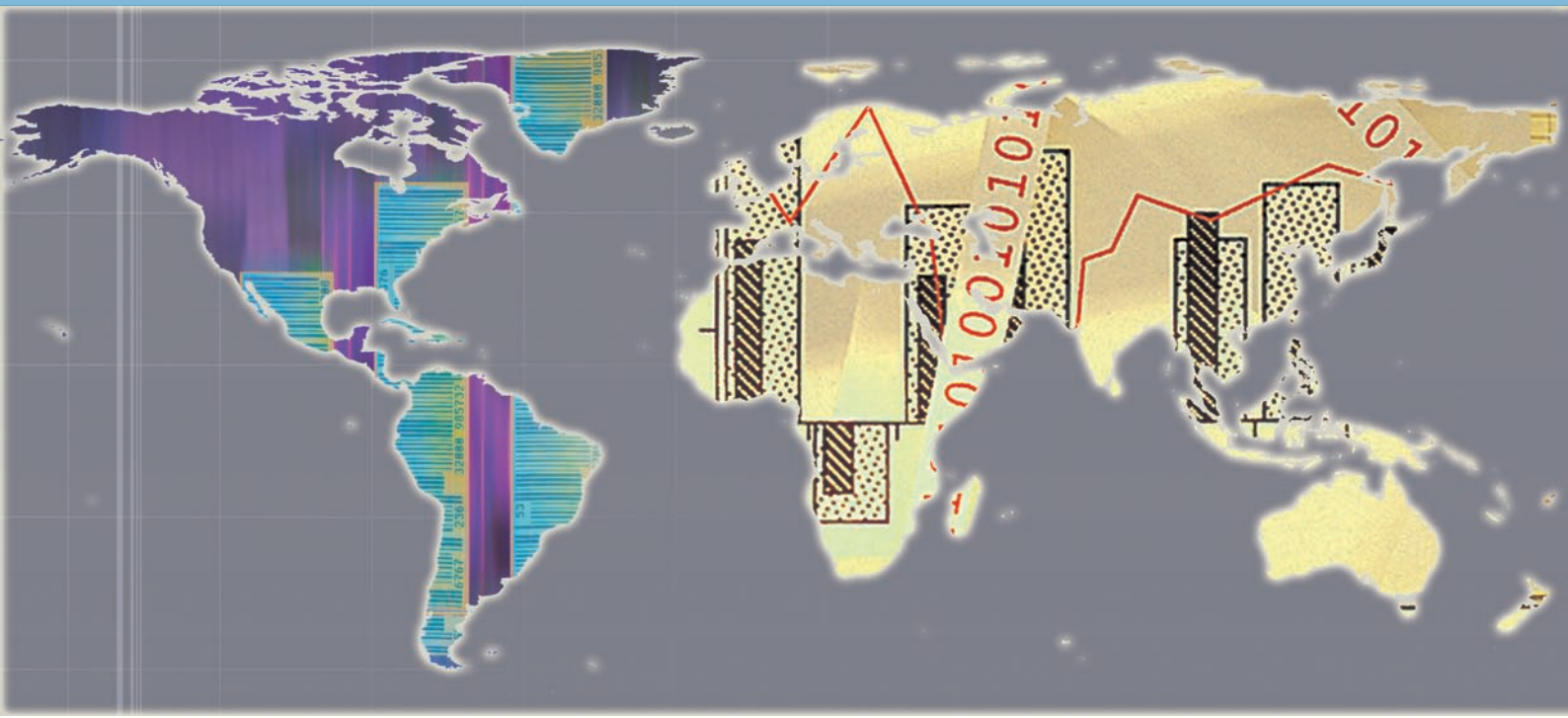
WORKING PAPER 18/2009



Structural Change and Sectoral Growth in Selected East Asian Countries

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

RESEARCH AND STATISTICS BRANCH
WORKING PAPER 18/2009

Structural Change and Sectoral Growth in Selected East Asian Countries

Nobuya Haraguchi
Strategic Research and Regional Analyses Unit
Research and Statistics Branch

Gorazd Rezonja
UNIDO Consultant

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna, 2010

Acknowledgements

We are grateful to the Institute of Developing Economies, Japan, for providing us with the Asian international input-output data for 1975, 1985, 1990, 1995 and 2000.

Maria Fermie was responsible for stylistic revision, Nevena Nenadic for graphic design and Debby Lee for coordination.

Disclaimer

Table of Contents

List of Figures

List of Tables

Abstract

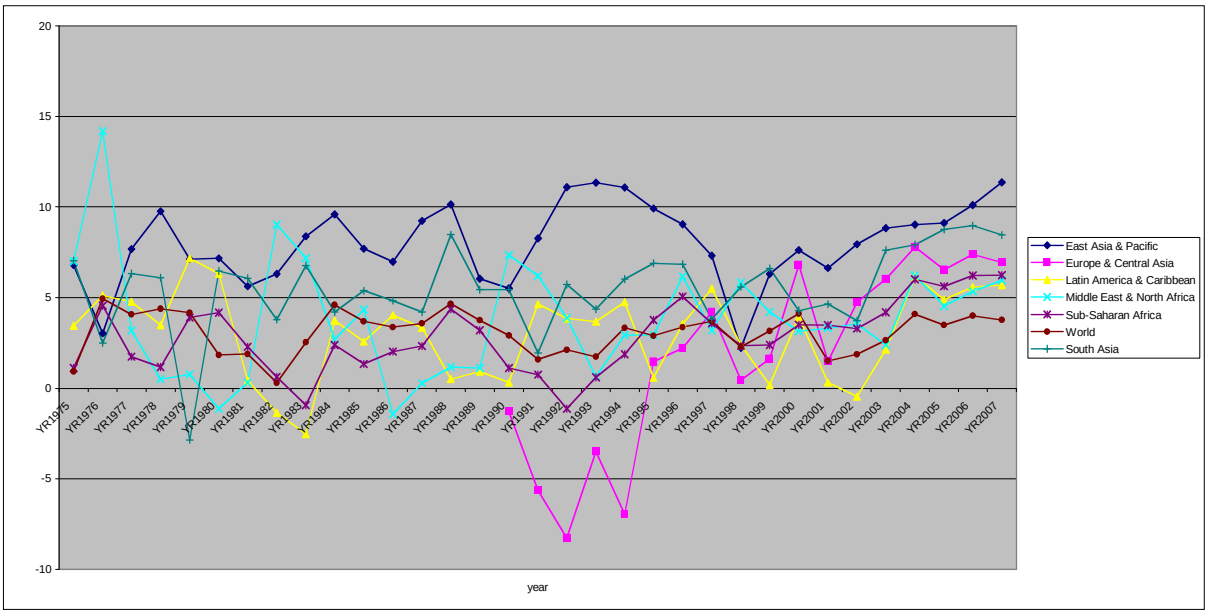
The purpose of this paper is twofold. First, to establish a benchmark of structural changes based on universal factors within a general equilibrium framework. Second, to elucidate the sectoral growth of selected East Asian countries and their diverse patterns of structural change to identify key structural differences in terms of domestic production capabilities and their role in the global and regional trading system. After a brief review of inter-regional growth differences, structural deviations from the normal pattern are depicted and the source of such deviations deduced. Using input-output data for five-year periods, from 1975 to 2000, sectoral growth and declines are examined in detail in conjunction with changes in the production process and final demand (both domestic and international). Finally, the effect these patterns of structural changes have had on the diverse development paths of five selected countries are analyzed, based on country-specific characteristics. This general framework of the determinants that played a significant role in their economic development provides a deeper insight into their overall success as well as diverse development patterns. In closing, the paper summarizes the findings of the study and draws possible policy implications for countries that aspire to emulate the success of the selected East Asian countries.

1. Introduction

Economic development, according to the United Nations (2007, p.1), "is fundamentally a process of structural transformation. This involves the reallocation of productive assets from traditional agriculture to modern agriculture, industry and services, and the reallocation of those factors among industrial and service sector activities. If successful in accelerating economic growth, this process involves shifting resources from low- to high-productivity sectors. More broadly, sustained economic growth is associated with the capacity to diversify domestic production structure: that is, to generate new activities, to strengthen economic linkages within the country and to create domestic technological capabilities." This paper treats these theoretical premises and demonstrates their significance by looking at selected economies in East Asia.

A close look at the changes in industrial output and its causes shows that structural changes occur as income levels rise. Shifts in sector shares, however, are only one aspect of structural change. Structural changes, driven by the relative growth and decline of sectors, are usually accompanied by changes in the demographic and gender compositions of the work force, nature of trade, income distribution, energy consumption and environment, which collectively affect the lives of people.

Figure 1. Annual GDP growth rates



Source: WDI (2009).

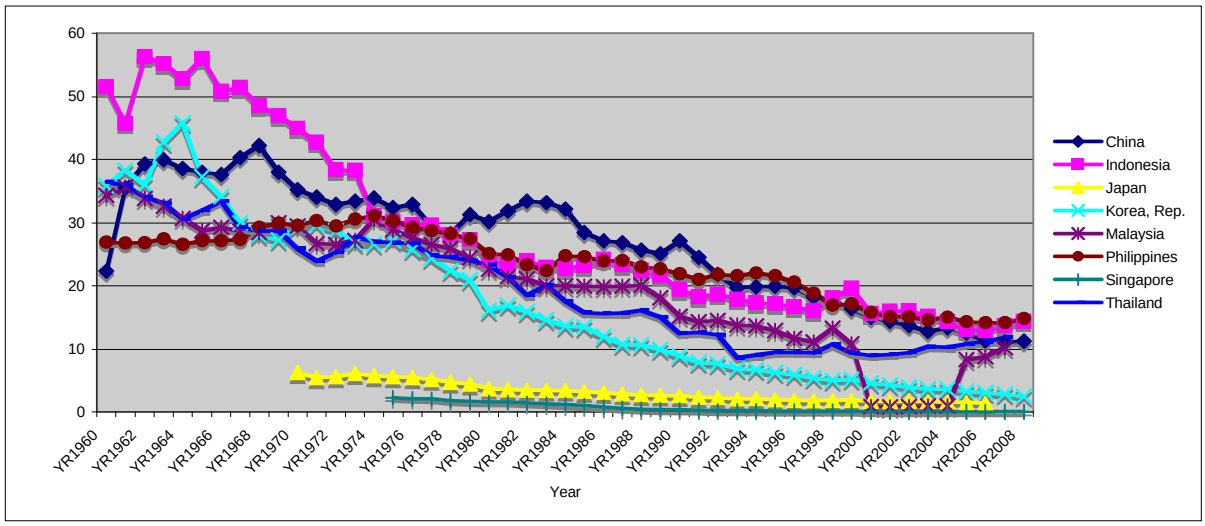
As shown in figure 1, East Asia, as a region, has grown faster than the others over the past 30 years. Similar to the experiences of current developed countries, the rapid and relatively sustained economic growth of East Asia has been based on a sharp increase in the manufacturing sector's share of total output and employment, a growing diversification of industrial production that permits each country to broaden its range of manufactured goods, and an increase in exports, with an emphasis on manufactures.

While following the conventional path of development through industrialization, East Asia has shown some distinct regional characteristics. This included the so-called "flying geese pattern" (Akamatsu, 1962), which means that all countries initially focused on technologically simple labour-intensive goods, such as clothing, sports goods, toys and processed foods. Although the speed of graduation from these varied, moves into a range of more capital-intensive, technologically-sophisticated items were always initiated by the four first-tier NIEs (newly industrializing economies), thereby vacating export markets that were then filled by the second-tier group (Weiss, 2005).[1] The regional hierarchical production network, which spread over East Asia made optimum use of the comparative advantages and led to the specialization of the respective economies and, to some extent, facilitated technology transfer among them. The region's complementary, rather than competing, economic structures and the dynamism of technological upgrading following that of the leading economies appear to have contributed to the growth of the region as a whole, indeed as "geese flying" together. Growth, along with equity, is also characteristic of the region's (especially Northeast Asia) development. Japan, the Republic of Korea and Taiwan Province of China managed to maintain relatively low Gini indices during this period of rapid growth.

As the East Asian economies grew, their basic economic structure changed as expected in theory, and evidenced in the pattern of earlier industrialized countries—the share of industrial value added in the economy increased as per capita income levels rose. Currently, agriculture in most East Asian countries accounts for less than 15 per cent of their respective gross domestic product (GDP). In the case of Japan, Republic of Korea and Singapore, this level fell drastically; below 5 per cent (figure 2).

[1] Such spillovers, where developed economies would open their markets to imports of labour-intensive or resource-intensive products, and at the same time developing countries would promote policies including higher protection of their nascent industries, is practically not feasible today, given the current international context (Haque, 2007, p. 6).

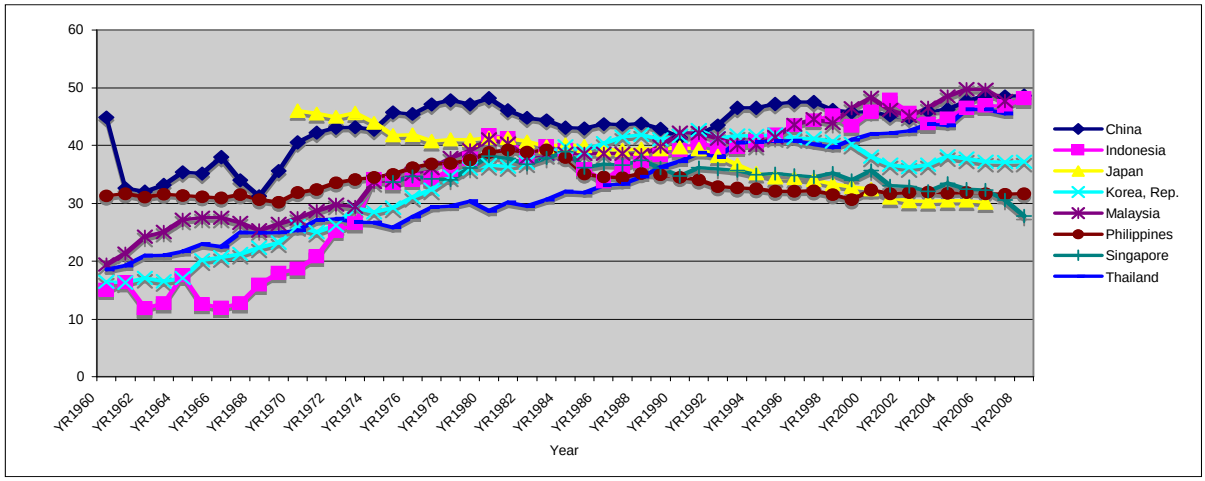
Figure 2. Share of agriculture in GDP, 1960-2006



Source: WDI 2009.

In terms of manufacturing as a share of GDP (figure 3), Indonesia, Republic of Korea, Malaysia and Thailand have been experiencing constant growth. In China, such growth was observed until the beginning of the 1980s, but since then it has been declining, increasing only marginally in recent years. Nevertheless, manufacturing as a share of GDP in China is still larger than in other countries. In recent years Thailand, however, has increased its share in manufacturing, superseding even that of China. Although no data is available for Singapore prior to 1975, it can be assumed that manufacturing as a share of GDP has been relatively constant. This also applies to the Philippines, which recorded growth in manufacturing until the beginning of 1970s—since then manufacturing as a share of GDP has somewhat stagnated, declining only marginally. Although data for Japan prior to 1996 is not available, it can be assumed that manufacturing suffered a relative decline, which reflects the period of deindustrialization and maturity with a large increase in services as a share of GDP (figure 4).

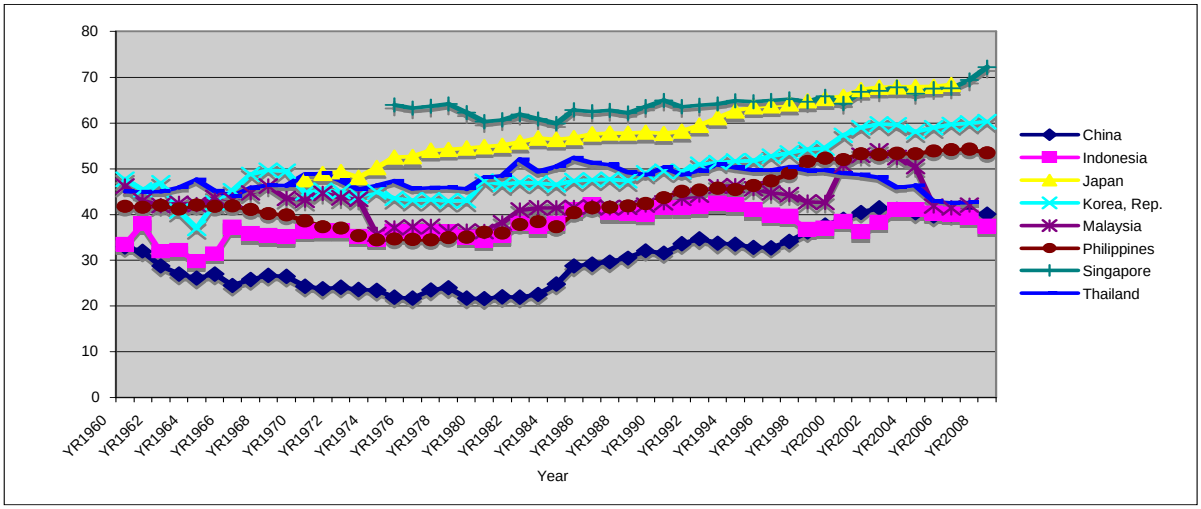
Figure 3. Share of manufacturing in GDP, 1960-2006



Source: WDI 2009.

Looking at the service sector (figure 4), Japan, Republic of Korea and Singapore recorded the highest percentage of services as a share of GDP. The Philippines also had a very high share of services as a share of GDP, which indicates a very unbalanced development path. The service sector in the Philippines declined until the mid-1980s but has been rising ever since. The same pattern can be observed in China. The service sector in Indonesia, Malaysia and Thailand has been following the same pattern, with decreases and increases interchanging marginally over the past 50 years. Figure 4 is somewhat in line with Kuznets' conclusion that the share of services in national product does not vary significantly with the level of per capita income.

Figure 4. Share of services in GDP, 1960-2006



Source: WDI 2009.

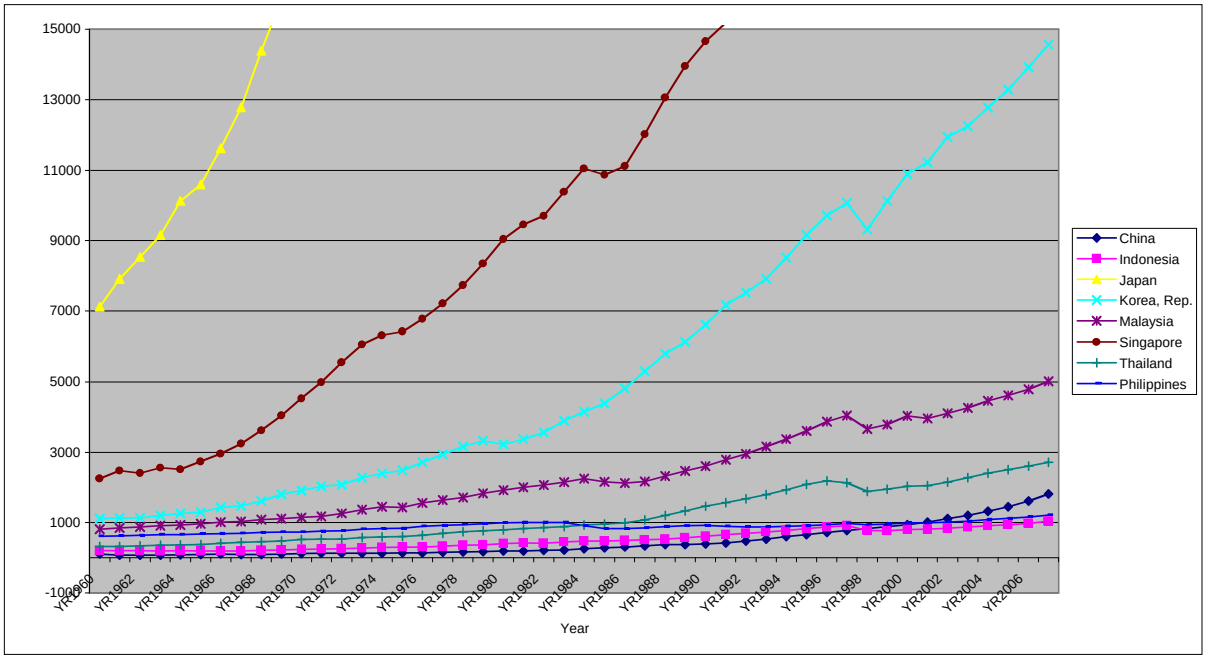
This reveals a very typical process of industrialization in some of these countries. Chenery (1960a, p. 635) characterizes this process as one that includes:

- a rise in the relative importance of the manufacturing industry,
- a change in the composition of industrial output,
- changes in production techniques and sources of supply (and demand) for commodities.

A rise in the relative importance of manufacturing can be observed in figure 3. The latter two are examined in detail in this paper.

The region's rapid growth and a generally similar pattern of structural change at a broadly aggregated level, as presented above, tend to indicate that the latecomers of East Asia have been following the path of the region's leading countries at a similar pace, and structural transformation occurred once their economies took off. However, a close examination of the experiences of individual countries reveals that divergence, rather than convergence, is a more appropriate characterization for their development. As can be seen in figure 5, their levels of GDP per capita have been steadily diverging with time.

Figure 5. GDP per capita in constant United States dollars: 1960–2006



Source: WDI 2009.

Excluding Japan and Singapore, other countries in the region recorded a similar level of GDP per capita in 1960—some US$1,000 or less. During the period 1960 to 2006, the Republic of Korea and Singapore recorded a significant increase in GDP per capita—an annual real growth rate of some 5.5 per cent—while at the bottom of the league, the Philippines, grew only at 1.4 per cent annually. The others recorded growth rates ranging from 3.5 to 4.5 per cent, except for China, which exceeded 6 per cent due to its very high growth during the past three decades. The fact that most East Asian developing countries started industrializing at similar stages of development and their subsequent divergence in growth provokes one to research more into the development of East Asia, in particular, the underlying industrial structures and their transformation.

This leads to a very challenging question: Why do some countries grow relatively faster than others? It is undoubtedly difficult to provide a straightforward answer to this important question. Nevertheless, an attempt is made here to present an overall pattern of structural change in resource allocation at the subsector level, and also show that structural changes occur as income levels rise. Accordingly, to determine the sustainable overall pattern of structural change, relevant exogenous variables, such as GDP per capita, market size and resource endowments, are used throughout this analysis.

This paper compares selected East Asian economies, namely, Indonesia, Republic of Korea, Malaysia, Philippines and Thailand, since 1975 and analyzes their structural change relative to both the world's norm as well as comparators in the region. Deviations from the structure, expected from their levels of income, size and resources, reveal the sectors that need to be examined in detail. Together with input-output analysis and country-specific analysis, this paper opens up some new areas of research, specifically in structural change and resource allocation.

Arguably, if the process of structural change, which should strengthen domestic technological capabilities and at the same time lead to diversity in terms of creating domestic linkages, can be sustained in terms of shifting resources from low- to high-productivity sectors, then such a process can indeed lead to overall economic growth. According to Chenery (1960, p. 650) "growth is likely to be accelerated by anticipating desirable changes in resource use and retarded by institutional arrangements or government policies that inhibit such changes."

2. Normal Pattern of Growth

The establishment of a more uniform and comprehensive description of structural change, based on a large sample of countries at the subsector level, is therefore necessary to identify countries that have been following similar development strategies for their resource allocations. The process of resource allocation results in systemic changes in the sectoral composition of domestic demand, international trade and production as income levels rise. Although, the determination of growth itself is not treated here, support is extended to the claim that such an approach provides for "the major features of resource mobilization and allocation, particularly those aspects needed to sustain further growth" (Chenery and Syrquin, 1975, p.3). As such, it represents the basis for policy formulation needed to enhance economic growth in low-income countries that are highly prone to poverty.

Once such a pattern is established, deviations based on case studies of East Asian economies can be determined. Thereafter, significant points of departure between groups of countries and also within respective groups can be established. Although these variables might explain the process of structural change very well, the importance of residual, which can be a consequence of either relevant variables not included in the model, or misspecification, or immeasurable variables, which are basically country-specific characteristics, cannot be neglected. Focusing particularly on the third aspect, it is important to also provide individual country analysis and make necessary comparisons. This pattern is not intended to be superimposed on low-income countries as such, but nevertheless needs to be integrated within a country-specific development framework. Furthermore, it represents a significant and improved benchmark, which closely follows the approach of Chenery and associates. Working on the basis of Chenery's preliminary work (1960) on the patterns of industrial growth, they define structural changes as a broad process of accumulation, resource allocation, and demographic and distributional transition. The starting point for their study was the pioneering work of Simon Kuznets, who first demonstrated the value of quantitative intercountry analysis of economic structures.

By focusing specifically on the resource allocation process, this report provides an updated version of the pattern of structural change based on a more detailed subsector breakdown for all countries, taking into consideration cross-section data. The existence of universal patterns of such structural change has been justified by Chenery and Syrquin (1975, p. 32) as a "result from an interaction between the demand effects of rising income and the supply effects of changes in factor proportions and technology."
If this objective can be satisfactorily achieved, then "each aspect of a country's development pattern, such as the observed rise in saving or in the level of industry, can be described in terms of three components:

(a) the normal effect of universal factors which are related to the level of income; (b) the effect of the other general factors such as market size or natural resources over which the government has little or no control; (c) the effects of the country's individual history, its political and social objectives and the particular policies the government has followed to achieve them" (Chenery and Syrquin, 1975, p.5).

Analysis of the uniformity in development patterns constitutes a first step toward identifying the sources of diversity. Although it is useful to know the average variation in economic structures with rising income, it is more important for development policy to investigate systemic differences in these patterns and associate them with a country's specific characteristics, such as resource endowments or market size differences or development strategy.

Studies on structural change usually investigate how the composition of some disaggregated economic activities within an economy differs from others and/or has changed over the years. The broadly aggregated classification of primary, secondary and tertiary sectors shows that there are theoretical and empirical indications, which show how the economic structure changes as countries develop, and how such developments can be measured against the established norms based on experiences of countries. However, while industrialization is known to be associated with economic development, it is still not clear how the structure within an industrial sector changes alongside a country's development. While this study is aimed at investigating structural differences and changes within the manufacturing sector across countries and over time, it is necessary to establish some benchmarks against which the distinct characteristics of a country's economic structure can be measured.

Chenery (1960) argued that sector *i*'s output is primarily a function of the country's income level, size of domestic market and availability of natural resources. In turn, the income level is determined by the levels of physical capital, human skills and natural resources. The purpose of this study is to estimate the output levels. Accordingly, income per capita is used as the explanatory variable without determining income per capita itself. Similar functions are applied to estimate the sectoral composition of domestic demand and international trade. Chenery's approach for determining normal output levels and their sources of demand is as follows:

$$LogX_i = \log \beta_{i0} + \beta_{i1} \log Y + \beta_{i2} \log N + \beta_{i3} \log R + \beta_{i4} \log R_i \quad (1)$$

$$X_i = C_i(Y, N, R) + E_i(Y, N, R) - M_i(Y, N, R) \quad (2)$$

Even though Chenery (1960) conceived the above based on theory, in practice he had to resort to more restrictive equations due to the lack of data and limited sample size. Furthermore, he seems to have believed that the income elasticity of supply was constant, or that the elasticities of various sectoral outputs might have indeed shown linear relationships in the early 1950s—the period of his study. This is because the sample taken then, due to the smaller differences in income levels among countries today, might not have been able to depict the whole range of the possible development trajectories of sectors. In his later work (Chenery and Syrquin, 1975), he introduced a quadratic term in the equation to allow a non-linear relationship. Cross-section analysis may mask the time effects on the sectoral pattern of development, though the approach is sufficient to meet the purpose of this paper, namely, to establish benchmarks to assess the relative importance of certain sectors in a country.

While Chenery's original approach is essentially adopted, a variable for a country's overall resource conditions using the trade flow of crude natural resources as the proxy is included. The sector-specific resource variable, R_i, is however not included in the equation due to the absence of a sound theoretical basis for specifying such a variable for each subsector within the manufacturing sector. Thus, here the variable for overall resource conditions, R, may not indicate the direct linkage between resource availability and growth in certain sectors, but is likely to show the indirect effects of how natural resource abundance or scarcity would generally influence the development of the manufacturing sector as a whole, or of some subsectors.

The experiences of countries have shown that a labour-intensive sector tends to grow faster, albeit at a relatively lower level of income. Besides, the sector's income elasticity of supply decreases when the level of income reaches a certain level, as relative factor prices appear to support the growth of a capital-intensive sector. Therefore, even within the manufacturing sector, development patterns of subsectors could vary, suggesting that the inclusion of a non-linear functional form is more appropriate.

In consideration of the above, this paper applies one of the following functional equations to estimate a sector's output growth pattern. The selection of the equation for each sector is based on the F-test results of the RESET test, the significance of the estimated coefficients and the R^2.

$$LogX_i = \log \beta_{i0} + \beta_{i1} \log Y + \beta_{i2} \log N + \beta_{i3} \log R \qquad (3)$$

$$LogX_i = \log \beta_{i0} + \beta_{i1} \log Y + \beta_{i2} \log Y^2 + \beta_{i3} \log N + \beta_{i4} \log R \quad (4)$$

$$LogX_i = \log \beta_{i0} + \beta_{i1} \log Y + \beta_{i2} (\log Y)^2 + \beta_{i3} (\log Y)^3 + \beta_{i4} \log N + \beta_{i5} \log R \quad (5)$$

Table 1 shows the deviations from estimated levels of output calculated with the logarithmic scale. Therefore, the numbers in the table do not indicate the volume but the degree of deviation only. Table 1 also shows that there are more positive than negative deviations in the manufacturing output of these countries. It is also apparent that the incidence and magnitude of positive deviations increased between 1975 and 2000. In particular, with the exception of Indonesia, the positive deviations seem to be more pronounced in those subsectors of manufacturing that produce heavy or final goods products.

Table 1. Deviations from the normal levels of output (in logarithmic scale), 1975 and 2000

		Republic of Korea		Malaysia		Thailand		Philippines		Indonesia	
	Output	**1975**	**2000**	**1975**	**2000**	**1975**	**2000**	**1975**	**2000**	**1975**	**2000**
15	Food and beverages	**-0.55**	-0.37	0.48	0.64	0.21	0.36	0.38	0.41	**-0.65**	-0.35
16	Tobacco products	0.13	-0.59	**0.85**	-0.11	**-1.21**	**-3.02**	0.51	0.86	**0.87**	**1.27**
17	Textiles	0.30	**1.04**	-0.15	0.64	0.65	0.65	-0.68	-0.50	-0.67	0.72
18	Wearing apparel		0.08		-0.04		0.59		0.99		1.05
19	Leather		0.50		-1.20		0.88		-0.24		0.74
18 & 19		**0.81**		-0.31		**-1.02**		-0.69		**-0.84**	
20	Wood products	0.58	-0.36	**2.08**	**1.88**	**1.10**	-0.18	0.78	-0.28	0.17	**1.65**
21	Paper and paper products	-0.12	0.04	-0.48	0.36	-0.02	-0.12	0.12	0.25	-0.83	0.83
22	Printing and publishing	-0.43	-0.01	**0.83**	0.37	0.31	-0.50	-0.14	0.30	**-0.63**	0.47
23	Coke, refined petro products	0.49	0.89	0.52	**1.40**	**1.40**	-3.80	0.63	0.95	0.27	**-3.11**
24	Chemicals and chemical products	0.02	0.35	-0.09	0.53	**0.99**	-0.29	-0.02	0.31	**-0.79**	0.03
25	Rubber and plastics products	-0.04	0.48	**1.95**	**1.69**	0.27	**1.01**	0.18	0.13	-0.33	0.50
26	Non-metallic mineral products	0.00	0.34	0.17	0.48	**0.51**	0.66	0.00	-0.12	**-0.72**	-0.23
27	Basic metals	0.33	1.10	0.16	0.84	**-1.74**	0.03	0.27	0.23	**-2.94**	-0.29
28	Fabricated metal products	**-0.84**	0.32	0.21	**0.94**	**0.67**	0.68	-0.17	0.00	-0.40	0.25
29	Machinery		0.48		0.63		0.54		0.30		-1.10
30	Office and comp equip		**2.14**		**4.27**		**2.14**		**3.71**		**-4.27**
29 & 30		-0.24		**1.00**		**0.91**		0.30		0.00	
31	Electrical machinery		0.64		**2.28**		0.04		0.82		0.35
32	Radio, TV com equip		**1.89**		**2.95**		**2.59**		**2.74**		**1.51**
31 & 32		0.27		**1.82**		**1.45**		0.04		-0.46	
33	Medical, precision instruments	0.78	0.25	0.61	**1.52**	-0.74	0.36	-0.69	**1.68**	**-1.67**	-0.07
34	Motor vehicle		0.86		1.27		1.07		0.38		-0.45
35	Other transport equip		1.22		1.04		-0.58		0.47		**1.64**
34 & 35		-0.15		0.48		**1.09**		0.15		-0.91	
36	Furniture; manufacturing n.e.c.	0.11	-0.04	0.23	**0.94**	0.17	**0.90**	-0.08	0.41	**-1.03**	0.46

Source: UNIDO calculations based on UNIDO statistics
Note: Highlighted figures indicate deviations of more than one standard deviation from the estimated pattern.

As seen in table 2, the deviation patterns are quite similar, with the exception of Indonesia, which has negative correlations with three countries that are statistically insignificant. The correlations among the other four countries range from 0.32—between Thailand and Philippines—to 0.76—between Malaysia and the Philippines, but most of their pair-wise correlations are statistically significant.

Table 2. Correlations of output deviations among selected countries, 2000

	Republic of Korea	Malaysia	Thailand	Philippines	Indonesia
Republic of Korea	1.000000				

Malaysia	0.598971	1.000000			
	3.664405	-----			
	0.0012	-----			
Thailand	0.439408	0.380665	1.000000		
	2.396394	2.016702	-----		
	0.0247	0.0550	-----		
Philippines	0.552474	0.758742	0.320621	1.000000	
	3.247103	5.706336	1.658258	-----	
	0.0034	0.0000	0.1103	-----	
Indonesia	-0.362452	-0.356025	0.098187	-0.347999	1.000000
	-1.905192	-1.866458	0.483350	-1.818503	-----
	0.0688	0.0742	0.6332	0.0815	-----

Source: UNIDO calculations based on UNIDO statistics.
Notes: Correlation; t-Statistic; Probability.

Despite the overall regional similarities, differences are visible from country to country. Looking at the mean and standard deviations, Malaysia has stronger positive deviations than the other countries, followed by the Philippines and the Republic of Korea. The mean of the positive deviations is higher for the Philippines than for the Republic of Korea. However, the latter reveals the lowest standard deviation among the five countries, indicating less concentration of deviations across the subsectors.

The above results simply show that the output level of some countries, especially Malaysia, exceeded the expected level, in accordance with the stage of development. However, in order to assess the impact on the economy, it is necessary to look at the production structure and linkages of each subsector. Before undertaking such a detailed analysis using input-output data, this section concludes by providing some indications on the structural differences between countries from the demand side. In addition to estimating the expected level of output, such estimations are also made for consumption, imports and exports, to see the demand structure of each subsector as well as the actual deviations of countries. Table 3 (A-E) shows the actual deviations of output, consumption, imports and exports from their expected levels.

Table 3. Actual deviations of outputs, consumption, imports and exports from their expected levels

ISIC Rev.3.1 Subsector	(A) Indonesia				(B) Republic of Korea			
	Output	Consumption	Imports	Exports	Output	Consumption	Imports	Exports
15	-0.349	-0.693	0.184	1.1	-0.367	-0.047	0.241	-1
16	1.274	1.275	1.014	2.374	-0.592	0.067	1.276	-0.421
17	0.716	0.074	0.22	1.365	1.041	0.583	-0.812	1.269
18	1.049	-8.47	-1.693	2.305	0.08	0.289	0.072	0.355
19	0.74	-1.107	0.588	1.225	0.504	0.12	-0.588	0.57
20	1.655	0.055	-0.17	2.765	-0.356	0.022	-0.054	-1.883
21	0.832	-0.058	0.353	2.955	0.042	0.242	-1.278	-0.266
22	0.468	0.15	-1.745	1.527	-0.009	-0.106	-1.227	-0.745
23	-3.115	-1.503	1.209	0.405	0.89	0.682	0.136	0.545
24	0.029	-0.23	0.393	0.983	0.346	0.339	-1.584	-0.098
25	0.501	1.096	-0.354	1.504	0.483	-0.806	-1.269	0.028
26	-0.23	-9.794	-0.606	1.205	0.335	0.408	-0.814	-0.809
27	-0.289	-0.334	0.137	0.937	1.096	0.844	-1.634	0.721
28	0.25	-0.117	0.23	0.825	0.322	0.139	-1.391	0.17
29	-1.1	-0.399	0.22	0.5	0.482	0.588	-1.714	0.289
30	-4.273	-8.26	-1.027	4.525	2.143	0.761	-1.026	2.15
31	0.347	-0.785	-0.272	2	0.641	0.661	-1.192	-0.223
32	1.507	-0.753	-1.023	3.834	1.892	1.392	-1.241	1.89
33	-0.066	-0.846	-0.21	1.333	0.253	0.705	-1.044	-0.396
34	-0.452	0.028	0.053	0.124	0.856	0.136	-1.93	1.288
35	1.64	1.426	1.009	1.054	1.222	0.523	-2.004	1.545
36	0.456	-8.502	-0.583	1.984	-0.038	-0.057	-0.616	-0.315
	(C) Malaysia				(D) Philippines			
15	0.636	0.131	0.511	1.68	0.407	0.246	0.63	0.619
16	-0.112	-0.698	0.342	2.632	0.864	0.877	1.139	0.808
17	0.637	0.228	0.547	1.13	-0.495	-0.847	0.907	0.257
18	-0.041	-0.652	-0.475	0.969	0.986	1.091	-0.463	2.369
19	-1.202	-1.069	0.025	-0.157	-0.239	0.267	0.321	0.649
20	1.884	1.881	0.432	3.105	-0.278	-0.095	0.95	1.262
21	0.364	0.083	0.67	0.555	0.254	-0.28	0.159	0.527
22	0.365	0.177	0.505	1.311	0.298	0.03	-0.108	0.483
23	1.402	0.998	1.301	1.707	0.946	0.338	0.164	0.209
24	0.527	0.212	0.899	1.263	0.306	-0.357	0.346	-0.632
25	1.69	1.154	0.677	2.184	0.13	-0.354	0.637	0.948
26	0.479	0.434	0.641	1.045	-0.123	-0.234	0.143	0.683
27	0.839	0.397	1.432	1.065	0.229	-0.044	0.427	0.314
28	0.939	0.576	0.894	1.24	-0.001	-0.494	0.091	0.306
29	0.625	-0.178	1.067	1.731	0.299	-1.025	0.368	0.899
30	4.273	2.64	1.998	5.894	3.711	2.214	2.058	6.135
31	2.278	2.174	1.752	2.386	0.821	0.325	0.854	2.515
32	2.952	1.973	3.29	5.372	2.744	1.74	2.985	6.021
33	1.521	0.616	1.619	2.888	1.68	0.373	0.597	2.43
34	1.272	-0.016	0.198	0.062	0.384	-0.138	-0.018	1.537
35	1.037	0.365	1.123	1.783	0.471	-0.235	0.33	1.288
36	0.937	1.052	0.644	2.162	0.407	0.211	0.218	1.549

Table 3. Actual deviations of outputs, consumption, imports and exports from their expected levels (Cont'd.)

(E) Thailand				
ISIC Rev.3.1 Subsectors	**Output**	**Consumption**	**Imports**	**Exports**
15	0.358	0.153	0.372	2.185
16	-3.023	-3.01	1.003	-0.276
17	0.65	0.35	0.681	1.367
18	0.59	1.111	-0.887	1.552
19	0.88	1.337	0.505	1.621
20	-0.179	-0.032	0.728	0.998
21	-0.12	-0.391	0.121	1.203
22	-0.503	-0.722	0.234	0.128
23	-3.801	-4.291	0.211	0.596
24	-0.289	-0.727	0.731	1.026
25	1.005	0.533	0.945	1.87
26	0.659	0.615	0.29	1.313
27	0.026	-0.342	1.108	0.627
28	0.675	0.284	1.17	1.278
29	0.538	-0.313	0.549	1.903
30	2.14	0.759	1.736	5.079
31	0.039	-0.024	1.352	2.473
32	2.59	1.726	2.158	4.273
33	0.361	-0.684	0.831	2.25
34	1.072	0.413	0.32	2.058
35	-0.578	-1.158	0.296	1.248
36	0.898	0.905	0.681	2.061

Source: UNIDO calculations based on UNIDO statistics.
Note: The numbers in the column of sub-sectors correspond to table 1.

Table 3 further indicates differences in the production structure. To summarize, table 4 shows if the mean of each column, in table 3, is statistically different, and if it is, whether it is positive or negative.

Table 4. Summary of deviations

	Output	**Consumption**	**Imports**	**Exports**
Republic of Korea	+	+	-	0
Malaysia	+	+	+	+
Thailand	0	0	+	+
Philippines	+	0	+	+
Indonesia	0	-	0	+

Source: UNIDO calculations based on UNIDO statistics.

Deviations from the expected levels concentrate on sectors that produce final products as well as parts and components for other sectors (sectors 29 to 36). It seems that Malaysia, Thailand and the Philippines are very active in international trade concomitant with their stage of development, country size and availability of natural resources. This may be due to their integration into the regional production chain.

Relative to its peer countries, Malaysia may be more advanced in processing manufactured products, as its positive deviation in the consumption of manufactured products seems to indicate. For that matter, in Thailand and the Philippines the normal level of processing may still be the same even though they seem to have abnormally high levels of manufactured trade.

Tables 3 and 4 reveal a different picture of the production structure in the Republic of Korea and Indonesia as against the other three countries. On the one hand, the Republic of Korea's negative deviation in imports and positive deviation in output and consumption reveal the likelihood of the existence of high production linkages within the economy. On the other hand, Indonesia's negative deviation in consumption, together with the expected level of output and imports, appear to indicate country's reliance on resource-based products with limited processing for its higher-than-the expected level of exports.

Based on deviations from estimated levels of output, consumption, imports and exports, these observations imply the existence of a diverse production structure among the countries treated. The Republic of Korea seems to have a strong domestic production base, while Malaysia, Thailand and the Philippines, especially the latter two, could be acting as processing hubs for certain tasks in international production chains. As Indonesia's manufacturing industry may not be integrated in the international production system to the same extent as its Southeast Asian neighbours, relatively low processed products are manufactured for exports.

The results that emerged from this section need to be verified and explained in more detail. The following sections, therefore, use input-output data to directly assess changes in the composition of industrial output, production techniques and sources of supply (and demand) for commodities.

3. Input-Output Analysis

Input-output tables represent a detailed account of the economic structure, in terms of demand and supply at the subsector level. Such a detailed account of the structure of an economy, which is based on domestic and international linkages, helps to determine relevant interindustry flows and their changes over time. On the basis of cross-country comparisons, the relevant significance of these linkages can be determined and general implications for overall economic development can be drawn, keeping in mind specific country characteristics at the domestic and international levels.

The input-output tables provided by the Institute of the Developing Economies (IDE), have been used here, and are based on 24-sector classifications for the years 1975, 1985, 1990, 1995 and 2000, which are further aggregated into 18 and 7 sectors.[2]

3.1. Structure

Table 5 shows the evolution of the sectoral composition of total domestic output between 1975 and 2000. As indicated in figures 2 to 4, input-output analysis also reveals similar shifts that occurred in the East Asian economies during the same period. Focusing particularly on agriculture, forestry and fishing, manufacturing and the service sectors, a decline in agriculture in all countries can be observed, although Indonesia and the Philippines still have the largest share of agriculture relative to the other East Asian economies. The service sector in Indonesia, Republic of Korea and the Philippines seems to have increased, while a decline, or stagnation, is observed in Malaysia and Thailand. However, as already indicated in the Introduction, the service sector did not vary much with rising income. Secondly, one can determine the rise in manufacturing among "latecomers", such as Indonesia, Malaysia, Philippines and Thailand. A relative decline can also be observed in the manufacturing sector of the Republic of Korea, which reflects the period of maturity, and the corresponding rise in the service sector.

[2] Although the regression equations were based only on the manufacturing sector, the agricultural as well as service sectors are utilized when considered relevant.

Table 5. Sectoral output (percentage share in total output), 1975–2000[3]

	1975	1985	1990	1995	2000
Indonesia					
Agriculture, forestry and fishing	18.04	14.61	13.71	10.60	10.59
Mining and quarrying	12.36	12.27	9.64	5.67	9.38
Manufacturing	30.42	31.09	33.02	37.40	39.21
Electricity, gas, water supply	0.77	1.08	1.21	1.21	1.13
Construction	9.23	10.73	10.44	10.43	8.43
Services incl. trade and transport	25.92	26.39	28.09	31.85	28.68
Public administration	3.27	3.83	3.89	2.84	2.57
Republic of Korea					
Agriculture, forestry and fishing	12.79	7.99	5.24	3.91	2.82
Mining and quarrying	0.96	0.73	0.54	0.40	0.20
Manufacturing	50.83	51.48	51.08	49.27	47.51
Electricity, gas, water supply	2.16	2.42	1.79	1.85	2.29
Construction	5.76	8.38	10.72	10.11	7.30
Services incl. trade and transport	25.71	27.20	27.30	31.32	36.68
Public administration	1.79	1.80	3.34	3.15	3.20
Malaysia					
Agriculture, forestry and fishing	13.53	9.13	9.13	4.38	4.05
Mining and quarrying	2.32	9.01	7.43	3.20	4.60
Manufacturing	45.42	39.85	47.76	56.61	55.34
Electricity, gas, water supply	1.00	2.23	2.71	1.75	1.90
Construction	4.51	9.20	4.43	8.93	4.93
Services incl. trade and transport	27.89	28.50	24.69	21.52	26.76
Public administration	5.33	2.08	3.84	3.60	2.43
Philippines					
Agriculture, forestry and fishing	17.82	17.34	15.49	16.59	8.61
Mining and quarrying	1.91	1.89	1.33	0.79	0.54
Manufacturing	38.30	37.76	40.12	37.04	42.74
Electricity, gas, water supply	0.99	2.39	1.76	2.41	3.83
Construction	6.15	5.75	6.63	6.52	5.37
Services incl. trade and transport	32.16	33.38	31.05	29.98	34.02
Public administration	2.67	1.50	3.61	6.68	4.91
Thailand					
Agriculture, forestry and fishing	17.63	10.46	6.50	5.19	5.18
Mining and quarrying	1.01	2.07	1.14	0.95	1.29
Manufacturing	37.90	40.75	43.99	45.87	49.08
Electricity, gas, water supply	1.22	2.70	2.15	2.33	3.41
Construction	6.72	6.46	9.59	9.40	3.53
Services incl. trade and transport	32.75	34.77	33.75	33.33	32.63
Public administration	2.76	2.79	2.87	2.93	4.88

Source: UNIDO calculations based on IDE input-output tables, 2009.

The Republic of Korea—the most developed among these countries—is taken as a benchmark for the present analysis. As indicated, input-output tables have to be viewed in terms of some kind of equilibrium, determined by supply and demand. Demand-side analysis entails a detailed comparison from the point of

[3] For percentage share in output of manufacturing sectors refer to Appendix 1. For percentage shares in value added of manufacturing sectors refer to Appendix 2.

view of a sector as a "buyer" of inputs. Supply-side analysis, on the other hand, entails the examination of sectors as "sellers" of their outputs in order to satisfy different sources of demand. From such an analysis extremely important information can be deduced. For example, one can determine the strength of a domestic economy (and its medium- to long-run potential), and the impact of trade on the domestic production structure. The *a priori* view is that both aspects are highly relevant, but not sufficient, for the sustainable development of a country. What matters is the sustainable mix between the two, which has to be augmented with the competitive production capabilities in the respective economies. This means that there needs to be a relatively high degree of domestic interrelatedness in order for an economy to sustain itself in the long-run without being affected by relevant external considerations. At the same time, there is a need for the economy to be integrated into the global trading system and a certain adjustment mechanism should be in place domestically, to allow countries to enhance the competitiveness of the domestic economy based on comparative advantage and trends in global markets. This is essentially a question of maintaining a sustainable balance between efficient and broad use of domestic resources (and also imported resources) and productive production capacity in order to satisfy domestic and external demand.

3.1.1. Supply-side Analysis

Beginning with supply-side analysis based on the input-output framework of the IDE, sector outputs are supplied to the following sources of demand:

- intermediate demand (I_d)
- final demand (F)
- export demand (E)

$$X_d = I + F + E \tag{6}$$

Final demand is further divided into four components: private domestic consumption, government consumption, gross domestic capital formation and increase in capital stock. Exports are divided into intermediate demand exports and final demand exports. Availability of such data makes it possible to analyze the supply-side structure of the East Asian economies in detail and determine its changes over time. First, these values are calculated as a share of each sector's output for the years 1975, 1985, 1990, 1995 and 2000, then average values are taken for the manufacturing sector as a whole and for the entire period, in order to get a broad aggregate view of the supply distribution (table 6).

Table 6. Supply of domestic output (manufacturing sector), 1975–2000

	D.I.	P.C.	G.C.	G.D.C.F.	I.C.S.	E.I.	E.F.	Discrepancy
Indonesia	50.67	23.52	1.47	4.13	0.41	9.77	10.26	-0.24
Republic of Korea	55.88	15.83	0.60	5.55	0.35	6.23	14.97	0.51
Malaysia	39.26	16.82	0.59	3.45	-1.13	15.56	24.83	0.61
Philippines	49.13	19.52	1.56	5.62	0.30	8.72	14.20	0.95
Thailand	48.42	19.20	1.00	6.19	1.07	8.65	15.03	0.44

Source: UNIDO calculations based on IDE input-output tables, 2009.

The distribution of domestic output reveals that the most significant component of demand in the selected five East Asian economies has been domestic intermediate demand, which accounted for some 50 per cent of domestic output in the observed period. The level of domestic intermediate demand, as a ratio to total output, was highest in the Republic of Korea and lowest in Malaysia. Domestic final demand accounted for some one fifth of the total output on average, with the Republic of Korea registering the lowest level of domestic final demand at 15.83 per cent. In terms of government consumption, Indonesia and the Philippines had the highest share in total output—1.47 and 1.56 per cent, respectively. Gross domestic capital formation, as a share of total domestic output, was highest in Thailand and the Republic of Korea—6.19 and 5.55 per cent, respectively. The share of increase in capital stock was most significant in Thailand, whereas Malaysia experienced a decrease in domestic capital stock on average for the observed period. In terms of exports to intermediate demand, the Republic of Korea had the lowest share among the five East Asian economies, and Malaysia the highest share in the observed period. The same pattern roughly corresponds in terms of exports to final demand, with Malaysia having the highest share and Indonesia the lowest share. As far as total exports are concerned, the pattern is rather similar in Indonesia and the Republic of Korea, although the share of exports to intermediate demand was higher in Indonesia, and the share of exports to final demand was higher in the Republic of Korea.

In comparing the same variables for 1975 and 2000 (table 7), the difference among the five East Asian economies is evident, particularly with regard to domestic intermediate demand and export demand. Domestic intermediate demand in the Republic of Korea, which was already very high in 1975 (50.13 per cent), increased to 59.34 per cent in 2000. While the share of domestic intermediate demand decreased significantly in Indonesia, Philippines and Thailand, and that of Malaysia stood at 37.73 per cent in 1975, increasing only slightly by 2000. The share of domestic private consumption decreased in all countries between 1975 and 2000. The same applies to government consumption. The share of gross domestic capital formation decreased in all countries, except in Thailand, which had the highest share in 2000. The same pattern applies for the variable increase in capital stock, except for Malaysia, which increased

between 1975 and 2000. The composition of exports did not change significantly in the Republic of Korea between 1975 and 2000—the share of intermediate export demand increased between 1975 and 2000 from 7.24 per cent to 8.55 per cent, and the share of final export demand decreased from 15.26 per cent in 1975 to 14.52 per cent in 2000. The share of exports increased in all other countries quite significantly, which corresponds to the fall in the share of domestic intermediate demand.

Table 7. Supply of domestic output (manufacturing sector), 1975 and 2000

	D.I.	P.C.	G.C.	G.D.C.F.	I.C.S.	E.I.	E.F.	Discrepancy
1975								
Indonesia	47.52	28.88	4.49	6.20	1.37	7.45	4.07	0.01
Republic of Korea	50.13	16.82	1.73	5.41	1.79	7.24	15.26	1.62
Malaysia	37.73	20.85	2.41	8.49	-1.79	9.67	25.88	-3.18
Philippines	49.63	23.09	3.94	6.58	5.27	3.59	5.36	2.54
Thailand	51.49	25.87	2.70	4.29	3.50	5.01	6.51	0.62
2000								
Indonesia	41.60	20.66	0.00	1.50	0.60	15.18	20.43	0.04
Republic of Korea	59.34	14.17	0.00	4.01	-0.21	8.55	14.52	-0.38
Malaysia	38.24	11.51	0.00	1.89	0.15	20.47	26.04	1.70
Philippines	43.92	15.20	0.00	3.46	-0.01	13.97	22.73	0.74
Thailand	40.98	14.45	0.00	4.21	2.25	14.15	23.92	0.04

Source: UNIDO calculations based on IDE input-output tables, 2009.

These variables have to be observed in relation to the change in the share of manufacturing in total output (table 5). Although the share of manufacturing decreased slightly in the Republic of Korea, it was still very high in 2000. The general pattern observed among the other economies of East Asia is that the increasing share of manufacturing output in total output corresponds to the growth in the share of exports and the decline in the share of domestic intermediate demand and domestic final demand.

3.1.2. Demand-side Analysis

Demand-side analysis of sectoral output based on input-output tables includes the following supply variables:

- total intermediate supply (I_s)
- import supply (M)
- value added (V)

$$X_d = I_S + M + V \qquad (7)$$

Table 8 shows that the average share of intermediate supply to domestic economy, for the observed period, was highest in the Republic of Korea, where more than 50 per cent of intermediate supply was

from other domestic sectors. The Republic of Korea is followed by Indonesia, whereas Malaysia, Philippines and Thailand had a similar share of domestic intermediate supply, some 40 per cent. Correspondingly, the share of intermediate imports was lowest in the Republic of Korea and Indonesia. In terms of the share of direct value added, Indonesia had the highest share, and the Republic of Korea, the lowest share.

Table 8. Demand for domestic output (manufacturing sector), 1975–2000

	D.I.	Imports	Value added
Indonesia	45.10	19.52	35.37
Republic of Korea	50.35	21.30	28.35
Malaysia	40.40	27.10	32.50
Philippines	39.26	28.24	32.50
Thailand	39.88	26.02	34.09

Source: UNIDO calculations based on IDE input-output tables, 2009.

Comparing the same variables for 1975 and 2000 separately, one can determine significant shifts during the period (table 9). In 1975, the Republic of Korea had the highest share of supplies of intermediate inputs from domestic sources and at the same time the highest share of intermediate imports. Correspondingly, the Republic of Korea had the lowest direct value added. In 2000, the Republic of Korea had the lowest share of intermediate imports and a correspondingly higher share of domestically sourced intermediate inputs, as value added did not change significantly. Indonesia had similar pattern on the demand-side as the Republic of Korea—a relatively high level of domestically-sourced outputs, which increased between 1975 and 2000, and relatively low level of imported intermediate goods. Indonesia had a very high direct value added in 1975, which increased in 2000. Malaysia had the highest share of value added in 1975 and the lowest share of domestically sourced intermediate inputs. Between 1975 and 2000, the share of domestically sourced inputs increased marginally. The increase in the share of intermediate imports was most significant in Malaysia, while the share of value added decreased between 1975 and 2000. In 2000, Malaysia had the lowest share of direct value added, while the Philippines had the lowest share of domestically-sourced inputs (the share of which decreased significantly, when compared to 1975) and the highest share of intermediate imports and a very high share of direct value added.

Table 9. Demand for domestic output (manufacturing sector), 1975 and 2000

	1975			2000		
	D.I.	**Imports**	**Value added**	**D.I.**	**Imports**	**Value added**
Indonesia	42.29	23.11	34.60	45.37	18.85	35.78
Republic of Korea	49.18	25.63	25.19	52.14	18.41	29.45
Malaysia	39.74	23.80	36.46	42.57	29.94	27.50
Philippines	47.93	22.83	29.24	32.36	35.71	31.93
Thailand	44.46	20.24	35.30	38.48	30.10	31.43

Source: UNIDO calculations based on IDE input-output tables, 2009.

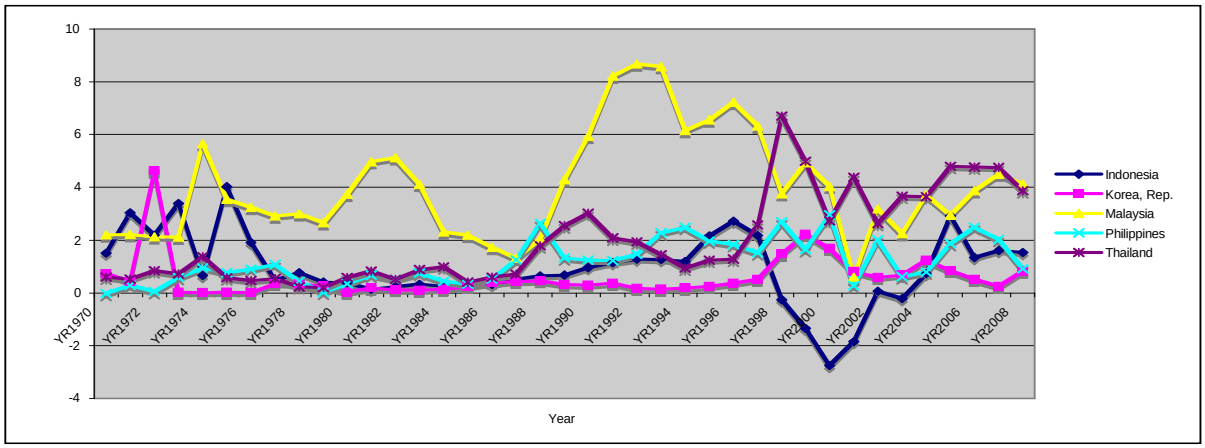
On the basis of the supply- and demand-side analysis, in the Republic of Korea, domestic intermediate supply and demand, as a share of sectoral output, was relatively larger than in other countries, which is a very distinguished feature of the Republic of Korea's economy. This indicates a very high degree of overall sectoral interrelatedness, thus revealing the strength of the Republic of Korea's economy. Correspondingly, imports of intermediate inputs have been relatively low and have in fact been decreasing in the Republic of Korea. Although the degree of the use and supply of domestic intermediate inputs has been rising, the degree of total exports decreased, but remained relatively stable at some 23 per cent of sectoral outputs (some 15 per cent of that includes exports of final products). This indicates the strong integration of the Republic of Korea into the global trading system, with a strong emphasis on the production of final consumer goods with high value added.

A very similar pattern holds also for Indonesia, although its share of intermediate domestic use and supply was relatively lower than that of the Republic of Korea. In terms of intermediate imports, there have not been any significant differences between the two countries. As far as exports are concerned, this share increased quite significantly in Indonesia between 1975 and 2000, although in terms of average, Indonesia had the lowest share of exports among these countries. It can thus be concluded that Indonesia's domestic economy is strongly interrelated, and simultaneously increased its participation in the global trading system.

Indonesia, Philippines and Thailand have been following a rather similar pattern, both in terms of demand and supply. This pattern shows relatively weak domestic linkages, which means that the strength of their domestic economies was relatively low. All three countries have a relatively high share of intermediate imports as well as total exports, which indicates their participation in global value chains (GVCs) and global production networks (GPNs).

Globalization has intensified production and trade, thereby increasing the pressure on manufacturers in developing countries. Accelerated technological advancements and liberalization of trade and investment increasingly result in fragmentation of activities in all stages of a production value chain. Some of these segmented activities can be performed in various locations across the globe and reintegrated again through the production system of GVCs and GPNs. A group of leading transnational corporations are playing a key role in organizing and controlling these production systems, thus benefiting from location differences in costs, infrastructure, capabilities in manufacturing, marketing and logistics, as well as in trade and investment regimes (Memedovic, 2004).

Figure 6. Foreign direct investment (FDI) as a share of GDP, 1970-2006

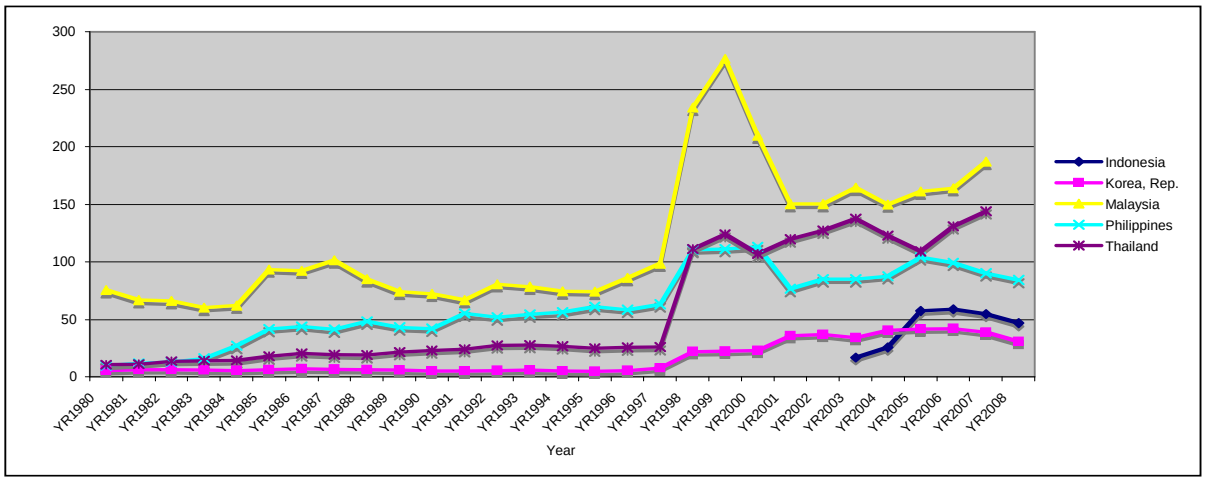


Source: UNCTAD 2009 and WDI 2009.

As can be seen from figure 6, the Republic of Korea, the most successful East Asian economy, had, on average, the lowest share in FDI throughout the period. The exception is Indonesia, where the share of FDI following the Asian crisis was negative. These shares indicate that the number of countries participating in GVCs and GPNs has been increasing. Transnational corporations, as represented by FDI, have been leading this process. Accordingly, they represent a good proxy for the level of integration in GVCs and GPNs. A further breakdown of FDI by sector would also indicate such trends.

The share of FDI stocks in gross capital formation (figure 7), gives a further indication of how much weight foreign enterprises carry within the entire domestic investment activities (represented by the level of gross capital formation (GCF) in East Asia).

Figure 7. FDI stocks as a share in GCF



Source: UNCTAD 2009 and WDI 2009.

This had far-reaching effects on competitiveness, cross-national transfer of new technology, ideas, skills, knowledge and learning, and potentially offers greater opportunities for reaching welfare gains. But it also brought about new challenges and threats (Memedovic, 2004, p. 1). The challenges countries have been facing were in the form of intensified competition, which forces prices down and production and technological capabilities up, making smaller suppliers, that do not possess the capabilities and competitive advantage in price, quality, quantity and delivery, which the modern production system calls for, extremely vulnerable. Even successful enterprises may find it difficult to sustain competitiveness as wage levels in their countries rise and market conditions change (Memedovic, 2004, p. 3). Another big challenge for the East Asian economies has been the emergence of China, which has affected these countries either through rising trade-competition with China at the respective domestic markets and important foreign markets, or through investment diversion to China, due to its very favourable environment for investment.[4] Although there have been gains for the economies of East Asia, they have been diverging, and as such have failed to grow on a per capita basis, which is the key for poverty alleviation.

The integration into the global and regional trading system for some of these countries, resulted in a decrease in domestic linkages, as presented below, because the focus was more on the production of intermediate goods intended for international transactions for further processing. It is important, however, for these countries to retain a somewhat diverse production structure, as this will provide the real dynamic

[4] Cheap, abundant, skilled and disciplined labour force; capabilities in full-package production; deepening of participation in GVCs and GPNs; large market size; good shipping connections; and the accession to the WTO make it a highly attractive place for foreign investors (Memedovic, 2004, p. 23).

advantage in the changing global environment as well as the conditions necessary to sustain long-term economic growth on a per capita basis.

3.2. Linkages

Interindustry linkage analysis was introduced in input-output analysis in the pioneering work of Chenery and Watanabe (1958), Rasmussen (1956) and Hirschman (1958). Since then those methods have been improved and extended in several ways. Measures such as backward (BL) and forward linkages (FL) have been widely used for the analysis of both interdependencies between economic sectors and for formulating development strategies.

The analysis by Song (1977), which compares the production structure of the Republic of Korea in 1970 with that of other countries, and with that of the Republic of Korea, at various points in time, is relevant to and complements the analysis here. Song (1977, p. 149) acknowledges that "the degree of comparability between production structures as defined in input-output tables depends on a number of factors. These include the level of aggregation of industries, changes in relative input prices, conceptual differences in treating various accounts, as well as statistical difficulties and methodological differences in gathering data and compiling input-output tables, etc." Due to data availability and credibility of the source of data, the analysis can, to some degree, modify the first, third and fourth issues. Song (1977) also points out differences in the size of domestic markets, factor endowments, role of the trade sector, pattern of final demand, production techniques, and the industry mix, which additionally influence the comparison. Some of these differences are taken into account in the present analysis.

The objective of this analysis is to measure the extent of domestic interrelatedness based on BL and FL and make the necessary comparisons across countries and time. BL and FL can be further divided into direct BL and FL, which are based on the matrix of technical coefficients (A) and total BL and FL, which also captures the indirect effects and are respectively based on Leontief's inverse matrix $(I-A)^{-1}$ and output inverse matrix $(I-B)^{-1}$.

The matrix of technical coefficients is also referred to as the direct requirements matrix. Direct requirements are purchases of resources (inputs) by a sector *j* from all sectors to produce one unit of output. The direct requirements matrix represents the core of input-output analysis (Raa, 2005, p. 14). These coefficients show the direct effects in all sectors due to one unit change in output in a particular

sector, thus, showing the direct interindustry linkages that tie the economy together. The direct requirements matrix can be obtained in the following way:

$$A = Q \cdot \hat{X}^{-1} \tag{8}$$

where Q (*n x n*) is the matrix of intermediate flows and $\hat{X}^{-1}$ (*n x n*) is the diagonal matrix of total output. The element of the direct requirements matrix is technical coefficient a_{ij}. The sum of the columns of the direct requirements matrix represents direct BL, which measures the dependence of industrial sector *i* on the purchase of material inputs (U_i) by other sectors. One of the problems in taking direct linkages is the neglect of the indirect impact. With respect to BL, Yotopoulos and Nugent (1973) proposed to remedy this deficiency by utilizing the sum of the columns of the Leontief inverse matrix or total requirements matrix, which is the inverse of technology matrix $(\boldsymbol{I} - A)^{-1}$.[5] If this matrix is denoted with $L = (\boldsymbol{l_{ij}})$, then the total requirements coefficients of $\boldsymbol{l_{ij}}$ show how much output is required *directly* and *indirectly* from each industry in the economy for every unit worth of output produced for final use. BL, based on the Leontief inverse matrix, are defined as the sum of the columns of the inverse matrix, which he called *index of the power of dispersion* (***p***) (Rasmussen, 1956). It measures the extent to which a unit change in final demand for the product of sector *j* causes production increases in all sectors.

FL, on the other hand, measure the dependence of all other sectors on sector *i*. Jones (1976) developed symmetrical measures of total FL, which may be derived from the "output inverse" $(I - B)^{-1}$, which is denoted as *G*. *B* equals:

$$B = \hat{X}^{-1} \cdot Q \tag{9}$$

[5] Yotopoulos and Nugent (1973, p. 335) believed that they had a "total linkage index", which also captures "something in the way of forward-linkage effect". However, according to Jones (1976, p. 325) "an index number of, say, 2.3 in textiles, simply means that to meet a unitary increase in textile output requires 2.3 units in increased output for the economy as a whole. This consists of 1.0 in final textile outputs plus 1.3 units in both direct inputs (e.g., cotton and electricity) and indirect inputs (e.g., fertilizer for cotton and Bunker C for electricity). The index is thus completely insensitive whether the unit of textile output is exported, used as an input to some other industries, or buried. Therefore, the Yotopoulos and Nugent 'total linkage index' measures direct plus indirect effects on supplier industries, but not on user industries." The Leontief inverse therefore does not provide a measure of FL symmetrical to that provided by the column sum for BL.

The typical element of B (n x n) matrix is the element b_{ij} and represents the share of the output of sector *I*, which is used for further production of sector *j*. In other words, it represents an additional output of sector *j* per unit of the production of sector *i*. Direct FL is taken as a sum of rows of *B* matrix and total FL as a sum of rows of $(I-B)^{-1}$.

According to Carter (1970) "measures of structural change based on inverse coefficients have some important advantages over direct coefficients comparisons. Inverse coefficients are insensitive to certain troublesome changes in industrial division of labour (specialization) and in accounting practice (classification procedures)", which can be observed with the direct requirements matrix. On the other hand, the disadvantage of the inverse matrix is that they tend to 'obscure the primary locus of change' as they consider both direct and indirect effects. For the present analysis, both direct and total BL and FL are therefore used.

Table 10. Direct and total average backward and forward linkages (all sectors)

	Year	Direct BL	Average	Direct FL	Average	Total BL	Average	Total FL	Average
	1975	0.44		0.47		1.73		1.80	
	1985	0.45		0.52		1.80		1.95	
Republic of	1990	0.46	**0.45**	0.56	**0.53**	1.84	**1.80**	2.04	**1.95**
Korea	1995	0.44		0.53		1.77		1.95	
	2000	0.47		0.55		1.84		2.03	
	1975	0.34		0.42		1.47		1.57	
	1985	0.40		0.47		1.61		1.72	
Indonesia	1990	0.42	**0.40**	0.48	**0.45**	1.66	**1.61**	1.75	**1.69**
	1995	0.43		0.49		1.67		1.78	
	2000	0.42		0.41		1.65		1.62	
	1975	0.34		0.41		1.48		1.58	
	1985	0.35		0.38		1.52		1.57	
Malaysia	1990	0.38	**0.36**	0.40	**0.39**	1.62	**1.55**	1.65	**1.60**
	1995	0.34		0.39		1.51		1.59	
	2000	0.39		0.38		1.60		1.59	
	1975	0.43		0.44		1.64		1.65	
	1985	0.39		0.46		1.61		1.72	
Philippines	1990	0.37	**0.37**	0.50	**0.45**	1.57	**1.55**	1.79	**1.69**
	1995	0.32		0.45		1.45		1.66	
	2000	0.32		0.42		1.47		1.65	
	1975	0.39		0.48		1.59		1.74	
	1985	0.40		0.50		1.66		1.83	
Thailand	1990	0.37	**0.39**	0.49	**0.48**	1.57	**1.60**	1.78	**1.76**
	1995	0.37		0.48		1.57		1.75	
	2000	0.40		0.44		1.62		1.71	

Source: UNIDO calculations based on IDE input-output tables, 2009.

In table 10, the values of both direct and total BL and FL are presented for the five East Asian countries for the period 1975–2000 for all sectors. The values for each year correspond to average values for 18 sectors of the whole economy. Additionally, the average values of linkages for the observed period were calculated. Generally, one can observe that total BL and FL change proportionally to the direct BL and FL. On average, the Republic of Korea had the highest direct BL and FL among the countries throughout the period, which indicates the strong interdependence among the domestic sectors, as already indicated earlier. A similar conclusion can be drawn by observing total BL and FL, which include also the indirect effects. The same pattern also corresponds to Indonesia. This implies that there is a strong interrelation among the domestic sectors, which shows the strength and potential of the domestic economy. As already indicated, this is not sufficient. A country needs to be integrated into the global trading system to allow it to enhance its competitiveness (although not automatically) in conjunction with the efficient use of domestic resources.

In comparing these results with those of Song (1977), it can be concluded that significant structural changes have taken place in terms of domestic linkages. When comparing the Republic of Korea with Japan, Italy, the United States, Norway and India, and with the Republic of Korea itself, in different periods, in general, the Republic of Korea had relatively low values in all linkages. Furthermore, the author observes that "Korea's lower degree of interdependence among productive sectors (at that time) seems to be caused to a great extent by the relatively greater importance of agriculture and forestry in the Korean economy" (Song, 1977, p. 154). In addition, it was argued that such a result could be due to a relatively high level of exports and greater import-dependence in the Republic of Korea in some sectors. It can therefore be confirmed that there has been a significant structural shift in the Republic of Korea's economy, with linkages increasing ever since. The same applies also to Indonesia, (not included in the analysis by Song).

The other three countries have been decreasing their direct and total linkages (except Thailand, where BL started increasing marginally since 1990). This clearly indicates the fact that these countries have been involved in establishing themselves as processing hubs for certain tasks in international production chains, as stated above.

Simple correlations reveal further interesting aspects of structural change. Although manufacturing has been clearly important in all countries, it is necessary to determine the strength of domestic intermediate demand in terms of BL among the countries and determine whether any significant similarities or divergences exist among them. At the same time, it is necessary to determine the strength of the domestic

intermediate supply, in terms of FL. In tables 11-14, BL and FL are correlated for all 18 sectors of the economy. The East Asian economies were much more similar in 1975 than in 2000, particularly in terms of BL. Such divergence cannot be clearly distinguished as regards FL.

The production structure in 1975, in terms of demand sectors (tables 11 and 12) was rather similar across countries, except between the Republic of Korea and Indonesia. In 2000, this changed. Currently, the Republic of Korea and Indonesia appear to be more correlated than in 1975. Although not statistically significant, currently, the Republic of Korea and Malaysia do not appear to correlate as in 1975. The same applies to the Republic of Korea and Thailand. At 90 per cent level of significance, it appears that the Republic of Korea and the Philippines also do not correlate as much as they did in 1975.

The production structure in the Republic of Korea and Indonesia, in terms of the supply sector (table 13 and 14), were less similar in 1975 than in 2000. The correlation coefficient between the Republic of Korea and the Philippines did not change significantly and was quite similar in both years. The production structure in the Republic of Korea and Malaysia, in terms of FL, correlated more in 1975 than in 2000. The same applies to the Republic of Korea and Thailand.

Table 11. Total backward linkages, 1975

	Indonesia	**Republic of Korea**	**Malaysia**	**Philippines**	**Thailand**
Indonesia	1.000000				

Republic of Korea	0.470652	1.000000			
	2.133706	-----			
	0.0487	-----			
Malaysia	0.578389	0.813886	1.000000		
	2.836073	5.603105	-----		
	0.0119	0.0000	-----		
Philippines	0.507414	0.798870	0.809141	1.000000	
	2.355403	5.312481	5.507974	-----	
	0.0316	0.0001	0.0000	-----	
Thailand	0.629956	0.871365	0.909054	0.903446	1.000000
	3.244557	7.103959	8.726664	8.429595	-----
	0.0051	0.0000	0.0000	0.0000	-----

Source: UNIDO calculations based on IDE input-output tables, 2009.
Notes: Covariance analysis: Ordinary; Date: 09/02/09 Time: 13:57; Sample: 1 18; Included observations: 18; Correlation; t-Statistic; Probability

Table 12. Total backward linkages, 2000

	Indonesia	Republic of Korea	Malaysia	Philippines	Thailand
Indonesia	1.000000				

Republic of Korea	0.554345	1.000000			
	2.664202	-----			
	0.0170	-----			
Malaysia	0.530594	0.301460	1.000000		
	2.503908	1.264672	-----		
	0.0235	0.2241	-----		
Philippines	0.596422	0.400015	0.466802	1.000000	
	2.972187	1.745819	2.111361	-----	
	0.0090	0.1000	0.0508	-----	
Thailand	0.433443	0.295761	0.457036	0.323326	1.000000
	1.923887	1.238450	2.055368	1.366711	-----
	0.0723	0.2334	0.0565	0.1906	-----

Source: UNIDO calculations based on IDE input-output tables, 2009.
Notes: Covariance analysis: Ordinary; Date: 09/02/09 Time: 14:26; Sample: 1 18; Included observations: 18; Correlation; t-Statistic; Probability.

Table 13. Total forward linkages, 1975

	Indonesia	Republic of Korea	Malaysia	Philippines	Thailand
Indonesia	1.000000				

Republic of Korea	0.456130	1.000000			
	2.050223	-----			
	0.0571	-----			
Malaysia	0.457877	0.765012	1.000000		
	2.060150	4.751506	-----		
	0.0560	0.0002	-----		
Philippines	0.785608	0.781033	0.548623	1.000000	
	5.078885	5.002703	2.624770	-----	
	0.0001	0.0001	0.0184	-----	
Thailand	0.545476	0.864070	0.762646	0.705121	1.000000
	2.603312	6.866262	4.716314	3.977622	-----
	0.0192	0.0000	0.0002	0.0011	-----

Source: UNIDO calculations based on IDE input-output tables, 2009.
Notes: Covariance analysis: Ordinary; Date: 09/08/09 Time: 15:07; Sample: 1 18; Included observations: 18; Correlation; t-Statistic; Probability.

Table 14. Total forward linkages, 2000

	Indonesia	Republic of Korea	Malaysia	Philippines	Thailand
Indonesia	1.000000				

Republic of Korea	0.679371	1.000000			
	3.703326	-----			
	0.0019	-----			
Malaysia	0.763954	0.628735	1.000000		
	4.735704	3.234154	-----		
	0.0002	0.0052	-----		
Philippines	0.801964	0.785158	0.750976	1.000000	
	5.369938	5.071291	4.549099	-----	
	0.0001	0.0001	0.0003	-----	
Thailand	0.789307	0.782197	0.650186	0.710968	1.000000
	5.142068	5.021874	3.423042	4.044041	-----
	0.0001	0.0001	0.0035	0.0009	-----

Source: UNIDO calculations based on IDE input-output tables, 2009.
Notes: Covariance analysis: Ordinary; Date: 09/08/09 Time: 15:10; Sample: 1 18; Included observations: 18; Correlation; t-Statistic; Probability.

The detailed analysis of total BL and FL in the manufacturing sector shows which sectors have above average values of linkages.[6] As already determined earlier, the Republic of Korea had the highest average level of BL throughout the period. This can also be determined on the basis of detailed analysis, as demonstrated in table 15. In the Republic of Korea, practically the entire manufacturing sector registered above average linkages, except for the petroleum and petroleum products sector. In terms of FL, an above average value can be found in sectors such as lumber and wooden products; pulp, paper and printing; chemical products; petroleum and its products; non-metallic mineral products; metal products; and other manufacturing products. As established earlier, Indonesia also had relatively high BL. Except for machinery, practically all the sectors had above average BL. The levels of total BL throughout the period have been changing much more in the Republic of Korea, where there was much more consistency with regard to BL. In the pulp, paper and printing; and chemical products sectors, BL has been decreasing, whereas it has been increasing in the transport equipment; and other manufacturing products sector. In terms of FL, the structure of the economy was rather similar in the Republic of Korea, but levels of FL were lower in Indonesia (table 16).

[6] Average values have been calculated on the basis of all sectors in the economy.

Generally speaking, one can observe a rather similar production structure regarding BL in Malaysia, Philippines and Thailand. Sectors such as food, beverage and tobacco; textiles, leather, and leather products; lumber and wooden products; pulp, paper and printing; chemical products; rubber products; non-metallic mineral products; metal products; machinery; transport equipment; and other manufacturing products *(*in Malaysia also petroleum and petroleum products) also had above average value in 2000. Similarity in the structure is also observed with respect to FL.

Table 15. Total backward linkages, selected years

	1975	1985	1990	1995	2000	1975	1985	1990	1995	2000
	Indonesia					**Republic of Korea**				
Food, beverage and tobacco	1.84	1.96	1.93	1.89	1.92	2.00	2.11	2.13	2.01	2.10
Textile, leather, and the products thereof	1.78	1.85	1.87	1.88	1.80	2.19	2.22	2.19	1.89	2.04
Lumber and wooden products	1.75	1.84	1.76	1.96	1.90	1.55	1.67	1.69	1.74	1.88
Pulp, paper and printing	1.35	1.57	1.87	1.79	1.63	1.88	2.07	2.01	1.89	2.10
Chemical products	1.52	1.48	1.62	1.61	1.62	1.84	1.83	1.86	1.80	1.96
Petroleum and its products	1.83	1.73	1.67	1.55	1.41	1.23	1.24	1.30	1.20	1.16
Rubber products	1.93	1.99	1.94	2.15	1.66	1.92	1.92	1.98	1.80	1.87
Non-metallic mineral products	1.49	1.78	1.80	1.75	1.70	1.89	1.94	1.86	1.92	1.99
Metal products	1.45	1.62	1.73	1.64	1.76	2.10	2.27	2.21	2.12	2.16
Machinery	1.22	1.31	1.34	1.52	1.61	1.78	1.88	1.91	1.80	1.81
Transport equipment	1.31	1.56	1.58	1.57	1.71	1.81	1.99	2.14	2.06	2.34
Other manufacturing products	1.37	1.34	1.49	1.68	1.65	1.92	2.04	2.05	1.94	2.12
Average	1.47	1.61	1.66	1.67	1.65	1.73	1.80	1.84	1.77	1.84
	Malaysia					**Philippines**				
Food, beverage and tobacco	1.81	1.93	2.23	1.91	2.15	1.95	1.96	1.94	1.85	1.86
Textile, leather, and the products thereof	1.62	1.67	1.67	1.60	1.60	1.79	1.62	1.47	1.36	1.35
Lumber and wooden products	1.62	1.97	2.16	1.77	1.86	1.96	2.11	1.91	1.62	1.61
Pulp, paper and printing	1.43	1.43	1.66	1.53	1.60	1.54	1.82	1.61	1.38	1.43
Chemical products	1.76	1.54	1.85	1.60	1.85	1.63	1.72	1.66	1.40	1.56
Petroleum and its products	1.06	1.51	1.54	1.43	1.65	1.17	1.21	1.09	1.06	1.17
Rubber products	1.79	1.75	1.63	1.52	1.78	1.74	1.54	1.77	1.55	1.30
Non-metallic mineral products	1.49	1.63	1.40	1.41	1.72	1.85	1.78	1.82	1.55	1.81
Metal products	1.71	1.63	1.51	1.52	1.48	1.64	1.99	1.71	1.59	1.57
Machinery	1.51	1.31	1.55	1.37	1.30	1.90	1.37	1.42	1.39	1.19
Transport equipment	1.64	1.26	1.39	1.41	1.51	1.71	1.54	1.54	1.59	1.64
Other manufacturing products	1.30	1.49	1.38	1.50	1.49	1.75	1.54	1.36	1.29	1.30
Average	1.48	1.52	1.62	1.51	1.60	1.64	1.61	1.57	1.45	1.47
	Thailand									
Food, beverage and tobacco	1.93	2.01	1.90	1.92	1.95					
Textile, leather, and the products thereof	1.93	2.00	1.87	1.86	1.91					
Lumber and wooden products	1.84	1.70	1.60	1.55	1.49					
Pulp, paper and printing	1.64	1.67	1.39	1.46	1.52					
Chemical products	1.63	1.57	1.64	1.67	1.65					
Petroleum and its products	1.14	1.22	1.12	1.10	1.14					
Rubber products	1.79	1.93	1.83	1.79	1.92					
Non-metallic mineral products	1.78	1.84	1.79	1.75	1.68					
Metal products	1.74	1.71	1.50	1.37	1.46					
Machinery	1.60	1.49	1.35	1.35	1.37					
Transport equipment	1.65	1.70	1.38	1.48	1.54					
Othermanufacturing products	1.46	1.49	1.59	1.67	1.65					
Average	1.59	1.66	1.57	1.57	1.62					

Source: UNIDO calculations based on IDE input-output tables, 2009

Table 16. Total forward linkages, selected years

	1975	1985	1990	1995	2000	1975	1985	1990	1995	2000
	Indonesia					**Republic of Korea**				
Food, beverage and tobacco	1.16	1.22	1.24	1.33	1.44	1.24	1.43	1.55	1.56	1.66
Textile, leather, and the products thereof	1.64	1.70	1.56	1.57	1.40	1.63	1.70	1.72	1.43	1.52
Lumber and wooden products	2.00	1.55	1.47	1.57	1.35	1.71	2.07	1.90	1.92	2.08
Pulp, paper and printing	1.65	2.14	2.43	2.31	1.80	2.45	2.74	2.83	2.57	2.71
Chemical products	1.79	2.07	2.19	2.28	1.75	2.37	2.46	2.48	2.29	2.53
Petroleum and its products	1.62	1.98	2.07	2.26	1.85	2.47	2.55	2.59	2.28	2.11
Rubber products	1.45	2.10	2.09	2.16	1.88	1.61	1.35	1.45	1.81	1.94
Non-metallic mineral products	2.12	2.07	1.98	2.01	1.79	2.03	2.35	2.46	2.44	2.53
Metal products	1.79	1.98	2.16	2.03	1.82	2.47	2.61	2.72	2.59	2.70
Machinery	1.54	1.59	1.80	1.84	1.20	1.44	1.54	1.52	1.50	1.48
Transport equipment	1.46	1.74	1.57	1.59	1.81	1.42	1.28	1.53	1.46	1.50
Other manufacturing products	1.67	1.71	1.59	1.52	1.33	1.31	1.71	1.94	1.99	2.09
Average	1.57	1.72	1.75	1.78	1.62	1.80	1.95	2.04	1.95	2.03
	Malaysia					**Philippines**				
Food, beverage and tobacco	1.29	1.30	1.99	1.47	1.91	1.25	1.38	1.29	1.17	1.31
Textile, leather, and the products thereof	1.53	1.39	1.47	1.25	1.30	1.46	1.52	1.40	1.30	1.24
Lumber and wooden products	1.48	1.64	1.53	1.16	1.28	1.91	1.64	1.67	1.44	1.47
Pulp, paper and printing	1.79	2.10	2.17	2.17	2.04	1.98	2.25	2.34	2.07	2.18
Chemical products	1.85	1.53	1.49	1.52	1.68	2.05	2.08	2.30	2.08	1.99
Petroleum and its products	2.10	1.73	1.82	1.49	1.78	2.07	2.39	2.34	2.21	2.39
Rubber products	1.11	1.42	1.93	1.58	1.22	1.81	1.80	2.07	1.88	1.83
Non-metallic mineral products	2.08	2.07	2.08	2.11	1.99	1.84	2.35	2.21	2.07	2.16
Metal products	1.35	1.74	1.94	1.97	1.84	2.03	1.84	1.90	1.88	2.14
Machinery	1.14	1.24	1.20	1.10	1.10	1.37	1.06	1.25	1.15	1.03
Transport equipment	1.47	1.33	1.41	1.29	1.48	1.55	1.48	1.44	1.46	1.04
Other manufacturing products	1.38	1.56	1.30	1.67	1.38	1.53	1.33	1.88	1.62	1.18
Average	1.58	1.57	1.65	1.59	1.59	1.65	1.72	1.79	1.66	1.65
	Thailand									
Food, beverage and tobacco	1.30	1.41	1.50	1.50	1.48					
Textile, leather, and the products thereof	1.78	1.78	1.60	1.55	1.46					
Lumber and wooden products	1.78	1.80	1.57	1.46	1.30					
Pulp, paper and printing	1.99	2.42	2.25	2.14	2.14					
Chemical products	1.81	1.75	1.83	1.84	1.87					
Petroleum and its products	2.41	2.58	2.44	2.28	2.17					
Rubber products	1.65	1.98	1.76	1.87	1.68					
Non-metallic mineral products	2.01	1.97	2.17	2.07	1.71					
Metal products	2.03	1.83	1.91	1.79	1.55					
Machinery	1.95	1.55	1.36	1.31	1.25					
Transport equipment	1.49	1.72	1.33	1.37	1.60					
Other manufacturing products	1.32	1.42	1.31	1.32	1.35					
Average	1.74	1.83	1.78	1.75	1.71					

Source: UNIDO calculations based on IDE input-output tables, 2009.

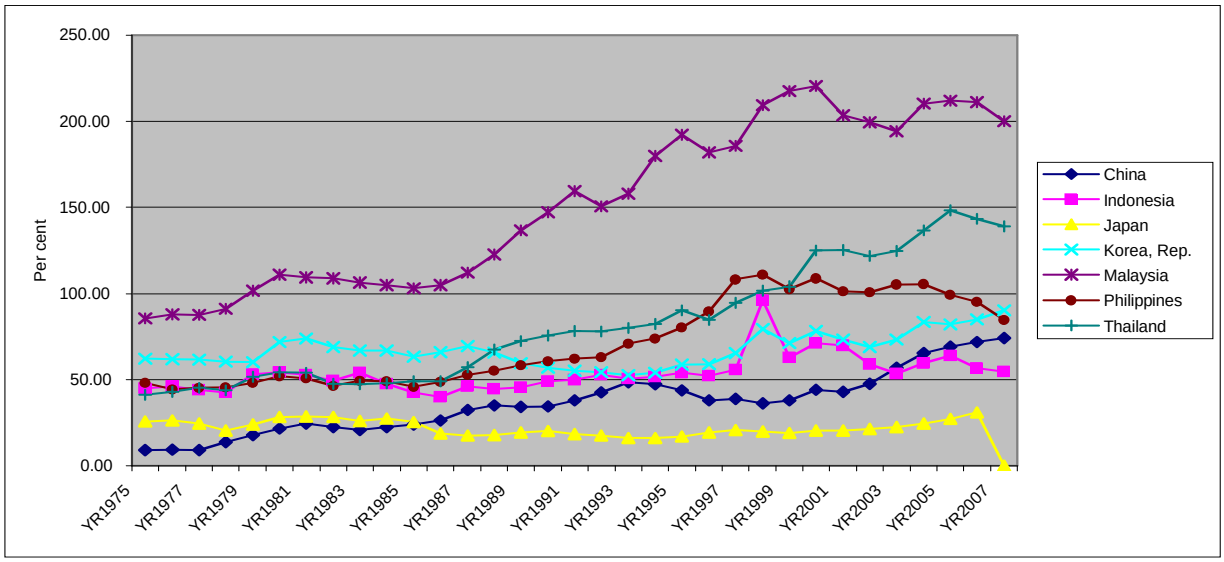
In order to draw relevant conclusions, based on established patterns of resource allocation as well as input-output analysis, additional country-specific analysis was conducted. It also shed more light on some of the key points and reasons for the aforementioned divergence.

4. Country-specific Analysis

Before concluding, based on the paper's results and other information, this section discusses the main themes of this paper—factors that have contributed to the diverging paths of development among the five Asian countries—using the most successful country, the Republic of Korea, as the benchmark.

Deviations from the estimated expected levels of output, consumption, imports and exports explain the differences in the production and demand structures. The external orientation of Malaysia, Thailand and the Philippines is confirmed by their relatively high share of outputs going to foreign intermediate uses or foreign final consumption. As shown in figure 8, the share of trade in GDP for these countries has been usually higher than Indonesia or the Republic of Korea. The larger the population, the lower the share of trade. Thus, the size effect may have contributed to the lower share of trade in GDP in Indonesia. However, given the smaller population size in the Republic of Korea than that in Thailand and the Philippines, external orientation of the latter two economies relative to the Republic of Korea is even more evident here.

Figure 8. Share of trade in GDP



Source: WDI database.

Table 17 shows the real growth of GDP and GDP per capita of the countries for the period covered in this paper, with intervals corresponding to the years of the input-output data used here.

Table 17. Real GDP and GDP per capita growth

GDP growth	Whole	1975-1985	1985-1990	1990-1995	1995-2000	2000-2007
Indonesia	0.0581	0.0677	0.0713	0.0787	0.0070	0.0506
Rep. of Korea	0.0730	0.0738	0.0964	0.0781	0.0438	0.0468
Malaysia	0.0694	0.0681	0.0686	0.0947	0.0479	0.0512
Philippines	0.0309	0.0233	0.0473	0.0217	0.0393	0.0497
Thailand	0.0650	0.0671	0.1031	0.0862	0.0045	0.0509
GDP per capita growth	**Whole**	**1975-1985**	**1985-1990**	**1990-1995**	**1995-2000**	**2000-2007**
Indonesia	0.0396	0.0459	0.0524	0.0619	-0.0066	0.0373
Rep. of Korea	0.0608	0.0583	0.0856	0.0673	0.0351	0.0425
Malaysia	0.0423	0.0421	0.0383	0.0669	0.0226	0.0316
Philippines	0.0067	-0.0026	0.0226	-0.0013	0.0177	0.0288
Thailand	0.0497	0.0474	0.0886	0.0737	-0.0061	0.0428

Source: UNIDO calculations based on WDI.

Malaysia

Arguably, Malaysia is the second most successful country among the five, and can in fact be compared with the Republic of Korea, in terms of GDP per capita at the beginning of the 1960s (figure 5). The subsequent diversion of development between the two countries was not so much due to the difference in their "growth"—meant here as production volume expansion—but can be attributed more to differences in the production structure and social transformations.

Table 18. Annual average growth of manufacturing output and value added, 1975-2000

	Malaysia	Republic of Korea	Indonesia	Thailand	Philippines
Manufacturing output growth	0.1107	0.0950	0.0801	0.0817	0.0359
Manufacturing value added growth	0.1025	0.1066	0.1064	0.0883	0.0248

Source: UNIDO calculations based on WDI database and IDE data

Note: The output data from the IDE input-output tables were deflated by the MVA deflators in order to have estimates for the constant output growth rates.

Malaysia outpaced the Republic of Korea in terms of manufacturing output, as shown in table 18. Output growth in of Malaysia has been accelerating since 1985 as the country was rapidly integrated into international economy, as shown in figure 8. It experienced more than 15 per cent annual average growth until 1995—a few years before the Asian financial crisis. However, such rapid output growth did not

correspond with the pace of value added growth (table 18). As discussed in the linkage analysis earlier, weak domestic production linkages in Malaysia in comparison with the Republic of Korea seem to have contributed to the lack of value added capabilities in the former (table 19).

Table 19. Comparison of production linkages between the Republic of Korea and Malaysia

		Agriculture, forestry and fishing	Mining and quarrying	Manufacturing	Electricity, gas, water supply	Construction	Services + trade and transport	Public administration
2000	Total	1.6277	1.5960	1.9349	1.5475	1.9570	1.5607	1.4513
Rep. of Korea	VR	0.6250	0.6344	0.2769	0.4630	0.4404	0.6184	0.6848
	TV	0.8810	0.9091	0.6410	0.7001	0.8220	0.8857	0.8896
	Total	1.4480	1.2084	1.4935	1.4244	1.6635	1.3838	1.5323
Malaysia	VR	0.6149	0.7382	0.2286	0.6150	0.3078	0.5903	0.4484
	TV	0.8002	0.8453	0.4339	0.8059	0.5669	0.7789	0.6923
1995	Total	1.5544	1.5062	1.8880	1.6360	1.9732	1.5003	1.5666
Rep. of Korea	VR	0.6563	0.6851	0.3185	0.4895	0.4156	0.6558	0.6009
	TV	0.9049	0.9286	0.6969	0.7775	0.8403	0.9129	0.8566
	Total	1.2938	1.1609	1.5055	1.4172	1.7090	1.5079	1.5277
Malaysia	VR	0.6906	0.8540	0.3142	0.6334	0.2680	0.6179	0.5513
	TV	0.8367	0.9329	0.5554	0.8227	0.5782	0.8601	0.7649
1990	Total	1.5748	1.5688	2.0166	1.5615	1.9493	1.5210	1.6727
Rep. of Korea	VR	0.6577	0.6742	0.2762	0.5258	0.4596	0.6638	0.5554
	TV	0.9088	0.9270	0.6932	0.7907	0.8490	0.9147	0.8374
	Total	1.3768	1.2374	1.7309	1.5015	1.9910	1.5060	1.5063
Malaysia	VR	0.6926	0.8079	0.3018	0.6006	0.2075	0.6374	0.5966
	TV	0.8641	0.9288	0.6507	0.8340	0.6280	0.8918	0.8351
1985	Total	1.5753	1.6745	1.9812	1.5886	2.0513	1.5442	1.0000
Rep. of Korea	VR	0.6584	0.6152	0.2475	0.5963	0.3989	0.6515	1.0000
	TV	0.9020	0.8983	0.6364	0.8216	0.8071	0.8930	1.0000
	Total	1.3666	1.1411	1.6742	1.6537	1.7145	1.3846	1.0000
Malaysia	VR	0.6979	0.8613	0.2944	0.3731	0.2832	0.6234	1.0000
	TV	0.8748	0.9342	0.6434	0.6591	0.6143	0.8125	1.0000
1975	Total	1.3540	1.4698	1.9264	2.0435	2.0580	1.5297	1.0000
Rep. of Korea	VR	0.7636	0.6942	0.2257	0.3293	0.3661	0.6641	1.0000
	TV	0.9317	0.9034	0.6517	0.7502	0.7963	0.9068	1.0000
	Total	1.2387	1.1616	1.6776	1.6169	1.8814	1.3223	1.0000
Malaysia	VR	0.8061	0.8528	0.3409	0.4468	0.2616	0.7212	1.0000
	TV	0.9291	0.9425	0.7699	0.7485	0.7115	0.9046	1.0000

Source: UNIDO calculations based on IDE input-output data.

Notes: Total indicates the total (including direct and indirect) linkage effects of the sector, which are expressed as the amount of expected output increase in the economy due to one dollar increase in the production of the sector. VR stands for the value added ratios of the sectors, which are calculated as total value added of a sector divided by total output of that sector. TV means the expected increase of value added in the economy due to the total effects (including direct and indirect) of one dollar increase in the production of the sector.

The manufacturing sector of the Republic of Korea had higher domestic linkages than Malaysia throughout the period 1975 to 2000. The country's high manufacturing linkages did not raise the economy's value added as much as expected by its high domestic linkages until 1985, due to the low value

added ratios. However, the low value added per dollar output increase was compensated by the rapid increase in output volume during the same period. In other words, the country's manufacturing sector was probably able to competitively price its products by keeping the returns to production factor (value added) relatively low. Yet due to the high domestic linkages, the country was able to increase the valued added of the economy more than countries with lower production linkages expected.

This is not the case with Malaysia. Once the country's value added ratios started declining, the manufacturing sector's per dollar impact on the country's total value added decreased substantially due to low domestic linkages. Considering the period's correspondence with the rapid increase in the country's share of foreign trade, its participation in international production and the resultant production volume expansion were likely to be supported by keeping wage and profit levels low and substantially increasing imports rather than domestic processing. As long as growth in international demand for the country's processed products continues, quantitative expansion can sustain the country's economic growth. However, growth in terms of value added, that is GDP, cannot be expected to be as high as that of the Republic of Korea, where real GDP and per capita grew faster even in 1987, when it was at the development level that Malaysia is currently in, unless Malaysia increases its output growth, and/or strengthens its domestic production linkages. It is not easy to achieve either of them as Malaysia's output growth rate is already very high, relative to the region's comparators. Besides, the country's international integration, by definition, entails increasing international linkages rather than, if not at the cost of, domestic linkages.

Malaysia's development prospects hinge largely on the two factors. First, a decline in population growth would help to increase GDP per capita growth. As can be seen in table 20, Malaysia's population growth rate between 1975 and 2000 was the highest among the five countries. This pushed down the per capita growth rate despite the high growth of the economy as a whole. Secondly, as discussed above, the weakness of the Malaysian economy is its reliance on quantitative expansion rather than qualitative deepening of production. Overcoming this seems more challenging than decreasing population growth. The problem here is the production structure which has been probably facilitated by the economy's external orientation. The objective of this paper is not to suggest what is needed to improve the situation. To say the least, Malaysia needs to strengthen its technological capabilities in order to improve the

stagnant productivity growth and enable the country to engage in higher value-added tasks in international production chain.[7]

Table 20. Population growth rates

Population growth	1975-2000	1975-1985	1985-1990	1990-1995	1995-2000
Indonesia	0.0178	0.0209	0.0180	0.0158	0.0136
Republic of Korea	0.0115	0.0147	0.0099	0.0102	0.0084
Malaysia	0.0260	0.0249	0.0292	0.0261	0.0248
Philippines	0.0249	0.0273	0.0255	0.0231	0.0212
Thailand	0.0157	0.0221	0.0152	0.0119	0.0072

Source: UNIDO calculations based on WDI database.

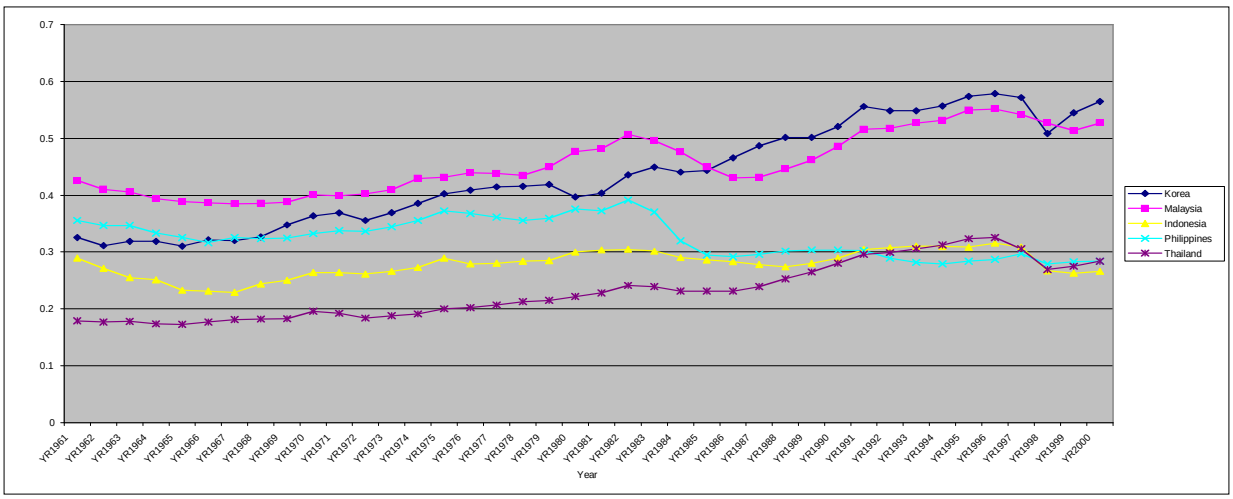
Thailand

Starting with a very low level of development—40 per cent—and half the GDP per capita of Malaysia and the Philippines, respectively, at the beginning of 1960s (figure 5), Thailand has grown at a rapid pace, when compared with Malaysia's rapid quantitative expansion (table 21). In terms of qualitative deepening, there are indications that Thailand performed even better than Malaysia during the last quarter of the twentieth century. However, the level of the country's productivity was the lowest among the five countries in 1961, and was less than 20 per cent that of the United States (figure 9). Nevertheless, during the following 40 years, Thai productivity grew by 47 per cent, faster than the other four countries, albeit a substantial productivity gap with the Republic of Korea and Malaysia still exists.

In terms of the production structure, although domestic linkages have been lower than that of the Republic of Korea, overall Thailand has maintained a fairly high level of linkages relative to other Southeast Asian countries. Moreover, due to its high value added ratio, the impact of the increase in manufacturing production on total value added was higher than that of the Republic of Korea in earlier years and, since the reversal, the gap remained smaller than that between the Republic of Korea and Malaysia.

[7] Based on UNIDO world productivity database, between 1975 and 2000, the productivity growth of Malaysia was only 12 per cent, which was lower than that of the Republic of Korea and Thailand.

Figure 9. Changes in the productivity level with reference to the United States



Source: UNIDO World Productivity Database.

Thus, in terms of growth and production linkages (table 17 and 21), Thailand's performance can be compared with that of the Republic of Korea, and was probably better than that of Malaysia. The reason why Thailand did not succeed in closing the GDP per capita gap with the Republic of Korea and Malaysia, is due to differences in the initial stage of development. If a country starts at a much lower level of GDP per capita—assuming all other conditions are constant—growing at the same rate as countries with a higher initial level of GDP per capita will not close but increase the gap with them.

The above discussion points that Thailand's prospects of catching up with the region's more developed countries depend on whether it can grow faster than them without eroding domestic linkages too much. This presents tremendous challenges to Thailand as the country's growth rate has decreased along with the region's growth trend following the Asian financial crisis. When the Republic of Korea and Malaysia were at Thailand's current level of GDP per capita in 1975 and 1990, respectively, they were growing faster than Thailand currently is. If it is to catch up with the more advanced countries, Thailand cannot afford to follow the regional growth trend. It would have to sustain its fast growth rate of the 1980s and 1990s—prior to the Asian financial crisis—even if growth in the more mature economies is slow.

Table 21. Comparison of production linkages between the Republic of Korea and Thailand

		Agriculture, forestry and fishing	Mining and quarrying	Manu-facturing	Electricity, gas, water supply	Construction	Services + trade and transport	Public administration
2000	Total	1.6277	1.5960	1.9349	1.5475	1.9570	1.5607	1.4513
Rep. of Korea	VR	0.6250	0.6344	0.2769	0.4630	0.4404	0.6184	0.6848
	TV	0.8810	0.9091	0.6410	0.7001	0.8220	0.8857	0.8896
	Total	1.5115	1.4599	1.6205	1.7528	1.8187	1.5297	1.9959
Thailand	VR	0.6201	0.7007	0.2811	0.5096	0.3118	0.6357	0.3579
	TV	0.8560	0.9198	0.5670	0.9122	0.6938	0.8825	0.8958
1995	Total	1.5544	1.5062	1.8880	1.6360	1.9732	1.5003	1.5666
Rep. of Korea	VR	0.6563	0.6851	0.3185	0.4895	0.4156	0.6558	0.6009
	TV	0.9049	0.9286	0.6969	0.7775	0.8403	0.9129	0.8566
	Total	1.4489	1.4599	1.6368	1.7357	1.7116	1.4774	1.5955
Thailand	VR	0.6438	0.6747	0.3172	0.5228	0.3860	0.6490	0.5953
	TV	0.8659	0.9071	0.6239	0.9116	0.7235	0.8938	0.9060
1990	Total	1.5748	1.5688	2.0166	1.5615	1.9493	1.5210	1.6727
Rep. of Korea	VR	0.6577	0.6742	0.2762	0.5258	0.4596	0.6638	0.5554
	TV	0.9088	0.9270	0.6932	0.7907	0.8490	0.9147	0.8374
	Total	1.4401	1.3907	1.6569	1.8446	1.7185	1.4737	1.6176
Thailand	VR	0.6616	0.7226	0.3210	0.4730	0.3820	0.6477	0.5805
	TV	0.8807	0.9156	0.6409	0.9252	0.7186	0.8851	0.9115
1985	Total	1.5753	1.6745	1.9812	1.5886	2.0513	1.5442	1.0000
Rep. of Korea	VR	0.6584	0.6152	0.2475	0.5963	0.3989	0.6515	1.0000
	TV	0.9020	0.8983	0.6364	0.8216	0.8071	0.8930	1.0000
	Total	1.5682	1.5411	1.8216	1.9471	2.0997	1.5396	1.0000
Thailand	VR	0.6138	0.6454	0.3486	0.3961	0.2566	0.6281	1.0000
	TV	0.8939	0.9223	0.7536	0.8847	0.7909	0.8882	1.0000
1975	Total	1.3540	1.4698	1.9264	2.0435	2.0580	1.5297	1.0000
Rep. of Korea	VR	0.7636	0.6942	0.2257	0.3293	0.3661	0.6641	1.0000
	TV	0.9317	0.9034	0.6517	0.7502	0.7963	0.9068	1.0000
	Total	1.3307	1.2436	1.7951	1.9214	1.8838	1.4406	1.0000
Thailand	VR	0.7703	0.8269	0.3257	0.4281	0.3624		1.0000
	TV	0.9567	0.9550	0.7953	0.8741	0.8271	0.9476	1.0000

Source: UNIDO calculations based on IDE input-output data.
Note: For explanation, refer to the Notes given in table 19.

Keeping domestic production linkages and the share of local value added in output at a reasonably high level is equally crucial for Thailand, otherwise it would need to produce even higher volumes of outputs to attain the same GDP growth rate. In this regard, the continuous decrease in per dollar effect of Thai manufacturing production on total value added is alarming (table 21). As in Malaysia, the internationalization of the economy seems to have coincided with the downward movement of domestic value added (figure 8 and table 21). International trade could play an important role in increasing Thai production and will enhance economic growth, although that could raise the share of imported inputs in manufactured products. Overcoming this dilemma is the key for the future success of Thailand.

Indonesia

Starting with the lowest GDP per capita among the five countries in 1960, over the 40 years the country essentially succeeded in closing the gap with the Philippines, where GDP per capita in 1960 was three

times bigger. Although output growth was mediocre among the countries, Indonesia's high domestic linkages helped to achieve a comparable rate of manufacturing value added growth via-à-vis the Republic of Korea and Malaysia (tables 18 and 22). Thus, in the case of Indonesia, productivity growth rather than the linkage structure was the main factor that contributed to keeping the country behind the Republic of Korea, Malaysia and Thailand. Despite the large population of the country, which was more than twice the size of the second largest in the group, the pace of manufacturing output growth was so slow that the output level was smaller than that of the Republic of Korea, Malaysia and Thailand in 2000.

As evident in table 1, the production level of many sectors in Indonesia was lower than the outputs estimated, based on the country's income, size and natural resource availability. Furthermore, table 2 indicated that Indonesia's production structure of the manufacturing sector was different—albeit at a 10 per cent significance level—from the Republic of Korea, Malaysia and the Philippines, which tended to have higher-than-normal output levels for sectors with a high degree of processing.

Indonesia had relatively higher production shares in resource-based and low-technology subsectors (Appendices 1 and 2), while the share of the country's major exports in world exports are generally declining (Appendix 3). Considering these points together with the structural and linkage analyses in this paper, the situation of the Indonesian economy can be described as follows. Given the rich labour and natural resource endowments of the country, it had enormous comparative advantages for producing labour-intensive and resource-based products. Though growth in world demand for these products was relatively low, which probably contributed to the slow growth of the country's outputs, they allowed Indonesia to make good use of their own resources for production, resulting in high domestic linkages and total value added (table 22). However, to enhance economic growth, the country needs to shift production to sectors that have a higher growth potential, but doing so might compromise domestic linkages. Usually such a shift requires a country to specialize in tasks in fast-growing sectors where the country has an advantage. This would increase imports as well as exports, while generating limited domestic value added. Thus, given the low productivity level of Indonesia (figure 9), even if such a shift is possible, the external orientation and specialization in tasks in growing sectors could drastically reduce domestic linkages and engender only limited impact on the GDP growth. Hence, the key for the future of the Indonesian economy is to develop and promote new products within subsectors that use abundant domestic resources and not shift to fast-growing and technologically-distant subsectors.

Table 22. Comparison of production linkages between the Republic of Korea and Indonesia

		Agriculture, forestry and fishing	Mining and quarrying	Manu-facturing	Electricity, gas, water supply	Construction	Services + trade and transport	Public administration
2000	Total	1.6277	1.5960	1.9349	1.5475	1.9570	1.5607	1.4513
Rep. of Korea	VR	0.6250	0.6344	0.2769	0.4630	0.4404	0.6184	0.6848
	TV	0.8810	0.9091	0.6410	0.7001	0.8220	0.8857	0.8896
	Total	1.3567	1.2559	1.7627	1.9184	1.7904	1.5613	1.4855
Indonesia	VR	0.7393	0.7854	0.3539	0.2877	0.3508	0.6020	0.6456
	TV	0.9309	0.9635	0.7767	0.8964	0.7634	0.8941	0.8876
1995	Total	1.5544	1.5062	1.8880	1.6360	1.9732	1.5003	1.5666
Rep. of Korea	VR	0.6563	0.6851	0.3185	0.4895	0.4156	0.6558	0.6009
	TV	0.9049	0.9286	0.6969	0.7775	0.8403	0.9129	0.8566
	Total	1.2908	1.2554	1.7912	1.7682	1.9298	1.5082	1.4302
Indonesia	VR	0.8135	0.8143	0.3585	0.4792	0.3449	0.6614	0.7003
	TV	0.9704	0.9771	0.8207	0.9194	0.8490	0.9373	0.9270
1990	Total	1.5748	1.5688	2.0166	1.5615	1.9493	1.5210	1.6727
Rep. of Korea	VR	0.6577	0.6742	0.2762	0.5258	0.4596	0.6638	0.5554
	TV	0.9088	0.9270	0.6932	0.7907	0.8490	0.9147	0.8374
	Total	1.2805	1.2656	1.7780	2.0462	1.9388	1.4632	1.3894
Indonesia	VR	0.8083	0.8031	0.3324	0.3278	0.3013	0.6779	0.7013
	TV	0.9683	0.9769	0.8028	0.8622	0.8036	0.9301	0.9006
1985	Total	1.5753	1.6745	1.9812	1.5886	2.0513	1.5442	1.0000
Rep. of Korea	VR	0.6584	0.6152	0.2475	0.5963	0.3989	0.6515	1.0000
	TV	0.9020	0.8983	0.6364	0.8216	0.8071	0.8930	1.0000
	Total	1.2172	1.2194	1.7884	2.3609	1.9051	1.4457	1.0000
Indonesia	VR	0.8564	0.8317	0.3101	0.2196	0.3484	0.6983	1.0000
	TV	0.9765	0.9800	0.8282	0.8607	0.8445	0.9352	1.0000
1975	Total	1.3540	1.4698	1.9264	2.0435	2.0580	1.5297	1.0000
Rep. of Korea	VR	0.7636	0.6942	0.2257	0.3293	0.3661	0.6641	1.0000
	TV	0.9317	0.9034	0.6517	0.7502	0.7963	0.9068	1.0000
	Total	1.1136	1.0568	1.7192	1.5227	1.6392	1.3557	1.0000
Indonesia	VR	0.9119	0.9582	0.3013	0.5085	0.3646	0.7210	1.0000
	TV	0.9830	0.9902	0.8302	0.7872	0.7580	0.9273	1.0000

Source: UNIDO calculations based on IDE input-output data.
Note: For explanation, refers to Notes given in table 19.

Philippines

If the Republic of Korea was the East Asian miracle par excellence, then the Philippines was the country which did not share in the high performance of the East Asian region in the twentieth century. The country's development lagged far behind, increasing the GDP per capita gap not only with the Republic of Korea but also with the other three countries. There were multiple causes that contributed to have such slow development—average annual GDP per capita growth rate of less than 1 per cent. Indeed, the Philippines exhibited weaknesses on most of the issues discussed in this paper.

As shown in table 18, between 1975 and 2000, output growth of the Philippines was much lower than that of the other countries. On top of this, the decline in domestic linkages over the years, as evidenced in table 23, further reduced the impact of production on the valued added of the economy. The decline in the total linkage effect of the manufacturing sector was the largest among the five countries, and in 2000 demand

inducement effects of the service sector almost matches those of the manufacturing sector. The economy could no longer be described as driven by the manufacturing sector. As seen in figures 3 and 4, while the share of manufacturing remained stagnant since the beginning of the 1970s, the service sector has been rising ever since. At the same time, the share of agriculture was relatively higher than in other economies (figure 1). This shows that the Philippines might have already started the process of deindustrialization during its low stage of development.

As table 24 indicates, between 1985 and 2001, exports of the Philippines were solely due to a passive factor, one of meeting the demands for their existing products. There were no significant changes in the export volume due to an increase in the market share of exporting commodities or diversifying into new products. The declining share in major exports in world exports (Appendix 3), further bodes ill for the future growth of the country.

The decline in productivity could have been one of the main factors that contributed to the country's slow development. Productivity in comparison with the Untied States decreased since 1961, from 35 per cent to only 28 per cent the level of that of the United States (figure 9), indicating a further increase in the productivity gap between the two countries. During this period, GDP growth in the Philippines was lowest among the five countries. Low GDP growth, coupled with the high population growth, resulted in a negligible GDP per capita growth (tables 17 and 20).

Table 23. Comparison of production linkages between the Republic of Korea and the Philippines

		Agriculture, forestry and fishing	Mining and quarrying	Manu-facturing	Electricity, gas, water supply	Construc tion	Services + trade/ and transport	Public administration
2000	Total	1.6277	1.5960	1.9349	1.5475	1.9570	1.5607	1.4513
Rep. of Korea	VR	0.6250	0.6344	0.2769	0.4630	0.4404	0.6184	0.6848
	TV	0.8810	0.9091	0.6410	0.7001	0.8220	0.8857	0.8896
	Total	1.3418	1.4202	1.4869	1.7871	1.4410	1.4629	1.3877
Philippines	VR	0.6923	0.5935	0.3148	0.3476	0.5585	0.6152	0.6868
	TV	0.8652	0.8073	0.5671	0.6708	0.7577	0.8446	0.8975
1995	Total	1.5544	1.5062	1.8880	1.6360	1.9732	1.5003	1.5666
Rep. of Korea	VR	0.6563	0.6851	0.3185	0.4895	0.4156	0.6558	0.6009
	TV	0.9049	0.9286	0.6969	0.7775	0.8403	0.9129	0.8566
	Total	1.4057	1.3603	1.6042	1.5477	1.5873	1.4407	1.4213
Philippines	VR	0.6910	0.5706	0.3202	0.5757	0.4756	0.6345	0.6508
	TV	0.9289	0.7403	0.6520	0.8197	0.7536	0.8615	0.8893
1990	Total	1.5748	1.5688	2.0166	1.5615	1.9493	1.5210	1.6727
Rep. of Korea	VR	0.6577	0.6742	0.2762	0.5258	0.4596	0.6638	0.5554
	TV	0.9088	0.9270	0.6932	0.7907	0.8490	0.9147	0.8374
	Total	1.4561	1.4101	1.7333	1.6016	1.7253	1.5045	1.4481
Philippines	VR	0.6753	0.5959	0.3181	0.5668	0.4391	0.6331	0.6476
	TV	0.9256	0.7881	0.7010	0.8373	0.7696	0.8879	0.8896
1985	Total	1.5753	1.6745	1.9812	1.5886	2.0513	1.5442	1.0000
Rep. of Korea	VR	0.6584	0.6152	0.2475	0.5963	0.3989	0.6515	1.0000
	TV	0.9020	0.8983	0.6364	0.8216	0.8071	0.8930	1.0000
	Total	1.4023	1.5263	1.7751	1.7623	1.8759	1.5250	1.0000
Philippines	VR	0.7318	0.5962	0.3360	0.4973	0.4530	0.6533	1.0000
	TV	0.9497	0.8624	0.7765	0.8536	0.8739	0.9282	1.0000
1975	Total	1.3540	1.4698	1.9264	2.0435	2.0580	1.5297	1.0000
Rep. of Korea	VR	0.7636	0.6942	0.2257	0.3293	0.3661	0.6641	1.0000
	TV	0.9317	0.9034	0.6517	0.7502	0.7963	0.9068	1.0000
	Total	1.2668	1.3936	1.8002	2.1290	2.0422	1.4639	1.0000
Philippines	VR	0.8104	0.7359	0.2714	0.3010	0.3144	0.6989	1.0000
	TV	0.9571	0.9282	0.7485	0.8296	0.8232	0.9513	1.0000

Source: UNIDO calculations based on IDE input-output data.

Note: For detailed explanation, refer to Notes given in table 19.

Table 24. East Asia: Impact of demand and competition changes on East Asian intraregional trade

Trader	Exports (thousands of dollars)			Factors underlying the (millions of dollars)*1985-2001 export change		
	1985	1995	2001	Demand factor	Competitive factor	Diversification
Brunei Darussalam	922	951	1,192	2,073	-1,796	-7
Cambodia	3	276	182	2	150	27
China	10,867	90,799	127,796	43,052	69,649	4,228
Hong Kong (SAR)	6,637	20,016	20,981	38,480	-29,183	5,047
Indonesia	1,953	12,008	17,155	4,516	9,473	1,213
Rep. of Korea	2,559	40,346	55,748	13,070	36,365	3,754
Lao P.D. Republic	17	190	220	18	71	114
Malaysia	6,844	37,642	46,759	23,367	11,417	5,131
Mongolia	4	111	242	53	185	0
Philippines	**1,071**	**4,645**	**14,736**	**12,979**	**536**	**150**
Singapore	6,032	38,979	41,806	25,678	5,594	4,502
Taiwan, Prov. of China	4,994	49,069	62,477	28,293	25,918	3,272
Thailand	1,982	17,548	24,359	9,172	10,156	3,049
Viet Nam	182	1,916	4,354	484	3,396	292

Source: The World Bank based on UN COMTRADE statistics.

* The demand factor isolates the effects of the increase or decrease in regional demand for other East Asian countries' exports. This factor shows the increase or decrease in exports that would have occurred had there been no change in the country's market shares from the 1990 or 1995 base period. The competitive factor shows the change in exports, *over or under that associated with demand changes,* due to changes in a country's import market shares. Any difference between the change in the total exports and the sum of these two factors is due to product diversification.

5. Conclusions

This paper deals with broad as well as specific structural changes in terms of the manufacturing sector. The purpose was to demonstrate the shift in domestic output, domestic consumption and international trade (resource allocation), affected by supply and demand variables. The cross-country analysis, based on cases studies in combination with changes that occur over time, is highly relevant in the field of economic development, particularly when trying to perceive those factors that determine per capita growth and factors that are needed to sustain such growth. Both points could have significant implications for poverty alleviation. Chenery and Syrquin (1975, p.3) highlighted the significance of cross-country comparison in research as "an essential part in understanding the process of economic and social development…Through such comparisons, uniform features of development can be identified and alternative hypothesis as to their causes tested."

On the basis of econometric regressions, a benchmark, or 'normal pattern of growth', was established, based on a single equation approach by Chenery in 1960. The impact of income, size and resource endowments in the resource allocation process, which involves domestic production, consumption and international trade, was measured. Using the pattern of growth and the actual values of the dependent variables, it was possible to calculate the relevant deviations and compare them among countries and, more specifically, across sectors. Looking at domestic production, it can be determined that (i) Asian countries have more positive than negative deviations in their manufacturing outputs, (ii) the incidence and magnitude of the positive deviations increased simultaneously between 1975 and 2000. Means and standard deviations reveal that despite some general regional similarities, differences between countries strongly indicate the stage of development at the respective levels of income, size and resource endowments. Estimations on consumption, imports and exports also reveal some significant aspects. Looking at international trade, the analysis reveals that Malaysia, Thailand and the Philippines were very active in international trade—in line with their stage of development, country size and availability of natural resources—which mainly reflects their integration into the global value chain and global production structures. On the one hand, the analysis shows that the production structure of the Republic of Korea and Indonesia differs from the other three countries. On the other hand, the analysis of Republic of Korea reveals mainly negative deviations in imports and positive deviations in output and consumption. Indonesia, for its part, shows negative deviations mainly in consumption together with the expected levels of output and imports, which strongly reflect the country's reliance on resource-based products, with limited processing for its higher-than-the normal level of exports.

Input-output analysis, to a large extent, confirms the results obtained through regression estimates. Countries were systematically analyzed and compared in terms of supply and demand. By applying this approach, on the basis on input-output tables, it was possible to determine the differences in domestic production structures, as well as the role each country plays in the global trading system. The pattern for the Republic of Korea and Indonesia reveals very strong interrelatedness among domestic sectors, which indicates the strength and potential of the domestic economy. At the same time, the pattern for Malaysia, Philippines and Thailand exhibits their increasingly important role as processing hubs for certain tasks in international production chains. Even though it was possible to clearly determine the patterns of structural change in each country, it cannot be concluded that domestic interrelatedness in conjunction with international trade is sufficient for sustainable long-term economic growth. Again, although this hypothesis seems to apply to the Republic of Korea, it does not fully apply to Indonesia, which has been lagging behind the Republic of Korea significantly, in terms of economic development, but nevertheless

has a high degree of domestic interrelatedness as well as a relatively strong presence in the global trading system.

As demonstrated in the paper, economic development can be identified with sustainable structural change, which can generate domestic technological capabilities and create linkages within domestic economies. Although, the significance of international trade cannot be undermined as such, its composition clearly matters and, if it leads to decreases in domestic linkages, it can lead to deterioration of long-term growth prospects.

References

Akamatsu K. (1962), "A historical pattern of economic growth in developing countries" *Journal of Developing Economies* 1(1):3-25.

Carter, A. P. (1970), "Structural change in the American economy" *Harvard University Press.*

Chenery, H. B. (1960), "Patterns of industrial growth" *The American Economic Review*, 50(4): 624-654.

Chenery, H. B. and Syrquin, M. (1975), "Patterns of development 1950–1970" *Oxford University Press.*

Chenery, H. B. and Watanabe, T. (1958), "International Comparisons of the Structure of Production" *Econometrica*, 26(4):487-521

Haque, I. ul. (2007), "Rethinking industrial policy" UNCTAD Discussion paper.

Hirschman, A. O. (1958), "The strategy of economic development" *Yale University Press.*

Institute of Developing Economies (2009), *Asian International Input/Output Tables [CD-ROM]*.

Jones, L. P. (1976), "The measurement of Hirschmanian linkages" *The Quarterly Journal of Economics*, 90(2): 323-333.

Memedovic, O. (2004), "Inserting local industries into global value chains and global production networks: opportunities and challenges for upgrading with a focus on Asia" *UNIDO working paper.*

Raa, Thijs ten (2005), "The economics of input- output analysis" *Cambridge University Press.*

Song, B.-N. (1977), "The production structure of the Korean economy: international and historical comparisons" *Econometrica*, 45(1).

The World Bank Group (2009), World Development Indicators. [Online]. Available at: devdata.worldbank.org/data-query/ [Accessed 25 July 2009].

UNIDO (2009), World Productivity Database. [Online]. Available at: https://www.unido.org/data1/wpd/Index.cfm [Accessed 10 August 2009].

United Nations (2009), UN Comtrade. [Online]. Available at: http://comtrade.un.org/db/ [Accessed 5 August 2009].

Weiss, J. (2005), "Export growth and industrial policy: lessons from the East Asian miracle experience" *Draft paper*. Asian Development Bank, Manila.

Yotopoulos, P.A. and Nugent, J. B. (1973), "A Balanced-Growth Version of the Linkage Hypothesis: A Test" *The Quarterly Journal of Economics*, 87(2): 157-171.

Appendices

Appendix 1. **Share in total output: manufacturing, selected years**

Indonesia	**1975**	**1985**	**1990**	**1995**	**2000**
Food, beverage and tobacco	16.40	12.29	10.58	12.99	12.14
Textile, leather and products thereof	2.81	2.06	3.80	4.46	4.87
Lumber and wooden products	0.96	1.56	2.42	2.35	2.13
Pulp, paper and printing	0.56	0.54	1.16	1.48	2.07
Chemical products	0.98	1.70	2.13	2.79	2.81
Petroleum and petroleum products	1.65	4.19	3.15	1.73	2.00
Rubber products	0.97	0.97	1.11	1.52	0.60
Non-metallic mineral products	0.60	0.90	0.73	0.85	0.88
Metal products	1.10	1.74	2.27	2.14	2.27
Machinery	0.73	1.36	2.04	2.50	3.90
Transport equipment	3.35	3.20	3.01	3.03	3.97
Other manufacturing products	0.31	0.58	0.61	1.55	1.57
Republic of Korea					
Food, beverage and tobacco	14.17	9.22	7.17	5.13	4.31
Textile, leather and products thereof	10.39	7.75	6.04	4.04	3.33
Lumber and wooden products	1.16	0.76	0.86	0.85	0.54
Pulp, paper and printing	1.46	1.85	1.92	2.11	1.70
Chemical products	4.75	5.03	4.60	4.70	4.71
Petroleum and petroleum products	4.61	4.58	2.15	2.38	3.88
Rubber products	0.83	1.17	1.33	0.72	0.52
Non-metallic mineral products	1.52	1.83	1.87	1.88	1.19
Metal products	4.40	6.80	7.49	7.67	6.14
Machinery	3.80	6.95	9.53	11.48	13.30
Transport equipment	1.89	3.28	5.22	6.03	5.77
Other manufacturing products	1.85	2.28	2.89	2.29	2.13
Malaysia					
Food, beverage and tobacco	15.12	13.19	10.31	6.83	6.40
Textile, leather and products thereof	2.53	1.47	3.04	1.92	1.94
Lumber and wooden products	2.64	1.92	3.31	2.70	2.29
Pulp, paper and printing	1.03	0.85	1.50	1.31	1.17
Chemical products	1.64	2.89	3.84	2.83	2.44
Petroleum and petroleum products	2.55	3.53	1.93	1.22	3.63
Rubber products	5.93	3.84	4.75	2.94	0.90
Non-metallic mineral products	1.20	1.21	1.11	1.57	1.21
Metal products	6.82	3.10	2.99	3.83	3.89
Machinery	3.54	4.20	11.38	21.20	25.91
Transport equipment	1.05	2.88	1.69	3.24	2.57
Other manufacturing products	1.38	0.79	1.91	7.02	2.98
Philippines					
Food, beverage and tobacco	17.91	17.60	18.47	15.62	14.78
Textile, leather, and the products thereof	3.66	2.45	4.21	4.18	2.31
Lumber and wooden products	1.60	1.31	1.33	1.27	0.80
Other manufacturing products	1.38	0.79	1.91	7.02	2.98

Appendix 1. Share in total output: manufacturing, selected years (Cont'd.)

	1975	1985	1990	1995	2000
Philippines					
Food, beverage and tobacco	17.91	17.60	18.47	15.62	14.78
Textile, leather, and the products thereof	3.66	2.45	4.21	4.18	2.31
Lumber and wooden products	1.60	1.31	1.33	1.27	0.80
Pulp, paper and printing	1.39	0.97	1.04	0.72	0.53
Chemical products	1.92	2.74	2.79	2.44	1.62
Petroleum and its products	4.09	4.61	3.32	3.34	3.14
Rubber products	0.45	0.51	0.62	0.57	0.26
Non-metallic mineral products	0.98	0.64	1.09	0.73	0.80
Metal products	2.39	3.02	2.95	3.05	1.36
Machinery	1.24	2.36	2.53	3.42	12.95
Transport equipment	1.95	1.01	0.68	0.67	1.32
Other manufacturing products	0.73	0.53	1.10	1.03	2.86
Thailand					
Food, beverage and tobacco	15.89	13.92	10.06	8.68	9.17
Textile, leather, and the products thereof	5.75	8.53	9.42	8.74	6.95
Lumber and wooden products	1.38	1.19	1.64	1.38	0.84
Pulp, paper and printing	1.02	0.97	0.87	1.16	1.37
Chemical products	1.60	1.25	1.39	1.66	3.47
Petroleum and its products	2.71	3.38	1.91	2.05	3.83
Rubber products	0.97	1.40	1.31	1.72	1.15
Non-metallic mineral products	0.91	1.47	2.16	1.92	1.36
Metal products	2.39	1.97	2.23	2.10	2.15
Machinery	1.47	2.19	5.00	7.40	10.64
Transport equipment	2.54	2.75	4.92	4.97	4.13
Other manufacturing products	1.28	1.73	3.09	4.10	4.03

Source: UNIDO calculations based on IDE input-output tables, 2009.

Appendix 2. Value added: manufacturing, selected years

	1975	1985	1990	1995	2000
Indonesia					
Food, beverage and tobacco	27.23	24.34	28.78	34.62	34.63
Textile, leather, and the products thereof	31.56	34.16	32.40	34.81	34.78
Lumber and wooden products	39.90	38.71	44.87	33.76	35.54
Pulp, paper and printing	45.72	37.33	36.77	39.67	35.03
Chemical products	39.13	31.24	31.30	33.71	33.27
Petroleum and its products	24.30	26.93	30.22	38.28	41.91
Rubber products	23.86	37.19	40.37	38.54	34.77
Non-metallic mineral products	53.57	41.88	38.93	43.18	42.74
Metal products	28.94	40.77	34.82	39.30	30.43
Machinery	32.38	31.70	32.44	31.31	31.58
Transport equipment	35.16	44.40	41.26	41.96	43.52
Other manufacturing products	33.48	31.29	22.70	33.82	31.20
Average	**34.60**	**35.00**	**34.57**	**36.91**	**35.78**
Republic of Korea					
Food, beverage and tobacco	16.96	24.12	24.62	28.76	27.29
Textile, leather, and the products thereof	24.27	22.56	22.47	30.32	29.93
Lumber and wooden products	19.91	20.47	26.14	32.51	32.55
Pulp, paper and printing	29.88	29.13	31.48	35.02	28.67
Chemical products	22.18	25.90	27.49	30.28	22.83
Petroleum and its products	24.06	16.33	16.60	35.42	33.54
Rubber products	22.03	32.05	34.30	33.60	36.53
Non-metallic mineral products	36.72	33.27	39.85	37.68	35.34
Metal products	15.53	20.25	23.33	25.71	25.53
Machinery	30.78	29.07	31.36	35.47	28.15
Transport equipment	30.39	29.98	32.33	31.95	24.67
Other manufacturing products	29.63	29.06	31.45	34.72	28.32
Average	**25.19**	**26.02**	**28.45**	**32.62**	**29.45**
Malaysia					
Food, beverage and tobacco	31.78	23.97	25.50	28.20	24.50
Textile, leather, and the products thereof	31.44	29.91	30.46	25.68	25.14
Lumber and wooden products	48.46	30.12	23.22	29.01	29.94
Pulp, paper and printing	38.55	42.65	29.59	30.80	30.80
Chemical products	29.19	36.76	31.04	32.33	25.07
Petroleum and its products	21.93	20.42	27.69	28.83	24.12
Rubber products	33.74	42.92	58.61	55.99	27.61
Non-metallic mineral products	44.08	41.33	58.02	50.46	35.32
Metal products	32.91	17.73	21.11	24.81	22.42
Machinery	35.23	31.31	23.71	32.15	17.96
Transport equipment	28.56	38.88	38.61	36.97	34.55
Other manufacturing products	61.67	35.32	26.74	21.52	32.52
Average	**36.46**	**32.61**	**32.86**	**33.06**	**27.50**

Appendix 2. Value added: manufacturing, selected years (Cont'd.)

	1975	1985	1990	1995	2000
Philippines					
Food, beverage and tobacco	27.51	33.05	32.53	33.29	36.83
Textile, leather, and the products thereof	27.79	35.39	30.93	29.55	38.78
Lumber and wooden products	30.11	26.37	33.06	41.08	41.13
Pulp, paper and printing	51.66	34.72	26.70	27.21	39.05
Chemical products	31.57	36.58	32.82	39.18	29.70
Petroleum and its products	11.48	33.45	28.89	26.35	28.41
Rubber products	30.56	38.48	33.19	43.51	31.55
Non-metallic mineral products	31.13	37.75	32.79	36.59	25.98
Metal products	29.03	27.06	24.19	29.30	26.59
Machinery	29.35	29.37	32.57	26.72	24.47
Transport equipment	25.21	61.07	36.23	17.34	23.04
Other manufacturing products	25.49	39.61	47.03	41.90	37.63
Average	**29.24**	**36.08**	**32.58**	**32.67**	**31.93**
Thailand					
Food, beverage and tobacco	31.21	34.79	32.08	32.00	30.34
Textile, leather, and the products thereof	33.27	33.32	31.04	33.18	32.89
Lumber and wooden products	39.81	38.07	39.03	37.23	44.44
Pulp, paper and printing	38.29	35.87	33.29	32.22	35.00
Chemical products	36.53	35.52	32.28	29.50	30.69
Petroleum and its products	24.50	29.41	35.60	42.70	24.80
Rubber products	37.86	37.93	43.29	43.88	28.79
Non-metallic mineral products	39.73	36.37	42.54	40.56	40.90
Metal products	29.81	29.97	29.56	28.43	35.69
Machinery	32.44	42.67	25.57	24.16	18.45
Transport equipment	27.02	29.33	30.70	28.08	26.31
Other manufacturing products	53.12	50.95	31.69	31.98	28.83
Average	**35.30**	**36.18**	**33.89**	**33.66**	**31.43**

Source: UNIDO calculations based on IDE input-output tables, 2009.

Appendix 3. Top 10 exports and their growth of shares in world exports, 2006

	Exports (value)	Growth of share in world exports (annual percentage)
Republic of Korea		
All industries	325,457,247	
1 Electrical, electronic equipment	85,576,801	2
2 Vehicles other than railway, tramway	42,605,290	13
3 Boilers, machinery; nuclear reactors, etc	42,313,369	**-3**
4 Ships, boats and other floating structures	21,492,885	3
5 Mineral fuels, oils, distillation products, etc	20,920,395	4
6 Optical, photo, technical, medical, etc apparatus	18,535,495	63
7 Plastics and articles thereof	15,391,310	3
8 Iron and steel	13,985,417	2
9 Organic chemicals	12,730,401	13
10 Articles of iron or steel	5,875,965	4
Malaysia		
All industries	160,669,231	
1 Electrical, electronic equipment	49,987,489	**-7**
2 Boilers, machinery; nuclear reactors, etc	32,682,657	**-2**
3 Mineral fuels, oils, distillation products, etc	22,064,138	**-2**
4 Animal,vegetable fats and oils, cleavage products, etc	6,971,745	**-4**
5 Rubber and articles thereof	4,826,658	8
6 Wood and articles of wood, wood charcoal	4,656,241	**-1**
7 Plastics and articles thereof	4,474,987	4
8 Optical, photo, technical, medical, etc apparatus	3,993,738	1
9 Organic chemicals	2,551,733	0
10 Commodities not elsewhere specified	2,369,229	1
Thailand		
All industries	130,578,702	
1 Boilers, machinery; nuclear reactors, etc	23,923,741	**7**
2 Electrical, electronic equipment	23,257,774	**-4**
3 Vehicles other than railway, tramway	10,092,986	23
4 Rubber and articles thereof	8,778,905	12
5 Mineral fuels, oils, distillation products, etc	6,507,873	7
6 Plastics and articles thereof	6,490,277	6
7 Meat, fish and seafood food preparations nes	3,990,740	**-2**
8 Pearls, precious stones, metals, coins, etc	3,674,960	**-4**
9 Cereals	2,657,416	4
10 Organic chemicals	2,548,558	19

Appendix 3. Top 10 exports and their growth of shares in world exports, 2006 (Cont'd.)

	Exports in value	Growth of share in world exports (annual percentage)
Indonesia		
All industries	100,798,616	
1 Mineral fuels, oils, distillation products, etc	27,619,520	**-11**
2 Electrical, electronic equipment	7,291,409	**-11**
3 Animal,vegetable fats and oils, cleavage products, etc	6,069,939	8
4 Rubber and articles thereof	5,529,132	18
5 Ores, slag and ash	4,994,074	**-13**
6 Boilers, machinery; nuclear reactors, etc	4,362,347	**-5**
7 Articles of apparel, accessories, not knit or crochet	3,374,674	**-2**
8 Wood and articles of wood, wood charcoal	3,355,625	
9 Paper & paperboard, articles of pulp, paper and board	2,805,339	**-1**
10 Articles of apparel, accessories, knit or crochet	2,159,239	1
Philippines		
All industries	47,410,117	
1 Electrical, electronic equipment	22,191,386	**-11**
2 Boilers, machinery; nuclear reactors, etc	8,731,570	**-11**
3 Vehicles other than railway, tramway	1,562,041	3
4 Copper and articles thereof	1,374,063	10
5 Articles of apparel, accessories, not knit or crochet	1,346,438	
6 Articles of apparel, accessories, knit or crochet	1,247,028	**-2**
7 Mineral fuels, oils, distillation products, etc	1,093,081	**-3**
8 Optical, photo, technical, medical, etc apparatus	983,172	**-5**
9 Wood and articles of wood, wood charcoal	688,340	35
10 Edible fruit, nuts, peel of citrus fruit, melons	639,605	**-6**

Source: International Trade Centre, http://www.intracen.org/menus/Countries.htm

Printed in Austria
V.10-51431—March 2010—200

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69
E-mail: unido@unido.org, Internet: www.unido.org