Manufacturing competitiveness in East Asia : an empirical assessment

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Manufacturing Competitiveness in East Asia: An Empirical Assessment

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SUMMARY

Much of East Asia's growth and development over the past few decades has been built on its competitiveness in manufacturing. This research seeks to examine the factors driving the competitiveness of seven economies – China, South Korea and the ASEAN-5 countries of Malaysia, Thailand, Indonesia, Singapore and the Philippines – in the manufacturing sectors from 2000 to 2010. Since the competitiveness of manufacturing can be broadly defined as the ability to produce manufactured products that can compete on international markets, this study uses export trade data of the East Asian economies as a proxy for their manufacturing competitiveness.

Employing a panel and pooled data estimation technique, the study finds that unit labour costs, infrastructure, real exchange rates and global demand are crucial determinants behind manufacturing competitiveness. The empirical results suggest that policy measures to reduce trade barriers, lower unit labour costs by improving labour productivity through education and skills training as well as developing infrastructure are vital in boosting manufacturing competitiveness. Liberalising the services sectors is also essential as manufacturing requires good access to high-quality financial services, for instance. Faced with a more challenging internal and external environment such as rising costs emanating from rapid demographic changes or the threat of potential protectionism from the developed nations, the East Asian countries may also need to further implement certain structural reform measures like improving the quality of institutions or strengthening governance so as enhance their attractiveness as an investment destination and further fostering greater intra-regional trade.

Chapter 1 – Introduction

The manufacturing sector has been instrumental in driving the industrialization and economic development in East Asia during the past three decades. It has been a major locomotive of economic growth of the East Asian economies – not only has the manufacturing sector contributed critically to the output and employment of the national economy, it has also created a healthy ecosystem in which domestic and foreign investment can boost the country's technological and research capabilities in manufacturing and generate spillover effects to other industries like construction, real estate and infrastructure development. Manufacturing productivity growth is generally higher than that of most other activities of the economy and it has significant linkages with the rest of the economy, contributing demand for high-quality services such as business, legal, ICT, logistics, and finance.¹ Manufacturing drives R&D and contributes to exports, allowing the East Asian economies to increase their export revenue and improve their balance of payments by virtue of their manufacturing sectors/industries.

Research shows that the competitiveness of manufacturing is critical for economic development (Amable 2000, Fagerberg 2000, Peneder 2003, Szirmai 2012, Szirmai &

¹ McKinsey (2012c) estimates that 30%–50% of manufacturing jobs in advanced economies are service-type functions. McKinsey also estimates that Chinese manufacturers created demand for \$50 billion in services, while its service companies created demand for \$600 billion in manufactured goods inputs.

Verspagen 2011).² The prosperity of East Asia over the past few decades was built on the manufacturing competitiveness of the Asian countries, first in light consumer goods like textiles and other labour-intensive products, then in a wide range of intermediate goods. More recently, this prosperity has been based on the manufacture of electronics products and capital equipment. Indeed, the advancement of manufacturing capabilities is directly linked to increasing economic prosperity for a nation and its citizens. Recent research by Ricardo Hausmann and Cesar Hidalgo provide a compelling case that manufacturing does matter – once a country begins to manufacture goods thus building knowledge and capabilities, its path to prosperity becomes much easier. Using export trade data for only manufactured goods from 128 countries over the past 60 years, the authors from Harvard and MIT find that a significant portion (over 70%) of the income variations in countries can be explained by economic complexity, i.e., the more advanced manufacturing capabilities and more sophisticated product sets made, the higher the prosperity for the nation.³

² According to a recent study by ADB, modern industrial and service economies have manufacturing at their core.

³ The research by Hausmann and Hidalgo looks at both the composition and quantity of the nation's manufacturing. They created a measure of the sophistication of an economy based on how many products a country exports successfully and how many other countries also export these products. They argue that sophisticated economies export a large variety of "exclusive" products that few other countries can make. To do these, these economies have accumulated productive knowledge and developed manufacturing capabilities that others do not have. Importantly, they demonstrate that economies find it easier to master new products that are similar to the ones they already made. It is easier to graduate from assembling toys to assembling televisions than to jump from textiles to aerospace. See Hausmann, R Hidalgo, C.A., et al. (2011), *The Atlas of Economic Complexity: Mapping Paths to Prosperity*. Center for International Development at Harvard University.

However, East Asia's manufacturing is now facing unprecedented challenges, which arise through internal and external factors. Internally, wages in these economies have been rising rapidly as the middle classes grew and companies face increasing pressure to attract skilled labour. For instance, wages in Indonesia grew at a compound annual growth rate (CAGR) of 10.8% from 2000-2005 and 7% CAGR from 2005-2010. In the Philippines, wages grew at a 9.5% CAGR from 2005-2010. Projections for these two ASEAN countries suggest CAGRs for wages of 9.5% for Indonesia and 6.4% for the Philippines from 2010-2015.⁴ Unless productivity rises, wages are expected to increase further in the future as demographic headwinds set in and tighten the labour supply arising from an ageing population.

Just as importantly, steadily appreciating real exchange rates is also affecting the costs of doing business in East Asia. Most of the economies have experienced cost pressures which led to a pick-up in their real effective exchange rate (REER). Singapore for instance is facing rising business costs and its external competitiveness has generally declined over the years due to an appreciating nominal effective exchange rate (NEER) which rose some forty percent between 1990 and 2000. As the Asian economies are rebalancing their economies from more export-oriented growth models to more domestic-led growth, this shift towards domestic-led growth, which is inherently more inflationary due to positive output gaps, is likely to further raise business costs and dampen manufacturing competitiveness.

⁴ "The Future of Manufacturing: Opportunities to Drive Economic Growth". A World Economic Forum Report in collaboration with Deloitte Touche Tohmatsu Ltd, Apr 2012.

In addition, the East Asian economies face higher levels of exchange risk or volatility as they are typically open to trade, although currency exposure impacts industries differently (the industries with the highest currency exposure are generally metals, commodities and construction/building products). Apart from currency fluctuations that can cause significant and unexpected cost anomalies for manufacturing firms with global operations, political instability can cause a deterioration in business sentiment among domestic and foreign investors thereby leading to a decline in manufacturing output and growth. For instance, the instability of the Estrada and Arroyo Governments as well as fears of instability under Presidents Habbibie, Abdurrahman Wahid and Megawati Sukarnoputri have had a detrimental effect on the investment climate in the Philippines and Indonesia in the 1990s. Similarly, unstable coalition governments have dented Thailand's investment attractiveness in the nineties. These uncertainties adversely affected foreign investment that is critical to manufacturing and labour productivity of the host country.

To compound these internal challenges, the East Asian countries face the threat of protectionism which has been on the rise in response to the global economic crisis. Since 2008, countries like the EU have adopted discriminatory policies to shield their domestic industries from foreign competition in the face of global growth slowdown. Such protectionist measures have evolved from transparent policy instruments such as tariffs towards measures that are less regulated by international trade rules. Since the 2008 G20

summit, bailouts and state aid were the most frequently cited examples of policies designed to discriminate against foreign commercial activities.⁵

The rise of China as a manufacturing powerhouse due to its abundant and relatively low cost labour and continued investments in science, technology and manufacturing physical infrastructure, has further posed a threat to East Asia. Over the years, China has rapidly developed core capabilities in producing a wide range of products ranging the gamut from labour-intensive goods to relatively capital intensive or sophisticated products like telecommunications and machinery equipment. Whilst being a competitor to its East Asian neighbours, its provision of low cost goods have also benefited these economies which in turn supply resourced-based manufactures to the mainland.⁶ Externally, China is expected to maintain its competitive edge in manufacturing for some time. Although there are already signs of rising cost pressures in the economy (due to rising minimum wages), it continues to have a structural labour surplus with significant unemployment and underemployment. According to the IMF Article IV Consultation (2011), China's labour costs have been growly broadly in line with productivity at an aggregate level. Wage pressures are mostly being absorbed by productivity gains, manufacturing unit labour costs are rising only slowly and corporate profit margins are not being compressed by rising costs.⁷ Thus in China's context, firms were/are able to maintain a competitive edge

⁵ Ibid.

⁶ Chew S.B. & Liu Y.H., "Competition in Trade between China and ASEAN", *Advances in Pacific Basin Business, Economics and Finance*, Vol. 3, 1998.

⁷ Refer to <http://www.imf.org/external/pubs/ft/scr/2011/cr11192.pdf>.

as the productivity of capital is high, which in part is due to the underpricing of other factors of production (such as energy) and insufficient environmental protection.

Given the crucial importance of the manufacturing sector in East Asia, there is a need to examine issues pertinent to manufacturing. The principal focus of this study is to examine what determines the competitiveness of manufacturing in selected countries in the region. More specifically, can the East Asian economies still maintain the competitiveness of their manufacturing industries (and thus avoid the middle income trap) and how important are the various determinants to the country's manufacturing competitiveness? Domestically, the steady real exchange rate appreciation on the back of wage increases will clearly have an impact on manufacturing. The quality and quantity of infrastructure can also affect manufacturing costs.

To investigate the above issues, the study employs a pooled or panel data estimation technique to assess the degree of importance of factors influencing manufacturing competitiveness. Trade data is used as a proxy to measure manufacturing competitiveness. In a broad sense, international competitiveness can be defined as the ability of the country to produce and sell goods and services which can compete on international markets. The competitiveness of East Asian manufacturing can be captured by export market shares, given that most of these countries' manufactured products are in the form of exports of machinery components and products given the highly trade-dependent nature of these economies. Since the manufacturing industries in East Asia produces many internationally tradeable products, we draw theoretical support from existing literature on trade for

factors that might determine export (or manufacturing) competitiveness. Generally, the more competitive a product is, the larger is the export share or increase in demand for the product. A rise in global or external demand is one factor influencing export volume. Other factors that affect manufactured exports are the various countries' unit labour costs, REERs and infrastructure.

This study makes some key contributions to the existing literature on manufacturing competitiveness. First, there are scant studies done on analysing the competitiveness of manufacturing sectors in East Asia. Past literature have mainly focused on countries outside the East Asian region, like in the advanced OECD or developing countries (LDCs) in Africa, the Middle East or Latin America. This thesis examines what drives the manufacturing competitiveness of East Asia. It aims to study the competitiveness of China, Singapore, Malaysia, Thailand, Indonesia, South Korea and the Philippines in the decade following the 2008-09 subprime crisis, i.e., 2000-2010. Using 2000-2010 as the sample years to model the regional economies' manufacturing competitiveness is apt because these countries have reached a certain comparable level of manufacturing development during this period; in fact in the case of China and some ASEAN countries like Malaysia and Thailand, their economies have now successfully transformed from lower-productivity agriculture to higher productivity manufacturing due to the adoption of export-oriented industrialization policies.

Second, this study also makes a novel contribution in including infrastructure as a regressor in the econometric specification on exports, which is rarely examined. One thing

worth noting is that other authors' calculation of infrastructure is not appropriate for East Asia as they use different indicators like paved highways, telephones or railways (the latter is not applicable to Singapore since the country does not depend on rail roads for transport). This study delivers some value-added to the current literature by computing a weighted-index of infrastructure for different types of infrastructural categories that includes electricity which is important for manufacturing.

The dissertation is organised as follows. Following the first introductory chapter, the second chapter gives an overview or background of manufacturing developments in the East Asian countries. The third chapter reviews past literature and recent studies on competitiveness. The fourth chapter analyses the factors driving manufacturing competitiveness using an econometric model while the fifth chapter discusses the empirical findings and further explores the prospects of manufacturing in East Asia. The last chapter concludes with policy implications.

Chapter 2 – Manufacturing Development in East Asia

2.1 Trends in Development of Manufacturing in the Region

During the last decade or so, the manufacturing sector of East Asia has been a key engine of growth for the region, reflecting a gradual and long-term shift in output from lower-productivity agriculture to higher-productivity manufacturing. In recent years, there were divergent trends across some East Asian emerging economies in terms of the relative size of each country’s manufacturing sector. While the share of manufacturing output relative to total economic output has risen notably in Korea and to some extent, Thailand, in most parts of East Asia, the sector’s share has become smaller, albeit to varying degrees (Table 1, Figure 1).

Table I: Manufacturing Share in GDP (%), 2000-2012

	2000	2006	2012
Malaysia	31	29	24
Indonesia	28	29	23
Singapore	27	25	21
Philippines	25	25	22
Thailand	34	34	34
China	32	31	-
South Korea	28	26	30

Source: World Bank, *World Development Indicators Online* (<http://publications.worldbank.org/WDI>).

Note: Latest figure for China is 2010.

The decline in manufacturing’s share of economic output over the past decade can be viewed as a positive development, reflecting an increasingly important services sector in

many economies. Whilst the large recent declines in most of ASEAN are rather notable and may somewhat suggest some loss of competitiveness compared to North Asian countries, countries like Korea and Taiwan have moved up the manufacturing value chain to produce higher-tech or more diversified products. In Korea, in particular, the recent rise in its share of manufacturing in output likely owes to the larger role of the trade sector in driving high-tech electronics production as well as shipbuilding. In Thailand, the increase in share has partly reflected solid growth in output, which predictably surged in the post-2011 flood period.

Figure I: Change in Manufacturing Output as a Share of GDP

Source: World Bank, *World Development Indicators Online*

The importance of manufacturing is further reflected in the export-oriented trade structure of the East Asian countries. With the shift in the commodity structure of exports and imports, East Asia is increasingly trading and specializing in products like machinery and

chemicals that exhibit increasing returns to scale⁸. Statistics from UN Comtrade reveal that within machinery, the exports of office and telecommunications equipment and electrical machinery have grown particularly rapid in the case of China, whose share of office and telecommunications equipment in overall exports increased remarkably, from 5% during the period 1990-2000 to 13% in 2000-2010, while the share of electrical machinery increased from 7 to 11% (Table 2). The ASEAN-5 countries, saw the exports of manufactured products like chemicals rose in the last decade while that of electrical machinery increased by three percentage points to 21% in the 2001-2010 period. Overall, machinery and transportation equipment accounted for a combined share of nearly half of the grouping's total exports from 2001-2010. For the whole region, machinery and transport equipment accounted for a considerable share, rising from 41 to 48% of East Asia's total exports, with the proportion of office and telecommunications machinery increasing significantly in the 2000-2010 period. For China, the rise has been particularly rapid, with trade (both exports and imports) in electrical appliances registering the fastest increase within the machinery and transport equipment category.

⁸ Scale economies create an incentive for firms to cluster spatially, leading to the formation of regional production networks.

Table II: Commodity Composition of Foreign Trade in East Asia (% of Total Trade)

	East Asia		ASEAN-4		China	
	1990-2000	2001-2010	1990-2000	2001-2010	1990-2000	2001-2010
Export						
Agriculture & Crude Materials (excluding fuels)	6.8	4.2	13.3	11.3	12.6	5.4
Fuel and Lubricants	6.8	6.6	10.2	13.1	3.8	2.1
Chemical & Related Products	5.1	6.7	4.4	7.6	5.4	5.2
Manufactured Goods	14.1	13.5	9.8	8.6	85	94.1
- Textiles and fabrics	5.2	3.5	2.3	1.3	7.9	5.1
Machinery & Transport Equipment	41.2	48.3	47.0	46.4	23.7	47.7
- Office Machines	9.9	11.3	14.7	11.5	5.0	13.2
- Telecommunications equipment	7.4	9.4	8.3	5.4	6.1	11.7
- Electrical Machinery & Appliances	14.8	14.8	17.8	20.9	7.1	10.7
Import						
Agriculture & Crude Materials (excluding fuels)	10.2	11.5	8.6	6.6	12.1	14.7
Fuel and Lubricants	9.6	16.2	8.3	15.1	5.5	11.5
Chemical & Related Products	9.5	9.9	8.5	7.6	13.1	11.3
Manufactured Goods	15.1	11.7	13.3	10.0	82.4	73.9
- Textiles and fabrics	3.5	1.6	2.3	1.0	7.6	2.0
Machinery & Transport Equipment	44.3	41.7	51.2	41.3	40	42.2
- Office Machines	4.8	5.0	6.5	5.7	3.2	4.7
- Telecommunications equipment	4.3	3.7	4.8	3.7	5.2	3.8
- Electrical Machinery & Appliances	16.0	19.4	20.1	19.1	10.4	19.9

Note: East Asia includes Korea, China and the ASEAN-5 countries of Singapore, Malaysia, Thailand, Philippines, Indonesia.
Source: UN Comtrade

2.2 Globalisation and Manufacturing Export Competitiveness

The rapid global expansion of manufacturing has dramatically changed the competitive landscape for economies in East Asia. Rapid globalization has accelerated the relocation of production processes from the higher wage economies to the low-wage countries and led to a proliferation of manufacturing supply chains and distribution networks in the region⁹. Through greater division of labour and specialization across various economies, production costs are reduced and manufacturing competitiveness increase which further promote exports and intra-regional trade. However, globalisation has also led to intense competition, whereby even small shifts in cost conditions can lead to significant changes in competitive positions among nations.

The shift-share analysis helps to shed some light on a country's international competitive position. Basically, the role of the shift-share is to compare changes in a competing East Asian country's exports to the destination market with the corresponding exports of a reference group. Any difference between the performance of the country concerned in a given commodity group and destination and that part of the total change in exports which might be ascribed to the rate of export growth of the reference group as a whole – the *share effect* – is referred to as the *export differential* or *shift effect* and is measured in absolute dollar terms. A positive value implies an improvement in competitiveness relative to the reference group and a negative value

⁹ The heterogeneity of the East Asian economies has given rise and created a lot of scope for gains from comparative advantage in manufacturing. For instance, the value-added per employee in manufacturing in 2004 was US\$76,580 in Singapore and US\$23,706 in Malaysia. This stood in sharp contrast to Indonesia and Philippines, where the value-added per employee in manufacturing was US\$8,914 and US\$13,628 respectively. For Thailand, the value-added per employee in manufacturing was about US\$8,276 in 2000. Such heterogeneity enabled international segmentation of production processes since the different countries had different comparative advantages

constitutes a deterioration in competitiveness. The export differential is in turn accounted for by three additive factors – the *industry mix effect*, the *competitive effect*, and the *interaction effect*. Inspection of these components may shed some light on the structural characteristics which lie behind any overall positive or negative net shifts.

In the shift share methodology, the industry mix effect (IME) shows how much of the export differential is due to a divergence between the competing economy's economic structure and the reference group. It will be positive if a country's share of exports in fast growing industries is larger than the reference group or its share in slow-growing industries is smaller. The competitive effect (CE) shows how much of the export differential is due to a difference between the export growth rate of the particular country and the group as a whole. If a country's growth exceeds the rate for the group, the effect is positive and it is deemed to have a competitive advantage in that product category. Finally, the interactive effect (IE) shows how much of the export differential is attributable to a combination of the industry mix effect and the competitive effect. It will take on a positive value if either the competing economy specializes on exports in which it has a competitive advantage or produces little of the exports in which it has no such advantage.

To give a mathematical exposition of the shift-share technique in analysing export market competition, consider a home country's export of commodity i to market j at time t , X_t^{ij} , and the reference economies' like exports with the $\hat{}$ sign, i.e., $\hat{X}_t^{ij}$. The change in the home country's exports between two periods t and $(t-1)$ can be expressed as follows:

$$\begin{aligned}
 X_t^{ij} - X_{t-1}^{ij} &= X_{t-1}^j \cdot \frac{\hat{X}_{t-1}^{ij}}{X_{t-1}^j} \left(\frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} - 1 \right) + X_{t-1}^j \cdot \left\{ \left(\frac{X_{t-1}^{ij}}{X_{t-1}^j} \right) - \left(\frac{\hat{X}_{t-1}^{ij}}{\hat{X}_{t-1}^j} \right) \right\} \cdot \left\{ \frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} - 1 \right\} \\
 &+ X_{t-1}^j \cdot \frac{\hat{X}_{t-1}^{ij}}{X_{t-1}^j} \cdot \left\{ \left(\frac{X_t^{ij}}{X_{t-1}^{ij}} \right) - \left(\frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} \right) \right\} \\
 &+ X_{t-1}^j \cdot \left\{ \left(\frac{X_{t-1}^{ij}}{X_{t-1}^j} \right) - \left(\frac{\hat{X}_{t-1}^{ij}}{\hat{X}_{t-1}^j} \right) \right\} \cdot \left\{ \left(\frac{X_t^{ij}}{X_{t-1}^{ij}} \right) - \left(\frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} \right) \right\}
 \end{aligned}$$

Summing across all commodities, the growth or change in size of export market j ,

$$\begin{aligned}
 [X_t^j - X_{t-1}^j] - X_{t-1}^j \cdot \sum_i \frac{\hat{X}_{t-1}^{ij}}{X_{t-1}^j} \left(\frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} - 1 \right) &= \\
 X_{t-1}^j \cdot \sum_i \left\{ \left(\frac{X_{t-1}^{ij}}{X_{t-1}^j} \right) - \left(\frac{\hat{X}_{t-1}^{ij}}{\hat{X}_{t-1}^j} \right) \right\} \cdot \left\{ \frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} - 1 \right\} &=> \text{industry mix effect} \\
 + X_{t-1}^j \cdot \sum_i \frac{\hat{X}_{t-1}^{ij}}{X_{t-1}^j} \cdot \left\{ \left(\frac{X_t^{ij}}{X_{t-1}^{ij}} \right) - \left(\frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} \right) \right\} &=> \text{competitive effect} \\
 + X_{t-1}^j \cdot \sum_i \left\{ \left(\frac{X_{t-1}^{ij}}{X_{t-1}^j} \right) - \left(\frac{\hat{X}_{t-1}^{ij}}{\hat{X}_{t-1}^j} \right) \right\} \cdot \left\{ \left(\frac{X_t^{ij}}{X_{t-1}^{ij}} \right) - \left(\frac{\hat{X}_t^{ij}}{\hat{X}_{t-1}^{ij}} \right) \right\} &=> \text{interaction effect}
 \end{aligned}$$

Previous studies using dynamic shift-share methods¹⁰ have tended to focus on selected countries like the ASEAN-5 or the NIEs using trade data at the SITC two or three-digit level in the category of electronics and electrical equipment. Here, a brief analysis is conducted to examine changes in the competitive position of each individual East Asian countries relative to the East Asian group as a whole, in terms of their exports to the region as well as to key markets of the USA and Europe between 1990 and 2008. The benchmark for assessing their individual competitiveness is the combined group of these countries. A dynamic version of shift-share analysis is applied to two categories of manufactured exports – intermediate products and final machinery. The data is from RIETI-TID 2009 which classifies industries like agriculture and manufacturing into primary, intermediate and final goods. For purposes of analysis, East Asian countries' manufacturing competitiveness in intermediate and final products are considered.

Calculations from the shift share study suggest that countries like Malaysia, Philippines and Thailand are generally competitive in the exports of intermediate goods, compared to other reference economies. Typically these ASEAN countries reported positive net shifts over the last two decades except in the crisis years of SARS

¹⁰ Positive and negative export differentials in a shift-share analysis are useful in revealing changes in relative competitiveness of a country. However, there are some limitations that need to be taken into account. Shift-share is not a mechanistic tool signaling an inevitable process of success or failure to compete in international markets since any adverse moments in export competitiveness relative to the group as a whole can be changed by implementation of policies such as export promotion subsidies or incentives for inward foreign investment. A negative export differential within a broad manufacturing category need not signify a loss of competitiveness overall but rather could be due to changing comparative advantage as rising real wages and productivity results in a restructuring away from labour-intensive industries towards higher value-added activities within a given manufacturing category. Nonetheless, shift-share analysis is still useful to assess a country's individual competitiveness against a benchmark of reference countries.

(2003) and the recent financial subprime crisis which started in 2007. Compared to her neighbours, Indonesia did not perform well in her intermediate goods exports over the 1990-2008 period, indicating that Indonesia is not as competitive in the production of intermediate goods relative to the other East Asian economies (Figure 2). Singapore recorded positive net shifts from the early till mid-1990s, highlighting her competitiveness in intermediate goods but being export-oriented, registered negative net shifts during the years of the Asian financial Crisis (1997-1998), dot-com bubble (2001) and subprime crisis (2007) when her exports deteriorated.

Similarly, Taiwan's net shift plunged sharply into negative territory during the Asian financial crisis and in 2001 as her exports were hit hard by the global electronics downturn. Generally Taiwan has shown her competitiveness in the export of intermediate goods destined for Europe and the US during the last two decades. On the other hand, Hong Kong's performance was lackluster. However, HK's results must be interpreted with care as her share of intermediate goods as well as final machinery was the lowest amongst the reference economies. For Korea, her decline in net shifts was the result of falling IME which signified lower concentration in intermediate products. This could be due likely to Korea outsourcing a large proportion of intermediate goods production to lower-cost economies like China. Over the last two decades, Japan has been rather competitive, as evident from the positive net shifts recorded over the years.

As for China, although its intermediate goods exports have been growing at a faster rate than the reference economies, her IME has generally been lower as her intermediate manufactures industry is not as well established as the other reference economies. This reinforces the fact that China serves more as a manufacturing

platform for the processing of intermediate products into final goods. For final machinery goods, China is a serious contender in the export markets of US and Europe, as evident in the fact that she has been able to maintain a large CE that has dwarfed that of her competitors since 1990 (Figure 3). Indeed, China's spectacular export growth in final machinery goods has been well ahead of the other reference economies for much of the period, reflecting its competitiveness in the production of final products.

Singapore was the only country among the reference economies to experience persistent negative net shifts throughout 1997 to 2008. Singapore's CE has been trending down sharply since 1996 as her export growth lagged more significantly behind the rest of the reference economies. While Singapore's CE for final machinery was generally weak, this has been offset by positive industry mix effect (IME) over the last two decades. In other words, the overall performance of Singapore compared to the reference economies can be attributed to the higher concentration of fast-growing final capital machinery goods in her exports compared to the reference group.

Almost all reference economies suffered a contraction in 2007 to varying degrees due to the recent subprime crisis. Korea's CE turned positive after the Asian financial crisis but plunged into negative territory since 2001. Korea's net shifts for most years during the 1990-2008 period were the result of negative and unfavourable IME that suggests a less-than-optimal industry mix for final machinery goods. For the other Northeast Asian economy of Taiwan, there were few years that net shifts were recorded as positive; Taiwan showed competitiveness during the few years prior to the AFC and her export performance rebounded after 1999 after which the net shift

continued a downward declining trend. However this does not imply that Taiwan's exports have dropped; looking at Taiwan's share effects, Taiwan's exports are still growing but relatively slower than the reference economies. Similarly for South Korea as her exports of final machinery were still growing respectably from 1990-2008 given her share effects but at a moderate rate than the other East Asian countries.

Looking at the ASEAN economies, Malaysia had been competitive over the past two decades although her declining export performance as reflected in the negative net shifts were the result of the Asian financial crisis, dot com bubble and subprime debacle. Philippines was competitive in most part of the period until 2002 when her export performance started to trend downward as reflected by her negative net shifts from 2002 to 2008. For Thailand, her net shift in final goods started to decline since 1997 largely because of sharp reversal in her CE from positive to negative. However, one interesting finding that emerged is that when looking at computed data for final consumer goods, Thailand recorded positive net shifts, suggesting that Thailand is competitive in the area of household consumer goods rather than capital goods. The same is said of Indonesia, whereby she recorded positive net shifts in the exports of household consumer goods rather than final machinery/capital products.

Figure II: Breakdown of Net Shift for the East Asian Country's Intermediate Goods Exports, 1990-2008

Philippines

Thailand

Singapore

Korea

Taiwan

Japan

Figure III: Breakdown of Net Shift for the East Asian Country's Final Machinery Exports, 1990-2008

Philippines

Thailand

Singapore

South Korea

Taiwan

Japan

Chapter 3 – Literature Review

3.1 Determinants in Manufacturing Competitiveness

The definition of competitiveness is admittedly broad. In a nutshell, it would appear from past or existing studies that competitiveness is a multi-dimensional concept and that it can be defined at the company, industry or national level. For the company, competitiveness is widely understood as the capacity or ability to compete (i.e., to provide products and services more effectively and efficiently than the relevant competitors), to grow (i.e., to gain market share) and to be profitable. At the industry level, a standard definition would be that competitiveness is the ability of the nation's firms to achieve sustained success against (or compared to) foreign competitors without protection or subsidies. At the national level, competitiveness is measured by the level and growth of the nation's standard of living, the level and growth of aggregate productivity, as well the ability of the nation's firms to penetrate world markets and increase their market share through exports or foreign direct investment.

The concept of competitiveness varies in economics and business management literature. To economists, the explanation of international competitiveness goes back many years to the theory of comparative advantage and factor pricing (Ricardo and Heckscher-Ohlin). While Ricardo focused on one production factor and differences in technology, Heckscher and Ohlin dealt with labour and capital inputs and justified comparative advantage on the basis of underlying differences in factor endowments and relative factor prices. In business literature, the concept of competitiveness lends itself to many different interpretations. While the term has a fairly clear meaning at the firm level (i.e., market shares or profitability), at the industry or sectoral level,

competitiveness is sometimes viewed as a relative concept. According to Corden (1994), "... one might say that an industry is internationally competitive if it produces tradeables and is profitable. A reduction in competitiveness is then a reduction in profitability in some or all tradeables industries. The lower the profitability, the lower the output and possibly employment in an industry."¹¹ Although this is a more specific, industry-based definition, it differs from the OECD (1994) definition that includes an element of sustained growth that is generally associated with competitiveness. "... Competitiveness (should) be understood as the ability of companies, industries, regions, nations and supranational regions to generate, while being and remaining exposed to international competitiveness, relatively high factor income and factor employment levels on a sustainable basis."

The OECD definition underlies the notion that national competitiveness does not mean just a low cost producer but being competitive in activities that are conducive to income growth. Being a static low wage producer of simple products would not be considered real or genuine competitiveness; some very efficient producers and nations are desperately poor – they are efficient in products which do not provide competitiveness in the income-raising meaning of the word. Authors like Reinert (1995) use the case of Haiti, which has the lowest production cost for baseballs, to illustrate that this would not lead to Haiti being described overall as a very competitive economy.¹² Reinert argued that it is by no means obvious that being the most efficient

¹¹ Corden, W.M. (1994) *Economic Policy, Exchange Rates and the International System*. Oxford University Press, Oxford. 323pp. Fagerberg (1996) supports the interpretation of competitiveness as a relative concept, which involves the comparison of performance across economic units. Hughes (1993) also defines competitiveness in terms of relative efficiency and international trade performance.

¹² Reinert, E. 1995. 'Competitiveness and Its Predecessors: A 500-Year Cross-National Perspective', *Structural Change and Economic Dynamics*, Vol. 6, pp. 23-42.

producer of an internationally traded product makes a country competitive, although it is difficult to be competitive if one is not efficient and have high productivity. It thus appears there is a very important distinction between having some activities that compete internationally on account of some static endowments but the competitive edge is lost when incomes rise, and having an economy or industrial sector that develops a broad competitive base capable of remaining competitive even as incomes rise.

One of the earliest works on national competitiveness advantage was written by the famous management guru Michael Porter. Porter (1990) pioneered the use of economic analysis to investigate important issues relating to “competitiveness” at the firm, industry and national level. In his famous book *The Competitive Advantage of Nations*, Porter developed the “cluster” and “diamond” concepts, a very granular view of the business environment which is complementary to the more traditional top-down approach to economic development, which emphasises factors such as institutional development, trade liberalisation, privatisation, and macroeconomic stabilisation. Porter concluded that nations ultimately succeed, not in individual industries, but in clusters (groups of interconnected firms, suppliers, related industries and institutions that arise in particular locations) connected through vertical and horizontal relationships. A nation’s economy typically consists of clusters, whose composition and sources of competitive advantage reflect the state of the economy’s development.

In his study of national competitive advantage, Michael Porter identified four sources or determinants that can affect the global competitiveness of companies located in particular countries. These four sources are the quality of factor (input) conditions, the

context of rules in which firms compete, local demand conditions and the presence of related supporting industries (represented by well-developed clusters). Porter created a model linking these four sources in a diamond (Figure 4) and argued that firms are most likely to succeed in industries or industry segments in which the four sources are favourable. He also argued that the sources in the diamond form a mutually reinforcing system in which the effect of one determinant or source is dependent on the state of the others.

Figure IV: Determinants (sources) of National Competitive Advantage

Source: Adapted from Porter, M.E. (1990) *The Competitive Advantage of Nations*, Free Press, NY.

Basically, as the diamond model illustrates, a competitive firm should have the basic factors of production such as land, labour, capital and materials, as well as advanced factors such as technological know-how, managerial skills and physical infrastructure. Demand conditions are also relevant in creating pressure for innovation and quality. The more sophisticated and demanding domestic customers are, the more competitive the domestic firms are likely to be. Further, related and supported industries provide companies an additional boost to their international competitiveness. When suppliers

are located near the producer, these firms can provide lower cost inputs that are not available to the producer's distant competitors. Firm strategy, structure and rivalry is another key ingredient for the firm to compete successfully at the domestic and global level. In conclusion, Porter's argument is that the degree to which a nation is able to achieve international success in a particular industry is a function of the combined impact of the four sources noted above. He also contended that government's policies can influence each of the four components in the diamond either positively or negatively.

Probably, the most well known authority or leading publications in studying national competitiveness are the *Global Competitiveness Report* (GCR) and the *World Competitiveness Yearbook* (WCY), respectively, by the World Economic Forum (WEF) and the Institute for Management Development (IMD). The GCR is based on Michael Porter's national diamond and measures the diamond's four categories, including factors of production, domestic demand conditions, local supporting industries, and firm strategy to rank 102 countries. The WCY constructs a model around four principle factors – economic performance, government efficiency, business efficiency, and infrastructure – to rank 60 countries and regions.

Like the IMD, the WEF's annual *Global Competitiveness Reports* have studied and benchmarked the many factors underpinning national competitiveness for more than three decades. The WEF define *competitiveness* as *the set of institutions, policies, and factors that determine the level of productivity of a country*. The level of productivity, in turn, sets the level of prosperity of an economy. The productivity level also determines the rates of return obtained by investments in an economy, which in turn

are the fundamental drivers of its growth. In other words, a more competitive economy is one that is productive and likely to grow faster over time. And to attain competitiveness and prosperity, it is not the type of industries that a country or region chooses to compete in but how productively it competes in those industries.

To benchmark national performance, the WEF used a weighted average of many different components, each measuring a different aspect of competitiveness, that are grouped into the following pillars found in the GCR:

- Infrastructure
- Institutions
- Macroeconomic environment
- Health and primary education
- Higher education and training
- Goods market efficiency
- Labour market efficiency
- Financial market development
- Technological readiness
- Market size
- Business sophistication

While the *Global Competitiveness Report* list the results of the pillars of competitiveness separately, the pillars are not independent; they tend to reinforce each other. A weakness in one area often has a negative impact on other areas. For instance, strong innovation capacity will be very difficult to achieve without a healthy, well-educated and trained workforce that is adept at absorbing new technologies. Also, without sufficient financing for R&D or an efficient goods market, it will not be possible to take bring new innovations to market. The Global Competitiveness Index aggregate the pillars into a single index and give some insight into the specific areas in which a particular country needs to improve.

In reality, the clusters of structural characteristics listed in the GCR and WCY which are deemed to be critical for international competitiveness are based on the results of theoretical and empirical research of modern economic growth theory (Barro and Sala-i-Martin, 1995). For instance, the importance of openness to international trade and finance in enhancing international competitiveness have been supported by Sachs and Warner (1995), Frankel and Romer (1996). The importance of the role of education has been empirically proven by Barro (1991). The significance of efficient financial institutions is confirmed by King and Levine (1993) while empirical evidence on the important role of quality infrastructure to international competitiveness and growth can be found in Munnell (1992). Coe and Helpman (1995) provided support for the importance of technology, research and development and technological diffusion through their work. The importance of the quality of political and judiciary institutions to international competitiveness and sustained development are already explored by Knack and Keefer (1995) while evidence on the importance of labour market flexibility is highlighted in Coe and Snower (1997).

Although most measures of competitiveness so far have been at the national level like the WEF and IMD, similar measures have been adopted to examine industries like manufacturing in certain countries. Using similar survey-based studies that draw upon comments and responses from business executives, a recent study by Deloitte sought to examine the drivers of global manufacturing competitiveness in nearly thirty economies. The drivers (Figure 5), which are broadly defined and grouped based on the 25 component indicators (Appendix Table 1), aim to reflect the critical interplay between market and government forces.

Figure V: Competitiveness Framework - Drivers of Global Manufacturing Competitiveness

Source: Diagram extracted from Deloitte and US Council on Competitiveness -2010 Global Manufacturing Competitiveness Index.

Ranking each of the drivers across regions globally, the study by Deloitte revealed that talent-driven innovation remains the top driver of manufacturing competitiveness, except for Mexico and South Africa. The availability of talented people – scientists,

researchers, engineers and production workers – drives manufacturing innovation and influences its overall competitiveness. Cost-related drivers occupy different positions across global regions, with costs of labour and materials ranked second by US and Canada executives, and ranked third or lower in Asia and Europe (Appendix Table 2). Energy costs and policies were viewed as the second most important driver by the European executives, as opposed to a third by those from Mexico and South America, fourth from the US and Canada, and fifth from Asia. These three drivers together form the “foundations” of manufacturing competitiveness, according to manufacturing executives surveyed.

The study further classified the next four drivers of manufacturing competitiveness as “contributory” government forces – economic, trade, financial and tax systems; the quality of physical infrastructure, government investments in manufacturing and innovation, and the legal and regulatory system. Appropriate regulations and policies on corporate taxes, trade, central banking and overall financial systems foster the necessary business climate for the industrial sectors to thrive. These vital systems emerged as the third most important driver supporting manufacturing competitiveness as indicated by executives from Canada and the US, whereas those from Asia, Mexico and South America, ranked it fourth. It did not make the top five for European executives, with this group giving more precedence to legal and regulatory systems. In Asia, executives view government investments in manufacturing and innovation as critical, ranking it the second most important driver for manufacturing competitiveness. This view is borne out by China’s direct FDI in energy, metals and chemicals and its many initiatives to support manufacturing, such as recalling scientists trained in the developed world while in South Korea, significant government support also has been

provided to establish industrial clusters and special economic zones.¹³ On the contrary, government investment does not appear as a top-five driver for other regional group, possibly due to the lesser role governments (versus private enterprises) play in manufacturing competitiveness in those regions.

The final three drivers of manufacturing competitiveness are more “localized”. While these three fell lower on the ranking list than the other drivers, all of them were nonetheless identified by executives as important considerations in defining the competitiveness of a country’s manufacturing sector. A highly qualified local supplier base supports manufacturing’s eco-system by contributing significantly to the value-added of the sector and is essential to improving a nation’s manufacturing competitiveness. The dynamics of the local business environment, including the size of the market which allows economies of scale and the intensity of local competition, as well as the quality and availability of healthcare (essential for the workforce to be efficient and productive) are deemed to be equally significant. Thus overall, according to the Deloitte report, the three clusters of drivers – foundational, contributory and localized – are all necessary conditions of country-level manufacturing competitiveness.

3.2 Measurement of Manufacturing Competitiveness

Since the macro-economic use of the word is inconsistently defined and can be quite elusive, how does one quantify competitiveness? Whilst there may be a strong case for constructing indices that reliably and objectively benchmark national performance, the

¹³ Deloitte and US Council on Competitiveness -2010 Global Manufacturing Competitiveness Index.

competitive scoreboards produced in the GCR and WCY, while comprehensive, are of limited value. This is principally because they rely to a large extent on opinion surveys and non-quantifiable factors. Similarly, the study by Deloitte depends on the survey responses of business executives that are used to devise a Global Manufacturing Competitiveness Index (GMCI) to rank various countries.¹⁴ While these reports have facilitated interpretation and cross-national comparison of the indicators that are evaluated at the international levels, many academics have criticised such indexes. Sanjaya Lall (2001), for instance, provided a sweeping critic of the GCR. Lall's main complaint is that the scope of competitiveness embodied in these indexes is too broad. He dismissed a definition of competitiveness that includes productivity and growth, and suggests that "all such efforts should be more limited in coverage, focusing on particular sectors rather than pulling in everything the economics, management, strategy, and other disciplines suggest." According to Lall, the phenomenon (competitiveness) is too multifaceted and complex to permit easy measurement.

Thus far, there are hardly any studies done to measure either the manufacturing competitiveness of a particular country or group of countries, or quantify the factors driving competitiveness performance. Most studies typically use exports and/or

¹⁴ To compute the GMCI, executive responses were standardized to adjust for potential country and cultural bias as well as for company size, which is captured through annual revenues in US dollars. A company's relative global experience in manufacturing was based on the physical presence of manufacturing operations and/or sales, service and distribution offices spanning multiple global geographic regions (Asia, Europe, North and South America). Manufacturers were deemed as having more global experience if their operational footprints were more dispersed regionally. Those manufacturers with presence in only one region received the lowest global experience weight, whereas operating in four global regions received the highest. This implies that larger, more globally experienced manufacturing organizations had a greater influence in defining the index rankings as well as in determining the key drivers and components of manufacturing competitiveness.

imports to compute indicators of competitiveness, since the estimation of a country's competitiveness generally assumes producing and competing on the global market. Dollar and Wolff (1993) define an economy competitive if it "harbours a large number of internationally competitive industries and enterprises". Such a definition validates the view that competitiveness can be assessed by looking at a country's performance in trade or direct investment abroad, as competitive economies will necessarily perform strongly on exports and overseas investment. This explains why trade indicators have been used extensively as a measure of competitiveness, as reflected in the widely employed measure of Revealed Comparative Advantage (Balassa, 1965) or market share increases (e.g. Sharpe, 1986; Fagerberg, 1988, Krugman and Hatsopoulos, 1987, Mandeng 1991, etc.). Furthermore, trade data is also easily available and allows one to compare quantitatively.

There are numerous studies devoted to analysing the international competitiveness of exports or export performance of a country or group of economies. In the international trade literature, a common approach to modeling trade flows takes the price and income differentials as explanatory variables; in other words, a country's exports are traditionally explained by its export prices relative to competitors' prices and by importing countries' real income. However, competitiveness in the long run does not depend on price or income factors alone. Non-price factors (for instance, technology, domestic production capacity, etc) that influences a country's export supply potential are deemed equally if not more important, as witnessed from Kaldor's paradox, a well established empirical result that proves there is no significant relationship between the growth of unit labour costs and the growth of output.¹⁵

¹⁵ The Kaldor paradox comes from the observation that the fastest growing countries in terms

Price differences are the most obvious influences of trade competitiveness. A *World Development* article by Riveros (1992) analysed the effect of labour market distortions on manufactured exports in twenty less developed countries (LDCs) using panel data. Results show that the labour costs significantly affect manufactured exports in these LDCs. Similarly, a paper published in *World Development* by Edward and Golub (2004) assessed South Africa's international price and cost competitiveness in manufacturing, particularly with regard to labour costs, and examined the quantitative relationships between South African cost competitiveness and exports of manufactured goods at an industry level. Edward and Golub calculated relative wages, productivity and unit labour costs for South Africa vis-a-vis a large number of developed, developing and transition partner countries for 24 manufacturing sectors over 1970–98. Technically, unit labour cost is the cost of labour per unit of output, i.e., the ratio of wages to productivity. The authors found considerable evidence to show that South African exports respond to relative unit labour costs and that export growth is, in part, influenced by some combination of moderate wage growth and improved productivity. Using time series and cross-section analyses and controlling for world income, they found strong effects of relative unit labour costs on trade flows by sector particularly in the late 1990s. Further decomposing the effects of RULC into relative productivity and relative wages and regressing manufacturing export volume on these variables, they found that relative wages are more important determinants of trade than relative productivity, but both still matter.

of income GDP and exports have experienced faster growth in relative unit labour costs. Hence relative prices, when taken alone, cannot be the major determinants of competitiveness. In the long term, a country cannot expect to see its exports growing because of a continuous decline in relative prices.

Edward and Golub (2004)'s paper used the Ricardian framework to provide an integrated method to understand the macro- and microeconomic factors determining trade flows. The basic idea is that relative unit labour cost is influenced both by sector-specific variables (productivity and wages) as well as the real exchange rate. Studies in trade typically draw on Ricardian theory that postulates that countries will specialise in industries in which they have a comparative cost advantage. In a dynamic context, this comparative advantage may shift over time as conditions evolve, and it is the immobile factor costs (through wages, productivity and exchange rates) that determine changing shares.

Although it has been conventional to analyse the impact of changes in RULC on trade performance without distinguishing between its component parts – wages, exchange rate and labour productivity – some academics nonetheless estimate the export equation with RULC decomposed into these three components. Carlin, W., Glyn A., & Reenen (2001) found that in the long-run, proportionate changes in the components of relative unit labour costs (exchange rate, wages and labour productivity) have approximately the same effect on export market shares, although their short-run dynamics differ. In their paper published in *Economic Journal*, they further investigate the relationship between export market shares (XMS) and relative unit labour costs using a long panel of a dozen manufacturing industries across 14 OECD countries. Industries are weighted by their share in world exports to ensure that due influence is given to the industries that are most important in world trade. Pooling the data across all sectors and countries and assuming common coefficients on the determinants of exports, the following specification is estimated:

$$\Delta \log (XMS_{ijt}) = \sum_{k=0}^5 \alpha_k \Delta \log (RULC)_{ijt-k} + \sum \beta_j COUNTRY_j + u_{ijt}$$

Including country-specific trends to account for factors that may impact XMS other than RULC (i.e, country dummies are effectively picking up a model misspecification), the regression results show the RULC terms to be jointly highly significant and yield a highly significant long-run elasticity. While there are clearly important effects of relative costs on export market shares, the country dummies as a whole are still jointly significant once the change in cost competitiveness (RULC) is included. It is thus clear that there are important influences on export market shares other than relative costs. The authors explained that if the change in RULC really explained all the systematic variation in the change in export market shares, then the country dummies would shrink to irrelevance. Their continued significance testifies to important trends in market shares that cannot be explained purely in terms of RULC.

Interestingly, the authors were able to find some support for the role of institutional factors that account for the underlying country trends in exports. Simple regressions of the residual country trends on a series of institutional variables suggested that countries whose exports are less sensitive to costs possess the following factors – (1) human capital accumulation, (2) disembodied technical progress (i.e., organisational change across the business sector as a whole, as reflected in aggregate business-sector total factor productivity growth); (3) ownership concentration (defined by the mean shareholding of the largest three shareholders in the 10 largest private sector non-financial companies). However, the authors admitted that their results are at best speculative and more work needs to be done.

The importance of non-price factors in international competitiveness particularly in connection with technological changes cannot be overlooked. Research shows that there are two channels through which research and development (R&D) activities could affect a country's competitive position. Through R&D, higher quality products are typically created, leading to a higher level of income elasticity. On the other hand, R&D may improve production technology and so lower unit costs and improve price competitiveness. Carlin, W., Glyn A., & Reenen (2001) explore the role of technology that might have an impact on export performance. Three measures of technology measured at industry level are used – R&D expenditure, patenting activity and investment in fixed capital as a proxy for embodied technological change. Controlling for cost changes, the authors found that relative investment shares have a marked effect on export market shares, which supports the idea that technological improvements embodied in new capital goods promote export performance in ways that are not picked up by the productivity trends. However, there was no robust evidence that R&D or patenting intensities have an impact on trade and the authors suggest that this may be because what matters for product quality is not the inputs to innovation, but whether past research is successful.

Studies have shown that it is not easy to measure technological competitiveness. A major problem is finding proxies for technology variables that best represent competitiveness or technological superiority. Many of the applied studies in this area use GDP per capita as a proxy for the level of technological development. Expenditure on R&D and patent statistics are also commonly used to detect the impact of technological competition on trade performance (Amable and Verspagen, 1995;

Landesmann and Pfaffermayr, 1997) but these two indicators can be imperfect measures in the sense that they neglect important aspects of technological activity (Fagerberg, 1988). Some sectors of the economy do a lot of R & D but do not patent, while others patent a lot without being especially R & D-intensive. Fagerberg pointed out that at the national level, cross-country studies show a close correlation between levels of R & D and levels of patenting activity, and that there would be a high degree of multicollinearity if both variables were to be included in the same model. As a proxy for technological development, Fagerberg composed a weighted average of (a) civil (non-military) R & D as percentage of GDP, and (b) external patent applications per capita adjusted for differences in the openness of the economy. His findings reveal that while unit labour costs capture an important dimension of competitiveness, technological competitiveness is also important in influencing international competitiveness and growth across countries.

It is worth noting that sensitivity to price variations depends very much on the type of goods exported, hence one would expect different price elasticities according to the industry of origin of the exported goods. Therefore, the value of a country's price elasticity of exports reflects to some extent the product mix of the economy's exported goods.¹⁶ Carlin, W., Glyn A., & Reenen found that the R&D intensity of an industry serves to dampen the responsiveness of export market shares to changes in relative costs. Re-running their baseline equation (listed earlier) separately for each industry and removing the outlier of the electrical machinery industry which is very high-tech and is also very cost-sensitive, it was found that industries with high R&D intensity

¹⁶ Amable, B. and Verspagen, B. (1995). "The role of technology in market shares". *Applied Economics*, Vol. 27, no 2, pp. 198.

are less sensitive to costs.

In addition, trade openness might also affect the variability of the cost-sensitivity of exports across industries and countries. Industries that opened up the most to trade were also those in which cost competition became more important, such as the textile industry. In the paper by Carlin, W., Glyn A., & Reenen published in *The Economic Journal*, the researchers discovered that across 10 of the 12 industries, the RULC elasticity was more statistically significant in the post-1984 period than the pre-1984 period. Cost competition in the majority of industries became more important in the 1980s than it was in the 1970s, and the most obvious explanation is that of increased competition. As a proxy for changes in competition in an industry, they use the average change in import penetration in the industry across the OECD. A simple regression of the change in elasticities against the change in global import penetration resulted in a significant negative correlation ($t = 2.15$). Based on this, the authors argue that globalisation has increased the importance of costs in determining export shares over the sample period.

Research in international trade literature further reveals that production capacity is another crucial factor in affecting export performance. Fagerberg (1988) acknowledged that capacity constraints can become an important consideration in influencing international competitiveness. According to him, “a lack of competitiveness in terms of technology or prices may sometimes be compensated by a high ability to meet demand, if some other country faces a capacity constraint”. Fagerberg points out the crucial role played by investments in creating new production capacity. His findings revealed that for both the United States and the United Kingdom,

the main factor behind the losses in market shares during the period 1961-73 seemed to have been slow growth in productive capacity caused by the unusually low shares of national resources devoted to investments. On the contrary, the net effect of growth in relative unit labour costs on the growth of market shares for exports turned out to be negligible.

Fagerberg's findings were supported by other studies which showed that domestic growth is an important determinant of the growth potential of a country's industrial exports. A fast-growing country could increase its exports more rapidly than a slow-growing country. Generally, a country that is growing faster is also improving qualities of old goods and introducing new goods. As the product cycle theory (Vernon, 1966) postulates, there are first-comers' advantages in gaining control of foreign markets or increasing foreign market shares. In a paper published in *The Review of Economics and Statistics* in 1977, Kazuo Sato examined the extent of influence that industrial capacity has in accounting for inter-country variations in the conventionally estimated world-income elasticity of export demand. A key finding that emerged is that (demand for) industrial exports growth has been susceptible to domestic capacity growth, a factor largely neglected in econometric studies of the export demand function.

Other studies further corroborate earlier findings that export growth could be affected by domestic industrial growth. In a recent article published by Jongwanich (2010) in *World Economy*, capacity utilization or production capacity is found to be a crucial factor in affecting the export performance of eight East and Southeast Asian economies (ASEAN-5, China, Korea, Taiwan) during the period 1993-2008. In

particular, long-run estimates of production capacity are not only statistically significant but large in absolute value. According to the author, this implies that supply-side factors such as infrastructure, logistics capabilities, skills and the general business climate, are likely to be important in determining export performance.

In addition to production capacity, Jongwanich (2010)'s findings further reveal that FDI becomes statistically significant in determining export performance in all manufactured export categories. Using time series, the author estimates separate export equations for the eight East Asian countries for three different categories of exports – total merchandise exports, manufacturing exports, and exports of machinery and transport equipment (SITC 7). The author suggested that the importance of FDI in determining export performance, even using aggregate data, tends to support the hypothesis that multinational corporations are likely to be in a better position to overcome fixed costs induced by exports and have a higher chance to successfully export.

Although key findings by Jongwanich (2010) suggest that world demand, FDI and production capacity have increased in importance in determining exports for the sample countries, the sensitivity of exports to real exchange rate is the main issue or focal point of the article. The author is particularly interested to analyse the role of real exchange rate for parts and components trade which has grown increasingly important for East Asia. His empirical results indicate that the real exchange rate elasticity is lowest for machinery and transport equipment which comprise mostly intermediate products. His findings appear to be in line with other studies that suggest that a surge in intermediate trade is likely to undermine the importance of real exchange rate in

affecting export performance (Jones and Kierzkowski, 2001; Arndt and Huemer, 2004). Similar studies also find that the rapid diversification of exports away from traditional products and towards assembly/component activities (which rely to a greater extent on imported parts and components) have tended to weaken the link between the real exchange rate and export performance.

Past and current research has widely used the panel or pooled method to estimate the factors influencing export performance, mainly in manufactured goods. This study aims to use manufacturing exports as a proxy to examine manufacturing competitiveness. Using manufactured exports as a proxy for manufacturing competitiveness is apt for two reasons. First, the products produced by the East Asian economies are typically manufactured commodities that are exported for sale overseas. Through the production and distribution networks, economies in East Asia manufacture mostly intermediate goods that are used as inputs by other economies for the production of final products that are consumed in the G3 or advanced countries. Second, competitiveness is relative in the sense that one can observe how competitive the economy is by comparing its export performance versus that of other rivals or competitors. Hughes (1993) argued that competitiveness is reflected in relative international trade performance, whether measured as shares of world export markets, the degree of import penetration or an index of revealed comparative advantage.¹⁷

¹⁷ Hughes also argued that competitiveness is a question of relative efficiency, whether dynamic or static. This can be measured by looking at relative performance levels, productivity and productivity growth for example. Kirsty S. Hughes (ed.), "Introduction: Internationalisation, Integration and European competitiveness", *European Competitiveness*, (Cambridge University Press, Cambridge), 1993.

To date, research on examining the manufacturing competitiveness of East Asia has been limited. Although price and non-price factors can be applied universally in any analysis examining export competitiveness, there are surprisingly few studies that employ supply-side factors which reflect infrastructure to analyse competitiveness of manufactured exports. It is well known that weak infrastructure is a major impediment to trade and competitiveness. Inadequate infrastructure can increase trade costs and hinder trade growth. The dependence of trade costs on infrastructure has been well documented but there is very little understanding of the exact nature of trade costs. Broadly speaking, trade costs can be defined as the cost incurred in getting a good to a final user other than the marginal cost of producing the good itself. Such costs usually include transportation costs (both freight costs and time costs), communication costs, policy barriers (tariffs and non-tariff barriers) and local distribution costs (wholesale and retail). Determining total trade costs can therefore be more complex than adding together an ad valorem tariff value and unit shipping costs. There is little consensus on the functional form that best describes trade costs.

In most studies, the use of trade costs is proxied by distance and used in gravity models, which are the standard analytical framework for the estimation of bilateral trade flows. The idea is that transport costs increase with geographical distance and that this matters for trade between the economy and its trading partners. The gravity model estimates trade and investment flows between two countries on the basis of their economic sizes¹⁸, distance, population and other factors but such a model is not feasible to estimate trade flows where trade in parts and components are significant. Due to the proliferation of the global and regional manufacturing supply chains, the

¹⁸ GDP is often used as a proxy for market sizes.

country's GDP is not an appropriate determinant of its imports of intermediate goods from its trading partner unless the product is a consumer good.

Since infrastructure is hardly quantified in the standard export equation examining competitiveness of manufactured exports, it is the aim of this thesis to address the gap in the literature. Several approaches to building an infrastructure index have been employed by different authors. Owen (1987) graded countries in terms of infrastructure by using a linear average of several infrastructure measures, establishing a value of 100 for one country and relating the others to it. Hulten (1996) chose to normalize individual measures of infrastructure in quartiles. He then assigned a value to each of the ordered quartiles and, from these infrastructure rankings, constructed an index by taking simple averages. Limão and Venables (2001) built an index from four variables – kilometres of road, kilometres of paved highways, and of railways per square kilometre of country area, as well as telephone mainlines per person. Factor components were used to normalize the variables and a Cobb Douglas production function was employed. Most of the research examining the role of infrastructure for trade or economic development usually normalises infrastructure variables to make them independent of country size; hence, telephone mainlines and kilowatts of electricity were divided by population while roads, paved roads and railways were normalized by square kilometres of country area. This methodology was inspired by Canning, who proposed normalizing rival goods by population on the basis that the quantity of the good divided by population indicates average consumption.¹⁹ However for non-rival (public) goods like roads, normalising by population does not give

¹⁹ Canning, David (1998), "A database of world infrastructure stocks, 1950-1995", Washington D.C., World Bank research paper.

average per capita consumption, since an increase in population does not reduce average consumption with a fixed stock of non-rival infrastructure.

So far, the research examining the role of infrastructure are centred on advanced and developing economies outside Asia and not specifically confined to the region. In spite of its importance in a policy context, the impact of infrastructure has rarely been empirically analyzed in the case of East Asia. This study aims to contribute to existing literature by examining the significance of infrastructure for East Asia's manufacturing competitiveness. Drawing on some aspects of past methodology, this study will compute a weighted-index of infrastructure for three types of infrastructure categories – Roads (Transport), Telephones (Telecommunications), Electricity Generating Capacity (Energy). The rationale for including kilowatts of electricity generating capacity is that it contributes to manufacturing activities and is crucial for telecommunications, computers and machinery. The rationale for including roads instead of railways or airports/seaports is that it is relatively more important as a form of transportation infrastructure for many economies like China and Singapore (the latter has hardly any rail roads). The next chapter will discuss in detail the methodology behind the infrastructure index as well as other variables that are important determinants of East Asia's manufactured exports.

Chapter 4 – Model And Estimation

4.1 Hypothesis and Model

To underpin the empirical work, an econometric model needs to be laid out. The multi-country models in the past literature provided the framework for the empirical analysis in this study. In order to explain the determinants of manufactured exports, the equation takes into account both demand-side factors such as world income and relative prices, as well as supply-side variables that influence firms' ability to supply products to the export market. Theoretically, the export demand equation of a country is a function of its export prices relative to competitors' prices and the importing countries' real income. Import demand is usually proxied by real Gross Domestic Product (GDP) of the importing economy. The export demand equation could thus be represented by the following (Equation 1):

$$X_{ij}^d = f(GDP_i, \left[\frac{E_{ij} * P_j^M}{P_i^X} \right]) \quad (1)$$

where

X_{ij}^d = real demand for country i 's exports;

P_i^X = price of country i 's domestic exports in the world market, in domestic currency

P_j^M = price of goods in world market in currency of importer j

E_{ij} = bilateral nominal exchange rate (domestic currency per importer currency), i.e., an increase represents depreciation

GDP_j = proxy for importer j 's real income.

An increase in relative prices between that of the importer and country i is expected to induce an increase in demand for i 's products while export demand is also expected to increase as the importer's real income rises. The price effect is typically proxied by the real exchange rate in most export functions. The real exchange rate or the real effective exchange rate are a measure of competitiveness based on relative prices that has been used by many authors and by literature as old as Lipshitz and Mc Donald (1991), Durand and Giorno (1987) and Helleiner (1989). A rise in the real exchange rate is expected to have a negative impact on exports since this implies that domestic goods are becoming more expensive relative to the goods of the other country. Using ER_{ij} to represent the bilateral real exchange rate of country i 's vis-à-vis its importer, it can be measured as $ER_{ij} = E_{ij} * \frac{P_j^M}{P_i^C}$ whereby P_i^C refers to country i 's consumer price index (ER_{ij} is derived by deflating the nominal exchange rate with the CPI). Hence, a decline in the real effective exchange rate suggests an improvement in export competitiveness, which could arise from a decline in the nominal exchange rate (i.e., depreciation), a relatively slower rate of domestic cost/price increases, or a combination of both.

On the supply side, most empirical studies modeling the export supply have adopted a "neoclassical" approach, according to which the supply of non-traditional exports is explained by relative output prices and the capacity to produce. These studies have demonstrated the importance of labour costs and domestic production capacity in affecting export performance. Although some academics have used production or industrial capacity growth (i.e., actual industrial production) to capture the effect of firms' ability to produce for the export market, endogeneity could arise since the

explanatory variable might be affected by the reverse causality from the dependent variable. An increase in exports might also boost domestic production in the tradeable sector, not merely the other way round. To address this potential problem, an index of infrastructure is calculated and included as a determining factor in the export supply function (Equation 2 below):

$$X_{ij}^s = f(\text{Infrastructure}, \left[W_i / \frac{Q_i}{N_i} \right]) \quad (2)$$

where

X_{ij}^s = real supply export value

W_i = wages in manufacturing sector, in national currency

Q_i = volume of output (value added at constant prices), in national currency

N_i = employment

In this study, unit labour costs is included as an explanatory variable in the model alongside with infrastructure. Some studies have documented the use of the unit labour cost criterion with the rationale that these indicators are a good basis of international comparison among countries using similar technologies, as they are a function of important underlying determinants of competitiveness, i.e., wage rates, labor productivity and exchange rates (Turner and Golub, 1997 or Hickman 1992). An increase in unit labour cost, which is the ratio of wages to productivity, is expected to lower the quantity of exports supplied. Export supply is also expected to increase as the country's infrastructure improves. Well developed infrastructure is key to integrating the domestic or home market as well as cost effectively connecting it to international markets thereby enhancing the entire manufacturing value chain.

The purpose of the econometric model is to produce an analytical structure appropriate to interpret the empirical estimates of an export equation that incorporates both demand and supply-side influences. The following reduced export equation (Equation 3) will be performed for manufactured exports in this study:

$$X = f (ER_i, GDP_i, ULC_i, Infrastructure_i) \quad (3)$$

4.2 Data and Estimation

Data on manufactured exports is based on the Harmonized System (HS) code of tariff nomenclature which is an internationally standardized system of names and numbers for classifying traded products developed and maintained by the World Customs Organization. It is a classification system comprising 21 sections and 96 chapters. Since the key interest in this research is on manufactures, primary or agricultural items like animal or foodstuffs are excluded. We also do not consider mineral fuels like oil or raw materials such as natural rubber. However, there are products made with commodities that would constitute manufactures, such as rubber tyres used in motor vehicles, or products made with wood. A list of the HS codes on manufactured goods is given in Appendix Table 3. The data on these products is extracted from the World Trade Atlas (WTA) database.

In this study, seven East Asian economies are selected based on their level of development in manufacturing. They are China, Singapore, Malaysia, Thailand, Indonesia, Philippines and South Korea. Although there are regional variations in the economic development of these economies, they are within the league of the low to high middle level income status. In the context of East Asia, Taiwan, Hong Kong and

Japan are also considered as East Asian economies but due to the United Nations' lack of data on infrastructure for Taiwan, the country is regrettably excluded from the sample study. Japan is also excluded due to the fact that it is a highly advanced economy and its state of manufacturing has developed at least a decade earlier than the other Asian countries. Hong Kong is mainly a services-oriented economy and thus it would not be meaningful to include it in the study that examines manufacturing competitiveness.

The sample period runs from 2000 to 2010. One main reason is due to the fact that the latest data available for most countries on road infrastructure is 2010. Another key reason is that since trade patterns change and shift dynamically, taking a relatively shorter sample period from 2000-2010 is more appropriate than a longer time frame spanning two or three decades even though a longer sample yield more observations. In this study, since the methodology used is pooling data from across seven countries over eleven years, the problem of insufficient data observations is not an issue and test for structural break for changes and shifts in trade patterns or the dot.com IT crisis need not be carried out. In this study too, WTA provides highly disaggregated trade statistics on Singapore's domestic exports from 1999. It would be appropriate to consider only domestic exports in Singapore's case given its entrepot nature – a sizeable portion of its total exports would be re-exports (goods which are exported from Singapore in the same form as they have been imported without any transformation) rather than domestic exports.

Data on the real effective exchange rate (REER) is sourced from the Bank of International Settlements (BIS). The series (CPI-based REER estimates) are indexed to

the year 2005 if the base year is different. World demand or income is proxied using real OECD GDP. It is measured as the weighted average of the real incomes of the OECD countries, which together account for more than three quarters of shipments from East Asia. GDP data for the 34 economies is extracted from the CEIC database. A list of the data characteristics is presented in Appendix Table 4.

Data on ULC for many (especially developing) countries is not readily available for extraction due to incomplete data series on wages and productivity. Since unit labour costs can be defined as nominal wages relative to real labour productivity, one can compute ULC as the average nominal wage of workers divided by labour productivity, which in turn is computed as real GDP over total employment. Data on the GDP, total wages in manufacturing as well as employment in manufacturing are extracted from CEIC. Annual data is extracted if the quarterly data is not available. In China's case, national income statistics are not available on a quarterly basis so annual data is used instead to compute China's ULC. First, annual data on real GDP in the secondary industry that is indexed using 1978 as the base year is available. This is divided by employment in the secondary industry (persons, million) to derive the labour productivity. It is then re-indexed to the year 1980. To derive the annual ULC, the annual wage in manufacturing (expressed in local currency) is first indexed to 1980 and then divided by the productivity. The computed series is then splined using Eviews to give quarterly data on the unit labour costs. In Indonesia's case, the ULC estimates are also splined since annual data is more readily available than quarterly data.

Different countries have real GDP data that is in constant prices in different years expressed in their respective national currencies. For instance, Thailand's real GDP is in 1988 constant prices while Malaysia's real GDP is in 2000 constant prices. These are indexed to 1980, same as China. In the case where the data set on the number of people employed in manufacturing is not available for some of the years, older data sets are used to yield calculated values for missing years. For instance in the case of Korea, as the data on the number of persons employed in manufacturing is only available from 1Q 2004 onwards, we extract the older (discontinued) set data on employment (persons, thousands) to calculate a backdated figure. We first divide the figure in 4Q 2004 by the number in 4Q 2003 in the older series to get the change. The figure for 4Q 2004 which is already available in the new series is then divided by this change to obtain the estimate for 4Q 2003. Similarly for Malaysia, there are some series on employment that provides data for earlier years but is discontinued in later years like 2004 or 2005. In such a case, the later series on employment which provide figures in later years are then used and what is needed is to work out the figures for earlier years is to use the method as mentioned above. For Singapore, ULC data is readily available from the Department of Statistics online. Finally, estimates of manufacturing ULCs show that such costs generally increased for most economies for the past few decades, with the largest increase recorded for Indonesia (Figure 6).

Figure VI: Annual average change in manufacturing unit labour costs, (in national currency), %

Note: There is no change in South Korea’s ULC during the 2000-2010 period. Singapore’s data is from www.singstats.gov.sg
Source: Other country’s estimates are calculated from data provided by CEIC.

For infrastructure, three broad categories are used – roads, telecommunications and energy. Data on the road density (*kilometres of road per 100 square kilometres of land area*) is sourced from the World Bank. In the telecommunications category, data on mobile cellular subscriptions per 100 inhabitants and fixed broadband internet subscribers per 100 inhabitants are sourced from the ITU World Telecommunications/ICT Indicators database. Fixed telephone lines are not used because it will not capture the rapid change in telecommunications particularly during the past decade. With respect to energy, electricity generating capacity in kilowatt per thousand inhabitants is used and is sourced from the United Nations Energy Statistics database.

To calculate an index for infrastructure, data collected on the three categories are first indexed using 2000 as the base year. The two indicators (mobile and internet) are

aggregated before being indexed. As for road transportation, data on road density is not available for most years for Thailand and the Philippines. To overcome this problem, only the telecommunications and energy data are utilized in the computation of the infrastructure index for these two countries. The indices for the respective infrastructure categories will carry the value of “1” in the year 2000 and increase in subsequent years. This is logical as the infrastructure stock is expected to increase along with the country’s economic development.

Finally, different weights are allocated to the computed infrastructure indices. Bigger weightage is given to the road transportation index than to the other indices, reason being that electricity is known to be closely correlated with GDP and the latter can be multicollinear with exports. In addition, the indices for telecommunications are greater than the indices for road transportation and energy, reflecting the rapid advances in mobile usage and internet penetration rates. As such, it makes sense to allocate a relatively smaller weight to telecommunications. How much weight to allocate to the respective indices depend on subjective judgement. For instance, in the case of China, a weight of 0.5 is given to road transportation, 0.2 for telecommunications and 0.3 for energy. The combined figure for the infrastructure index is 4.5 which is greater than the infrastructure indices for other economies. According to intuition and anecdotal evidence, this would make sense given that China has taken concrete steps toward building the physical infrastructure – roads, logistics, ports, rail, telecommunications and electric grids – and its internet penetration rate is higher than the world’s average.²⁰ As for other developing countries, the index of infrastructure vary from 3.2

²⁰ According to a new publication by the World Bank, “Urban China: Toward Efficient, Inclusive, and Sustainable Urbanization, 2014”, China spent around 10% of GDP a year on infrastructure investment, far higher than 3–4 percent average of other developing countries, or 2% average in

for Philippines, between 3.5 and 3.6 for Thailand and Indonesia to 3.8 for Malaysia. The infrastructure indices for Korea and Singapore would be lower than the other ASEAN economies since they are already more developed in terms of infrastructure. Like other countries, more weight is allocated to the energy index for Korea and Singapore since the change in telecommunications is more rapid than that of energy usage and building of roads. For all sample countries, the allocated weights are adjusted based on subjective judgements.

4.3 Results and Sensitivity Analysis

The regression equation to be estimated is the following:

$$\ln(EX_{it}) = \beta_1 \ln(REER_{it}) + \beta_2 \ln(WGDP_{it}) + \beta_3 \ln(ULC_{it}) + \beta_4 (Infrastructure_{it}) + \varepsilon_{it}$$

- EXPC = Manufactured Exports
- REER = Real Effective Exchange Rate
- WGDP = World demand
(proxied by OECD’s real GDP in constant 2005 prices, US dollars)
- ULC = Unit labour cost
- Infrastructure = Index of Infrastructure

The manufactured export data for the eight economies is denominated in local currency and deflated by export price indices, with the exception of Indonesia and Philippines where the producer price index is used. The sample period is Q1 2000 to

developed countries. Enormous infrastructure investment in China is generally justified by the rapid rate of urbanization. Refer to <http://www.worldbank.org/content/dam/Worldbank/document/EAP/China/Urban-China-SRs4-7.pdf>.

Q1 2010. A time dummy variable which takes the value of 1 for the subprime or Lehman crisis period from Q4 2008 – Q4 2009 is also included.

The export equation is first estimated using the panel data fixed effects. Using panel data has many advantages and one of the benefits is that it is able to control for individual heterogeneity. Panel data suggests that individuals, firms, states or countries are heterogeneous. Time-series and cross-section studies not controlling this heterogeneity run the risk of obtaining biased results. As such, not accounting for potential unobserved heterogeneity²¹ causes serious misspecification. There is potential heterogeneity among the East Asian countries and to the extent that the data allow it, one should examine this. The fixed effects method, which is widely used in studies examining the determinants of exports, is used for estimation purposes. The fixed effects terms reflect the country-specific components that may affect a country's export performance. One of the merits behind the fixed effects approach is that it addresses the possibility of omitted-variables bias by controlling for all factors that are fixed over the sample period, not only those included in the estimation. Because the time-invariant factors that variables (like institutional characteristics, factor endowments and government policy) are meant to proxy for are often difficult to measure or are unobservable, it is difficult (if not impossible) to include enough variables to account for all of the important factors. The key advantage of using the fixed-effects estimator is that it produces consistent estimates even in the presence of

²¹ "Unobserved heterogeneity" refers to omitted variables that are fixed for an individual (at least over a long period of time). It is a form of omitted variables bias.

time-invariant, unobservable factors that vary across observations and are correlated with the explanatory variables.²²

Table III: Panel Data Regression Results

Dependent Variable: Exports	
Explanatory Variables	
REER	-1.31** (0.29)
WGDP	2.73** (0.11)
ULC	-0.21** (0.08)
Infra	0.21** (0.05)
Dummy (lehman crisis)	-0.14** (0.03)
Diagnostics/Model Fit	
R-squared	0.99
Wooldridge test for autocorrelation	0.88 [#]
No. of observations	287

All variables are in log form. Numbers in parentheses are standard errors.
** Significant at the 5% level.
Rejects the null hypothesis of first-order serial correlation at the 5% significance level.

The results in Table 3 show that all the variables have the expected sign and statistically significant. The relative importance of the real effective exchange rate and the unit labour cost can be directly inferred from ordinary least square estimates of b_1 and b_2 . These parameters are akin to the price and income elasticities commonly estimated in standard export demand equation. The estimate coefficient for b_3 and b_4 provides an indication of the average sensitivity of East Asian manufactured exports to

²² In the absence of correlation between individual country unobservable individual effects and trade determinants, the appropriate method is the random effects. If however, there is correlation between individual country effects and trade determinants, then fixed effects method on the panel data will be the most appropriate.

the unit labour costs and infrastructure. A 1% change in the unit labour costs for instance implies that East Asia's manufactured exports will fall by 0.22%. Tests of statistical significance on the regression estimates are performed using robust standard errors that take explicit account of potential heteroskedasticity and cross-sectional correlation in the disturbance term.

Most multi-country studies analyzing the factors that determine exports generally pool time series and cross sections together, a method typically employed in trade literature. To examine what contributes to the competitiveness of manufactured exports in each of the seven economies, this research uses a pooled regression (a variant of panel model) to generate estimates for the cross-section and country-specific coefficients.

Table IV: Pooled Regression Results

Dependent Variable: Manufactured Exports					
	Constant	REER	WGDP	ULC	Infrastructure
China	-131.88	-0.830**	5.556**	-0.476	0.547**
	(20.45)	(0.370)	(0.694)	(0.456)	(0.125)
Malaysia	-7.50	-1.376**	1.449**	-0.800**	0.000
	(14.55)	(0.438)	(0.506)	(0.265)	(0.094)
Thailand	-52.10	-0.142	2.702**	-0.122	0.221**
	(8.15)	(0.137)	(0.276)	(0.292)	(0.035)
Indonesia	-7.96	-0.470**	1.548**	-0.542**	0.023
	(16.64)	(0.208)	(0.573)	(0.158)	(0.097)
Philippines	64.63	-2.696**	-0.753	-0.419*	0.231
	(27.91)	(0.204)	(0.932)	(0.221)	(0.172)
Singapore	-29.47	-1.358**	2.071**	-0.420**	0.368**
	(16.77)	(0.310)	(0.573)	(0.105)	(0.142)
South Korea	-36.85	-0.091	2.315**	-0.089	1.670**
	(17.48)	(0.106)	(0.585)	(0.181)	(0.238)
Diagnostics/Model Fit					
R-squared			0.99		
No. of observations			287		
Standard error of regression			0.08		

Figures in parentheses are white heteroskedasticity-consistent standard error. ** Significant at the 5% level. * Significant at the 10% level.

Table 4 shows the regression results. All the variables (in logarithm form) have the expected signs. Except for the Philippines where the sign is wrong for the *WGDP* variable, all the signs are correct – *REER* and *ULC* are negative while *WGDP* and *infrastructure* are positive. World demand, proxied by real OECD GDP, is statistically significant for most economies (except Philippines), suggesting that being open to trade and harnessing the benefits of globalization is critical in influencing the economies' competitiveness in manufacturing.

Some other interesting findings are also observed. The variable *real effective exchange rate* is statistically significant for almost all economies except Thailand and South Korea. The result for Korea is in line with other studies showing that the correlation between Korea's exports and world GDP is high while no positive correlation was found between Korea's exports and its exchange rate (i.e., JPYKRW and USDKRW). This suggests that the bigger threat to Korea's exports is growth disappointment in the external economies, rather than the changes in the *won*.

As for the *ULC*, the variable is statistically significant for Malaysia, Indonesia and Singapore, suggesting that unit labour costs is important in determining the manufacturing competitiveness of these three ASEAN countries. As data computed for Korea shows that there is *zero* change in the country's manufacturing *ULC* during the period 2000-2010, it is not surprising that unit labour cost is not an important factor underlying South Korea's manufacturing competitiveness. For China, one can possibly explain why *ULC* is not statistically significant and that the country has maintained its global export market share despite losing cost competitiveness in recent years. This could imply that China still holds a comparative edge in other areas such as economies

of scale, supply chain efficiencies and improving product quality, many of which are unquantifiable. Indeed, the regressions results show that infrastructure is of crucial importance to China's manufacturing competitiveness, as shown by its highly statistical significance result. Understandably, infrastructure also figures prominently for Thailand, which is a manufacturing hub for electronics and auto transport equipment and as such, agglomeration of economies of scale is important in maintaining its competitiveness in manufacturing. Similarly, infrastructure is also vital in determining the manufacturing competitiveness of Singapore and South Korea which are relatively more developed than the other economies in the sample.

A robustness check show that the regressors are robust to the econometric specification used and the standard errors are heteroskedasticity consistent. The results shed some light on what drives manufacturing competitiveness and provide some validation for survey-based studies on the determinants of an economy's competitiveness.

Conducting a sensitivity check on the regression model results show that the estimates are robust and consistent with the actual changes in the variables for the sample period. Table 5 compares the predicted and actual changes in real export of manufactures. The predicted export growth is decomposed into the income effect (proxied by the real OECD GDP), price effect (REER) as well as other component variables like the *ULC* and *infrastructure*. For all the countries (except Malaysia and Philippines), the magnitude of the change in predicted export growth turns out to be close to the actual export growth, suggesting that the model has reasonably high explanatory power in capturing the influences affecting manufacturing competitiveness of most countries. For instance, in the case of Singapore when its real exchange rate appreciated during

the sample period, *ceteris paribus*, its manufactured exports is expected to decline by nearly 8 percent. This, coupled with changes in the unit labour costs, infrastructure and world income, will likely result in Singapore's manufactured exports to rise by 35 percent, about 10% point less than its actual increase during the sample period.

From Table 5, it is evident that changes in infrastructure dominate the impact on predicted export growth for economies such as China, Philippines and South Korea. Changes in infrastructure also accounts for a large proportion of the change in the predicted export growth of Singapore and Thailand, suggesting that infrastructure is very important in influencing the manufacturing competitiveness of many EA countries. This is consistent with many and recent studies showing that subpar infrastructure can adversely affect an economy's competitiveness and even cause the country to run a large risk of growth slowdown and being caught in the so-called "middle income trap".²³

The sensitivity results further show that the change in a country's manufactured exports is also dependent on the external demand for its goods. Therefore, how open the economy is, to a large extent, will determine how competitive its manufactured products are. Table 5 shows that the changes in the *WGDP* generate or account for the largest proportion of changes in the predicted export growth for the ASEAN-4 economies of Singapore, Indonesia, Malaysia and Thailand. This result is again consistent with many studies showing that deepening trade integration and openness to trade like implementing appropriate policies to eradicate trade barriers and

²³ The middle-income trap is the phenomenon of hitherto rapidly growing economies stagnating at middle-income levels and failing to rise to the high-income levels of advanced economies. This has often happened as a result of a sharp and persistent slowdown after a period of relatively strong growth.

streamlining customs procedures are key to increasing a country's export competitiveness. As for ULC, although the impact is smaller than the other explanatory variables in accounting for the change in the predicted export growth, it is still considerably significant for a number of countries particularly for Indonesia, Malaysia, Philippines and China. This suggests that institutions and good policies are vital in ensuring the manufacturing competitiveness of economies. This has important policy implications – the liberalization of factor markets, easing stringent product, credit and labour market regulations policies, investing in human capital, are crucial in raising or sustaining a country's manufacturing competitiveness. Since the liberalization of factor markets and services sectors very often depend on the institutions and the political will of governments to implement structural reforms, the quality of institutions and governance are hence to be considered as part of a critical interplay of factors influencing the country's manufacturing competitiveness.

Table V: Sensitivity Test Results

Country	Decomposition				Predicted (ΔEX)	Actual (ΔEX)
	ΔREER	ΔWGDP	ΔULC	ΔInfrastructure		
China	-6.8	77.84	-41.65	82.3	112	140
	8.16 * (-0.83)	14 * (5.556)	49.7 * (-0.476)	149.69 * (0.547)		
Malaysia	-1.63	20.3	-12.54	0.0	6	21
	1.18 * (-1.38)	14 * (1.45)	15.67 * (-0.8)	135.23 * (0.00)		
Thailand	-0.82	37.83	2.15	28.17	67	59
	5.75 * (-0.142)	14 * (2.702)	-17.6 * (-0.122)	127.35 * (0.221)		
Indonesia	-11.75	21.67	-51.65	2.92	-39	-31
	25 * (-0.47)	14 * (1.548)	95.3 * (-0.542)	126.76 * (0.023)		
Philippines	-7.56	-10.5	-11.38	28.15	-1	21
	2.8 * (-2.7)	14 * (-0.75)	27.1 * (-0.42)	122.37 * (0.23)		
Singapore	-7.93	29.4	6.16	20.32	45	35
	5.83 * (-1.358)	14 * (2.071)	-14.66 * (-0.42)	54.91 * (0.368)		
South Korea	0.87	32.41	-0.73	76.82	109	105
	-9.66 * (-0.091)	14 * (2.315)	8.1 * (-0.089)	46 * (1.67)		

Note: Figures in parenthesis are the regression coefficients generated by the model. The change in the explanatory variable is first derived from the difference in natural log of the value in end and beginning period of the sample and multiplied by 100 to yield percent change. This is later multiplied by the regression coefficient to get the predicted change. The actual change in the exports is computed by taking the difference in natural log in value of exports in the beginning and end (quarterly) period and multiplied by 100.

Chapter 5 – Country Specific and Non-Quantifiable Factors Driving Competitiveness

5.1 Socio-Economic and Political Factors

Once dubbed a miracle for its spectacular performance by the World Bank in 1993, the East Asian countries were able to sustain growth rates far higher than those of the other countries, developing or industrial due to the success of their manufacturing.²⁴

The EA economies are now among the most competitive exporters of manufactured products in the world, with China, South Korea, Singapore and Thailand ranked amongst the top twenty nations by Deloitte (2012) for manufacturing competence. That they are ranked again as the most competitive location for manufacturing in five years underscores their solid fundamentals in industrial sectors that are underpinned by appropriate macroeconomic policies and improved sound institutions.

There are a myriad of competitiveness factors that span the economic, political and social dimensions. Areas like political institutions, reflected in the transparency of economic policy making, effectiveness of existing legal frameworks, protection of intellectual property rights, etc, affect the quality of the business environment that in turn influences the productivity and competitiveness of firms. Similarly, the quality of

²⁴ Most of the sustained growth miracles of the past 60 years have been manufacturing miracles. Most manufactured goods are network hubs, meaning that they tend to be connected to other goods. A country which is successful in making machinery for instance is likely to find it easier to move into new products in the similar product space or cluster. Manufacturing thus creates a set of stepping stones or stairway to development than other activities like mining or agriculture. World Economic Forum (WEF), “The Future of Manufacturing: Opportunities to Drive Economic Growth”, a WEF report in collaboration with Deloitte Touche Tohmatsu, April 2012.

healthcare services and education are part of the social infrastructure that is crucial in driving the long-term competitiveness performance of economies. These factors are typically non-quantifiable in export equations and hence, this section aims to discuss the non-measurable determinants that could affect the EA country's manufacturing competencies under two building blocks of macroeconomic competitiveness and microeconomic competitiveness in the Porter framework. For ease of discussion, the manufacturing capabilities of the seven countries in the sample are analysed according to their relative strength in macro- and microeconomic factors.

In a nutshell, macroeconomic factors, which are heavily influenced by governmental actions, create and influence the broad setting in which businesses operate. Although they do not directly affect the productivity of firms like key factors of production (i.e., labour, materials, energy) do, soundness in these factors is vital to support firms' efforts to raise productivity. The macroeconomic competitiveness of the economy can be assessed on a few main fronts, namely social infrastructure, political institutions and macroeconomic policy. The effectiveness of political institutions, safeguards of property and legal rights, and adequate provisions of basic healthcare and education are some conditions that can indirectly affect the business climate for a country's manufacturing sectors to thrive. Fiscal and monetary policies affect short-term fluctuations in economic activity and ultimately firms' abilities to operate in an environment of low inflation and macroeconomic stability in the longer term.

As for microeconomic competitiveness, these are factors that directly affect the manufacturing firm's operations and they can be accessed by four dimensions outlined in the Porter framework – the quality of factor inputs that can be accessed for

productive use; the demand conditions in which firms operate; the strength of the related and supporting clusters which influences the level of positive externalities for manufacturing supply chains; and the context for strategy and rivalry that promotes manufacturing innovation and technological transfer. In the latter's case, government investments in the areas of science, technology and engineering – including the establishment and support of research institutions, the provision of technological support for manufacturers – creates a country-level climate for manufacturing innovation. These types of government investments typically foster knowledge creation and dissemination and have a strong positive influence on the long-term competitiveness of a country's manufacturing sector.

5.2 South Korea

Korea's manufacturing sector has steadily gained strength in the past decade and its global dominance in the manufacturing field is well known. Key manufacturing industries have now gained recognition in the global arena, with brands like Samsung and Hyundai holding their own against Japanese rivals like Sony and Toshiba. Korea has also emerged as the world's largest shipbuilding nation and Korean automobile manufacturers are now a significant force around the world as are its electronics (semiconductors and displays) and appliance makers.

South Korea's foremost competitive strength lies in its supporting and related industries and clusters, as well as the sub-category of strategy and operational effectiveness under micro competitiveness. Despite high labour costs, substantial investment in R&D, technology and innovation has created sophisticated, high value-

added goods that dominate the global market. There is also an extensive network of regional clusters whereby industrial clusters are established under various pillars of manufacturing that allow industrial firms to generate innovation and consequently, higher productivity. Further, Korea's industrial policy supports a broad base of manufacturing infrastructure development, including industrial parks, ports and transportation systems, which helped to enhance manufacturing competitiveness.

In terms of macroeconomic competitiveness that is important for manufacturing, South Korea has fairly strong social and political institutions which is reflected in its highly educated workforce, protection of intellectual property rights, and effective rule of law. More significantly, South Korea has strong institutional capacity to react to internal or external shocks. Its solid macroeconomic fundamentals left it well positioned to cope with the global economic turmoil that erupted in 2008; its large foreign currency reserves for instance enabled it to stabilize the domestic market by intervening directly in the foreign exchange market, to supply desperately needed dollars to financial institutions and to establish the US\$30 billion swap-line with the US. Its aggressive implementation of counter-cyclical measures enabled the economy to rebound from the crisis rapidly. In September 2008, Seoul implemented a fiscal stimulus package equivalent to 1.2% of its GDP, totaling some US\$11 billion and in March 2009, the government announced a 28.9 trillion won supplementary budget (equal to around 3% of GDP) to boost the domestic economy. In fact, the government's two fiscal packages, including the original budget and supplementary budget (which totaled 3.6% of GDP) was one of the largest fiscal expansions among G-20 countries (IMF 2009a). Actions to support activities in the real economy, for instance, extending credit to businesses, in particular, the small- and medium-sized enterprises (SMEs) were vital

to prevent a deterioration in the macroeconomic climate that would have hurt manufacturing prospects even further.

Although South Korea has first-world manufacturing exporters, its manufacturing success is too dependent on a clutch of huge conglomerates. The service sector is relatively under-developed while the labor market is too inflexible for an economy seeking rapidly to redeploy resources to higher-value industries. To sustain future manufacturing competitiveness, South Korea needs to further implement structural reforms to make the SMEs more productive and efficient so that they could “supplement” or support the export-oriented *chaebols* in areas like services that are crucial for manufacturing.

5.3 China

China’s emergence as a manufacturing juggernaut over the past decade underscores its formidable capabilities in ascending the technological and manufacturing value-added chain in production and innovation. An abundance of highly skilled workers, scientists, researchers and engineers have helped to solidify the country’s science and technology base.²⁵ China’s tremendous progress in infrastructure building, particularly in highways, railways, ports, aviation hubs, power facilities, water supply facilities and telecommunication networks, has also contributed to industrial productivity and

²⁵ The Chinese government, which has made it a top priority to invest in building science and technology capabilities, has developed a plan to build an innovation-oriented country in the next 15 years and become a power in science and technology by the middle of the 21st century. According to the guidelines on medium- and long-term programs for science and technology development (2006-2020), China’s entire investment in research and development is expected to reach 2.5% of its GDP by 2020, while science and technology will contribute to 60% and above to the mainland’s development.

competitiveness.²⁶ China has a sufficient power supply, highly developed highway and railway network, the world's largest port cargo volume, extensive coverage of communication networks, and a social system supporting the effective operation of this infrastructure; therefore, manufacturing enterprises in China have been provided with a favourable fundamental environment for investment. To meet future infrastructure needs, the government has also correspondingly set up large-scale investment programs, including continuous expansion of the railway network in China, which is already the largest of the kind around the world, to 120,000km by 2020; investment of RMB3.45 trillion in smart grid construction in the next decade; and construction of a 85,000km highway network by 2020 (Deloitte, 2011).

Local business dynamics (or local demand conditions in Porter's framework) is another major factor influencing the competitiveness of China's manufacturing. In the last three decades, China has experienced the most extensive urbanization in human history. Hundreds of millions of people have moved away from their traditional living and production modes, which had been passed down from generation to generation, and have moved into cities. Demand in housing, transportation, communication, education, entertainment and other human activities have therefore provided an unprecedented market for China's manufacturing industry. Large-scale urbanization makes it possible for all kinds of products to find their market niches in the mainland. From the most advanced technological products to the most general daily consumer products, China's market demand seems endless. It is likely that in future, China will maintain an advantage in local market conditions as the traditional *hukou* or household

²⁶ Using the World Bank's Logistics Performance Index (LPI) which is a composite of six major components that address both the 'hard' and 'soft' infrastructure needed to facilitate global trade, China currently excels globally in terms of relative manufacturing labour cost to LPI.

registration system policy is eased to allow workers to move in and out of the cities as employment opportunities arise.²⁷ This will provide some boost to the economy's manufacturing output and enable firms to reap economies of scale which lead to productivity gains.

Overall, China is comparatively stronger in the microeconomic aspect of competitiveness than macroeconomic factors. According to data from the World Bank Group, China's composite tax burden ranked 31st among the documented 209 countries and regions in the survey. It has also indicated that China is among the top 15% of countries with heaviest taxation. Among major industrial countries, China's tax burden is ranked after France, but above that of the other countries.

In addition, there is general ambivalence regarding the current environment of intellectual property protection in China. While businesses support the legislation in relation to intellectual property protection in China, they also have little confidence in its practice. Although foreign-invested companies have a strong desire to bring more technology into China, they have serious concerns regarding the state of intellectual property protection in China. They are worried that local competitors will have the capability to reproduce their technology, and are concerned as to whether local partners would maintain their commitments for long-term mutual benefit after they have obtained the technology. As the foundation of technological innovation,

²⁷ According to an urbanization report from the United Nations, urban population growth in China has been ranked the top in the world for the last 30 years. Between 2000 and 2005, urban population growth reached a peak of 105 million, with average annual growth of 20 million, which was around 32% of the world's total. Between 2006 and 2010, China's urban population growth stabilized at around 15 million per year, which was around 24% of the world's total, and still remained at No.1 in the world. In the coming ten years, China's urban population growth will remain stable until 2025 when it will begin to slowly decrease.

intellectual property protection is critical for the future development of manufacturing industry in China. Lack of intellectual property protection will therefore hinder the success of the manufacturing in any country.

Currently, technological innovation in China is still concentrated in few companies in few sectors, and is not yet widespread. The government has set a series of objectives for industrial development, proposed independent innovation, and urged the large enterprises to invest in R&D for up to 3% of sales. However, in execution, large manufacturing enterprises do not have specific objective assessments on the effectiveness of their R&D investment. According to the study by Deloitte (2011), it was found that some of the Chinese companies simply spend the R&D funds to acquire prototypes and conduct peripheral testing; and spend very little on core technology or real innovation. Therefore the R&D effectiveness and technical transfer rate in these companies remains very low. To prepare for future global competition, China's manufacturing industry should not only achieve technological innovation in individual enterprises but should also enhance the organization and integration of downstream and upstream businesses in the industrial chain, i.e. realising innovation across the entire industrial chain. For example, in the automotive industry, success is usually due more to innovation in areas like engines, gearboxes, and automobile electronics than OEM itself. Only with well-integrated innovation efforts across the entire value chain can the overall development of the sector be realized.

5.4 Malaysia

Malaysia's competitiveness in manufacturing comes from its strength in many aspects

of microcompetitiveness, chief of which is its success in creating industrial clusters that raised manufacturing competitiveness. Typically, a cluster is defined as an agglomeration of inter-linked or related activities comprising industries, suppliers, critical supporting business services, requisite infrastructure and institutions. Its defining characteristic is high connectivity. Malaysia's state of cluster development is manifested in its Second Industrial Master Plan or IMP2 (1996-2005) which is based on Michael Porter's cluster approach towards industrial development.²⁸ Under the IMP2, Malaysia's industrial sector was classified into eight industry clusters, namely – electrical and electronics, transportation, chemicals, textiles and apparel, materials and advanced materials, machinery and equipment, agro-based and food products, and resource-based industries. Of these eight industry clusters, the electrical and electronics industry (comprising components, consumer electronics and industrial electronics) is one of the leading industrial sub-sectors in terms of employment, output, value-added and export. The information technology (IT) project, called the Multimedia Super Corridor (MSC), belongs to this dynamic industrial subsector and was successful in attracting foreign investors to the enclave due to the hard infrastructure (such as fiber-optic telecommunications networks and modern transportation networks) as well as soft infrastructure, packaged with incentives and a conducive legal and regulatory environment.

Further, Malaysia's capital market infrastructure is crucial in fostering a conducive

²⁸ Malaysia's Second Industrial Master Plan (IMP2) followed the success of IMP1 that was intended to provide a blueprint for an accelerated industrial development. This accelerated development was to be achieved through a concerted structural transformation of the Malaysian economy from one relying mainly on the production and exports of primary commodities to a more sophisticated as well as broad-based industrial economy. In fact, the success of the First Industrial Master Plan boosted the confidence of Malaysian economic policy-makers to launch the IMP2.

business environment for manufacturing firms. Since the Capital Market Plan 1 (blueprint for development of capital market), firms have a variety of avenues to raise funds to finance their growth and this is particularly important as the country restructures from traditional manufacturing to a more innovation-based economy. Venture capital availability and ease of access to loans and financing through the local equity market are factors that improve the quality of the business environment in Malaysia.

However, there are some impediments to manufacturing as seen from Malaysia's weaknesses in the macroeconomic competitiveness sub-areas of human development and rule of law. There is a shortage of skilled labour, as such, more can be done to strengthen basic health and education, as well as lowering the business costs of crime and corruption. In terms of infrastructure, Malaysia fares poorly on communications infrastructure, for instance, low penetration rate of telephone lines per 100 inhabitants although logistical infrastructure has generally strengthened with better quality of port infrastructure. Further, weak intellectual property protection reflects Malaysia's poor legal framework that can affect the country's manufacturing competitiveness.

5.5 Indonesia

Given its vast natural resources and relatively competitive wages vis-à-vis countries like China, Indonesia's manufactured goods are mainly labour-intensive products like garments, toys or shoes and its exports are mainly dominated by commodities and low-tech intensive manufactures. Indonesia's manufacturing competitiveness is

underpinned by its favourable demographics (i.e., large population) that is a potential source of robust domestic demand for manufacturing production.

More significantly, Indonesia's manufacturing competitiveness has been underpinned by recent macroeconomic stability. Since the move to an inflation-targeting regime in 2005, the country has made progress in stabilising CPI inflation while the country's economic fundamentals have further improved with the public debt-to-GDP ratio falling substantially due to increasingly prudent fiscal management. These, coupled with sound budget management which have put the country on a strong fiscal footing, have led to an improved macroeconomic climate that is beneficial to manufacturing firms.

Despite an improved macroeconomic climate, the general business environment still remains problematic. The legal system lacks transparency, tends to favour the political elite and sometimes appears discriminatory against foreign interests. Labour laws are also inflexible, corporate governance is weak and corruption is endemic. Worst, the regulatory climate remains unfavourable to FDI with a high incidence of policy flip-flops. For instance, a new regulation passed in March 2012 decreed that foreign mining firms would have to divest half of their stake to locals ten years after their operation, a particularly inhibitive proposal given the long period it takes resource firms to recoup large sunk costs.

In addition, infrastructure remains woefully inadequate particularly in the transport and electricity sector. The 2012-13 Global Competitiveness Report ranked Indonesia 78th among 144 countries for its quality of infrastructure while Malaysia and Thailand

obtained 32nd and 46th position respectively. Indonesia's infrastructure spending is still not rising fast enough to keep pace with the growing needs of the economy and this can adversely affect or even lead to a deterioration in manufacturing competitiveness.

Indonesia's political economy is also another aspect that remains a challenge for manufacturing. As power is diffused given the proliferation of parties and fiscal decentralization, government effectiveness is reduced. Given the impending elections in 2014, with the current president expected to step down after two terms in office, future uncertainty has increased. More policies in the direction of protectionism, trade restrictions and foreign ownership limitations may be imposed ahead of the 2014 major elections since these issues are popular with the electorate. To minimise investment uncertainty and boost manufacturing prospects, Indonesia should eschew the creeping protectionism and nationalism that have motivated policy decisions and measures. There is much scope to improve the business environment such as cutting red tape and strengthening the rule of law and contract enforcement.

5.6 Thailand

Thailand's manufacturing sector has become increasingly diversified over the years and its manufacturing competitiveness in sectors such as machinery, consumer electronics and motor vehicles depends on a host of factors. First, an ecosystem of industrial clusters and related supplier firms have helped to enhance the manufacturing capabilities of Thai firms. In 2001, a National Competitiveness Committee was created to develop specific industrial clusters – automobiles, food, tourism, fashion, and software. The cluster concept became the main industrial and innovation policy at the national, regional and local levels. A cluster mapping of the country was conducted to

identify significant agglomerations of firms in various geographical locations. At the regional level, Thailand was divided into 19 geographical areas which were to implement cluster strategies focusing on a few strategic products or services. Investment packages were extended for strategic clusters, such as hard disk drives and semiconductors while incentives were granted by the Board of Investment to Thai firms to participate in global value chains.

Two manufacturing sectors in Thailand that readily come to mind and are successful in attracting increased investment levels and expansion are the automotive and petrochemical industries. Both of these industries support supplier development for plastics, electronics, metal, appliance, and consumer products with similar suppliers and process technology or by providing higher value-added feedstock integration. Thailand's automobile manufacturing industry now accounts for more than 10% of the country's GDP, and is the number one manufacturing industry in Thailand in terms of value. In 2005 production of new vehicles passed the one million unit mark, and Thailand is now famously known as the "Detroit of the East" that leads the region in the production of transportation vehicles for export. Thailand's manufacturing competitiveness, in part, can be attributed to the abolishment of local content requirements in the auto industry in 2000, two years ahead of the WTO deadline. This was instrumental in the decision by General Motors to select Thailand as its ASEAN manufacturing base in preference to other countries such as Indonesia, given the presence of a large number of established auto parts manufacturers in the automotive clusters.

Exposing the industries to international competition is also crucial in lifting the manufacturing competitiveness of Thai firms. The government brought forward the implementation of the 0-5% import tariff ceiling of the ASEAN Free Trade Agreement (AFTA) by one year to 1 Jan 2002 to spur competition and enlarge the regional market. Competition generates pressures and opportunities in both the domestic and export markets and stimulates investment in technology development. According to UNIDO²⁹, trade liberalization in Thailand has almost certainly contributed to encouraging some firms towards deepening their technological capabilities and activities. Trade liberalization provides the impetus for firms to seek improvements in production organization, develop design capabilities, improve quality and access new markets.

Thailand's diversified manufacturing sector is the largest contributor to economic growth. Although high-technology products such as integrated circuits and parts, hard disc drives, electrical appliances, vehicles, and vehicle parts are now leading Thailand's growth in exports, future performance depends on moving up the value-added ladder away from low-wage industries where regional competition is growing. Key reforms are needed to open up the financial sector, further improve the foreign investment climate, enhancing telecommunications capabilities and eradicating red tape (which encourages corruption). Infrastructure bottlenecks (particularly in and around Bangkok and the eastern seaboard) also need to be removed as logistics networks and electricity generation increasingly run the risk of bottlenecks and may pose a challenge to manufacturing competitiveness.

²⁹ UN Industrial Development Organisation, "Thailand's Manufacturing Competitiveness: Promoting Technology, Productivity and Linkages", SME Technical Working Paper Series, Working Paper No. 8, Sep 2002.

5.7 Philippines

Historically, the Philippines is relatively less competitive in manufacturing compared to its more developed neighbours in ASEAN and East Asia. However, the country's macroeconomic fundamentals have improved considerably during the past decade, with its government budget in balance and inflation easing to low single digits. Coupled with a fairly educated English-speaking workforce and lower labour costs compared to its neighbours like Thailand, Indonesia or China that experienced minimum wage hike pressures, the Philippines' improved macroeconomic climate is a boost to manufacturing.

But obstacles to manufacturing still exist. Philippines lacks a competitive network of clusters to enhance the competitiveness and productivity of its firms. While Philippines' main exports are in machinery and electronics like semiconductors and electrical appliances, there is a lack of developing networks of competitive parts and components suppliers and subcontractors that is crucial to the development of strong industries. Linkages can promote supplier clusters, inducing firms to locate close to MNC affiliates and strengthening the technological level and dynamism of existing clusters (World Bank, 2004). The more competitive the country's suppliers are, the greater the potential for creating and sustaining deeper linkages with MNCs and for engaging in higher value added activities. In the Philippines, the deepening of high-technology industries has remained weak due to limited backward linkages and low value added of high-technology export products. In the auto parts industry, for instance, the linkage between the automotive assembly sector and local parts and

components has remained weak. After almost three decades of import substitution which was centered on local content policy, a large part of the parts and components industry still remains underdeveloped.

Further, the Philippines has a history of political instability. Revelations about the depth and pervasiveness of corruption, violence associated with the militant Islamist group Abu Sayyaf and other insurgencies are all threats that worsen the investment environment. In the World Bank's *Ease of Doing Business Report 2013*, which ranks countries according to ease in several areas, including starting a business, registering property, obtaining credit, paying taxes and protecting investors, the Philippines ranked 138th out of 185 economies, down two notches from 136th place in 2012. Poor infrastructure, bureaucratic red tape and unpredictable policies are seen as impediments to FDI and hence manufacturing. Only by undertaking the necessary measures to address these areas will the Philippines be able to improve its manufacturing competitiveness.

5.8 Singapore

Singapore's manufacturing still remains fairly competitive despite its labour costs being amongst the highest in the EA region. Its infrastructure in telecommunications, sea and air links is world class, its workforce is highly educated and its political and business regime is stable and transparent. Despite increased competition in Asia for FDI flows, Singapore continues to be an attractive destination for investors especially for high value-added industries. In the 1990s, a healthy rise in manufacturing investments in Singapore was reported (Table 6). In the ten-year period from 1990 to

2009, manufacturing investments, growing at an average annual rate of 15%, more than tripled from S\$2.5 to S\$9.2 billion From 2000 to 2010, manufacturing investments rose at an average compound growth rate of 12% per annum.

Table VI: Manufacturing Investments in Singapore

Year	S\$ billion
1990	2.5
1991	2.9
1992	3.5
1993	3.9
1994	5.8
1995	6.8
1996	8.1
1997	8.5
1998	7.8
1999	8.0
2000	9.2
2009*	11.8
2010*	12.9

* represent investment commitments.
Source: EDB

Singapore’s main manufacturing activities are in petroleum, pharmaceuticals and electronics such as semiconductors and processor chips, and the island-state has also emerged as a major manufacturing site and a regional centre for oil supply, servicing and refining. Manufacturing competitiveness has been enhanced by the existence of industry clusters in the form of business and industrial parks. By being in close proximity to supporting industries that are clustered spatially, manufacturing firms are able to specialize in niches of production and harness agglomeration benefits like lower logistic costs and knowledge spillovers thereby reaping productivity gains.

Singapore's pursuit of a free trade policy and signing of free trade agreements with many trading partners also meant that manufacturing firms has greater access to external markets that allow them to tap on overseas demand for their products. To maintain its long-term competitiveness, Singapore is trying to develop industries that are knowledge or innovation driven but for manufacturing to further move up the value-added technology ladder, it needs talent and Singapore's small population meant it has limited skilled talent or resources which can be a constraint to manufacturing. Although skilled foreign labour can be imported to plug in the necessary labour shortage, this has to be balanced against social needs. Currently, the domestic economy is undergoing a structural transition and the government's efforts to wean the economy from excessive foreign labour have already led to tight labour markets that saw wages rise more rapidly than productivity. Similarly, land/infrastructure constraints had led to price pressures in the property and car markets and this has translated into higher rent and transportation logistics costs for manufacturing firms.

5.9 Challenges and Prospects

The EA countries have achieved respectable economic growth over the past decade on account of their manufacturing successes. However they face many challenges on the international and national level in order to sustain their competitive edge in manufacturing. First, the emergence of protectionism particularly in periods of global downturns can jeopardise the manufacturing prospects of economies that are especially open to foreign trade. With supply chains and production networks becoming more global, manufacturing becomes susceptible to protectionist measures that have evolved over time. To protect domestic industries, countries are moving

away from transparent policy instruments such as tariffs and towards measures that are less regulated by international trade rules such as export subsidy, local content requirement, etc. These discriminatory measures not only create friction but also distorts open and free trade and hampers the globalization of manufacturing.

In addition, it has become more challenging for EA economies to maintain their manufacturing competitiveness due to the proliferating supply chains regionally and worldwide. This disaggregation of supply chains, which has resulted in the spread of various aspects of production across the world, leaves companies more vulnerable to foreign exchange rate fluctuations. Over the past decade, major currencies have demonstrated high degrees of fluctuation resulting in significant supply chain cost swings for manufacturers with global operations and globally disaggregated supply chains. Exposure to foreign currency fluctuations can cause significant and unexpected cost anomalies for producers in East Asia (particularly for those operating in countries with fairly flexible exchange rates) and this may directly affect the country's manufacturing competitiveness.

Another challenge that the EA countries face is the looming threat of an ageing population and shrinking workforce due to declining fertility and low birth rates. This meant that manufacturing companies will face a talent crisis or shortage of labour. The ageing population will change workforce demographics, tighten labour supply, exacerbate the talent shortage and increase the tax burden on the working population whose relative size is declining. Some countries like South Korea and Singapore have already seen an absolute decline in the size of their domestic workforce. Although other countries like Indonesia and China have much larger and younger populations,

they are expected to experience the same demographic headwinds in a decade or two's time and hence face pressure to move up the value-added production chain (i.e., to reduce reliance on cheap labour) or risk damaging their manufacturing competitiveness in the long term.

Although the EA economies have adopted the necessary industrial policies to build up their manufacturing, the extent of competitiveness differ among the various countries. Given the region's eclectic mix, the challenges that each country faces with respect to manufacturing are quite different. For instance, political instability or uncertainty in some ASEAN countries like Philippines or Indonesia can be a major problem affecting manufacturing prospects while for countries like Singapore, the institutional quality is not a major issue but it has a very small industrial base that prohibits the production of many types of manufactures compared to China or South Korea. China is already posing serious competition to its EA neighbours due to its comparative advantage in manufacturing both labour and capital-intensive machinery whereas South Korea have attained success in manufacturing end-products like computer tablets or smartphones unlike Singapore that produces mainly periphery goods such as electronics parts and components for use in these end-products. The priority issues that each EA country has to address in raising its manufacturing competitiveness are different; as such, each economy has to identify its strengths and weaknesses and adopt the necessary measures or reforms if it were to enhance its competitiveness performance in the long term.

Despite wide cross-country heterogeneity, the EA economies will all need to continually invest in physical and human capital to raise total factor productivity (TFP)

growth and manufacturing competitiveness. A new IMF study (*Regional Economic Outlook*, April 2013) has shown that the main proximate driver of a sustained slowdown in growth has often been a persistent decline in the growth of TFP, a crude measure of technological progress. Continual investment in infrastructure is also pertinent if the country is to sustain economic growth and manufacturing competitiveness. While infrastructure alone will not lead directly to best-in-class manufacturing, a serious lack of infrastructure or a steadily decaying infrastructure will create serious obstacles for the supply chain networks of manufacturing production. The challenge for the developing EA countries is thus to develop new infrastructure while the challenge for the relatively developed economies is to refurbish old infrastructure that may have become obsolete.

Chapter Six – Conclusion

The empirical findings from this research validate existing authoritative studies like the Global or World Competitiveness Reports that attempt to benchmark the many factors underpinning national competitiveness. These studies typically use the survey responses of business executives and construct indices that integrate both the micro- and macroeconomic aspects of competitiveness which are then used to rank countries or economies. However, they do not quantify the important factors driving competitiveness. This thesis contributes to the current literature by employing trade data that are internationally comparable to examine what drives manufacturing competitiveness in East Asia. Thus far, there have been scant studies analyzing this issue in East Asia and this research adopts a panel data approach to estimate the relative importance of both price (demand) and non-price (supply-side) factors that are commonly found in international trade literature. A new contribution that this study makes is the incorporation of infrastructure and the computation of a weighted index to estimate the quantity and quality of infrastructure in the respective East Asian countries. Although infrastructure is typically for a country's national use and the benefits are not merely confined to manufacturing sectors, manufacturing, more so than other segments of the economy, relies on efficient infrastructure for complex supply chain networks and access to new markets. This is particularly important as East Asian manufacturing are vertically integrated these days – the proliferation of regional supply chains imply that adequate infrastructure (like transportation and telecommunication) are important in enabling the intra-regional movements of materials or inputs for the production of final or intermediate goods. The importance of infrastructure also cannot be ignored as many authoritative studies have

documented its importance – manufacturers generally do better in countries with good access to high-quality transport, telecommunications, electricity, and financial services.

In this research, it is found that unit labour costs, infrastructure, real effective exchange rate and world income are some of the critical variables determining manufacturing competitiveness. The results obtained indicate that regressors like unit labour costs and REERs are negatively correlated with manufacturing competitiveness while infrastructure and global demand are positively correlated. This study further examines, through pooled regression, the sensitivity of each EA country to these demand and supply variables. Empirical results reveal that world income is highly statistically significant for almost all economies, suggesting that dismantling barriers to trade is critical to unleashing competition and induce manufacturing firms to be more competitive. Real effective exchange rate is also highly statistically significant for a large number of economies in the region. This suggests that implementing policies to reduce factor costs that are reflected in the real effective exchange rates are important. Competitive costs for labour, materials and energy – key factors of production – are deemed critical to a nation's manufacturing competitiveness, and such domestic cost increases could ultimately feed through to inflation and reflected in the real effective exchange rate. Governments would have to manage the optimal path of their REER going forward through a policy-induced appreciation of the nominal exchange rate.

The other explanatory variables – ULC and infrastructure – are found to influence competitiveness in manufacturing for slightly more than half of the countries in the sample. ULC is important as a measure of competitiveness given that labour

compensation is often a major component of the cost structure of production and therefore, influences prices in the industry. The underlying rationale is that in low productivity countries (sectors), a high wage rate can make production costly and jeopardize long-run competitiveness. In high productivity countries (sectors), however, a high average wage rate can be offset by high productivity and, therefore, can still maintain export competitiveness despite rises in wages. Therefore, ULC matters in manufacturing.

In East Asia, some countries are clearly experiencing higher ULC rises than some, due to the rapid pace of population aging or increases in minimum wages without a corresponding rise in labour productivity. Given that competitiveness is a long run phenomenon and ULC most likely affect competitiveness in the long term given that manufacturing firms need time to adjust and adopt measures to improve their productivity, it is thus important to analyse how competitive an economy is by looking at its unit labour cost and whether it has been rising faster or slower compared to other countries. Policies to improve productivity through education and skills training as well as infrastructure development are, needless to say, necessary and crucial. Liberalising services sectors with the aim of improving productivity is also important since services such as telecommunications and travel, logistics, banks, and ICT provision are complementary to manufacturing.³⁰ Other non-quantifiable factors also

³⁰ Evidence indicates that the linkage between manufacturing and services is increasing and that services are important inputs to manufacturing. According to a special study by ADB, recent work has studied and estimated quantitatively the role that service quality plays using three indicators of manufacturing competitiveness: (i) the degree of product differentiation, measured by the Grubel-Lloyd index; (ii) prices obtained in export markets; and (iii) the duration of trade. Product differentiation increases as the quality of these indicators increases, although there are differences across sectors and country groups (by income). Manufacturers do better, in terms of product differentiation and export prices, in countries with good access to transport and services and their exports tend to be more resilient over time.

matters, for instance, manufacturing innovation through R&D, political stability and efficient government bureaucracy. In the case of China and Korea, for instance, ULC is not statistically significant and a major reason behind the manufacturing competitiveness of these two East Asian economies could be attributed to their large production bases that enable firms to reap economies of scale and supply chain efficiencies. However, it is difficult to quantify agglomeration or economies of scale, hence, one limitation of this study lies in not being able to measure such factors or other variables like political instability. This could be a potential area of research in the future, to develop a methodology that capture such influences as well as to enlarge the sample size by including more emerging economies such as India or Vietnam.

Appendix

Appendix I.1 Components of Competitiveness Drivers

Drivers	Components
Talent-driven innovation	Quality and availability of labour force
	Quality and availability of scientists, researchers and engineers
	Capacity for manufacturing innovation
Cost of labour and materials	Cost competitiveness of materials
	Cost competitiveness of labour
	Availability of raw materials
Energy cost and policies	Cost competitiveness of energy
	Energy policies
Economic, trade, financial and tax systems	Tax system
	Trade policy
	Central bank and economic policies
Quality of physical infrastructure	Efficient transportation infrastructure, uninterrupted availability of power supply, robust communications network
Government’s investments in manufacturing and innovation	Government’s emphasis on investments in manufacturing
	Government’s investments in science, technology and engineering
Legal and regulatory system	Legal and regulatory environment
	Regulatory compliance costs
	Labour laws and regulations
	Intellectual property protection and enforcement
Supplier network	Availability of local qualified supplier base
Local business dynamics	Size of local market
	Intensity of local competition
Quality and availability of healthcare	Availability of affordable and quality healthcare

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index.

Appendix I.2 Regional Comparison – Drivers of Manufacturing Competitiveness

Drivers	Rank			
	Asia	United States & Canada	Europe	Mexico & South America
Talent-driven innovation	1	1	1	2
Government’s investments in manufacturing and innovation	2	7	8	7
Cost of labour and materials	3	2	4	5
Economic, trade, financial and tax systems	4	3	6	4
Energy cost and policies	5	4	2	3
Quality of physical infrastructure	6	6	3	1
Legal and regulatory system	7	5	5	6
Supplier network	8	8	7	9
Local business dynamics	9	9	9	10
Quality and availability of healthcare	10	10	10	8

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index.

Appendix I.3 List of Harmonized System Codes for Manufactured Products

HS Code	Section VI: Products of the Chemical or Allied Industries
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes
29	Organic chemicals
30	Pharmaceutical products
31	Fertilizers
32	Tanning or dyeing extracts; dyes, pigments, paints, varnishes, putty and mastics
33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations
34	Soap, organic surface-active agents, washing preparations, lubricating preparations, artificial waxes, prepared waxes, polishing or scouring preparations, candles and similar articles, modeling pastes, "dental waxes" and dental preparations with a basis of plaster
35	Albuminoidal substances; modified starches; glues; enzymes
36	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations
37	Photographic or cinematographic goods
38	Miscellaneous chemical products
4006	unvulc rubber forms nesoi & unvulc rubber articles
4007	vulcanized rubber thread and cord
4008	plates, sheets, profile shapes etc, soft vulc rubber
4009	tubes, pipes & hoses of unhard vulcanized rubber
4010	conveyor or transmiss belts of vulcanized rubber
4011	new pneumatic tires, of rubber
4012	retread or used pneu tires, solid tires etc, rubber
4013	inner tubes for tires, of rubber
4014	hygienic or pharm articles of unhard vulcan rubber
4015	art of apparel & access of unhard vulcanized rubber
4016	articles nesoi of unharded vulcanized rubber
4017	hard rubber in all forms: articles of hard rubber
41	Raw hides and skins (other than furskins) and leather
42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silkworm gut)
43	Furskins and artificial fur; manufactures thereof
	Section IX: Wood and Articles of Wood; Wood Charcoal; Cork and Articles of Cork; Manufacturers of Straw, of Esparto or of other Plaiting Materials; Basketware and Wickerwork
44	Wood and articles of wood; wood charcoal
45	Cork and articles of cork
46	Manufactures of straw, of esparto or of other plaiting materials; basketware and wickerwork
	Section X: Pulp of Wood or other Fibrous Cellulosic Material; Waste and Scrap of Paper or Paperboard and Articles Thereof
47	Pulp of wood or of other fibrous cellulosic material; waste and scrap of paper or paperboard
48	Paper and paperboard; articles of paper pulp, of paper or of paperboard

49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans
	Section XI: Textile and Textile Articles
50	Silk
51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric
52	Cotton
53	Other vegetable textile fibers; paper yarn and woven fabric of paper yarn
54	Man-made filaments
55	Man-made staple fibers
56	Wadding, felt and nonwovens; special yarns, twine, cordage, ropes and cables and articles thereof
57	Carpets and other textile floor coverings
58	Special woven fabrics; tufted textile fabrics; lace, tapestries; trimmings; embroidery
59	Impregnated, coated, covered or laminated textile fabrics; textile articles of a kind suitable for industrial use
60	Knitted or crocheted fabrics
61	Articles of apparel and clothing accessories, knitted or crocheted
62	Articles of apparel and clothing accessories, not knitted or crocheted
63	Other made up textile articles; sets; worn clothing and worn textile articles; rags
	Section XII: Footwear, Headgear, Umbrellas, Sun Embrellas, Walking Sticks, Seatsticks, Whips, Riding-crops and Parts Thereof; Prepared Feathers and Articles Made Therewith; Artificial Flowers; Articles of Human Hair
64	Footwear, gaiters and the like; parts of such articles
65	Headgear and parts thereof
66	Umbrellas, sun umbrellas, walking sticks, seatsticks, whips, riding-crops and parts thereof
67	Prepared feathers and down and articles made of feathers or of down; artificial flowers; articles of human hair
	Section XIII: Articles of Stone, Plaster, Cement, Asbestos, Mica or similar materials; Ceramic Products; Glass and Glassware
68	Articles of stone, plaster, cement, asbestos, mica or similar materials
69	Ceramic products
70	Glass and glassware
	Section XIV: Natural or Cultured Pearls, Precious or Semiprecious Stones, Precious Metals, Metals Clad With Precious Metal, and Articles Thereof; Imitation Jewelry; Coin
71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal and articles thereof; imitation jewelry; coin
	Section XV: Base Metals and Articles of Base Metal
72	Iron and steel
73	Articles of iron or steel
74	Copper and articles thereof
75	Nickel and articles thereof
76	Aluminum and articles thereof

77	(Reserved for possible future use)
78	Lead and articles thereof
79	Zinc and articles thereof
80	Tin and articles thereof
81	Other base metals; cermets; articles thereof
82	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof of base metal
83	Miscellaneous articles of base metal
	Section XVI: Machinery and Mechanical Appliances; Electrical Equipment; Parts Thereof; Sound Recorders and Reproducers, Television Image and Sound Recorders and Reproducers, and Parts and Accessories of such articles
84	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof
85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles
	Section XVII: Vehicles, Aircraft, Vessels and Associated Transport Equipment
86	Railway or tramway locomotives, rolling-stock and parts thereof; railway or tramway track fixtures and fittings and parts thereof; mechanical (including electro-mechanical) traffic signalling equipment of all kinds
87	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof
88	Aircraft, spacecraft, and parts thereof
89	Ships, boats and floating structures

Appendix I.4 Data Characteristics

(I) Manufactured Exports (MEX)

	China (PRC)	Malaysia (MYS)	Thailand (THA)	Indonesia (IDN)	Philippines (PH)	S'pore (SGP)	Korea (KOR)
Q1 2000	461,044	72,616	563,643	118,638	247,366	23,653	33,682
Q1 2003	761,382	76,984	655,018	89,488	441,084	29,714	45,057
Q1 2006	1,482,460	100,887	898,122	97,568	289,757	37,978	71,860
Q1 2010	1,864,750	89,859	1,020,700	87,393	305,664	33,509	97,052

Note: World Trade Atlas. All figures in local currency million, real terms except for Indonesia and Korea which are in billions LC.

(II) World Income (WGDP)

	WGDP is proxied by OECD GDP (US\$, 2005 Constant Price)
2000 Q1	8,444,715,333,364
2010 Q1	9,716,152,893,992

Calculated from data in CEIC.

(III) Index of Infrastructure

	China (PRC)	Malaysia (MYS)	Thailand (THA)	Indonesia (IDN)	Philippines (PH)	S'pore (SGP)	Korea (KOR)
Q1 2000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Q1 2003	1.616	1.632	1.643	1.163	1.594	1.311	1.171
Q1 2007	3.315	2.853	2.703	2.047	2.605	1.676	1.407
Q1 2010	4.468	3.866	3.576	3.552	3.164	1.731	1.584

(IV) REER (2005=100)

	China (PRC)	Malaysia (MYS)	Thailand (THA)	Indonesia (IDN)	Philippines (PH)	S'pore (SGP)	Korea (Kor)
Q1 00	107.3	103.6	107.9	93.6	120.1	107.8	106.2
Q1 03	105.3	106.5	97.6	104.1	99.9	98.0	108.9
Q1 06	102.2	102.9	105.8	115.8	109.5	104.7	129.7
Q1 10	116.4	104.6	114.3	120.2	123.5	114.3	101.3

Note: Data from Bank of International Settlements.

(V) Unit Labour Cost in Manufacturing
(1980=100)

	China (PRC)	Malaysia (MYS)	Thailand (THA)	Indonesia (IDN)	Philippines (PH)	S'pore (SGP)	Korea (Kor)
Q1 2000	266.1	173.8	205.3	704.2	1102.8	121.8	214.1
Q1 2006	316	176.8	205.2	1164.6	1379.3	117.5	252.6
Q1 2010	437.6	203.3	172.2	1826.8	1445.9	105.2	232.1

Note: For Singapore, the ULC is indexed using 2005 as the base year.

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