "Do Small and Medium sized Enterprises Gain from Global Production Networks?: Evidence from the Republic of Korea" written by Hea-Jung Hyun explores the impact of global production sharing on performance of SMEs. Using unique Korean firm-level data during 2006–2009, Hyun investigates the impact of SMEs' participation in global production networks on company performance. The empirical results of this work suggest three main findings: First, Hyun shows that the relocation of production abroad may positively affect SMEs' productivity.

Second, SMEs are positively influenced by offshoring to ASEAN nations and negatively affected by offshoring to Japan. Thus, Korean firms seem to gain from lower variable costs of production to ASEAN, not from technology sourcing to Japan. Hyun also shows that arm's-length transaction through foreign suppliers has a positive effect on SMEs' productivity, while foreign insourcing through cross border vertical integration does not have a significant impact. The results of this work indicate that Korean SMEs benefit from international outsourcing and the gains from offshoring may depend on the choice of location and organizational form. Since ASEAN nations are rapidly participating in regional production networks through vertical specialization in manufacturing, Korean SMEs seem to gain from 'thick input market' where firms' ability to search for business partners increase in these areas by contracting out external subcontractors. The results of Hyun's analysis suggest that the strategic use of production networks in Asia to take advantage of lower transaction costs will be beneficial to SMEs in the Republic of Korea.

Chapter 5, "Changing Competitiveness of the Japanese Manufacturing Sector and Firms in Regional Production Networks in Asia" written by Shujiro Urata attempts to examine the competitiveness of the Japanese manufacturing sector. Urata examines Japanese foreign trade relationships with Asian economies and Japanese firms' activities in Asia by focusing on intermediate goods. Urata reveals that Japan still has a comparative advantage in the production of high-quality and high-value intermediate goods even though the Japanese manufacturing sector has been losing competitiveness compared with its competitors in the PRC, the Republic of Korea, and other Asian economies. Asian operations of Japanese firms have been profitable and a large portion of profits are recycled back to Japan, part of which is used for R&D activities in Japan. Urata asks if Japan can continue to expand and improve the quality of skilled workers and researchers and remain an important country in manufacturing and services. The role of the Japanese government for the Japanese manufacturing sector to remain competitive is proposed. Urata argues that the Japanese government can contribute significantly to maintaining the competitiveness of the Japanese manufacturing sector by pushing the establishment of region-wide FTAs including the Regional Comprehensive Economic Partnership (RCEP) and the Trans-Pacific Partnership (TPP). These regional frameworks could provide a business friendly environment characterized as free, open, transparent, and stable business environment that would benefit Japanese firms to run efficient and profitable business operations.

Chapter 6, "Services Sector Integration in Asia: Emerging Regional Service Business Models" written by Shintaro Hamanaka focuses on the integration of service sectors in Asia. Services industries in ASEAN are experiencing a dynamic evolution because of regional agreements that intend to transform the economic activities in the region. Hamanaka attempts to examine emerging service business models at the regional level, with a special reference to regional service integration agreements. The emerging service business models are that foreign companies may establish only one commercial presence in a gateway country and supply the services

in the entire region using it. This work analyzes the activities of Japanese service corporations in Asia. Hamanaka shows that Japanese service corporations' activities in ASEAN follow a new trend defined by emerging service business models. Japanese service corporations recently concentrate its foreign direct investments (FDI) into Singapore and attempt to supply services to the entire ASEAN region using the commercial presence in Singapore. Hamanaka argues that Japanese corporations contribute to ASEAN services market integration. Specifically, intra-ASEAN services such as logistics services in the region provided by Japanese corporations become feasible partly because of the regional integration agreement at the ASEAN level. Hamanaka reveals that new regional business models are emerging because of the regional agreement at the ASEAN and ASEAN-Japan level.

Among the advanced nations in the world, Germany is the only one that sustains its strong competitive manufacturing sector, and is the world champion in merchandise exports. Finding the factors that help Germany maintain its competitiveness in manufacturing can provide insights to Asian economies that continue to lose competitiveness in their manufacturing sectors, especially in terms of the ability to create jobs. Chapter 7, "What has been Maintaining Germany's Competitiveness in Manufacturing?" written by Federico Foders and Manuel Molina Vogelsang provides the determinants of the German economy's outperforming other European nations. Foders and Vogelsang attempt to empirically analyze the trade and technology specialization and the price or cost performance of the German economy over the past decades complemented with data on R&D expenditures to identify the leading product groups in which German industry is specialized. They also estimate the degree of vertical specialization characterizing the German export sector to determine the role that global value chains play in strengthening Germany's competitiveness in manufacturing. Various indicators Foders and Vogelsang estimate show that Germany's manufacturing sector is particularly strong in the field of middle-range technologies such as steel, chemical, and mechanical industries. They also show that the key determinant of

Germany's competitiveness in manufacturing is product quality and the quality of German products is characterized by relatively high research intensity and is closely related to R&D effort and industrial design and patenting activity. Foders and Vogelsang draw the following implications from the empirical results that Germany's future performance will be influenced by current and future challenges and its ability to respond to them by adjusting its R&D, industrial design, and patenting activity. And the fact that Germany has the lowest share of researchers working in the private sector will pose a problem of sustainability in the future.

In a nutshell, the success of the new *Factory Asia* hinges on two tasks: first, how fast can Asia expand its own domestic and regional markets; and second, how fast can Asia upgrade its competitiveness in the manufacturing sector. As analyzed in great detail and depth in this book, small and big obstacles stand in the way of fulfilling these tasks. Without clever economic reasoning, shrewd strategy, and immense political entrepreneurship, the new *Factory Asia* will remain as an unfinished agenda on the desk of the Asian planner.

Abbreviations

2SLS	two stage least squares
ADB	Asian Development Bank
ADBI	Asian Development Bank Institute
AFAS	ASEAN Framework Agreement on Services
APEC	Asia-Pacific Economic Cooperation
APTA	Asia-Pacific Trade Agreement
ARIC	Asia Regional Integration Center
ASEAN	Association of Southeast Asian Nations
ATT	average treatment effect
BEC	broad economic categories
BERD	business expenditures on R&D
BIT	bilateral investment treaty
BPCB	bare printed circuit board
BTA	bilateral trade agreement
CEPA	Comprehensive Economic Partnership Agreement
CPC	Central Product Classification
DO	domestic outsourcing
DVI	domestic vertical integration
EC	European Commission
EPA	Economic Partnership Agreement
EPO	European Patent Office
EPZ	export processing zone
EU	European Union
FDI	foreign direct investment
FI	foreign insourcing
FO	foreign outsourcing
FTA	free trade agreement
FTZ	free trade zone
GATS	General Agreement on Trade in Services
GDP	gross domestic product
GERD	gross domestic expenditure on R&D
GPN	global production network
GVC	global value chains
HEI	higher education institution
HQ	high quality

HS	Harmonized System
HT	high-technology
IfM	Institut für Mittelstandsforschung
IMF	International Monetary Fund
IPC	International Patent Classification
ITA	Information Technology Agreement
JBIC	Japan Bank for International Cooperation
JEL	Journal of Economic Literature
JETRO	Japan External Trade Organization
JIT	just-in-time
JPEPA	Japan-Philippines Economic Partnership Agreement
JPO	Japan Patent Office
JSEPA	Japan-Singapore Economic Partnership Agreement
JTEPA	Japan-Thailand Economic Partnership Agreement
KERI	Korea Economic Research Institute
KfW	Kreditanstalt für Wiederaufbau
KIEP	Korea Institute for International Economic Policy
KIS	Korea Information Service
KORUS	US-Korea Free Trade Agreement
KOSDAQ	Korean Securities Dealers Automated Quotations
KOSPI	Korea Composite Stock Price Index
KSIC	Korean Standard Industrial Classification
LE	large enterprise
LT	low technology
METI	Ministry of Economy, Trade and Industry
MFN	most-favored-nation
MKE	Ministry of Knowledge Economy
MNC	multinational corporation
MT	medium-technology
NAFTA	North American Free Trade Agreement
NIE	newly industrialized economy
NTB	non-tariff barrier
NTM	non-tariff measure
OECD	Organisation for Economic Co-operation and Development
OLS	ordinary least squares

PCBA	printed circuit board assembly
PCT	Patent Cooperation Treaty
PP	primary product
PTA	plurilateral free trade agreement
R&D	research and development
RB	resource-based
RCA	revealed comparative advantage
RCEP	Regional Comprehensive Economic Partnership
REER	real effective exchange rate
RLA	revealed scientific literature advantage
ROH	regional operating headquarter
ROO	rules of origin
RPA	revealed patent advantage
RTA	regional trade arrangement
RXA	relative export advantage
SITC	Standard International Trade Classification
SME	small and medium-sized enterprise
STAN	Structural Analysis Statistics
TFP	total factor productivity
TiVA	Trade in Value Added initiative
TPP	Trans-Pacific Partnership
UNCTAD	United Nations Conference on Trade and Development
UNESCAP	United Nations Social and Economic Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
USD	US dollar
USPTO	United States Patent and Trademark Office
UV	unit value
VS	vertical specialization
WIPO	World Intellectual Property Organization
WoS	Web of Science
WTO	World Trade Organization

Part I

Beyond *Factory Asia*

Chapter 1

Beyond *Factory Asia*: Fuelling Growth in a Changing World

Ramesh Subramaniam and Thiam Hee Ng*

Asian Development Bank

Abstract

Factory Asia—these two simple words help define Asia's phenomenal economic growth over the past two decades. A growing population eager to earn more provided relatively cheap and abundant labor in the last decade of the 20th century and the early part of the current century, producing many of the manufactured consumer goods the world needed. East Asia's exports surged, particularly final goods destined for the United States (US) and eurozone economies. The array of goods produced and traded evolved rapidly—from agricultural to (low-value) manufacturing, and in a few cases, into services.

However, the global financial crisis and uncertain growth prospects in the United States and the eurozone have dampened demand for Asian exports. At the same time, rising wages threaten to erode the cost advantage that the region once had, managing supply chains has become more complex, and new technologies are transforming manufacturing.

This chapter aims to explore how Asian economies can move beyond *Factory Asia*. It will examine the strategies that Asian economies can pursue to meet these challenges. The chapter concludes by discussing a range of policy, institutional, legal, and regulatory issues relating to reforms that will drive Asia's economic and social transformation in its quest for a new *Factory Asia* model.

Keywords: production network; Asian manufacturing; manufacturing policy
JEL Classification: F20; O14

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* Ramesh Subramaniam is Deputy Director General, Southeast Asia Regional Department and Thiam Hee Ng is Senior Economist, Office of Regional Economic Integration at the Asian Development Bank. We would like to thank Mitzirose Legal and Carol Ongchangco at the Asian Development Bank for their valuable research assistance. The chapter has also benefited from comments and suggestions from many Asian Development Bank colleagues. All errors remain ours.

1. Introduction

Asia has shown tremendous dynamism over the past five decades, despite wide intraregional diversity. Most of the enviable economic growth has been driven by a relentless focus on exports. In several Asian economies, success in export-led manufacturing took gross domestic product (GDP) per capita to the levels of developed countries. Asia's transformation has run through five phases:[1]

1. Japan's ascent in the 1960s, which helped its rapid recovery from postwar destruction.
2. Export driven growth initiated in the 1970s by the original Asian Tigers—Hong Kong, China; the Republic of Korea; Singapore; and Taipei,China.
3. A cooperative approach to development pioneered in the 1980s by the Association of Southeast Asian Nations (ASEAN).
4. Economic liberalization in the People's Republic of China (PRC) beginning in the late 1980s, aided by the rapid development of production networks, creating the moniker *Factory Asia*.
5. Early reforms in the 1990s gave credence to India's large growth potential, which began to bear fruit in the 2000s.

Throughout these five phases, there was a remarkable transformation in global manufacturing, characterized by the rapid rise of manufacturing in Asia. Baldwin and Lopez-Gonzalez (2013) showed that in 1970, the United States (US), Germany, and Japan dominated the sector globally, accounting for 52% of total value added in manufacturing. But from 1970 to 2010, the Group of 7 lost 24 percentage points in world share (from 70% to 46%), with 18 of those 24 points lost since 1990.[2] The big winner was the PRC, whose share rose 18 percentage points between 1970 and 2010—with 16 of those percentage points coming since 1990. Six other developing nations—including four from Asia (India, Indonesia, the Republic of Korea, and Thailand)[3]—saw each of their shares rise by more than 0.5 percentage point of the global total. Together, these 'six risers' gained seven percentage points of global manufacturing, with five of these happening since 1990.

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1. This typology is drawn from Gyohten (2006).
2. The Group of 7 includes Canada, France, Germany, Italy, Japan, the United Kingdom, and the US.
3. The other developing nations were Poland and Turkey.

Building on this success, Asia is now poised for a possible "Asian Century". Given its current growth trajectory, by 2050 Asia can expect to attain living standards comparable to that of Europe today. Furthermore, its share of the global economy could swell to more than half. However, the Asian Development Bank (2011) noted that Asia's continued ascent is not "pre-ordained". Indeed, Asia must grapple with many issues, not the least of which are regional and global economic crises.

The impact of the 1997 Asian financial crisis lingers, and the aftermath of the 2008 global financial crisis—with the sluggish US recovery and eurozone financial or fiscal restructuring—will be felt for years to come. While Asia has thus far proven its resilience, and its share of the global economy and wealth continue to rise, it may be time for the region to enter a new development phase. The continued weak economic prospects in advanced economies' necessitate a rethinking of the *Factory Asia* model—as traditional demand will likely remain weak. Also, Asian economies face rising labor and factor costs, which gradually erode their price advantage. New technologies and processes could potentially transform manufacturing and leave developing countries at a disadvantage.

Factory Asia refers to the model of regional production networks connecting factories in different Asian economies; producing parts and components that are then assembled, with the final product shipped mainly to advanced economies (see Ando and Kimura 2005). These networks form part of regional and global value chains. While production networks are an important part of manufacturing in Asia, they have generally been confined to East Asia. Physical proximity, ease of trade—and many other factors—shape production networks (see Johnson and Noguera 2012). There are countries with large or emerging manufacturing sectors outside these production networks. Their manufacturing output is primarily aimed at domestic markets, while some countries have been successful in finding a niche in exporting intermediate or final goods directly. The main premise in this monograph is that developing Asia can build on the success of the *Factory Asia* model, and significantly strengthen manufacturing in general.

This chapter aims to summarize some recent developments and issues, and pose several strategic questions about the future of *Factory Asia*. The focus will be on how *Factory Asia* will have to evolve to meet the coming challenges. Section 2 provides an overview of Asian manufacturing, analyzing key trends in production and trade across all economies

(both in- and outside *Factory Asia*). Section 3 analyzes the key issues and challenges facing *Factory Asia*. Section 4 offers strategic options for *Factory Asia* economies and those on the periphery, providing specific policy recommendations to address major challenges. It also examines several issues relevant to advanced economies and Section 5 provides the concluding remarks.

2. Asian Manufacturing and Global Production Networks

Manufacturing will remain an important contributor to wealth in Asia in the near future. What is special about the sector is that its productivity growth generally tends to be higher than other sectors. Most fast-growing Asian economies have benefited from shifting labor from low productivity agriculture to higher productivity manufacturing. Yet, as the region becomes richer, manufacturing's share may tend to decline as consumption patterns shift more toward services. Nevertheless, manufacturing's role extends beyond its contribution to GDP—it drives productivity growth and innovation. By its very nature, manufacturing combines assorted intermediate inputs to produce a final product. Hence, it has strong spillover effects on other parts of the economy.

Hausmann et al. (2011) have shown that richer countries tend to manufacture "sophisticated" goods that few other countries produce. This is because they have accumulated knowledge and capabilities that other countries lack. This accumulated knowledge can be leveraged into related areas and achieve higher incomes. *Factory Asia's* value chain fragmentation allowed the region's economies easier entry into producing more sophisticated manufactures.

Baldwin and Lopez-Gonzalez (2013) argue that the production networks that have been the bedrock of *Factory Asia* will proliferate further, offering a way for less-developed countries to move into manufacturing. While unable to build entire networks from scratch, by participating in production network these countries can bypass several critical skill-sets—such as design, engineering, procurement, and distribution can gain a toehold in manufacturing. This lowers the requirement for joining a value chain, thus allowing countries to more easily gain a foothold in manufacturing.

Asian economies are increasingly important in global manufacturing as measured by value added (Table 1). The rise of the PRC and the Republic of Korea was aided by the growing importance of production networks. The same applies to Indonesia as well to a considerable extent. However, India has also shown impressive gains in manufacturing—which has focused more on serving its relatively large domestic markets. The increasing importance of Asian manufacturing can also be seen in the rankings of the top manufacturing exporters (Table 2). In 2011, the PRC edged out both the US and Germany to become the top global manufacturing exporter. Similarly, the Republic of Korea has moved from outside the top 10 to rank 5th. Hong Kong, China and Singapore are also among the top 15 manufacturing exporters; but as major shipping hubs, they handle large amounts of trade for their neighbors.

Table 1: Country Ranking by Manufacturing Nominal Gross Value Added

Rank	1980	1990	2000	2011
1	United States	United States	United States	PRC
2	Japan	Japan	Japan	United States
3	Germany	Germany	PRC	Japan
4	PRC	Italy	Germany	Germany
5	France	France	United Kingdom	Italy
6	Italy	United Kingdom	Italy	Republic of Korea
7	United Kingdom	PRC	France	Brazil
8	Brazil	Russian Federation	Republic of Korea	Russian Federation
9	Spain	Spain	Mexico	France
10	Mexico	Brazil	Canada	India
11	Canada	Canada	Brazil	United Kingdom
12	Australia	Republic of Korea	Spain	Mexico
13	Netherlands	Mexico	India	Indonesia
14	India	Turkey	Turkey	Spain
15	Switzerland	India	Russian Federation	Canada

PRC = People's Republic of China.
Note: The PRC data for 1980, 1990 and 2000 refers to "Mining, Manufacturing and Utilities". The former Soviet Union is not included in the rankings.
Source: UN National Accounts Main Aggregate Database.

Table 2: Country Ranking by Value of Manufacturing Exports

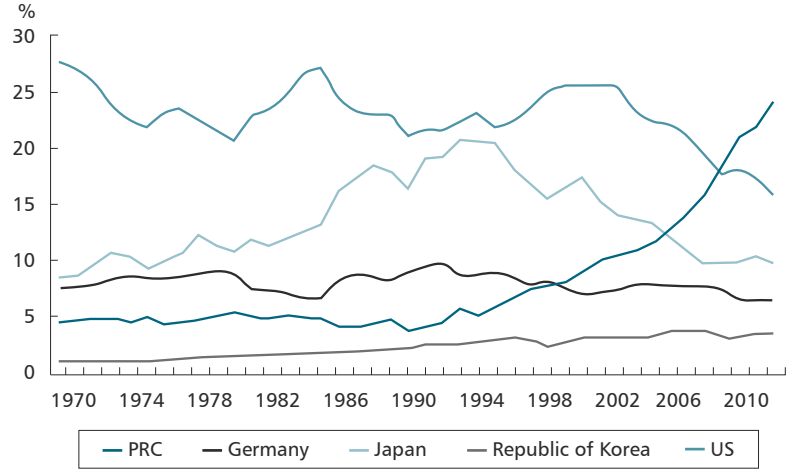
	1998	2000	2011
China, People's Rep. of	7	5	1
Germany	2	2	2
United States	1	1	3
Japan	3	3	4
Korea, Rep. of	12	10	5
France	4	4	6
Italy	6	7	7
Netherlands	11	12	8
Hong Kong, China	9	9	9
Belgium	10	11	10
United Kingdom	5	6	11
Singapore	14	14	12
Canada	8	8	13
Mexico	13	13	14
Spain	15	15	15

Note : Data for Belgium in 1998 refers to Belgium-Luxembourg.
Source: UN Comtrade.

The rise of Asian manufacturing is also evident in the increased share of value added in global manufacturing (Figures 1, 2). The most spectacular rise has been in the PRC, which overtook Germany, Japan, and then the US to top the list. While impressive, other Asian countries have also been grabbing a larger share of the global manufacturing pie. The shift toward Asia both reflects the role of manufacturing as a driver of growth and the move of industries from developed economies to Asia. Most economies in the region continue to industrialize, while many developed economies have seen their manufacturing sectors shrink (Figures 3, 4).

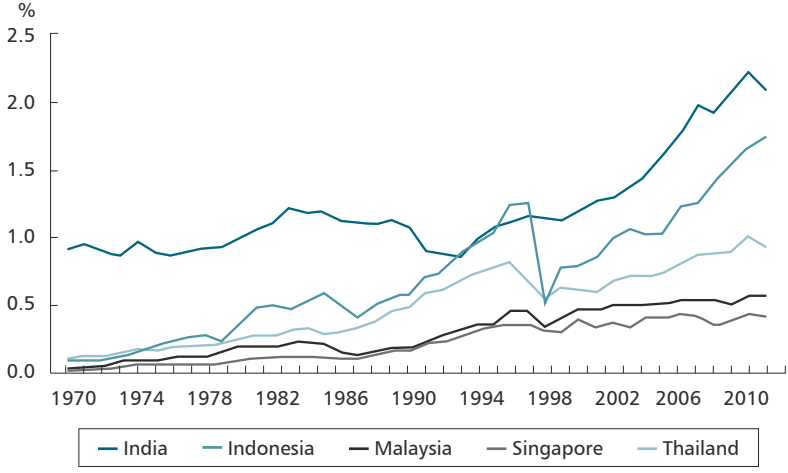
The region has rapidly become a production base for many global firms. Much manufacturing moved to Asia in search of lower production costs. Over time, they have also become more competitive—and in more technologically advanced industries. Well-known, large emerging Asian brands such as Acer, Lenovo, Huawei, Hyundai, Infosys, Samsung, Tata and scores of others are now challenging the dominance of those previously well-entrenched—from the US, Europe, and Japan.

Figure 1: Manufacturing Value Added as Share of Global Value Added—Selected Advanced and Asian Economies



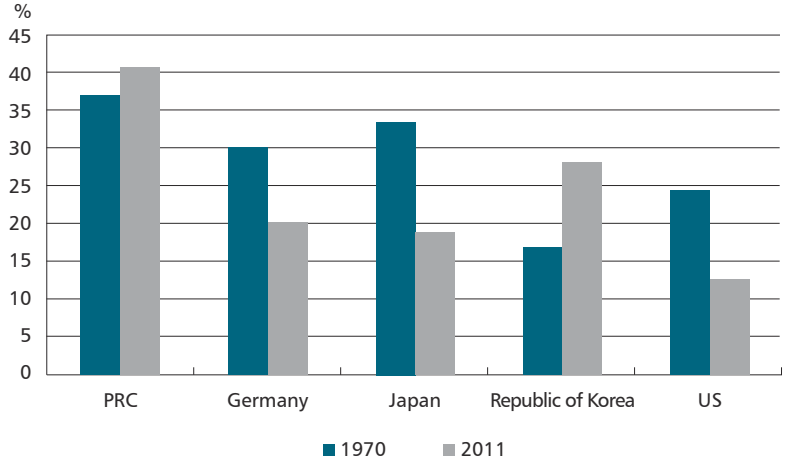
PRC = People's Republic of China, US = United States.
Source: ADB calculations using data from UN National Accounts Main Aggregate Database.

Figure 2: Manufacturing Value Added as Share of Global Value Added—Selected Asian Economies



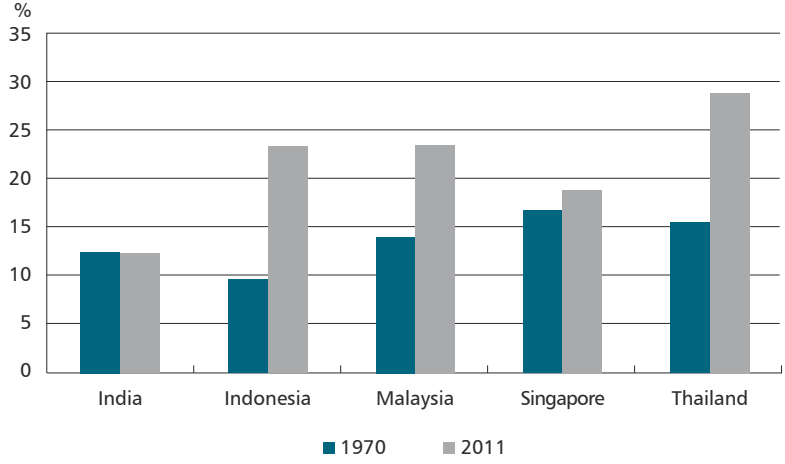
Source: ADB calculations using data from UN National Accounts Main Aggregate Database.

Figure 3: Manufacturing Value Added as Share of GDP for Selected Economies



PRC = People's Republic of China, GDP = gross domestic product, US = United States.
Source: ADB calculations using data from UN National Accounts Main Aggregate Database.

Figure 4: Manufacturing Value Added as Share of GDP for Asian Economies



Source: ADB calculations using data from UN National Accounts Main Aggregate Database.

One way to illustrate the manufacturing dynamism in Asia is to examine the evolving pattern of manufacturing trade balances in the region. Following McKinsey Global Institute (2012), we divide manufacturing output into five different categories (Table 3). The types of products produced under the *Factory Asia* model are more likely, but not exclusively, to fall under the last two categories—global technologies/innovations and labor intensive tradables.

Table 3: Categories of Manufacturing

Sector	Key Traits	Examples of Industries
Global Innovation for Local Markets	• High research and development (R&D) intensity; with competition driven by innovation and quality • High trade intensity, but assembly and production can be regionalized • Geared towards serving customers located near factories	• Chemicals and pharmaceuticals • Transport equipment, including automotive • Machinery, electrical appliances
Regional Processing	• High local content requirement, and located near sources of raw materials and final demand • Highly complex and costly logistics • Low tradability • Automated production, with little R&D	• Rubber and plastics • Fabricated metals • Food and beverages • Printing and publishing
Energy/ Resource Intensive Commodities	• Intermediate inputs to other sectors; low tradability • Price competition with little product differentiation	• Wood products • Paper and pulp • Basic metals • Minerals-based products • Refined petroleum, coke and nuclear products
Global Technologies/ Innovators	• High R&D intensity, with competition driven by it • Highly tradable, with very high value to weight ratio which makes it economical for the products to be manufactured far from the source of final demand	• Computers and office machinery • Semiconductors and electronics • Medical, optical and other precision equipment
Labor Intensive Tradables	• High exposure to price competition • Highly labor intensive • Globally traded, with low proximity needs for production	• Textiles, apparel, leather • Furniture, jewelry, toys and other manufactured goods

Source: McKinsey Global Institute (2012).

Data are available on value added in the five manufacturing categories for the PRC, India, Indonesia, Japan, and the Republic of Korea (Table 4). While there are some variations within countries over time, there is considerable variation across countries. Japan continues as a pioneer in globally innovative products manufactured locally (for example, automobiles). More recently, the Republic of Korea has excelled as a leader in global technology, holding the largest share among the five countries for this category. The PRC leads in energy intensive manufacturing, followed by global innovation for local markets. While Indonesia holds the largest share in labor intensive products, during 2001–2010 it also positioned itself as a manufacturer of globally innovative products and regionally processed goods. It has also sharply reduced production of energy intensive commodities. India's manufacturing has shifted toward global innovation for local markets and away from labor intensive tradables.

Table 4: Sector Share of Total Manufacturing Value Added (%)

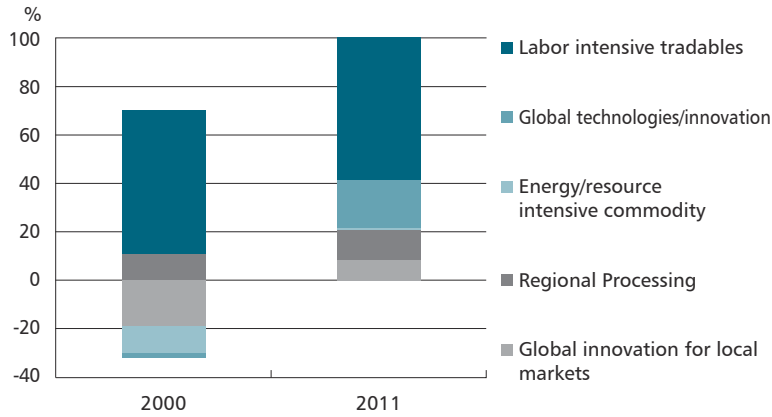
Sector	PRC		India		Indonesia		Japan		Republic of Korea	
	2000	2010	2004	2010	2001	2010	2002	2009	2001	2011
Global innovation for local markets	25.5	29.6	35.5	36.7	28.0	36.0	42.8	41.2	36.3	38.5
Regional Processing	15.5	14.8	17.5	17.7	30.7	35.4	26.9	29.3	18.9	15.4
Energy/ intensive commodities	46.1	43.6	32.5	32.7	23.4	14.3	14.5	13.0	16.0	15.8
Global technologies/ innovators	5.6	4.8	3.8	3.2	3.6	2.6	10.7	11.8	19.0	25.5
Labor intensive tradables	7.2	7.2	10.8	9.7	14.4	11.7	5.0	4.7	9.4	4.8

PRC = People's Republic of China.
Source: ADB calculations using data from national sources and Industrial Statistics Database 2012, United Nations Industrial Development Organization.

The changing production structure is also reflected in a country's manufacturing trade balance (Figures 5–9). The five countries examined show that a rising trade surplus in any particular category indicates improved competitiveness in the corresponding manufacturing category.

For the PRC, there is a considerable shift in composition of the trade balance between 2000 and 2011 (see Figure 5).[4] While labor intensive tradables remain important, there has been a huge rise in the share of global technologies and innovation, evident through the increasing importance of electronics. The PRC now has a trade surplus in global innovation for local markets—as it boosts production in machinery and transport equipment. It is interesting that, while the PRC has moved up the value chain into more technologically advanced products, it nonetheless remains competitive in relatively low-technology labor intensive tradables.

Figure 5: Manufacturing Trade Balance—People's Republic of China

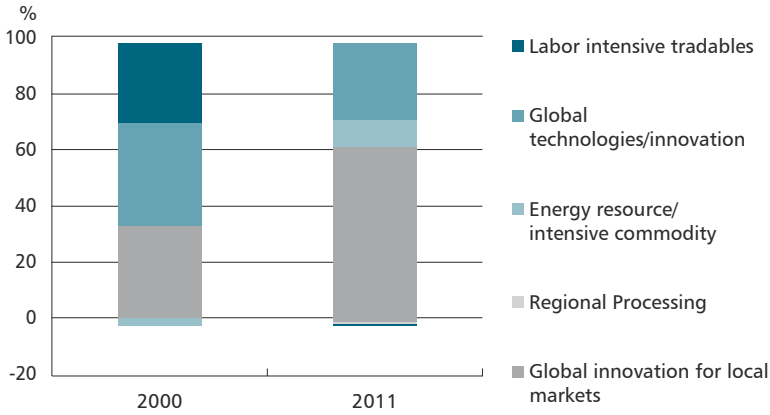


Source: ADB calculations using data from UN Comtrade.

For the Republic of Korea, the change in the pattern of manufactured exports has been equally dramatic (see Figure 6). From having a large trade surplus in labor intensive tradables, it now has a slight deficit. This is not surprising as higher wages made labor intensive industries less competitive. Instead, the country has made the transition into more technologically advanced products. It has greatly increased its trade surplus in global innovation for local markets given the large gains made (mainly) in automobile manufacturing. It also sustained its large surplus in global technologies and innovation as it retained its lead in electronics.

4. Athukorala (2011) maps out the evolution of manufactured trade in several countries, including the PRC, and its rapidly evolving role in parts and components trade.

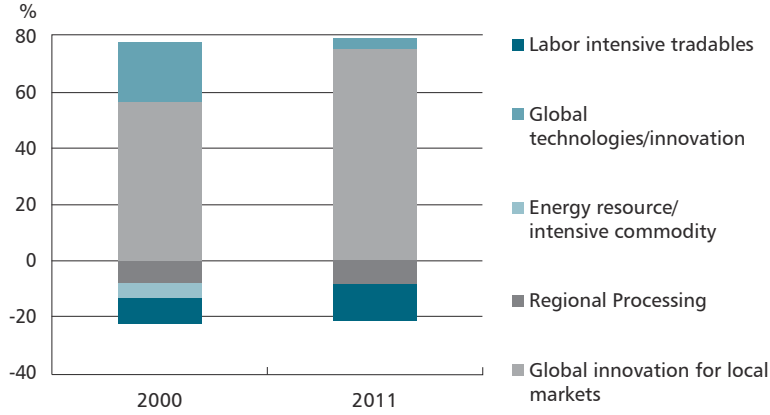
Figure 6: Manufacturing Trade Balance—Republic of Korea



Source: ADB calculations using data from UN Comtrade.

As an advanced industrialized country, Japan has shown few shifts in the structure of industrial production (see Figure 7). Nevertheless, there is some impact of *Factory Asia's* rise on Japanese manufacturing. In 2000, there was a large trade surplus in global technologies and innovation. However, as much electronics production migrated abroad, the trade surplus in those sectors dropped considerably. Japan still maintains competitiveness in machinery and automobile manufacturing, seen in the larger surplus for the "global innovation for local markets" category.

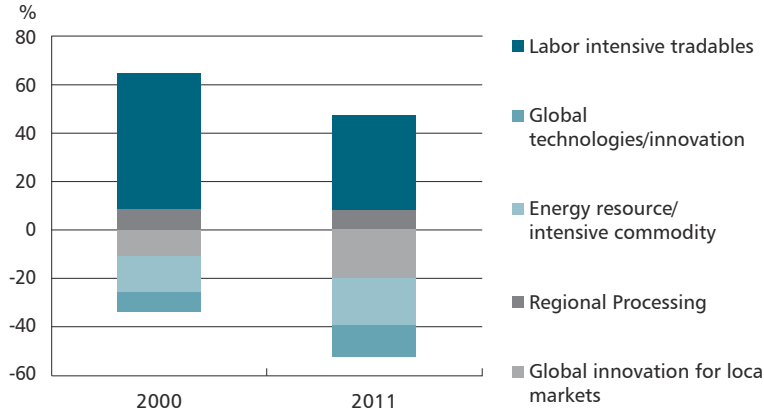
Figure 7: Manufacturing Trade Balance—Japan



Source: ADB calculations using data from UN Comtrade.

In contrast with the other countries, manufacturing in India is more inward oriented and caters more to domestic demand (see Figure 8). While the PRC, Japan and the Republic of Korea hold large trade surpluses in manufactures, India has a small deficit. There has been little change in the composition of these trade patterns. India continues to hold a surplus in labor intensive tradables, reflecting its low labor costs. This may indicate significant potential for the country should it reorient its trade strategy in the future.

Figure 8: Manufacturing Trade Balance—India

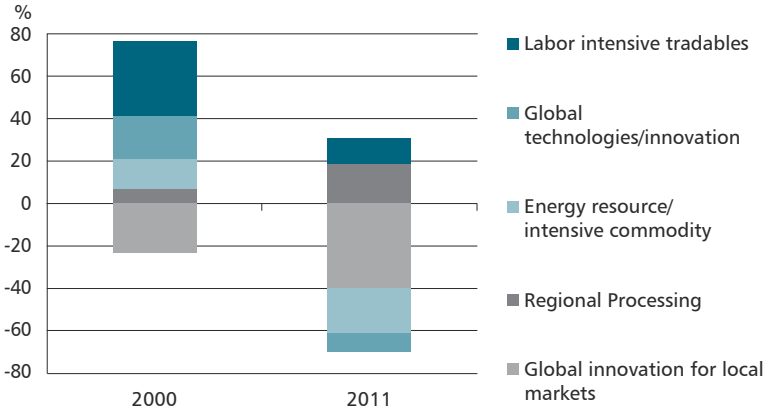


Source: ADB calculations using data from UN Comtrade.

Another domestic-oriented manufacturer is Indonesia (see Figure 9). It had an overall trade surplus in manufactured exports in 2000. However, it now holds a deficit as the economy relies more heavily on commodity exports. Also, the trade deficit likely reflects rapid economic growth, which increased imports of capital goods. Similar to India, Indonesia continues to hold a trade surplus in labor intensive tradables and regional processing.

In sum, it appears that the PRC and the Republic of Korea managed to gain strong and niche positions in the global production networks for high-tech products. However, economies such as India and Indonesia have not shown much of a shift toward more high-end goods. While the spread of global production networks has drawn in new participants in *Factory Asia*, this does not guarantee that countries can easily make the shift into manufacturing sophisticated products.

Figure 9: Manufacturing Trade Balance—Indonesia



Source: ADB calculations using data from UN Comtrade.

Given the potential of global production networks to jumpstart manufacturing in developing economies, several important questions face Asian policy makers. Should nations strive to set up their own international production networks? Which supply chains should they join? What role can government and policy play in helping promote entry into a global production network? What is the optimal technology policy a country should pursue to facilitate knowledge transfer? How important is the size of the domestic market in attracting foreign direct investment? Can smaller nations mimic what the PRC has done in developing manufacturing?

3. Issues and Challenges in Moving Beyond *Factory Asia*

Asia has thrived under the *Factory Asia* growth model. However, with changing global trends, the future of manufacturing could look quite different from what it is today. Asia faces a number of issues if it is to transform manufacturing. These can be viewed as challenges as well as opportunities.

The key issues the region is expected to face fall under three main categories (Table 5). The first includes issues that may affect the demand for *Factory Asia's* products. In particular, the protracted slower growth in advanced economies following the global financial crisis means demand for *Factory Asia's* output will likely shift to developing markets. In the second category, issues with implications on the cost structure of *Factory Asia* are examined. Technological changes that affect manufacturing production are

discussed under the last category. For each issue, a subjective assessment is given of the impact on manufacturing and probability of its likelihood.

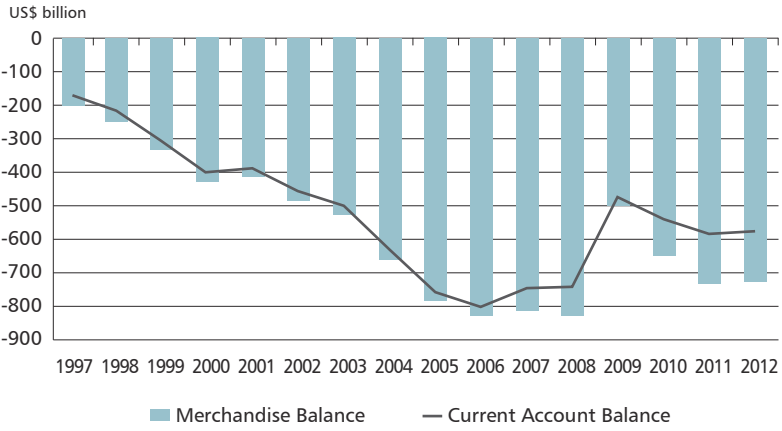
Table 5: Trends and Issues Facing *Factory Asia*

Trends	Issues	Impact	Probability
I. Changing global economic landscape and evolving consumer tastes will affect demand for *Factory Asia's* products.	1. Weaker growth in advanced countries will see demand shifting away from developed markets to emerging economies.	High	High
	2. *Factory Asia* will have to learn to cater to the demand of the growing middle-class consumers in the region.	High	High
	3. Asia's manufacturers need to build strong brand identity to compete globally.	Low to High	High
	4. Weak economic growth and high unemployment may give rise to protectionist tendencies in advanced economies.	Low	Low
II. Rising production costs means that *Factory Asia's* traditional cost advantage is gradually eroding.	5. Long and complex supply chains are becoming more vulnerable to natural disaster and reputational risks.	Medium	Medium
	6. Wages in Asia have been rising faster than developed countries narrowing the cost differential.	Medium	High
	7. Exchange rates have become more volatile making it harder to manage production networks across several countries.	Medium	High
	8. Shortage of skilled workers could hamper the region's move to producing more sophisticated products.	High	High
	9. Changing demographics in some countries will result in a smaller pool of labor.	High	High
	10. Production has been shifting from high-cost countries to lower-cost countries.	High	High
III. New technologies are changing the nature of manufacturing.	11. Software is becoming more important in manufactured products and taking a greater share of the value.	Medium	High
	12. Advances in robotics and additive manufacturing technologies could herald a new era in manufacturing.	Medium	High

Once again, the analysis must be understood in the context of Asia's vast diversity. Countries are at different levels of development. Some manufacture goods at the frontier of technology, while others are simply trying to gain a foothold in global production networks. Hence, the key issues referred to below may not apply similarly to all countries. However, the issues covered are relevant to most countries in the region, including those that have not yet adopted the *Factory Asia* model.

Issue No. 1: Economic Prospects after the Global Financial Crisis. One key issue is the slow recovery and continued weak outlook in advanced economies after the 2007/08 global economic crisis. For now, most Asian economies run trade surpluses with the US and Europe. This is possible because the US economy was able to grow despite large trade deficits. However, continued weak economic conditions and high fiscal deficits limit its ability to run large trade deficits in the future (Figure 10). Similarly, the eurozone continues to struggle to move out of recession and economic prospects remaining weak there.

Figure 10: US Current Account and Merchandise Trade Balance



US = United States.
Source: Haver Analytics.

Furthermore, over the medium-term, an ageing population in many advanced economies will also signal significant changes in consumption patterns, resulting in lower demand for manufactured products and greater demand for health and medical services. In addition, the rise of *Factory Asia* was accompanied by falling trade barriers—both worldwide and regionally—cheaper transportation costs, improved capital mobility, and far more efficient communication. While some of these advantages will remain and perhaps deepen, others may not, leaving the export-led model of *Factory Asia* facing future headwinds. Asia will have to adapt and take advantage of these changing global trends if it is to reinvent itself.

So, who will buy the products Asian factories are churning out? Asia's income growth will likely continue to outpace that of the developed world in the coming decades. As part of rebalancing the sources of growth, the

shift away from exports toward greater domestic demand will intensify. This could redirect some current exports. But this implies some countries will likely run smaller surpluses or even deficits as demand grows for other countries' exports.

Issue No. 2: Asia's Expanding Middle Class. The rising middle class in Asia could help sustain *Factory Asia's* output. Between 1990 and 2009, the share of middle class population rose 38 percentage points, more than doubling from 21% to 59% (Figures 11a, 11b). In absolute terms it has risen more than three-fold over the same period—from 563 million to 2 billion. The demand for consumer durables will continue to grow rapidly. Car ownership in the PRC and India has sharply increased with the PRC now topping the US as the world's largest automobile market, with annual sales of nearly 12 million, up from just 1 million in 1992 and 2 million in 2000.

Issue No. 3: Quality and Branding. Firms in Asia thus far have competed mostly on price. However, to sustain and continue growing in the future they will need stronger brand identities. The impact is likely to be minimal for low-value products, where branding and quality is less important. However, for medium- to high-value products (for example, consumer durables and medium or high technology products), quality and branding are very important. Quality control will become more important even for generic suppliers of brand name products— demonstrated in the garment sector where some countries have lost out in competition with emerging new players.

Higher profits and margins can be sustained only through building long lasting, well-acknowledged brands. This means Asian manufacturers will have to focus on longer-term reputations for quality and innovation rather than a short-term focus on price. As incomes rise and rebalancing continues, consumers will consider product quality and safety along with cost. Firms will have to adapt to this strategic shift. It is beginning to happen. While Western brands may still carry stronger brand recognition, Asian brands are becoming globally recognized in their own right.

Issue No. 4: Protectionism. The rise of *Factory Asia* has been helped by the increasingly liberal global trade regime. Falling tariffs and reduced trade barriers have made it easier to ship products to market—not just for developed economies but for developing Asian economies as well. This helped promote the growth of production networks.

Figure 11a: Change in Middle Class Population Share, 1990–2009 (percentage points)

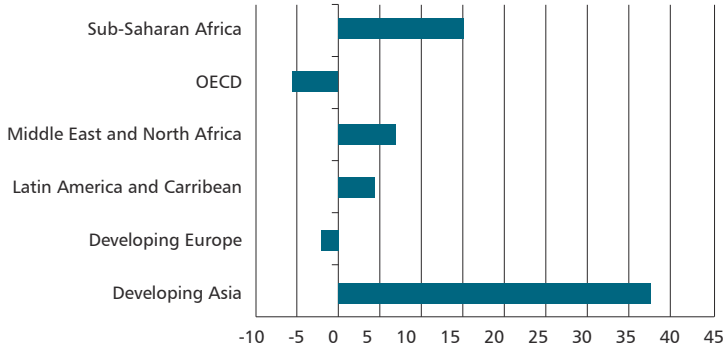
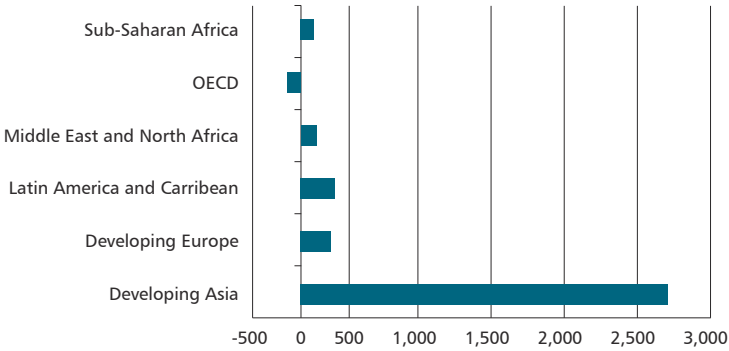


Figure 11b: Change in Middle Class Expenditure, 1990–2009 (US$ billion)



OECD = Organisation for Economic Co-operation and Development.
Note: Developing Asia consists of Armenia, Azerbaijan, Bangladesh, Cambodia, the People's Republic of China, Georgia, India, Indonesia, Kazakhstan, Kyrgyz Republic, the Lao PDR, Malaysia, Mongolia, Nepal, Pakistan, the Philippines, Sri Lanka, Tajikistan, Thailand, Turkmenistan, Uzbekistan and Viet Nam. Developing Europe consists of Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Latvia, Lithuania, Macedonia, Moldova, Poland, Romania, Russian Federation, Turkey and Ukraine.
Latin America and Caribbean consist of Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Peru, Uruguay and Venezuela. Middle East and North Africa consist of Algeria, Djibouti, Egypt, Iran, Jordan, Morocco, Tunisia and Yemen. OECD consists of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Slovak Republic, Spain, Sweden, the United Kingdom and the United States.
Sub-Saharan Africa consists of Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Rwanda, Senegal, Sierra Leone, South Africa, Swaziland, Tanzania and Uganda.
Source: Chun (2012).

However, this liberal trade regime may be taking a more restrictive turn. Governments in advanced economies are facing pressures to protect domestic industries as unemployment remains high or rising. As a result, protectionist sentiments have grown in advanced economies. For instance, Evenett (2012) showed that hundreds of discriminatory measures have been introduced worldwide since November 2008. Further, the sectors most affected by these discriminatory measures have been in manufacturing. Hence, access to developed markets could easily become more difficult, at least until economic conditions in these markets improve considerably. Asia must also be careful about not resorting to protectionism. With a greater share of final demand now in Asia, it is important to ensure that goods can flow freely through the region.

Issue No. 5: Rising Complexity in Managing Supply Chains. Trade has boomed on the back of falling transportation costs. However, with these rising and likely to remain elevated, there may be a shift toward shorter supply chains. This is likely to be aggravated by problems in managing long supply chains, related to adherence to safety and core labor standards. Industries with low density value will be more affected by higher transportation costs.

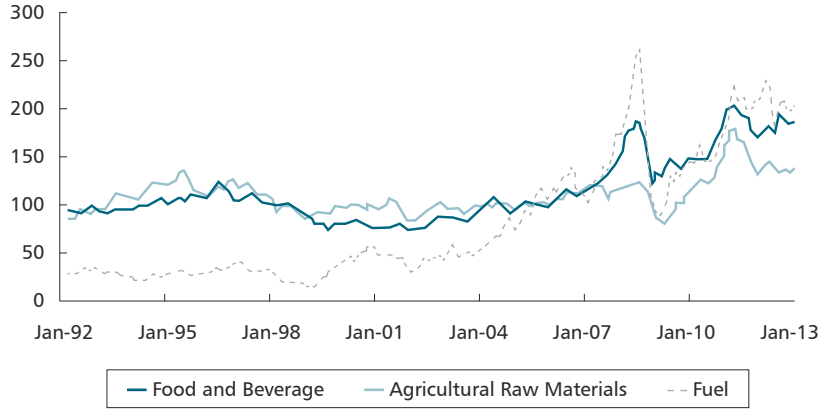
Global value chains are also exposed to disruptions caused by natural disasters, as painfully demonstrated by Japan's 2011 Tohoku earthquake and tsunami, and flooding in Thailand later that year. In the future, manufacturers companies may need to prioritize between economies of scale in concentrating production in one area and spreading production over several locations to ensure greater resilience, given the trade-off between efficiency and risk of disruption.

Throughout the 1990s and 2000s, Asia benefitted from stable commodity prices, particularly fuel. However, commodity price trends in the future may not be as favorable as in the past. Rapid population and income growth globally will raise demand for raw materials. Not only is it likely that commodity prices will rise, but they could also be much more volatile (Figure 12). This will pose serious challenges to manufacturers whose products are intensive in commodity inputs. Besides becoming more volatile, commodity price movements have also become more correlated. Price increases in one commodity tend to spread to others.

Several global companies faced with the challenge of managing complex supply chains are transferring some of their production operations back to their home countries. There are several reasons driving the on-shoring trend. Long delivery routes increase costs of holding inventories and leave firms vulnerable to rapidly changing demand. Producing close to consumers allows for faster turn-around time and allows for greater flexibility in meeting demand. Also, in the traditional model of off-shoring, production is separated from design and research and development. However, as manufactured products grow more sophisticated and development time for new product models is compressed, there may be a need for closer collaboration between design and production. This favors relocating production close to the design base. It is still too early to say this is a long-term trend. Nonetheless, companies are increasingly recognizing that outsourced relationships can be convoluted and insecure, leaving them vulnerable to reputational risks and supply disruptions.

Figure 12: Long-term Trends in Commodity Price

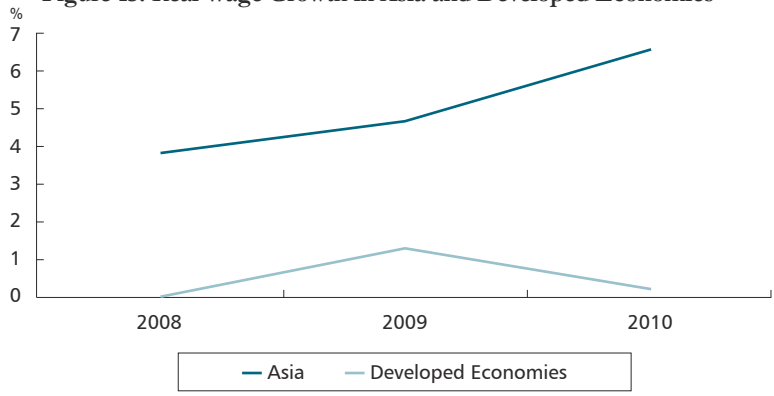
(2005 = 100)



Source: International Monetary Fund data on Primary Commodity Prices; accessed on 11 March 2013.

Issue No. 6: Narrowing Wage Differentials. One primary driver of manufacturing growth in Asia has been the vast pool of cheap labor. But with incomes rising fast, the wage gap is closing. Asia can no longer solely rely on cheap labor as a source of comparative advantage. Recent trends suggest that while real wages in developed economies have remained stagnant, they continue to climb in Asia (Figure 13). Between 2000 and 2010, wages rose by 6% in developed countries but surged 86% in Asia (see

Figure 13: Real Wage Growth in Asia and Developed Economies



Note: Computed using population weights. Asia includes the People's Repubic of China, India, Indonesia, the Republic of Korea, Malaysia, the Philippines, and Thailand. Developed Economies includes Austria, Canada, Czech Republic, Estonia, Germany, Hungary, Italy, Latvia, Lithuania, Poland, Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom, and the United States.
Source: ADB calculations using data from Global Wage Database 2012, International Labour Organization.

International Labor Organization 2012). Rising real wages are a sign of successful development and should be welcomed as they increase the living standards. Yet, if wage growth outpaces productivity gains, it will reduce the cost advantage and may drive companies to relocate manufacturing.

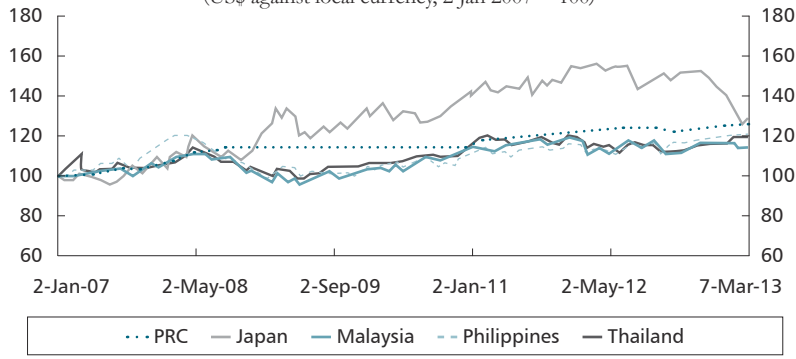
In addition, as the region accelerates the pace of rebalancing toward more regional and domestic demand, wage differentials across Asia will be smaller than wage differentials with advanced economies. Therefore, low wages may no longer be an important source of cost advantage. If their only advantage is low wages, less-developed countries will find it difficult to join supply chains. At the same time, the ability of countries to invest and absorb emerging technologies will have major implications on how Asia can position itself in internationalizing production and—more importantly—for job-creation.

Issue No. 7: Managing Exchange Rate Fluctuations. Prior to the global financial crisis, the region's exchange rates were relatively stable against the US dollar. With the fragility of the US and European banking systems—and interest rate differentials between advanced and emerging markets—the region's currencies appreciated as capital inflows spiked. However, the trend is not uniform. From the beginning of 2007 to the end of 2012, the Japanese yen gained against the US dollar mainly due to its "safe haven" status. This hurt Japanese manufacturing competitiveness. Japan's new monetary policy is trying to change that. Others, whose currencies have

appreciated include the PRC, Malaysia, Thailand, and the Philippines (Figures 14a, 14b). Meanwhile, other currencies such as the Vietnamese dong have depreciated against the dollar. The divergence and volatility in exchange rate movements have made it more difficult to plan and manage manufacturing operations across several exchange rate regimes.

Figure 14a: Exchange Rate Movements in Selected Asian Currencies

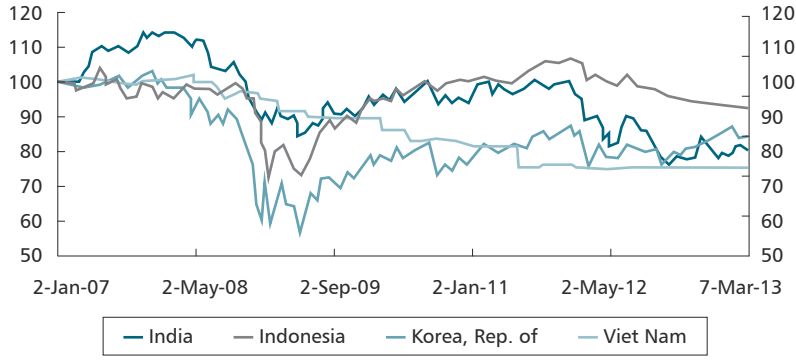
(US$ against local currency, 2 Jan 2007 = 100)



PRC = People's Republic of China.
Source : ADB calculations using data from Datastream.

Figure 14b: Exchange Rate Indexes in Selected Asian Currencies

(US$ against local currency, 2 Jan 2007 = 100)



Source : ADB calculations using data from Datastream.

Issue No. 8: Shortage of Skilled Workers. Rising real wages and skills shortages are hurting several developing economies in Asia. As noted earlier, rising real wages have begun to bite as "total landed cost"

advantages diminish. The lead time required for upgrading skills is long, and Asian economies may get squeezed from both ends unless concerted efforts are taken to improve technical and vocational skills. The changing nature of manufacturing also means manufacturing jobs will be different in the future. Work will most likely be a lot more skill-intensive. Yet, while much attention is given to producing scientists, engineers and researchers, ensuring the availability of skilled technicians and hands-on shop-floor type talent is equally important in developing advanced manufacturing capabilities.

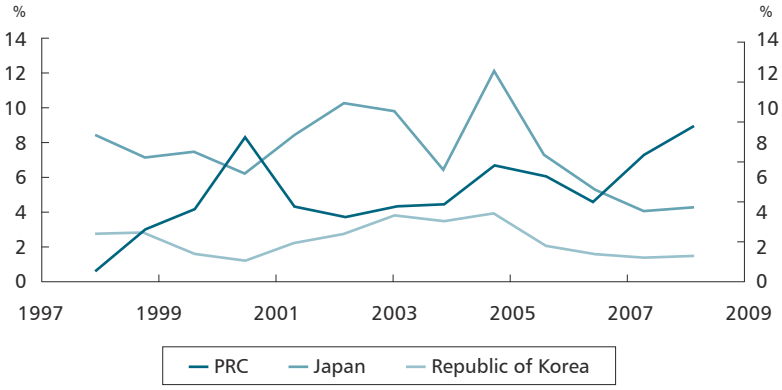
Issue No. 9: Changing Demographics. Japan and the original "Asian tigers" have birth rates below replacement levels. Their populations are projected to shrink. Even the PRC—which benefits from a large supply of rural labor—faces the prospect of a shrinking labor force. Das and D'Niaye (2013) note that the PRC's working age population will soon peak and then sharply decline. In fact, the PRC's working-age population fell in 2012 and the trend is expected to accelerate. Excess labor supply from rural areas may be drying up, causing manufacturing labor shortages in the future. This could place further upward pressures on wages. Yet other countries in the region—such as India and the Philippines—maintain young and growing populations. Nonetheless, wages are rising in those countries as well.

Issue No. 10: Taking Domestic Strengths Abroad. In addition to wage and demographic factors, countries also aspire to consistently move up the value chain, also to avoid the middle-income trap. This has begun in the PRC, for example. This portends some major changes. First, there may be geographic shifts within or between countries in producing lower-value products. In the PRC, there has been a move to relocate factories to less-developed inland provinces where wages are lower. Yet, while the PRC may no longer be considered a low-cost producer, it is also difficult for manufacturers to look elsewhere in the short term given the PRC's infrastructure and skilled worker advantage. Hence, there may be more emphasis by PRC companies toward targeting the domestic rather than overseas market. The rising value of the renminbi may further accelerate the trend by making exports less attractive.

Faced with rising labor costs, the PRC will also move away from labor-intensive production, transferring it to lower cost countries—the "leading dragon phenomenon" (Chandra, Lin and Wang 2013). This holds the

potential of creating jobs in other countries in the region. There is already a rising trend of foreign direct investment by the PRC within Asia, similar to Japan in the 1980s (Figure 15). In addition, Japanese corporations also appear to be investing in mergers and acquisitions, estimated at $65 billion in 2011, a record high (see Iinuma 2012).

Figure 15: FDI Share of the PRC, Japan and the Republic of Korea in Total Asian FDI Inflows



PRC = People's Republic of China, FDI = foreign direct investments.
Note: ADB calculations using the Asia Regional Intergration Center(ARIC) Database on FDI. http://www.aric.adb.org/indicator.php.Accessed on 12 March 2013.
Source: ARIC, ADB.

Lower-cost manufacturing will continue as firms migrate to countries like Viet Nam and Bangladesh. But infrastructure bottlenecks may limit the type of manufacturing that could be transferred, and the level of product sophistication. Also, many countries have recently enacted minimum wage increases. Viet Nam raised its minimum wage by up to 18%, Thailand 35% and Indonesia by an average 40%. Malaysia recently introduced a minimum wage for the first time. While this may be good from a welfare perspective, it could hurt competitiveness in industries with a high proportion of labor costs. There are several competing factors that will influence the industry and product configuration.

Issue No. 11: Growing Importance of Software. The frequency of hardware replacements (for example, computers and mobile phones) will likely slow in developed countries, with software and applications gradually defining the market. Another future trend is a potential backlash against built-in obsolescence and product upgrade cycles. Currently, electronics

consumers appear locked into a two-year upgrade cycle. The region's manufacturers have benefitted from the shortening of product cycles. However, as hardware becomes more powerful, it may eventually reach a point where consumers are satisfied with the hardware they have and will simply upgrade software. As a result, margins for hardware manufacturers will get squeezed.

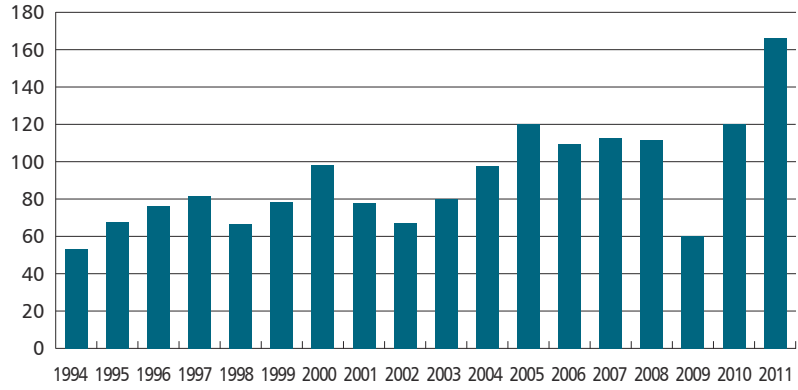
Also, as consumers become more affluent, a greater premium is placed on design and customized products. Thus, there could be a shift away from the mass-produced products which Asia does so well. In addition, electronic chips or sensors are increasingly embedded into a vast array of products. In the automobile industry, for example, there is growing dependence on electronics and software to enhance safety and efficiency. Vehicles with automated parking systems are already available while self-driving cars have been extensively tested and could become the wave of the future. Contemporary cars such as the Chevy Volt holds around 10 million lines of code—more than a Boeing 787 airliner (see Paur 2010).

Issue No. 12: New Technologies—Robotics, Additive Manufacturing. There is clearly a move toward greater efficiency and productivity of factor inputs, shaped by the pressure to produce goods at the lowest possible price while meeting consumer demand. Greater use of advanced techniques—including robots—will gain momentum. Adjustments to rising wages and changing demographics have increased factory automation in Asia. Estimates from the International Federation of Robotics show there has been a steady increase in industrial and professional robots over the past 20 years (Figure 16). Asia has become the largest market for industrial robotics, led by Japan, the Republic of Korea, and the PRC, with the latter growing fastest over the past five years.

The rapid growth reflects growing sophistication in manufacturing. Most of the robots are destined for the automotive and electronics industries, areas which the PRC continues to target. The increased use of robots could be a way for the PRC to maintain its competitiveness as labor costs rise. As they have for decades, robots are becoming ever-more sophisticated, able to handle increasingly complex tasks. In the near future, robots could become more ubiquitous in Asia's manufacturing as demand for higher precision can no longer be met by humans. This could pose challenges for new entrants to value chains if low labor costs will no longer be an advantage.

Figure 16: Worldwide Shipments of Industrial Robots

('000 of Units)



Source : International Federation of Robotics Statistical Department.

Ever since the dawn of the Industrial Age, manufacturing has been equated with factory production using large machinery and an ample workforce for economies of scale. But additive manufacturing processes—such as 3D printing—allow for customized production at low cost. This means production could potentially take place without large machine tools or assembly lines. Long and complex supply chains may no longer be necessary as the complete product can be built from scratch without the assembly of different components.

3D printing remains relatively new, but could herald an era of significant production decentralization. Key inputs would be the design—which would be fed into the printer's computer—and the products produced. Factories could become obsolete. Customized products could be built on demand. Further hurdles must be overcome before additive manufacturing is widely adopted. At the moment, the technology is not cost effective and raw material costs remain prohibitive: the cost of raw plastic needed for 3D printing is around 30 to 100 times the cost of material used in injection molding.

While the exact impact of additive manufacturing is hard to predict, several scenarios are possible. First, it is likely that the time-lag between product design and delivery will be considerably reduced. Customers will also demand products customized to their tastes and preferences. 3D printing allows for additional batches to be produced at minimal additional cost. Most relevantly for Asia, 3D printing has the potential to challenge

the low-cost production model by allowing for just-in-time manufacturing near the point of sale. These features will likely revamp the supply chain.

4. How to Move Beyond *Factory Asia*

Asian manufacturing is at a critical juncture. *Factory Asia* has brought large dividends for parts of the region and helped secure Asia on the global economic landscape. The gains made will be a major contributor to the potential "Asian Century", just as the Industrial Revolution shifted the balance of economic power to the Western world. Yet, the global financial crisis has been a loud wake-up call for the region to adjust, just as the Asian financial crisis was a turning point in addressing financial distortions and macroeconomic restructuring. In the immediate future, rebalancing toward domestic and regional demand—which is already well underway—will be supported by the newly emerging middle class. However, the region's economic growth—and hence that of the middle class— is far from pre-ordained. Unless all countries in the region—large and small— address the myriad challenges facing them, the Asian Century may become a pipedream. The issues considered in this chapter are among those challenges.

In this subsection, several strategic options are posited in order for countries and economies to move beyond *Factory Asia*. Options have been classified for five different country categories (Table 6). Investment in education and training, infrastructure, and strengthening links between services and manufacturing will be crucial for all in moving beyond the *Factory Asia* model. For countries already a part of *Factory Asia*, their main goal is to further move up the value chain and expand markets. Meanwhile, for countries currently outside the model, there may be advantages in joining production networks. Manufacturing remains a key driver of growth, and being part of a production network enables countries to obtain access to technology and new markets. Countries with large domestically oriented manufacturing could leverage their strengths to leapfrog traditional technologies and move up the value chain by joining the production network.

Regional cooperation is vital to the continued success and evolution of *Factory Asia*, given its complex challenges. The smooth flow of goods and investment throughout the region—a necessary part of *Factory Asia*—has been underpinned by enhanced regional cooperation, resulting in trade liberalization and the opening of markets. If anything, this momentum will have to be deepened in the future.

Table 6: Strategic Options Beyond *Factory Asia*

	Large Domestic Markets	Small Domestic Markets
Within *Factory Asia*	**Group 1** (Notable Examples: People's Republic of China and Indonesia) • Move up the value chain to produce higher value added and sophisticated products to supply both domestic and global markets • Leverage knowledge gained to develop home grown technologies • Support small and medium enterprises (SMEs) for investing in new technology • Build up domestic brands that can be expanded to other markets • Invest in education to upgrade the quality of the workforce	**Group 2** (Notable Examples: All Newly Industrialized Economies) • Shift from production to knowledge economy • Invest in research and development, innovation, and strive to be a technology leader • Expand to new emerging markets **Group 3** (Notable Examples: Cambodia; Malaysia; Philippines; Thailand; Viet Nam; and to some extent, Bangladesh and Sri Lanka) • Solidify current position in production networks (for middle income) • Aim to move up on value chain (for middle income) • Aim to carve out a niche in lower-value manufacturing as other countries progress up the value chain (for lower income) • Improve investment climate, and attract foreign direct investment to further strengthen and expand the industrial base • Improve skills and training for workers to increase productivity
Outside *Factory Asia*	**Group 4** (Notable Examples: India and Pakistan) Use large domestic market potential to attract manufacturing investment and technology, by continuously improving the investment climate • Leverage knowledge and experience in domestic manufacturing to leapfrog to higher value chain levels • Support small- and medium-sized manufacturers in joining production networks	**Group 5** (Notable Examples: All Central Asian economies; and Pacific Island and other economies) • Identify constraints to joining production networks • Improve infrastructure and logistics to reduce transportation costs • Strengthen existing manufacturing sectors while diversifying into new areas

Building on the strategic options for the different country groups, one can summarize the challenges and offer some indicative policy measures to move beyond *Factory Asia* (Table 7).

Table 7: Policy Recommendations for Moving Beyond *Factory Asia*

Issues	Policy Recommendations
1.Weaker growth in advanced countries will see demand shifting away from developed markets to emerging economies	•Take supportive measures to boost domestic demand •Forge effective regional and south-south cooperation, while multi-lateralizing free trade •Provide smart incentives for targeting markets within the region
2.*Factory Asia* will have to learn to cater to the demand of the growing middle-class consumers in the region.	•Ensure investment stays adequately high, as consumption demand goes up •Support inclusive and environmental sustainable growth measures
3.Asia's manufacturers need to build strong brand identity to compete globally.	•Ensure country labor and safety standards comply with generally accepted international norms, and invest in lumpy facilities (e.g. standards laboratories) for quality testing and assurance •Facilitate public-private dialogues to boost country and product identity (e.g. through sector/industry promotion facilities)
4.Weak economic growth and high unemployment may give rise to protectionist tendencies in advanced economies.	•Regional and global groups to cooperate to keep protectionist tendencies in check
5.Long and complex supply chains are becoming more vulnerable to natural disaster and reputational risks.	•Private sector to adopt strategies to diversify risks away from a single country focus, and public sector to adopt enabling policies in investment-recipient as well as origin countries
6.Wages in Asia has been rising faster than developed countries narrowing the cost differential.	•Adopt accommodative policies to support private sector efforts to move up on value chain
7.Exchange rates have become more volatile making it harder to manage production networks across several countries.	•Develop financial markets and products to help private sector manage risks
8.Shortage of skilled workers could hamper the region's move to producing more sophisticated products.	•Adopt public sector measures to support skills development, directly through education interventions as well as by enabling private sector to continuously re-skill workers
9.Changing demographics in some countries will result in a smaller pool of labor.	•Countries in the region to cooperate between themselves, and facilitate private sector efforts to align skills and other inputs with economic activities to boost competitiveness
10.Production has been shifting from high-cost countries to lower-cost countries.	•Support the entry of small and medium enterprises into production networks •Governments to launch effective public-private dialogue to facilitate private sector positioning of investments or industries in appropriate lower cost locations in the region
11.Software is becoming more important in manufactured products and taking a greater share of the value.	•Support continuous skills upgrading, to facilitate value chain and product sophistication
12.Advances in robotics and additive manufacturing technologies could herald a new era in manufacturing.	•Countries to invest directly in research and development as well absorption of new technology

continued on next page

Table 7 continued

Issues	Policy Recommendations
7.Exchange rates have become more volatile making it harder to manage production networks across several countries.	• Develop financial markets and products to help private sector manage risks
8.Shortage of skilled workers could hamper the region's move to producing more sophisticated products.	• Adopt public sector measures to support skills development, directly through education interventions as well as by enabling private sector to continuously re-skill workers
9.Changing demographics in some countries will result in a smaller pool of labor.	• Countries in the region to cooperate between themselves, and facilitate private sector efforts to align skills and other inputs with economic activities to boost competitiveness
10.Production has been shifting from high-cost countries to lower-cost countries.	• Support the entry of small and medium enterprises into production networks • Governments to launch effective public-private dialogue to facilitate private sector positioning of investments or industries in appropriate lower cost locations in the region
11.Software is becoming more important in manufactured products and taking a greater share of the value.	• Support continuous skills upgrading, to facilitate value chain and product sophistication
12.Advances in robotics and additive manufacturing technologies could herald a new era in manufacturing.	• Countries to invest directly in research and development as well absorption of new technology

For reasons outlined earlier, markets within the region will have to be a strong target for the region's manufacturers. There will need to be a change in mindset from producing for western to eastern markets. Given the diversity in conditions, income, tastes, and cultures across countries in Asia, the importance of design and customized products will grow in importance.

At the same time, the region will have to ensure that the benefits from future growth will be more evenly shared. As the region transforms itself, countries need to ensure training and skills upgrading for existing workers intensifies so they can compete in the new environment. Small- and medium-scale enterprises should be encouraged to participate in production networks that have been traditionally dominated by large multinationals.

Global trends will continue to have a major impact on manufacturing in the region. In the past, policies have generally focused on making the region an attractive low-cost base for global manufacturing firms. In the

future, however, there may be a shift toward locating production sites closer to future consumers. In this sense, Asia is likely to benefit as a growing source of demand for its own manufactured output.

Policymakers will also have to change their mindset and view other developing Asian economies as potential customers. While the private sector—as it has done thus far—will lead economic ties through investments, major economies need to boost regional cooperation. Beyond generalities, countries may need to adopt specific measures—such as policy and financial incentives for firms to venture into nontraditional markets within the region. Governments may also help manufacturers build connections in fast-growing markets. Addressing behind-the-border challenges and making trade freer regionally and globally should be among the priority government efforts in the region.

As the labor cost advantage—the most important for the region in the past 25 years—narrows, countries will have to find and build other advantages. While demographics are shifting in a few major economies, there is abundant labor in others. Future manufacturing will be more skill-dependent—ensuring the supply of highly-skilled workers will be key to its success (ADB 2013). Besides higher education in science and technology, technical and vocational education must be prioritized to ensure school-leavers are well-equipped to join modern manufacturing industries. With advances in information and communication technology, students must be shown the trends and opportunities that can steer them toward subjects that will be in great demand in the future. Countries faced with the prospects of losing jobs to other, more cost-effective locations, should invest more in education and infrastructure to move up the value chain. Manufacturing jobs have traditionally been seen as less "prestigious"—the higher skills required in the future should negate those preconceptions. The private sector also needs to invest in continuous skills upgrading. Faced with evolving technologies, continuous and strategic support for skills development can help the region to be more flexible and adaptable to an uncertain future. Regional cooperation will help facilitate skills mobility. The ASEAN Economic Community 2015 framework provides for this, and these efforts must be nurtured by policymakers.

World-class infrastructure is crucial to attract manufacturing giants. The PRC in particular has made tremendous strides in improving infrastructure. With declining tariffs in the region and the world, the private sector

has shifted its focus from tariffs to reducing transport and transaction costs, along with other non-tariff barriers such as border procedures and logistics services. These are critical for sustaining manufacturing growth in the future. Asia has indeed made progress in providing infrastructure, but remaining gaps and financing needs are huge. Logistics, so vital for manufacturing, remain far behind that of North America or Europe, for example. Investing in infrastructure and logistics facilities is critical for the smaller Southeast Asian economies and almost all South Asian economies, as they strive to redefine their manufacturing landscape. Unless addressed, the short-term wage and cost advantages these economies have will dissipate with low-value manufacturing production moving to Latin America or Africa.

5. Conclusions

While changing global trends will have an impact on *Factory Asia*, it is likely to continue as an important source of growth for the region. Asia can sustain its position as manufacturing powerhouse if it adapts to the trends and transforms itself. A considerable part of the region remains outside *Factory Asia* and could benefit from joining. As early participants of *Factory Asia* move up the value chain, there are opportunities for other economies to fill the gap.

Traditionally, *Factory Asia* focused on manufactured products exported to developed economies. However, consumer demand from the West will likely be weaker with slower growth in advanced economies. Hence, the new *Factory Asia* will have to evolve toward serving customers within the region—without appearing to become *Factory Asia*. Asia's growing middle class is a large potential market. To succeed, the region's manufacturers must continue to invest and improve quality, design, marketing, and branding.

Economies that are part of production networks should use the skills and experience acquired to move up the value chain and produce higher value added products. The Republic of Korea has succeeded in becoming a technological leader in electronics, while the PRC is also making impressive headway. Japan's technology dominance will continue. Together, these three are likely to define the future landscape. The new growth strategy will be more knowledge-intensive and require more investment in human capital and R&D.

SMEs are typically bypassed in public-private sector dialogues. Special mechanisms—and not necessarily subsidies—are needed to boost SME access to regional production networks. Well-tried recipes—such as common facility clusters that support SMEs—may need to be revisited with the specific goal of helping them join global value chains. Dedicated support for value chain financing will help. The evidence shows transport corridors work, and thus need to become more integrated within overall economic planning. That way SMEs can play a larger role in producing intermediate goods or providing logistics and other supporting services.

For countries that are currently outside *Factory Asia*, they should look for ways to participate in networked production via the *Factory Asia* model. Those who dominate early have the potential to direct their investments and technology into other economies. To facilitate the process, governments must improve infrastructure and liberalize trade to facilitate the flows of goods and services across borders. Greater inter-regional (South-South) cooperation could help countries learn from others' experience in production networking. Countries joining production networks afresh would not necessarily have to start at the bottom of the value chain. They can leverage existing strengths and experience to start higher up on the value chain.

While the factory-driven growth model thus far has helped lift millions out of poverty, it has also had an adverse environmental impact. The looming threat of climate change has already begun to encourage countries to seek a greener path for manufacturing. Technological advances have made manufacturing more environmentally friendly, and Asia is already a leader in green technologies such as solar and wind power. If countries were to embrace these comparative advantages, the region could set itself on the path to sustainable manufacturing growth. At the same time, countries will also have to ensure the benefits from the new *Factory Asia* model are evenly spread. One way is to help support the participation of small and medium enterprises in regional production networks that have mostly been the province of multinationals. In short, the future should be guided by the goal of achieving growth that is inclusive as well as environmentally sustainable.

Continuous learning and intense competition are essential to increase as well as sustain Asia's growth in the future. At the same time, the region does need to enhance cooperation at various levels to maintain its overall

competitiveness compared with other parts of the world. Despite the complexities in forging a common vision (see Baldwin 2008), what the sub-regions and the region overall need is just that. Otherwise, given the fairly strong supply-side integration in parts of Asia (such as East Asia), the risk of the region as a whole losing its competitiveness is high. There are several steps to forging regional cooperation that are positive and in the right direction. Trade and financial integration is improving, and risk-sharing arrangements are in place. The various sub-regions can build on the initiatives of the past two or more decades, and look to a brighter and sustainable future.

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Chapter 2

Can Free Trade Agreements Support the Growth or Spread of *Factory Asia*?

Jayant Menon*
Asian Development Bank

Abstract

Free Trade Agreements (FTAs) have been proliferating in Asia for more than a decade. Production networks and the product fragmentation trade that they generate have been growing for a much longer period. Although FTAs are not necessary for the formation of production networks, can they support their further growth or spread? This is unlikely for a number of reasons. First is the fact that utilization rates of FTAs in Asia are extremely low, contradicting the assertion that they promote this or any other type of trade. Second, most product fragmentation trade already travels at zero or low tariffs because of the International Technology Agreement (ITA), various duty-drawback schemes, or the location of most multinationals in duty-exempt export processing zones. Furthermore, the likelihood of meeting rules of origin (ROOs) requirements for trade that involves limited value-addition or transformation is low. Almost all FTAs involving Asian countries are relatively shallow, focusing on tariff reductions rather than addressing trade facilitation and other non-tariff barriers (NTBs) that would have a greater impact on promoting production networks. Even if they were to deepen over time, it is difficult or costly to remove NTBs in a preferential manner. For these reasons, it would be more useful if FTA preferences were multilateralized, and other accords offered to all on a most-favored-nation (MFN) basis. This combined with national liberalization actions that deal with incumbency issues, irrespective of nationality, would be the best way to support the growth of production networks in current participants and its spread to new ones.

Keywords: production networks; product fragmentation; free trade areas; trade facilitation; Factory Asia.
JEL Classification: F14; F15; F23.

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1. Introduction

One of the defining characteristics of trade patterns in East Asia is the high share of product fragmentation trade in regional trade, so much so that the description *Factory Asia* is now commonplace. This share is much higher than in more integrated regions of the world, such as the European Union (EU) and the North American Free Trade Agreement (NAFTA). If trade in parts and components characterize trade flows, then trade policy has come to be dominated by the proliferation of FTAs, particularly since 2000. The growth in the number of FTAs has been so rapid that it is now known as the "noodle bowl" of criss-crossing and often overlapping FTAs. Are the two related and, if so, how?

It is clear that the decision to set up production networks or the growth in product fragmentation trade can take place without FTAs. This is evidenced by the fact that production networks preceded the advent of FTAs in Asia. Clearly they are not necessary but can they promote further growth of production network trade? If so, how? Or conversely, do FTAs complicate the conduct of such trade and thereby deter it? This chapter attempts to answer these questions.

We begin in section 2 by reviewing the growth in product fragmentation trade in Asia, and the rapid rise in the number of FTAs. We also examine the pattern of such trade, including its geographic and commodity composition, and assess the quality of FTAs in Asia in order to judge how they may affect product fragmentation trade. Since product fragmentation trade can be affected by either changes to tariff or trade facilitation costs, we examine each separately. Section 3 focuses on tariffs, while Section 4 deals with trade facilitation.

2. The Growth in Product Fragmentation Trade and the Proliferation of FTAs

Despite the breakthrough in Bali at the 9th Ministerial Meeting of the World Trade Organization (WTO) with agreement on a trade facilitation deal, the Doha Round as originally envisaged remains elusive. Partly as a reflection of this, bilateral free trade agreements (BTAs) have proliferated. Almost every country in the world today is a member of at least one plurilateral free trade agreement (PTA) and/or BTA, and most are members of multiple BTAs. While Asia was a relative latecomer to

preferential liberalization in the form of participating in FTAs, they have been catching-up rapidly of late (see section 2). The outcome of this proliferation of often overlapping BTAs and PTAs is described as the spaghetti bowl effect or, in the Asian region, the noodle bowl effect. It refers to the increased cost of doing business, and welfare losses associated with trade diversion, due to inconsistencies between various elements of the agreements.[2]

The share of trade emanating from production networks worldwide is much higher in East and Southeast Asia than in any other region in the world (Table 1). In 2009–2010, product fragmentation exports accounted for 62.5% of total manufacturing exports in the region, compared to the world average of 52.8%. Parts and components account for more than half of total product fragmentation exports in the region. This share is much larger compared to that in world exports and intra-regional exports in the EU and NAFTA

While a large and rapidly rising proportion of parts and components exports is intra-regional (within emerging Asia), the majority of final products exports goes to countries outside the region (Athukorala 2010). This means that emerging Asia's export dynamism based on global production sharing depends significantly on the rest of the world.

One option under consideration in Asian policy circles for supporting regional trade growth in the face of slow growth in world demand is to form a region-wide FTA. The Association of Southeast Asian Nations (ASEAN)-led Regional Comprehensive Economic Partnership (RCEP), formally endorsed at the 19th ASEAN Summit held in November 2011, is one such example. The RCEP will initially include all the ASEAN+6 countries and will form the largest FTA in Asia. Apart from attempting to harmonize the various intra-regional bilateral FTAs, the formation of such a bloc is often touted as carrying the potential to support the growth and spread of production networks. The argument put forward is as follows: Trade within global production networks is expected to be more sensitive to tariff changes than trade in final goods because of multiple border crossings associated with the former. Consequently, a one percentage point

2. These include, for instance, different schedules for phasing out tariffs, different rules of origin, exclusions, conflicting standards, and differences in rules dealing with anti-dumping and other regulations and policies (see Pangestu and Scollay 2001).

Table 1: Representative ITA Products and Number of HS Codes
(by attachment)

	Number of HS codes	Sample Products
Attachment A1	112	Computers and computer peripherals: Personal computers, laptops, work stations, monitors, keyboards, hard drives, CD-ROM drives, smart cards, printers, scanners, and other input/output units
		Telecommunications equipment: telephone sets, cordless phones, mobile handsets, pagers, answering machines, switches, routers, hubs, modems, fiber optic cables
		Semiconductors: microprocessors, integrated circuits, printed circuits, diodes, resistors
		Software: magnetic tapes, unrecorded media
		Office equipment: certain photocopy machines, fax machines, cash registers, adding machines, calculators, automatic teller machines (ATM)
		Scientific and measuring devices: spectrometers, chromatographs, flow meters, gauges, optical radiation devices
		Other: Loudspeakers, digital still cameras, parts
Attachment A2	78	Semiconductor manufacturing equipment (SME): etching and stripping apparatus, vapor deposition devices, sawing and dicing machines for wafers, spinners, ion implanters, wafer transport, handling and storage machines, injection molds, optical instruments, parts and accessories
Attachment B	13[a]	Computers, electric amplifiers, flat-panel displays, network equipment, monitors, pagers, CD and DVD drives, plotters, printed circuit assemblies, removable storage devices, set-top boxes

Attachment B products are covered regardless of where they are classified in the HS system. ITA Committee members have made attempts to narrow divergences in the customs classification of some Attachment B products (WTO G/IT/W6/Rev.3), though there is no agreed-upon list. This chapter uses such codes as a proxy.

reduction in tariff rates within the consolidated bloc leads to a decline in the cost of production of a vertically integrated good by a multiple equal to the number of borders crossed within the bloc, in contrast to a one % decline in the cost of a final good. Tariff reductions may also make it more profitable for goods that were previously produced entirely in one country to become vertically specialized. Consequently, in theory, the trade-stimulating effect of FTAs would be higher for product fragmentation trade than for trade in final goods, other things remaining unchanged.

3. Preferential tariff reductions and product fragmentation trade

It is sometimes argued that the proliferation of FTAs has supported intra-regional trade through the spread of production networks, and that their continued growth will be enhanced by expanding or increasing the number of FTAs. The logic behind this assertion rests on the fact that unlike trade in final goods, product fragmentation trade generally involves multiple border crossings. With this difference between the two, it is argued that trade within global production networks is generally more sensitive to tariff changes than is trade in final goods (Yi 2003). Since a tariff can be levied each time a good-in-process crosses a border, the reduction or elimination of tariffs within the free trade area can lead to a multiplier effect whereby the cost savings is a multiple determined by the number of border crossings within the FTA. Furthermore, tariff reductions of this type may make it more profitable for goods that were previously produced entirely in one country to become vertically specialized, exploiting differences in cost competitiveness across members of the FTA. Consequently, in theory, the trade-stimulating effect of FTAs could be higher for product fragmentation trade than for trade in final goods, other things being equal (Athukorala 2012).

How does this pan out in practice in Asia? Should policymakers pursue more FTAs to capture the multiplier effect from tariff reductions on production fragmentation trade? There are a number of reasons for policymakers to be wary in considering this option for Asia. The compelling reason for avoiding the FTA option is that it is simply unnecessary. First and foremost, most if not all product fragmentation trade already travels at duty-free or at very low tariffs across the region, for a number of reasons. Most important is the ITA, a multilateral agreement of the WTO. As described in section 2, most product fragmentation trade in Asia involves products classified as electronic parts and components. Products covered under the ITA and the number of HS codes are listed in Table 1, and include computer hardware and peripherals, telecommunications equipment, computer software, semiconductor manufacturing equipment, analytical instruments, and semiconductors and other electronic components. This covers almost all constituent products involved in fragmentation trade classified to this category. As shown in Table 2, all of the key players in production networks in Asia are signatories of the ITA, including the People's Republic of China (PRC); Japan; the Republic of Korea; the original ASEAN members or ASEAN5;

Hong Kong, China; and Taipei,China. In the decade spanning 1997–2007, more than 80% of ITA trade involved an Asian country (Table 2). In 2008, the three largest users of the ITA were the PRC, Japan and Singapore, and when combined with the Republic of Korea, accounted for half the total ITA exports. As Anderson and Mohs (2010, p. 13) point out, "A prominent feature of expanding ITA trade is the broadening participation of Asian countries, particularly (the People's Republic of) China, and an increasingly important role for other developing countries". Furthermore, since ITA participants must eliminate their tariffs on an MFN basis, even non-ITA signatories that are members of the WTO will enjoy duty-free access in these products.

Table 2: ITA Membership Asian Countries, 1997–2007

Country	Year joined ITA	Total ITA trade ($ mil)	Share of ITA Trade (%)	
			Total Asia	Total ITA
PRC	2003	250,202	69.32	56.23
Georgia	1999	38	0.01	0.01
India	1997	3,077	0.85	0.69
Kyrgyz Republic	1999	26	0.01	0.01
Malaysia	1997	58,416	16.18	13.13
Philippines	1997	21,460	5.95	4.82
Thailand	1997	22,368	6.20	5.03
Viet Nam	2007	5,375	1.49	1.21
Total Asia		360,962	100.00	81.13
Total ITA member countries		444,937		

How about product fragmentation trade outside the electronics parts and components sector? Here again it appears that FTAs have little to offer since most of the multinationals operate out of export processing or free trade zones (EPZs or FTZs), where they are duty-exempt. Even if they do not, various duty-drawback schemes that provide for duty-free trade in parts and components are available as fall-back options.

These factors operate against a backdrop of low and falling tariffs on parts and components, which have more to do with unilateral actions than preferential ones. In this respect, Vezina (2010) suggests that a highly liberalizing race-to-the-bottom unilateralism has been taking place in emerging Asia in the 1980s and 1990s (see also Baldwin 2010; 2011). Vezina suggests that unilateral tariff cutting in Asia's emerging economies have been driven by competition to attract FDI from Japan. Using spatial econometrics,

he shows that tariffs on parts and components, a crucial locational determinant for Japanese firms, converged across countries following a contagion pattern, driving them to lower and lower levels. In a study on autos and auto parts, and hard disk drives in ASEAN, Cheewatrakoolpong et al. (2013) conclude that investment promotion policies contributed more to the emergence of international production networks than FTAs. The many country-sector studies in the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) (2011b) also come to the general conclusion that FTAs, in their current form, have had little or no impact on production networks in the region.

The findings of Vezina (2010); Cheewatrakoolpong et al. (2013) and UNESCAP (2011b) apply to emerging Asia, and mainly the original ASEAN economies of Indonesia, Malaysia, the Philippines, Singapore and Thailand. How about other Asian economies in South Asia and Central and West Asia? Tariffs and other barriers to trade remain relatively high in many parts of South Asia, and many Central Asian countries are not yet members of the WTO. A number of these countries are also actively

Table 3. East Asia-South Asia FTAs

In Effect
1. APTA (1976)
2. India-Singapore CECA (2005)
3. Pakistan – PRC FTA (2007)
4. Pakistan - Malaysia CEPA (2008)
5. India-Korea CEPA (2010)
6. India-ASEAN CECA (2010)
7. India-Malaysia CECA (2011)
8. India–Japan CEPA (2011)
Signed (Not in Effect)
9. Pakistan-Indonesia FTA
10. Preferential Tariff Arrangement-Group of Eight Developing Countries
Under Negotiation
11. Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC)
12. Trade Preferential System of the Organization of the Islamic Conference
13. India-Indonesia CECA
14. India-Thailand Free Trade Area
15. Pakistan-Singapore FTA
Proposed
16. Comprehensive Economic Partnership for East Asia (CEPEA/ASEAN+6)
17. People's Republic of China-India RTA
18. ASEAN-Pakistan FTA
19. Pakistan-Brunei Darussalam FTA
20. Pakistan-Philippines FTA
21. Pakistan-Thailand FFTA
22. Singapore-Sri Lanka CEPA
23. Bangladesh-Malaysia

FTA = free trade agreement.

pursuing FTAs (Table 3). If FTAs have not played much of a role in promoting the growth or spread of production networks in Southeast Asia, can they help countries in these other regions participate in production networks? The short answer is that it is highly unlikely, for a number of reasons. A key factor relates to a defining characteristic of FTAs, which is its preferential nature.

Even if we put aside the ITA, FTZs and duty-drawback schemes, it appears that FTAs are still unlikely to play an effective role in promoting this type of trade due to their need to protect the provision of preferences by excluding non-members. The impact that preferential tariff reductions can have on product fragmentation trade relates to the need to implement ROO in order to exclude trade that does not comply with or meet minimum requirements. First, unlike trade in final goods, formulating and implementing ROOs for production network-related trade is far more complicated. If the conventional value added criterion is employed, it is highly unlikely that intermediate inputs emanating from outside the region will qualify. This is because the activities involved are low-value added by their very nature. If, on the other hand, the 'change in tariff lines'-based ROOs are applied, then this may disqualify inputs from both outside and inside the region once they travel across the next border. This is because trade in parts and components generally belong to the same tariff codes at the HS-6 digit level, which is the normal base for designing this type of ROOs. The following illustrative example, provided by Athukorala and Kohpaiboon (2011) is compelling: electrical appliances assembly plants in Thailand, for instance, which use imported bare printed circuit board (BPCB) together with other locally procured electronic components (e.g. diodes, integrated circuits, semi-conductors) to printed circuit board assembly (PCBA) for export are not eligible for FTA concessions because BPCBs and PCBAs belong to the same HS code 853690.

Second, the process of international production fragmentation is characterized by continuous emergence of 'new' products. Given the obvious administrative problems involved in revising ROOs in tandem, these product inventions and innovations naturally opens up room for unnecessary administrative delays and/or tweaking of rules as a means of disguised protection (Elek 2008).

Therefore, countries in South or Central Asia are unlikely to be able to use FTAs as trade policy instruments to promote their engagement in

production networks in an effective way. This is not to suggest that FTAs cannot have an impact in these countries. Highly preferential concessions provided on a bilateral basis in an otherwise highly trade-restrictive environment is bound to have an impact. Indeed, these conditions provide an almost perfect setting for trade diversion to thrive. In this environment, utilization of FTA concessions could become highly firm or industry specific, presenting economy-wide distortions that reduce national welfare as ramifications of the well known theory of the second-best. Furthermore, they are likely to mainly affect intensive margins—the amount of a good traded, rather than extensive margin—the range of goods that are traded, further limiting potential benefits of participating in production networks. They are also self-limiting by nature. The preferential nature of FTAs stand in the way of what we have observed to be the 'natural' expansion of production networks in countries and regions actively involved in the process. By limiting the scope to members only, or specific firms of industries, growth is likely to be choked-off over time. Production networks survive by growing and spreading across countries and sectors, in response to relative factor price adjustments and related developments, and FTAs are not designed to accommodate either of these features of their expansion.

In sum, when it comes to tariff liberalization, it appears that FTAs have been largely irrelevant. The factors described above combine to account for the embarrassingly low utilization rates of FTAs in Asia reported in almost all studies, directly contradicting the assertion that FTAs matter in promoting this or any other type of trade. Indeed, the estimated impacts of these FTAs in studies assuming full utilization may greatly exaggerate their benefits (Menon 2013a). Rather than promoting production networks, it is more likely that product fragmentation trade has prospered despite the noodle bowl of overlapping FTAs in the region.

The preferential nature of FTAs can also thwart the 'natural' expansion of production networks by limiting their growth to members of the bloc. This applies particularly to countries trying to participate in production networks for the first time, using FTAs to substitute for generally high tariff and other barriers. When they do have an effect, and this is likely the more restrictive the overall trade regime is, then it is also likely to be highly firm or industry specific, driven by trade diversion and presenting economy-wide distortions. FTAs are unlikely to be effective in promoting the growth and spread of production networks because they will be self-

limiting, preventing their natural spread and suffocating their growth.

Even proposals for mega FTAs such as the recently proposed RCEP would exclude about two-thirds of the countries of the region, depending on how Asia is defined. Experience also suggests that creating such mega FTAs tend to be possible only through resort to the lowest, rather than highest, common denominator, thereby making their concessions weak or even redundant (Menon 2009).[3] This is often necessary in order to secure consensus. Putting aside the difficulties in creating such consolidated mega blocks, every South Asian country except for India and all Central Asian countries would fall outside such an agreement. This would not only disadvantage the excluded countries, but it would also hurt the members by limiting the switching and spreading of tasks that serves to sustain production networks. Therefore, to support the natural growth of production networks, it would be more useful if these preferences were multilateralized, and offered to all on an MFN basis, than consolidated within discriminatory FTAs, however large. Apart from supporting the growth of production networks, it would remove trade diversion and the costs associated with implementing ROOs, while increasing the benefits that flow from non-discriminatory trade. Baldwin (2013) raises considerable concern over the recent trend to tie-up regional blocs around the world to create mega ones, pointing to how they can only lead to further "fragmentation and exclusion", and goes further to call for a new institution—a second WTO—to govern the process of liberalizing global supply chain trade. Although the likelihood of a new institution emerging is low, the decision to pursue a multilateral agreement on trade facilitation, expected before the WTO's Ministerial Summit in Bali in October 2013, may serve to deliver the kind of reforms required to support production networks (see Section 4).

3. In South Asia for instance, the establishment of a region-wide FTA had little effect on intra-regional trade, or no effect in neutralizing existing BTAs. On the contrary, the FTA has been largely rendered redundant while the BTAs have thrived. For instance, 93% of Sri Lanka's exports to India currently enter duty-free under their BTA. The Bangladeshi Minister of Commerce, Amir Chowdury, explains why: 'When it comes to (our) regional FTA, big economies like India and Pakistan may not offer handsome duty cuts due to distinct interests with an individual country. But they may offer large duty cuts in bilateral FTAs with Bangladesh.' And this is why Bangladesh and other South Asian countries continue to pursue BTAs with each other (and outsiders) even after the formation of the consolidated FTA (see also Hill and Menon, 2008).

Although the creation of consolidated regional blocs, or the expansion of FTAs to include other members of the region, appear unlikely to be able to support the growth or spread of production networks, what about cross-regional FTAs? If an FTA is concluded with a country or bloc that represents a major destination for final goods, then the prospects for the FTA to affect production networks could be different. Take, for example, the case of the Japan-United States (US) FTA. If the concessions within the FTA are significant enough to promote a significant increase in exports of final goods from Japan to the US, then the FTA could potentially support the growth, although not necessarily the spread, of production networks within the region. Similarly, the recent trend to pursue tie-ups between plurilateral FTAs (see Economist, 2013c) could indirectly spur product fragmentation trade if the linkage results in increased demand for final goods. That is, an increase in demand for final goods produced within production networks would drive an increase in product fragmentation trade in the region.

4. Trade facilitation

Production fragmentation trade is the output of complex production systems characterized by the setting up of global value chains. These networks are dependent on efficient logistics (Hesse and Rodrigue, 2004). As Memedovic et al. (2008) point out, the benefits arising from production networks cannot be realized without co-developments in modern logistics services underpinned by innovations in containerization, intermodal transport and the application of information technology in physical distribution and materials management. Logistics is a wide-ranging concept but from the point of view of cross-border movements of product fragmentation trade, the relevant aspect is trade facilitation.[4] Countries involved in production networks and the trade that they generate stand to gain the most from facilitating trade. The question then is how effective

4. Although there is no universally accepted definition of trade facilitation, it is usually taken to refer to reforms aimed at making complicated and time-consuming cross-border trade procedures less inefficient. In other words, the idea is to cut the often excessive amount of red tape at the border. More formally, The Doha Ministerial Declaration (WTO 2001), for example, refers to trade facilitation as "expediting the movement, release and clearance of goods, including goods in transit". Persson (2008) suggests that another popular way to define the issue is to refer to the simplification and harmonization of international trade procedures, where such procedures are the activities, practices and formalities involved in collecting, presenting, communicating and processing data required for the movement of goods in international trade. This is the broad definition that we employ here. See also WTO (2007).

are FTAs in moving forward the trade facilitation agenda. Even though production networks preceded the proliferation of FTAs, has the growth in product fragmentation trade led to a deepening of existing FTAs, or the advent of new, deeper ones, particularly in relation to trade facilitation aspects?

If FTAs are largely redundant when it comes to reducing tariffs on product fragmentation trade, then they have proven largely incapable of addressing trade facilitation aspects that matter when it comes to promoting this type of trade in Asia.

A number of studies also confirm the failure of many of the FTAs involving an Asian partner to deepen their coverage, and to deal adequately with trade facilitation issues. In a major study assessing the quality of FTAs, WTO (2011) finds that most of the FTAs show relatively limited WTO+ or the General Agreement on Trade in Services (GATS)+ commitments in their design. In particular, ASEAN countries other than Singapore have shown relatively limited WTO+ or GATS+ commitments. Sally (2007) argues that Asian FTAs are by-and-large preferential-tariff agreements on a limited range of goods. Even the better ones are trade-light and barely WTO+ in that they do not seriously tackle non-tariff and regulatory barriers. In short, almost all FTAs involving Asian countries are relatively shallow, focusing on tariff reductions. Even when new WTO−X issues are covered by FTAs, the areas embodying legally enforceable and therefore substantive commitments are relatively few, and generally avoid trade facilitation and tend to address investment, competition policy, intellectual property rights, and the movement of capital (Table 4).

In sum, Asian FTAs generally tend to focus on tariff liberalization rather than trade facilitation or other WTO+ or GATS+ issues. In this way, Asian FTAs appear unlikely to be able to support the growth or spread of production networks by facilitating the trade in parts and components.

Since production fragmentation trade continues to grow within certain subregions of Asia, a related question is whether higher levels of trade in parts and components increase the likelihood of signing deeper agreements. In other words, does the causation run in the reverse direction, from increased product fragmentation trade leading to deeper FTAs, over time, rather than vice-versa? There is some evidence to support the reverse causality argument but the studies are not confined to Asia and therefore

Table 4. New Issues in FTAs

FTA	Government Procurement Chapter	Investment Chapter	Trade Facilitation Chapter	Competition Policy	Intellectual Property Rights	New Issues (overall)
1. APTA (1976)	No Provision	No Provision	No Provision	No Provision	No Provision	Shallow
2. India-Singapore CECA (2005)	No Provision	Standard	Standard	No Provision	Standard	Limited
3. Pakistan – PRC FTA (2007)	No Provision	N/A	No Provision	No Provision	No Provision	Shallow
4. Pakistan - Malaysia CEPA (2008)	No Provision	Standard	Above Standard	No Provision	Standard	Limited
5. India-Korea CEPA (2010)	No Provision	Above Standard	Above Standard	No Provision	Standard	Moderate
6. India-ASEAN CECA (2010)	No Provision	No Provision	Standard	No Provision	No Provision	Shallow
7. India-Malaysia CECA (2011)	No Provision	Above Standard	Above Standard	No Provision	No Provision	Limited
8. India–Japan CEPA (2011)	Standard	Standard	Above Standard	Standard	Above Standard	Moderate

APTA = Asia-Pacific Trade Agreement, PRC = People's Republic of China, CECA = Comprehensive Economic Cooperation Agreement, CEPA = Comprehensive Economic Partnership Agreement, FTA = free trade agreement.

cover all regions. For instance, Orefice and Rocha (2011) examine 96 FTAs reported to the WTO between 1958 and 2010. After taking into account other FTAs determinants, they find that a ten % increase in the share of product fragmentation trade over total trade increases the depth of an agreement by approximately six percentage points. Hayakawa and Yamashita (2011) consider over 250 FTAs with trade flows distinguished into parts and components and final goods for the period 1979-2008. Their gravity equation estimates suggest that the concurrent year effects of FTA formation on trade in parts and components are unseen, whereas FTAs have positive and pervasive effects on both types of trade flows six and nine years after the FTA formation.

Although it is likely that these results are heavily influenced by the deeper FTAs signed between developed countries, could it be that Asian FTAs will evolve to be the same over time, and eventually contribute to the growth and spread of production networks? On the contrary, there is an emerging sentiment of resistance towards the upgrading of FTAs into deeper Comprehensive Economic Partnership Agreements (CEPAs) in the region. To cite just a few recent examples, the Indonesian Chamber

of Commerce has voiced concern over such progression in a general way, while Sri Lanka has also rejected calls for a CEPA with India. The "deepest" of the proposed mega-blocs, the Trans-Pacific Partnership (TPP), has missed its target of completion by 2012, and is likely to miss the next deadline of end–2013.[5] On 8 October 2012 in Lexington, Virginia, Mitt Romney complained about how "this President had not signed a single free trade agreement in the past four years". Even if this is a temporal issue, however, there is a fundamental reason for avoiding FTAs as a trade policy instrument in promoting trade facilitation or other forms of liberalization that promotes production networks.

That fundamental reason, as with tariff liberalization, relates to the need to be preferential or discriminatory in the provision of the concession or reform. But unlike tariff liberalization, it is often difficult or costly to remove non-tariff barriers or measures (NTBs or NTMs) in a preferential manner. It is usually impractical for these types of concessions to be exchanged in a discriminatory fashion—once an NTB or NTM is removed, the cost of excluding non-members is likely to be high, if not prohibitive, like with most public goods. This difficulty and associated cost vary by type of measure. While export subsidies or export licensing, for example, could be offered or applied preferentially, production subsidies cannot be reduced in the same way. With reducing production subsidies arguably the biggest barrier to reforming agricultural trade, the problem is real.

Even if it were possible to exclude third parties, this could seriously derail the reform program. A recent study by UNESCAP (2011a) notes that preferential treatment negotiated with selected trading partners typically involves additional documentary requirements. The study presents

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5. See "Nation Must Review Its Trade Pacts, Kadin says", Jakarta Globe, 2 September 2012; available at: http://www.thejakartaglobe.com/business/nation-must-review-its-trade-pacts-kadin-says/541720#.UENeI3L-NEk.email: "Sri Lanka not keen on CEPA with India", Business Standard, 24 August 2012; available at: http://www.business-standard.com/india/news/sri-lanka-not-keencepaindia/484201/; and on delays with concluding the TPP, see The Economist (2012c, p. 33). Confirming the bipartisan confusion over motivation, this statement appeared amid concerns over the situation in the Middle East, as part of a "major speech on foreign policy". Similarly, almost a third of the press statement issued by the US Secretary of State Hillary Clinton on 15 March 2012 on the coming into force of the US-Korea Free Trade Agreement (KORUS) is devoted to non-economic issues: "...it will strengthen the US. partnership with a key ally in a strategically important region. This is a powerful signal of America's commitment to the Asia Pacific and to securing and sustaining our role as a regional leader and Pacific power."

evidence of significant delays associated with such requirements since FTAs have adopted different approaches to the rules on substantive measures relating to trade facilitation. Moreover, differences in their scope, depth, and level of detail have often translated into varying degrees of administrative inefficiency, through a maze of different procedures applied to respective trading partners under different FTAs.

If the costs associated with complying with FTA based trade facilitation provisions are high, then the benefits that flow are also generally quite low, when compared with other modalities of liberalization. The results reported in Dee (2006) show that if 'deep' economic integration initiatives were limited to reform of regulations that explicitly discriminated against foreigners, and that the reforms were undertaken on a preferential basis, they would add only trivially to the gains from preferential liberalization of tariffs on merchandise trade. Dee (2006) therefore concludes that "there may be a few limited areas where FTAs can usefully supplement a domestic regulatory reform program... but … because they tend to be preferential – even in their 'new age' provisions – they tend to focus reform efforts away from where the big gains are to be made". These big gains can only be realized through unilateral regulatory reform in the East Asian subregion. Because of its more comprehensive coverage that targets the non-discriminatory restrictions that add to real resource costs, comprehensive unilateral reform would yield gains of more than five times that of an FTA.

Although such unilateral actions that also deal with incumbency, whether domestic or foreign, are optimal, is there a role that the WTO can play in coordinating the reform effort in a non-preferential manner? The difficulty of reaching agreement on Doha's ambitious all-or-nothing single-undertaking program, aimed at addressing a wide variety of issues, is becoming increasingly clear. Attention has therefore shifted towards a compromise involving sectoral deals, including one that addresses trade facilitation, which was concluded at the Bali Ministerial in December, 2013. The impact of this agreement on the growth and spread of production networks is expected to be significant.

Conclusion

FTAs have been proliferating around the world, and most of the action over the past decade or so has involved at least one country from the Asian region. It is sometimes argued that the proliferation of FTAs in Asia has supported intra-regional trade through the spread of production networks, and that their continued growth will be enhanced by expanding or increasing the number of FTAs. Is this what policymakers should do? Although it is clear that FTAs are not necessary for the growth or spread of production networks, since product fragmentation trade preceded the advent of FTAs, can they support further growth or spread of these networks? In this paper, we argue that there are a number of reasons for policymakers to be wary of pursuing this option. First is the fact that almost all studies point to embarrassingly low utilization rates of FTAs, directly contradicting the assertion that they matter in promoting this or any other type of trade. Indeed, the estimated impacts of these FTAs in studies assuming full utilization may greatly exaggerate their benefits. Second, and this may explain the first, most if not all product fragmentation trade already travels at duty-free or at very low tariffs across the region, either because of the ITA agreement that covers trade in electronics parts and components, various duty-drawback schemes, or the fact that most multinationals operate out of export processing zones, where they are duty-exempt.

Rather than promoting production networks, it is more likely that product fragmentation trade has prospered despite the noodle bowl of over-lapping FTAs in the region. At best, they have been irrelevant; at worst, they have interfered. To support the growth of production networks, it would be more useful if these preferences were multilateralized, and offered to all on an MFN basis. This would remove trade diversion and the need to implement rules-of-origin (and associated cost and confusion), as well as increase the benefits that flow from non-discriminatory trade. Given that most of the non-tariff accords in FTAs can be easily multilateralized, there is a good case to pursue this course of action.

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Part Ⅱ

Outsourcing Risks of Asian Manufacturing and Services

Chapter 3

The Effect of International Outsourcing on Job Growth in the Republic of Korea

Namsuk Choi*
Korea Economic Research Institute

Abstract

This chapter empirically investigates the effect of international outsourcing, measured by foreign value added content share of gross exports, on Korean firm-level employment in manufacturing industries. Using the joint OECD-WTO statistics on trade in value added and Korean firm-level employment data between 2000 and 2009, this study finds that international outsourcing has negative and statistically significant effects on job growth in Korean manufacturing employment. However, the effect of international outsourcing on employment differs on labor intensity of the manufacturing industries. In particular, a 1% increase in foreign value added content share of gross exports in the labor-intensive industries (instrumented by lowering sector-specific tariffs) decreases firm employment level by 0.27%, while it increases 0.31% in the high-technology industries in the Republic of Korea. Overall the effect of international outsourcing on job growth in the manufacturing sector decreases firm employment by 0.13%, implying that the net displacement effects in the labor-intensive industries dominate the net productivity effects in the high-technology industries. The empirical findings are robust even after taking into account the roles of headquarters intensity and firm heterogeneity in outsourcing.

Keywords: international outsourcing; employment; productivity effect; global value chain
JEL Classification: F16, F21, F23, L23

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* All errors are mine alone. Please send all correspondence to Namsuk Choi, Korea Economic Research Institute, 24 Yeoui-daero, Yeongdeungpo-gu, Seoul, 150-756, Republic of Korea. E-mail: nchoi@keri.org. Phone: 82-2-3771-0037. Fax: 82-2-785-0272.
OECD-WTO are the initials of the Organisation for Economic Co-operation and Development and the World Trade Organization.

1. Introduction

In recent decades, one of the prominent patterns of international trade is inseparability of trade and investment. The share of Asia in world exports increased from 25% in 2001 to 32% in 2012. At the same time, fragmentation of the production process across firms within industries in Asia is increasingly common and has affected international sourcing strategies of firms, who face decisions whether to outsource stages of production process abroad or integrate. Thus, international outsourcing strategies of firms play significant role in trade pattern and home country employment.

The international fragmentation of production in Asia has increased intermediate goods exports in the manufacturing sector among Asian partners. Export activities are interdependent on imports as the global value chains (GVCs) become more complex across countries. The higher level of domestic content of exports in the Republic of Korea may reflect that Korean firms are upgrading their activities and roles within GVCs. As Korean firms gain prominence in the GVCs, Korean domestic contents of exports replace the foreign contents by taking over the higher value added activities in Asia. Effective participation in *Factory Asia* and GVC thus requires further investment in skill building and upgrading, and technology dissemination.

International outsourcing may improve productivity, bring about technological innovation and raise competitiveness for the home country. The tasks that are internationally outsourced increase the complexity of tasks that were not outsourced and improve the productivity of the skilled and unskilled labor at home.

This chapter aims to analyze the effect of international outsourcing on job growth in the manufacturing sector of the Republic of Korea. In particular, we investigate how intermediate input outsourcing for exports affects Korean manufacturing employment, and to what extent international outsourcing affects job growth in the labor-intensive sectors of the Republic of Korea. In addition, we attempt to analyze why job growth in the Korean economy and the ongoing supply chains (global value chains) in Asia are increasingly interdependent. This chapter empirically examines the extent to which Korean firm-level job growth is affected by the changes in foreign value added content share of gross

exports, domestic value added in exports and foreign valued added in imports at the industry level.

On one hand, we take on the model approach in Ottaviano et al. (2013) that lower offshoring costs help increase the share of offshore workers by sending low-skilled or complementary jobs to offshore workers. Cheaper offshoring can also increase the overall native workers at home because native workers can increase task complexity by specializing in higher-skilled jobs. According to Ottaviano et al., the productivity effect of offshoring dominates displacement effect of offshoring when offshore workers, immigrants, and native workers specialize in tasks according to their comparative advantages. This chapter, on the other, draws Antràs and Helpman (2004) and Antràs and Chor (2013) theory of organization of the global value chains to differentiate the offshoring into foreign direct investment (FDI) and international outsourcing. We take into account the roles of headquarters intensity and firm's different levels of productivity to focus on the effect of international outsourcing on job growth in Korean manufacturing industries.

In this chapter, we use foreign value added share of gross exports data at the industry level to take into account the role of international outsourcing. The effects of international outsourcing in the labor-intensive industries are differentiated by following the OECD high-technology sector classification as used in Hatzichronoglou (1997), and relating it with the Korean Standard Industrial Classification (KSIC) level as used in Jang and Hyun (2012) and Choi (2012). We categorize low and medium-low technology industries, such as basic metals, chemicals and minerals, food products, other manufactures, textiles and apparel, wood and paper as labor-intensive industries, and these industries correspond at the KSIC middle level (medium-low tech 22, 33, 24, 23, 25, 19, 24; low tech 17, 18, 13, 14, 10, 11, 12, 16, 32). High and medium-high technology industries include electrical equipment, machinery, transport equipment, chemicals and minerals etc. We also adopt Antràs et al. (2012)'s 'upstreamness' measure and analyze the Korean manufacturing's standing within *Factory Asia*. Finding out whether Korea and Asian countries specialize in particular stages of global value chains helps us understand the interdependence of Korean industries with Asian countries.

We find that the increase of international outsourcing by 1% may decrease the manufacturing jobs by 0.13%. In labor-intensive jobs, a 1%

increase affects a 0.27% decrease of jobs in the labor-intensive industries. On the contrary, a 1% increase in international outsourcing increases high and medium-high technology industry jobs by 0.31%. The productivity effect of global outsourcing in the technological industries is less than the net job displacement effect of international outsourcing in the labor industries. Thus, taken these effects as a whole, displacement effect dominates productivity effect and international outsourcing may decrease job growth in the Republic of Korea. This chapter contributes in the area of trade and employment by investigating the role of participating in the global value chains and its impact on firm level job growth in the Republic of Korea.

This chapter is organized as follows: section 2 reviews related literature in outsourcing and global value chains, while section 3 explains stylized facts on international outsourcing in Asia. Section 4 builds an empirical model and conducts empirical analysis to test hypothesis and interprets the results in the following section 5. Finally, section 6 presents concluding remarks and policy implications.

2. Literature Review

We merge the two strands of literature on international trade and employment. First strand is firm's international outsourcing strategies on organizing the global value chains. Why do multinational firms outsource? Outsourcing refers to the acquisition of goods and services from an unaffiliated firm, while offshoring is the sourcing of goods and services in a foreign country. Outsourcing is related to ownership. But offshoring emphasizes the location of business operation. When offshoring refers to ownership as well as location, it is engaged in FDI. Depending on ownership and location of operation, offshore-outsourcing is an intermediate case that multinational firms acquire goods and services from an unaffiliated firm in a foreign country.[1] In this chapter, international outsourcing is defined as sourcing of all goods and services from a firm in a foreign country without discriminating the ownership of the firm. As shown in Table 1, international outsourcing in this paper includes the acquisition of goods and services from both foreign affiliates and foreign unaffiliates.

1. See Helpman (2011, chapter 6).

Table 1: Outsourcing and Offshoring, Four Possibilities of Production

Ownership \ Location	Foreign	Domestic
Affiliated (in-house)	multinational integration (engaged in FDI): - (itself) intra-firm trade, - (third party) arm's length trade to third party at home, supply foreign markets via foreign subsidiaries, export platform to third countries	Integration
Unaffiliated (outsource)	Foreign Outsourcing, arm's length trade	Outsourcing

FDI = foreign direct investment.
Source: Helpman (2011).

Helpman (2011) summarizes the Grossman and Rossi-Hansberg (2008) model of offshoring. Grossman and Rossi-Hansberg (2008) decompose the impact of the cost reduction in offshoring unskilled-labor-intensive tasks into a productivity effect, a relative price effect and a labor supply effect. When the relative price is constant and labor supply effect does not change the relative factor prices, the wage of unskilled labor increases due to the productivity effect of offshoring.

Why does a firm choose to own a foreign producer? If a firm has greater revenue under integration than under outsourcing, the firm decides to internalize the foreign supplier. However, when relative importance of component is high in the manufacturing of final goods, the firm prefers to outsource intermediate inputs in order to provide foreign supplier with strong incentives to invest and work hard. Antràs (2003) shows that there is a cutoff level of the relative importance of intermediate inputs such that firms above this cutoff prefer outsourcing rather than integration. This cutoff level of tradeoffs between vertical integration and outsourcing explains why international outsourcing in Asia is related to producing high-quality intermediate inputs. We examine whether international outsourcing is dominant in the labor-intensive sector whereas complex integration of FDI appears in the capital-intensive sector.

Second strand is the interdependence of offshoring and jobs in the global value chains. International outsourcing matters for home country job growth. Ottaviano et al. (2013) analyze the effects of offshoring on jobs related to a direct displacement effect and an indirect productivity

effect by paying attention to the simultaneous patterns of substitutability among natives, immigrants, and offshore workers. In their analysis, jobs are "tasks" and firms across countries trade tasks.

Ottaviano et al. (2013) empirically show how the complexity of tasks performed by native workers responds to the changes in offshoring and immigration. They demonstrate that easier offshoring raises the average complexity of native tasks. In line with the Ottaviano et al. (2013) findings, we expect that as firms participate in the global value chains, it increases efficiency of the sequential production process and leads to task upgrading of native workers in the domestic labor market. The task complexity increases in the intensity of use of communication and cognitive skills and decreases in the manual content of the task. This productivity effect associated with participation in the GVC raises the demand for native workers. As a result employment level in the Republic of Korea increases.

The Trade in Value Added (TiVA) database recently compiled by OECD-WTO is important in three aspects.[2] First, exports in value added terms are measured as domestic value added embodied in foreign final demand. Final destination of goods and services traded across countries is used to identify the role of intermediate import contents producing exports. Without using final destination, the imported inputs that are used to produce exports are accounted for as imports just like the imported intermediate inputs for the production of domestic final demand. Thus, using final destination of imported intermediate inputs for exports; the trade in domestically added value can be measured correctly.

Second, it differentiates re-imported domestic value added embodied in domestic final demand. Since intermediate imports may contain "returned" domestic value added, the value needs to be subtracted from exports and imports and treated as domestic value added. Then only the foreign value added embodied in domestic final demand needs to be regarded as imports. For example, Korean intermediate imports in 2009 contain 5% of the returned Korean domestic value added. In the upstream domestic industries, domestically produced intermediates are shipped abroad, assembled, and re-imported. And then they are finally consumed at home.

2. The Organisation for Economic Co-operation and Development and the World Trade Organization (OECD-WTO) released on May 2013 their joint database on trade in value added (TiVA), which aims to track global production networks and supply chains.

In this case, the intermediates imports in gross terms generate double counting of exports and imports. The foreign value added only needs to be accounted for as foreign value added imports and the rest of intermediate imports as domestic value added.

Third, trade in value added terms reveals how significant the role of intermediate inputs of services is for goods exports. In service and foreign direct investment liberalization, access to more efficient services may improve the export competitiveness of goods industries.

In addition, trade in value added may shed light on trade and employment. 'Job content of trade' helps understand the role of trade on employment. The trade in value added shows exactly where jobs are created. When comparative advantages apply to tasks rather than final products, the skill composition of the domestic content of exports reflects the jobs created in the exporting country. In gross terms, imports manufactured in a foreign country are regarded as jobs lost and transferred to the exporting country. In value added terms, while the importing country may lose jobs at the assembly stage, one would find the extent to which the important contribution of those working in the areas of high- and medium-skill intensive tasks. For instance, in value added terms, the Republic of Korea has been adding jobs in research, development, and design and marketing activities that are increased with foreign trade. The Republic of Korea has been specializing in exports that intensively use medium- and high-skilled labor.

With product differentiation and firm heterogeneity, international trade increases total factor productivity in both import-competing and exporting industries (Helpman 2011). The degree of firm heterogeneity explains the effect of outsourcing on domestic employment (Helpman, Melitz, and Rubinstein, 2008). Thus, it needs to be taken into account to explain the variation of employment associated with outsourcing in a typical sector.

Firm heterogeneity matters in trade to explain a key property of industrial structure. Within a certain industry, firms vary significantly in size, productivity, factor proportions, wages, and participation in foreign trade (Helpman et al. 2004). Firms that export are systematically different from domestic firms and multinational firms. Garetto (2013) theorizes input sourcing and multinational production by emphasizing the driving forces such as technological heterogeneity and the implication of imperfect

competition in prices. Accounting for the role of firm heterogeneity within an industry thus helps explain the changing trends in the patterns of foreign trade and foreign direct investment.[3]

We combine these two strands of literature on outsourcing and job effects to investigate the effect of international outsourcing in manufacturing industries on job growth in the Republic of Korea. Understanding firms' decisions on outsourcing strategies helps us investigate the effect of international outsourcing on jobs in the global value chains.

3. Stylized Facts on International Outsourcing in Asia

Increasingly more Korean firms are participating in the global value chains in the 2000s, and it may increase productivity and employment of the Korean manufacturing industries. In this section, we explore the changing trade pattern of the Republic of Korea associated with global value chain participation.

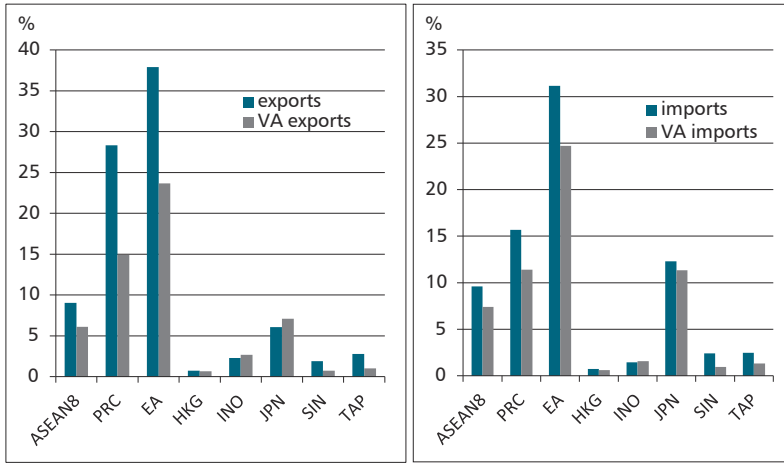
As shown in Figure 1, the difference between exports of the Republic of Korea to its Asian trading partners and Korean domestic value added created by foreign economies' final demand is high. In Eastern Asia (the People's Republic of China (PRC); Japan; the Republic of Korea; Hong Kong, China; and Taipei,China) about 14.3% points (37.9% of exports minus 23.6% of value added exports) of exports share are actually demanded by other developed economies. The figure demonstrates that the Republic of Korea is participating in *Factory Asia*'s processing trade. It can be inferred that the Republic of Korea may use the Asian trading partners as export platform or Asian global exports require large amount of intermediate imports from the Republic of Korea.

On the right-hand side of Figure 1, the blue bar indicates Korean gross imports from Asian trading partners and the gray bar indicates the level of foreign value added embodied in Korean domestic final demand. Thus, the

3. A multinational firm builds a plant of its own in a foreign country, manufactures intermediate parts there, and imports them back to its assembly plant at home. In this case, it impacts the home country's imports directly. These imports are documented as intrafirm trade. If the re-imported intermediates are sold to other domestic manufacturers, the shipments raise arm's length trade. Imports generated by offshoring consist of intrafirm trade and arm's length trade.

difference may reflect the amount of re-exported intermediate imports. Whether or not the Republic of Korea's Asian trading partner serves as its export platform or large amount of exports are foreign value added imports in Korean exports, the difference between gross trade and value added trade illustrates that the Republic of Korea is an important part of *Factory Asia*. It also shows that the Republic of Korea participates deeply in the processing trade of Asia.

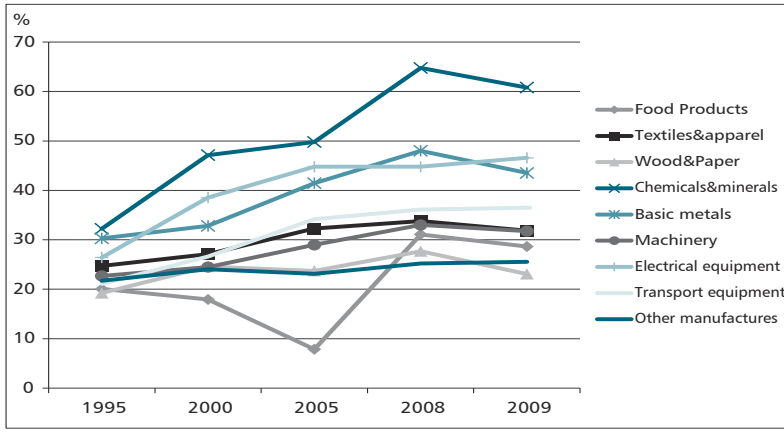
Figure 1: Exports and Imports of the Republic of Korea in Gross and Value Added Terms, by Partner Economy
(as % of total in year 2009)



ASEAN8 = Brunei Darussalam, Cambodia, Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam; PRC = People's Republic of China; EA= the People's Republic of China; Hong Kong, China; Japan; the Republic of Korea; and Taipei,China; HKG= Hong Kong, China; INO= Indonesia; JPN= Japan; SIN = Singapore; TAP = Taipei,China.
Source: OECD-WTO Trade in Value Added (TiVA), May 2013.

As shown in Figure 2, foreign value added content shares of Korean exports in various industries are rapidly increasing over time. In particular, electrical equipment and basic metals contain about 30% of foreign content in its exports in 1995. In 2009, about 45% of foreign content are used to produce exports. About 16% points increase in foreign value added content of exports indicates that international outsourcing in the manufacturing sector is a prevalent trading pattern for the past two decades.

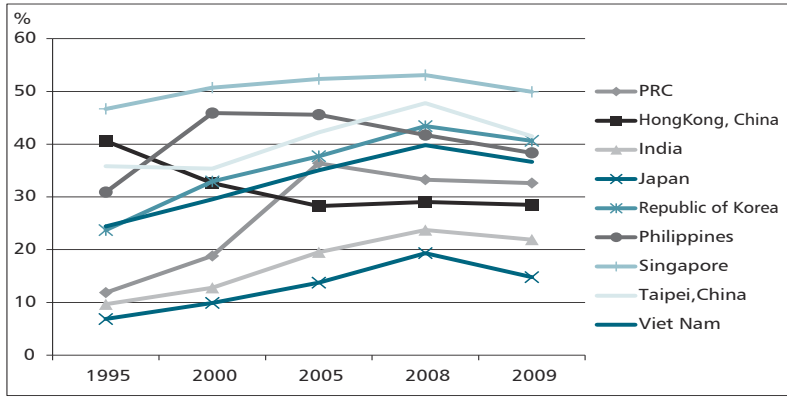
Figure 2: Foreign Value Added Content Share of Gross Exports by Industries—Republic of Korea



Source: OECD-WTO Trade in Value Added (TiVA), May 2013.

Figure 3 compares foreign value added content share of gross exports at the country level from 1995 to 2009. In Singapore, gross exports contain about 50% of foreign value added content. The Republic of Korea has 40% of foreign value added content of exports after 2008. The Republic of Korea has a very high share of foreign value added content of export not only among Asian economies but also among the OECD countries. It shows that the Republic of Korea has an important role as a center of *Factory Asia*.

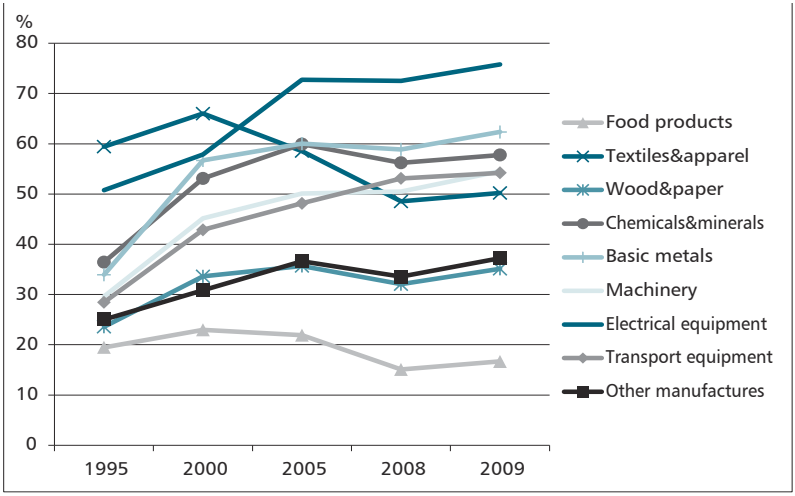
Figure 3: Foreign Value Added Content Share of Gross Exports, by Country, 2009



Note: PRC = People's Republic of China.
Source: OECD-WTO Trade in Value Added (TiVA), May 2013.

In Figure 4, re-exported intermediate imports as a % of total intermediate imports are shown at the industry level. Electrical equipment re-exported 50% of its intermediate imports in 1995. The share of re-exported intermediate imports has continually increased over time. In 2009, the share reached about 76%. It illustrates that about three-quarters of its intermediate imports are used in the final production stage for exports. In electrical equipment, basic metals, chemical and metals, transport equipment, machinery, textile and apparel industries, Korean firms internationally outsource intermediate inputs. And the re-exported intermediates share is greater than its domestic uses of imported intermediate inputs.

Figure 4: Share of Total Intermediate Imports that are Re-Exported by Industry—Republic of Korea



Source: OECD-WTO Trade in Value Added (TiVA) - May 2013.

In Table 2, least and most upstream manufacturing industries for the PRC, Japan, the Republic of Korea, and the United States (US) are shown. The industries are ranked by the measure of manufacturing industry's 'upstreamness' in the Republic of Korea. We use the upstreamness measure of Antràs et al. (2012) to show how fragmentation of production is developed in Korean industries. The measure of upstreamness can explain how countries specialize in particular stages of global production processes. It reveals whether the Republic of Korea specializes in more upstream or downstream production stages.

Relative production-line position of Korea's machinery and equipment industry in the global value chains is 2.26.[4] It is higher than the US at 1.79 but lower than the PRC at 2.40. Upstreamness is the average position in the value chains at which input enters into use. Thus, Korean firms enter into the global value chains later than the PRC but earlier than the US. In other words, the US is located at the downstream stage of global value chains. The US is located closest to the final sales and distribution stage. If the machinery and equipment industry's stage inputs are substitutable, the US would internationally outsource the downstream to provide strong incentives to foreign suppliers in the PRC and the Republic of Korea (Antràs and Chor, 2013).[5]

As shown in Table 2, the Republic of Korea's industry average of upstreamness was 3.14 in the year 2005. It was lower than the PRC (3.40) but higher than Japan (2.68) and the US (2.12). Downstream stage cannot commence before upstream stage is completed.[6] Located in downstream stages of the global value chain can be more beneficial for firms to increase value added. Food products, textiles, building ships, machinery and equipment, and motor vehicle industries in the Republic of Korea are located at the downstream stages compared with the PRC. Thus, these industries may have a comparative advantage in international outsourcing to the PRC.

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4. As defined in Antràs et al. (2012), a measure of industry upstreamness is an average distance from final use (namely consumption, investment, net changes in inventories and net exports). The measure of upstreamness is larger than 1 (where all output goes only to final uses) and it rises with relatively higher levels of industry upstreamness. In the most downstream industries, almost all of their outputs go directly to the end users. In contrast, the most upstream industries are associated with processing raw materials.
5. Antràs and Chor (2013) show that downstreamness matters for a firm's organizational decision on foreign outsourcing. They show that industry downstreamness increases when a firm expands unique global sequential production process. Since the production process is sequential in nature, at each stage, firms decide whether or not to make or buy stage inputs. Outsourcing of the downstream in the value chain increases in substitutes case, while integration of the downstream increases in complements case. Depending on the marginal contribution of an intermediate supplier, stage input becomes a sequential substitute. Substitute case occurs when the marginal contribution of an intermediate input supplier decreases as the value of production up to a stage of the value chain increases. If stage inputs are substitutes, firms integrate the upstream but outsource the downstream of the production process.
6. A measure of industry downstreamness is a reciprocal of upstreamness measure.

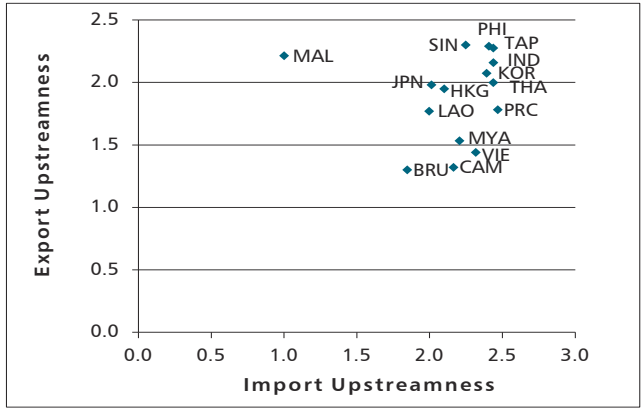
Table 2: Least and Most Upstream Industries
(Manufacturing in year 2005)

OECD STAN industries (year 2005)	Upstreamness			
	KOR	Japan	PRC	US
Pharmaceuticals	2.041	1.978		
Food products	2.115	1.416	2.454	1.558
Textiles and apparel	2.186	1.700	3.535	1.441
Building and repairing of ships and boats	2.189	5.270		1.622
Machinery and equipment, n.e.c.	2.263	2.029	2.395	1.794
Aircraft and spacecraft	2.360	2.213		
Other manufactures	2.435	2.631	3.706	1.492
Office, accounting and computing machinery	2.491	1.282	3.793	1.921
Medical, precision and optical instruments	2.588	1.482	3.009	
Motor vehicles, trailers and semi-trailers	3.083	2.888	3.111	1.625
Fabricated metal products, except machinery and equipment	3.203	2.608	3.431	2.615
Other non-metallic mineral products	3.219	2.760		2.541
Pulp, paper, paper products, printing and publishing	3.314	3.221	4.135	2.293
Wood and products of wood and cork	3.341	2.753	3.226	2.568
Electrical machinery and apparatus, nec	3.353	2.629	3.325	2.089
Rubber and plastics products	3.731	3.336	2.969	2.494
Radio, television and communication equipment	4.122	1.231		
Iron and steel	4.768	4.617	4.223	3.335
Non-ferrous metals	4.876	3.807		
Chemicals excluding pharmaceuticals	5.141	3.790	4.262	2.344
Industries Average	3.141	2.682	3.398	2.115

PRC = People's Republic of China, KOR = Republic of Korea, OECD STAN = Organisation for Economic Co-operation and Development Structural Analysis Statistics, US = United States.
Source: Antràs et al. (2012).

In Figure 5 country-level export and import upstreamness are measured by using industry-level exports and imports as weights for industry upstreamness index shown in Table 2. As shown in Figure 5, the relative global production line positions of the Republic of Korea and of the other Asian countries are closely located. It implies that the Republic of Korea and other economies are becoming more interdependent in the global value chains.

Figure 5: The Relative Production Line Position of Asian Economies' Trade



BRU = Brunei Darussalam; CAM = Cambodia; PRC = People's Republic of China; HKG = Hong Kong, China; IND = India; JPN = Japan; KOR = Republic of Korea; LAO = Lao PDR; MAL= Malaysia; MYA = Myanmar; PHI = Philippines; SIN = Singapore; TAP = Taipei,China; THA = Thailand; VIE = Viet Nam.
Source: Antràs et al. (2012).

4. Empirical Analysis

(1) Empirical Methodology and Specifications

The impact of international outsourcing on job growth in the Republic of Korea is analyzed focusing on falling outsourcing costs. International outsourcing may increase job growth in the Republic of Korea as foreign trading of complex tasks that make stage inputs in the global value chains increases.

The development of GVCs in the Asian region depends mainly on the processing trade in the PRC, and also other low-cost and low-technology manufacturers in East Asian economies. The Republic of Korea has upgraded its industrial capacities and exports by offshoring its low-cost activities to foreign export platforms in cheap labor-abundant countries of Asia.

We hypothesize that easier international outsourcing negatively affects job growth in Korean manufacturing industries. However, the effect of international outsourcing on job growth differs with respect to the labor intensity at the industry level. In particular, international outsourcing may

decrease job growth in the labor-intensive sector while it may increase in the capital-intensive sector. The differential effects of international outsourcing on job growth depend on the productivity effect and the displacement effect of international outsourcing.

The productivity effect associated with international outsourcing may exceed the displacement effect. Ottaviano et al. (2013) show that native and offshore workers are specialized in tasks of different skill complexity; natives specialized in high complexity tasks and offshore workers in intermediate or low complexity tasks. In this chapter, we build an empirical model to analyze the effect of falling barriers to outsourcing on the tasks, and the employment level of Korean workers. A decrease in offshoring costs leads to task upgrading of natives; the offshore workers are assigned the least complex among the high complex tasks previously performed by native workers. Then the employment share of native workers decreases as the group of workers from which tasks are taken away sees its employment share fall. However, when the efficiency gains from offshoring are large enough, employment levels may increase all groups of workers.[7] The changes in employment levels are affected by the improvement of the overall efficiency of the production process. Thus, we expect that easier international outsourcing in Asia has a negative effect on native worker employment. However, easier outsourcing increases the employment levels of natives especially on the high complex tasks.

This chapter builds an empirical model taking full account of the following characteristics of international outsourcing in the global value chains. First, in the Dixit and Stiglitz (1977) variety model, productivity of firm increases as the variety of firm's intermediate input choices increases. Second, multinational firms take part more deeply in the global value chain. As firms' participation in the global value chains intensifies, they increase re-exported intermediate imports since they upgrade their productivity by choosing more efficient intermediated inputs. Complexity of tasks is upgraded in GVC and the increased productivity affects firms' output, sales and employment. Thus, we expect that as firms' GVC participation increases, its productivity is also increased, which invoke the

7. Grossman and Rossi-Hansberg (2008) show the productivity effect of task trade and identify the differences between trading tasks and trading goods. Trading tasks bring shared gains to all domestic factors in contrast to the distributional conflicts associated with trading goods.

increase of net exports of domestic value added. As a result, job growth in the manufacturing sector in the Republic of Korea rises.

Third, Antràs and Chor (2013) show that downstreamness matters for determination of foreign outsourcing. They demonstrate how downstreamness of an industry in the global value chains affects a firm's organizational decision between vertical integration and outsourcing.

Fourth, Yeaple (2003) shows that FDI in two foreign locations can substitute or complement each other depending on the level of transport costs. In contrast to FDI, international outsourcing imports intermediate inputs through arm's length trade. In this chapter, firm-level heterogeneity is controlled to take into account the role of productivity dispersion across firms within industries on firm's organizational forms (Antràs and Helpman, 2004). Since the degree of firm heterogeneity differentiates the outsourcing and integration decision of multinational enterprises, we may take into account the differential effects of international outsourcing on job growth in the Republic of Korea. We test these hypotheses regarding the effects of international outsourcing on manufacturing job growth in the Republic of Korea by estimating the following model:

$$\begin{aligned}\text{Job growth}_{ikt} = {} & \beta_0 + \beta_1 \text{ international outsourcing}_{jkt} + \\ & \beta_2 \log(\text{captial intensity})_{ikt} + \beta_3 \log(\text{R\&D intensity})_{ikt} + \\ & \beta_4 \text{ firm heterogeneity}_{kt} + \text{time fixed effects}_t + \\ & \text{industry fixed effects}_k + \varepsilon_{ijkt}. \end{aligned} \quad (1)$$

The dependent variable Job growth$_{ikt}$ is the logarithm of the employment level in firm i and industry k at time t. International outsourcing$_{jkt}$ is share of foreign value added content embodied in gross exports to country j in industry k at time t; log (capital intensity)$_{ikt}$ is the logarithm of capital intensity of firm i in industry k at time t; and log (R&D intensity)$_{ikt}$ is the logarithm of R&D intensity of firm i in industry k at time t. Firm heterogeneity$_{kt}$ is dispersion of firm productivity in industry k and year t. In all specifications, the time and industry fixed effects are controlled. ε_{ijkt} is errors that contains heteroskedasticity.

We control international outsourcing with foreign value added content share of gross exports. It is the % of value added created in the foreign country that used to produce exports of home country. This variable reflects arm's length trade between firms across countries. Participation

in GVC is endogenous to complexity of tasks. As firms outsource across countries within industries, firms would have greater variety of intermediate input choices and choose efficient inputs for final goods production by building and upgrading skill contents in the global production line (Dixit and Stiglitz 1977, Antràs and Chor 2013). As the firm increases its productivity by specializing in high complex tasks, its outputs, sales and employments increase. In this chapter, we control foreign value added content share of gross exports to take into account the role of intermediate input variety on productivity improvement and its consequential effect on employment level.

In addition, we also control participation in global value chain in Asia as a proxy variable of international outsourcing. We estimate how increasing participation in GVC in Asia (value added exports; domestic value added embodied in foreign final demand, VA imports; foreign value added embodied in domestic final demand) affects job growth in the Republic of Korea. We want to show that manufacturing industries with larger participation in GVC (global outsourcing) increase native employment growth greater than those with delayed entrance to the global value chain. When firms increasingly participate in GVC, efficiency gains can be reaped by hiring offshore workers to perform tasks in which they have comparative advantages, giving native workers the opportunity to specialize in the tasks to their own comparative advantage. This productivity effect associated with the improved task assignment may offset the displacement effect of international outsourcing on native worker's employment (Ottaviano et al. 2013).

In line with Antràs and Helpman (2004), we control headquarters intensity and firm heterogeneity. The relative importance of intermediate inputs is measured by labor intensity at the industry level. In this chapter, we separate the sample to control for the labor intensive industries. Asia is labor abundant and has a comparative advantage in labor-intensive industries. As a result, international outsourcing in labor-intensive industries in Asia can be more prevalent than internalization of foreign producers into parent country firms using complex integration of vertical FDI, horizontal FDI, and platform FDI. To control the importance of intermediate imports and the role of labor intensity in the labor-intensive sector, we separate the sample in the labor-intensive industries by following the high and low technology sector classification of OECD (Hatzichronoglou, 1997).

Firm heterogeneity is also controlled in estimation equation (1). Antràs and Helpman (2004) show that in addition to the relative importance of intermediate inputs, firm heterogeneity affects outsourcing. They show that international outsourcing is higher in sectors with lower headquarters intensity and in sectors with lower productivity dispersion. Thus, we control firm heterogeneity to separate the role of headquarters intensity in the causal relationship between international outsourcing and job growth in the Republic of Korea. Lower headquarters intensity at the industry level affects firms to outsource stage inputs that are used in the global value chain. Firms that internationally outsource intermediate inputs import their intermediates at arm's length. However, those that integrate foreign suppliers import intermediates from their foreign affiliates through intrafirm trade.

Within firms that offshore, the least productive outsource, while the most productive integrate. In this chapter, we expect that firms that acquire intermediate inputs in Asian economies mostly outsource at the labor-intensive industries. And the degree of arm's length imports varies across sectors and countries. In the estimation equation (1), headquarter intensity and productivity dispersion are measured by the logarithms of parent firms' capital intensity (Antràs and Chor, 2013) and R&D intensity (log of R&D/ Sales), and firm heterogeneity at the industry level. We expect that as headquarters intensity and firm heterogeneity decrease, international outsourcing rises.

We implement the two stage least squares (2SLS) estimation using sector-specific tariffs as instruments for international outsourcing.[8] Trade cost dimension of international outsourcing, which hampers the re-import of the output generated by internationally outsourced tasks is considered. Since the international outsourcing is endogenous to falling barriers of outsourcing costs, we control the home country sector-specific tariffs at the first stage of estimation. We expect that falling sector-specific tariffs increase international outsourcing at the industry level. This may explain cost-driven factors of the increasing participation in the GVC.

8. Ottaviano et al. (2013) use sector-specific tariffs as instrument for offshore employment in an industry-year.

(2) Data Sources and Descriptions

Firm-level employment data in the Korean manufacturing sector is obtained from the KISLINE and it includes companies listed in the Republic of Korea stock exchange and under financial account auditing.[9] The data cover the period from 2000 to 2011.

We use the joint OECD-WTO database on Trade in Value added (TiVA) for international outsourcing in 1995, 2000, 2005, 2008, and 2009. TiVA consists of 34 OECD countries and 23 non-member economies including major emerging countries like Brazil, the Russia Federation, India and the People's Republic of China (BRICs). And several economic zones such as ASEAN8, NAFTA, OECD, and EU27 are available in the trade in value added data.[10] In Korean bilateral trade in value added, there are total of 6,175 observations on industry level. Not all TiVA variables have full observations, and the data are unbalanced. The Republic of Korea's trading partners in Asia include ASEAN8; the PRC; Hong Kong, China; India; Japan; Russian Federation; and Taipei,China. The unit is US million dollars.

Foreign value added content share of gross exports is share of gross exports that embody value added content of a foreign country. It is available at the partner country-industry level. Share of domestic value added embodied in foreign final demand is a % of domestic value added in foreign final demand at the industry and partner country level. Share of foreign value added embodied in domestic final demand is % of foreign value added that is demanded by domestic final demand at the industry and partner country level.

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9. KISLINE is the firm-level database compiled by NICE Information Service Co., Ltd. in the Republic of Korea.
10. ASEAN8 comprises of Brunei Darussalam, Cambodia, Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam. North American Free Trade Agreement (NAFTA) comprises of Canada, Mexico, and the US. EU27 comprises of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

Capital intensity is firm level physical capital stock. R&D intensity is calculated by summing up firm level R&D expenditure and divided by industry level total sales. Firm heterogeneity is dispersion of firm productivity at the industry level (Helpman et al. 2004). It is built by regressing log of firm ranking on log of firm size in the industry. The slope of the estimation equation of log rank on log size shows the dispersion of firm productivity in the industry. These firm-level employment, headquarters intensity, and firm heterogeneity variables are obtained from Korean firm-level business activity data from 2000–2011(KISLINE, 2013). The unit of account is million won.

Sector-specific tariffs are compiled at the HS 6-digit applied tariff rates from the WTO. We use correspondence of HS 6-digit product code with the Korean Standard Industrial Classification (KSIC) middle level. The sector-specific tariffs are industry level average applied tariff rates in the Republic of Korea.

We separate the sample by relating OECD technological industry classification code with the KSIC code as Jang and Hyun (2012) and Choi (2012). Low and medium-low technology industries such as basic metals, chemicals and minerals, food products, other manufactures, textiles and apparel, wood and paper are categorized as labor-intensive industries. It corresponds at the KSIC middle level (medium-low tech 22, 33, 24, 23, 25, 19, 24; low tech 17, 18, 13, 14, 10, 11, 12, 16, 32). However, high- and medium-technology industries include electrical equipment, machinery, transport equipment and chemicals and minerals etc.[11]

5. Results

(1) Initial Estimates

11. Chemicals and minerals industry is classified in both labor-intensive and high-tech industries. While the Korean employment data is highly disaggregated at the firm level, the OECD-WTO TiVA data is aggregated at the industry level. Merging the disaggregated firm-level employment data with the aggregated industry-level trade data may treat firms with different degrees of technology intensity as the same within industry. However, when the different levels of technology intensity of firms are emphasized, some firms may be classified as labor-intensive and others as high-tech intensive in the chemicals and minerals industry.

The effect of international outsourcing on Korean firm-level employment is estimated and the results are reported in Table 3. Columns (1), (2), and (3) show the 2SLS effects of increasing international outsourcing on employment level of Korean manufacturing firms. The roles of headquarters intensity and firm heterogeneity are also controlled independently. In all columns, we use sector-specific tariffs as an instrument for the foreign value added share of gross exports (Ottaviano et al., 2013). The impact of the cost of international outsourcing on the explanatory variable, displayed in the first stage of regression, is statistically significant at the 1% level and has the expected sign. As the cost of international outsourcing increases foreign value added content share of gross exports in the manufacturing sector decreases.

In columns (2) and (3), we separate the sample to the labor-intensive industries and the high-and medium-technology industries. We differentiate the effects of international outsourcing in the labor intensive industries. In line with Antràs and Helpman (2004), we control the relative importance of intermediate inputs by labor intensity at the industry level. The heteroskedasticity robust standard errors are reported in each regression.

The results are interesting as foreign value added content share of gross exports negatively affects Korean firm-level job growth. Column (1) shows that an increase in the share of foreign value added by 1% decreases Korean firm-level employment by 0.13% over the period between 2000 and 2009. The negative effect of international outsourcing on employment level of the Korean manufacturing sector implies that recent job decline in the manufacturing sector in the 2000s was driven by the displacement effect of international outsourcing. It is statistically significant at the 1% level.

Column (2) shows that the increasing international outsourcing negatively affects firm employment level of Korean labor-intensive manufacturing industries. In particular, an increase in the share of gross exports that embody foreign value added content by 1% decreases Korean firm-level employment by 0.27% over the period 2000 to 2009. The estimated effects are statistically significant at the 1% level. And at the first stage, the decline of international outsourcing costs (tariffs) statistically significantly increases international outsourcing. This suggests that over the 10 years considered (2000–2009), the displacement effect of international outsourcing on employment in the labor-intensive industry was dominating

Table 3: Effects of International Outsourcing on Firm Employment

Dependent variable: ln (employment) Specifications	All industries (1) IV	Labor-intensive (2) IV	Tech-intensive (3) IV
Foreign value added share of gross exports	-0.132*** (0.0497)	-0.272*** (0.0908)	0.306** (0.119)
ln (Capital intensity)	0.483*** (0.00612)	0.454*** (0.0123)	0.511*** (0.00783)
ln (R&D intensity)	0.00525 (0.00897)	-0.0140 (0.0154)	0.236*** (0.0369)
Firm heterogeneity	-0.0160** (0.00660)	-0.0472*** (0.0177)	-0.776*** (0.105)
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
First stage:	Foreign value added share of gross exports	Foreign value added share of gross exports	Foreign value added share of gross exports
Sector-specific tariffs	-0.074*** (0.010)	-0.068*** (0.127)	-0.120*** (0.027)
Constant	4.019* (2.155)	13.11*** (4.058)	-22.97*** (6.334)
Observations	21,367	8,503	12,864
R-squared of first stage	0.937	0.943	0.954

OLS = ordinary least squares.
Notes: All regressions include industry and year fixed effects. Heteroskedasticity-robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

over the productivity effect (Ottaviano et al. 2013). The importance of intermediate inputs in the labor-intensive industry is more likely to be increasing over the past 10 years.

This finding suggests that in labor-intensive industries such as basic metals, food products, other manufactures, textiles and apparel, and wood and paper, the tasks and stage intermediate inputs that were outsourced internationally were more likely to be at the lower complexity. Thus, the domestic workers with a comparative advantage on lower complexity tasks have experienced difficulty for job displacement to the higher end of the task spectrum for domestic workers.

Column (3) shows that the 2SLS effect of international outsourcing on employment level in the high- and medium-technology industries is positive and statistically significant at the 1% level. In contrast to the results shown in columns (1) and (2), the easier international outsourcing brings positive effects on the increasing employment level in the high-tech industries. In particular, an increase in the share of foreign value added of gross exports by 1% increases Korean firm-level employment by 0.31% over the period between 2000 and 2009. The first stage estimation also confirms the expected role of falling outsourcing costs on international outsourcing. These findings are in line with the empirical results of previous literature (Grossman and Rossi-Hansberg 2008, Ottaviano et al. 2013).

Empirical evidence on the role of easier international outsourcing on the increasing complexity of the tasks performed by native workers is shown in Ottaviano et al. (2013). They construct skill intensity index and regress it on the costs of immigration and offshoring. With easier offshoring and immigration, the skill intensity of native tasks increases. Productivity effects become strong enough so that native employment growth with participation in GVC is greater than lagging global exposure. While the result shown in this chapter is not direct evidence of this, the dominating productivity effect in the Korean high-technology industries shown in column (3) is consistent with this explanation.

In all columns, the effect of firm heterogeneity on employment level in the Korean manufacturing sector is negative and statistically significant at the 1% level. Within industry as the productivity dispersion between the least productive firms and most productive firm decreases, most firms' source intermediate inputs domestically and the employment level increases. These findings are in line with related literature on the role of firm heterogeneity on exporting and offshoring (Antràs and Helpman 2004).

(2) Alternative Specifications and Robustness

In Table 4, we estimate the corresponding direct regressions of Korean manufacturing employment on easier international outsourcing with respect to the 2SLS estimations shown in Table 3. The employment level in the Korean manufacturing sector is regressed directly on the sector-specific tariffs as a measure of international outsourcing costs rather than using it as an instrument variable for foreign value added content share

Table 4: Effects of Outsourcing on Employment—Direct OLS
(measured by Sector-Specific Tariffs)

Dependent variable: ln (employment) Specifications	All industries (1) Direct OLS	Labor-intensive (2) Direct OLS	Tech-intensive (3) Direct OLS
Sector-specific tariffs	0.00911*** (0.00155)	0.0194*** (0.00184)	-0.0462*** (0.00478)
ln (Capital intensity)	0.504*** (0.00301)	0.482*** (0.00542)	0.521*** (0.00338)
ln (R&D intensity)	0.0124*** (0.00417)	-0.0267*** (0.00522)	0.0458*** (0.0115)
Firm heterogeneity	-0.00580 (0.00421)	0.00747*** (0.00380)	-0.728*** (0.0504)
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Constant	-3.256*** (0.0468)	-3.623*** (0.0879)	-3.521*** (0.0685)
Observations	58,347	23,201	35,146
R-squared of first stage	0.559	0.521	0.590

OLS = ordinary least squares.
Notes: All regressions include industry and year fixed effects. Heteroskedasticity-robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

of gross exports. In column (1), an increase in the cost of international outsourcing (sector-specific tariffs) has significantly positive effects on Korean manufacturing employment level. As international outsourcing costs rise, the displacement effect of employment decreases and the domestic employment level rises.

The sample is separated between labor-intensive sector and high-tech intensive sectors and the results of corresponding direct regressions are shown in columns (2) and (3). In column (2), the effect of increasing international outsourcing costs on job growth in Korean labor-intensive industries is positive and statistically significant. However, in column (3) higher costs of international outsourcing decrease employment level in the high-tech industries. This finding suggests that the productivity effect of international outsourcing on employment level is greater than displacement effect in the high-tech industries. Thus, raising barriers on international outsourcing negatively affects the positive effect of task upgrading and

efficiency gains associated with international outsourcing on employment level in the high-technologies industries.

In Table 5, we use greater participation in GVC as a proxy variable of global outsourcing in ASEAN countries. The 2SLS effects of value added exports (imports) of the Republic of Korea to (from) ASEAN countries on Korean manufacturing employment level are statistically significant at the 1% (10%) level. In the first row of Table 5, the rising share of total domestic value added exports embodied in foreign final demand in ASEAN countries increases firm-level employment in the Korean manufacturing industries. On the contrary, in the second row columns (2) and (4) the rising foreign value added imports from ASEAN countries that embodied in Korean domestic final demand decrease domestic employment level in the Korean manufacturing industries.

At the first stage in columns (1) and (3), the increasing outsourcing costs increase value added exports. However, column (5) shows that the decline of international outsourcing in the high-technology sector increases value added exports. Similarly in columns (2), (4) and (6), at the first stage, the easier international outsourcing helps increase the share of value added imports in all manufacturing industries regardless of factor intensity. Interesting is the finding in column (6) the easier international outsourcing increases value added imports and as a result the employment level in the high-tech industries increases.

These findings suggest that easier international outsourcing in high-tech industries increases participation in the GVC. As a result, the increases in value added exports and imports respectively positively affect firm employment level in Korean high-tech industries. In other words, over the past 10 years (2000–2009), the high-tech industries such as electrical equipment, machinery, transport equipment, chemicals and minerals became more interdependent with ASEAN countries. It is partly because falling international outsourcing costs to Asia significantly raises value added trade of Korean firms, and the productivity effects were likely to be more significant than the displacement effect.

When firms increasingly participate in the GVC, efficiency gains can be reaped by hiring offshore workers to perform tasks in which they have comparative advantages, giving native workers the opportunity to specialize in the tasks to their own comparative advantage. This productivity effect

associated with the improved task assignment may offset the displacement effect of international outsourcing on native worker's employment (Ottaviano et al. 2013).

Table 5: Effect of GVC Participation on Employment, trading with ASEAN8

Dependent variable: ln (employment) Specifications	All industries (1) IV	All industries (2) IV	Labor-intensive (3) IV	Labor-intensive (4) IV	Tech-intensive (5) IV	Tech-intensive (6) IV
Share of Value added Exports	0.480*** (0.165)		1.181*** (0.421)		0.461*** (0.121)	
Share of Value added Imports		-1.422* (0.784)		-1.734** (0.708)		0.116*** (0.031)
ln (Capital intensity)	0.490*** (0.006)	0.477*** (0.009)	0.473*** (0.015)	0.443*** (0.014)	0.507*** (0.006)	0.507*** (0.006)
ln (R&D intensity)	0.044*** (0.014)	0.012 (0.011)	-0.027 (0.021)	0.06 (0.04)	0.212*** (0.023)	0.208*** (0.023)
Firm heterogeneity	-0.018*** (0.007)	0.019 (0.012)	-0.001 (0.005)	0.048*** (0.019)	-0.650*** (0.079)	-0.608*** (0.08)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
First stage	Share of VA exports	Share of VA imports	Share of VA exports	Share of VA imports	Share of VA exports	Share of VA imports
Sector-specific tariffs	0.02*** (0.003)	-0.007*** (0.003)	0.016*** (0.004)	-0.01*** (0.002)	-0.8*** (0.002)	-0.317*** (0.011)
Constant	-5.264*** (0.728)	12.67 (8.662)	-11.59*** (3.000)	18.64** (8.819)	-6.897*** (0.792)	-5.454*** (0.360)
Observations	21,367	21,367	8,503	8,503	12,864	12,864
R-squared of first stage	0.858	0.962	0.767	0.979	0.942	0.957

Notes: ASEAN8 comprises Brunei Darussalam, Cambodia, Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam, VA = value added.

Notes: All regressions include industry and year fixed effects. Heteroskedasticity-robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

6. Conclusions

This chapter empirically investigates the extent to which lowering international outsourcing costs brings productivity effects on job growth in manufacturing industries. Using firm-level Korean manufacturing employment data and OECD-WTO statistics on industry-level trade in value added shares over the period 2000 to 2009, this study finds that the lowering international outsourcing costs decreases Korean manufacturing employment. However, the effects of international outsourcing on job growth in the Republic of Korea differ across industries. In particular, in the high-technology industries, an increase of the share of foreign value added content of gross exports by 1% increases Korean firm employment by 0.31%. On the contrary, in the labor-intensive industries, it decreases firm employment by 0.27%. Overall, the 1% increase in international outsourcing decreases firm employment by 0.13%. This suggests that the productivity effect of international outsourcing on job growth in technology-intensive sector is offset by the displacement effect of international outsourcing in labor-intensive industries.

In addition, this paper finds that Korean firms' increasing participation in GVC through Asia (ASEAN) has a positive and significant impact on increasing firm-level employment. In particular, the positive effect of value added exports and imports of the Republic of Korea with ASEAN associated with declining international outsourcing costs (tariffs) on firm-level employment in the technology-intensive industries is positive and statistically significant over the past 10 years (2000–2009).

The empirical evidence assembled in this chapter suggests that the interdependence between job growth in the Republic of Korea and its production line position within the evolving global value chains in Asia has been increasing recently. International outsourcing in high-tech industries and labor-intensive industries affects the complexity of tasks of the workers and the employment level in the Republic of Korea. In knowledge and capital-intensive (high-technology) industries, the Republic of Korea has a comparative advantage regarding development of complex tasks and downstream stages of global production processes. In contemporary world economy, Asia is devoted to developing domestic markets and improving market competitiveness in the manufacturing sector. The Republic of Korea is located geographically proximate distance with other economies of Asia, has relatively lower outsourcing costs to Asia, and Korean

industry's production line position in the global value chains is similar to those of the Asian economies. Thus, it is quite plausible that Korean firms continually expand international outsourcing in *Factory Asia* to improve its global competitiveness in the manufacturing sector.

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Chapter 4

Do Small and Medium Enterprises Gain from Global Production Networks? Evidence from the Republic of Korea

Hea-Jung Hyun*
Kyung Hee University

Abstract

This chapter explores the impact of global production sharing on firm performances of small and medium enterprises (SMEs). Using unique Korean firm-level data, we find that SMEs benefit from relocation of production abroad. Empirical evidence shows that there are strong positive impacts of offshoring on firm productivity and these effects are manifested when firms choose to offshore to ASEAN (Association of Southeast Asian Nations) through external suppliers rather than foreign affiliates. These results suggest that strategic choice of global engagement to take advantage of lower transaction costs may be suitable to SMEs.

Keywords: global production networks; offshoring; small and medium enterprises; foreign insourcing; foreign outsourcing.
JEL Classification: F23; L22.

*Assistant Professor, College of International Studies, Kyung Hee University, Republic of Korea. Email: hjhyun@khu.ac.kr. Tel: +82-31-201-2306. Fax: +82-31-201-2281.

1. Introduction

The structural change of the global economy is characterized as integration of trade and disintegration of production (Feenstra, 1998). The remarkable increase in international production sharing that is reflected in unusually high growth rates for the exchange of components or partially manufactured goods is well documented in published studies (Ng and Yeats, 2003). The rapidly growing production sharing followed by an expansion of the production networks in East Asia is not an exception and has been one of the most important features of globalization of this region. East Asia's share in total network production sharing increased from 32.2% in 1992–1993 to 40.3% in 2006–2007. Between these periods, there has been a sharp increase in parts and components in network trade across all economies in East Asia (Athukorala, 2010).

This kind of global production sharing is used interchangeably with the term offshoring, or fragmentation. Offshoring, often described as 'trade in tasks' (Grossman and Rossi-Hansberg, 2006) refers to relocation of production abroad either inhouse or through external suppliers. That is, offshoring includes both sourcing to firms' own foreign affiliates (foreign insourcing) and subcontracting business process to third parties in another country.

The critical issue regarding offshoring may be its impact on firms' performances. The possible negative impact of offshoring on domestic operation and performances has often been described as 'exporting jobs to foreign countries' and the potential hollowing-out effect through relocating a domestic production site abroad has often been public debate in many countries. However, provided international fragmentation is complementary to domestic activity and firms can enhance competitiveness through substantial cost reduction, the effect of offshoring is not necessarily negative (Ando and Kimura, 2013).

Firms may gain from specialization and the division of production through fragmentation may improve both the level and the growth of productivity of firms. The offshoring can further benefit firms as it can allow firms to purchase higher quality intermediates abroad and reorganize production to concentrate resources in most efficient stages at home (Gorg et al. 2008). These effects, however, may be conditional depending on firms' strategies on the choice of location and organizational structure.

Using French manufacturing industry data, Jabbour (2010) explores the impact of the offshoring strategies on firms' performances. He finds that international outsourcing in developing countries outperforms any other sourcing strategies. Furthermore, offshoring to developing countries, where the firms benefit from lower costs of production has significant impact on productivity while there is no evidence of significant effect of technology sourcing in developed countries. Hijzen et al. (2010) examine the impact of offshoring on productivity using Japanese manufacturing firm-level data and find that global sourcing of intermediate inputs to foreign affiliates has a positive effect on productivity, while the effect is not clear in case of sourcing to a third party. Thus, they put an emphasis on the role of firms' organizational structures in the effects of global sourcing.

Another issue regarding firms' participation in global production network is its effects on small and medium enterprises (SMEs) as well as large enterprises (LEs).[1] The role of SMEs in economic development and growth through more efficient resource allocation and influence on market evolution has been well recognized in documents (Yang and Chen, 2009; Acs, 1992; You, 1995). Despite the emphasis on the role of SMEs, however, the related empirical evidence strongly supports the hypothesis that there is positive association between firm size and efficiency (Taymaz, 2005). Globalization may help to explain this stylized fact. In this decade, internationally engaged firms are larger and more productive (Helpman et al., 2004) rather than SMEs with relatively limited foreign experiences. The rapidly increasing trend of globalization, however, is expected to have a substantial impact on the firm performances of SMEs as well as large firms. As trade is liberalized, it is required for SMEs to survive an increasingly competitive environment and to take advantage of the business opportunities through global production networks. Therefore, we need to explore the empirical evidence of the role and the significance of global engagement on SMEs.

While there is a large body of work on the impact of global production fragmentation on average firms (Hijen et al., 2010; Gorg and Hanley, 2005; Gorg et al., 2008; Criscuolo and Leaver, 2005; Amiti and Wei,

1. According to National Statistical Office of the Republic of Korea, SME is defined as a firm with less than 300 employees or with asset value less than eight billion won. In this chapter, we adopt the first definition.

2009; Tomiura, 2007; and Wagner, 2011), rigorous microlevel study of the performances of SMEs as active participants of global production networks are virtually absent, mostly due to the lack of reliable firm-level data containing information on firms' production activity abroad. Harvie (2010) describes the pattern of globalization and contribution of SMEs on Asia-Pacific Economic Cooperation (APEC) regional economies and the potential opportunities and challenges facing SMEs from participation in production networks. The paper is useful in figuring out the whole picture of the role of SMEs in global production networks, but it lacks rigorous empirical evidence. Ando and Kimura (2013) investigate the pattern of globalizing corporate activities of Japanese manufacturing firms and the impact of these patterns on firms' domestic operations. They find that Japanese firms with expanding operations in East Asia are more likely to increase domestic employment, foreign direct investment (FDI) and trade both in scope and scale. In his survey paper, Kimura (2006) lists 18 facts on production and distribution networks in East Asia and suggests that SMEs have played major roles in FDI in East Asia.

In this chapter, we examine whether SMEs gain from global production sharing. To our knowledge, this is the first to attempt to find empirical evidence of the impact of SMEs' involvement in the global production networks (GPNs) on firms' performances. We used Korean firm-level data which provide explicit and detailed information on global sourcing decisions. Our data allows the sourcing decision in 2001 and 2006, the sourcing region and organizational choice between integration versus disintegration. Our data merged with financial statement also contains information on firms' characteristics such as employment, output, physical capital, R&D and age.

Linkage between global production and firms' performances is inherently an empirical issue. In fact, the major issue in firm-level studies is that the causality between two variables may go in either direction: from participation in global production networks to firm performances or reverse causality. The possibility of reverse causality from firm productivity to internationalization is documented in the theoretical model. In their seminal paper, Helpman et al. (2004) suggest that only the most productive firms, which can bear the higher fixed costs of investment in host foreign countries engage in FDI, less productive firms export, and the least productive firms serve only the domestic market. In a similar context, Antràs and Helpman (2004) also show that only the most productive firms

engage in offshoring and less productive firms outsource to domestic firms. Provided that it is highly plausible that firms' organizational structure and access to international market is endogenously determined, it seems important to control for a potential endogeneity problem in exploring the relationship between firms' global engagement and performances. To resolve these endogeneity issues, this chapter employs average treatment effect combined with propensity score matching estimation technique.

The remainder of this chapter is organized as follows: Section 2 provides theoretical background of our empirical model. Section 3 outlines the econometric framework and section 4 describes the data. Section 5 reports the empirical results. Section 6 concludes.

2. Theoretical Backgrounds

Participation in global production networks may have significant impact on firms' performances. Since it is highly likely that firms' global engagement takes the form of specialization across countries, firms may gain from specialization (Hijzen et al. 2010). The effects of production sharing on firm performances, however, may depend on the choice of location. If we assume that there are two countries, the North and the South, firms in the North may be able to save costs by contracting out some former costly activities to firms in the South that operate at lower costs. More specifically, offshoring of low-skilled or labor-intensive intermediate inputs to the South will save marginal costs of production, which may lead to increase in productivity in the North. Saved marginal costs and increase in employment of skilled labor in R&D sector will raise incentive for innovation and technological progress for reinforcing comparative advantage, which will result in a positive effect on productivity, resurrecting the Schumpeterian idea of creative destruction. As for the South, offshoring could be a source of technological transfer from the North through learning by doing effects or producing intermediate goods in the subsidiaries. In a similar context, Antras and Helpman (2004) show that the final good producer trades off the benefits of lower variable costs in the South against those of lower fixed costs in the North. With these forces, high-productivity firms acquire intermediate inputs in the South, whereas low-productivity firms acquire them in the North as high productivity firms care more about lower marginal costs compared with lower fixed costs and vice versa. Offshoring to the South will allow firms to downsize, reallocate their resources to enhance core competencies and

increase their profitability. In contrast, firms offshore to the North may not benefit from lower variable costs, but may gain from lower transaction costs due to high quality of institutions and more advanced technologies (Jabbour, 2010).

The impacts of GPN may also depend on the way firms are organized. By introducing the within-sector heterogeneity according to different productivity levels, Antras and Helpman (2004) describe the global firm's decision on ownership structures. For the choice between vertical integration and outsourcing, a final good producer should consider the net effect of the benefits of ownership advantage from vertical integration against the benefits of better incentives for the independent supplier of parts. When facing high transaction costs compared to monitoring costs, firms have incentive to integrate to reduce hold-up problems by relocating some stages of production to their own foreign affiliates abroad, easily exercising managerial control over tasks in subsidiaries and can reduce monitoring costs. When transaction costs can be substantially saved compared to the cost of internal management, however, firms may increase vertical disintegration to take advantage of reduced transaction costs and gains from specialization (Hyun and Hur, 2013). McLaren (2000) argued that trade liberalization can thicken input markets, thereby mitigating the hold-up problem and reducing transaction costs, resulting in downsizing and vertically disintegrated industries. These effects are manifest in SMEs rather than LEs. SMEs are known to use more labor-intensive and more standardized technologies, whereas large firms use more relationship-specific inputs and headquarter service (or capital) intensive technologies (Yang and Chen, 2009). Because labor-intensive technologies are more easily transferred between firms, SMEs intensively using these technologies may have incentive to depend on arm's length transaction to take advantage of reduced transaction costs due to thick market established in global production networks. On the other hand, facing more relationship-specific investment and incomplete contract, LEs tend to integrate with input supplier to reduce transaction costs under incomplete contracts.

3. Empirical Model

In this section we build empirical strategy to test the effect of global production on SMEs' performances. For baseline model, we adopt a two-step estimation procedure to derive a total factor productivity (TFP) index

and then estimate the impact of offshoring on SMEs' TFP. In most of the tables representing the empirical results, we report the results for whole sample and large enterprises as well as SMEs for comparison purposes. To examine the condition under which GPN can affect firm performances, we further conduct estimation of the impact of offshoring undertaken in previous years on firm performances in current year by region of production network and organization of global engagement.

3.1. Measurement of Productivity and Baseline Model

To measure firm performance, we use TFP. We derive regression based measure of firm-level TFP in the form of conventional Cobb-Douglas production function. The production function is given in equation (1).

$$lnY_{it} = c + \beta_0 lnA_{it} + \beta_1 lnK_{it} + \beta_2 lnL_{it} + \mu_t + u_{it} \quad (1)$$

Where Y, K, L is output per labor, real capital per labor and labor respectively. A_{it} represents TFP of firm i at time t and measured as the residual of the regression of the natural logarithm of output per labor on the logarithm of capital stock per labor and the logarithm of the number of workers for each industry. The output is measured as total sales of a firm. The capital stock is computed as sum of the stock of building, machine, and transportation. Since we have no information on working hours at the firm level, we use number of workers as a measure of labor. μ_t and u_{it} represent the year dummies and the error term, respectively.

Based on the estimation of productivity in equation (1), we derive our baseline model as follows:

$$lnA_{it+k} = \delta_0 + \delta_1 Offshoring_{it} + \delta_2 lnAge_{it} + \delta_3 lnR\&D_{it} + \delta_4 Export_{it} + \varrho_{t+k} + \theta_j + \varepsilon_{it+k} \quad (2)$$
where $k = 1 \sim 3$

To estimate the importance of the decision to participate in global production network for the firm performances and the control for simultaneity problem, we eliminate the firms that formerly experienced offshoring in 2001 and we restrict the data sample to non-offshoring firms at year 2001. The dependent variable lnA_{it+k} is the residual of regression result of equation (1). $Offshoring_{it}$, a proxy for firms' global production network, is a dummy variable taking the value one if firm i is involved in offshoring at

time t or zero otherwise. Control variables include age, R&D and exporting. $lnAge_{it}$ is the natural logarithm of the number of years of operation. $lnR\&D_{it}$ is natural log of the ratio between the number of workers in R&D department and total employees. $Export_{it}$ is a dummy variable taking value one if firm i is an exporter and zero otherwise at time t. ϱ_{t+k} is year-specific effect observing macroeconomic shocks common to all firms at time t by lead k. θ_i is industry fixed effect to control for unobserved heterogeneity in the determinants of industry-specific productivity. If our theoretical prediction that the participation in GPN raises average firm performances holds, δ_1, the coefficient of lagged offshoring dummy variable is expected to be positive and statistically significant.

3.2. Robustness Check: Endogeneity Issues

Even though we estimate the effects of lagged proxy for SMEs' participation in GPN on their performances to avoid reverse causality, it is possible that the potential endogeneity problem may still remain as it is hard to find appropriate instrument variables from our firm-level data. To resolve this potential endogeneity problem and to confirm the results from empirical test on the impact of global engagement on firms' productivity from baseline model, we employ propensity score matching estimation technique combined with average treatment effect model. This methodology is particularly useful to address a potential endogeneity problem in the absence of appropriate instrumental variable (Damijan et al., 2010). As a first step for empirical test, we identify firms' probability of conducting offshoring, a propensity score. Second, we match global firms and non-global firms based on probability of offshoring and estimate the average treatment effects of lagged offshoring on TFP. Following Rosenbaum and Rubin (1983), the propensity score is defined as the conditional probability of assignment to a particular treatment given the pre-treatment characteristics:

$$p(x) \equiv Prob\{z = 1 \mid x\} = E\{z \mid x\} \tag{3}$$

where $z = \{0,1\}$ is the indicator of offshoring decision and x is a vector of observed pretreatment attributes. We match firms separately for each year using three different matching techniques: the one-to-one nearest neighbor matching method, radius, and local linear regression matching method. For each treatment case, each propensity score $p(x)$ can be computed. Based on this $p(x)$, the Average Treatment Effect (ATT) can be estimated:

$$\hat{\alpha}_{ATT} = E\{y^1 - y^0 \mid z = 1\} = E\{E\{y^1 - y^0 \mid z = 1, p(x)\}\}$$
$$= E\{E\{y^1 \mid z = 1, p(x)\} - E\{y^0 \mid z = 0, p(x)\} \mid z = 1\} \quad (4)$$

where y^1 and y^0 denote the potential outcome, firm performances in the two counterfactual situations of treatment and no treatment of offshoring, respectively. Thus, ATT in our model can be estimated as the ex-post average difference in natural log of TFP between recipients and non-recipients of the treatment for which propensity score $p(x)$ are identical.

4. Data Description

4.1. Key Variable: Decision Regarding Global Engagement

To construct the variable of offshore activities, we used survey data for Korean firms' decisions on four types of organizational form: domestic outsourcing, foreign outsourcing, domestic vertical integration, and foreign insourcing. The 2007 survey—"The survey on international outsourcing by Korean manufacturers"—includes information on various outsourcing activities of 1,000 firms in 2001 and 2006.[2]

To perform the survey, 1,000 firms were drawn through a random sampling process from those listed on Korea Composite Stock Price Index (KOSPI), Korean Securities Dealers Automated Quotations (KOSDAQ), and statutory audited firms. The random selection process was conducted by Gallup Korea under mandate by the government of the Republic of Korea, Ministry of Knowledge Economy (MKE) and the Korea Institute for International Economic Policy (KIEP) in 2007. Second, a survey agent officially visited each of the randomly chosen 1,000 firms and asked the following questions:[3]

(i) Outsourcing Question: "Did your company purchase any intermediate inputs (not raw materials) from independent input suppliers? If Yes, was it done within the Republic of Korea or abroad? If abroad,

2. The survey was first used in a study of Korean firms' outsourcing behavior in 2007 (see KIEP-Policy Analysis, 2007).

3. In fact, there are about 26 questions in the survey written in Korean, of which two questions were translated, which are relevant to our study.

choose the location from the People's Republic of China (PRC), Japan, ASEAN, European Union (EU), North America, and ROW (Rest of the World)

(ii) Insourcing Question: "Did your company procure any intermediate inputs (not raw materials) from your own affiliates? If Yes, was it done within the Republic of Korea or abroad? If abroad, choose the location from the PRC, Japan, ASEAN, EU, North America, and ROW (Rest of the World)

These questions were asked for both the years 2001 and 2006. The first two questions in (i) were designed to identify whether a firm used domestic outsourcing or foreign outsourcing. Also the next question is about the choice of location. The second two questions in (ii) were designed to distinguish between the two internal-sourcing modes of domestic vertical insourcing or cross-border vertical insourcing followed by the question on the location. This yields four categorical vertical structure decisions. However, these four types are not mutually exclusive; many firms tend to choose a mixed-type optimal strategy. For example, firms can outsource to domestic suppliers and in-source to their own foreign affiliates at the same time. Thus, based on multiple answers in the survey, we reclassified the organizational choices into the following four types: domestic outsourcing only (indicated by DO), domestic vertical integration only (DVI), foreign insourcing (FI), and foreign outsourcing (FO). After excluding firms with incomplete answers or unlikely value of variables, we were left with 753 firms. Table 1 shows a noticeable change in organizational form between 2001 and 2006.

Table 1: Firm Share of Organizational Structure by Industry (%)

Industry (21 KSIC with 2-digit code)	DVI	FI	FO	DO	DVI	FI	FO	DO
	2001				2006			
Food Manufacturing	50	5.3	5.3	39.5	44.7	2.6	7.9	44.7
Textile	33.3	3.7	18.5	44.4	21.4	10.7	21.4	46.4
Apparel and Fur Products	6.7	13.3	40	40	0	31.3	43.8	25
Leather, Bags and Shoes	37.5	12.5	12.5	37.5	12.5	25	12.5	50
Timber and Wooden Products	50	0	0	50	50	0	0	50
Pulp, Paper and Paper Products	58.8	0	5.9	35.3	52.9	0	5.9	41.2
Publishing, Printing and Copying Documents	40	0	0	60	40	0	0	60
Cokes, Petroleum and Nuclear Fuel	40	0	0	60	40	0	0	60
Compound and Chemical Products	52.6	2.6	4x.4	40.4	41.2	2.6	8.8	47.4
Rubber and Plastics	62.5	10	5	22.5	42.5	10	5	42.5
Nonmetallic Minerals	51.4	5.7	2.9	40	38.9	8.3	5.6	47.2
Ferrous Metal Products	46.4	3.6	3.6	46.4	42.1	5.3	5.3	47.4
Nonferrous Metal Products	30	6.7	16.7	46.7	10	13.3	16.7	60
Miscellaneous Machinery and Equipment	25	7.1	15.5	52.4	18.8	12.9	20	48.2
Computer and Office Instruments	30.8	15.4	23.1	30.8	23.1	15.4	23.1	38.5
Electric Machinery and Electric Converters	35.7	7.1	11.9	45.2	23.3	11.6	20.9	44.2
Electronic Parts, Video, Sound and Telecommunication Facilities	30.2	11.4	13.4	45	21.9	18.7	23.2	36.1
Medical appliances, Precision and Optical Instruments	38.1	9.5	9.5	42.9	30.4	13.0	21.7	34.8
Auto and Trailers	28.1	4.7	14.1	53.1	11.9	14.9	22.4	50.7
Miscellaneous Transportation Equipment	9.1	18.2	27.3	45.5	0	33.3	25	41.7
Furniture	44.4	0	22.2	33.3	11.1	0	33.3	55.6

DVI = domestic vertical insourcing, FI = foreign insourcing, FO = foreign outsourcing, and DO = domestic outsourcing.

Note: The above numbers are % shares of a type of vertical integration out of the total number of firms in each industry. The numbers of firms for each category in each industry were collected from the Gallup Korea (2007) survey, one of the main datasets used in this chapter.

The majority of manufacturing industries (18 out of 21 industries) experienced a decrease in domestic vertical integration between 2001 and 2006. This decreasing trend in domestic vertical integration was offset by increasing foreign insourcing during the same period. FI either increased or remained the same in 20 out of 21 industries between 2001 and 2006. This trend also applied to foreign outsourcing. The share of foreign outsourcing either increased or remained unchanged in most industries except for the transportation equipment industry. There was no clear change in the pattern of domestic outsourcing. DO decreased in seven industries while it increased in 11 other industries. Interestingly, six out of seven industries that experienced a fall in DO increased FO instead, reflecting increasing trend of internationalization of sourcing.

Table 2 shows the regional and organizational pattern of offshoring by Korean firms in 2006. Among the source regions of global production networks, the PRC ranks top for all three groups of firms. More than half of small and medium firms that engaged in offshoring source their tasks to the PRC. Among all six group of regions, the share of Japan, ASEAN, EU and North America ranges from 9% to 11.7%. In terms of organizational structure, SMEs tend to procure more tasks using arms' length transaction than LEs, while the share of intra-firm offshoring is similar between SMEs and LEs.

Table 2: The Pattern of Korean Firms' Participation in Global Production Networks

Country/Region of Offshoring	Whole		SME		LE	
PRC	142	(47.0)	98	(52.1)	44	(38.6)
Japan	40	(13.2)	17	(9.0)	23	(20.2)
ASEAN	30	(9.9)	20	(10.6)	10	(8.8)
EU	36	(11.9)	22	(11.7)	14	(12.3)
North America	37	(12.3)	22	(11.7)	15	(13.2)
ROW	17	(5.6)	9	(4.8)	8	(7.0)
Organizational Form	**Whole**		**SME**		**LE**	
FI	92	(30.4)	57	(30.3)	35	(30.7)
FO	75	(24.8)	56	(29.7)	19	(16.7)

PRC = People's Republic of China, EU = European Union, FI = foreign insourcing, FO = foreign outsourcing, ROW = Rest of the World.
Notes: The numbers in upper panel represent the number of firms that offshore to a certain region. The numbers of lower panel indicate number of firms choosing either FI or FO. The numbers in parentheses are % of location or organization of firms involved in offshoring.

4.2. Other Control Variables

The main control variables that we used are firm age, R&D intensity, and firms' experience in foreign markets measured as exporting.[4] Since the proxy for global production network is offshoring and this constitutes intermediate input purchase, we exclude imports from measurement of exposure to foreign market.

Let us explain the data sources and mechanisms of how the variables affect the firms' performances. Our data on firm i's age (number of years after establishment; Age_{it}), capital intensity (amount of fixed assets per worker; K/L_{it}) and size (total sales; $Size_{it}$) of firm i were taken from 'KISVALUE'. This is a publicly available Korean firm-level database provided by the Korea Information Service. This database contains detailed financial data based on financial statements of individual firms registered as corporations and listed on the Korea Stock Exchange. Our survey dataset includes number of workers in R&D department, but does not include detailed financial data such as age, fixed assets, employment, and total sales, because it was designed to obtain information about firms' global activities. Fortunately, it does contain firms' identification codes. Using this information, we were able to merge the survey data with 'KISVALUE'. Next, we explain the control variables and the hypothetical mechanisms linking the variables described above and firms' choice of global engagement and performances.

Age_{it} is the natural log value of the number of years since a firm i was established until time t. More number of years in operation may allow firms to learn more about raising efficiency in production and enhance more advanced managerial skills. However, Olley and Pakes (1996) suggest that the ambiguous effect of age in the production function is not at odds in related studies.

$R\&D_{it}$ represents the R&D intensity of firm i at time t, measured as the natural log value of R&D experts divided by the number of total employee. Competence-based theory of the firm view firms as learning organizations and suggests that the key source of productivity advantage is

4. We did not include imports as control variable to avoid double counting as offshoring is a type of import.

related to intangible assets such as R&D and advertisement (Nelson, 1991; Itami, 1987; Ito and Lechevalier, 2010). In empirical test, Griliches (1980) found that R&D intensity may be a potential determinant of productivity growth. This implies that R&D intensive firms are more likely to perform better. In their recent analysis, on the other hand, Ito and Lechevalier (2009) found no significant role of R&D in firm performance.

Another variable related to the performance of firm is $export_{it}$, a dummy variable taking value one if firm *i* exports and zero otherwise at time *t*. The idea is that exporters may learn from exporting (Learning-by-exporting) or improved access to foreign market through exporting encourage firms to invest in raising productivity (Lileeva and Trefler, 2010).

Table 3: Offshoring Activities and Firms' Characteristics

	Whole		SME		LE	
Variable	Offshoring	Non-offshoring	Offshoring	Non-offshoring	Offshoring	Non-offshoring
Sales (billion won)	225.521	174.235	57.015	48.786	576.813	498.971
Labor (number)	445.107	335.542	138.236	120.658	1144.093	929.378
LnTFP	0.054	-0.111	0.062	-0.146	0.035	-0.016
R&D intensity (Number of R&D labor/Total employee)	0.194	0.117	0.229	0.133	0.114	0.075
Age	23.555	25.841	20.951	23.066	28.983	32.846
Export dummy	0.901	0.755	0.919	0.719	0.864	0.846
Number of firms	182	571	123	409	59	162

LE = large enterprises, SME = small and medium enterprises, TFP = total factor productivity.
Notes: Mean values are reported for each group in 2006. Each group is classified based on firms' size and international engagement.

Basic statistics for the variables are provided in Table 3. The variables shown in the tables are the values before the natural log was taken except the log of TFP and represent pooled data for the year 2006. The total sales of a firm amounted to 200 billion won on average. The mean values of total sales of SMEs are around 50 billion won and the number of employee is 124, while LEs' total sales are 519 billion won and the number of workers is 987. Within each group of size, we observe interesting regularities in variables between offshoring firms and non-offshoring firms. On average, firms that are involved in offshoring are larger, more

productive, more R&D intensive, more likely to export and younger than firms that are not engaged in offshoring. The dispersion in productivity between offshoring firms and non-offshoring firms is larger among SMEs compared to LEs. To judge whether our sample of firms reflects Korean manufacturing firm population, we compared the KISVALUE dataset and our sample data in terms of the shares of firms in each manufacturing industry (Table A). The second column in the table lists the industry distribution of all 7,662 manufacturing firms in KISVALUE. They are listed in KOSPI, KOSDAQ, and statutory audited firms. The third column lists the industry distribution of 753 firms in our sample dataset. The correlation coefficient between industry shares of the two datasets was 0.90. Thus, the distribution of industries in our firm-level dataset was close to the true distribution of the firms in the manufacturing industry.

Table 4: Offshoring and Firm Performances

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent Variables lnTFP								
	Whole			SME			LE		
	t-1	t-2	t-3	t-1	t-2	t-3	t-1	t-2	t-3
lnAge	0.00619	-0.00727	-0.0122	-0.0317	-0.0572	-0.0688	0.00856	0.0151	0.0183
	(0.0262)	(0.0329)	(0.0476)	(0.0341)	(0.0423)	(0.0614)	(0.0418)	(0.0545)	(0.0806)
LnR&D intensity	-0.0052*	-0.005	-0.0046	-0.0073**	-0.0079*	-0.0080	-0.0071	-0.0050	-0.0025
	(0.0027)	(0.0034)	(0.005)	(0.0033)	(0.0041)	(0.0059)	(0.0052)	(0.007)	(0.0105)
Export dummy	0.0529	0.0513	0.0398	0.0450	0.0433	0.0285	0.130*	0.134	0.120
	(0.0397)	(0.0499)	(0.0727)	(0.0474)	(0.0592)	(0.0861)	(0.0720)	(0.0933)	(0.140)
Offshoring	0.164***	0.164***	0.174***	0.191***	0.196***	0.216**	0.0429	0.0327	0.0235
	(0.0367)	(0.0461)	(0.0670)	(0.0465)	(0.0580)	(0.0839)	(0.0563)	(0.0742)	(0.111)
Observations	2,133	1,396	677	1,577	1,034	501	556	362	176
R-squared	0.132	0.137	0.129	0.137	0.148	0.148	0.206	0.193	0.165

LE = large enterprises, SME = small and medium enterprises, TFP = total factor productivity.
Notes: Robust standard errors are in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% respectively.
All regressions include year and industry fixed effects.

5. Empirical Results

5.1. Baseline Results

5.1.1. Overall Impact of Global Production Networks

Table 4 presents the baseline results of the overall impact of GPN on firm-level TFP based on simple OLS estimation using the TFP index. The columns (1) through (3) report the impact of offshoring on natural log of TFP for all firms in our dataset, (4) through (6) for small and medium enterprises, (7) through (9) for large enterprises. The coefficient of the effects of offshoring in column (1) shows that there may be a statistically significant and positive impact of offshoring in previous year on current TFP. This effect is consistent when we included lag two and three in column (2) and (3) respectively. Also as to the impact of offshoring on TFP for SMEs, the positive and significant effects of offshoring in lagged values are detected. In subgroup of LEs, however, there is no evidence of the positive association between ex-ante offshoring and ex-post firm performances. Thus, it seems that the positive impacts of offshoring on TFP for whole population of firms are mostly driven by that of SMEs rather than LEs. In terms of the control variables, the effect of firm age on performance is not statistically significant in all model specifications. R&D intensity has negative effect on firm performances but statistical significance is dissipated over time in case of all firms and SMEs. Exporters enjoy premium in firm performance only in one year later among large firms. There is no clear evidence of learning-by-exporting for SMEs and this may be highly associated with insignificance of the relationship between exporter status and TFP in next few years for average firms in our whole sample. These results are in line with Olley and Pakes (1996) and somehow similar to Ito and Lechevalier (2009) in which the effect of export on intra-industry productivity dispersion in Japanese firms is positive and the effect of R&D intensity is insignificant.

5.1.2. Impact of Global Production Networks by Region

To explore whether there is any regional heterogeneities in the effect of offshoring on firm performances, we included partner region dummy variables classified based on the source of offshoring: the PRC, Japan, ASEAN, North America, EU, and ROW. Table 5 reports the effects of offshoring on firm performance by the source region. Columns

(1) through (3) represent the relationship between the offshoring to a specific region on firm productivity for whole sample, while columns (4) through (6) for SMEs and (7) through (9) for LEs, respectively. Columns (1) through (3) show that the impacts of offshoring to the PRC and ASEAN member countries are positive, but statistically insignificant for average firms in whole sample of the data. Offshoring to Japan has a clearly negative impact on firm performances in lag one and two and the significance disappears after three years. The effects are positive and significant in case of offshoring to North America and EU.[5] Some of the results seem to stem from those of the offshoring activities of SMEs while others may come from LEs. Columns (4) through (6) show that the effects of offshoring activities to the PRC and North America conducted by Korean SMEs are positive but not statistically significant. The firm-level performances of SMEs are negatively affected by the offshoring to Japan in previous years while positively affected by production networks in ASEAN and EU. The pattern of estimation results on the effects of GPN in Japan and EU on large firms' performances is similar to those for SMEs. Offshoring to Japan has a significant and negative impact while EU has strongly positive impact on TFPs. The effects of global engagement in both ASEAN and the PRC are negative but statistically insignificant. There is, however, the positive impact of North America. The estimation results of the effects of other control variables are consistent with Table 4. In sum, participation in GPN in ASEAN seems to benefit only SMEs while offshoring to EU positively affects firm performances regardless of firm size.

5. The dummy variable indicating ROW is excluded from empirical test to avoid collinearity problem with other regional dummy variables.

Table 5: Partner Countries/Regions of Global Production Networks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent Variables lnTFP								
Variables	Whole			SME			LE		
	t-1	t-2	t-3	t-1	t-2	t-3	t-1	t-2	t-3
LnAge	0.0186	0.00529	-0.000354	-0.0294	-0.0545	-0.0671	0.0428	0.0551	0.0639
	(0.0263)	(0.0329)	(0.0478)	(0.0342)	(0.0425)	(0.0620)	(0.0415)	(0.0543)	(0.0807)
LnR&D intensity	-0.0055**	-0.0053	-0.0050	-0.0072**	-0.0077*	-0.0078	-0.0083	-0.0067	-0.0048
	(0.0027)	(0.0034)	(0.0050)	(0.0032)	(0.0041)	(0.0060)	(0.0052)	(0.0069)	(0.0105)
Export dummy	0.0617	0.0594	0.0459	0.0549	0.0532	0.0357	0.122*	0.126	0.113
	(0.0397)	(0.0499)	(0.0728)	(0.0474)	(0.0593)	(0.0867)	(0.0711)	(0.0921)	(0.139)
PRC	0.0544	0.0560	0.0863	0.0718	0.0777	0.122	-0.0609	-0.0815	-0.0837
	(0.0435)	(0.0549)	(0.0807)	(0.0532)	(0.0670)	(0.0981)	(0.0726)	(0.0958)	(0.147)
Japan	-0.252***	-0.293***	-0.256	-0.243**	-0.323**	-0.250	-0.398***	-0.380**	-0.431*
	(0.0888)	(0.111)	(0.161)	(0.115)	(0.144)	(0.209)	(0.132)	(0.168)	(0.243)
ASEAN	0.126	0.134	0.142	0.237**	0.257**	0.262	-0.109	-0.106	-0.0406
	(0.0815)	(0.102)	(0.147)	(0.105)	(0.130)	(0.187)	(0.117)	(0.153)	(0.227)
North America	0.163**	0.192**	0.208	0.0097	0.0531	0.0857	0.328***	0.328**	0.274
	(0.0778)	(0.097)	(0.143)	(0.105)	(0.131)	(0.192)	(0.102)	(0.134)	(0.206)
EU	0.383***	0.374***	0.284*	0.410***	0.385***	0.245	0.567***	0.612***	0.706**
	(0.0934)	(0.117)	(0.169)	(0.112)	(0.140)	(0.208)	(0.160)	(0.205)	(0.285)
Observations	2,133	1,396	677	1,577	1,034	501	556	362	176
R-squared	0.140	0.145	0.135	0.143	0.153	0.150	0.247	0.237	0.218

ASEAN = Association of Southeast Asian Nations, PRC = People's Republic of China, EU = European Union, LE = large enterprises, SME = small and medium enterprises, TFP = total factor productivity.
Notes: Robust standard errors are in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% respectively. All regressions include year and industry fixed effects.

5.1.3. Impact of Global Production Networks by Organizational Structure

This section provides empirical test results on the role of firms' organizational structure in the effects of offshoring on performance. Table 6 reports the estimation results on the impact of the way production networks are organized on firm productivity. In this model specification organization decision is classified into three mutually exclusive types: offshoring production to its own foreign affiliates (FI), foreign outsourcing by arms' length transaction (FO), and domestic vertical integration or domestic outsourcing. To avoid multicollinearity, dummy variables indicating domestic procurement are excluded from regression. Columns (1) through (3) show that for whole sample, both FI and FO have positive

impacts on firm productivity, but statistical significance of FI disappears after two years. These results are closely associated with results from subgroups by firm size. Columns (4) through (6) provide strong evidence that small and medium firms gain from foreign outsourcing while there is no significant impact of foreign insourcing through cross-border vertical integration. In contrast, large firms shown in columns (7) through (9) benefit from offshore production in their own foreign subsidiaries though the effects are statistically significant only in lag one and there is no gain from foreign outsourcing. This result lends support to theoretical prediction that upon globalization, small and medium firms that have chosen vertical disintegration to take advantage of reduced transaction costs in thick global input markets may indeed gain from specialization.

Table 6: Organization of Global Engagement: Foreign Insourcing vs. Outsourcing

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent Variables lnTFP								
VARIABLES	Whole			SME			LE		
	t-1	t-2	t-3	t-1	t-2	t-3	t-1	t-2	t-3
LnAge	0.0092	-0.0012	-0.0054	-0.0229	-0.0444	-0.0548	0.0022	0.0108	0.0146
	(0.0263)	(0.0330)	(0.0478)	(0.0342)	(0.0424)	(0.0615)	(0.0416)	(0.0543)	(0.0807)
LnR&D intensity	-0.0048*	-0.0045	-0.0041	-0.0065**	-0.0069*	-0.007	-0.0071	-0.0049	-0.0023
	(0.0027)	(0.0034)	(0.005)	(0.0033)	(0.0041)	(0.0059)	(0.0052)	(0.007)	(0.0105)
Export dummy	0.0582	0.0580	0.0454	0.0603	0.0599	0.0410	0.129*	0.132	0.116
	(0.0398)	(0.0500)	(0.0727)	(0.0474)	(0.0591)	(0.0859)	(0.0718)	(0.0932)	(0.140)
FI dummy	0.0981**	0.0558	0.0670	0.0356	-0.0157	0.0163	0.137**	0.118	0.0943
	(0.048)	(0.0604)	(0.0884)	(0.0626)	(0.0786)	(0.115)	(0.0672)	(0.0878)	(0.132)
FO dummy	0.185***	0.229***	0.253***	0.247***	0.299***	0.328***	-0.0895	-0.0717	-0.0590
	(0.0509)	(0.0636)	(0.0923)	(0.0606)	(0.0749)	(0.108)	(0.0890)	(0.118)	(0.180)
Observations	2,133	1,396	677	1,577	1,034	501	556	362	176
R-squared	0.130	0.138	0.130	0.137	0.152	0.153	0.214	0.198	0.168

FI = foreign insourcing, FO = foreign outsourcing, LE = large enterprises, SME = small and medium enterprises, TFP = total factor productivity.
Notes: Robust standard errors are in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% respectively.
All regressions include year and industry fixed effects.

5.2. Robustness Check

To confirm the baseline results, we employed average treatment effects as a robustness check. Table 7 reports empirical results on the estimates and standard errors of the average treatment effects of lagged offshoring on current productivity based on the propensity score matching estimation. We compare estimates of four different types of matching: nearest neighbor matching, radius matching, and local linear regression matching. Standard errors are estimated using bootstrap with 200 repetitions. Table 7 shows that matching confirms the link between ex-ante participation in global production networks and ex-post firm performances reported in Table 4.

Table 7: Robustness Check: Average Treatment Effect

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Whole			SME			LE		
	ATT	SE	Obs.	ATT	SE	Obs.	ATT	SE	Obs.
Nearest Neighbor Matching	0.175	0.049	687(2128)	0.1756	0.0865	493(1522)	0.0779	0.0745	194(538)
Radius	0.1272	0.033	687(2128)	0.1596	0.0393	493(1522)	0.0325	0.045	194(538)
Local Linear Regression Matching	0.1476	0.0398	687(2128)	0.1442	0.07	493(1522)	0.0901	0.065	194(538)

LE = large enterprises, SME = small and medium enterprises.
Notes: Bootstrapped standard errors with 200 repetitions are reported. Number of treated observations and number of untreated observations in parentheses.

Column (1) through (3) represent observed coefficient of average treatment effects, standard errors and number of treated and untreated observations respectively in case of whole sample of the data. Columns (4) through (6) correspond to small and medium enterprises, (7) through (9) to large enterprises. Columns (1) through (6) show that, in case of whole sample and SMEs, offshoring dummy variable in lagged term has significantly positive impacts on the current TFP. In terms of large firms, the offshoring activity is positively correlated with firm performances, but statistically insignificant. The results using radius matching and local linear regression matching method as well as nearest neighbor matching method all support the baseline model in that lagged global engagement undertaken by SMEs has a statistically significant and positive impact on firm productivity while there is no evidence of significant impact of offshoring by large firms. Thus, again our empirical results for robustness check confirm the tests for baseline model.

For further sensitivity analyses, we carry out the same procedure with section 5.1. to examine the effect of offshoring on firm performance taking labor productivity as dependent variable. The results are reported in Appendix Table B1 to B3. The positive impacts of offshoring through foreign outsourcing on labor productivity of SMEs are confirmed. But there are differences in the effects by region between the case of TFP and labor productivity. There are significantly positive impacts of offshoring to the PRC and North America, which were insignificant in case of TFP, on labor productivity of SMEs. The positive effects of ASEAN are still confirmed.

6. Conclusions

This study uses unique Korean firm-level data from 2006 to 2009 to investigate the impact of the SMEs' participation in global production network on firms' performances. The empirical results suggest three main findings. First, we show that relocation of production abroad may positively affect the SMEs' productivity. Second, SMEs are positively influenced by offshoring to ASEAN and negatively affected by offshoring to Japan. Third, arm's-length transaction through external suppliers abroad has a positive effect on SMEs' productivity, while foreign insourcing through cross-border vertical integration does not have significant impact. These findings are confirmed to controlling for the endogeneity of offshoring by matching technique. These results indicate that overall, Korean SMEs benefit from global production sharing and the gains from offshoring may depend on the choice of location and organizational form. As most members of ASEAN are developing economies, the theoretical prediction of trade-off between higher productivity for serving the South to save variable costs and the lower productivity for the North to benefit from lower fixed cost and to access better technology may hold for Korean SMEs. According to productivity measure, however, these two effects may be complementary to contribute to productivity gain. Furthermore, the location choice may be highly linked to organizational structure in global engagement. Given ASEAN is rapidly experiencing vertical specialization in manufacturing, Korean SMEs seem to gain from 'thick input market' in these areas by contracting out external subcontractors abroad rather than foreign insourcing. These results suggest that the strategic choice of global engagement to take advantage of lower transaction costs may be suitable to SMEs.

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Appendix A

Table A: Distribution of Industries

Industry (21 KSIC with 2-digit code)	% share (KISVALUE)	% share (Our sample)
Food Manufacturing	5.3	4.56
Textile	3.42	2.99
Apparel and Fur Products	3.03	1.99
Leather, Bags and Shoes	0.87	0.85
Timber and Wooden Products	0.67	0.43
Pulp, Paper and Paper Products	2.02	2.28
Publishing, Printing and Copying Documents	2.75	0.57
Cokes, Petroleum and Nuclear Fuel	0.38	0.71
Compound and Chemical Products	9.48	14.81
Rubber and Plastics	5.13	5.98
Nonmetallic Minerals	4.23	4.84
Ferrous Metal Products	7.57	7.55
Nonferrous Metal Products	6.34	3.7
Miscellaneous Machinery and Equipment	12.89	0.43
Computer and Office Instruments and Electronic Parts, Video, Sound	12.84	19.66
Electric Machinery and Electric Converters	5.02	5.13
Medical appliances, Precision and Optical Instruments	3.09	2.85
Auto and Trailer	9.63	8.97
Miscellaneous Transportation Equipment	3.07	1.14
Furniture	1.61	0.57

KIS = Korea Information Service, KSIC = Korean Standard Industrial Classification.

Table B1: Offshoring and Firm Performances: Labor Productivity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent Variables ln (Labor Productivity)								
	Whole			SME			LE		
	t-1	t-2	t-3	t-1	t-2	t-3	t-1	t-2	t-3
LnAge	0.0302	0.0243	0.0404	-0.00535	-0.0195	7.84e-06	0.0449	0.0498	0.0534
	(0.0284)	(0.0357)	(0.0518)	(0.0366)	(0.0460)	(0.0671)	(0.0486)	(0.0623)	(0.0918)
LnR&D intensity	-0.00364	-0.00324	-0.00387	-0.00518	-0.00498	-0.00561	-0.00713	-0.00652	-0.00537
	(0.00309)	(0.00390)	(0.00561)	(0.00353)	(0.00445)	(0.00639)	(0.00714)	(0.00922)	(0.0137)
Export dummy	0.0289	0.0191	0.0271	0.0180	0.00236	0.00233	0.111	0.109	0.0994
	(0.0427)	(0.0539)	(0.0772)	(0.0503)	(0.0635)	(0.0906)	(0.0837)	(0.106)	(0.159)
FO dummy	0.166***	0.181***	0.199***	0.191***	0.214***	0.242***	0.0400	0.0437	0.0454
	(0.0396)	(0.0499)	(0.0714)	(0.0495)	(0.0624)	(0.0887)	(0.0656)	(0.0848)	(0.126)
Observations	2,114	1,381	667	1,559	1,019	491	555	362	176
R-squared	0.200	0.197	0.194	0.194	0.192	0.195	0.289	0.280	0.259

LE = large enterprises, SME = small and medium enterprises.

Notes: Robust standard errors are in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% respectively. Natural log of labor productivity is the natural log of sales per labor. All regressions include year and industry fixed effects.

Table B2: Partner Countries/Regions of Global Production Networks: Labor Productivity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent Variable ln (Labor Productivity)								
VARIABLES	Whole			SME			LE		
	t-1	t-2	t-3	t-1	t-2	t-3	t-1	t-2	t-3
LnAge	0.0384	0.0323	0.0472	-0.00869	-0.0237	-0.00656	0.0730	0.0819	0.0917
	(0.0285)	(0.0359)	(0.0522)	(0.0367)	(0.0462)	(0.0677)	(0.0488)	(0.0627)	(0.0929)
LnR&D intensity	-0.00388	-0.00342	-0.00418	-0.00510	-0.00480	-0.00547	-0.00845	-0.00833	-0.00819
	(0.00309)	(0.00391)	(0.00563)	(0.00352)	(0.00445)	(0.00641)	(0.00714)	(0.00924)	(0.0138)
Export dummy	0.0332	0.0241	0.0304	0.0162	0.00207	-0.00153	0.105	0.106	0.0989
	(0.0427)	(0.0540)	(0.0775)	(0.0503)	(0.0636)	(0.0911)	(0.0836)	(0.106)	(0.159)
PRC	0.108**	0.120**	0.184**	0.140**	0.156**	0.249**	-0.0446	-0.0568	-0.0701
	(0.0470)	(0.0594)	(0.0857)	(0.0565)	(0.0715)	(0.102)	(0.0854)	(0.111)	(0.169)
Japan	-0.124	-0.156	-0.103	-0.0716	-0.143	-0.0443	-0.321**	-0.289	-0.336
	(0.0971)	(0.1230)	(0.1790)	(0.1250)	(0.1590)	(0.2370)	(0.1550)	(0.1950)	(0.2800)
ASEAN	0.0922	0.106	0.0436	0.239**	0.272**	0.178	-0.186	-0.185	-0.134
	(0.0878)	(0.110)	(0.156)	(0.111)	(0.139)	(0.195)	(0.138)	(0.178)	(0.264)
North America	0.282***	0.280**	0.19	0.326***	0.309**	0.143	0.420**	0.461*	0.585*
	(0.101)	(0.127)	(0.182)	(0.119)	(0.151)	(0.222)	(0.188)	(0.238)	(0.330)
EU	0.0842	0.0939	0.0871	-0.134	-0.114	-0.112	0.350***	0.334**	0.289
	(0.0838)	(0.106)	(0.152)	(0.111)	(0.140)	(0.201)	(0.120)	(0.156)	(0.237)
Observations	2,114	1,381	667	1,559	1,019	491	555	362	176
R-squared	0.204	0.200	0.197	0.200	0.197	0.199	0.313	0.304	0.288

ASEAN = Association of Southeast Asian Nations, PRC = People's Republic of China, EU = European Union, LE = large enterprises, SME = small and medium enterprises.

Notes: Robust standard errors are in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% respectively. Natural log of labor productivity is the natural log of sales per labor. All regressions include year and industry fixed effects.

Table B3: Organization of Global Engagement: Foreign Insourcing vs. Outsourcing: Labor Productivity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent Variable ln (Labor Productivity)								
VARIABLES	Whole			SME			LE		
	t-1	t-2	t-3	t-1	t-2	t-3	t-1	t-2	t-3
LnAge	0.0309	0.0267	0.0421	-0.00405	-0.0165	0.00211	0.0476	0.0548	0.0578
	(0.0284)	(0.0358)	(0.0520)	(0.0367)	(0.0461)	(0.0675)	(0.0487)	(0.0623)	(0.0919)
LnR&D intensity	-0.00350	-0.00297	-0.00349	-0.00460	-0.00419	-0.00469	-0.00782	-0.00742	-0.00656
	(0.00309)	(0.00390)	(0.00561)	(0.00353)	(0.00445)	(0.00640)	(0.00714)	(0.00923)	(0.0137)
Export dummy	0.0341	0.0285	0.0368	0.0303	0.0205	0.0203	0.108	0.107	0.0971
	(0.0427)	(0.0539)	(0.0772)	(0.0503)	(0.0634)	(0.0907)	(0.0836)	(0.106)	(0.159)
FI dummy	0.0844	0.0400	0.0570	0.0495	-0.00261	0.0360	0.104	0.0744	0.0557
	(0.0519)	(0.0657)	(0.0950)	(0.0662)	(0.0841)	(0.122)	(0.0804)	(0.103)	(0.154)
FO dummy	0.178***	0.211***	0.203**	0.199***	0.235***	0.222**	0.0804	0.124	0.154
	(0.0477)	(0.0601)	(0.0861)	(0.0576)	(0.0722)	(0.103)	(0.0845)	(0.109)	(0.165)
Observations	2,114	1,381	667	1,559	1,019	491	555	362	176
R-squared	0.201	0.197	0.193	0.193	0.192	0.191	0.294	0.285	0.264

FI = foreign insourcing, FO = foreign outsourcing, LE = large enterprises, SME = small and medium enterprises.
Notes: Robust standard errors are in parentheses. ***, **, and * indicate statistical significance at 1%, 5%, and 10% respectively. Natural log of labor productivity is the natural log of sales per labor. All regressions include year and industry fixed effects.

Chapter 5

Changing Competitiveness of the Japanese Manufacturing Sector and Firms in Regional Production Networks in Asia

Shujiro Urata*
Waseda University

Abstract

Japanese manufacturing sector has been losing competitiveness compared with its competitors in the People's Republic of China (PRC), the Republic of Korea and other Asian economies as these economies have been successfully catching up, partly thanks to the emergence for regional production networks, under which technology and management know how are transferred. Japanese manufacturing sector lost competitiveness in final consumption goods and now it is losing competitiveness in intermediate goods such as parts and components, which have important positions in regional production networks. However, Japanese manufacturing sector still has competitiveness in high quality and high value intermediate goods. Similar finding is obtained from an analysis of the Asian affiliates of Japanese manufacturing firms in that Japanese firms are trying to maintain and improve their competitiveness in high quality and high value added products, while they recognize that competition against Chinese and Korean counterparts in terms of prices is futile for them. Instead, Japanese firms are eager to expand their R&D activities. Japanese firms have been successful in generating funds for R&D from their profitable operation in Asia. In order for Japanese firms to continue to be competitive and improve their competitiveness, they need to keep their Asian operation profitable. Japanese government should help Japanese manufacturing sector by creating a business friendly environment in Asia and Asia-Pacific through establishing the Regional Comprehensive Economic Partnership (RCEP), and the Trans-Pacific Partnership (TPP) and by providing assistance in research and development. Finally, Japanese government needs to implement domestic reforms in a number of areas so that competitive Japanese firms can expand their operation.

Keywords: regional production networks; intra-regional trade; trade in intermediate goods; fragmentation strategy; foreign direct investment.
JEL Classification: F14; F15; F23.

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1. Introduction

Japan's economic relations with Asian economies have rapidly become increasingly close in recent years, mainly through trade and foreign direct investment (FDI). In Asia, Japanese firms have pursued a "fragmentation strategy", which refers to breaking down production processes and assigning each process, through FDI, to the country or region suited to implement it most efficiently. As a result, when a certain product is manufactured, its intermediate goods and parts or components are actively traded between production bases located in various Asian economies, leading to the formation of a regional production network, or a supply chain, and increasing intra-regional trade in Asia. The formation of such networks has significantly contributed to the economic growth not only of Asian economies but also of Japan, as technology and management know-how, which contribute significantly to economic growth, is transferred through the regional production networks. The factors behind the formation of such networks include the presence of wide gaps in the quality of workers and the level of wages among Asian economies due to differences in the degree of economic development as well as the liberalization of policies on trade and direct investment in Asian economies.

The characteristics of intra-regional trade in intermediate goods within regional production networks have been changing, as many economies are successfully catching up with Japan, which was a leading country in the supply of intermediate goods. The importance of Japan as a supplier of intermediates in the regional production networks has been declining while the importance of the People's Republic of China (PRC) and the Republic of Korea has been increasing. This development indicates declining importance of Japan in the regional production network and declining competitiveness of Japan as a supplier of intermediate goods, but this does not necessarily mean declining importance and/or competitiveness of Japanese firms because they are shifting a substantial part of their operation to foreign countries, especially to Asian economies.

In light of these observations, this chapter attempts to examine the competitiveness of the Japanese manufacturing sector by examining Japanese foreign trade relationships with Asian economies and Japanese firms' activities in Asia. Such analysis is expected to contribute to the discussions of policies and measures not only for Japan, which is eager to overcome the challenges from many Asian countries, but also for the

PRC, the Republic of Korea and other Asian economies, which are rapidly catching up with Japan, for formulating desirable trade and investment policies for the government and private firms.

The remainder of the chapter is structured as follows. Section 2 examines Japan's trade relationship with Asian economies by focusing on intermediate goods, which have become a large part of international trade in East Asia, as a result of the formation of regional production networks. Section 3 discusses Japanese firms' FDI with a focus on Asia. In the discussions, procurement patterns of intermediate goods by the Asian affiliates of Japanese firms are analyzed, as it is closely related to intra-regional trade in intermediate goods. Furthermore, an analysis of Japanese firms' domestic and foreign strategies is conducted, in relationship to the competitiveness of the Japanese manufacturing sector. Section 4 provides some remarks on the possible role of the government for improving the competitiveness of Japanese manufacturing sector and firms.

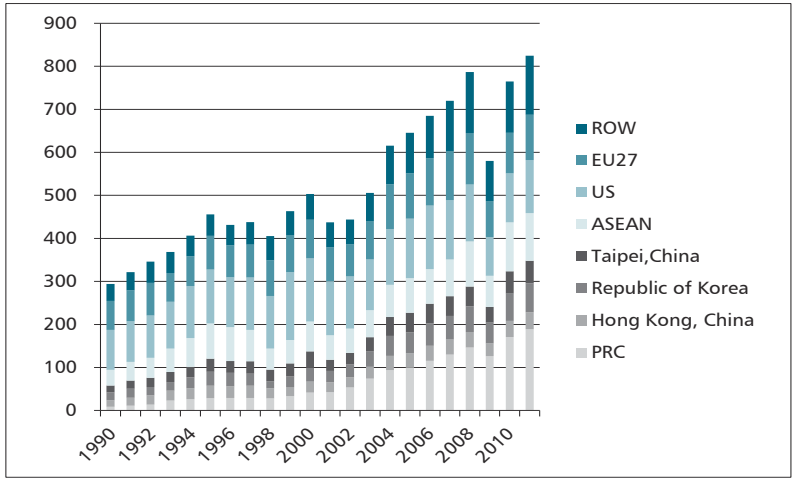
2. Japan's Trade with East Asia

2. 1. Increasing Importance of East Asia for Japan's Trade

Japan's trade with East Asia expanded notably from the early 1990s to the early 2010s. Specifically, Japan's exports to East Asia increased 4.8-fold from 94.7 billion US dollars in 1990 to 458.7 billion US dollars in 2011 (Figure 1a), while Japan's imports from East Asia increased 5.4-fold from 64.1 billion US dollars to 347.3 billion US dollars (Figure 1b). During the 1990–2011 period, Japan's exports to and imports from the world increased 2.8-fold and 3.5-fold, respectively, from 298.2 billion US dollars and 233.2 billion US dollars to 824.4 billion US dollars and 824.4 billion US dollars, respectively. It is to be noted that Japan's trade balance with East Asia remained to be substantially in Japan's surplus, but its trade balance with the world changed dramatically from a large surplus to a slight deficit.[2] A major reason behind this dramatic change in Japan's overall trade balance is a sharp increase in imports of oil and natural gas for energy production, which was attributable to the shutdown of nuclear power plants in Japan, resulting from the Great Eastern Japan earthquake and tsunami in March 2011.

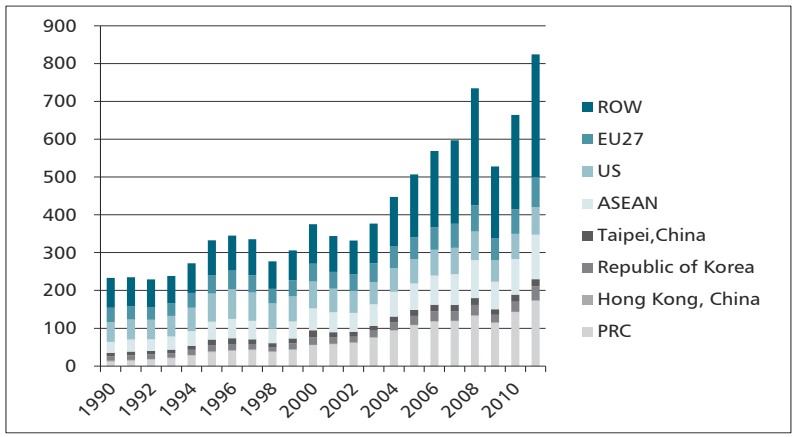
2. To be more precise, Japan's exports to the world in 2011 were US$824.370 billion, while its imports from the world were US$824.428 billion.

Figure 1a: Japan's Exports by Economies
(US$ billion)



ASEAN = Association of Southeast Asian Nations, PRC = People's Republic of China, EU = European Union, ROW = rest of the world, US = United States.
Note: EU27 consists of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom. The EU now has 28 members as Croatia joined the EU on July 1, 2013.
Source: Constructed from the data obtained from RIETI, RIETI-TID 2012.

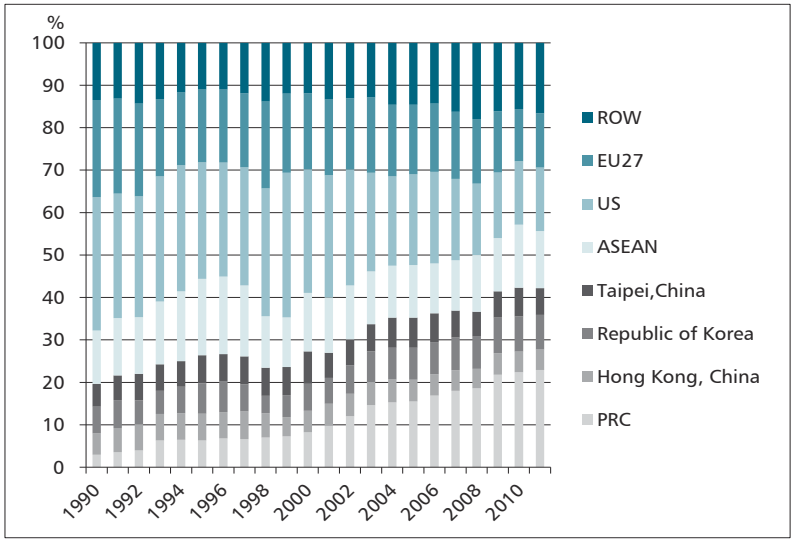
Figure 1b: Japan's Imports by Economies
(US$ billion)



ASEAN = Association of Southeast Asian Nations, PRC = People's Republic of China, EU = European Union, ROW = rest of the world, US = United States.
Source: Constructed from the data obtained from RIETI, RIETI-TID 2012.

As the rates of the increase for Japan's exports to and imports from East Asia were greater than their counterparts for Japan's exports to and imports from the world, the shares of East Asia in Japan's overall trade increased. For Japan's exports, the share of East Asia in its overall exports increased as much as 23.4 percentage points in 21 years from 32.2% in 1990 to 55.6% in 2011 (Figure 1c). The share of East Asia in Japan's overall imports increased as well, but not as much compared to the case of exports, i.e., 14.6 percentage points from 27.5% to 42.1% (Figure 1d). These figures indicate that, for Japan, East Asia is more important as an export destination rather than an import source.

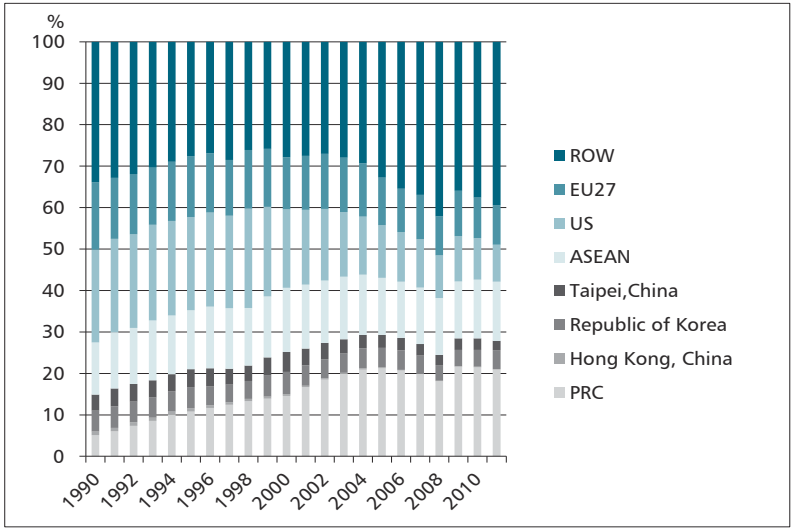
Figure 1c: Japan's Exports by Economies: Compositional Shares



ASEAN = Association of Southeast Asian Nations, PRC = People's Republic of China, EU = European Union, ROW = rest of the world, US = United States.
Source: Constructed from the data obtained from RIETI, RIETI-TID 2012.

In the past the United States (US) and Europe were Japan's important trading partners, but their importance declined very sharply from the early 1990s to early 2010s. The shares of the US and the European Union's 27 member countries (EU27) were 31.4 and 22.9% in 1990, respectively, but these shares declined notably to 15.0 and 12.8% in 2011. The similar declining trends can be found for Japan's imports, as the shares of the US and the EU27 declined from 22.3 and 16.3% to 8.9 and 9.6%, respectively, during the 1990–2011 period.

Figure 1d: Japan's Imports by Economies: Compositional Shares



ASEAN = Association of Southeast Asian Nations, PRC = People's Republic of China, EU = European Union, ROW = rest of the world, US = United States.
Source: Constructed from the data obtained from RIETI, RIETI-TID 2012.

Several reasons can be identified for the increasing share of East Asia and decreasing shares of the US and the EU in Japan's trade. One important factor is the difference in economic growth rates between East Asia on one hand, and the US and the EU27 on the other hand. A region experiencing high economic growth expands imports as the purchasing power of the people increases, thanks to a rapid increase in income, while it can expand export capacity as production capacity increases with active investment, supported by rapid economic growth. Considering this point, it is only natural to observe an increasing importance of East Asia in Japan's overall trade.

Another important factor is active FDI by Japanese firms. As discussed in more detail in a later section, Japanese firms began to undertake FDI in the latter half of the 1980s, when they were faced with rapid and sharp appreciation of the yen. Faced with declining competitiveness of production in Japan, due to yen appreciation, many Japanese firms, particularly those in electronics machinery, relocated their manufacturing operation to East Asia, where low wage labor is abundantly available. These firms adopted the fragmentation strategy under which they broke up the entire production process into several sub-processes and located

sub-processes in economies or regions, where these sub-processes can be performed at least cost. Fragmentation strategy has led to the formation of production networks or supply chains as parts and components, which were produced under the sub-processes at different locations, were transported or traded actively involving manufacturing bases in Japan and East Asian economies. We will come back to see the impacts of production networks or supply chains on international trade in more detail later.

We saw the increasing importance of East Asia in Japan's foreign trade. However, there are wide variations among the East Asian economies in their importance in Japan's foreign trade. Among the economies in East Asia, the PRC registered the largest increase in its shares in Japan's exports as well as imports. Indeed, a rapid and substantial expansion of Japan's trade with the PRC is the main reason for the large increase in the share of East Asia in Japan's overall trade, as observed above. The shares of the PRC in Japan's exports and imports increased from 3.0 and 5.1% in 1990 to 22.9 and 20.9% in 2011, respectively. During the same period, the shares of remaining East Asia [the Association of Southeast Asian Nations (ASEAN) and Newly Industrializing Economies (NIEs)]in Japan's overall exports and imports did not change much.[3] Specifically, their share in exports increased slightly from 29.2 to 32.8%, while their share in exports declined slightly from 22.4 to 21.2%. Among the NIEs, the shares of the Republic of Korea and Taipei,China in Japan's exports increased from 6.3 and 5.4% in 1990 to 8.2 and 6.3% in 2011; respectively, while the share of Hong Kong, China declined slightly from 5.0 to 4.8%. Unlike the case for Japan's exports, the shares of all NIEs in Japan's imports declined from 1990 to 2011; Hong Kong, China (0.9→0.1); the Republic of Korea (5.0→4.6); and Taipei,China (3.9→2.2). The shares of ASEAN in Japan's exports and imports rose slightly from 12.5 and 12.6% in 1990 to 13.5 and 14.3%, respectively, during the 1990–2011 period.

3. The NIEs in this chapter indicate Hong Kong, China; the Republic of Korea; and Taipei,China unless otherwise noted. Singapore, which is also considered an NIE, is included in ASEAN.

2.2. Changing Patterns of Japan's Comparative Advantage compared with East Asian Economies

One can identify several interesting changes in the patterns of Japan's trade with East Asian economies. As discussed below, these changes reflect the changing patterns of Japan's comparative advantage compared with its trading partners in East Asia. Let us examine the changing patterns of Japan's exports first and then turn to its imports.

Concerning Japan's exports to East Asia, which are shown in the first and second columns in Table 1, major export products remained more or less the same between 1990 and 2011. Specifically, chemical products, ferrous and non-ferrous metal products, general machinery, and electrical machinery are major export products, as their respective shares in Japan's total exports remain larger than 10% for both 1990 and 2011. However, there are changes in their importance from 1990 to 2011. The shares of processed materials, including chemical products and ferrous and non-ferrous metal products in Japan's exports increased, while the corresponding shares for machinery, general machinery and electrical machinery, declined slightly. Although there are some differences in the patterns of Japan's exports to different East Asian economies, the increasing share of processed materials and declining share of machinery products can be found for Japan's exports to more or less all East Asian countries listed in the table. Some notable observations include the following: (i) the share of chemical products increased substantially and registered high values in 2011 for Japan's exports to the Republic of Korea and Taipei,China; and (ii) the share of ferrous and non-ferrous metal products increased notably and registered high values in 2011 for Japan's exports to the Republic of Korea and ASEAN.

Turning to general machinery and electrical machinery, whose shares in Japan's exports declined but remained high, one finds some differences in the patterns of Japan's exports to East Asian economies. To begin with general machinery, one observes an increase in its share for Japan's exports to the PRC, from 16.9% in 1990 to 22.6% in 2011, unlike the declining shares observed for Japan's exports to other East Asian economies. The rate of decline is particularly notable for Japan's exports to the Republic of Korea, as the share of general machinery in Japan's exports to the Republic of Korea declined 8.1 percentage points from 27.8 to 19.7% from 1990 to 2011. For electrical machinery, the share in Japan's exports remained

Table 1: Japan's Trade with East Asia by Economy and Region (%)

	East Asia		PRC		Hong Kong, China		Republic of Korea		Taipei,China		ASEAN	
	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011
Exports												
Food and agricultural products	1.1	0.7	0.7	0.1	2.5	2.7	0.4	0.6	1.3	1.4	0.8	0.6
Textile products	4.3	1.5	7.9	2.2	8.9	1.8	3.9	0.7	3.2	0.6	2.3	1.0
Pulp, paper and wood products	2.5	1.7	2.7	1.8	4.1	1.4	2.1	1.2	3.0	1.4	1.9	2.0
Chemical products	11.3	16.5	11.9	15.3	7.7	10.0	15.3	25.3	13.9	25.4	9.4	11.2
Petroleum and coal products	0.9	2.6	0.7	1.3	0.3	5.1	2.5	2.7	0.7	0.5	0.4	4.8
Ceramic and cement products	1.6	2.1	1.4	1.3	1.9	2.1	1.7	3.8	2.0	4.3	1.2	1.3
Ferrous and non-ferrous metal products	11.9	15.5	17.8	11.7	5.5	12.1	11.4	21.2	12.5	14.0	13.0	20.4
General machinery	22.5	20.6	16.9	22.6	12.3	12.7	27.8	19.7	21.1	18.1	25.8	21.6
Electrical machinery	23.7	22.9	24.8	24.3	29.2	35.2	23.8	14.4	24.1	23.6	21.0	20.8
Home electronics and appliances	5.0	1.4	1.8	1.5	9.4	3.5	2.9	0.8	4.5	1.0	5.3	1.2
Transportation equipment	9.8	7.7	9.7	9.5	5.4	2.5	2.8	3.4	9.2	5.0	15.4	10.3
Precision machinery	2.3	5.1	1.2	7.1	2.6	3.7	3.3	4.9	2.3	4.0	1.9	2.9
Toys and sundries	3.2	1.8	2.5	1.2	10.1	7.2	2.0	1.1	2.2	0.7	1.6	1.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Imports												
Food and agricultural products	13.9	6.3	16.0	5.4	7.0	17.1	11.8	5.5	23.5	4.6	11.4	8.2
Textile products	12.0	10.5	28.6	17.7	15.7	1.8	20.9	2.0	9.5	3.3	2.2	3.8
Pulp, paper and wood products	12.4	6.7	7.8	5.8	13.8	1.4	12.1	2.1	9.9	3.1	15.0	10.1
Chemical products	3.8	9.4	4.9	9.7	3.1	2.7	5.0	12.2	6.6	17.2	2.0	6.9
Petroleum and coal products	28.0	15.2	24.8	1.1	0.4	0.0	4.7	23.0	0.6	0.2	49.1	35.8
Ceramic and cement products	2.7	1.6	3.2	1.9	9.4	18.1	4.2	1.0	1.7	2.7	1.8	0.9
Ferrous and non-ferrous metal products	9.0	8.9	5.0	6.4	10.8	9.8	15.7	21.2	9.3	12.6	7.8	8.1
General machinery	3.5	10.9	0.6	15.1	5.4	8.9	4.2	9.6	6.2	9.0	3.4	5.5
Electrical machinery	5.2	15.7	2.3	16.8	6.3	10.5	8.5	18.3	11.8	31.6	2.9	10.9
Home electronics and appliances	2.0	5.6	0.9	7.7	2.1	1.5	4.2	1.4	2.7	4.6	1.3	3.9
Transportation equipment	0.8	2.0	0.1	2.0	0.4	0.6	0.7	1.7	4.1	3.9	0.1	1.9
Precision machinery	0.5	1.9	0.1	2.1	1.3	3.8	0.6	1.2	1.3	3.9	0.4	1.6
Toys and sundries	6.2	5.2	5.7	8.1	24.4	23.6	7.5	0.9	12.9	3.2	2.6	2.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

ASEAN = Association of Southeast Asian Nations, PRC = People's Republic of China.
Source: Constructed from the data obtained from RIETI, RIETI-TID 2012.

more or less at the same level for Japan's exports to East Asian economies except for its exports to the Republic of Korea and Hong Kong, China. The share of electrical machinery declined substantially from 23.8% in 1990 to 14.4% in 2011 for Japan's exports to the Republic of Korea, while the corresponding share increased for Japan's exports to Hong Kong, China.

Some other notable changes in the composition of Japan's exports to East Asian economies include the following: (i) the share of textiles was somewhat high for Japan's exports to the PRC and Hong Kong, China in 1990 but the share declined noticeably over time; (ii) in Japan's exports to ASEAN, transportation machinery accounts for a relatively large share but it declined from 15.4 to 10.3% from 1990 to 2011; and (iii) the share of transportation machinery in Japan's exports for other East Asian economies remain relatively low, less than 10%, in 1990 and 2011. This may reflect at least two phenomena. One is that although the share of automobiles, a major component of transportation machinery, has been increasing rapidly in production and consumption in ASEAN countries, the share may remain relatively small, compared to other industries such as electronic machinery and textiles, resulting in low shares in Japan's overall exports. Another reason may be that Japan does not export assembled automobiles partly because of high transportation cost and high tariffs on automobiles in many East Asian economies; rather it exports parts and components of automobiles, which are assembled in East Asian economies. As such, the value of Japan's exports in transportation machinery in East Asia remains relatively low.

An examination of the changes in the compositional shares of Japan's imports from East Asian economies reveals several interesting developments. One notable change is an increase in the shares of machinery products, particularly general and electrical machineries, whose shares increased from 3.5 and 5.2% in 1990 to 10.9 and 15.7% in 2011, respectively. The rate of increase is particularly high for Japan's imports from the PRC, as the shares of general machinery and electrical machinery in Japan's overall imports from the PRC increased from 0.6 and 2.3% in 1990 to 15.1 and 16.8% in 2011, respectively. Similar increasing trends can be discerned for Japan's imports from other East Asian economies, but in most cases, the rate of increase is not as large compared to the case of its imports from the PRC. One notable exception may be electrical machinery imports from Taipei,China, whose share in Japan's overall imports from

Taipei,China increased from 11.8% in 1990 to as high as 31.6% in 2011. It should also be noted that despite their relatively small shares, the share of other machinery products, namely, home electronics and appliances, transportation equipment, and precision machinery increased their shares from 1990 to 2011. Furthermore, it is to be mentioned that the share of chemical products increased in Japan's imports from East Asia. The rate of increase is particularly high for Japan's imports from the Republic of Korea and Taipei,China.

In contrast to the case for machinery imports, the shares of food and agricultural products, textiles, pulp, paper and wood products, and petroleum and coal products in Japan's overall imports from East Asia declined notably from 1990 to 2011. As for food and agricultural products, the rate of decline is particularly high for Japan's imports from the PRC and Taipei,China; while for textiles the rate of decline is substantial for Japan's imports from the PRC; Hong Kong, China; and the Republic of Korea. One observes interestingly different patterns for Japan's imports of petroleum and coal products from different East Asian economies. The share of petroleum and coal products accounts for a large share of Japan's imports from ASEAN, although it declined from 49.1 to 35.8% from 1990 to 2011. The share of petroleum and coal products declined sharply from 24.8 to 1.1% during the same period for Japan's imports from the PRC, while the corresponding share increased notably for its imports from the Republic of Korea, from 4.7% to 23.0%.

The changes in the compositional patterns of Japan's exports to and imports from East Asian economies largely reflect the changes in the patterns of comparative advantage of Japan and East Asian economies. Based on this understanding, one may observe that Japan gained comparative advantage in the production of chemical products and ferrous and non-ferrous metal products, while it lost comparative advantage in the production of machinery products, particularly general machinery and electrical machinery. These observations turn out to be partially correct. To examine the changing patterns of comparative advantage, or the competitiveness of the industries, the competitiveness index, here defined as (exports-imports)/(exports+imports), is computed and the results are shown in Table 2.[4] The index is constructed in such a way that a positive

4. The competitiveness index computed here can be considered as a very rough indicator of competitiveness of an industry.

Table 2: Competitiveness of Japanese Products compared with East Asian Products

	East Asia		PRC		Hong Kong, China		Republic of Korea		Taipei,China		ASEAN	
	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011
Food and agricultural products	-0.798	-0.751	-0.935	-0.945	0.440	0.746	-0.902	-0.660	-0.821	-0.065	-0.843	-0.877
Textile products	-0.309	-0.680	-0.667	-0.757	0.603	0.956	-0.538	-0.208	-0.262	-0.297	0.117	-0.586
Pulp, paper and wood products	-0.536	-0.503	-0.592	-0.502	0.359	0.954	-0.568	0.027	-0.316	0.121	-0.728	-0.681
Chemical products	0.629	0.398	0.279	0.269	0.895	0.988	0.659	0.575	0.571	0.613	0.704	0.211
Petroleum and coal products	-0.911	-0.633	-0.960	0.116	0.678	1.000	-0.082	-0.653	0.345	0.741	-0.979	-0.774
Ceramic and cement products	-0.081	0.272	-0.513	-0.151	0.186	0.676	-0.198	0.751	0.351	0.632	-0.102	0.135
Ferrous and non-ferrous metal products	0.321	0.393	0.444	0.332	0.570	0.963	0.071	0.282	0.400	0.515	0.354	0.410
General machinery	0.812	0.426	0.909	0.242	0.885	0.968	0.829	0.571	0.710	0.699	0.813	0.574
Electrical machinery	0.742	0.315	0.772	0.225	0.941	0.986	0.634	0.169	0.558	0.355	0.802	0.287
Home electronics and appliances	0.585	-0.491	0.178	-0.655	0.940	0.980	0.060	0.022	0.488	-0.251	0.685	-0.541
Transportation equipment	0.895	0.667	0.975	0.676	0.981	0.988	0.719	0.565	0.590	0.565	0.988	0.675
Precision machinery	0.731	0.555	0.817	0.578	0.864	0.954	0.788	0.756	0.514	0.488	0.731	0.256
Toys and sundries	-0.138	-0.379	-0.524	-0.720	0.495	0.860	-0.397	0.385	-0.546	-0.212	-0.122	-0.207
Total	0.193	0.138	-0.158	0.045	0.754	0.955	0.230	0.282	0.268	0.476	0.113	-0.030

ASEAN = Association of Southeast Asian Nations, PRC = People's Republic of China.
Note: Competitiveness is measured by (exports – imports)/(exports + imports).
Source: Computed from the data obtained from RIETI, RIETI-TID 2012.

value indicates the presence of competitiveness and a negative value the absence of competitiveness. Accordingly, the higher the value is, the more competitive the product or industry is.

The results of the computation indicate that the overall competitiveness of the Japanese industry declined as the competitiveness index for overall trade declined from 0.193 in 1990 to 0.138 in 2011. Despite a decline, the Japanese industry can be regarded as still competitive, because the overall competitiveness index remains positive. Consistent with our observation above, ferrous and non-ferrous metal products increased their competitiveness compared with East Asia as the competitiveness index increased from 0.321 in 1990 to 0.393 in 2011. However, the case of chemical products is different. Contrary to the observation made above, competitiveness of chemical products declined from 0.629 in 1990 to 0.398 in 2011, although it remained positive in 2011. Somewhat opposite patterns can be found for many machinery products. Specifically, the degree of competitiveness declined for all the machinery products, but the competitiveness index remained positive in 2011 except for home electronics and appliances, which changed from 0.585 in 1990 to −0.491 in 2011.

Several notable changes in Japan's competitiveness compared with some individual East Asian economies should be noted. For chemical products, Japan's competitiveness compared with ASEAN declined substantially, while it remains still high compared with the Republic of Korea and Taipei,China. For general machinery, the decline in Japan's competitiveness is substantial in its comparison with the PRC. For electrical machinery and home electronics and appliances, the decline in Japan's competitiveness is particularly significant compared with all the East Asian economies and ASEAN, except Hong Kong, China. For transportation machinery and precision machinery, Japan's competitiveness declined somewhat noticeably in its comparison with ASEAN, but it remained relatively high compared with other East Asian economies.

The preceding investigation of the changing patterns of competitiveness for Japanese industries compared with Asian counterparts shows that Japan still has competitiveness in many machinery sectors but the degree

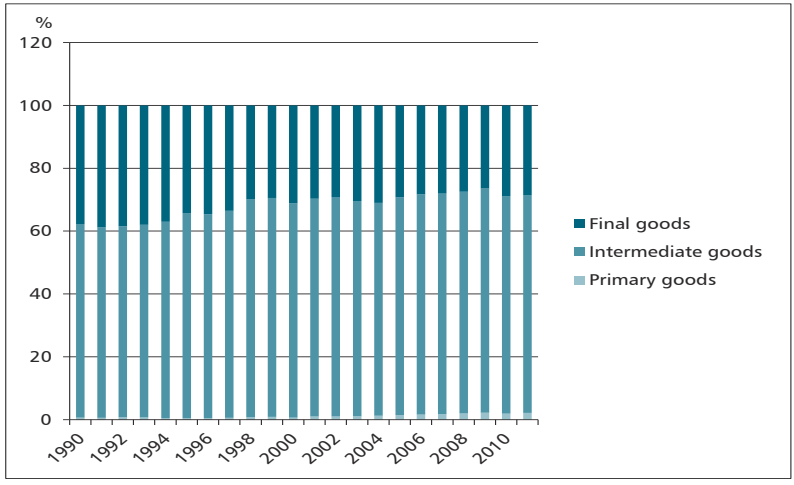
5. See Kimura (2006) on regional production networks in East Asia.

of competitiveness declined over time. Moreover, Japan does not have competitiveness in many resource-based products including food and agricultural products, textiles, pulp, paper and wood products, and petroleum products. These changes in patterns of Japan's competitiveness compared with East Asian economies seem to indicate successful catching-up by many East Asian economies.

2.3. Increasing Importance of Intermediate Goods in Japan's Trade with East Asia: Emergence and Expansion of Regional Production Networks

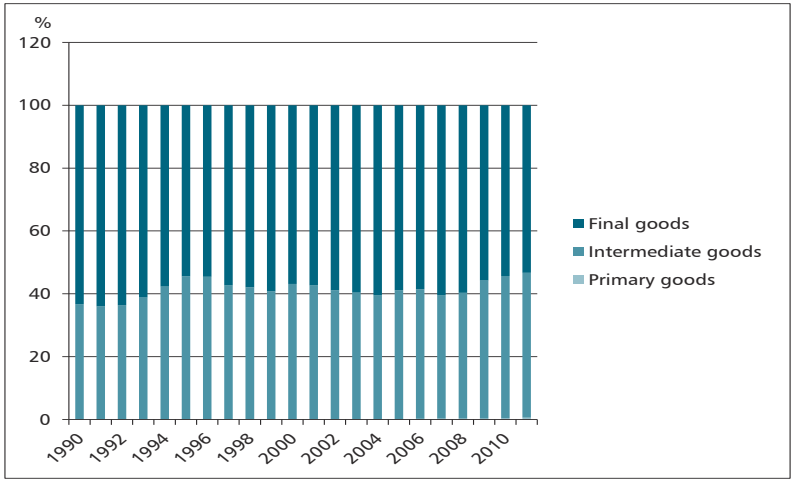
An examination of Japan's trade with East Asia from the characteristics of products reveals an emergence of interesting patterns. Figures 2a shows the changing composition of Japan's exports to East Asia for three kinds of goods—primary goods, intermediate goods, and final goods. The share of intermediate goods increased from 61.5% in 1990 to 69.1% in 2011. By contrast, the share of final goods declined from 37.8 to 28.7% during the same period. The share of primary goods remains very small: 0.3% in 1990 and 1.5% in 2011. A very high share of intermediate goods in Japan's exports to East Asia can be discerned when it is compared to the corresponding share of 46.1% for Japan's exports to non-East Asia in 2011 (Figure 2b).

Figure 2a: Composition of Japan's Exports to East Asia



Source: Constructed from the data obtained from RIETI, RIETI-TID 2012.

Figure 2b: Composition of Japan's Exports to Non-East Asia



Source: Constructed from the data obtained from RIETI, RIETI-TID 2012.

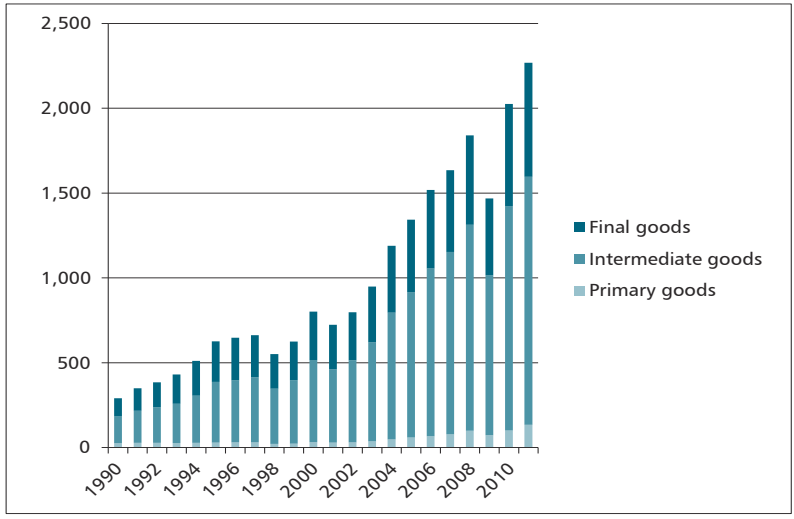
Composition of Japan's imports from East Asia and non-East Asia is very different from that of Japan's exports. Similarly to the case of Japan's exports to East Asia, the share of intermediate goods in Japan's imports from East Asia increased from 41.8% in 1990 to 48.2% in 2011. Although the share of intermediate goods in overall imports increased, the share in 2011, that is 48.2%, is much lower than 69.1%, registered for Japan's exports to East Asia. What is notable for the case of Japan's imports is the increasing share of final goods from 37.0% in 1990 to 44% in 2011. While the shares of intermediate goods and final goods in Japan's imports from East Asia increased, the share of primary goods declined significantly from 21.2 to 7.8% from 1990 to 2011. A significant decline in the share of primary goods in Japan's imports from East Asia does not mean that the import value declined in absolute terms but the rate of increase of Japan's imports of primary goods from East Asia did not increase as fast as those of intermediate or final goods. Indeed, Japan's imports of primary goods from East Asia more than doubled from 1990 to 2011, but Japan's imports of intermediate and final goods from East Asia increased as much as 6.3 and 6.4 times, respectively.

We saw increasing shares of intermediate goods in Japan's exports to and imports from East Asia. This is mainly attributable to the emergence of regional production networks or supply chains and their expansion

in East Asia.[5] Regional production networks have been constructed, as multinational corporations (MNCs), particularly those from Japan, the Republic of Korea; Taipei,China; the US; and several European countries, have adopted the "fragmentation" strategy in their international business. Under the fragmentation strategy, an MNC breaks down the entire production process into a number of sub-processes, including product development, manufacturing of parts and components, assembling final goods, distribution of final goods, etc., and locates each sub-process in an economy or region, where a particular sub-process can be conducted at the least cost, by undertaking FDI. By adopting the fragmentation strategy, MNCs can conduct efficient business operation. The fragmentation strategy has been actively pursued by MNCs in machinery industry, which uses a large number of parts and components in the production of final goods. The presence of a large number of parts and components in machinery industry provides opportunity to reduce cost by adopting the fragmentation strategy.

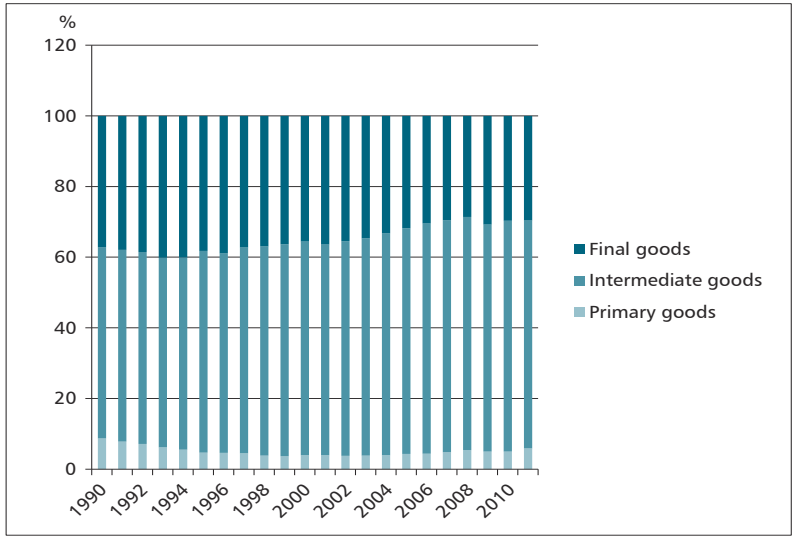
Many MNCs have adopted the fragmentation strategy and as a consequence constructed production networks, resulting in active international trade in intermediate goods in East Asia (Figure 3a). Indeed, the share of intermediate goods in total intra-East Asia trade increased from 54.2 to 64.4% from 1990 to 2011, while the corresponding shares for primary goods and final goods declined from 8.7 and 37.2% in 1990 to 5.9 and 29.6% in 2011, respectively (Figure 3b). As a result of active adaptation of fragmentation strategy and construction of regional production networks by MNCs in East Asia, particularly the PRC, which has been the center of such operation, has come to be regarded as the factory for the world. Given future prospects of rapid economic growth of East Asian developing economies, East Asia is likely to become a market for the world. If this happens, the pattern of intra-regional trade in East Asia may change to one focusing more on final goods. Discussions of the factors leading to the emergence of regional production networks will be given in a later section, where Japan's FDI is discussed.

Figure 3a: Intra-East Asia Trade by Products
(US$ billion)



Source: Constructed from the data obtained from RIETI, RIETI-TID 2012.

Figure 3b: Product Composition of Intra-East Asia Trade

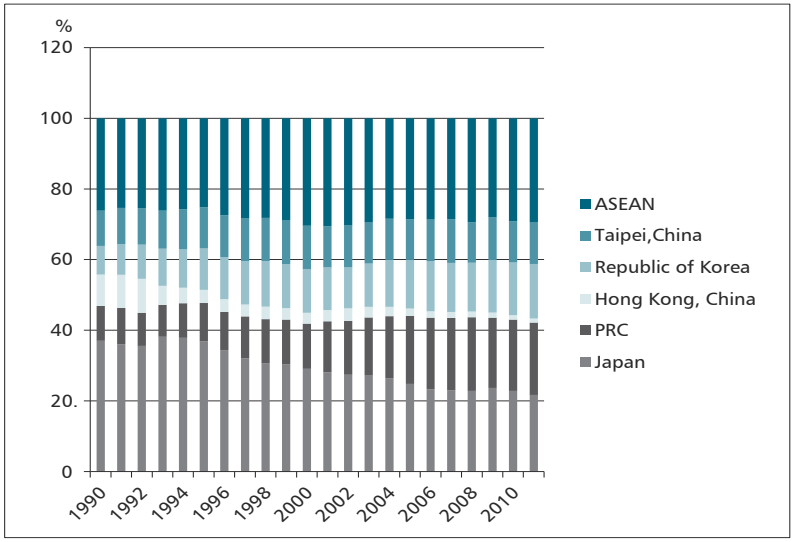


Source: Constructed from the data obtained from RIETI, RIETI-TID 2012.

2.4. Changing Competitiveness of Intermediate Products Produced by East Asian Economies

We saw a rapid expansion of intra-East Asia trade in intermediate goods. Indeed, intra-East Asia trade in intermediate goods increased 9.3-fold from 1990 to 2011, while intra-East Asia trade in primary goods and final goods increased at a lower rate, 5.3-fold and 6.2-fold, respectively. Let us examine the changing competitiveness of Japan; the PRC; Hong Kong, China; the Republic of Korea; Taipei,China; and ASEAN in their intermediate goods exports in East Asia. To see the changing pattern of competitiveness of these countries and ASEAN, the shares of these countries and ASEAN in intra-East Asia exports are computed and the results are shown in Figure 4. From the figure, one observes that Japan and Hong Kong, China lost their shares notably from 37.0 and 8.1% in 1990 to 21.7 and 1.2% in 2011, respectively, while the PRC and the Republic of Korea gained the shares significantly from 9.9 and 8.1% in 1990 to 20.5 and 15.4% 2011, respectively. Taipei,China and ASEAN also gained their shares, but the rates of increase were much lower compared to the cases of the PRC or the Republic of Korea. These findings indicate that Japan and Hong Kong,

Figure 4: Sources of Imports of Intermediate Products for East Asia



ASEAN = Association of Southeast Asian Nations, PRC = People's Republic of China, EU = European Union, ROW = rest of the world, US = United States.
Source: Constructed from the data obtained from RIETI, RIETI-TID 2012.

China lost competitiveness in the production of intermediate goods, while the PRC and the Republic of Korea gained competitiveness. These findings seem to indicate that Japan and Hong Kong, China became less important in regional production network as a supplier of intermediate goods, while the PRC and the Republic of Korea increased importance. However, these findings based on aggregate figures mask the variations among different sectors, thus we will conduct similar analysis for chemical products, ferrous and non-ferrous metal products, general machinery, electrical machinery, transportation machinery, and precision machinery, which account for large shares of intermediate goods trade in East Asia.

Table 3 reports the import sources of chemicals, ferrous and non-ferrous metal products, general machinery, electrical machinery, transportation equipment and precision machinery for Japan, the PRC; Hong Kong, China; the Republic of Korea; Taipei,China; ASEAN; and East Asia in 1990 and 2011. An examination of the changes in import sources for East Asia reveals a quite similar pattern observed above for overall trade, that is, a reduction of the shares for Japan and Hong Kong, China and an increase of the shares for the PRC and the Republic of Korea for all the products. The rate of increase is particularly notable for the PRC. The changes in the shares for Taipei,China and ASEAN are mixed, although all the shares except for one product increased for both Taipei,China and ASEAN. In 1990, Japan was a dominant supplier of intermediate goods classified under all the products listed in the table in East Asia, but that situation changed dramatically by 2011. For general machinery and electrical machinery, Japan was surpassed by the PRC in terms of the compositional shares regarding the import sources for East Asia. Japan remained the largest supplier of intermediate goods in chemicals, ferrous and non-ferrous metal products, and transport equipment in 2011, while the PRC became the largest supplier in general machinery. For electrical machinery, ASEAN became the largest supplier and for precision machinery; Taipei,China became the largest supplier.

To compare competitiveness of Japan, the PRC; Hong Kong, China; the Republic of Korea; and Taipei,China in the supply of intermediate goods, it is more appropriate to use the data for ASEAN because it excludes these economies from export destinations. The figures under the column "ASEAN" show a similar pattern of changes in competitiveness of these countries, as observed above using the data for East Asia. In other words, in ASEAN the importance of Japan as a supplier declined in all

Table 3: Import Patterns of Intermediate Goods of East Asian Economies/Regions
(%, US$ million)

Chemicals														
Sources	Japan		PRC		Hong Kong, China		Republic of Korea		Taipei,China		ASEAN		East Asia	
	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011
Japan	-	-	15.7	15.8	16.8	15.0	34.6	35.2	29.8	32.0	20.7	11.9	17.6	16.1
PRC	3.8	22.6	-	-	21.2	22.3	1.5	17.6	0.0	14.1	2.3	12.1	4.1	10.1
Hong Kong, China	0.3	0.0	11.9	0.7	-	-	0.4	0.1	0.7	0.1	1.3	0.6	1.8	0.4
Republic of Korea	3.5	6.6	1.6	17.1	4.3	8.4	-	-	2.5	10.8	3.4	6.3	2.8	10.4
Taipei,China	3.0	4.6	0.0	12.8	16.7	16.2	1.3	3.0	-	-	4.1	6.3	3.9	8.2
ASEAN	3.8	9.5	4.2	10.8	6.3	9.5	2.4	6.4	4.3	8.0	9.8	20.0	5.6	11.8
East Asia	14.5	43.4	33.3	57.1	65.2	71.4	40.1	62.3	37.3	64.9	41.4	57.1	35.7	57.1
US	38.4	19.7	24.0	11.0	12.0	9.4	24.5	12.6	29.0	11.7	20.6	10.5	26.1	12.3
EU	32.6	25.4	22.8	11.7	19.6	12.3	19.7	12.7	18.8	10.7	24.2	11.9	24.4	13.8
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
World (value)	14,432.7	62,251.9	5,653.4	168,833.3	6,299.0	20,597.2	7,964.6	46,307.7	6,927.9	38,381.4	15,575.8	92,676.2	56,853.4	429,047.8

Ferrous and non-ferrous metal products														
Sources	Japan		PRC		Hong Kong, China		Republic of Korea		Taipei,China		ASEAN		East Asia	
	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011
Japan	-	-	38.3	20.3	17.1	8.0	31.4	25.2	28.2	25.7	29.9	21.6	19.1	17.8
PRC	2.7	21.8	-	-	17.5	17.9	3.1	30.0	0.0	20.2	3.4	12.4	3.6	13.9
Hong Kong, China	0.4	0.1	5.7	0.3	-	-	0.2	1.4	3.4	2.0	0.8	1.3	1.2	0.8
Republic of Korea	8.8	15.6	2.9	10.7	4.8	5.6	-	-	3.2	7.4	5.1	7.1	5.4	8.0
Taipei,China	3.6	4.4	0.0	6.2	9.5	11.8	2.4	2.3	-	-	3.7	5.7	3.3	5.5
ASEAN	6.0	11.0	1.3	3.2	3.5	7.1	2.3	3.4	2.9	6.3	10.6	13.2	5.9	7.7
East Asia	21.5	52.8	48.2	40.8	52.4	50.4	39.5	62.3	37.7	61.6	53.5	61.3	38.5	53.7
US	12.2	4.4	4.5	3.5	13.9	11.3	10.1	3.4	7.0	2.9	4.5	4.3	8.8	4.7
EU	11.1	5.2	21.0	11.9	16.9	4.7	9.5	6.5	12.6	4.8	18.0	5.9	14.2	7.2
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
World (value)	19,759.7	45,853.4	3,989.7	96,202.9	4,467.5	42,079.2	6,326.4	49,042.3	6,692.7	27,825.7	15,607.2	103,608.9	56,843.2	364,612.5

continued on next page

Table 3 continued

General machinery														
Sources	Japan		PRC		Hong Kong, China		Republic of Korea		Taipei,China		ASEAN		East Asia	
	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011
Japan	-	-	17.1	23.5	29.8	9.5	40.2	23.1	51.6	24.3	28.8	18.7	24.6	17.2
PRC	0.5	32.1	-	-	14.1	47.1	1.6	18.8	0.0	32.1	0.7	15.0	1.7	18.6
Hong Kong, China	1.6	0.1	33.6	0.2	-	-	0.4	0.8	5.7	0.1	4.2	2.0	6.0	0.8
Republic of Korea	5.0	8.2	0.3	13.5	1.0	2.5	-	-	1.1	3.5	1.9	1.9	2.0	6.0
Taipei,China	2.9	4.2	0.0	7.2	8.8	4.0	1.7	1.7	-	-	4.0	1.9	3.2	3.9
ASEAN	8.3	12.1	0.7	9.1	8.3	13.1	1.7	4.5	2.9	5.4	14.6	17.5	8.9	12.0
East Asia	18.2	56.7	51.8	53.5	62.1	76.0	45.6	49.0	61.4	65.5	54.1	57.0	46.4	58.5
US	57.5	23.2	11.1	11.0	19.5	6.9	33.6	16.8	17.6	16.4	25.3	21.2	30.6	15.8
EU	19.3	16.1	34.6	31.4	17.2	13.2	18.6	27.2	13.3	14.2	16.8	16.1	19.3	21.0
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
World (value)	5,905.8	24,791.3	3,016.7	60,851.3	2,275.6	31,001.4	3,707.9	19,237.4	1,803.7	10,773.2	11,820.9	65,409.7	28,530.5	212,064.4

Electrical machinery														
Sources	Japan		PRC		Hong Kong, China		Republic of Korea		Taipei,China		ASEAN		East Asia	
	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011
Japan	-	-	29.3	18.7	26.3	9.3	40.2	23.1	47.4	21.5	29.2	13.1	30.4	14.1
PRC	1.2	31.3	-	-	14.4	33.8	1.6	18.8	0.0	19.2	0.3	13.0	2.9	16.2
Hong Kong, China	1.0	0.2	39.8	1.0	-	-	0.4	0.8	4.6	0.2	2.6	2.2	4.6	1.0
Republic of Korea	9.8	10.7	4.9	23.9	7.7	7.0	-	-	4.2	15.7	4.5	10.5	5.0	13.7
Taipei,China	11.1	12.4	0.0	10.1	14.0	15.7	1.7	1.7	-	-	6.1	12.5	6.4	11.7
ASEAN	8.6	22.9	1.2	28.1	15.3	26.2	1.7	4.5	8.5	19.2	18.7	24.6	12.6	25.0
East Asia	31.6	77.5	75.1	81.9	77.6	92.1	45.6	49.0	64.6	75.9	61.3	75.8	61.6	81.7
US	53.4	14.0	6.3	5.4	13.9	4.0	33.6	16.8	25.6	8.5	23.5	11.7	25.5	8.0
EU	12.6	6.4	16.5	8.1	7.6	2.0	18.6	27.2	5.8	4.9	13.4	9.1	10.9	6.6
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
World (value)	6,506.1	40,823.0	2,315.8	190,015.9	7,210.5	124,113.8	3,707.9	19,237.4	6,198.7	45,267.6	18,214.2	142,916.4	47,392.1	589,111.8

Table 3 continued

Transportation equipment														
Sources	Japan		PRC		Hong Kong, China		Republic of Korea		Taipei,China		ASEAN		East Asia	
	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011
Japan	-	-	11.0	35.9	29.1	11.9	41.2	23.6	77.0	44.6	62.2	30.1	37.6	28.5
PRC	0.6	27.6	-	-	21.5	27.8	1.6	23.8	0.0	23.3	0.7	5.9	1.6	9.0
Hong Kong, China	0.0	0.1	65.7	0.0	-	-	0.0	0.0	0.3	0.0	0.3	1.1	19.6	0.4
Republic of Korea	2.4	7.5	0.2	10.4	4.6	2.6	-	-	2.9	4.3	0.5	1.8	1.1	5.9
Taipei,China	7.8	4.0	0.0	1.9	14.4	5.7	2.4	0.8	-	-	2.9	2.8	3.0	2.3
ASEAN	1.8	17.1	4.8	1.8	4.0	11.7	0.6	1.3	2.0	7.5	2.4	19.7	3.0	10.0
East Asia	12.6	56.2	81.7	49.9	73.6	59.6	45.8	49.5	82.3	79.7	69.0	61.4	65.8	56.1
US	50.6	17.7	8.7	5.4	7.3	11.9	38.6	19.7	2.7	8.5	14.7	18.2	17.4	12.6
EU	30.4	21.9	6.2	42.5	18.4	21.8	13.7	24.6	5.6	10.2	14.0	15.5	13.1	27.5
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
World (value)	1,499.1	7,825.4	3,655.5	25,309.8	669.9	1,268.9	842.2	5,445.1	1,170.1	3,145.3	4,476.4	21,496.8	12,313.2	64,491.3

Precision machinery														
Sources	Japan		PRC		Hong Kong, China		Republic of Korea		Taipei,China		ASEAN		East Asia	
	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011	1990	2011
Japan	-	-	25.4	21.5	47.5	15.4	62.2	52.2	56.7	39.3	46.7	23.6	37.8	23.1
PRC	0.7	38.6	-	-	15.9	45.9	2.9	22.1	0.0	37.5	0.3	21.1	4.3	17.8
Hong Kong, China	2.6	0.3	35.7	0.4	-	-	2.0	0.3	5.0	0.2	4.3	3.7	4.5	0.6
Republic of Korea	4.9	4.1	0.1	19.9	4.1	2.0	-	-	0.7	10.6	1.9	2.5	2.7	11.3
Taipei,China	8.9	13.5	0.0	45.2	8.9	23.4	3.3	5.5	-	-	4.4	5.0	5.6	27.8
ASEAN	7.5	18.4	1.1	4.4	3.2	4.4	1.3	2.1	4.9	2.2	16.3	15.3	7.4	6.3
East Asia	24.6	74.9	62.3	91.3	79.6	91.2	71.7	82.1	67.3	89.8	73.9	71.2	62.3	86.9
US	42.6	13.9	17.7	2.9	7.5	3.6	12.0	9.6	21.1	5.4	10.3	12.5	18.9	5.8
EU	28.3	9.7	19.5	4.1	12.4	3.8	14.1	7.0	7.9	3.6	12.6	11.6	16.3	5.5
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
World (value)	411.3	3,618.6	100.7	19,543.1	413.8	6,450.1	212.7	3,852.0	186.0	3,067.3	461.3	3,897.8	1,785.8	40,428.9

ASEAN = Association of Southeast Asian Nations, PRC = People's Republic of China, EU = European Union, US = United States.
Source: Computed from the data obtained from RIETI, RIETI-TID 2012.

products, while the importance of the PRC increased in all products. The importance of the Republic of Korea and Taipei,China as suppliers of intermediate goods increased in many products, but not in all the products, while the direction of the change in the importance of Hong Kong, China was mixed.

Several notable developments should also be pointed out from Table 3. First, for all the economies shown in the table, the importance of the PRC as a supplier of intermediate goods in all the products increased tremendously from 1990 and 2011. This obviously reflects successful development of many industries in the PRC. Second, for Japan, East Asia has become a very important source of intermediate goods over time, while the importance of non-East Asia, namely the US and the EU, declined noticeably. This development reflects increasing competitiveness of East Asian economies in the production of intermediate goods. It may also indicate an expansion of regional production networks of Japanese MNCs, which involve their affiliates in East Asia in their operation in Japan. Third, for the PRC, the importance of Hong Kong, China declined precipitously. This can be attributed to an opening up of the PRC economy in that the importance of Hong Kong, China as an entrepôt trade site declined, enabling the PRC to rely less on Hong Kong, China for its foreign trade. By contrast to the case of Hong Kong, China, the importance of the Republic of Korea and Taipei,China for the import sources for the PRC increased substantially from 1990 to 2011 in all products. Particularly notable developments can be found for Taipei,China in precision machinery, where the share of Taipei,China increased from zero in 1990 to 45.2% in 2011.

Our investigation of the changes in the importance of the import sources of intermediate goods for East Asia by using sectoral trade data revealed a declining importance of Japan on the one hand and an increasing importance of the PRC; the Republic of Korea; Taipei,China; and ASEAN. In order to further delve into the changing roles of Japan, the PRC, and the Republic of Korea as suppliers of intermediate goods in East Asia, the changes in the prices of imported machinery parts from these countries to Thailand was computed and compared them with an objective of discerning any differences in the quality of intermediate goods, which would be reflected in their prices, supplied by Japan, the PRC and the Republic of Korea.

A summary of the results of the computation of the unit prices for

the 2001–2011 period using the United Nations (UN) Comtrade database at Harmonized System (HS) Codes 4-digit commodity classification is shown in Table 4. J, K, and C indicate unit prices of imports from Japan, the Republic of Korea, and the PRC respectively. The table is divided into three parts. The first part, which is designated as J>K,C, includes the parts, for which imported price from Japan are higher compared to those from the PRC or the Republic of Korea. The second and third parts can be read accordingly. For each part, three sub-sections are constructed, depending on the levels of the prices. Classification or designation of the products is based on the trend for the 2001–2011 period. For example, for the product 8413, the price of imports from Japan was higher than the prices of imports from the PRC or the Republic of Korea more or less throughout the period. Furthermore, the price of imports from the Republic of Korea was higher than that of the PRC more or less throughout the period. The products, for which the positions of the prices of imports from Japan, the Republic of Korea, and the PRC fluctuated over time, are shown as unclassified.

According to the results of the analysis, out of 27 products, for which the relationship between the prices of imports from Japan, the Republic of Korea, and the PRC was found to be stable, the price of imports from Japan was found to be higher compared to the prices of imports from the PRC or the Republic of Korea for 24 products. Among those 24 products, for the four products, which are shown in the block letters, the price gap between the prices of imports from Japan on the one hand, and the prices of imports from the Republic of Korea or the PRC on the other, narrowed significantly. A comparison of the prices of imports from the Republic of Korea and the PRC shows that for many products the prices of Korean imports are higher than the PRC imports. These findings indicate that in terms of quality ladder, imported intermediate goods from Japan are of high quality, which is followed by imported intermediate goods from the Republic of Korea, and those imports from the PRC are of relatively low quality. These patterns appear to reflect the capability and business strategies of the firms from Japan, the Republic of Korea, and the PRC in that Japanese firms can specialize in the production of high-quality parts in Japan, while Korean and Chinese firms specialize in somewhat lower quality parts in their home countries.

Table 4: Prices of Imported Machinery Parts from the PRC, Japan, and the Republic of Korea in Thailand for 2001–2011

	J > K, C			K > J, C			C > J, K			Un-classified
	J > K > C	J > K = C	J > C > K	K > J > C	K > J = C	K > C > J	C > J > K	C > J = K	C > K > J	
Products	8413	8431	8482	8409					8531	8408
	8417	8473	8483	8545						8548
	8466	8484	8529							
	8480	8503	8536							
	8481	8533	8537							
	8505	8534								
	8532	8544								
	8535									
	8538									
	8546									
	8547									
	8708									

PRC = People's Republic of China.
Note: C, J, K indicate unit price of imported parts from the PRC, Japan, and the Republic of Korea, respectively, in Thailand.
Those numbers with block letters indicate that the gap in the prices narrowed.
The numbers are obtained by dividing the value by quantity, either units or kilograms.
The figures indicate 4-digit HS classifications, which are shown below.

HS	Product Description
8408	compression-ignition internal comb piston engines
8409	parts for engines of heading 8407 or 8408
8413	pumps for liquids, liquid elevators, parts thereof
8417	industrial or lab furnaces and ovens, non-electronic parts
8431	parts for machinery of headings 8425 to 8430
8466	parts etc. for machine tools of head 8456 to 8465
8473	Parts and accessories of computers and office machines
8480	Molding boxes for metal foundry; mold base; etc.
8481	Taps, cocks, valves for pipes, tanks for the like, including pressure reducing valve
8482	Ball or roller bearings
8483	Transmission shafts and cranks, bearing housing; gearing; etc.
8484	Gaskets and similar joints of metal sheeting combined with other material
8503	Parts suitable for use solely/principally with machines of hd no 85.01/85.02
8505	Electro-magnets; permanent magnets; magnetic chucks; etc.
8529	Part suitable for use solely/principally with televisions, receipt app
8531	Electric sound/visual signaling app (e.g. bell/siren, fire alarms)
8532	Electrical capacitors, fixed, variable or adjustable (pre-set)
8533	Electrical resistor (including rheostats), o/t heating resistor
8534	Printed circuits
8535	Electrical app for switching (e.g. fuse, switches, etc.) exceeding 1000 volt
8536	Electrical app for switching (e.g. fuse, switches, etc.) not exceeding 1000 volt
8537	Board and panels, equipped with two/more switches, fuses
8538	Part suitable for use solely/principally with boards, panels, fuses, switches
8544	Insulated wire/cable
8545	Carbon electrodes / brushes / lamp carbons
8546	Electrical insulators of any material
8547	Insulating fitting for electrical machines, app/equip (o/t insulator of hd no. 85.4)
8548	Electrical parts of machinery/appliances, nesoi
8708	Parts and access of motor vehicles

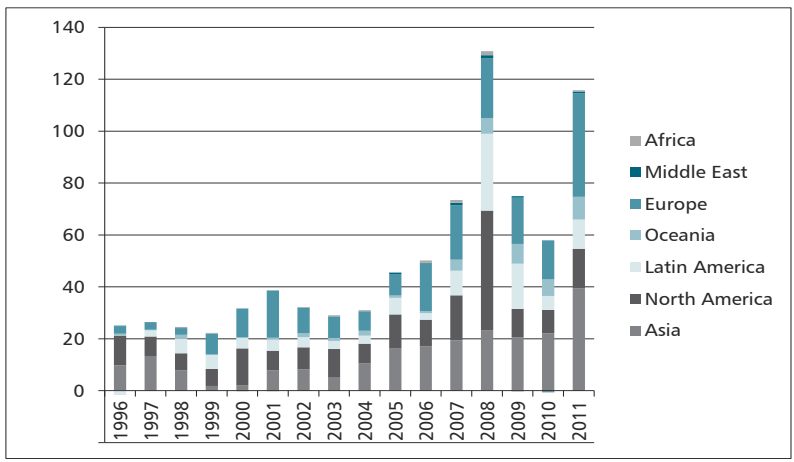
3. Japanese Foreign Direct Investment in Asia

We saw a rapid expansion of international trade in intermediate goods in East Asia in recent years in the previous section. We discussed the formation of regional production networks, or supply chains, by multinational corporations as one of the factors that have led to such development. With this observation in mind, we analyze FDI by Japanese firms, in order to deepen our understanding of their behavior and strategy, which in turn would have important impacts on the patterns of international trade in intermediate goods.

3.1. Increasing Importance of Asia for Japanese Foreign Direct Investment

Japanese FDI started to increase notably in the latter half of the 1980s, in response to various factors including a sharp yen appreciation and the emergence of the bubble economy in Japan. Japanese FDI remained more or less around the same level through the mid–2000s, after that it began to increase sharply until the global financial crisis in 2008–2009 (Figure 5). Japanese FDI declined sharply in 2009 but it rose again in 2011. Japanese FDI in Asia declined substantially in the late 1990s as a result of the Asian financial crisis, but it began to rise again in the 21st century.

Figure 5: Japanese Foreign Direct Investment Flows by Region
(US$ billion)



Source: Bank of Japan.

It maintained more or less the same level until 2010, and rose sharply in 2011. Inflow terms, Japanese FDI in Asia increased 22-fold from 1.8 US billion dollars in 1999 to 39.5 US billion dollars in 2011. Among the Asian economies, the PRC has been the largest recipient of Japanese FDI. Other large recipients include Singapore and Thailand. In terms of FDI stock value at the end of 2011, Asia accounts for 26.7% of Japanese FDI. Since the corresponding shares for North America and Europe are 29.7% and 23.9%, Asia is an important region for Japanese firms. As for the sectoral allocation of Japanese FDI in Asia, large shares are found in electrical machinery and transportation equipment in the case of manufacturing, and distribution (wholesale and retail) and finance and insurance in the case of non-manufacturing.[6]

Various factors can be identified to explain the substantial increase in Japanese FDI in general and in Asia in particular. One can divide those factors into two groups, push and pull factors. As to the push factors, those factors in investing country, in this case Japan, yen appreciation, availability of investable funds, and depressed economy, which are closely related to each other, are important. The yen-US dollar exchange rate was around 140–150 at the beginning of the 1990s, and then it began to appreciate to reach below 80 in mid-1990s. Since the mid-1990s through 2013, the yen-US dollar exchange rate fluctuated around 100 yen/dollar. Expansionary monetary policy resulted in the increase in the availability of investment funds, but a long recession did not lead to expansion of fixed investment in Japan. These developments encouraged Japanese firms to invest abroad.

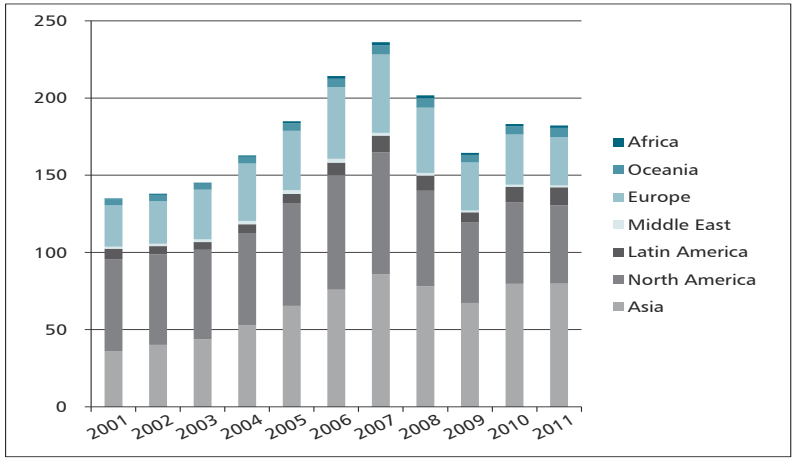
Concerning the pull factors, which are the factors in the FDI recipient economies, high growth and high growth prospects for Asian economies was one of the most important factors attracting Japanese FDI in Asia. Liberalization of trade and FDI policy pursued by many Asian economies in the forms of unilateral and regional frameworks also contributed to the expansion of Japanese FDI in Asia. An improvement in infrastructure such as transportation and communication infrastructure and reliable supply of electricity has made it easier for Japanese firms to undertake FDI.

6. The FDI data are obtained from the JETRO database. http://www.jetro.go.jp/world/japan/stats/fdi/

So far we examined Japanese firms' overseas operation by using the data on FDI. In order to analyze Japanese firms' overseas operation in more detail, we examine the information on their overseas activities.

An examination of the magnitude of sales of overseas affiliates of Japanese firms shows that the value of sales of their affiliates in Asia more than doubled in ten years from 35.9 trillion yen in 2001 to 79.8 trillion yen in 2011 (Figure 6). Sales of the affiliates in North America in 2001 was 59.5 trillion yen in 2001, much larger compared to the value for the Asian affiliates, but it declined to 50.8 trillion yen in 2011, largely because of the negative impacts of the global financial crisis. Sales of European affiliates increased from 26.8 trillion yen in 2001 to 31.3 trillion yen in 2011. Among the affiliates in Asia, sales of those in the PRC, ASEAN4 (Indonesia; Malaysia; the Philippines; and Thailand), and the NIEs3 (the Republic of Korea; Taipei,China; and Singapore) amounted to 27.4, 22.9 and 18.1 trillion yen, respectively, in 2011. As a result of rapid increase in the value of sales by Asian affiliates, their share in the sales of all overseas affiliates of Japanese firms increased from 26.6% in 2001 to 43.8% in 2011, indicating increasing importance of Asia for Japanese firms.

Figure 6: Sales of Overseas Affiliates of Japanese Firms
(Trillion yen)



Source: METI, Kaigai Jigyo Katsudo Kihon Chosa, 2001 and 2011 Surveys [Comprehensive Survey of Overseas Activities of Japanese Firms].

To see the importance of overseas operation for Japanese firms, we examine the changes in the overseas sales ratios, which is defined as overseas sales/(overseas sales + sales in Japan), for Japanese manufacturing sector (Table 5). The overseas sales ratio for the entire manufacturing sector increased from 14.6% in 2002 to 18.0% in 2011. This figure is computed by including all Japanese firms including those firms with and without overseas affiliates. If we only consider Japanese firms with overseas affiliates, then the overseas sales ratio, which is shown at the bottom of Table 5, is significantly higher. Indeed, the overseas sales ratio for Japanese firms with overseas affiliates was 32.1% in 2011, 14 percentage points higher compared to the ratio including the firms without overseas affiliates.

Wide variations in the overseas sales ratios can be found among different manufacturing sectors. Transportation equipment registers the highest overseas ratio at 38.6% in 2011. Other sectors with high overseas ratios include information and communication equipment (26.7%) and general purpose machinery (24.8%). Generally speaking, machinery sectors show high overseas sales ratios compared to natural resource-based sectors such as food, wood and pulp, and ceramics. As overseas operation increases its importance for the Japanese firms, success or failure of overseas operation has become an important factor determining the performance of Japanese firms and the Japanese economy.

3.2. Procurement Patterns of Intermediate Goods of Asian Affiliates of Japanese Firms

In our analysis of the patterns of international trade in intermediate goods in East Asia in section 2, we found that the importance of Japan as a source of intermediate goods for East Asia declined while the importance of other Asian economies, particularly the PRC, increased. We also argued that foreign trade in East Asia appeared to be influenced significantly by multinational corporations' FDI. With these observations in mind, we examined FDI in Asia in the previous section. In this section, we examine the procurement behavior of Asian affiliates of Japanese firms, which were set up by FDI. Such investigation is expected to shed light on the changing patterns of foreign trade in East Asia, because Asian affiliates of Japanese firm have significant presence in many countries in Asia.

Table 5: Overseas Sales Ratios for Japanese Manufacturing Industries (%)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Manufacturing	14.6	15.6	16.2	16.7	18.1	19.1	17.0	17.0	18.1	18.0
Food	4.6	4.9	4.4	4.2	4.2	4.9	3.8	4.7	5.0	4.9
Textiles	6.6	8.4	7.3	6.3	9.0	11.1	9.5	6.2	6.2	8.3
Wood products, paper, pulp	4.3	3.8	4.2	3.0	4.7	4.2	4.2	3.7	4.5	4.3
Chemicals	13.4	13.6	15.3	14.8	17.9	16.6	17.4	15.1	17.4	18.5
Petroleum and coal products	2.0	1.6	1.8	2.6	4.4	2.5	1.3	1.6	2.4	5.2
Ceramics, stone, clay	5.8	5.3	6.3	6.6	12.0	10.7	11.8	11.6	13.6	10.7
Iron and steel products	8.9	9.4	10.6	9.6	10.6	11.7	10.3	10.7	11.2	10.2
Non-ferrous metal products	10.1	7.9	9.4	10.2	10.3	12.1	11.0	11.8	14.7	14.8
General purpose machinery								21.2	28.3	24.8
Machine tools								8.0	11.1	11.5
Office machine								12.9	13.8	15.0
General Machinery	10.1	10.7	11.7	13.1	14.3	14.4	12.8			
Electric Machinery	21.0	23.4	9.5	11.0	11.8	11.5	13.0	13.0	11.8	12.8
Information and communication equipment			33.1	34.9	34.0	32.2	28.1	26.1	28.4	26.7
Transportation equipment	32.2	32.6	36.0	37.0	37.8	42.0	39.2	39.3	39.2	38.6
Precision machinery	12.9	12.8	12.4	13.8	8.9	9.4	7.9			
Others	6.1	6.0	7.9	9.4	9.7	9.3	9.1	8.7	9.1	11.5
Manufacturing*	29.1	29.7	29.9	30.6	31.2	33.2	30.4	30.5	31.9	32.1

Note: Overseas Production Ratio is defined as overseas sale/(overseas sales + domestic sales).
*includes only those firms with overseas affiliates.
Source: METI, Kaigai Jigyo Katsudo Kihon Chosa, 2011 Survey [Comprehensive Survey of Overseas Activities of Japanese Firms].

Table 6 shows the sources of procurement of intermediate goods for the affiliates of Japanese firms in Asia, the PRC including Hong Kong, China; ASEAN4 (Indonesia; Malaysia; the Philippines; and Thailand); and NIEs3 (the Republic of Korea; Taipei,China; and Singapore). The data are obtained from an annual survey conducted by the Ministry of Economy, Trade and Industry (METI). The most interesting finding may be that Japan became a less important source for the procurement of intermediate goods for the Asian affiliates of Japanese firms. This pattern can be found for the affiliates in the PRC, including Hong Kong, China; ASEAN4; and NIEs3. For example, the share of Japan as a source of procurement of intermediate goods for the manufacturing Asian affiliates declined from 36.1% in 2001 to 26.9% in 2011. The rate of decline is particularly noticeable for iron and steel products and transportation equipment. Among the affiliates in Asia, the rate of decline in the share of Japan as a source of procurement in iron and steel products was substantial for the affiliates in the NIEs3, while the substantial decline of the importance of Japan as a source of procurement in transportation equipment is found for the affiliates in ASEAN4.

In contrast to declining importance of Japan as a source of intermediate goods for the Asian affiliates of Japanese firms, the importance of local procurement increased. For the Asian affiliates, the share of local procurement in total procurement in manufacturing increased from 43.9% in 2001 to 60.3% in 2011. Sharp increase in the share of local procurement is found for petroleum and coal products, iron and steel products, electric machinery, and transportation equipment. For the PRC affiliates, large increases in the share of local procurement can be observed for iron and steel products, electrical machinery and transportation equipment. For the ASEAN4 affiliates, the rate of increase in the importance of local procurement in total procurement is particularly high for transportation equipment. For the affiliates in the NIEs3, the importance of local procurement in total procurement increased sharply for food, iron and steel, and transportation equipment.

Several factors can be identified to explain the declining importance of Japan and increasing importance of local market as a source of procurement of intermediate goods for the Asian affiliates of Japanese firms from 2001 to 2011. First, a sharp appreciation of the yen during the 2001–2011 period discouraged the Asian affiliates from procuring intermediate goods from Japan. The yen appreciated from around 120–130 yen/dollar around

Table 6: Sources of Procurement of Intermediate Goods for Asian Affiliates of Japanese Firms (%)

	2001				2011			
	Procurement Sources				Procurement Sources			
	Japan	Local	Asia	Total	Japan	Local	Asia	Total
Asia								
Manufacturing	36.1	43.9	17.4	100	26.9	60.3	10.9	100
Food	8.0	67.9	10.9	100	5.7	91.3	1.9	100
Textiles	25.0	58.5	6.9	100	22.6	57.1	14.3	100
Wood products, paper, pulp	6.2	90.0	2.2	100	16.5	77.6	3.9	100
Chemicals	17.1	60.3	16.1	100	23.2	58.4	15.2	100
Petroleum and coal products	2.7	35.9	56.1	100	32.5	65.8	1.5	100
Iron and steel products	63.2	27.1	8.7	100	43.7	49.1	6.8	100
Non-ferrous metal products	19.0	64.2	11.3	100	13.7	72.1	12.9	100
General Machinery	38.2	56.0	5.4	100	27.5	60.4	6.8	100
Electric Machinery	32.7	41.1	25.3	100	21.5	59.2	18.6	100
Information and communication equipment	37.0	31.5	29.7	100	40.0	35.7	23.8	100
Transportation equipment	46.4	47.4	3.9	100	22.9	70.7	4.5	100
Others	40.8	43.9	12.4	100	33.5	51.1	12.8	100
PRC + Hong Kong, China								
Manufacturing	37.6	43.2	16.9	100	26.4	62.5	10.1	100
Food	9.7	76.7	3.0	100	6.6	91.2	0.6	100
Textiles	41.3	53.0	5.0	100	24.6	58.1	13.3	100
Wood products, paper, pulp	12.0	87.9	0.0	100	-	-	2.3	100
Chemicals	32.2	34.6	14.1	100	24.6	57.9	15.0	100
Petroleum and coal products	22.3	77.7	-	100	58.1	40.8	1.1	100
Iron and steel products	70.4	19.9	7.7	100	-	66.4	2.7	100
Non-ferrous metal products	26.0	62.5	3.9	100	11.6	72.6	15.3	100
General Machinery	37.9	57.9	4.0	100	21.9	70.7	5.9	100
Electric Machinery	27.7	36.2	35.7	100	22.6	64.7	12.3	100
Information and communication equipment	41.0	32.0	25.4	100	40.2	37.2	22.3	100
Transportation equipment	36.8	59.3	1.1	100	22.8	73.4	2.7	100
Others	40.8	36.7	20.2	100	-	-	10.2	100

Table 6 continued.

	2001				2011			
	Procurement Sources				Procurement Sources			
	Japan	Local	Asia	Total	Japan	Local	Asia	Total
ASEAN4								
Manufacturing	34.7	45.3	17.4	100	26.0	60.8	11.5	100
Food	1.4	92.9	2.3	100	6.4	89.9	3.4	100
Textiles	23.2	40.9	13.8	100	21.2	54.2	15.5	100
Wood products, paper, pulp	2.1	91.8	3.7	100	13.3	80.1	3.7	100
Chemicals	13.5	58.9	21.4	100	17.2	52.6	26.2	100
Petroleum and coal products	5.6	89.6	3.9	100	23.6	56.1	17.9	100
Iron and steel products	60.2	31.0	8.1	100	68.1	23.4	8.3	100
Non-ferrous metal products	15.8	70.4	8.8	100	10.0	78.2	9.4	100
General Machinery	28.4	63.2	8.2	100	32.5	52.8	12.7	100
Electric Machinery	28.9	45.0	25.4	100	17.8	57.6	24.1	100
Information and communication equipment	28.4	36.0	33.5	100	38.1	39.4	22.0	100
Transportation equipment	54.8	39.6	3.0	100	25.0	67.6	6.0	100
Others	47.8	41.0	10.2	100	22.4	60.6	14.1	100
NIEs3								
Manufacturing	36.3	41.0	20.3	100	34.1	49.2	13.0	100
Food	19.5	31.7	48.1	100	1.5	91.5	6.9	100
Textiles	9.0	80.9	1.9	100	9.3	74.4	12.7	100
Wood products, paper, pulp	-	84.6	-	100	-	-	-	-
Chemicals	16.8	68.6	11.2	100	28.6	62.1	6.3	100
Petroleum and coal products	1.0	10.5	81.0	100	-	-	-	-
Iron and steel products	60.8	26.2	12.6	100	38.9	37.9	18.4	100
Non-ferrous metal products	20.4	46.5	28.5	100	47.1	42.8	10.0	100
General Machinery	54.9	35.4	8.1	100	38.1	35.7	2.6	100
Electric Machinery	50.5	40.4	7.3	100	25.0	31.5	41.2	100
Information and communication equipment	45.2	25.1	28.4	100	43.3	27.5	28.6	100
Transportation equipment	22.6	62.2	12.2	100	16.5	78.0	3.5	100
Others	25.9	61.9	4.8	100	58.0	25.9	13.9	100

ASEAN4 = Indonesia; Malaysia; the Philippines; and Thailand, PRC = People's Republic of China, NIEs3 = the Republic of Korea; Singapore; and Taipei,China.
Sources: Computed from the data obtained from METI, Kaigai Jigyo Katsudo Kihon Chosa, 2001 and 2011 surveys [Comprehensive Survey of Overseas Activities of Japanese Firms].

80 yen/dollar in 2011. Faced with higher prices of Japanese intermediate goods in US dollar or local currency, the Asian affiliates shifted their procurement sources from Japan to local market or to the third countries. Second, Asian affiliates of Japanese firms developed local procurement networks of parts and components supplies over time, as the knowledge about local firms increased and improved along with the length of operation. This type of behavior was found in a study of foreign affiliates of Japanese firms by Kiyota et al. (2008). Third, somewhat related to the previous point, successful industrialization or upgrading of technological level of Asian economies provided an opportunity for the affiliates of Japanese firms to increase local procurement, as parts and components produced by local firms became acceptable to Japanese firms.

Before ending this section, we should look at the importance of other Asian economies (other than Japan or the economy of affiliate location) as sources of procurement. For the Asian affiliates, the importance of other Asian economies as a procurement source declined from 2001 to 2011. This is partly due to substantial increase in the importance of local procurement. However, there are few cases where the importance of other Asian economies in the procurement of intermediate goods increased. They include textiles, and non-ferrous metal products for the PRC affiliates, petroleum and coal products for the affiliates in ASEAN4, and electric machinery for the affiliates in the NIE3. Freer regional trade environment, which may be achieved by the establishment of a region-wide FTA, or Regional Comprehensive Economic Partnership, would promote intra-regional trade in East Asia, possibly increasing the importance of other Asia in the procurement of intermediate for the Asian affiliates of Japanese firms.

3.3. Changing Characteristics of Japanese Firms' Strategy in Asia

Our analysis in the earlier sections showed that the Japanese manufacturing sector, more precisely the manufacturing sector in Japan, is losing competitiveness compared with the PRC and Korean counterparts. Moreover, we saw that Japanese firms have been actively undertaking FDI in Asia. Indeed, there is a view that active FDI by Japanese firms has contributed to a loss of competitiveness of the manufacturing sector in Japan, as FDI has relocated manufacturing operation from Japan to Asia. In light of these observations, this section attempts to analyze Japanese firms' strategy in Asia and in Japan.

Many Japanese firms are likely to expand their overseas operation, particularly in Asia, by actively undertaking FDI. Several factors can be identified for this observation. First, pessimistic future prospects of the Japanese economy discourage Japanese firms from investing in Japan. Some of the reasons for pessimistic future prospects of the Japanese economy include demographic factors, huge government debt, regulation ridden economy, high energy prices, and closed economy. The absolute size of the Japanese population is declining because of low birth rate and because of limited inflow of foreign workers or immigrants. Low birth rate and high life expectancy of the Japanese population results in aging of the population, increasing dependency ratio and increasing demand for social security and medical care on the part of the government. Expected increase in government spending in social security will increase a burden on the government, which is already in huge debt.

Second, by contrast to the situation in Japan, the future prospects of many Asian economies are optimistic, attracting FDI from Japan. Many Asian economies, which are still in the low and middle income levels, have an ample opportunity to achieve economic growth. Having discussed favorable future prospects of the Asian economies, one needs to emphasize that these economies have to deal with many challenges such as human resource development, and infrastructure development, in order for them to achieve high economic growth. Indeed, many economies are argued to have fallen into a middle income trap.

Let us examine Japanese firms' strategy in Asia, as a success in their business in Asia is very important for their overall operation to be successful. Indeed, an increasingly large number of Japanese firms rely on profits repatriated from Asian operation for their operation in Japan. With this in mind, let us examine their strategy in Asia, first examining their countries of interest as their investment destinations, and then turning to some specific measures they are considering to adopt in Asia to compete against their competitors.

Among the Asian economies, the PRC has been the most attractive country for Japanese investment since the early 1990s. Although the PRC remains to be one of the most attractive FDI destinations for Japanese firms, many Japanese firms are diversifying their investment away from the PRC. There are several reasons for this change in the attitude of Japanese firms toward the PRC. One is rapidly rising wages. According

to the Wall Street Journal on 17 May 2013, private sector wage rose 14% in 2012, accelerated from 12.3% in 2011.[7] Rising wages result from not only shortage of labor but also the mismatch in demand for and supply of labor. Another reason for the declining interest of the PRC as an investment destination for Japanese firms is political problems between Japan and the PRC, which has led to a difficult business environment for Japanese firms.

In Asia, India, Indonesia, Myanmar, Thailand, and Viet Nam have been successful in attracting Japanese firms' interest, although realized investments in Myanmar have been rather low. The reasons for their attractiveness differ among the countries, but one of the common reasons is high growth potential, largely resulting from the possible realization of demographic bonus. In order for them to successfully attract FDI not only from Japan but also from other countries, they have to successfully deal with the challenges such as transparency and stability in policy implementation, development of human resources and infrastructure, as discussed above. It should be noted that improvement in connectivity either in the forms of physical connectively or communication/internet connectivity is very important for attracting foreign firms engaged in regional production networks.

According to a survey conducted by the Japan Bank for International Cooperation (JBIC) in the mid-2012, many Japanese firms are planning to strengthen their capability in producing high-quality, high-level products, since they cannot compete in terms of price against Chinese and Korean firms, their major competitors in Asia, as we saw in an earlier section.[8] In order to achieve this goal, many Japanese firms are expanding and improving their R&D capability not only at their headquarters but also at their affiliates in Asia. One of the challenges for Japanese firms is to attract capable workers and help develop capability of these workers. For this, Japanese firms have to provide an enabling and attractive work environment.

We discussed Japanese firms' strategy in Asia and now we turn to Japanese firms' strategy in Japan. According to a survey by JBIC (2012),

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7. http://online.wsj.com/article/SB10001424127887324767004578488233119290670.html
8. JBIC (2012).

the two most important challenges or goals are to strengthen and expand "manufacturing capability of high value added products" and "research and development". These two goals are consistent with the goals of Japanese firms' operation in Asia. In order to achieve these goals, Japanese firms have to expand R&D and improve quality of researchers by providing attractive environment for the investors and researchers not only locally but also from foreign countries. As noted above, many Japanese firms are recycling their profits from Asia to Japan, which are used to finance operations and activities including R&D in Japan. As such, it is of critical importance for Japanese firms to achieve successful operation in foreign countries, particularly in Asia. By contrast to these two functions, which are to be strengthened and expanded, many Japanese firms are planning to reduce manufacturing of standard products.

4. Concluding Remarks

We found that the Japanese manufacturing sector has been losing competitiveness compared with its competitors in the PRC, the Republic of Korea and other Asian economies by examining foreign trade statistics. Japanese manufactured exports, especially exports of intermediate goods, which are increasing in magnitude and in importance within growing regional production networks, have lost market shares in Asia against their PRC and Korean counterparts. Our analysis revealed that Japan still has a comparative advantage in the production of high-quality and high-value intermediate goods. Given the changing patterns of factor endowments in Japan and its trading partners in that Japan has become a more skilled worker and researcher abundant country relative to unskilled-workers or physical capital, it is only natural that Japan is specializing in skilled-labor intensive high-quality and high value added production. A key question for Japan is if Japan can continue to expand and improve the quality of skilled workers and researchers, in order to remain an important economy in manufacturing, and possibly in services.

Findings from the analysis of Japanese firms' activities in Asia are consistent with the earlier findings on the pattern of Japan's international trade with Asia. In other words, Japanese firms have been focusing on the production of high-quality and differentiated products in Asia, because they do not have a comparative advantage or price competitiveness in standard products. So far, Asian operation of Japanese firms has been profitable and a large portion of profits are recycled back to Japan, a part

of which is used for R&D activities in Japan, which in turn contributes to an improvement in the competitiveness of Japanese firms by developing new products, technologies, etc.

In order for Japanese manufacturing sector and firms in Japan to remain competitive, maintenance and expansion of this kind of virtuous cycle is very important. For that, Japanese government can contribute significantly. For example, Japanese government can push the establishment of region-wide free trade agreements including the Regional Comprehensive Economic Partnership (RCEP) and the Trans-Pacific Partnership (TPP) as these regional frameworks would provide business friendly environment characterized as a free, open, transparent, and stable business environment. Such business environment would benefit Japanese firms to run efficient and profitable business operation. Japanese government can help develop infrastructure, which needs to be developed in Asia, possibly with the private sector. Moreover, the Japanese government can provide financial and technical assistance for research and development by firms, universities and research institutions. Finally, the Japanese government can open up goods, services, investment, and to some extent labor markets in Japan by deeply committing itself to the RCEP and the TPP. In order for Japan to successfully open up its markets, the Japanese government has to implement domestic reforms in the areas closely related to market opening.

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Chapter 6

Services Sector Integration in Asia: Emerging Regional Service Business Models

Shintaro Hamanaka*
Asian Development Bank

Abstract

In identifying emerging services business model, this chapter analyzes the activities of Japanese service corporations in Asia, which are increasingly becoming regionally-oriented. Just like the integration of manufacturing sectors in the Association of Southeast Asian Nations (ASEAN) was triggered by Japanese manufacturing foreign direct investment (FDI) in the 1980s, Japanese services FDI has a potential to integrate service sectors in ASEAN. The impact on regional agreements on service business model is complex, however, especially from a Japanese corporations' perspective. On the one hand, there is a regional integration scheme at the ASEAN level. On the other, regional integration is pursued at Japan-ASEAN level [various Japan-ASEAN Economic Parthership Agreements (EPAs)] as well. Thus, using a case study method, this chapter identifies Japanese service corporations' emerging business models in ASEAN where a commercial presence in Singapore is usually used to supply services to the entire region.

This study demonstrates that, for example, Japanese corporations use a commercial presence in Singapore to supply services to Malaysian consumers, rather than using a commercial presence in Japan or Malaysia, which is old business models. Because of the market integration in ASEAN, for foreign companies, having one commercial presence in a gateway country in the region (such as Singapore) is sufficient to supply services in the entire ASEAN region. An alternative scenario is that Japanese companies establish a relatively large subsidiary in Singapore, which functions as regional head quarter and owns a subsidiary in Malaysia, as a Southeast Asian firm rather than a Japanese firm (investment from Southeast Asia is better protected than that from Japan because of ASEAN services integration). In order to illustrate new business model, this study proposes the idea of a "gateway" country that servers two main purposes: (i) connect the region with the outside world; and (ii) integrate the economic activities in the region.

Keywords: service agreement; regional integration; business mode; foreign direct investment (FDI); gareway; regional operating headquarters (ROH).
JEL Classification: F15; F6; F23; F55.

1. Introduction

Value chain is the key term to understanding economic development and integration both at global and regional levels. The existing studies of Asian economic integration tend to analyze regional production networks and regional value chains wherein physical products are produced, and their analytical focus has been on the integration of manufacturing sectors at the regional level. Service sectors are not necessarily forgotten, but they are usually only treated as an input to value chains or production networks or as a facilitator of integration of manufacturing sectors.

In contrast, this study sets its analytical focus on the integration of service sectors in Asia. Services industries in Southeast Asia defined as Association of Southeast Asian Nations (ASEAN) are experiencing a dynamic evolution, in particular, because of regional agreements that intend to transform the economic activities in the region. This study attempts to examine emerging service business models at the regional level, with a special reference to regional service integration agreements. It is natural for regional agreements that cover both goods and services trade liberalization to affect not only the integration of manufacturing sectors but also that of service sectors. Many corporations, especially services corporations, have recently reorganized their business models in Southeast Asia to realign with the commercial reality, such as technological development and the integration of regional service markets.

This study analyzes the activities of Japanese service corporations in Asia, which are increasingly becoming regionally-oriented. Just like the integration of manufacturing sectors in ASEAN was triggered by Japanese manufacturing foreign direct investment (FDI) in the 1980s, Japanese services FDI has a potential to integrate service sectors in ASEAN. The impact on regional agreements on service business model is complex, however, especially from a Japanese corporations' perspective. On one hand, there is a regional integration scheme at the ASEAN level. On the other, regional integration is pursued at Japan-ASEAN level (various Japan-ASEAN Economic Partnership Agreements [EPAs]) as well. Thus, using a case study method, this study identifies Japanese service corporations' emerging business models in ASEAN where a commercial presence in Singapore is usually used to supply services to the entire region.

It also seems useful to clarify what this chapter is not about. This research is not a repetition of a journalistic commentary that Singapore, which has a transportation and financial center, is the hub of services economic activities in ASEAN. The issue is not the hub of service activities per se but the service suppliers and business models. For example, just because trade is transshipped at Singapore does not mean that an international transport service is provided by a Singaporean firm. Likewise, a commercial presence in Singapore that supplies services to the region may not be a Singaporean firm. Rather, this study demonstrates that, for example, Japanese corporations use a commercial presence in Singapore to supply services to Malaysian consumers, rather than using a commercial presence in Japan or Malaysia, which are old business models. Because of the market integration in ASEAN, for foreign companies to have one commercial presence in a gateway country (such as Singapore) is sufficient to supply services to the entire ASEAN region. In order to illustrate the new business model, this study proposes the idea of a "gateway" country that serves two main purposes: (i) connect the region with the outside world; and (ii) integrate the economic activities within the region.

This chpater is structured as follows. Section 2 briefly reviews the related literature and points out that past literature mainly deals with goods-centric production networks or value chain and little research has been conducted from a services integration perspective. Section 3 overviews the game changers of services sector at the two levels: regional services agreements and domestic reforms. Because of the deregulation of services sectors and regional services market integration enable by agreements, a new business model that targets the entire region is emerging. Section 4 presents the hypothesis and explains the business models that are suitable to the new commercial reality such as regional integration. It also discusses the concept of "gateway" in details. Section 5 briefly explains the methodology of this study. It explains why the case study approach is effective in identifying regional services integration and services business model at the regional level. Section 6 introduces several case studies that highlight the emerging services business models in Asia, in light of regional services value chain. It covers logistics services and other services that are impacted by the logistics sector. Section 7 concludes.

2. Literature: From Production Networks to Services Value Chains

In the existing research on Asian economic integration, the term "production networks" was popularly used to describe the region-wide corporate economic activities in Asia. Hatch and Yamamura (1996) argue that Japanese companies attempt to build regional production alliances, describing such a situation as "Asia in Japan's embrace". The oft-cited edited book "Network Power: Japan and Asia" by Katzenstein and Shiraishi (1997) argues that Japanese corporations' production bases in Southeast Asia is the principal driving factor for integrating the economic activities in Asia, though it also points out that the Japanese production network is relatively "closed" compared to overseas Chinese networks.

One important point which is sometimes overlooked is that "production network" usually refers to the activities of the manufacturing industry. Merchandise trade is usually analyzed to examine production networks. This is simply natural because the term is about the "production" that implies that the final output consists of physical products. How the parts and components are produced and delivered to the final assembly stage is the issue and the efficient intermediate goods trade flow in the vertical integration is the question. For example, Ernst (1994) describes how East Asian production networks of Japanese electronics firms contribute to the regionalization of East Asian economies.[1] In short, the networks to produce goods as a final output, such as electronics products and automobiles had been the main subject of analysis in production network literature.

The term "value chain" was first used by Porter (1985). Simply put, a value chain is a set of activities whereby an organization creates value for its customers. This is more comprehensive (and perhaps more useful) to understand the contribution of a range of values added by various types of corporations. For example, economic activities of retailers are non-negligible in terms of "value" from the perspective of consumers, because they bring together various types of products and present them in a way that is convenient to customers. Recent literature on global value chain emphasizes a shift from "trade in goods" to "trade in tasks", that

1. Note that the term regionalization is usually used to describe market-driven integration, while regionalism is used to describe a stage-lead project to integrate the region. See Wyatt-Walter (1995).

emphasizes the fact that tasks or services are embedded or accumulated in products at each stage of value chain (for example, see WTO [World Trade Organization]-IDE [Institute of Developing Economies] 2011).

However, it is still true that the majority of research tends to analyze the value chains where the final output is physical products or goods (e.g. Sally 2013). While business and infrastructure services are necessary for the smooth operation of global value chains (WTO-IDE 2011, Banomyong 2010), services are usually considered an important input into the value chains. Alternatively, services are regarded as important as the final stage of value chains. In fact, any product, such as food products made from agricultural output, and televisions made of many parts and components are eventually sold, for example, at a supermarket, which is a distribution service sector. However, those views are still goods-centric, because the main objects of analysis are efficient flows and sales of goods. There is some research on "services value chains", but the majority focuses on business process outsourcing, which is about the non-core business that can be outsourced (Gereffi and Fernandez-Stark 2011, WTO-IDE 2011). In short, in existing studies, services are discussed as an intermediate input to manufacturing sectors or as the final stage of chains that link manufacturing output to consumers, or discussed as a peripheral area of value chains that can be "outsourced". As a result, dynamic change in regional services sector integration and services value chain development itself are sometimes overlooked.

What is lacking in existing literature is a clear services perspective in understanding the regional value chain or regional integration. This is especially true for Asia where the game of services sector activities is rapidly changing at the regional level. While several studies assess the impact of tariff reduction under regional agreements on intra-regional trade flows (especially intermediate trade flows), small attention has been paid to the emerging services business model at the regional level enabled by the signing of regional agreements.

3. Game Changers: Regional Services Integration Schemes

It is important to note that the web of regional agreements in Asia is fairly complex, at least from a Japanese perspective. On one hand, there is a regional integration scheme at the ASEAN level. On the other, regional integration is pursued at Japan-ASEAN level (various Japan-ASEAN

EPAs). Thus, it is reasonable to consider that the impact of regional agreements on a business model is also complex. This section examines the game changers at the two levels (regional and domestic) in turn.

Regional trade agreements that usually cover both goods and service trade liberalization affect not only regional integration of manufacturing sectors but also the integration of service sectors. However, the impact of regional agreement on service business models is more serious than goods or manufacturing business models for three reasons. First, service agreements usually employ "loose" or "leaky" rules of origin, compared to goods agreement (see below for details). Second, service trade liberalization usually entails services investment liberalization, which is usually called Mode 3 (services trade through commercial presence) under the General Agreement on Trade in Services (GATS) system. Third, services are usually provided by the combination of various modes of supply, not limited to Mode 3.[2]

3.1. Services Integration Agreement at the ASEAN Level

3.1.1. Priority Service Sector Integration

In November 2004 in Vientiane, the Lao People's Democratic Republic (Lao PDR), the ASEAN Framework Agreement for the Integration of Priority Sectors (otherwise known as the Vientiane Action Plan or VAP) was agreed to advance efforts at liberalizing priority sectors. The VAP listed eleven priority sectors of which four of them were service sectors (air transport, tourism, e-ASEAN and healthcare).[3] The Amendment Agreement on Priority Sectors that elaborated the procedures for designating priority sectors liberalization was adopted in December 2006. It was agreed there that the elimination of all limitations in Modes 1 and 2 should be achieved by the end of 2008. Mode 3 foreign equity participation should be allowed by the end of 2010.

2. Mode 1 is cross-border supply of services. Mode 2 is consumption abroad. Mode 4 is movement of natural persons.

3. They are: (i) agro-based products, (ii) air transport, (iii) automotives, (iv) e-ASEAN, (v) electronics, (vi) fisheries, (vii) healthcare, (viii) rubber-based products, (ix) textiles and apparel, (x) tourism, and (xi) wood-based products.

By August 2007 in Cebu, Philippines, the ASEAN Sectoral Integration Protocol for the Logistics Services Sector was agreed. The logistics sector was added as the fifth priority service sector. Because of time constraints, ASEAN countries agreed to set a timeline of logistics liberalization separate from other priority sectors, setting the target date at 2013, alongside the four other priority sectors by 2010. The logistics liberalization scheme of ASEAN mainly covers the following sub-sectors: (i) railway transport (central product classification [CPC] 7112), (ii) road transport (CPC 7123), (iii) maritime transport (CPC 7212, 7213), (iv) cargo handling (CPC 741), (v) storage and warehousing (CPC 742), (vi) transport agency (CPC 743), (vii) postal and courier (CPC 7512), and (viii) packaging (CPC 876).[4]

Under the Logistics Protocol, ASEAN members are committed to completing the liberalization of these sectors in a timely manner. Mode 1 (cross-border supply of services) and Mode 2 (consumption abroad) should be fully liberalized by 2013. For Mode 3 (services trade through a commercial presence), the plan is to increase the foreign equity cap to 49% by 2008, to 51% by 2010, and to 70% by 2013. In 2015, a 100% commercial presence of foreign-owned logistics entities will be allowed. This means that logistics-related investment should be completely free of restrictions by 2015 within ASEAN, enabling non-ASEAN entities to provide logistics services to ASEAN countries by establishing a commercial presence in any one ASEAN country.

3.1.2. Substantial Business Operation Rules

In order to understand the different implications to a business model in manufacturing and service sectors in a regional context, it is useful to first consider the different impacts on intra-regional trade in goods and services brought about by a regional agreement.[5] In the case of trade in goods, tariff-free imports via a regional agreement partner that originate from a non-member are usually regulated by rules of origin (ROO). However,

4. The ASEAN Logistics Protocol covers various measures that actually facilitate trade. Its Appendix lists 44 issues and the scope of the ASEAN logistics scheme is significantly more comprehensive, even in comparison with the GATS logistics negotiations.
5. Investments in services are usually covered by services trade agreements, while there are many bilateral investment treaties (BITs) covering services as well.

in the case of services, it is usually possible for companies outside the region to export or provide services across the entire region using a commercial presence in one country in the region, assuming that a regional services agreement is in place. This happens when a regional services and investment agreement adopts a "substantial business operation" rule with regard to the ROO in services. In fact, most regional services agreements in Asia, including the ASEAN Framework Agreement on Services (AFAS) and various ASEAN–Japan EPAs, adopt substantial business operation rules.[6]

Because a regional services agreement with substantial business operation ROO does not prohibit the import of services from outside via a partner country of the agreement, service providers from outside can strategically choose the best location to establish a commercial presence within the region to supply services to the entire area covered by a regional services agreement. While it is also true that the decision of location is essential for a manufacturing production base—since goods produced by a multinational company at a production base located in one free trade agreement member can be exported to other member countries as long as they meet ROO requirements—location decisions seem to be a more fundamental concern in the case of services, especially in the context of regional agreements. Many countries basically attempt to attract FDI in manufacturing and the usual practice is to offer investment incentives. However, service industries are usually highly regulated by government agencies and, in particular, investments in the services sector are usually strictly regulated, unlike the manufacturing sector. Because regulations on investments usually have negative impacts on FDI inflows in the services sectors (Kox and Nordas 2007), regional agreements to liberalize services trade and investment in the region are dramatically altering the environment in which international investments occur.

3.2. Services Integration at Japan-ASEAN Level

Services trade and investment between Japan and individual ASEAN countries has also been liberalized under their respective bilateral EPAs with Japan, but to a different extent and at various speeds. This can lead to complications in investment policy decisions on geographical considerations made by Japanese companies. As a result, Japanese FDI

6. For details, see Fink and Nikomboriak (2007).

in services among ASEAN members is experiencing dynamic structural changes, which in itself is an interesting fact deserving the attention of policymakers and scholars.

We will compare three countries that have a potential to become a gateway country for the ASEAN integrated services market for Japanese corporations: Singapore, Thailand and the Philippines. Singapore is a natural candidate, given its status of economy, that is, it is already a services-centered society. Thailand's services sector also has a potential to become a hub or gateway for ASEAN integrated markets, given that it is a hub or gateway for manufacturing sectors in ASEAN, especially for Japanese corporations (such as the automobile industry). The Philippines also has a potential to become a gateway to ASEAN for Japanese service corporations for two reasons. First is the geographical location; the country is located between Japan and other ASEAN countries. Second is that it has a strong business process outsourcing sector, which is one of the regional service value chains.

As compared in Table 1, Singapore has committed to maintain its liberal regulatory regime by making deeper commitments under its EPA with Japan than are present in Japan's EPA with Thailand or the Philippines.[7] While Singapore's transport and logistics commitments at the WTO/General Agreement on Trade in Services (GATS) negotiations have been relatively weak, its commitments under the Japan–Singapore EPA (JSEPA), signed in 2002, are substantial. Whereas Singapore's GATS commitments in transport services are limited to three sub-sectors, its commitments under JSEPA cover almost all sub-sectors, with the notable exception of air passenger transport.[8]

7. Thailand is sometimes chosen because the country has a strong desire to establish itself as the logistics hub or gateway of ASEAN. Theoretically speaking, the Philippines has a geographical advantage—it serves as Japan's gateway to ASEAN because of its location in the ASEAN region. For example, FedEx used Manila as a regional hub/gateway until 2009.
8. Singapore's current GATS commitments in transport include CPC7212 and CPC745 only.

Table 1: Transport Commitments under Japan's ASEAN Economic Partnership Agreements

Sectors or Sub-Sectors		JSEPA	JTEPA	JPEPA
A. Maritime Transport Services	a. Passenger transport (7211)	X	X	X
	b. Freight transport (7212)	X	X	X
	c. Rental of vessels with crew (7213)			
	d. Maintenance and repair of vessels (8868**)	X		X
	e. Pushing and towing services (7214)	X	X	X
	f. Supporting services for maritime transport (745**)	X	X	X
B. Internal Waterways Transport	a. Passenger transport (7221)	X		
	b. Freight transport (7222)	X		
	c. Rental of vessels with crew (7223)	X		
	d. Maintenance and repair of vessels (8868**)	X		
	e. Pushing and towing services (7224)	X		
	f. Supporting services for internal waterway transport (745**)	X		
C. Air Transport Services	a. Passenger transport (731)			
	b. Freight transport (732)			
	c. Rental of aircraft with crew (734)	X		
	d. Maintenance and repair of aircraft (8868**)	X	X	X
	e. Supporting services for air transport (746)	X	X	
D. Space Transport (733)		X		
E. Rail Transport Services	a. Passenger transport (7111)	X		X
	b. Freight transport (7112)	X		X
	c. Pushing and towing services (7113)	X		
	d. Maintenance and repair of rail transport equipment (8868**)	X	X	
	e. Supporting services for rail transport services (743)	X	X	X
F. Road Transport Services	a. Passenger transport (7121+7122)	X		X
	b. Freight transport (7123)	X	X	X
	c. Rental of commercial vehicles with operator (7124)	X	X	X
	d. Maintenance and repair of road transport equipment (6112+8867)	X		
	e. Supporting services for road transport services (744)	X		
G. Pipeline Transport	a. Transport of fuels (7131)	X		X
	b. Transport of other goods (7139)	X		X
C. Services auxiliary to all modes of transport	a. Cargo-handling services (741)			X
	b. Storage and warehouse services (742)	X	X	X
	c. Freight transport agency services (748)	X		X
	d. Other (749)			
I. Other Transport Services				

JPEPA = Japan-Philippines Economic Partnership Agreement, JSEPA = Japan-Singapore Economic Partnership Agreement, JTEPA = Japan-Thailand Economic Partnership Agreement.
** indicates that the service specified constitutes only a part of the total range of activities covered by the CPC concordance.
Source: Hamanaka (2011).

In contrast, Thailand's transport services commitments under the Japan–Thailand EPA (JTEPA) signed in 2007 are not at all comprehensive.[9] Its coverage is much more limited than Singapore's commitments under JSEPA. Thailand excludes critical sub-sectors for the logistics industry, such as freight transport agency services (CPC 748). Thailand's schedule in critical logistics and transport sectors usually maintains the 49% foreign equity cap restriction (e.g., maritime freight transport [CPC 212]) in line with its Foreign Business Act, and also includes several restrictions in Mode 3 (the form of commercial presence, nationality requirement). The only selling point of the JTEPA is that the Government of Thailand allows foreign majority ownership in logistics consulting services (part of CPC 86509), but the liberalization of this sub-sector alone does not address actual commercial needs.

The coverage of the Philippines' commitment under the Japan–Philippines EPA (JPEPA), on the other hand, is as broad as Singapore's, except regarding commitments in internal waterways transport, even though scheduling for the Philippines' transport sub-sectors are "standstill" commitments. However, the Philippines does have a 40% foreign equity cap restriction in many of its Mode 3 commitments.

3.3. Domestic Level Competitive Reforms

In addition to regional agreements (at the two levels), service policy reforms at the domestic level also play an important role in determining the rules of the game. Singapore has reformed its regulatory framework in the logistics sector and conducted a thorough liberalization of the sector.[10] Singapore has been attempting to attract international logistics suppliers to achieve its goal of being ASEAN's regional transport and logistics hub or gateway, and the country has allowed full foreign ownership in the primary logistics sub-sectors (freight transport agency services, and storage and warehouse services). Among ASEAN countries, apart from Singapore, only the Lao PDR and Cambodia allow full foreign ownership in the primary logistics sectors.

In contrast, the level of openness in the logistics sector of Thailand,

9. One of the few successes is that majority ownership via Japanese capital is allowed in the logistics sector, but the equity ceiling is pegged at 51%.
10. For a detailed analysis of Singapore's maritime industry, see Kind and Strandenes (2002).

for example, is not comparable with that of Singapore, despite the Government of Thailand claims that Thailand is ASEAN's logistics hub or gateway. Under the Foreign Business Act enforced in 2000, the Thai government restricts business operations of majority foreign-owned companies, which is applicable to most transport and logistics services. Moreover, Thailand's plan to open up its logistics sector to other ASEAN Framework Agreement on Service (AFAS) members simply follows the liberalization schedule under the AFAS logistics framework. Majority foreign ownership was only allowed in 2010. The foreign equity cap is due to be increased to 70% in 2013, and full foreign ownership will be permitted in 2015.

In the case of the Philippines, the government maintains a strict foreign equity cap on public utilities and services, including various transport services, as stated in the country's constitutional provisions. Specifically, foreign equity participation in public utilities in the Philippines should be no higher than 40%.

4. Hypothesis

4.1. The Idea of "Gateway"

It is important to distinguish two similar concepts: gateway and hub. The analogy of airline industry is helpful to understand the difference. Amsterdam is located in an ideal place to serve as a hub for intra-Europe passengers. This is because the city is geographically located at the center of Europe and traveling from one European city to another via Amsterdam is efficient in terms of distance. In contrast, Helsinki can be a good gateway from Asia to Europe. This is because the city is geographically located at the Northern or Eastern end of Europe and traveling from Asian cities to European cities via Helsinki is efficient in terms of distance.

The hub implies the center of intra-regional economic activities. In contrast, gateway emphasizes the fact that it connects the region with the outside world. The hub can be a gateway, but the two are not entirely the same. In general, the "gateway" country should mainly satisfy two conditions: (i) connect the region with the outside world; and (ii) integrate the economic activities in the region (because of the second function, a gateway tends to be a hub and vice versa). The gateway becomes important especially when the economic activities are liberalized within the region.

The gateway argument is highly applicable in the case of services, where substantial business operation ROO is employed. In the case of trade, it is widely said that, for example, "Mexico is a gateway to the North American Free Trade Agreement (NAFTA) market" (Jayalgi et al. 2010). However, for goods exported to Mexico from a third country to use an FTA, they should meet ROO requirements stipulated in the agreement, such as value added rules (certain portion of value should be added in Mexico so that the products are regarded as made in Mexico). In contrast, in the case of services, as far as a commercial presence established by a company from a third country has a substantial business in Mexico, such a presence is regarded as a Mexican firm. Then, the question is: which country can play the role of gateway? More specifically, which ASEAN country plays the role of gateway for ASEAN's integrated markets?

4.2. Hypothetical Conjecture: Implications of Game Changers to the Location of Gateway

The development of regional service and investment agreement has significant implications to service sectors at the regional level. Regional agreements that cover services is one of the critical factors to determine the gateway country for integrated service markets. The evolution of service business models at the regional level are distinct which is partly influenced by regional agreements. While manufacturing sectors in Asia started to integrate in the 1980s and 1990s when Japanese manufacturing corporations advanced into Southeast Asia, the integration of services sectors in Asia is facilitated by the Japanese services corporations that recently re-organized business in Asia.

On one hand, services trade and investment have been and will eventually be completely liberalized within the ASEAN region in the coming years for some sub-sectors. The scheme of integrating logistics services in ASEAN makes the ASEAN region an attractive services investment destination. In fact, ASEAN is fast becoming an attractive market for Japanese service companies (Hamanaka 2011). In addition, as we saw, ASEAN adopts relatively flexible ROOs for services sectors (i.e. substantial business operation rules). This means that one commercial presence in a region is sufficient to supply services in the entire region. For example, if a Japanese services company has one commercial presence in a gateway country, services can be provided in the entire ASEAN region using the base in the gateway country (because of substantial business

operation rules). In terms of the "gateway" theory, Japanese corporations can choose the best gateway country in ASEAN so that they can supply services in the entire region using the commercial presence in the gateway. In fact, such a concentration of service FDI into the gateway country seems to be evident already in some sectors (ibid). The question is how companies decide the location of commercial presence that can serve the entire region and how the actual business is conducted at the regional level.

On the other, services trade and investment between Japan and individual ASEAN countries are also liberalized under their respective bilateral EPAs, but to differing degrees. The recent proliferation of services agreements has drastically changed the restrictions and conditions on Japan's FDI in ASEAN. In comparing the three EPA partners of Japan in Southeast Asia, it is safe to consider that the EPA with Singapore gives the largest safeguard for the Japanese investment, which makes the country the most reasonable gateway country into ASEAN as far as transport/logistics sector is concerned. In addition, Singapore's regulations on logistics-related sectors are less restrictive than other ASEAN countries.

The hypothetical conjecture to be examined in this study drawn based on the implications of "game changers" discussed above is as follows:

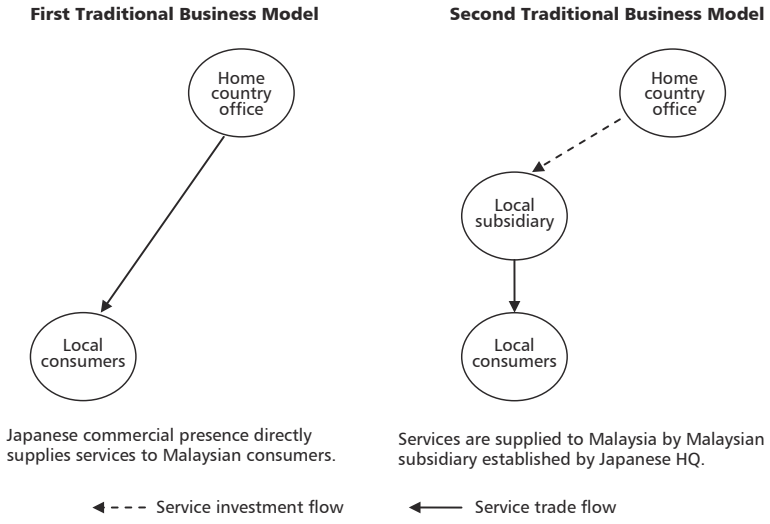
Given the integration of ASEAN services markets, Japanese corporations concentrate services FDI into a gateway country and use the commercial presence in the gateway country to supply services to the entire region of ASEAN.

4.3. Hypothetical Service Business Models

Should the hypothetical conjecture above be valid, what are the actual business models? It is first useful to review traditional business models for supplying services to foreign consumers (Figure 1). There are mainly two possibilities. First, services are supplied by the office in the home country to foreign consumers (the first traditional model in Figure 1). In this case, services move across international borders. This is so-called Mode 1 services trade transaction (cross-border transaction). The other popular way of supplying services to foreign consumers is to locally establish a commercial presence to supply services to consumer in the local market (the second traditional model in Figure 1). In this case, service suppliers move across the border (to establish a commercial presence). This is so-called Mode 3 of services trade (trade through a commercial presence).

The concerned countries in the old business models are limited to service supplier country and consumer country only.

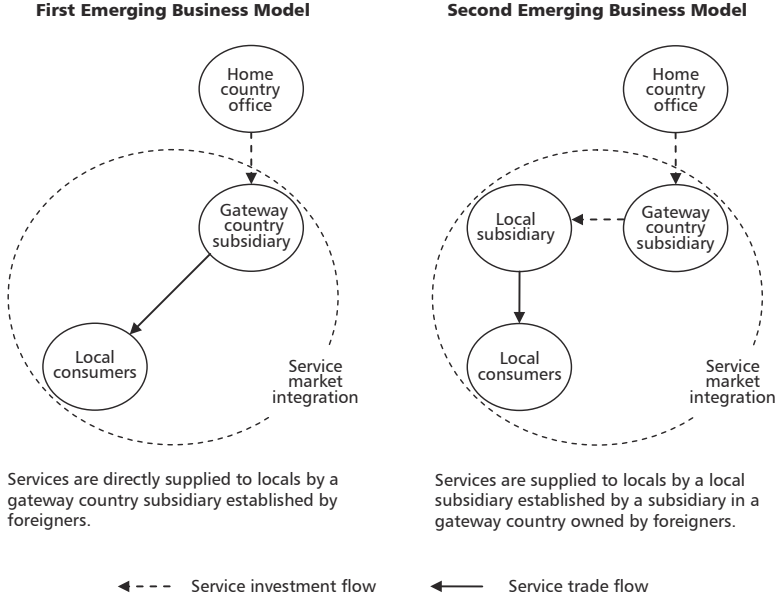
Figure 1: Traditional Services Business Models



Source: Author's illustration.

However, in the emerging new services business models, a third party country plays an important role. Again there are mainly two possible business models (Figure 2). First, home country office establishes a commercial presence in a gateway country, and such a commercial presence directly supplies services to consumers in other countries in the region (the first emerging model in Figure 2). In this case, two modes of services transactions are involved: Mode 3 (investment from home country to gateway country) and Mode 1 (trade from regional subsidiary to local market). Second, home country headquarter establishes regional subsidiary in a gateway country and it then establishes a local subsidiary that supplies services to local consumers (the second emerging model in Figure 2). In this case, there are two steps of Mode 3 transactions and domestic service transaction between local supplier and consumers.

Figure 2: Emerging Regional Services Business Models



Source: Author's illustration.

Emerging business models are not necessary innovative. Those models existed for a while. However, they become commercially feasible and meaningful because of the market integration at the regional level, such as that at the ASEAN level. The first emerging services business model can be meaningful only when there is a guarantee that international cross-border services supply by a gateway country subsidiary to local consumer in other countries in the region continue to be restriction free. Regional services integration agreement gives such an assurance. Likewise, the second emerging business model becomes more beneficial than the second traditional business model only when investment from a regional partner (a gateway country) is more protected and advantageously treated than the investment from home country. Note that because of substantial business operation rules, for example, a commercial presence in Singapore established by Japanese corporations are treated as Singaporean, not Japanese under the ASEAN services framework. Thus, Japanese corporations can "free-ride" on ASEAN services integration because its commercial presence in one ASEAN country is regarded as an "ASEAN firm", rather than a Japanese firm.

The distinction between the first and second emerging models is conceptual. In reality, the actual business model is a mixture of the two.

5. Methodology

5.1. Some Macrolevel Analysis

It is useful to see statistics to examine the services sector integration in Asia. First, some analysis of intraregional services trade flows would be useful. Here, the problem is that we do not have a good set of service trade data. Only a limited number of Asian countries publish service trade data by destination and it is not easy to examine the level of services trade integration in an accurate manner. While services trade statistics is limited, however, a recent study shows that regional bias of services trade in Asia is higher than that in goods trade, which is unique to Asia, unlike North America or Europe (Hamanaka 2013).

Second, given the limitation of services trade data, in order to know the progress of services sector integration in Asia, analyzing FDI data is useful. This is because, manufacturing FDI (for example, from Japan) has been the driving force of manufacturing sector integration in ASEAN as explained in Section 2. Thus, it is reasonable to consider that services FDI from Japan can be a driving force of services sector integration in Asia. In other words, just like Japanese manufacturing FDI into ASEAN led to production network in ASEAN, Japanese services FDI would lead to service value chain in ASEAN. Table 2 is a summary of FDI from Japan to ASEAN. It is very clear that services FDI is becoming more and more important, though FDI flows fluctuate. In 2004, the UNCTAD [United Nations Conference on Trade and Development] World Investment Report declared a "shift toward services" in FDI (UNCTAD 2004). Such a trend is also evident in ASEAN. It seems that the trend has been reinforced in the past decade. More than half of Japanese FDI into ASEAN is in non-manufacturing sectors, mainly service sectors.

Table 2: Japan's FDI in ASEAN
(JPY Billion)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total	558	809	917	652	659	771	1549	859	1003
Manufacturing	432	755	563	400	385	533	713	622	467
Non-manufacturing	26	54	354	252	273	238	836	236	535
- Services	30	35	234	175	257	209	808	224	522

ASEAN = Association of Southeast Asian Nations, FDI = foreign direct investment.
Note: The data in 2013 covers only the first half of the year (January–June 2013). Non-manufacturing sector includes three subsectors other than service (farming and forestry; fishery and marine products; mining).
Source: Author's compilation using Balance of Payment Statistics of Japan.

However, it is unclear if the high-level of intraregional service trade is caused by services sector integration in Asia, just like the past intraregional goods trade that was increased by manufacturing sector integration. Possibly, the high-level of intraregional service trade was achieved without integration of services sectors. Moreover, some may argue that services FDI targets domestic markets, and the increase in Japan's service FDI into ASEAN does not lead to the integration of services industries in ASEAN that triggers intraregional services trade, unlike the past Japan's manufacturing FDI into ASEAN that led to the integration of manufacturing industries in ASEAN that triggered intraregional goods trade.

Table 3 provides detailed country-by-country data on service FDI from Japan into ASEAN. It can be confirmed that services FDI is concentrating in Singapore.[11] Services FDI into Singapore not only targets domestic demands but also regional demands, as we will see in detail later.

11. Sector-by-sector analysis confirms that Japan's service FDI into ASEAN start to concentrate in Singapore, which also suggests the emerging new business model. See Hamanaka (2011).

Table 3: Japan's Service FDI in ASEAN
(JPY Billion)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
ASEAN Total	130	35	234	175	257	209	808	224	522
Singapore	-14	-13	113	36	189	107	207	244	150
Thailand	98	6	12	15	26	38	337	-253	22
Indonesia	19	17	33	29	19	14	128	73	150
Malaysia	22	8	23	31	14	32	46	58	28
Philippines	1	4	45	22	2	4	32	11	56

ASEAN = Association of Southeast Asian Nations, FDI = foreign direct investment.
Note: The data in 2013 covers only the first half of the year (January–June 2013). Negative figures mean a reduction in foreign asset.
Source: Author's compilation using Balance of Payment Statistics of Japan.

5.2. Methodology of Examining Services Sector Integration: Case Analysis

However, statistics do not tell us actual business models. In-depth company-level case studies seem to be an effective method to assess the services sector integration in Asia, and to identify concrete business models applied in their Southeast Asian operations. In particular, the manner in which Japanese and other countries' companies utilize their Singapore base to provide services to other ASEAN countries and whether Singapore, acting as a regional gateway, actually crowds out operations in other Southeast Asian countries, should be examined at the individual company-level.

Some may argue that case study approach is too descriptive and each case may not tell us the whole story because cases may not be representative. Note, however, that two decades before, a similar effort was made to identify the production network development. Ernst (1994, 6) wrote: "In order to understand changes in the international production networks, it is not sufficient to analyze just aggregate trade and investment data. Such an analysis needs to be complemented by a case-study approach".[12]

More is true for the analysis on recent development of services value chain because of the dearth of data. If the integration of service sectors

12. Corporate-level case study is still a useful method to understand the complex nature of production networks. For example, see Hiratsuka (2011).

is 20 years behind the evolution of production networks, what scholars studied 20 years before to identify production networks should be replicated to identify services sector integration nowadays.

6. Case Studies: Regionally-oriented Business Models of the Japanese Services Industries

This section provides case studies to depict the services sector integration in Asia driven by Japanese services FDI and emerging regional services business models. There have been many reported cases of Japanese companies that recently are employing more regionally-oriented business models. The typical case is the establishment of a Regional Operating Headquarters (ROH) in Singapore to cover the entire ASEAN region. In cases like this, a commercial presence in Singapore enables these companies to provide services, not only domestically in Singapore, but also in other ASEAN countries across borders. Below are illustrative examples of Japanese companies that largely operate their businesses in Asia via Singapore.

6.1. Regional Logistics Sector Business Model

Case 1: Nippon Express Co., Ltd.

Nippon Express Co., Ltd. is the largest Japanese total transportation company. Nippon Express's ROH for Asia and Oceania had been located in Hong Kong, China. However, in May 2010 it announced the company's decision to reorganize its structure in order to establish its ROH for South Asia and Oceania in Singapore, in addition to the ROH in Hong Kong, China that will cover the East Asia region (mainly the PRC). This is a response to the rapid increase in sales in Asia.[13] According to the press release of Nippon Express, while its overseas sales increased by 139% over the past decade, sales in the Asian region surged by 276% over the same period. Nippon Express explains that business needs in the PRC and ASEAN are different, and focusing on Southeast Asia by means of the ROH is necessary.[14]

13. See: http://www.nittsu.co.jp/press/2010/20100409-1.html
14. Since 2007, Nippon Express has also utilized Singapore as a logistics hub for transport between Japan and India. See: http://www.nittsu.co.jp/press/2008/20080121_1.htm

Nippon Express's institutional structure of ROH for the South Asian region and Oceania was strengthened by the establishment of a new regional body in Singapore in April 2012 that owns 18 subsidiaries in the region from nine countries. They are: Australia; India; Indonesia; Malaysia; New Zealand; the Philippines; Singapore; Thailand; and Viet Nam.[15]

It seems that there is a clear effect of using Singapore as a gateway for ASEAN on the quality of the company's services. In October 2013, the time required for Nippon Express's express delivery from Thailand to Indonesia was shortened by two days (it now requires only 1-3 days) by using the logistics base in Singapore. And its press release emphasizes that their services are particularly suitable to automobile industries that have production bases both in Thailand and Indonesia because the just-in-time (JIT) operation becomes possible thanks to their services. It says that delivery from all over the world to Indonesia will be handled at Singapore's high-speed logistics center.[16]

Case 2: Yamato Transport Co., Ltd.

Yamato Transport Co., Ltd. is the second-largest Japanese total transportation company. It also decided to establish an ROH for the ASEAN region in Singapore.[17] Singapore Yamato was transformed into Yamato Asia in November 2009. The plan was that Yamato Asia would develop an express parcel business, in particular "B to C" and "B to B" business in Singapore as well as in other ASEAN countries.

Yamato actually started to supply parcel business in Asia. In 2010, it started to offer Ta-Q-BIN services in Singapore.[18] Ta-Q-BIN provides same-day delivery and free re-delivery to anywhere in the country except no-go zones, 365 days a year. One telephone call is all it takes to have the driver come and pickup the parcel at the location that the user specifies. There is also a Real time Parcel Tracking System to manage the status of parcels during transportation.

15. See: http://www.nittsu.co.jp/press/2012/20120412-1.html
16. http://response.jp/article/2013/10/04/207858.html
17. See: http://www.yamato-hd.co.jp/news/h21/h21_59_01news.html
18. It also started Ta-Q-Bin in 2010 in Shanghai. In 2011, the same services became available in Hong Kong, China and Malaysia.

While the services were originally limited to domestic express delivery, Yamato recently started to offer Ta-Q-BIN services between Asia and Japan. For example, using this service, a certain company in Singapore started to import Japanese vegetables for the Japanese in Singapore. The parcel business has been expanding substantially due to a strong increase in mail-order purchases. Using the services it will offer, Yamato Transport expects that Japanese retailers specializing in the mail-order business will begin operations in Southeast Asia in the near future.

Furthermore, the company's long-term plan is to start express delivery services between Asian countries such as Singapore and the PRC, particularly Shanghai. In short expanding the network of Ta-Q-BIN from Japan to the entire Asia is the long-term goal of Yamato.[19] Singapore is expected to continue to be the gateway for Yamato's Ta-Q-BIN business in Asia. In particular, expanding the Ta-Q-BIN networks in other ASEAN countries is the immediate goal of Singapore base. The plan is to establish Ta-Q-BIN networks in ASEAN by 2019.

Yamato emphasizes that their services are very helpful for supply chain management ("B to B"), especially for SMEs. But at the same time, they also consider that the perspective of "demand" chain is equally important, especially in the case of "B to C". Purchase should be delivered to the consumer whenever convenient, after the mail-order purchases, and overall satisfaction of mail-order shopping largely depends on the quality of delivery that the logistics company supplies.[20]

Case 3: Kinokuniya Co., Ltd.

Kinokuniya is one of the largest book stores in Japan. Book sales in Japan continue to decline since 1996 and the sale of Kinokuniya in Japan also does not have a good future prospect. This is one of the reasons why Kinokuniya aggressively operates business abroad recently. It also has many book stores abroad, especially in Southeast Asia. For example, the Kinokuniya book store in Singapore is the largest book store in Singapore.[21] Unlike Japan, book sales in Asian countries continue to grow.

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19. http://www.yamato-hd.co.jp/investors/library/report/pdf/148/148_03.pdf
20. See: http://special.nikkeibp.co.jp/ts/article/aa0f/109427/page01_02.html
21. Kinokuniya also has ROH for the Asian region in Singapore, which has 18 stores in seven countries in Asia (Australia; Indonesia; Malaysia; Singapore; Taipei,China; Thailand; and the United Arab Emirates). The Singapore ROH has more than 1,000 staff from 27 countries.

Kinokuniya established a new company "Asian Basis", together with a Japanese software company INFOCITY.[22] Asian Basis is an e-commerce company that sells books in foreign languages, including Japanese, Japanese pop culture-related products and, in future, e-books as well. While the company is incorporated in Japan, its ROH will be in Singapore.[23] Target consumers are not limited to Singaporean and are throughout the entire ASEAN region.[24] Thus, Kinokuniya's e-commerce services are provided from Singapore to other ASEAN countries and perhaps purchases are delivered from Singapore. The company's plan is to gain the participation of various business partners in Japan and ASEAN in future such as logistics supplies and retailers in future.

6.2. Observations from Case Studies

Interesting observations can be drawn from the case studies above. First, the target of commercial presences in Singapore established by Japanese services corporations is not limited to the Singaporean markets. They attempt to supply services in the entire ASEAN region. This becomes possible partly because of the service market integration at the ASEAN level.

Second, relating to the above, Japanese corporations contribute to ASEAN services market integration. Intra ASEAN services (such as Bangkok–Jakarta logistics) are provided by Japanese corporations, which becomes possible partly because of the regional integration agreement at the ASEAN level. A commercial presence in one ASEAN country established by foreign companies (including Japanese companies) is regarded as a regional company in the ASEAN context, which means that such commercial presences are treated favorably.

Third, while services are sometimes directly provided from Singapore to other ASEAN consumers, a commercial presence may be established in other ASEAN countries by the Singaporean subsidiaries of Japanese corporations. Rather than the Japanese corporation directly investing

22. Innovation Network Corporation of Japan also invests to Asian Basis through a third-party share allotment.
23. See: http://www.kinokuniya.co.jp/contents/pc/20130822204915.html
24. See: http://www.incj.co.jp/PDF/1375836761.en.pdf

in other ASEAN countries, its Singaporean subsidiary invests in other ASEAN countries. Investment via Singapore seems better because the investor of such investment is regarded as Singaporean in terms of regional services agreement (such as ASEAN Framework Agreement on Service), provided that the Singaporean base has some substantial business operation in Singapore.

7. Conclusion

Services sectors in Asia are undergoing a great transformation. Some services sectors in ASEAN will be fully integrated in the near future, such as logistics sectors. Meanwhile, there is no strict rule of origin in the field of services. Thus, as far as substantial business operates, a commercial presence established by foreign companies is usually regarded as domestic supplies. Foreign companies may establish only one commercial presence in a gateway country and supply the services in the entire region using it.

Japanese service corporations' activities in ASEAN follow such a new trend. Japanese service corporations recently concentrated its FDI into Singapore and attempt to supply services to the entire ASEAN region using the commercial presence in Singapore. The target of commercial presences in Singapore established by Japanese service corporations is not limited to the Singaporean markets and they attempt to supply services in the entire ASEAN region. Japanese corporations contribute to ASEAN services market integration. Intra-ASEAN services are provided by Japanese corporations, which becomes feasible partly because of the regional integration agreement at the ASEAN level.

This is very similar to what we observed in the past in the manufacturing sectors. Manufacturing sectors in ASEAN started to integrate in the 1980s and 1990s partly because of the production networks established by Japanese manufacturing companies. It seems that Japanese services sectors are playing some role in the integration of services sectors in ASEAN. However, there are two important differences. First, Japanese manufacturing sectors advanced to ASEAN in the past in order to maintain the cost competitiveness after the Plaza accord, which triggered the appreciation of the Japanese yen. In the case of services, the principal reason why Japanese service corporations advance to Southeast Asia is the shrinking domestic market in Japan. Second, while the establishment of production networks in the 1980s and 1990s happened without regional

agreements, services agreement seems to play some positive role in the activities of Japanese corporations in Southeast Asia. This is because services industries are regulated and regional agreements are helpful for deregulation and the lock-in of reforms. In summary, because of the regional agreement at ASEAN and ASEAN-Japan level, new regional services business models are emerging.

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Part Ⅲ

Source of Germany's Competitiveness in Manufacturing

Chapter 7

What has been Maintaining Germany's Competitiveness in Manufacturing?

Federico Foders
Kiel Institute for the World Economy

Manuel Molina Vogelsang
Fraunhofer Gesellschaft

Abstract

The German economy has been outperforming other member countries of the European Union during the recent Great Recession and the still ongoing European debt crisis and in spite of the strong incentives for outsourcing or offshoring manufacturing activity existing in the world economy. What are the determinants of this surprising outcome? This chapter sets out to empirically analyze the trade and technology specialization and the price or cost performance of the German economy over the past decades. Drawing on standard indicators of trade and technological specialization (Revealed Comparative Advantage, Relative Export Advantage, Revealed Patent Advantage, Revealed Scientific Literature Index) and of the country's price or cost position (real effective exchange rate, unit labor cost, labor productivity), complemented with data on R&D expenditures and personnel, we identify the leading product groups in which German industry is specialized. Furthermore, we apply the unit value approach to determine whether the competitiveness of German manufacturing products is related to price or quality advantage. Also, we estimate the degree of vertical specialization characterizing the German export sector in order to determine the role global value chains play in strengthening Germany's competitiveness in manufacturing. All indicators presented are calculated for the People's Republic of China, Germany, Japan, the Republic of Korea, and the United States for the period 1990–2011. Our results confirm the work of other authors concerning the strong specialization of Germany in medium-range technology products. In contrast to most other studies we conclude that (i) quality is the main driver of German international competitiveness in selected product groups, (ii) the evolution of price and cost indicators determines competitiveness in other product groups and (iii) R&D efforts have contributed to develop and maintain German competitiveness in knowledge-intensive manufactured products. Finally, the chapter briefly discusses issues in public policy, particularly R&D activity and human capital accumulation, in the light of the empirical findings and taking into account major future challenges to manufacturing faced by the world economy.

Keywords: global value chains; trade and technological specialization.
JEL Classification: F14, F23, O3.

1. Introduction

According to standard macroeconomic indicators the German economy has been outperforming other member countries of the European Union during the recent Great Recession and the still ongoing European financial crisis.[1] The temptation to give a simple answer (i.e. good policy) to the question in the title of this chapter is strong, very strong indeed. Instead of succumbing to this temptation, we enquire into the determinants of this outcome and hope to find a somewhat more sophisticated answer. There are good reasons for doing so. First, the link between 'good policy' and competitiveness has been forcefully challenged in the literature. At the end of a piece on competitiveness, Krugman (1994, p.44) concludes that "competitiveness is a meaningless word when applied to national economies". Furthermore, he also qualifies the use of the word as an 'obsession' which is "both wrong and dangerous" (Krugman 1994, p.44) and argues convincingly that "the idea that a country's economic fortunes are largely determined by its success on world markets" (Krugman 1994, p.30) is just a hypothesis that does not necessarily need to be true. Second, even if nations should in fact compete with each other in the world economy, like firms do in the market, the measurement of competitiveness is not at all a straightforward matter and there is a need to assess a number of indicators for several countries before we can attempt to explain the existence of an advantage or disadvantage of a country compared with other countries in selected traded goods or value chains.[2] Third, while it remains to be seen whether the performance measured by an indicator relates directly to a policy, indicators may contribute to draw a picture of a country's economic outlook and help understand its position in the world economy. We therefore define competitiveness as a country's capacity to develop conditions that generate a sustainable level of prosperity. This definition is based on a broad set of indicators each of which

1. See the recent assessments of the German economy by the International Monetary Fund (IMF 2013) and the Organization for Economic Cooperation and Development (OECD 2012).
2. The early discussion of this topic addressed mainly prices and costs (Neary 2006), whereas recent approaches (Bayoumi, Saito and Turunen 2013; Huemer, Scheubel and Walch 2013; Sala-i-Martin 2010) include, among others, a long list of variables, such as institutions, infrastructure, labor, capital and goods markets, etc. While in most cases reference is made to an overall productivity measure to which all variables are assumed to contribute in some way or another, the transmission mechanism between the variables and the single measure is not generally thoroughly studied.

represents properties of a country that are not always within the reach of the instruments of economic policy. Moreover, our analyses focus on the manufacturing sector and we are particularly interested in trade and technology. We therefore do not adhere to definitions of competitiveness related to single measures like per capita income or measures of productivity such as the concept of 'foundational competitiveness' (Delgado, Ketels, Porter, Stern 2013). Although single measures might have their merits in a particular context, we prefer to follow the approach chosen by the authors of a recent book on competitiveness edited by De Grauwe (2010). One of the authors in particular, Sala-i-Martin (2010), gives an overview of the different pillars on which competitiveness can be assumed to rest. Also, we would like to mention the European Commission's approach as deployed in its European Competitiveness Report (2013) which assesses the competitiveness of all member countries of the European Union.

The remaining part of the chapter is organized as follows: the relevant literature is reviewed in section 2, our data, methodology and research strategy are presented in section 3 and our final results are discussed in section 4.

2. Literature Review

Economic studies on Germany's international competitiveness are extremely rare, even in Germany. This may be attributed to the fact that the interest in issues in competitiveness is greatest in policy and corporate circles; economists have only recently engaged in research on the competitiveness of countries as opposed to comparative advantage in trade or technology or the competitiveness of firms. In the book by De Grauwe (2010), several multi-country studies can be found—one of them attempting to explain the productivity gap existing between the United States (US) and Europe (Cotis, de Serres and Duval 2010). The latter concludes that heavily regulated labor markets in Europe constitute an important barrier for European countries to unleash their full economic potential and catch up with the US. Another paper in the book deals with price competitiveness among European Monetary Union countries (Fischer 2010) and tracks the German inflation rate in order to explain the level of price and cost competitiveness achieved by this country over the past decades. The German Federal Ministry of Economics and Technology (2010) published one of the few country reports on the competitiveness of

German manufacturing industry. It describes the most successful products belonging to the medium-range of technology and addresses some of the global trends expected to have a bearing on the future of the German manufacturing industry. The only German academic study known to us is the one by Gehrke and Krawczyk (2012) who have been monitoring technological developments in Germany and trade in research-intensive products for many years. This study uses several methods and excellent data on R&D in Germany. It concludes that medium-range technology products are largely competitive in the world economy on the basis of their quality. The latter is related to strong R&D activity, to intellectual property rights (patents and industrial design) and to an economy well-endowed with researchers and private and public research institutions. Moreover, the vertical specialization of Germany has also been studied, albeit generally on a firm level (Godart and Görg 2011). These authors find that foreign affiliates of German companies locate mainly within the European Union and that only a relatively small number of them are present in Eastern Europe. They conclude that "increased outsourcing of goods and services permit firms to achieve gains in production efficiency and competitiveness" (Godart and Görg 2011, p.362).

3. Data, Methodology and Research Strategy

As we devote special attention to the evolution of Germany's competitiveness in manufacturing compared with other major economies, in this section, we briefly present our data sources and the methodology used. Before touching upon these issues, we refer to our research strategy. In order to study the determinants of German competitiveness, we first estimate the country's specialization in the product groups defined in Table 1. After calculating several specialization indices (trade and patents), we identify the major product groups that seem to dominate the German trade and technological position in the period under study. As a second step, we ask whether this specialization is due to quality or price and calculate the corresponding revealed elasticities. Third step, we estimate the degree of vertical specialization associated with the leading German product groups. We then looked at the basic indicators of the German innovation system as compared with those of its competitors. Finally, we discuss relevant issues in public policy related to our results for Germany and other countries.

Table 1: Technological Classification of Trade Data at a Glance

Classification	Product examples	SITC codes	Share
1. Primary products	Fruits, meat, rice, cocoa, tea, coffee, wood, crude petroleum, natural gas	52	19.9%
2. Resource-based manufactures	Processed meats and fruits,	68	26.1%
Agro-based products	beverages, wood products, vegetable oils	37	14.2%
Other resource-based products	Petroleum and rubber products, ore concentrates, cement, glass	31	11.9%
3. Low-technology manufactures	Textile fabrics, clothing, headgear,	47	18.0%
Textile and footwear	footwear, leather	20	7.7%
Other low-technology products	Pottery, furniture, jewellery, toys, consumer goods, plastic products	27	10.3%
4. Medium-technology manufactures	Passenger vehicles, commercial	71	27.2%
Automotive	vehicles, motorcycles and parts	5	1.9%
Engineering	Engines, motors, industrial machinery, pumps, switchgear, ships, watches	37	14.2%
Process industries	Synthetic fibres, chemicals and paints, fertilisers, plastics, iron, pipes and tubes	29	11.1%
5. High-technology manufactures	Office, data and	19	7.3%
Electronics and electrical	telecommunication equipment, televisions, transistors, turbines	10	3.8%
Other high-technology products	Aerospace, pharmaceuticals, optical and measurement instruments, cameras	9	3.4%
6. Others	Electricity, cinema film, printed matter, gold, art	4	1.5%
		261	100%

Source: Own elaboration with data from UN COMTRADE.

Trade data used in this chapter refers to current US dollar merchandise exports and imports classified into the Standard International Trade Classification revision 3 (SITC) at the three-digit level for the period from 1990 to 2011.[3] We prefer Revision 3 to Revision 2, which goes further back in time, because it is more detailed and because it facilitates the matching of

3. More recent data is not available. With respect to 2012 data, 14.1% is still missing (29 July 2013).

Table 2: Sector Classification Regarding R&D Intensities

Classification	Industries
Low R&D intensity with R&D expenditure less than 1% of net sales	Oil and gas producers, industrial metals, construction and materials, food and drug retailers, transportation, mining, tobacco, multi-utilities
Medium-low R&D intensity with R&D expenditure between 1% and 2% of net sales	Food producers, beverages, travel and leisure, media, oil equipment, electricity, fixed line telecommunications
Medium-high R&D intensity with R&D expenditure between 2% and 5% of net sales	Electronics and electrical equipment, automobiles and parts, aerospace and defence, industrial engineering and machineries, chemicals, personal goods, household goods, general industrials, support services
High R&D intensity with R&D expenditure above 5% of net sales	Pharmaceuticals and biotechnology, health care equipment and services, technology hardware and equipment, software and computer services

Source: Own elaboration based on EU Industrial R&D Scoreboard (2013).

trade and patent data. Trade data is structured into nine sections, 68 groups and 261 subgroups and is obtained from the United Nations Commodity Trade Statistics database (UN Comtrade) that covers up to 99% of world merchandise trade. With respect to missing values, we note that figures for the People's Republic of China (PRC) in 1990 and 1991 as well as for Germany in 1990 are missing, as also is some data at the three-digit level for the countries studied. This well as applies to product code 562 (fertilizers) reported by the US for the period 2000–2007. We classify trade data into 15 technology groups, including six main groups and nine subgroups as shown in Table 1. The grouping follows the approach suggested by Lall (2000b) which is based on Pavitt (1984) and Hatzichronoglou (1996).[4] It uses R&D intensity of industrial sectors as an indicator (instead of technological complexity) in order to group products into one of the low, medium and high technology categories. Since the original approach draws on SITC revision 2, we extend the classification by introducing new product codes included in SITC revision 3. Unfortunately, we face the problem that productive activities at different stages of technological complexity were classified into the same product category (Lall, 2000b, p. 340). For example, pharmaceuticals (SITC code 541) include innovative drug developments

4. For a more comprehensive classification distinguishing between cutting-edge, high and research-intensive industries, see Gehrke, Frietsch, Neuhaeusler, Rammer and Leidmann (2013).

as well as generic drugs with an impact identical or equivalent to that of innovative drugs. It is also difficult to establish differences in quality within the product categories.

This notwithstanding, the classification into product groups differing in their technological content applied in this chapter provides useful insights into the technological dimension of international trade patterns. We complement these analyses by resorting to industrial R&D expenditures provided by the European Commission (EC 2013). The dataset is based on financial data of 1,500 research-intensive firms and consists of 405 EU-based and 1,095 foreign-based firms, which acount for around 90% of global business expenditures on R&D. The proposed grouping by the EC (2013) into high, medium-high, medium-low and low R&D intensity according to R&D intensity at the sectoral level is compatible with our technological classification of products as shown in tables 1 and 2. Available trade data is generally biased by tariff and non-tariff barriers to trade, which makes measurement of a country's specialization pattern difficult. We therefore draw on Balassa (1965) who proposed to measure the revealed comparative advantage (RCA) of countries on the basis of observed trade data. Vollrath (1991) suggested to adjust Balassa's RCA index in order to obtain a symmetrical range of values. We follow him and apply his version of the above-mentioned indices and calculate them for exports, imports, patents and scientific publications.[5] The bibliographic databases Scopus and the Web of Science (WoS) differ significantly. Since Scopus covers a significant share of articles exclusively, the number of scientific publications such as articles and conference proceedings exceed that of WoS. The divergence is mainly due to the wider coverage of engineering and to its comprehensive coverage of publications of the PRC. Therefore, data for scientific publications for the period from 1996 to 2011 was obtained from SCImago Journal & Country Rank based on data provided by the Scopus database.[6] Since Greenaway and Milner (1993) argue that the outlined specialization approach for trade data is biased by the omission of domestic demand, especially when country size matters, we also calculate the RCA index dividing domestic and world export ratios by domestic and world import ratios. In doing so, we acknowledge that domestic firms compete on both global and domestic markets.

5. For the indices, an excellent overview of the literature on measuring international specialization is provided by Iapadre (2001).
6. Accessible under http://www.scimagojr.com/

In order to compare the specialization patterns of the countries under study, we normalize the specialization indices in the range between +100 and –100 by making use of the hyperbolic tangent and multiplying by 100. Positive values point to a specialization in the analyzed technology group compared with the world economy, negative values indicate that the country is specializing in other technology groups. In addition, we assume that values of the relative export advantage (RXA), the RCA and revealed patent advantage (RPA) indices between –100 and –60 indicate an absence of specialization, whereas values between –60 and –20 indicate a weak specialization. On the other hand, values between –20 and +20 indicate an average specialization, values between +20 and +60 an above average specialization and finally values between +60 and +100 a strong specialization.

Furthermore, we classify the trade data into intermediate and final (capital and consumption) goods based on Broad Economic Categories (BEC) and using a concordance table provided by the UN (2003). The BEC are divided into nine parts, 14 groups and eight subgroups. It must be noted that the concordance table does not provide a classification for BEC 321 (motor spirit), 51 (passenger motor cars) and 7 (goods not elsewhere specified). Rather, the classification is left to the user's discretion. We classify BEC 321 and BEC 51 as consumption goods. By matching the SITC with the BEC codes we obtain 454 SITC-BEC matches. In a second step we drop all duplicates, all SITC matches with BEC 7 and the match of SITC 001 (live animals) with BEC 41 (capital goods), leaving a total of 363 SITC-BEC matches. Our concordance approach provides matches for 258 or 99% of the 261 SITC codes. The remaining 363 SITC-BEC matches define three groups. The first group provides a concordance for 173 or 66% of all SITC codes. Since the second group includes 65 or 25% of all SITC codes that were matched with both intermediate and final (either capital or consumption) goods, we assign 1/2 of the corresponding values to each category. Finally we assign 1/3 of the corresponding values to each category for 20 or 8% of all SITC codes that were matched with intermediate and final (capital and consumption) goods.

In order to measure the domestic value added embodied in export manufactures, we estimate the degree of vertical specialization (VS) following the approach of Hummels, Ishii, and Yi (2001). We define VS as the share of imported intermediate input content, namely foreign value added, in final good (consumption or capital) exports. First, we measure

the import content of a country's exports by calculating the ratio of imported intermediate inputs to gross value added, multiplied by exports. Second, we divide the ratio obtained in the first step by total exports, yielding the share of VS in total exports. Data for gross value added at current US dollar are drawn from the World Development Indicators provided by the World Bank. If a country uses no intermediate goods to produce and export goods, then VS equals zero. Basically, if the country only uses intermediate products to produce and export goods, and the whole gross value added is exported, then VS amounts to total exports. This measure does not indicate anything about the imported intermediates embodied in final goods sold within the country itself. Furthermore, the VS approach based on trade data is biased, as it happens with virtually all classifications, by the grouping process itself. As mentioned before, some products do not fit uniquely into one of the BEC. Nevertheless, while 66% of our SITC codes fit into specific product categories, our approach provides a first estimation of domestic value added within the technological groups. In order to enhance the measurement of VS, Hummels et al. (2001, p. 80) suggest to use input-output tables provided, for example, by the OECD Database for Structural Analysis instead of trade data. We use only trade data that cover the whole period under study, something input-output tables cannot provide. In order to analyze the geographic origin of the import content embedded in a country's exports, we use the geographic classification of the United Nations Conference on Trade and Development (UNCTAD).

In line with the empirical literature (Aiginger 1997), we measure the Unit Value (UV) for the defined technology groups to determine the nature of competition. A UV is defined as the ratio of the value of a good in current US dollar to its net weight in kilograms rather than in supplementary units. Although supplementary units are more accurate than net weights for some products, it is difficult to deal with changes in quantity units. Also, net weights are available for longer time periods than supplementary units. To determine the nature of competition, we define three groups (i) price competition, (ii) quality competition and (iii) nature of competition is ambiguous. Price competition takes place if the UV of exports is lower than the UV of imports and the amount of imports exceeds that of exports. Since consumers are not willing to pay higher prices for domestic goods than for similar goods imported, they choose to import the cheaper goods from abroad. Quality competition can be detected if the UV of exports exceeds the UV of imports and the amount of exports exceeds

that of imports. Unfortunately, theoretical predictions do not always fit the real world outcomes. Based on the information available, we are in a position to clearly define the nature of competition for 531 out of 1,177 cases (i.e. 45.1%) and we assume that the nature of competition in the remaining cases is ambiguous.

As shown by Frietsch and Schmoch (2010, pp. 186-187), international comparisons of patenting activity on the basis of national patent applications are highly home-biased, since domestic firms normally tend to have a strong interest in their home market. In addition, the application process at the domestic patent office is less costly, since applicants face lower admission costs and are more familiar with the administrative and legal procedures. We use international instead of domestic patent applications to avoid such a bias. To capture the international dimension of technology markets, Gerstenberger (1992) proposed to count all patent applications in at least two countries in order to achieve comparability. Since Germany, Japan and the US (hereafter referred to as the 'Triadic') achieved more than 26% of world medium and high-technology exports in 1991, Dernis and Khan (2004) proposed to compile a synthetic patent indicator that represents patent applications in the most important patent offices, namely the US Patent and Trademark Office (USPTO), the European Patent Office (EPO) and the Japan Patent Office (JPO). But since then, the world has changed. With the emergence of the newly-industrialized countries, the share of medium and high-technology exports of the Triadic fell to around 14% (2011). In 1987 the World Intellectual Property Organization (WIPO) introduced an international patent application process via the Patent Co-operation Treaty (PCT). Since applications filed under the PCT allow for the protection of inventions in each of its contracting states, they constitute a valuable indicator of technological developments of global relevance.[7] Therefore, we base our analysis of patent applications on those filed under PCT by the inventor's country of residence and priority date for the period from 1990 to 2010.[8] Patent data is obtained from the 8th edition of the International Patent Classification (IPC) at a four-digit level from the OECD Patent Statistics database. According to the IPC, the patent data is grouped into eight sections, 129 classes and 648 subclasses. While the original classification

7. The PCT allows for patent protection in 148 member countries as of 12 July 2013.
8. Unfortunately, more recent data is not yet available.

encompasses 664 subclasses, the database does not report values for 16 subclasses. Furthermore, we also analyze the data on total applications of utility models and industrial designs provided by the WIPO Intellectual Property Statistics Data Center. The data refers to applications for utility models and industrial design filed abroad by the applicant's country of origin.

In order to group the patent data into the same technology groups as the trade data, we use a concordance table developed by Lybbert and Zolas (2012), which assigns 256 out of 261 SITC codes to 564 out of 664 IPC codes. Compared to the approach of Schmoch, Laville, Patel, and Frietsch (2003), they use a methodology that "relies on data mining the patent abstracts and titles included in the PATSTAT database using keywords from the industry classification descriptions" (Lybbert and Zolas, 2012, p. 8). As a first step, we classify the 5455 SITC-PC matches into the 15 technology groups. Then we merge the patent data by all pair-wise combinations within the IPC codes. As the concordance table includes a weight that is constructed as a probability distribution so that the SITC code is matched with the IPC code, we weigh the patent applications with the provided weights and then calculate the totals of each technology group. Since each patent class, as well as each subclass, is usually embedded in a different production process and therefore in a different product, the totals by technology groups tend to exceed the totals of the original dataset.

For the purpose of analyzing the dynamics of technological performance, we developed a technological specialization matrix that combines the export and patent specialization in the 15 technological product groups. On the horizontal axis we plot the export specialization measured by the countries' RXA in the period 1990–2011, on the vertical axis we plot the technological specialization measured by the countries' RPA over the same time period. For each country the technological specialization matrix can be divided into four fields: the first quadrant shows technology groups with both export and patent specialization. Technology groups in the first quadrant indicate a strong specialization in comparison to the world average. Since firms are in a position to at least partly and temporarily exclude competitors from imitating innovative technologies by applying for national and international patents and thus securing a temporary protection of their monopoly, export specialization and patent specialization of countries constitute a possible outcome of

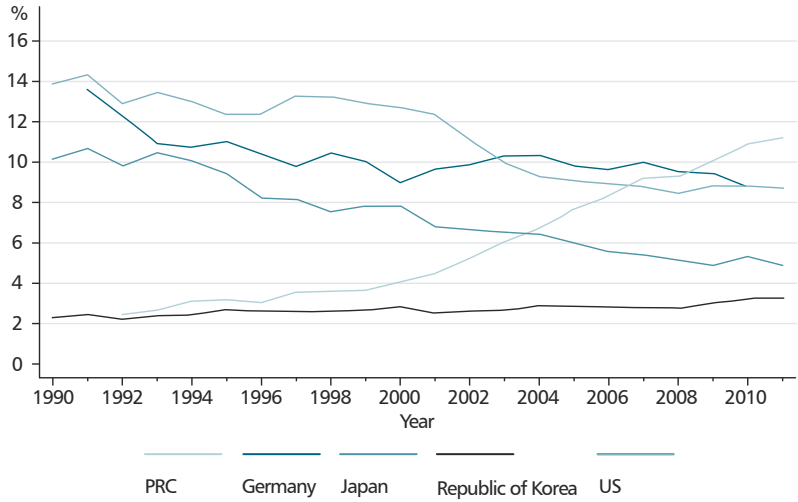
this process. By the same token, the first quadrant represents a country's technological strength. The second quadrant includes technology groups that show only a patent specialization and no trade specialization. Since the analysis is based on aggregated product codes, it is possible that exports of niche-products, with significant patent specialization, do not achieve the significance needed to determine the overall pattern of the group itself. We interpret this outcome in two ways: on the one hand, the country has not been able to transform the potential associated with patent specialization into export specialization. On the other, the patent specialization might have been maintained while the corresponding export specialization has been declining. We also look at the evolution over time in order to determine the direction of the specialization. In the third quadrant we see technology groups with neither export nor technological specialization, indicating that the country does not specialize at all in the product groups under consideration. We interpret the technology groups in this quadrant to represent a country's technological weakness. Finally, the fourth quadrant includes technology groups with export but no patent specialization. Export specialization can be interpreted in this case as reflecting trade that results from multinational companies taking advantage of global value chains. The analysis of export and patent specialization is complemented in this chapter by directly estimating the degree of vertical specialization using trade flows (Boileau and Sydor 2011) in an attempt to determine the technological sophistication of manufactured exports in the sense suggested by Lall et al. (2006).

4. Results

In our analysis of the determinants of Germany's competitiveness in manufactured products, trade plays a key role. We therefore present our results by giving first an overview of the position of Germany, the Republic of Korea, the US, Japan and the PRC in world trade. In recent decades, the distribution of export and import shares underwent dramatic shifts. While on average, almost 30% of manufactured exports in the period 1990–2011 can be attributed to the Triadic, this share has been declining fast: Germany's share stagnates at around 10%, the US's share dropped to 8.4% in 2008 and recovered only slightly after that and Japan's share reached 4.8% in 2011. By contrast, the Republic of Korea's share expanded from 2.3% in 1990 to 3.3% in 2011 and the PRC's share rose from 2.5% (1992) to around 11% in 2011 and thus accounts for the largest contribution in the sample (Figure 1).

The technological composition of world trade has also changed. The share of world primary and resource-based exports fell significantly from

Figure 1: World Export Shares

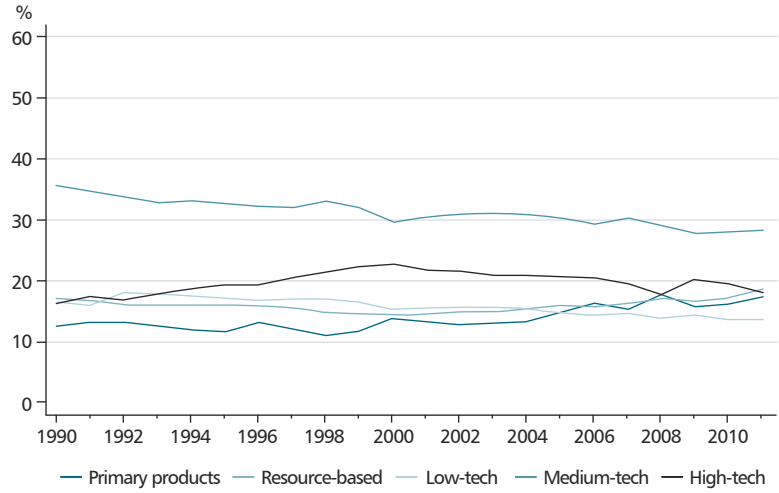


PRC = People's Republic of China, US = United States.
Source: Data from UN Comtrade.

about 43% in 1985 to around 26% in 1998 and increased again to 36% in 2011, reflecting strong Asian demand, particularly in the People's Republic of China and India (Figure 2). The share of low-technology products (LT) in world exports, however, remains stable at around 14%. Surprisingly, the share of medium-technology manufactures (MT) in world exports, perhaps the backbone of industrial production in the advanced countries, declined somewhat from 30% in 1985 to 28% in 2011. The latter's performance is associated with automotive and engineering products, while products from the process industries, important intermediate inputs for other production processes, experienced only a marginal change. The share of high-technology products (HT) in world exports continuously expanded from 12% in 1985 to 20% on average between 1998 and 2011. In our country sample, in the 1990s the US and the PRC were the most important exporters of resource-intensive products. In the case of the US, primary products (PP) and resource-based (RB) products represented some 22.9% of total exports, with the share of RB increasing from 14.6% to 20.3%. Agro-based exports fell from 7.5% to 5.8%, while other resource-based

manufactures grew from 7.1% to 14.5%. The PRC seems to have switched from exporting natural resources to higher value added products. Its combined share of PP and RB in total exports fell from 25.4% in 1992 to 12% in 2011. PP and RB represented on average 16.6% of German exports to the world economy; in the case of the Republic of Korea, the combined share increased from 10.2% in 1990 to 19% in 2011. The Japanese PP and RB export share expanded from 7% in 1990 to 11.8% in 2011.

Figure 2: Export Portfolio of the World
(Relative Share of Total Exports)

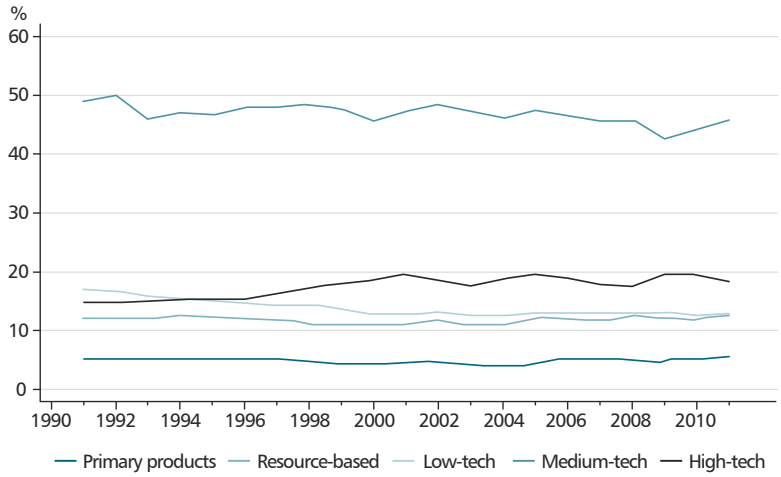


Source: Data from UN Comtrade.

Low-technology products (LT) are mainly produced by low-skilled labor in labor-intensive industries producing mostly differentiated products by applying mature, widely diffused technologies. According to the European Commission (EC, 2013, p. 52), the LT sector's R&D intensity amounts to 1–5% of net sales. The share of LT in total exports of the US and Japan remain more or less stable at around 9–10%. In contrast, the PRC, Germany, and the Republic of Korea have been reducing their LT exports in favor of technologically more complex goods. MT can be subdivided into automotive, engineering, and process industries. The production of automotive and engineering products often requires close cooperation with supplier networks in which innovative small and medium-sized enterprises

(SMEs) play a significant role. In addition, product development and design are also important. The car industry is a good example of an industry in which firms successfully outsource their assembly tasks in order to benefit from lower wages in other countries. In contrast, the process industries tend to produce mature and undifferentiated products in large-scale production facilities based on considerable R&D effort (Lall, 2000b, p. 342). While the share of MT exports has remained stable in the case of Germany; the US, Japan, the Republic of Korea and the PRC have been increasing their shares. Germany faced a slight reduction from 49% in 1991 to 45.7% in 2011, and with approximately 5% of world exports it currently is the major exporter of MT products (Figure 3). Whereas the share of automotive products remains constant at 15%, engineering dropped from 23% in 1991 to 20.9% in 2011; products from the process industries fell from 10.8% to 8.9%. The US has managed to maintain a share of 33.8% over time. MT products are the backbone of Japan's exports accounting on average for 53.1% of total exports. The Republic of Korea has increased its share of MT exports from 28.9% in 1990 to 43.6% in 2011. Significant increases were observed in the case of automotive (from 3.4% to 12%) and engineering products (from 15% to 22.2%). In the PRC, the share of MT exports rose from 15.3% in 1992 to 24.5% in 2011.

Figure 3: Export Portfolio of Germany
(Relative Share of Total Exports)



Source: Data from UN Comtrade.

Finally, we turn to the smallest but most dynamic group of high-technology products (HT), including office, data and telecommunication equipment, televisions, pharmaceuticals and aircraft. HT products are based on advanced and fast-upgrading technologies, which require substantial investments in R&D and skill acquisition along with a technically sophisticated infrastructure and highly specialized researchers and engineers. According to the EC (EC, 2013, p. 52), the HT sector's R&D intensity exceeds 5% of net sales. Special attention is devoted to product development and design, commonly in close cooperation with universities and R&D organizations. Since the assembly of some electronics and electrical products like televisions or cell phones occurs in technically unsophisticated, labor-intensive production processes, this activity is organized as a global value chain. As in the case of the other high-technology products, product development and design is still concentrated in advanced countries endowed with advanced levels of technology, a workforce mastering technical skills and technically sophisticated supplier networks. Therefore, comparative advantage in product development and design is largely determined by technological capabilities, whereas competitive advantage in final assembly is ruled by wage differentials (Lall, 2000b, p. 343).

Among the countries analyzed, Germany is the country that on average shows the lowest share of HT exports. Nevertheless, the share of HT products increased from 15% in 1991 to 18.4% in 2011. While in 1990, the US, Japan and the Republic of Korea showed the highest share of HT exports; in 2011 the highest shares of HT exports were registered in the Republic of Korea and the PRC. The US share of HT exports amounted to 30% in the period between 1990 and 2004 and fell to 18.2% in 2011. Japan managed to increase its share of HT exports from 27% in 1990 to 31.2% in 2000 and experienced a reduction to 18.9% in 2011. The Republic of Korea's share went up from 20.7% to 26.5% and stabilized at 30%. Between 1992 and 2011 the PRC's share of HT exports increased from 8.8% to 32.8%; interestingly, the share of electronic and electrical products increased from a low 5.4% to 27.1%.

Turning now to R&D expenditures, scientific publications and patent applications, it can be seen that the US and Japan are by far the largest R&D spenders (Table 3). While in 1996 both countries accounted for more than 80% of world expenditures for R&D, their shares fell to some 66% in 2010. Whereas Germany slightly reduced its share, the Republic

Table 3: Expenditures on R&D, 1996–2010

	1996	1998	2000	2002	2004	2006	2008	2010
Germany's share in world R&D	**8.6**	**8.2**	**8.0**	**7.7**	**7.3**	**7.0**	**7.1**	**7.1**
GERD	2.2	2.3	2.5	2.5	2.5	2.5	2.7	2.8
BERD	1.5	1.5	1.7	1.7	1.7	1.8	1.9	1.9
US's share in world R&D	**41.0**	**40.9**	**40.8**	**37.8**	**35.9**	**35.2**	**35.1**	**33.6**
GERD	2.6	2.6	2.7	2.6	2.5	2.7	2.9	2.8
BERD	1.8	1.9	2.0	1.8	1.8	1.9	2.0	1.9
Japan's share in world R&D	**41.0**	**40.9**	**40.8**	**37.8**	**35.9**	**35.2**	**35.1**	**33.6**
GERD	2.8	3.0	3.0	3.1	3.1	3.4	3.5	3.3
BERD	2.0	2.1	2.1	2.3	2.4	2.6	2.7	2.5
Republic of Korea's share in world R&D	**3.1**	**2.6**	**2.8**	**3.1**	**3.3**	**3.5**	**3.8**	**4.3**
GERD	2.4	2.3	2.3	2.4	2.7	3.0	3.4	3.7
BERD	1.8	1.6	1.7	1.8	2.1	2.3	2.5	2.8
PRC's share in world R&D	**2.3**	**2.8**	**4.1**	**5.4**	**6.9**	**8.6**	**10.4**	**14.6**
GERD	0.6	0.6	0.9	1.1	1.2	1.4	1.5	1.8
BERD	0.2	0.3	0.5	0.7	0.8	1.0	1.1	1.3

PRC = People's Republic of China, US = United States.
Note: World shares are calculated in current international US$, Gross Domestic Expenditures on R&D as a % of GDP (GERD) and Gross Business Expenditures on R&D as a % of GDP (BERD).
Source: Own calculations based on data provided by UNESCO Institute for Statistics.

of Korea and the PRC increased theirs from 3.1% to 4.3% and 2.3% to 14.6%, respectively. Changes in gross expenditures on R&D as a share of GDP (GERD), especially if business expenditures on R&D increase, point towards structural change in the composition of industries in the wake of a shift towards research-intensive activities. Based on the data available, the Republic of Korea and Japan show the highest research intensity, followed by the US and Germany. Despite significant progress in GERD, the PRC still needs to catch up with the leading countries. Whereas business expenditures on R&D (BERD) represent more than 70% of GERD in Japan, the Republic of Korea and the US; Germany and the PRC's firms account for more than 60% of GERD. As in the case of Germany, in the Republic of Korea, Japan and the US, government and higher education institutions (HEI) are responsible for the rest. In the PRC, the government alone accounts for nearly all of the remaining expenditures on R&D. Data on researchers in the sample countries reveal that Germany keeps the lowest share of researchers in the business sector, closely followed by the PRC. Also, the share of world researchers has been increasing in the

Republic of Korea and the PRC and decreasing in the rest of the sample (Table 4).

Table 4: Country Shares in World Researchers

	1996	1998	2000	2002	2004	2006	2008	2010
Germany's share of world researchers	**9.6**	**9.5**	**9.1**	**8.8**	**8.2**	**7.6**	**7.5**	**8.8**
Government	16.4	16.1	14.6	14.7	15.6	14.8	15.0	15.8
Higher education	28.7	27.8	26.0	26.8	24.3	24.0	25.4	27.6
Business sector	54.9	56.2	59.4	58.5	60.0	61.1	59.6	56.7
US's share of world researchers	**45.3**	**49.3**	**44.9**	**43.3**	**40.9**	**37.2**	**33.8**	**36.5**
Government	4.8	3.9	3.7	3.7	3.6	3.5	3.5	3.5
Higher education	16.4	14.4	14.6	14.2	13.8	13.6	13.6	13.6
Business sector	78.8	80.6	81.7	82.1	82.6	82.9	82.9	82.9
Japan's share of world researchers	**25.7**	**26.0**	**22.8**	**20.6**	**19.9**	**18.6**	**16.3**	**17.6**
Government	4.9	4.7	4.8	5.4	5.2	4.9	4.9	4.9
Higher education	27.5	27.1	27.7	23.6	23.6	23.3	18.8	19.1
Business sector	64.8	64.9	66.3	73.4	74.2	77.8	77.5	76.5
Republic of Korea's share of world researchers	**4.1**	**3.7**	**3.8**	**4.7**	**4.8**	**5.4**	**5.8**	**7.1**
Government	12.4	10.9	10.7	8.0	7.8	7.0	6.6	7.5
Higher education	19.6	23.3	21.8	17.6	17.1	14.2	14.7	14.9
Business sector	66.6	64.9	66.3	73.4	74.2	77.8	77.5	76.5
PRC's share of world researchers	**22.2**	**18.8**	**24.5**	**26.8**	**28.2**	**33.2**	**39.4**	**32.4**
Government	33.6	34.3	27.8	23.3	20.6	17.2	15.0	19.1
Higher education	24.6	34.1	21.3	22.0	22.3	19.3	16.4	19.8
Business sector	41.8	31.6	50.9	54.7	57.1	63.5	68.6	61.1

PRC = People's Republic of China, US = United States.
Note: Since some values for the USA are missing, we extra/interpolate values for researchers working in government from 2003-2010, for higher education for 1996,1998 and the period 2000 to 2010 and for business sector from 2008 to 2010. Figures for private non-profit and not specified are not reported here.
Source: Own calculations based on data provided by UNESCO Institute for Statistics.

According to figures provided by the Institut für Mittelstandsforschung (IfM), more than 99% of all German firms belong to the so-called 'Mittelstand'.[9] They contribute to almost 52% of value added and more than 37% of total turnover of all German firms. Almost 95% of these SMEs are family-owned with solid financing models based on low and in some cases even no debt at all. The recent findings of the Kreditanstalt für Wiederaufbau (KfW) SME panel show that German SMEs finance their investments mostly with equity (Schwartz 2012, p. 6). Figures provided by Kladroba and Hellmich (2013) indicate that the German 'Mittelstand' accounts for around 15% of BERD in 2011, the remaining 85% are attributed to large manufacturing firms. According to figures of the Stifterverband fur die Deutsche Wissenschaft (2013, p.8), the automotive industry accounts for around 33%, electrical industry (16%), engineering (9%), pharmaceuticals (8%) and chemicals (6.5%) of GERD. According to EC (2013), the sample countries account for 66.5% of global manufacturing R&D expenditures at the firm level. While 108 German firms account for 7.2%, 502 US firms account for 33.5%, 296 Japanese firms for 19.7%, 35 firms of the Republic of Korea for 2.3% and 56 PRC's firms for 3.7%.

With respect to scientific publications, an output measure, Germany's share remained stable at around 6% between 1996 and 2011. The scientific specialization of a country can be measured by calculating the revealed scientific literature advantage index (RLA). Applied to Germany, it indicates that there is a specialization particularly in physics, but also in chemistry, biochemistry, materials, and earth and planetary sciences. Surprisingly, Germany shows a weak scientific-specialization in engineering, indicating that apparently Germany does less basic research on engineering than other countries, although patenting in engineering is quite important. The share of the US dropped from 29% in 1996 to around 23% in 2011. The scientific focus in the US includes medicine (22.2%), biochemistry and genetics (12.1%), engineering (8.6%), agricultural sciences (6.4%) and physics (5.9%). Japan's share also fell, from around 8% in 1996 to 5% in 2011. Japanese researchers follow the German research pattern and

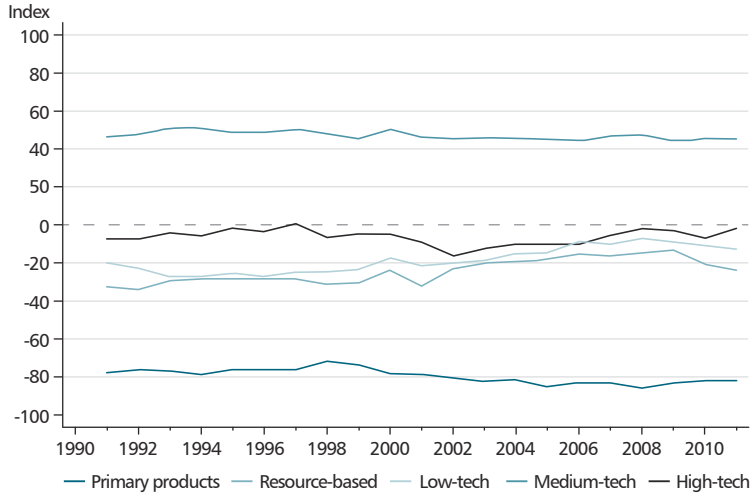
9. Only available in German, see http://www.ifm-bonn.org/statistiken/mittelstand-im-ueberblick/
In Germany the term 'Mittelstand' is used to denote SMEs with less than 500 employees and sales lower than EUR 50 million. See www.ifm-bonn.org.

publish mostly in medicine (18.5%), biochemistry and genetics (12.9%), physics (11%), engineering (10.1%) and chemistry (8.3%). The RLA for Japan points to an above average specialization in biochemistry and genetics, chemicals and physics. Scientific specialization in engineering achieves world average level and medical publications show a below average specialization. The Republic of Korea increased its share from around 1% in 1996 to nearly 3% in 2011, whereas the focus is on engineering (15.3%), physics (10.6%), material sciences (10.5%), biochemistry and genetics (10.1%) and medicine (10.5%). Scientific research in the Republic of Korea shows an above average specialization in material sciences, physics and engineering, and an average specialization in biochemistry and genetics as well as no specialization in medicine. Finally, there is a significant increase in the PRC's share in scientific publications. While its participation was 2% in 1996, it reached 15% in 2011; its scientific output mostly focuses on engineering (20.4%), material sciences (11.7%), physics (9.8%), chemistry (9.5%) and medicine (7.4%). Furthermore, the PRC's scientific specialization index indicates an above average specialization in engineering, materials science and chemistry, but no specialization in medicine.

Patent applications vary widely across countries and industries. The five countries in our sample accounted for 65% of world patent applications in 1990, a share that increased to 70% in 2010. Most of the applications take place in the US, Japan and Germany. The Republic of Korea and the PRC increased their shares from 0.2% to 5.1% and 0% to 6.5%, respectively. Whereas the five countries in our sample account for around 89% of industrial design applications worldwide, their combined share fell to 38% in 2011. Germany is by far the largest applicant in industrial design protection, accounting for 16% in 2011. The US accounts for 10% and Japan for 7%. The Republic of Korea and the PRC increased their shares over time, reaching 2.7% and 2.4% in 2011, respectively.

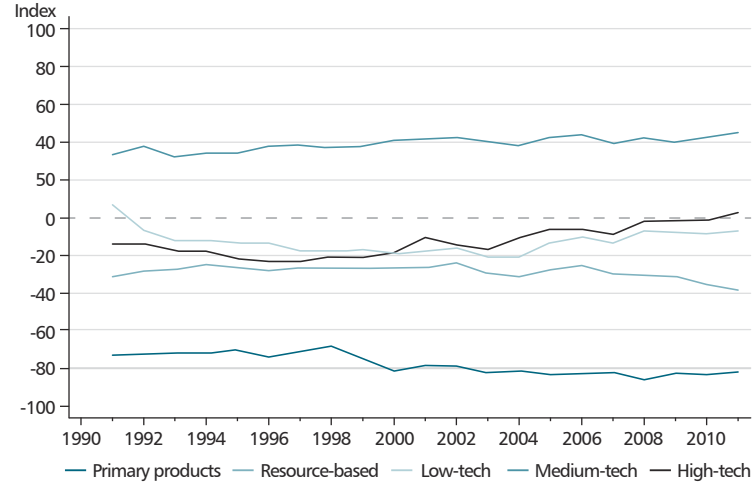
When assessing the simple trade shares above, a number of salient features of our sample countries were identified. A glance at the indices of revealed comparative advantage (RCA) and revealed export advantage (RXA) confirm most of these features: according to figures 4 and 5 Germany specializes strongly in MT and also shows a weak specialization in HT, while Japan and the US strongly specialize in MT and HT. The Republic of Korea shows a strong specialization in two product groups (HT and MT) and an average specialization in LT, with MT increasing over time. The PRC is revealed by the RCA to specialize strongly only in LT.

Figure 4: Revealed Comparative Advantage (RCA) of Germany



Source: Own calculations with data from UN Comtrade.

Figure 5: Relative Export Advantage (RXA) of Germany

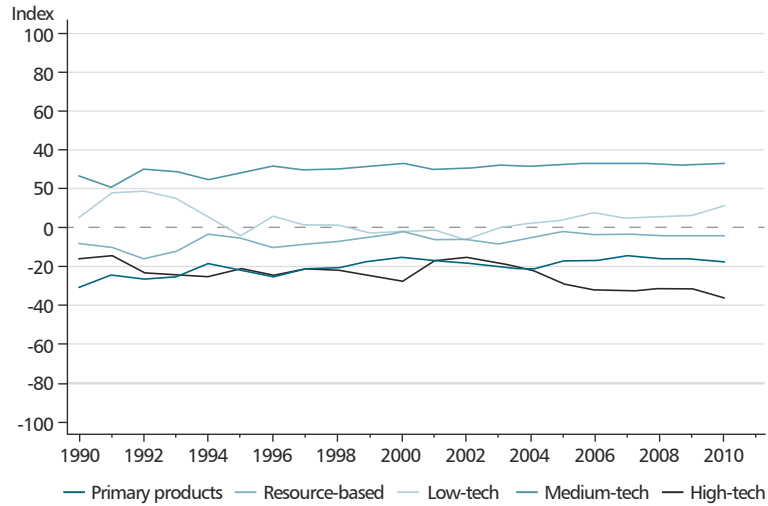


Source: Own calculations with data from UN Comtrade.

The RXA confirms the results for Germany, the Republic of Korea, Japan and the US but not for the PRC. For the PRC the RXA shows a strong specialization in LT and an average specialization in HT.

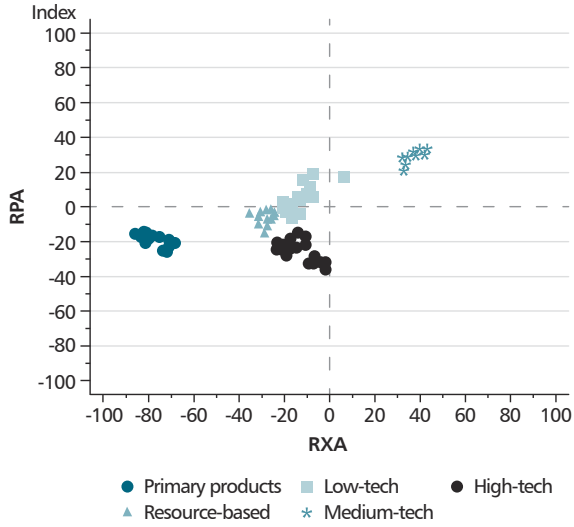
The big question posed by the trade specialization patterns discussed above is whether they match the technological specialization. Figure 6 helps in identifying the patent specialization of our sample (not all countries are shown): the US concentrates on HT and PP; Japan on MT, RB and LT; Germany (as expected) on MT; and the Republic of Korea on LT and HT. The PRC's pattern is somewhat complex including several products groups and a specialization that changes over time. In order to clarify the issue, it is helpful to turn to our technological specialization matrices (Figures 7 to 11): in the case of Germany trade and patent specialization result in a clear specialization in MT; for the US, the match is for HT; and for Japan (like for Germany) for MT. The Republic of Korea and the PRC show a multiple specialization: the Republic of Korea in LT, MT and HT; and the PRC in PP, LT and HT. As the results for the latter are not that clear, we take a closer look at the evolution over time. The Republic of Korea shows an improving specialization pattern in RB, MT and HT, whereas LT specialization indicators deteriorate over time. Surprisingly, the RXA

Figure 6: Relative Patent Advantage (RPA) of Germany



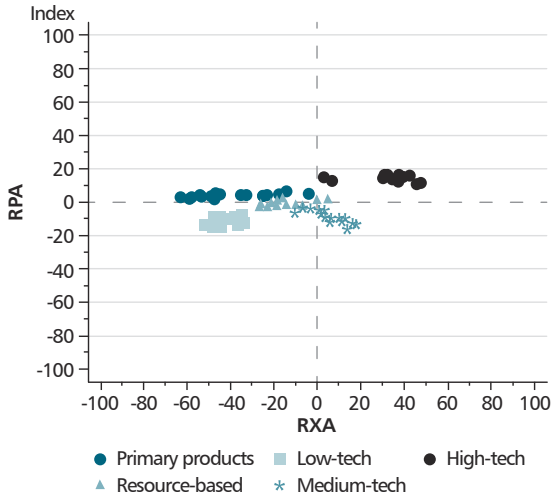
Source: Own calculations with data from UN Comtrade.

Figure 7: Technological Specialization Matrix (Germany)



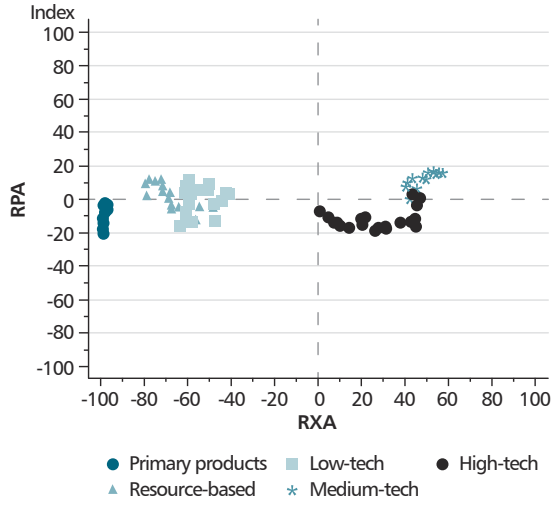
PRA = Relative Patent Advantage, RXA = Relative Export Advantage.
Source: Own calculations with data from UN Comtrade and OECD patent statistics.

Figure 8: Technological Specialization Matrix (US)



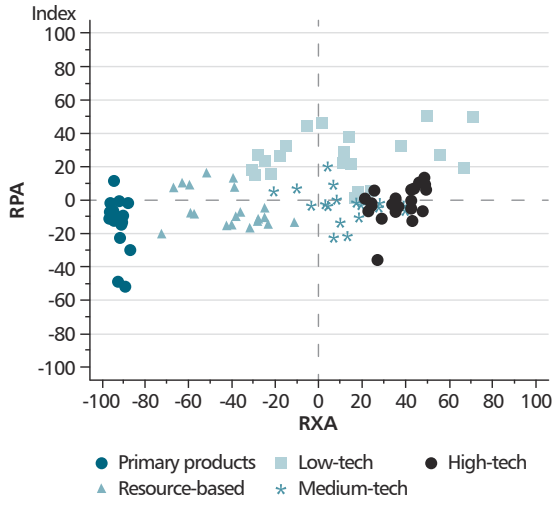
PRA = Relative Patent Advantage, RXA = Relative Export Advantage, US = United States.
Source: Own calculations with data from UN Comtrade and OECD patent statistics.

Figure 9: Technological Specialization Matrix (Japan)



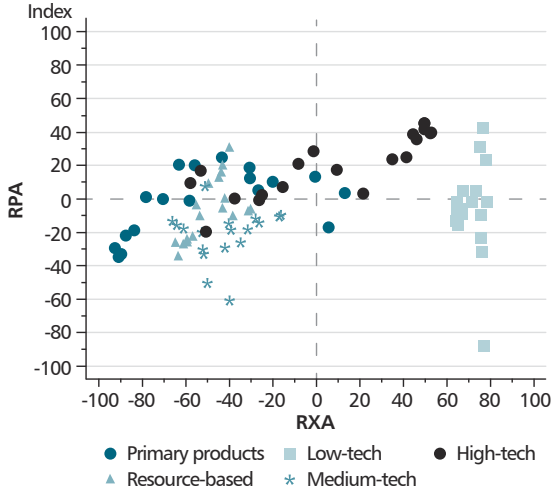
PRA = Relative Patent Advantage, RXA = Relative Export Advantage.
Source: Own calculations with data from UN Comtrade and OECD patent statistics.

Figure 10: Technological Specialization Matrix (Republic of Korea)



PRA = Relative Patent Advantage, RXA = Relative Export Advantage.
Source: Own calculations with data from UN Comtrade and OECD patent statistics.

Figure 11: Technological Specialization Matrix (PRC)



PRC = People's Republic of China, RXA = Relative Export Advantage.
Source: Own calculations with data from UN Comtrade and OECD patent statistics.

for PP deteriorates while the RPA improves. In the case of the PRC, both specialization indicators for PP, RB and LT deteriorate over time and the specialization indicators for MT improve. Regarding HT, the RXA indicator improves, while the RPA stays more or less stable.

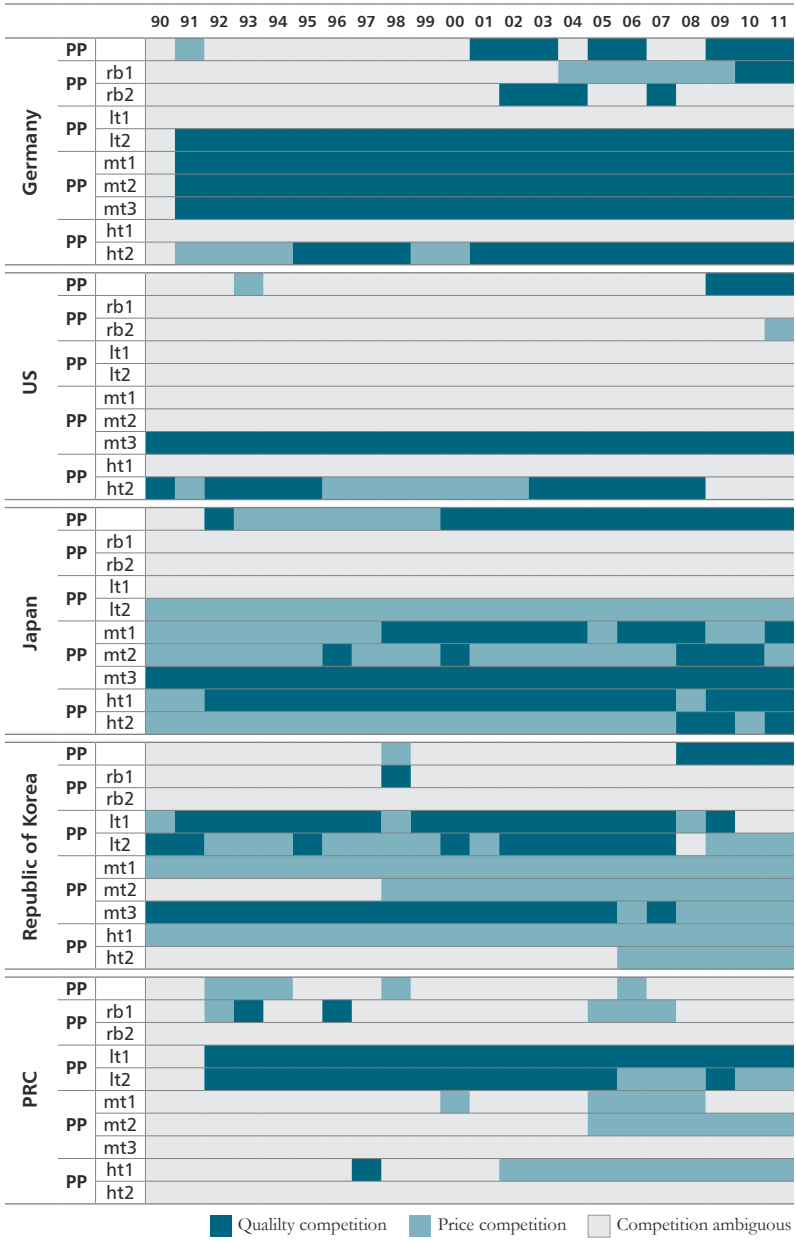
At this point we turn to the role of global value chains and present our estimates of vertical specialization (VS). Our estimates are included in Table 5: the shares of VS in exports increase for all countries over time. The Republic of Korea and Germany are the countries with the highest shares, whereas Japan shows the lowest share of VS in exports. Japan and the Republic of Korea show their highest shares of VS in PP exports, whereas in RB exports, the Republic of Korea, Germany and the PRC show the highest shares. Regarding LT exports, the available data indicates that Germany and the Republic of Korea use a considerable amount of foreign-produced intermediate goods. In the case of MT exports, the Republic of Korea, Germany and the PRC rely strongly on VS. Finally, the latter three countries also account for the highest shares of VS in HT exports. The geographic distribution of imports of intermediate products reveals that Germany imports intermediate products mainly from other

Table 5: Vertical Specialization

	1990	1995	2000	2005	2010
Germany	**23.4**	**19.4**	**27.4**	**33.6**	**33.6**
Primary products	3.5	2.9	3.8	5.9	5.7
Resource-based	4.0	3.3	4.5	5.1	5.3
Low-technologies	4.9	4.0	4.7	5.0	5.1
Medium-technologies	7.0	5.9	8.2	10.2	9.8
High-technologies	3.8	3.3	6.2	7.4	7.5
US	**9.4**	**11.0**	**13.1**	**14.4**	**14.2**
Primary products	1.5	1.4	1.8	2.6	2.8
Resource-based	1.4	1.4	1.7	2.1	1.9
Low-technologies	1.8	2.1	2.4	2.6	2.4
Medium-technologies	3.1	3.6	4.0	4.2	3.7
High-technologies	1.5	2.5	3.1	2.9	3.3
Japan	**7.5**	**6.2**	**8.0**	**11.2**	**12.5**
Primary products	2.8	1.9	2.4	3.6	4.4
Resource-based	1.8	1.3	1.4	2.0	2.3
Low-technologies	1.0	1.0	1.2	1.5	1.6
Medium-technologies	1.0	0.9	1.2	1.8	1.9
High-technologies	0.8	1.1	1.8	2.1	2.3
Republic of Korea	**29.4**	**29.0**	**33.7**	**34.5**	**46.6**
Primary products	7.0	6.1	9.4	10.1	14.4
Resource-based	5.7	4.8	4.7	5.2	8.2
Low-technologies	2.9	3.0	2.7	3.5	4.7
Medium-technologies	8.4	8.5	6.7	7.6	10.8
High-technologies	5.2	6.0	9.6	8.0	8.4
PRC	**20.2**	**19.2**	**20.4**	**32.7**	**26.3**
Primary products	2.2	2.1	3.1	4.8	5.2
Resource-based	2.5	2.6	2.9	4.8	5.0
Low-technologies	3.4	3.0	2.5	2.9	1.4
Medium-technologies	8.8	8.0	6.2	8.6	6.6
High-technologies	3.3	3.4	5.8	11.7	8.0

PRC = People's Republic of China, US = United States.
Note: Figures for Germany in 1990 were not available, therefore we report figures for 1991, same is true in the case of the PRC, while figures reported refers to 1992. Furthermore, other-technologies were excluded.
Source: Own calculations based on data provided by UN Comtrade and the World Bank.

Figure 12: Unit Values, 1990–2011



PRC = People's Republic of China, US = United States.
Source: Own calculations with data from UN Comtrade.

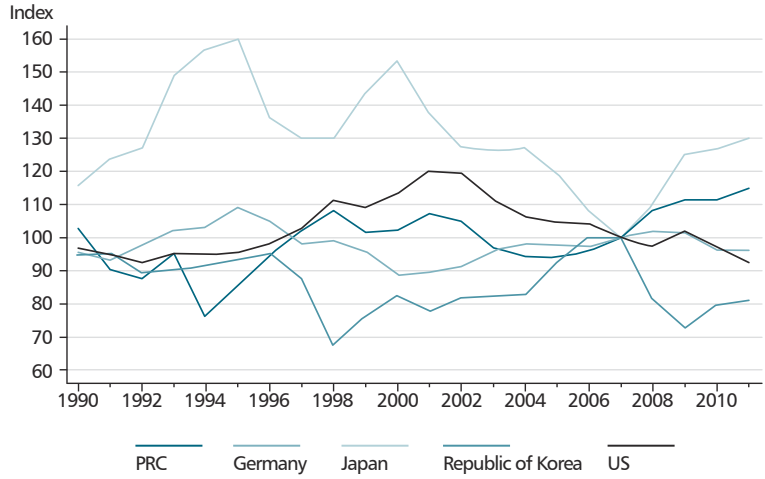
member countries of the European Union and that the US relies on Canada and Mexico for this purpose. Japan, the Republic of Korea and the PRC organize value chains with the participation of other Asian countries.

Concerning the nature of competition we present our estimates calculated with the unit value method (UV) mentioned in the last section. Based on the results of UV outlined in Figure 12, we attempt to establish whether the product groups our sample countries are specialized in are subject to price or quality competition on the world market. Price competition seems to prevail for LT (Japan), MT (PRC and the Republic of Korea) and HT (PRC, Japan, the Republic of Korea and the US). Quality competition is obtained for PP (Japan), LT (PRC, Germany and the Republic of Korea), MT (Germany, Japan, the Republic of Korea and the US) and HT (Germany, Japan and the US). Quality competition seems to be particularly relevant for Germany's specialization.

Due to the fact that price competition also plays a role in explaining specialization patterns, we will now take a look at price and cost indicators (Figures 13, 14 and 15). Real effective exchange rates (REER) are traditionally used to determine the price competitiveness of countries. We use data from a database supplied by the Bruegel Institute in Brussels (Darvas 2012) which includes a REER on the basis of the consumer price index. As may be seen from figure 13, the Republic of Korea is the only country experiencing a strong depreciation since 2007; all other countries see their REER appreciate, especially Japan. This indicator puts the Republic of Korea at the top. Turning to figure 14, we see the nominal unit labor costs (data from the OECD), excluding the PRC. From this indicator we may conclude that Japan occupies the best position and that (nominal) costs are increasing in Germany and in the Republic of Korea as well as in the US; the fact that the US shows the weakest performance in this respect. Finally, we take a look at labor productivity (Figure 15; data from the OECD): the Republic of Korea features productivity increasing at a high rate, while the other countries (again excluding the PRC) show only very slowly increasing labor productivities.[10]

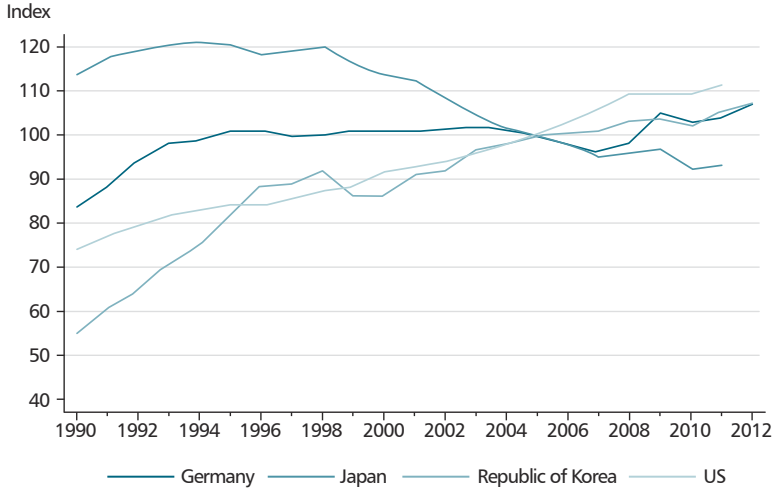
10. For reasons of space we do not include all tables and figures in the Appendix. The authors will be pleased to provide the data to interested readers.

Figure 13: Real Effective Exchange Rate (REER)
(Based on Consumer Price Index, 2007 = 100)



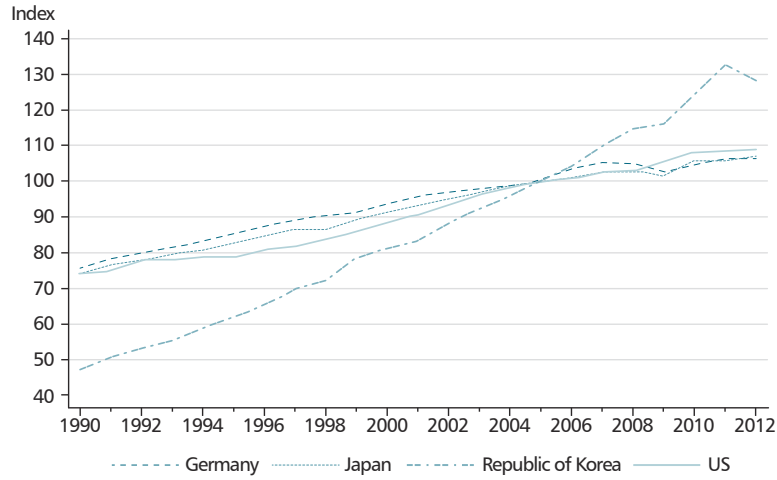
PRC = People's Republic of China, US = United States.
Source: Darvas (2012).

Figure 14: Nominal Unit Labour Costs
(Index OECD Base Year, 2005 = 100)



US = United States.
Source: OECD Online data bank.

Figure 15: Labour Productivity of the Total Economy
(GDP per Hour Worked Index, 2005 = 100)



US = United States.
Source: OECD Online data bank.

5. Conclusions

Germany is one of the few advanced countries in the world economy with a share of manufacturing industry in gross value added of around 20%. As most indicators show, Germany's manufacturing sector is particularly strong in the field of middle-range technologies and earned the country important market shares in world trade. German trade specialization matches technological specialization well and largely emerges as a result of product quality and vertical specialization in the relevant product group. The latter consists of automotive and engineering products as well as products derived from the process industries. Although this pattern of specialization is shared in part with Japan and the US, the Republic of Korea and the PRC also have developed strong positions in medium-technology products. The quality of German products is characterized by relatively high research intensity and is closely related to R&D effort and industrial design and patenting activity. German trade specialization, however, also includes products that are subject to price competition the international success of which depends on the evolution of price and cost indicators compared with Germany's major trade partners.

As world trade expands, Germany's share has been declining in line with that of Japan and the US. In contrast, the shares of the Republic of Korea and the PRC have been increasing. In the wake of globalization, global value chains account for an increasing share of world trade. In our sample, the Republic of Korea shows the highest share of intermediate imports in its exports, followed by Germany; the PRC also relies to a larger extent on vertical specialization than Japan and the US. Germany's future performance will be influenced by current and future challenges and its ability to respond technologically to them by adjusting its R&D, industrial design and patenting activity. Compared with the sample countries, Germany has the lowest share of researchers working in the private sector and at the same time the highest share of researchers working for the government and in higher education. This poses a problem of sustainability. More worrying than structural issues seems to be the stagnation in German patenting activity over the past decade.

Future challenges faced by Germany and other open economies include the consequences of climate change and of population ageing for the composition of GDP and particularly the manufacturing sector. Technologies aiming at a mitigation of climate change and enabling economies to adapt to climate change are expected to play a leading role over the next decades. Also, the need to substitute scarce natural resources for new materials and capital will have to be addressed by R&D and process and product innovations. Furthermore, to the extent that the bottlenecks existing in the supply of qualified labor (including researchers) are not overcome, structural change in Germany could slow down.

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APPENDIX

Methods

We use the standard formula for the **Relative Export Advantage (RXA)** index which assumes that domestic firms compete with other firms on a global level. Hence, the indicator is defined as the ratio of exports x in technology group j and the sum of exports by country i to the ratio of the sum of world exports x in technology group j and the overall sum of world exports

$$RXA_{ij} = 100 * \tanh \ln \left[\frac{\left(x_{ij} / \sum_{i} x_{ij} \right)}{\sum_{j} x_{ij} / \sum_{ij} x_{ij}} \right]$$

The **Revealed Comparative Advantage (RCA)** index is calculated as the ratio of exports x and imports m of country i in technology group j over the ratio of the sum of exports to the sum of imports of the country taken into consideration:

$$RCA_{ij} = 100 * \tanh \ln \left[\frac{\left(x_{ij} / m_{ij} \right)}{\sum_{j} x_{ij} / \sum_{j} m_{ij}} \right]$$

In order to measure domestic value added in export manufactures, we focus on input-output relationships. Following the seminal work by Hummels et al. (2001, pp. 78-79) we define **Vertical Specialization (VS)** as the ratio of imported intermediate inputs M to gross value added Y, multiplied by exports X of country i in technology group j:

$$VS_{ij} = \frac{M_{ij}}{Y_i} * X_{ij}$$

Finally, in order to establish whether quality or price determines export advantage, we follow Aiginger (1997) and estimate the Unit Values (UV) of traded goods (a type of elasticity). A UV is defined as the ratio of the value of an export good x or import good m in current US dollar to its quantities of country i in technology group j:

$$UV_{ij} = \frac{x_{ij}}{net\ weight\ of\ x_{ij}}$$

In doing so, we recommend to use the net weight in kilograms instead of supplementary units. Although supplementary units are more accurate than net weights for some products, it is rather difficult to deal with changes in those units. Furthermore net weights are available for a longer time period than supplementary units.

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ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to approximately two-thirds of the world's poor: 1.6 billion people who live on less than $2 a day, with 733 million struggling on less than $1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

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Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org

Korea Economic Research Institute
45th Fl. FKI Tower, 24 Yeoui-daero, Yeongdeungpo-gu
Seoul 150-756, Republic of Korea
www.keri.org

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