A joint Initiative of Ludwig-Maximilians-Universität and Ifo Institute for Economic Research

Working Papers

SIGNIFICANCE OF DEVELOPMENT STAGE THEORY FOR EXPLAINING INDUSTRIAL GROWTH PATTERN BETWEEN ASIAN NICs AND SELECTED ADVANCED ECONOMICS

Chang Woon Nam

CESifo Working Paper No. 662 (9)

February 2002

Category 9: Industrial Organisation

CESifo
Center for Economic Studies & Ifo Institute for Economic Research
Poschingerstr. 5, 81679 Munich, Germany
Phone: +49 (89) 9224-1410 - Fax: +49 (89) 9224-1409
e-mail: office@CESifo.de
ISSN 1617-9595

CESifo *Working Paper No. 662*
February 2002

SIGNIFICANCE OF DEVELOPMENT STAGE THEORY FOR EXPLAINING INDUSTRIAL GROWTH PATTERN BETWEEN ASIAN NICs AND SELECTED ADVANCED ECONOMIES

Abstract

The East Asian miracle was real. Prior to the 1997 economic and currency crises, Asian NICs — Hong Kong, Korea, Singapore and Taiwan — achieved remarkable annual GDP growth. In these countries the overall economic performance was significantly determined by the industrial development triggered by changes in domestic demand, increases in FDI, intensive innovation efforts of indigenous firms, and export expansion of manufactured goods. Furthermore, fast economic growth and active state interventions like those adopted in most NICs were accompanied by various structural changes in the industrial sector. This study examines the applicability of the development stage theory for explaining the growth dynamics of industrial production in Asian NICs for the period 1980-95 and compares their specialisation pattern with that of more advanced economies like Japan, West Germany and the US.

JEL Classification: O1, O4, O5, L6.

Keywords: development stage theory, industrial growth and specialisation, Asian NICs, Japan, West Germany, the US.

Chang Woon Nam
Ifo Institute for Economic Research
Poschinger Str. 5
81679 Munich
Germany
nam@ifo.de

Introduction

In the period of 1980–95 East Asia was the fastest growing economic bloc in the world. In particular Asian NICs such as Hong Kong, Singapore, South Korea and Taiwan achieved remarkable GDP growth which was initiated by rapid industrial development. Furthermore major economic policy measures (like import substitution, export promotion, incentives for domestic and foreign investments, subsidisation of technology development, etc.) were (and still are) strongly industry-oriented in these countries. High growth performances and active state interventions like those experienced in NICs were also accompanied by various structural changes in the industrial sector (World Bank, 1993; Ozawa, 2001). As a consequence, the changes in industrial emphases from natural resource- and labour-intensive to high-tech industries were pronounced in Asian NICs in the period of 1980-95, as their overall economy became more advanced in the course of time.

This study primarily examines the applicability of the general development stage theory for explaining the growth dynamics of industrial production in NICs for the years between 1980 and 1995, and compares their specialisation pattern with that of more advanced economies like Japan, West Germany and the US. In contrast to previous studies which were often limited to examining the life-cycle of a few specific industries in different countries or concentrated on the changes in the composition of major export items of foreign trade, this study attempts to identify the ultimate changes in each country's industrial competitiveness — also triggered by economic and political factors mentioned above — adopting various statistical methods. In order to tackle these issues in an empirical way, data on real manufacturing value added (MVA) expressed in 1990 US dollars are applied for the period mentioned above, as are collected by UNIDO.

Critical Assessment of Existing Theoretical and Empirical Investigations Relevant to Various Industrial Development Stages in Asia

Industrial development as well as the specialisation pattern among Japan, the Four Tigers (Hong Kong, Singapore, South Korea and Taiwan), ASEAN countries and China are generally examined in Asia by adopting a simple (but practical) way of finding out where the economy or the life cycle of leading industries of one country is currently positioned in the past growth-path of a more developed country: "A developing country, in an open economy context, industrialises and goes through industrial upgrading, step by step, by capitalising on the learning opportunities made available through its external relation with the more advanced world" (UNCTAD, 1995a, p.259). In other words, apart from the

changes in the life-cycles of dominating industries over time (for example, from a concentration on labour-intensive textile industry, steel and chemical industries to automobiles, etc.) and, consequently, in the domestic industrial structure of a country in the course of economic growth, such a development stage analysis model also provides in a regional hierarchy framework an explanation for the industrial relocation from a developed country to a less-developed one through trade and foreign direct investment in response to a shift in competitiveness (Akamatsu, 1961; Kojima, 1975 and 2000; Kojima and Ozawa, 1985; Ozawa, 1995 and 2001; UNCTAD, 1996; Nam and Nam, 1999).[1]

In combination with two kinds of markets (i.e. domestic and export markets) and five types of industries (i.e. R&D-intensive and easily imitable high-tech industries, as well as capital-, labour- and natural resource-intensive industries - see Table 1), the stages of industrial (and economic) development can generally be divided into three phases, through which countries progress:

- stage 1: natural resource and labour driven,
- stage 2: capital and imported technology driven, and
- stage 3: R&D and innovation driven.

[1] In East Asia such a development stage theory is examined more popularly in the context of the flying-geese approach that was originally constructed as a catching-up cycle model. Akamatsu (1961) initially explained the development of an industry, from the introduction of its products to a developing economy through imports via the establishment of local production facilities to the growth of exports. When a sequential appearance of imports, domestic production and export is presented in a graphic form, it produces a pattern similar to a flying formation of wild geese with the V-shape (Ozawa, 1995). For the early 1930s Akamatsu discovered such patterns in the Japanese 'consumer goods industry' (i.e. cotton yarn and cotton fabrics) and, with a time lag, in the 'producer goods industry' (i.e. cotton textile machinery), which also suggests the changes in the specialisation and competitiveness of the manufacturing sector in the course of time. The role of FDI as an additional channel for the 'recycling comparative advantage' (UNCTAD, 1996, p.75) was integrated into the initial model by Kojima (1975), who investigated the interactive path of FDI-enhanced trade and economic growth between an economically advanced home country and the developing host countries. For example, 'pro-trade FDI' flows from a comparatively disadvantaged industry in a developed home country to a comparatively advantaged industry in a developing host country, reinforcing the basis for, and benefits from, trade. From the conventional point of view, firms usually start to supply their goods in a foreign market with exports. When the sales volume reaches a satisfactory level, they will be willing to move to foreign production. However, multinational companies can establish production facilities for 'producer goods' at the very beginning of their life-cycle without first exploring a developing host country market through exports, which makes import of such goods unnecessary in the country. If this type of business action is successful, both production and export curves for the producer goods will take place almost simultaneously in the early stage of industrial growth of the developing country without much time-lag after the appearance of a production curve for consumer goods. In this way, multinational companies can reduce the time needed to build up competitive consumer goods industries and to move from it to higher-grade capital goods industries in a developing country (Kojima and Ozawa, 1985; UNCTAD, 1995b).

Table 1 Classification of industry types

Types	Industries classified according to International Standard Industrial Classification of All Economic Activities (ISIC)
R&D-intensive high-tech industries	Professional & scientific equipment (385) Non-electrical machinery (382) Transport equipment (384)
Easily imitable high-tech industries	Industrial chemicals (351) Other chemical products (352) Rubber products (355) Electrical machinery (383)
Capital-intensive industries	Food products (311/2) Beverages (313) Tobacco products (314) Textiles (321) Glass & glass products (362) Other non-metal mineral products (369) Other manufacturing industries (390)
Labour-intensive industries	Wearing apparel (322) Leather & fur products (323) Footwear (324) Wood & wood products (331) Furniture & fixtures (332) Paper & paper products (341) Printing & publishing (342) Plastic products (356) Pottery, china & earthenware (361) Metal products (381)
Natural resource-intensive industries	Petroleum refineries (353) Miscellaneous petroleum & coal products (354) Iron & steel (371) Non-ferrous metals (372)

Source: OECD (1992), Industrial Policy in OECD Countries; Annual Review, Paris; Heitger, Schrader and Bode (1992), Die mittel- und osteuropaeischen Laender als Unternehmensstandort, Kiel; UNIDO (1996), Industrial Development – Global Report 1995, Oxford; Nam and Nam (1999), Recent Industrial Growth and Specialisation in Selected Asian Countries, Review of Asian and Pacific Studies, No. 18.

According to this evolutionary approach, each nation is on a continuum within one of these three stages, and as it moves forward, it takes on a new series of competitive tasks in the world economy and leaves less sophisticated activities to countries at the lower level of economic development. The natural resource and labour driven stage of economic development includes countries that generate most of their GDP from processing and exporting natural resources and agricultural products. In addition, cheap, manual-skilled labour in these countries host a variety of simple mass-production assembly plants. In the second stage, countries are more technologically advanced than countries in the first stage. Domestic and foreign investments are funnelled into plants, taking advantage of scale economies, using transferred technology from more advanced countries, and producing

standardised products with mass labour inputs provided by the local population. In other words, industrial production in the capital and imported technology driven stage is also, to a large extent, labour-intensive and its success strongly depends on the endowment of manual and skilled work forces and their absorption capacity for foreign technology. In the third R&D and innovation driven stage, firms are challenged by the increased levels of world competition to innovate new products derived from high levels of technology and know-how. Apart from the well-known impacts of the modern R&D infrastructure and the high-quality human capital in generating and implementing new technologies in the development of new products, the innovative industrial firms' (permanent and institutionalised) networks with research institutions and high-tech business service firms as well as other industrial companies in the context of national innovation system become crucial for the country's continued economic and industrial growth in the third stage.

However, a sharp separation among the three development stages is weakening as these phases now overlap, due partly to the rapid integration of the world market and the intensive globalisation of business activities of multinationals including trade, foreign direct investment as well as technology transfer (Nam and Nam, 1999; Ozawa, 2001). Moreover it is likely that the 'innovation-imitation lag' (UNCTAD, 1996, p.80) between advanced countries (like Japan, West Germany and the US) and NICs has been significantly reduced in the past twenty years, mainly thanks to the greater flexibility and divisibility in production technology and to a rapid accumulation of physical and human capital in NICs that has enabled them to introduce new technologies embodied in capital goods and has accelerated the learning and catching-up process.

Apart from the enhancement of theoretical approaches mentioned above, the development stage model has been widely applied in a large number of empirical studies which attempted to compare the speed, causes and consequences of the economic and industrial growth process of Asian NICs (and other countries like China, Indonesia, Thailand, etc.) in the context of the regional development hierarchy. Additionally extensive work has also been carried out in investigating the major changes in individual industries' comparative advantages in the world market and in identifying the subsequent transformation of industrial structure that accompanies the rapid economic progress in those Asian countries.

In the Chenery-Syrquin framework of development pattern, the convergence (or divergence) in industrial and economic performance among Japan, the Four Tigers and other rapidly emerging markets like China and Indonesia in a given period of time has been often measured (Chenery and Syrquin, 1977; Chenery, 1981; Song, 1992; Heitger, 1993; Kitano, 1994; Maddison, 1995; Nam, 1997). Partly overemphasising the contribution of the industrial sector to the development of the entire economy and underestimating the differences in economic and structural basis as well as in absorption

capacities of foreign technologies and innovations from one country to another, such multilateral approaches have also been applied in Asia, when predicting the future (economic and) industrial growth dynamics of a follower country required to reach the leader's current level and the anticipated changes in specialisation patterns of the former country during the catching-up process (Nam and Nam, 1999).

Regarding the international transfer of industries in accordance with changes in comparative advantage, Ezaki (1995) observed for NICs and some ASEAN countries that certain specific industries like synthetic fibre and steel production follow the pattern of the 'catching-up product cycle' in different development tiers, which begins with the import substitution and later reaches the export expansion through the continuous increase in domestic production over the indigenous demand. Yet this type of smooth industrial transmission could not be applied well in China, for example, since, due mainly to its potentially huge domestic market, the country's relative dependence on import substitution and exports of those industries mentioned above would probably become far less significant compared to that of domestic demand (Yamazawa and Watanabe, 1988; Ezaki, 1995; Pomfret, 1997).

Assuming that changes in trade structure of a country are closely associated with those in the industrial structure of the country, a number of empirical studies have also been made — based on the revealed comparative advantage (RCA) concept by Balassa (1965) — to identify the changes in international competitiveness of selected industries in different Asian countries over time. Taking the machinery industry as an example, Ezaki (1995) suggested that the competitiveness of ASEAN countries increased rapidly from the lower level in the period 1966-85, while NICs achieved a higher competitiveness than the world average. On the other hand, Japan experienced the gradually decreasing competitiveness in the same period of time, which, in turn, implies that the catching-up process has already taken place among ASEAN, NICs and Japan in the machinery sector since the mid-1960s. In a broader industrial classification, Yamazawa and Watanabe (1988) argued that patterns of changing international competitiveness (measured in terms of RCA values in 1968, 1972 and 1977) among those Asian countries mentioned above were quite different between labour-intensive light industries, and capital-intensive heavy and chemical industries. Such types of RCA analyses have been supplemented by the international comparison of changes in composition of principal exports of manufacturers (Hughes, 1989; Lloyd and Toguchi, 1996). For instance, these studies suggested that exports of some labour- and capital-intensive products (e.g. textiles, wearing apparel, leather products, metal products, etc.) played a key role in the exports of all NICs in the period of 1970-85 but they have continuously lost significance in the course of time. Due to the export diversification towards more skill- and technology-intensive (electrical and non-electrical) machinery and transport equipment in NICs, their trade with the advanced

countries has gradually shifted from inter-industry to intra-industry patterns since the mid-1980s.

Lastly, recent assessments of the development stage model have also been centred on the linkages of foreign direct investment among Asian countries at different levels of industrialisation, in which the role played by more advanced countries and major economic and location factors underlying the changes in investment flows in this rapidly integrating area have been crucial aspects (Blomqvist, 1995; Grow, 1995; UNCTAD, 1996). According to those studies, massive foreign investments with related technology transfer made by foreign firms have allowed, for example, China to achieve much greater industrial diversification with modern capital stock and stimulated a more rapid change in specialisation patterns from the labour-intensive to the capital-intensive ones at an earlier development stage (between 1985-95) than was the case in NICs (in the 1970s and the beginning of the following decade), producing domestic manufacturers and exporters of rather sophisticated industrial goods including some high-tech products and capital goods as well as labour-intensive products at the same time (UNCTAD, 1996).

Statistical Models for the Calculation of Industrial Growth and Specialisation

Apart from the shift-share analysis of principal industries between 1980 and 1995, three simple statistical models are additionally adopted in this study to identify the degree of industrial specialisation and to calculate the growth index of individual manufacturing branches as well as to measure the extent of development interdependence among industries in the investigated countries. The model for calculating the degree of industrial specialisation has been developed by UNIDO and is widely applied in the international comparison of industrial concentration (and diversification) for economies in different development stages.

When $s_i(t)$ shows the share of i-th industry in total manufacturing value added (MVA) of a country in the year t, and ln is the natural logarithm, the degree of specialisation in the year t, $h(t)$, is defined as follows:

$$(1) \qquad h(t) = 100\,[1 + \{ \sum_{i=1} s_i(t) \ln s_i(t) \} / h_{max}(t)]$$

where $h_{max}(t) = ln\,(N)$ in the year t, N indicates the total number of investigated industries that are predetermined for the comparative analyses and $N > 1$. If one country has N number of industries and the MVA share of individual industries are all equal in the year t,

the degree of specialisation for the country is 0 in the same year. If among those given total number of industries *N* only one industry exists in a country, the value is 100 in the year *t* (UNIDO, 1996, p.116).

The industrial growth index (IGI) of *i*-th industry compared to the changes in total MVA between the year *t* and *t+1* is defined as follows:

$$(2) \quad IGI_i = ln\ [\{Q_i(t+1) / Q_i(t)\} / \{\sum_{i=1} Q_i(t+1) / \sum_{i=1} Q_i(t)\}]$$

where $Q_i(t)$ is the MVA of *i*-th industry in the year *t* and *ln* is the natural logarithm. When the production of an industry in a country grows at the same rate as the total MVA in a given period of time, the IGI value of the industry amounts to 0. If the industry grows faster than the national MVA, then IGI is positive.

In order to examine the MVA development interdependence between two industries in the long-run the well-known Pearson's correlation coefficient ($r_{1,2}$) is calculated which can be technically expressed as

$$(3) \quad r_{1,2} = \sum_{t=1} (x_{1,t} - x_1^*)(y_{2,t} - y_2^*) \ / \ \sqrt{\sum_{t=1} (x_{1,t} - x_1^*)^2 \sum_{t=1} (y_{2,t} - y_2^*)^2}$$

where $x_{1,t}$ and $y_{2,t}$ denote MVA values of the industries 1 and 2 in the year *t*, while x_1^* and y_2^* are the arithmetic means of two different variables observed in the entire investigated years between 1980 and 1995.

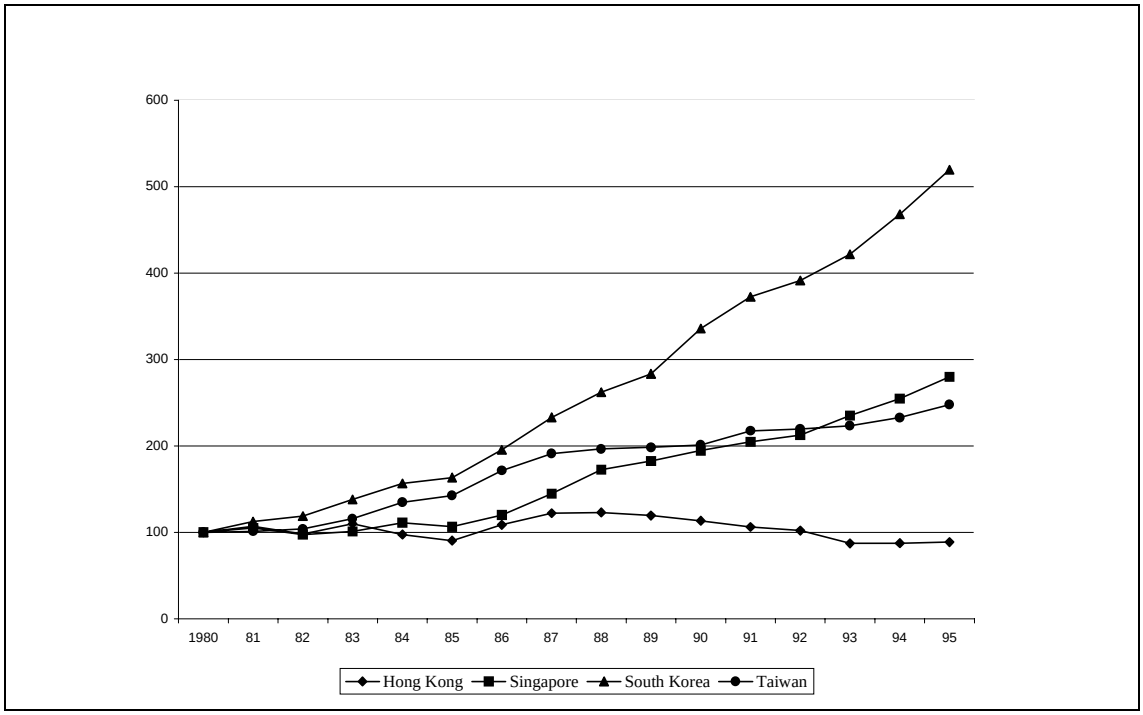
Comparison of Recent Industrial Growth and Structural Change in Asian NICs and Selected Advanced Economies (1980-1995)

(a) Shift-share Analysis of Leading Industries, Degree of Specialisation and Industrial Growth Index

In the comparison of relative development of total MVA among Asian NICs in the investigated years, one is immediately impressed by the most remarkable growth dynamic of South Korea followed by Singapore and Taiwan (Figure 1). By contrast, Hong Kong's overall economic performance depended more strongly on the growth of the service sector than the industrial one since the beginning of the 1980s: its MVA continued to decline in the 1990s and reached below the 1980 level in 1995. This fact gives a first idea that all

NICs did not have similar industrial growth pattern between 1980 and 1995. In spite of the mature economic stage and the high level of industrial production, Japan, West Germany and the US were also able to gradually increase total MVA in the investigated period of time (Figure 2). The past industrial growth trend between Japan and West Germany seems to be better correlated than that between Japan (or West Germany) and the US (see, for example, the difference between 1989 and 1993).

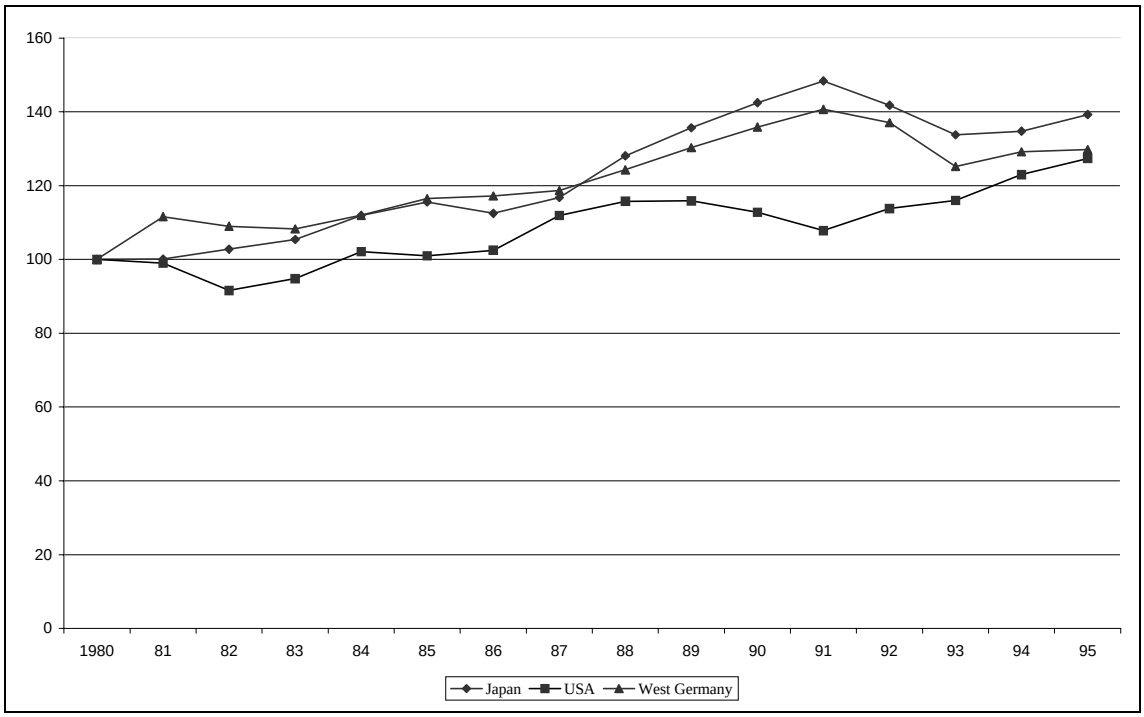
Figure 1 Relative growth of total industrial production in Asian NICs (1980=100)



Source: UNIDO database; Calculation of the Ifo Institute for Economic Research

The degree of specialisation calculated by UNIDO is designed to give an overview of the concentration of industrial activities and the changes in manufacturing structure of a country within a given period of time. As shown in Table 2, these measures calculated for the investigated countries have changed in the course of time. A continuous concentration in the specialisation of the industries took place in Singapore, Taiwan and South Korea, while a rather obvious diversification occurred in Hong Kong between 1980 and 1995. In Japan and West Germany, a weak diversification tendency was observed in the period 1990-95, whereas the US experienced a minor concentration in the same period of time. Furthermore, significant disparities in overall specialisation degrees which correspond to the development stages of individual countries are hardly seen. Since 1980, for example, Hong Kong and Singapore had higher degrees than those in the selected advanced economies, which are more or less comparable to those of South Korea and Taiwan.

Figure 2 Relative growth of total industrial production in selected advanced economies (1980=100)



Source: UNIDO database; Calculation of the Ifo Institute for Economic Research

Table 2 Degree of industrial specialisation in Asian NICs and selected advanced economies

Country	1980	1985	1990	1995
Hong Kong	24.2	22.6	21.3	19.4
Singapore	19.9	23.2	24.7	28.6
South Korea	9.1	9.5	10.4	11.4
Taiwan	10.0	9.7	10.4	12.9
Japan	11.8	15.1	15.8	15.2
West Germany	12.1	14.7	15.4	15.2
USA	11.9	13.5	12.3	12.8

Source: UNIDO database; Calculation of the Ifo Institute for Economic Research

Although the changes in the overall degree of specialisation were generally less significant in the course of time (except the case for Hong Kong and Singapore), one can easily identify the movements of a country's comparative advantage when the position of leading

industries measured in terms of MVA shares are shown. To be sure, an increase of the MVA share of an industry in a given period is the consequence of the fact that this industry has been growing faster than the total MVA in a country. In the following, major findings of empirical analyses carried out on the basis of MVA share analysis and the elaboration of the industrial growth index (IGI) are shown for the selected countries in a systematic way.

A relatively clear specialisation towards high-tech industries was most obvious in the changes of leading industries in South Korea between 1980 and 1995 (Table 3). Labour-, capital- and natural resource-intensive industries such as textiles, chemical industries, metal products, iron & steel etc., which experienced — partly also due to the strong government support — significant growth in the 1970s, have gradually lost their MVA shares since 1980. A remarkable industrial concentration took place in the beginning of the 1980s in the field of electrical machinery. The specialisation of transport equipment, another high-tech industry, successfully started at the end of the 1980s and reached a MVA share of over 10% since 1990. This fact was reflected by the high IGI values (over 0.5) for these two high-tech industries as well, while non-electrical machinery also achieved a comparable development between 1980 and 1995 (Table 4). Yet the similar growth dynamic was also given in many labour-intensive industries including footwear, furniture and fixture, plastic products and metal products. In Taiwan electrical machinery was the overwhelmingly dominant industry in the period of 1980-95, its MVA share reaching ca. 20% in 1995. Among other high-tech industries, transport equipment enhanced its ranking in the 1990s, while a relatively low MVA share of non-electrical machinery should be noted. Throughout the entire investigated period some capital-, labour- and natural resource-intensive industries like textiles, plastic products, petroleum refineries and iron & steel also made an important contribution to industrial production in Taiwan. Measured in terms of IGI values, Taiwan's dominating electrical engineering did not grow faster than the national average, due in part to its high share. While all investigated capital- and natural resource-intensive industries were lagging with negative ICI values in South Korea, some Taiwanese industries in such groups including glass and glass products and iron & steel grew relatively faster. Singapore's experience appears to be a combination between that of Korea and Taiwan in the years 1980-95. In particular electrical machinery remained in Singapore the most important high-tech industry since the beginning of the 1980s, whereas non-electrical machinery and transport equipment gradually gained significance in the course of time. Apart from those high-tech industries like non-electrical machinery, industrial chemicals and other chemical products, some capital- and labour-intensive industries such as tobacco, glass and glass products, paper and paper products, printing and publishing, plastic products, metal products, etc. achieved higher IGI values than 0 in Singapore. In spite of the distinctive specialisation toward high-tech industries (like non-electrical machinery and transport equipment as shown by IGI values) and the

persisting dominance of electrical machinery expressed in terms of its MVA share, Hong Kong's past industrial performance was found to be rather different than that in other Asian NICs: wearing apparel and textiles — two typical capital- and labour-intensive industries — continued to enjoy their importance between 1980 and 1995. Moreover, a rapid growth of the printing and publishing industry — another capital-intensive one — was observed in the same period of time.

In Japan, West Germany and the US there were less evident changes in the industrial specialisation pattern. The high-tech industries such as transport equipment, electrical machinery and non-electrical machinery continuously played the leading role with higher MVA shares than 10%. However, it should be noted that since 1990 the share for professional and scientific equipment amounted to over 5% in the US, while the same share remained negligible in Japan and West Germany (Table 5). Surprisingly some labour- and capital-intensive industries such as food and metal products were also usually among those with MVA shares between 5% and 10% in these advanced countries.

Due to its high industrial production level, none of the Japanese industries achieved an IGI value higher than 0.5000 in the period 1980-95, whereas other chemical products were the only industrial item in West Germany that belonged to this IGI category (Table 6). In both countries high-tech industries with highest MVA shares including non-electrical machinery, transport equipment and electrical machinery as well as the chemical industry generally grew more rapidly than the national average. On the other hand, labour-, natural resource- and capital-intensive industries (except food, and glass and glass products in Japan) were lagging or growing slowly in these economies, although a few labour-intensive industries like printing & publishing, plastic and metal products developed faster than the overall MVA growth. By contrast the IGI values for the US show somewhat diverging trends: the leading advanced industries like non-electrical machinery, industrial chemicals, electrical machinery, etc. achieved a below-average nation-performance in the same period of time. Unlike the case in former advanced countries, the IGI value for professional and scientific equipment — the most sophisticated industrial area — was remarkably the highest in the US, which led to the rapid increase in the MVA share in the first half of the 1990s, as mentioned above.

Table 3 Industrial specialisation in Asian NICs measured in % share of manufacturing value added (MVA)

1980	1985	1990	1995	1980	1985	1990	1995
Hong Kong				**South Korea**			
Industries with higher than 10.0% MVA share				***Industries with higher than 10.0% MVA share***			
Wearing apparel; Textiles; Electrical machinery	Wearing apparel; Textiles; Electrical machinery	Wearing apparel; Textiles	Textile; Wearing apparel; Electrical machinery; Printing & publishing	Textiles	Electrical machinery; Textiles	Electrical machinery; Transport equipment	Electrical machinery; Transport equipment
Industries with MVA shares between 5.0% and 10.0%				***Industries with MVA shares between 5.0% and 10.0%***			
Metal products; Plastic products	Plastic products; Metal products; Printing & publishing	Electrical machinery; Non-electrical machinery; Printing & publishing; Plastic products; Metal products	Non-electrical machinery; Metal products	Electrical machinery; Food; Iron & steel; Transport equipment; Tobacco; Other chemical products; Industrial chemicals	Transport equipment; Food; Iron & steel	Non-electrical machinery; Textiles; Iron & steel; Food; Metal products	Non-electrical machinery; Textiles; Food; Metal products; Iron & steel
Singapore				**Taiwan**			
Industries with higher than 10.0% MVA share				***Industries with higher than 10.0% MVA share***			
Electrical machinery; Transport equipment	Electrical machinery	Non-electrical machinery; Electrical machinery	Non-electrical machinery; Electrical machinery	Electrical machinery	Electrical machinery	Electrical machinery	Electrical machinery
Industries with MVA shares between 5.0% and 10.0%				***Industries with MVA shares between 5.0% and 10.0%***			
Non-electrical machinery; Metal products	Transport equipment; Non-electrical machinery; Petroleum refineries; Metal products; Other chemical products	Transport equipment; Metal products; Petroleum refineries; Other chemical products	Transport equipment; Metal products	Textiles; Petroleum refineries; Food; Industrial chemicals; Transport equipment; Plastic products; Other manufacturing industries; Iron & steel; Wearing apparel	Textiles; Food; Industrial chemicals; Plastic products; Wearing apparel; Petroleum refineries; Other manufacturing industries; Transport equipment; Iron & steel	Transport equipment; Textiles; Plastic products; Metal products; Industrial chemicals; Iron & steel; Food	Metal products; Transport equipment; Petroleum refineries; Textiles; Iron & steel; Plastic products; Non-electrical machinery

Source: Table a2 and a3 in Annex; Calculation of the Ifo Institute for Economic Research

Table 4 Industrial growth in Asian NICs 1980-1995

	Lagging or slowly growing industries with negative IGI values	Fast growing industries with IGI values between 0.0001 and 0.4999	Very rapidly growing industries with IGI values larger than 0.5000	Lagging or slowly growing industries with negative IGI values	Fast growing industries with IGI values between 0.0001 and 0.4999	Very rapidly growing industries with IGI values larger than 0.5000
	Hong Kong			**South Korea**		
R&D-intensive high-tech industries	Professional & scientific equipment		Non-electrical machinery; Transport equipment	Professional & scientific equipment		Non-electrical machinery; Transport equipment
Easily imitable high-tech industries	Rubber products; Electrical machinery	Industrial chemicals; Other chemical products		Industrial chemicals; Other chemical products; Rubber products		Electrical machinery
Capital-intensive industries		Beverages; Textiles; Other non-metal mineral products; Other manufacturing industries	Food; Tobacco; Glass & glass products	Food, Beverages; Tobacco; Textiles; Glass & glass products; Other non-metal mineral products; Other manufacturing industries		
Labour-intensive industries	Wearing apparel; Leather & fur products; Footwear; Wood & wood products; Furniture & fixtures; Plastic products; Pottery, china & earthenware; Metal products		Paper & paper products; Printing & publishing	Wearing apparel; Wood & wood products; Pottery, china & earthenware	Leather & fur products; Paper & paper products; Printing & publishing	Footwear; Furniture & fixtures; Plastic products; Metal products
Natural resource-intensive industries	Iron & steel	Non-ferrous metals		Petroleum refineries; miscellaneous petroleum & coal products; Iron & steel; Non-ferrous metals		

	Singapore			Taiwan		
R&D-intensive high-tech industries	Transport equipment; Professional & scientific equipment		Non-electrical machinery	Professional & scientific equipment	Transport equipment	Non-electrical machinery
Easily imitable high-tech industries	Rubber products	Other chemical products; Electrical machinery	Industrial chemicals	Industrial chemicals;	Other chemical products; Rubber products; Electrical machinery	
Capital-intensive industries	Food; Beverages; Textiles; Other non-metal mineral products; Other manufacturing equipment	Tobacco; Glass & glass products		Food; Beverages; Tobacco; Textiles; Other manufacturing industries	Glass & glass products; Other non-metal mineral products	
Labour-intensive industries	Wearing apparel; Leather & fur products; Wood & wood products; Furniture & fixtures;	Paper & paper products; Printing & publishing; Plastic products; Pottery, china & earthenware; Metal products		Wearing apparel; Leather & fur products; Wood & wood products; Furniture & fixtures; Paper & paper products; Printing & publishing	Footwear; Plastic products; Pottery, china & earthenware	Metal products
Natural resource-intensive industries	Petroleum refineries; Miscellaneous petroleum & coal products; Iron & steel	Non-ferrous metals		Miscellaneous petroleum & coal products	Petroleum refineries; Iron & steel; Non-ferrous metals	

Source: Table a1 in Annex

Table 5 Industrial specialisation in advanced economies measured in % share of manufacturing value added (MVA)

1980	1985	1990	1995	1980	1985	1990	1995
Japan				**USA**			
Industries with higher than 10.0% MVA share				***Industries with higher than 10.0% MVA share***			
Non-electrical machinery; Electrical machinery	Electrical machinery; Non-electrical machinery; Transport equipment	Electrical machinery; Non-electrical machinery; Transport equipment	Electrical machinery; Non-electrical machinery; Transport equipment	Non-electrical machinery; Transport equipment	Transport equipment; Non-electrical machinery; Electrical machinery	Transport equipment; Non-electrical machinery	Transport equipment; Non-electrical machinery
Industries with MVA shares between 5.0% and 10.0%				***Industries with MVA shares between 5.0% and 10.0%***			
Transport equipment; Iron & steel; Food; Metal products; Printing & publishing	Food; Metal products; Iron & steel; Printing & publishing	Food; Metal products; Iron & steel; Printing & publishing; Other chemical products	Food; Metal products; Other chemical products; Printing & publishing;	Electrical machinery; Food; Metal products; Printing & publishing; Industrial chemicals	Food; Printing & publishing; Metal products; Other chemical products	Food; Electrical machinery; Printing & publishing; Other chemical products; Professional & scientific equipment; Industrial chemicals; Metal products	Food; Electrical machinery; Printing & publishing; Other chemical products; Professional & scientific equipment; Metal products
West Germany							
Industries with higher than 10.0% MVA share							
Non-electrical machinery; Transport equipment; Electrical machinery	Non-electrical machinery; Transport equipment; Electrical machinery	Non-electrical machinery; Electrical machinery; Transport equipment;	Electrical machinery; Non-electrical machinery; Transport equipment				
Industries with MVA shares between 5.0% and 10.0%							
Iron & steel; Food; Petroleum refineries; Metal products; Industrial chemicals	Industrial chemicals; Metal products; Other chemical products	Metal products; Industrial chemicals; Other chemical products; Food	Metal products; Other chemical products; Food; Industrial chemicals				

Source: Table a4 and a5 in Annex; Calculation of the Ifo Institute for Economic Research

Table 6 Industrial growth in selected advanced countries 1980-1995

	Lagging or slowly growing industries with negative IGI values	Fast growing industries with IGI values between 0.0001 and 0.4999	Very rapidly growing industries with IGI values larger than 0.5000	Lagging or slowly growing industries with negative IGI values	Fast growing industries with IGI values between 0.0001 and 0.4999	Very rapidly growing industries with IGI values larger than 0.5000
		Japan			**USA**	
R&D-intensive high-tech industries	Professional & scientific equipment	Non-electrical machinery; Transport equipment		Non-electrical machinery	Transport equipment	Professional & scientific equipment
Easily imitable high-tech industries		Industrial chemicals; other chemical products; Rubber products; Electrical machinery		Industrial chemicals; Rubber products; Electrical machinery	Other chemical products	
Capital-intensive industries	Beverages; Tobacco; Textiles; Other non-metal mineral products	Food; Glass & glass products; Other manufacturing industries		Textiles; Glass & glass products; Other non-metal mineral products; Other manufacturing industries	Food; Beverages	Tobacco
Labour-intensive industries	Wearing apparel; Leather & fur products; Wood & wood products; Furniture & fixtures; Paper & paper products; Pottery, china & earthenware	Printing & publishing; Plastic products; Metal products		Wearing apparel; Leather & fur products; Footwear; Pottery, china & earthenware; Metal products	Wood & wood products; Furniture & fixtures; Paper & paper products; Printing & publishing	Plastic products
Natural resource-intensive industries	Petroleum refineries; Miscellaneous petroleum & coal products; Iron & steel; Non-ferrous metals			Petroleum refineries; Iron & steel; Non-ferrous metals	Miscellaneous petroleum & coal products	
		West Germany				
R&D-intensive high-tech industries	Professional & scientific equipment	Non-electrical machinery; Transport equipment				

Easily imitable high-tech industries	Rubber products	Industrial chemicals; Electrical machinery	Other chemical products	
Capital-intensive industries	Food; Beverages; Tobacco; Textiles; Glass & glass products; Other non-metal mineral products; Other manufacturing industries			
Labour-intensive industries	Wearing apparel; Leather & fur products; Footwear; Wood & wood products; Furniture & fixtures; Printing & publishing; Pottery, china & earthenware	Paper & paper products; Plastic products; Metal products		
Natural resource-intensive industries	Petroleum refineries; Miscellaneous petroleum & coal products; Iron & steel	Non-ferrous metals		

Source: Table a1 in Annex

(b) Variation of Correlation Coefficients among Different Types of Industries in Asian NICs and Advanced Economies

The following empirical analysis is aimed at examining the simple, theoretical logic of parallel development of dominating industries classified into the same industrial group in a given economic development stage. A priori one can easily presume that in the selected advanced economies the growth among various R&D-intensive high-tech industries is more strongly correlated than that in Asian NICs within the investigated period of 1980-95. This can be explained by the fact that these developed countries at the mature economic phase have long had large shares of such advanced industries and their industrial structure changed in a quite limited manner within the investigated period of time. On the other hand, the catching-up process experienced by NICs tends to lead the fast growth of a few preferred high-tech industries, which can, in turn, cause a rather unbalanced specialisation within this industrial field. Moreover the correlation coefficient between industries belonging to those capital- or labour-intensive industry groups is likely to be higher in Asian NICs. These industry groups generally played the role of foundation for the rapid structural change towards high-tech industries in NICs but still remained powerful in the years between 1980 and 1995. In the selected advanced countries, however, a larger share of capital- and labour-intensive industries were declining or retarding, while a few continued to grow as shown before. Unlike the former statistical analyses based on the industrial performance of individual nations, the correlation coefficient between the two industries is calculated for the entire Asian NICs and for the whole group of selected advanced economies so that this empirical work can be carried out on the basis of sufficient observations.

In the category of R&D-intensive high-tech industries the correlation coefficients of professional and scientific equipment with the items non-electrical machinery and transport equipment is significantly higher in the selected advanced industries than those in NICs. Yet the growth correlation between transport equipment and non-electrical machinery appeared to be more intact in the Four Tigers during the period of 1980-95 (Table 7). The general trend of parallel development between easily imitable high-tech industries was also more obvious in the advanced countries, except the case of correlation for electrical machinery with industrial chemicals and other chemical products, of which indexes are relatively higher in NICs (Table 8). In other words, the rapid growth and specialisation of industries like transport equipment, non-electrical machinery and electrical machinery in NICs certainly disturbed the overall trend that can be expected between economies in different development stages.

Table 7 Correlation coefficients among R&D-intensive high-tech industries in Asian NICs and selected advanced economies

	Professional & scientific equipment	Non-electrical machinery	Transport equipment
	Asian NICs		
Professional & scientific equipment	1.0000		
Non-electrical machinery	0.7622	1.0000	
Transport equipment	0.8225	0.9421	1.0000
	Japan, West Germany & USA		
Professional & scientific equipment	1.0000		
Non-electrical machinery	0.8399	1.0000	
Transport equipment	0.9517	0.9340	1.0000

Source: UNIDO database; Calculation of the Ifo Institute for Economic Research

Table 8 Correlation coefficients among easily imitable high-tech industries in Asian NICs and selected advanced economies

	Industrial chemicals	Other chemical products	Rubber products	Electrical machinery
	Asian NICs			
Industrial chemicals	1.0000			
Other chemical products	0.8048	1.0000		
Rubber products	0.7587	0.8215	1.0000	
Electrical machinery	0.9170	0.9360	0.7788	1.0000
	Japan, West Germany & USA			
Industrial chemicals	1.0000			
Other chemical products	0.9307	1.0000		
Rubber products	0.8490	0.9301	1.0000	
Electrical machinery	0.6060	0.7666	0.9058	1.0000

Source: UNIDO database; Calculation of the Ifo Institute for Economic Research

Regardless of the minor case for other manufacturing products with other individual industries like food products, textiles, glass and other non-metal mineral products, correlation coefficients between capital-intensive industries were significantly higher in Asian NICs than in the selected advanced economies (Table 9). This trend was also quite obvious for major labour-intensive industries between 1980 and 1995, except for the correlation of wearing apparel and printing and publishing with the rest of the industries in

this group (Table 10). Moreover, the coefficient gap between the Four Tigers and the selected advanced economies was the largest for the natural resource-intensive industries within the same period of time (see, for example, the correlation between petroleum refineries and iron and steel in Table 11).

Table 9 Correlation coefficients among capital-intensive industries in Asian NICs and selected advanced economies

	Food products	Beverages	Tobacco products	Textiles	Glass & glass products	Other non-metal mineral products	Other manufacturing products
	Asian NICs						
Food products	1.0000						
Beverages	0.9260	1.0000					
Tobacco products	0.8682	0.8484	1.0000				
Textiles	0.9565	0.9198	0.9282	1.0000			
Glass & glass products	0.9907	0.9055	0.8597	0.9479	1.0000		
Other non-metal mineral products	0.9843	0.8902	0.8307	0.9279	0.9938	1.0000	
Other manufacturing products	0.7222	0.8738	0.6042	0.7277	0.6664	0.6537	1.0000
	Japan, West Germany & USA						
Food products	1.0000						
Beverages	0.8636	1.0000					
Tobacco products	0.4786	0.8242	1.0000				
Textiles	0.9358	0.7100	0.2513	1.0000			
Glass & glass products	0.9638	0.7742	0.3315	0.9401	1.0000		
Other non-metal mineral products	0.7219	0.3069	-0.2042	0.8107	0.7972	1.0000	
Other manufacturing products	0.9613	0.7132	0.2454	0.9718	0.9706	0.8493	1.0000

Source: UNIDO database; Calculation of the Ifo Institute for Economic Research

Table 10 Correlation coefficients among labour-intensive industries in Asian NICs and in selected advanced economies

	Wearing apparel	Leather & fur products	Footwear	Wood & wood products	Furniture & fixtures	Paper & paper products	Printing & publishing	Plastic products	Pottery, china & earthenware	Metal products
					Asian NICs					
Wearing apparel	1.0000									
Leather & fur products	0.7362	1.0000								
Footwear	0.6982	0.8762	1.0000							
Wood & wood products	0.6786	0.8531	0.8810	1.0000						
Furniture & fixtures	0.7129	0.9165	0.9727	0.9226	1.0000					
Paper & paper products	0.7356	0.9333	0.9314	0.9570	0.9633	1.0000				
Printing & publishing	0.7149	0.8985	0.8734	0.7305	0.9002	0.8680	1.0000			
Plastic products	0.7174	0.7344	0.8850	0.9114	0.8993	0.9087	0.7240	1.0000		
Pottery, china & earthenware	0.5301	0.6167	0.7008	0.8479	0.7148	0.8253	0.5214	0.8855	1.0000	
Metal products	0.6824	0.8408	0.9062	0.8701	0.9256	0.9452	0.8628	0.9284	0.8536	1.0000
					Japan, West Germany & USA					
Wearing apparel	1.0000									
Leather & fur products	0.8771	1.0000								
Footwear	0.8201	0.7397	1.0000							
Wood & wood products	0.8861	0.8226	0.5031	1.0000						
Furniture & fixtures	0.9265	0.6908	0.6776	0.8606	1.0000					
Paper & paper products	0.9663	0.8034	0.6773	0.9206	0.9628	1.0000				
Printing & publishing	0.9316	0.8245	0.5656	0.9650	0.9076	0.9697	1.0000			
Plastic products	0.7142	0.6615	0.2327	0.8854	0.7384	0.8077	0.8985	1.0000		
Pottery, china & earthenware	-0.0688	0.2876	-0.2990	0.2090	-0.2682	-0.0774	0.1133	0.3397	1.0000	
Metal products	0.8966	0.8554	0.6489	0.8678	0.8052	0.8843	0.9030	0.8490	0.2197	1.0000

Source: UNIDO database; Calculation of the Ifo Institute for Economic Research

Table 11 Correlation coefficients among natural resource-intensive industries in Asian NICs and selected advanced economies

	Petroleum refineries	Misc. petroleum & coal products	Iron & steel	Non-ferrous metals
		Asian NICs		
Petroleum refineries	1.0000			
Misc. petroleum & coal products	0.3484	1.0000		
Iron & steel	0.8086	0.7323	1.0000	
Non-ferrous metals	0.8008	0.7139	0.9937	1.0000
		Japan, West Germany & USA		
Petroleum refineries	1.0000			
Misc. petroleum & coal products	0.2642	1.0000		
Iron & steel	-0.4809	0.2719	1.0000	
Non-ferrous metals	0.2242	0.8839	0.5088	1.0000

Source: UNIDO database; Calculation of the Ifo Institute for Economic Research

Conclusion

In the framework of development stage theory this study primarily examines the growth dynamics of industrial production in four NICs (Hong Kong, Singapore, South Korea and Taiwan) and compares their degrees of specialisation and changes in comparative advantages with those in selected advanced nations, namely Japan, West Germany and the US. For this purpose, data on real manufacturing value added (MVA) expressed in 1990 US dollars are applied for the period of 1980-95. These were the years prior to the unforgettable financial and currency crises in 1997, in which these investigated Asian NICs achieved a remarkable economic success and rapidly emerged as important counterparts of developed countries on the world market. Major findings of this empirical study are:

- Most Asian NICs experienced more rapid MVA growth (from a lower level) than the selected industrial nations in the investigated years. One can easily postulate that the so-called catching-up process took place in Asian economies. To a certain extent, a strong international relocation of Japanese firms and their production activities abroad made an important contribution to the industrial development in NICs (see also Kojima, 1995).
- Unlike the wide-spread presumption, all NICs did not have a similar industrial growth

pattern between 1980 and 1995. For example, Hong Kong's real MVA declined in the beginning of the 1990s and its 1995-level was lower than the 1980-level. Measured in terms of industrial specialisation degrees, a gradual, manufacturing concentration took place in most Asian NICs except Hong Kong, where a significant diversification was observed in the same period of time. Yet an obvious difference in such specialisation degrees which corresponds to the relevant countries' development stages was hardly seen: the calculated specialisation degrees for advanced economies were comparable to those of South Korea and Taiwan.

- The shift-share analysis of dominant industries and the elaboration of IGI made for the period 1980-95 show in the individual Asian NICs a clear movement towards high-tech industries like electrical machinery, transport equipment and non-electrical machinery. Although a few capital- and labour-intensive industries remained exceptionally powerful, most of these industries generally experienced a slower than average growth and the loss of their MVA share over the course of time. By contrast Japan, West Germany and the US had less evident changes in the industrial specialisation pattern. Those high-tech industries mentioned above played the dominant role for the entire period.
- A further confirmation of the development stage theory and its applicability is derived from the measurement of correlation coefficients among various industrial types in Asian NICs and the selected advanced nations. More precisely, the past growth between the two (R&D-intensive or easily imitable) high-tech industries was in general more strongly correlated in advanced economies, while in NICs coefficient values were significantly higher between the individual industries classified into capital-, labour- and natural resource-intensive manufacturing groups.

This is not the end of story. Further research is urgently needed in the same theoretical context in order to adequately integrate several crucial, more recent economic events which will surely challenge Asian NICs in a new global order and change the pattern of industrial specialisation in these countries drastically within a short period of time. A thorough update of the relevant MVA data set is the crucial prerequisite for this task. In particular the contagious financial crises in 1997 have raised serious questions about the sustainability of the development stage theory in Asia (Kojima, 2000). As a consequence of such economic shocks modernisation of industrial structure is still going on in Asian NICs. Taking South Korea as an example, labour- and capital-oriented good producers were most seriously struck by the crisis, which led to a large number of bankruptcies of firms and job replacements, followed also by the restructuring and down-sizing of some high-tech industries including automobiles and electronic industries carried out in the course of the forced rearrangement of large conglomerates. Such initial actions also created vicious chain-reactions there and have had bad impacts on their subsidiaries and

other industrial and service firms as well as the entire economic structure of the county (Nam, 2000). Hong Kong, Taiwan and Singapore did not suffer immediately when the Asian crises occurred. Yet they have been increasingly facing the still-persisting negative spill-overs from the major victims (South Korea, Indonesia, Thailand, etc.) and the global economic consequence of the crises, whereas Japan has been in recession since the mid-1990s (Ozawa, 2001).

China, due to the huge indigenous market potential, to its abundant labour and to a faster specialisation towards more skill- and knowledge-oriented goods encouraged by massive FDIs, has recently been able to expand its industrial production and exports of various manufacturing goods ranging from labour- and capital-intensive types like wearing apparel, toys as well as iron and steel to those high-tech ones like electrical machinery and also non-electrical machinery. China's aggressive emergence in these segments of the world market have been forcing Koreans and Taiwanese to move to more R&D-intensive industries and high-order services based on the sophisticated information and communication technology. As a reaction Asian NICs did their best during the 1990s to exploit comparative advantages in this high-tech area and also achieved a great success on the world market for computers, semiconductors including microchips, etc. However, it should be borne in mind that the price fall of semiconductors world-wide made these countries less immune to the speculative attack that occurred in the initial crisis phase, which significantly increased their trade deficits around the mid-1990s (Wade, 1998; Nam, 2000). More recently, the industrial growth in Asian NICs (including Singapore and Taiwan) has been additionally damaged by the sudden, unexpected decline of the so-called new economy world-wide, which drove US economic expansion in the last decade and was seen to hold a promising future. Asian NICs should continue to look for an exit from the current economic dilemma which can only be accomplished by more intensive product innovation and technological development, outsourcing of less-productive activities abroad as well as rapid movement to a modern service society — the same strategies that advanced industrial countries have long since adopted to safeguard their market positions.

References

Akamatsu, K. (1961), "A Theory of Unbalanced Growth in the World Economy", *Weltwirtschaftliches Archiv* 86: 196-217.

Balassa, B. (1965), "Trade Liberalisation and 'Revealed' Comparative Advantage", *The Manchester School of Economic and Social Studies* May: 99-124.

Blomqvist, H. (1995), "Intraregional Foreign Investment in East Asia", *ASEAN Economic Bulletin* 11: 280-297.

Chenery, H. (1981), *Structural Change and Development Policy,* Oxford: A World Bank Research Publication.

Chenery, H. and M. Syrquin (1977), *Patterns of Development 1955-1975*, London: Oxford University Press.

Ezaki, M.(1995), "Growth and Structural Changes in Asian Countries", *Asian Economic Journal* 9: 113-135.

Grow, R.F. (1995), "Sino-Japanese Economic and Technology Relations", in: Simon, D.F and H.P. Lee (eds.), *Globalization and Regionalization of China's Economy*, Seoul: The Sejong Institute: 75-108.

Heitger, B. (1993), "Comparative Economic Growth: Catching Up in East Asia." *ASEAN Economic Bulletin* 10: 68-82.

Heitger, B., K. Schrader and E. Bode (1992),. *Die mittel- und osteuropaeischen Laender als Unternehmensstandort,* Kieler Studien 250, Kiel: Institut fuer Weltwirtschaft an der Universitaet Kiel.

Hughes, H. (1989), "Catching Up: The Asian Newly Industrializing Economies in the 1990s", *Asian Development Review* 7: 128-144.

Kitano, M. (1994), "The New China: Dynamism and Vulnerability", *The Pacific Review* 7: 153-161.

Kojima, K. (1975), "International Trade and Foreign Investment: Substitutes or Complements", *Hitosubashi Journal of Economics* 16: 1-12.

Kojima, K. (1995), "Dynamics of Japanese Investment in East Asia", *Hitosubashi Journal of Economics* 36: 93-124.

Kojima, K. (2000), "The Flying-Geese Model of Asian Economic Development: Origin, Theoretical Extensions and Regional Policy Implications", *Journal of Asian Economics* 11: 375-401.

Kojima, K. and T. Ozawa (1985), "Toward a Theory of Industrial Restructuring and Dynamic Comparative Advantage", *Hitosubashi Journal of Economics* 25: 135-145.

Lloyd, P.J. and H. Toguchi (1996), "East Asian Export Competitiveness: New Measures and Policy Implications", *Asian-Pacific Economic Literature* 10: 1-14.

Maddison, A. (1995), *Monitoring the World Economy 1820-1992*, Paris: OECD Development Center.

Nam, C.W. (1997), "China's Recent Economic Performance in International Comparison", *International Quarterly for Asian Studies* 28: 345-360.

Nam, C.W. (2000), "Some Western Misunderstandings Surrounding the Origin of the Korean and Asian Economic Crises", *Review of Asian and Pacific Studies* 19: 21-44.

Nam, C.W. and K.Y. Nam (1999), "Recent Industrial Growth and Specialisation in Selected Asian Countries", *Review of Asian and Pacific Studie*s 18: 13-39.

Organization for Economic Cooperation and Development (OECD, 1992), *Industrial*

Policy in OECD Countries: Annual Review, Paris.

Ozawa, T. (1995), *The Flying-geese Paradigm of Tandem Growth: TNCs' Involvement and Agglomeration Economies in Asia's industrial Dynamism*. Paper Presented at the 1995 AIB Annual Meeting in Seoul, 15-18 November, 1995 (mimeo).

Ozawa, T. (2001), "The Hidden Side of the Flying-Geese Catching-up Model: Japan's Dirigiste Institutional Setup and a Deepening Financial Morass", *Journal of Asian Economics* 12: 471-491.

Pomfret, R. (1997), *Is China a "Large Country"?* Paris: OECD Development Center.

Song, B.N. (1992), *The Rise of the Korean Economy*. Hong Kong et al.: Oxford University Press.

United Nations Conference on Trade and Development (UNCTAD, 1995a), *Trade and Development Report 1995*, New York and Geneva: United Nations Publication.

United Nations Conference on Trade and Development (UNCTAD, 1995b), *World Investment Report 1995. Transnational Corporations and Competitiveness*, New York and Geneva: United Nations Publication.

United Nations Conference on Trade and Development (UNCTAD, 1996), *Trade and Development Report 1996*, New York and Geneva: United Nations Publication.

United Nations Industrial Development Organization (UNIDO, 1996). *Industrial Development. Global Report 1995*. Oxford et al.: Oxford University Press.

Wade, R. (1998), "From Miracle to Cronyism; Explaining the Great Asian Slump", *Cambridge Journal of Economics*, 22: 693-706.

World Bank (1993), *The East Asian Miracle: Economic Growth and Public Policy*, New York: Oxford University Press.

Yamazawa, I. and T. Watanabe (1988), "Industrial Restructuring and Technology Transfer", in: Ichimura, S. (ed.), *Challenge of Asian Developing Countries: Issues and Analysis*, Tokyo: Asian Productivity Organisation: 203-226.

Statistical Annex

Table a1 Industrial growth index (IGI) between 1980 and 1995 in the investigated countries

		Hong Kong	Singapore	South Korea	Taiwan	Japan	West Germany	USA
311/2	Food products	0.7549	-0.2218	- 0.1883	- 0.2945	0.1160	-0.1581	0.1273
313	Beverages	0.4059	-0.2915	- 0.6838	- 0.1952	- 0.2895	-0.0180	0.0818
314	Tobacco products	1.3397	0.0331	- 1.2036	- 0.6371	- 0.5089	-0.0990	0.5963
321	Textiles	0.0469	-1.7108	- 0.6796	- 0.3557	- 0.5959	-0.3620	-0.1185
322	Wearing apparel	-0.5924	-0.9916	- 0.2897	- 0.7679	- 0.1654	-0.6719	-0.3618
323	Leather & fur products	-0.6887	-0.4664	0.2762	- 1.8350	- 0.3752	-0.9150	-0.5830
324	Footwear	-2.9913	-1.6212	0.8049	0.6914	- 0.3551	-0.8035	-1.1407
331	Wood & wood products	-0.8676	-2.3220	- 0.2520	- 1.1097	- 0.6974	-0.1717	0.1420
332	Furniture & fixtures	-1.4907	-0.4461	0.8595	- 0.3223	- 0.2757	-0.2123	0.0209
341	Paper & paper products	0.7587	0.2602	0.0491	- 0.5466	- 0.0277	0.2769	0.0073
342	Printing & publishing	0.9899	0.3844	0.2464	- 0.0047	0.1197	-0.1422	0.3210
351	Industrial chemicals	0.4726	1.0450	- 0.3652	- 0.1753	0.0663	0.0915	-0.0124
352	Other chemical products	0.2755	0.3355	- 0.1416	0.7519	0.2552	0.7205	0.3876
353	Petroleum refineries	na	-0.9998	- 0.3012	0.0860	- 0.4580	-0.2253	-0.9241
354	Misc. petroleum & coal products	na	-1.1779	- 1.0338	- 0.6669	- 0.5989	-1.6133	0.0753
355	Rubber products	-1.7026	-1.4211	- 1.2407	0.0055	0.0666	-0.0640	-0.0130
356	Plastic products	-0.8618	0.2816	0.8118	0.0371	0.3161	0.4472	0.5757
361	Pottery, china & earthenware	-0.5722	0.2733	- 0.5131	0.2911	- 0.1645	-0.7227	-0.1217
362	Glass & glass products	0.6541	0.2852	- 0.0424	0.0519	0.0758	-0.0484	-0.1889
369	Other non-metal min. products	0.1937	-0.2544	- 0.0361	0.1517	- 0.0813	-0.0757	-0.2850
371	Iron & steel	-0.2297	-1.1647	- 0.0883	0.0856	- 0.5390	-1.2096	-0.5574
372	Non-ferrous metals	0.2027	0.0749	- 0.2187	0.2516	- 0.6590	0.3156	-0.4355
381	Metal products	-0.4824	0.2249	0.5059	0.6765	0.1170	0.3356	-0.3064
382	Non-electrical machinery	1.2432	1.2116	0.9073	0.5949	0.0462	0.0528	-0.2380
383	Electrical machinery	-0.2018	0.0144	0.5865	0.3935	0.2630	0.2136	-0.0340
384	Transport equipment	0.5510	-0.5493	0.6163	0.2414	0.1241	0.0691	0.0960
385	Profess. & scientific equipment	-0.1760	-0.0829	- 0.2879	- 0.2188	- 0.2924	-0.4186	0.5095
390	Other manufacturing industries	0.1711	-1.1680	- 0.3727	- 0.8914	0.0546	-0.2457	-0.1127

Source: UNIDO database; Calculation of the Ifo Institute for Economic Research

Table a2 Manufacturing value added in Hong Kong and Singapore 1980-1995 (in 1990 million US dollars)

		Hong Kong				Singapore			
		1980	1985	1990	1995	1980	1985	1990	1995
311/2	Food products	233	250	397	439	184	241	322	412
313	Beverages	143	182	200	190	79	102	139	165
314	Tobacco products	117	185	394	395	38	47	64	109
321	Textiles	1485	1406	1801	1379	107	38	72	54
322	Wearing apparel	2775	2324	2455	1360	194	211	294	201
323	Leather & fur products	63	37	38	28	10	7	11	18
324	Footwear	85	90	35	4	14	7	9	8
331	Wood & wood products	65	47	38	24	129	58	55	39
332	Furniture & fixtures	89	79	66	18	61	82	89	108
341	Paper & paper products	160	132	275	302	69	109	189	251
342	Printing & publishing	419	511	877	998	196	307	514	805
351	Industrial chemicals	57	52	64	81	79	185	584	629
352	Other chemical products	111	103	154	129	219	358	600	853
353	Petroleum refineries	0	0	0	0	785	423	725	806
354	Misc. petroleum & coal products	0	0	13.2	13	265	109	192	227
355	Rubber products	42	25	16.3	7	67	28	35	45
356	Plastic products	813	893	759	304	129	137	327	476
361	Pottery, china & earthenware	8	4	6	4	1	1	2	4
362	Glass & glass products	14	25	19	24	16	6	31	59
369	Other non-metal min. products	80	68	95	86	125	188	149	270
371	Iron & steel	45	25	44	32	95	65	97	83
372	Non-ferrous metals	51	29	40	55	14	23	41	43
381	Metal products	923	671	716	505	314	400	730	1098
382	Non-electrical machinery	272	344	1077	835	488	496	2737	4572
383	Electrical machinery	1427	1097	1153	1033	1452	2061	2707	4110
384	Transport equipment	254	229	334	390	765	630	890	1232
385	Profess. & scientific equipment	523	421	536	389	122	119	200	316
390	Other manufacturing industries	362	369	432	381	105	78	114	91
	Total	10614	9600	12034	9405	6124	6513	11918	17084

Source: UNIDO database

Table a3 Manufacturing value added in South Korea and Taiwan 1980-1995 (in 1990 million US dollars)

		South Korea				Taiwan			
		1980	1985	1990	1995	1980	1985	1990	1995
311/2	Food products	2334	3248	6047	10046	1712	2750	2911	3160
313	Beverages	874	1212	1889	2292	802	1164	1623	1635
314	Tobacco products	1747	2288	2794	2724	7288	835	885	954
321	Textiles	4051	5226	6833	10668	2442	3211	3544	4240
322	Wearing apparel	1385	2051	3401	5386	1436	2382	2196	1651
323	Leather & fur products	211	429	1144	1445	321	358	194	127
324	Footwear	171	335	594	1987	114	360	487	564
331	Wood & wood products	365	415	876	1474	557	635	677	455
332	Furniture & fixtures	154	323	972	1890	210	367	487	377
341	Paper & paper products	652	1081	2123	3558	826	1054	1372	1185
342	Printing & publishing	672	1162	2531	4467	386	415	745	952
351	Industrial chemicals	1526	2022	4182	5503	1560	2592	3344	3244
352	Other chemical products	1553	2255	4926	7004	348	585	1088	1829
353	Petroleum refineries	1158	1712	2865	4452	1757	2154	2431	4745
354	Misc. petroleum & coal products	322	462	517	595	33	36	37	42
355	Rubber products	1005	1443	3063	1510	362	531	732	902
356	Plastic products	549	1124	2734	6424	1480	2484	3454	3806
361	Pottery, china & earthenware	136	170	275	423	149	220	330	494
362	Glass & glass products	302	486	991	1504	200	266	419	522
369	Other non-metal min. products	1281	1689	3697	6420	854	925	1588	2463
371	Iron & steel	1921	3236	6187	9138	1461	1858	2965	3944
372	Non-ferrous metals	405	531	1201	1691	246	353	667	784
381	Metal products	972	1961	5145	8376	1025	1655	3391	4996
382	Non-electrical machinery	1027	2304	7004	13221	760	1143	2360	3414
383	Electrical machinery	2427	5743	15066	22669	3162	4590	8432	11613
384	Transport equipment	1762	4425	10242	16955	1551	2051	3966	4893
385	Profess. & scientific equipment	327	459	1144	1274	335	469	590	667
390	Other manufacturing industries	561	948	1769	2008	1478	2088	1999	1502
	Total	29852	48739	100209	155105	26296	37530	52916	65162

Source: UNIDO database

Table a4 Manufacturing value added in Japan and USA 1980-1995 (in 1990 million US dollars)

		Japan				USA			
		1980	1985	1990	1995	1980	1985	1990	1995
311/2	Food products	47748	56157	66676	74693	96623	104527	119830	139843
313	Beverages	9249	9295	10305	10660	17982	19213	21140	24868
314	Tobacco products	3481	1227	2003	2915	9379	14128	22560	21697
321	Textiles	28470	26745	27046	21854	35065	31975	34960	39689
322	Wearing apparel	9509	9853	11921	11227	30117	26319	25480	26727
323	Leather & fur products	1635	1712	1865	1565	2817	1877	2210	2004
324	Footwear	1285	1154	1478	1255	4492	2935	2320	1829
331	Wood & wood products	16594	12072	14006	11509	19748	18287	20830	29006
332	Furniture & fixtures	6987	6657	8730	7388	14982	15744	16910	19459
341	Paper & paper products	17171	17105	22287	23266	45358	48992	57200	58225
342	Printing & publishing	31537	36437	47938	49517	67588	86799	103180	118731
351	Industrial chemicals	25468	29464	38076	37909	59259	51533	73480	74582
352	Other chemical products	28535	34629	46764	51304	54098	64508	81770	101579
353	Petroleum refineries	12210	8053	4841	10759	35035	16504	22820	17719
354	Misc. petroleum & coal products	1960	1249	1540	1500	4065	4099	4390	5586
355	Rubber products	7654	8898	11403	11396	12226	13035	13430	15379
356	Plastic products	17481	23784	30796	33403	22138	29396	37320	50168
361	Pottery, china & earthenware	2993	2851	2984	3537	1842	1545	1840	2079
362	Glass & glass products	5304	7061	8467	7970	9851	9102	10080	10393
369	Other non-metal min. products	23175	21594	26652	29763	24818	23634	23980	23784
371	Iron & steel	48773	44210	48539	39632	46865	28600	31780	34203
372	Non-ferrous metals	13755	9177	11976	9913	21833	13593	17510	17999
381	Metal products	41330	46194	62905	64718	80971	73444	70360	75948
382	Non-electrical machinery	72428	93902	126563	105659	156461	137298	145060	157156
383	Electrical machinery	71688	110735	133884	129908	113966	132165	112400	140372
384	Transport equipment	59218	79148	95594	93392	123756	152353	154030	173594
385	Profess. & scientific equipment	10485	12219	12798	10903	42541	47861	76520	90233
390	Other manufacturing industries	9550	11411	13730	14050	18362	15518	18720	20905
	Total	625673	722992	891767	871566	1172238	1183983	1322110	1493790

Source: UNIDO database

Table a5 Manufacturing value added in West Germany 1980-1995 (in 1990 million US dollars)

		West Germany			
		1980	1985	1990	1995
311/2	Food products	27563	22278	28590	30555
313	Beverages	9577	10381	11911	12212
314	Tobacco products	10254	11765	12633	12059
321	Textiles	10336	11367	11849	9344
322	Wearing apparel	7323	5766	5887	4857
323	Leather & fur products	1388	1030	944	722
324	Footwear	1788	1492	1153	1040
331	Wood & wood products	6656	5001	6179	7279
332	Furniture & fixtures	8235	6344	7885	8647
341	Paper & paper products	7568	10739	13490	12962
342	Printing & publishing	9128	8514	10255	10281
351	Industrial chemicals	20697	34083	35537	29449
352	Other chemical products	11879	23854	27942	31702
353	Petroleum refineries	21725	19704	19130	22517
354	Misc. petroleum & coal products	1469	1123	528	380
355	Rubber products	4752	5924	6414	5787
356	Plastic products	9046	11597	17313	18370
361	Pottery, china & earthenware	1935	1379	1555	1220
362	Glass & glass products	3698	3943	4791	4575
369	Other non-metal min. products	11781	10029	12031	14182
371	Iron & steel	28012	19618	19205	10850
372	Non-ferrous metals	3723	7018	7734	6628
381	Metal products	21456	29130	39181	38966
382	Non-electrical machinery	50856	69550	82544	69610
383	Electrical machinery	45271	58270	72568	72776
384	Transport equipment	46357	59811	67434	64497
385	Profess. & scientific equipment	9209	7089	8011	7868
390	Other manufacturing industries	2523	2417	2849	2562
	Total	394206	459214	535541	511842

Source: UNIDO database