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# The global economic recession and industrial structure: Evidence from four Asian dragons

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# The Global Economic Recession and Industrial Structure: Evidence from Four Asian Dragons

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**Abstract**

The collapse of exports that has attended the current global economic recession threatens the export-led economic growth of the four Asian dragons. To better understand the economic performances and future prospects of the four dragons, this paper first examines the economic structural changes that have taken place in Hong Kong, China; the Republic of Korea; Singapore; and Taipei,China, as well as the gradual shifting of the sources of economic growth away from the manufacturing sector and toward the service sector. Following this, a panel data set for the four dragons for the period 1995–2008 is constructed and a fixed-effects model applied to the data. The estimated coefficients deriving from the application of the model indicate that growth in the service sector, exports, and gross fixed capital formation each have a positive and statistically significant impact on economic growth. While the estimated coefficient is not significant, there is also a hint of a positive causal relationship between manufacturing sector growth rates and GDP. The empirical results confirm the shifts observed in industrial structures and the contribution of the service sector to economic growth. New service development (NSD), which integrates manufacturing output with high value-added services, is anticipated to be a new engine for economic growth and deserves more attention, especially in the realm of government policymaking within the four Asian dragons.

**JEL Classification: F01, E6, O12**

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# 1. INTRODUCTION

The economies of East Asia and Southeast Asia have historically featured generally sound developmental paths with considerable macroeconomic stability. Among them, the four dragons of the newly industrialized economies (NIEs)[1] were the best economic performers of the 1970s, 1980s, and 1990s, that is, until the onset of the Asian financial crisis in 1997. These economies had the benefits of technical progress and lower labor costs to enhance the development of their capital-intensive industries, and this development has, in turn, provided the capital and labor resources necessary for the growth of their service sectors. Although there has been some disagreement regarding sources of growth (Krugman 1994), the medium-term sustainability of growth for the economies in the region has generally been taken for granted. All four economies are classified as high-income economies by the World Bank and advanced economies by the International Monetary Fund (IMF). The recovery path from the Asian financial crisis was rather bumpy, although there was a quick rebound in 1999. The bursting of the US high-tech bubble in 2001 resulted in another interruption to economic growth for these four export-oriented economies, which rely heavily on high-tech original equipment manufacturers (OEM) as their main source of export-led growth.

The subprime loan crisis has had drastic consequences for economies that depend excessively on exports and the four NIEs in Asia are no exception. The severity of this global economic crisis is well represented by unemployment rates. In May–June 2009 unemployment rates reached new levels, high for recent years, of 5.9%, 5.4%, and 4.0% respectively for Hong Kong, China; the Republic of Korea; and Taipei,China; while rates of 9.5% and beyond were recorded for the United States and the Euro area. The decline in export growth was a primary reason for these levels of unemployment. The growth of Singapore's economy was flat over the same period. Taipei,China suffered a –44.5% decline in exports in January 2009 following its fourth-quarter fall in electronics exports in 2008. Hence, Taipei,China's aggregate export growth rate also declined, falling 12% in the first quarter of 2009, and remaining negative until the fourth quarter of 2009.

Over the last two to three decades, there has been a well-recognized and growing emphasis on the development of service sectors for the four Asian dragons, especially in Hong Kong, China. The dual currents of globalization and accelerating technological progress that have enabled services to predominate in the economies of most developed countries (Froehle et al. 2000) have also been assimilated into the newly industrialized economies. For example, throughout the period 1995–2008, the service sector was the major component of gross domestic product (GDP) growth in Singapore and service industries accounted for about 66% of Singapore's gross value-added over this time.

The remainder of this paper is organized as follows. Section 2 reviews the experiences of the Asian financial crisis in 1997, the bursting of the high-tech bubble in 2001, and the subprime crisis in 2008 and explores their implications for each of the four economies. Section 3 utilizes a fixed-effects model incorporating data related to service sectors, manufacturing sectors, exports, and gross fixed capital formation, amongst other things, to examine the growth of economies and the industrial structures of the four economies for the period 1995–2008. Section 4 presents and discusses the concept of new service development (NSD), which strategically integrates existing strengths in both the service and manufacturing sectors to promote industrial innovation, as a tool to support growth rebalancing for Asia. This is linked with a discussion of the composition of international trade for each of the four Asian dragons, so as to shed some light on the future prospects for these economies. Section 5 discusses the macroeconomic stabilization policies that have

[1] The term began to be used in the 1970s and 1980s when the four Asian dragons of Hong Kong, China; the Republic of Korea; Singapore; and Taipei,China rose to global prominence with their exceptionally fast industrial growth, commencing in the 1960s. All have now evolved far beyond the status of NIEs (Park and Ryu 2006; Huang 2008).

been implemented within these four Asian economies in response to the current global economic crisis. The final section offers some concluding points regarding the future paths of development for the four dragons and the associated preliminary policy implications.

# 2. OVERVIEW OF PREVIOUS CRISES AND THEIR IMPLICATIONS

Since the 1960s, East Asia has featured sustained rapid economic growth, with impressive structural change and substantial improvement in quality of living standards. During the period 1990–1996, East Asia, which accounted for around one fifth of world gross output, was responsible for half of all international economic growth and for two thirds of global investment. Most people did not anticipate that the era of rapid growth, rising living standards, and increasing international competitiveness in Asian economies would be interrupted by a financial crisis. The sudden devaluation of the Thai baht on 2 July 1997 marked the onset of the Asian financial crisis. The waves of turbulence in currency and equity markets spread immediately from Thailand to Malaysia, Indonesia, and the Philippines, and had reached the Republic of Korea and Hong Kong, China by October 1997. The Asian economies which were not hit hard, such as Singapore and Taipei,China, opted to let their currencies devalue or float rather than resist the speculative pressure building against them. With this crisis the first bout of truly global contagion ensued, as stock markets in the United States and Europe fell sharply, and as other emerging market economies were forced to raise interest rates in order to prevent a "run" on currencies.

Among the four NIEs, Hong Kong, China; the Republic of Korea; and Singapore suffered negative economic growth in 1998 but quickly rebounded in 1999. Taipei,China, on the other hand, maintained a positive GDP growth rate of 4.55% in 1998—a drop of 2.04% from 6.59% in 1997—yet it was the last economy to rebound after the crisis and its recovery was slow. The basic diagnosis was that East Asia had exposed itself to the crisis by maintaining volatile capital flows which led to currency instability and extremes in interest rates[2] (Hsieh 2000), which in turn had caused inefficient investment spending and jeopardized the stability of the banking system (Radelet and Sachs 1998). the Republic of Korea's extensive industrial restructuring contributed, at least partly, to its deep-V rebound to 9.49% GDP growth in 1999. The remaining three Asian dragons all made significant and confidence-reviving improvements in their financial and other sectors.

The deep decline in the US' electronics sector in 2001 resulted in another interruption to the economic growth of the export-oriented economies of the four Asian dragons. The sharp fall in high-tech exports saw the GDP growth rates of Hong Kong, China and the Republic of Korea slow to 0.50% and 3.84% respectively (Tables 1 and 2) while in Singapore and Taipei,China growth rates slipped to –2.37% and –2.17% respectively (Tables 3 and 4) in 2001, an even worse outcome than that which followed the 1997 Asian financial crisis. The 2001 recession was the worst experienced by Taipei,China in more than four decades and it indicated problems of over-concentration on lower-end high-tech exports.

At the time of the outbreak of the subprime loan crisis in 2008, most Asian economies were models of prudence. While American and European households were borrowing up to the hilt, their Asian equivalents were tucking away their savings. Yet many countries in Asia seem to have been hit harder by the crisis than their spendthrift Western counterparts. In the last quarter of 2008, GDP slumped by around 15% and exports fell by more than 50% for the four dragon economies. The 1997 financial crisis had been caused by Asia's excessive

[2] The Asian financial crisis has its roots in attempts at financial reforms in East Asia in the early 1990s. The East Asia embarked on financial market deregulation and capital flow liberalization in the second half of the 1980s, and the process of liberalization was accelerated in the 1990s. The financial reforms were aimed at upgrading financial institutions, but in fact left the economies exposed to the instabilities of international financial markets.

dependence on foreign capital and, during this crisis, the four Asian NIEs had been tripped up by their excessive dependence on exports. Similarly, by September 2008 Taipei,China's exports had already slumped dramatically (Ministry of Finance; Taipei,China 2009). While the other three economies still enjoyed double digit (year-on-year) export growth rates, by the fourth quarter of 2008 all four dragons were experiencing negative growth in GDP and an economic recession ensued (World Bank 2009).

The global economic crisis, which originated with the subprime loan crisis in the United States, has had a severe impact on the entire world. Asia and the United States are deeply linked in many ways and the US is the main export market for the four dragons. The crisis resulted in a slump in export earnings for many Asian economies, including the People's Republic of China (PRC), India, Japan, the four dragons, and others. Low economic growth rates of around 2.0% were observed in 2009 for Singapore and Hong Kong, China, a consequence of their large financial service sectors and their export-oriented industries, which featured the US as a major export partner. In the Republic of Korea, exports fell a year-on-year 32.8% in January 2009.

The governments of the four Asian dragons opted to support their domestic financial systems and provided fiscal stimuli for economic growth. Economically, the Republic of Korea is one of the few Asian countries running a current account deficit (US$12.6 billion in January–August 2008). With banks leveraged and loan-deposit ratios of more than 130%, the Republic of Korea's stock market and currency face precipitous challenges, as companies in the Republic of Korea have hoarded dollars for debts.

The four dragons were all undermined by the global economic recession, and further affected by the slump in world trade. Mainly due to their excessive dependence on exports, the four economies all suffered from the global downturn although the economic performance of each individual economy varied significantly. For this reason, a brief profile of each economy will be illustrated below.

## 2.1 Hong Kong, China

The economy opened 2009 with a recession of –7.79% growth in GDP in the first quarter, year-on-year, as compared with an average growth performance of 3.76% over 2004–2008 (Table 1). Given the importance of financial services and international trade to this economy, a severe economic downturn was to be expected. Although Hong Kong, China is one of the freest economies in the world, its export growth rate dropped to its lowest point in the first quarter of 2009.

The Government of Hong Kong, China implemented expansionary monetary and fiscal policies commencing in September 2008. The Hong Kong Monetary Authority (HKMA) injected HK$179 billion (US$23 billion) into the banking system through open market operations and de-linked the base rate from interbank rates, among other monetary measures. As an example of its expansionary fiscal policies, in December 2008 the government announced an HK$100 billion (US$12.8 billion) package of loan guarantees for small and medium-sized firms. One of the major concerns affecting economic prospects was the unemployment rate, and this was further aggravated in the second quarter of 2009.

**Table 1: Economic Performance—Hong Kong, China**

| Period | GDP growth rate (%) | GDP per capita (US$) | Exchange rate (to US$) | U/E rate (%) | CPI | Foreign exchange reserves (US$ million) | Stock price index (Hang Seng Index, HK) | Export growth rate (%) |
|---|---|---|---|---|---|---|---|---|
| 1995 | 2.293 | 23490 | 7.736 | 3.210 | 100.383 | | 10073 | 9.916 |
| 1996 | 4.193 | 24040 | 7.734 | 2.830 | 106.742 | 63,840 | 13451 | 5.646 |
| 1997 | 5.056 | 25940 | 7.742 | 2.210 | 112.933 | 92,823 | 10723 | 4.815 |
| 1998 | (6.026) | 24880 | 7.745 | 4.580 | 116.133 | 89,625 | 10049 | (4.458) |
| 1999 | 2.556 | 25490 | 7.758 | 6.200 | 111.550 | 96,256 | 16962 | 4.517 |
| 2000 | 7.951 | 26570 | 7.791 | 4.930 | 107.375 | 107,545 | 15096 | 16.268 |
| 2001 | 0.497 | 25930 | 7.799 | 5.080 | 105.650 | 111,174 | 11397 | (1.672) |
| 2002 | 1.841 | 24870 | 7.799 | 7.270 | 102.442 | 111,921 | 9321 | 9.042 |
| 2003 | 3.006 | 25720 | 7.787 | 7.850 | 99.800 | 118,387 | 12576 | 12.797 |
| 2004 | 8.467 | 27490 | 7.788 | 6.740 | 99.417 | 123,569 | 14230 | 15.422 |
| 2005 | 7.082 | 28150 | 7.777 | 5.570 | 100.325 | 124,280 | 14876 | 10.598 |
| 2006 | 7.020 | 29530 | 7.768 | 4.760 | 102.350 | 133,210 | 19965 | 9.439 |
| 2007 | 6.380 | 31560 | 7.801 | 3.980 | 104.425 | 152,702 | 27813 | 8.045 |
| 2008 | 2.365 | 30863 | 7.787 | 3.433 | 108.900 | 182,539 | 14387 | 5.113 |
| Average 1995–2008 | 3.763 | 26435 | 7.772 | 4.903 | 105.602 | 115,990 | 14351 | 7.535 |
| 2008Q1 | 7.283 | 32346 | 7.782 | 3.400 | 107.733 | 160,775 | 22849 | 10.481 |
| 2008Q2 | 4.115 | 31391 | 7.800 | 3.300 | 109.400 | 157,609 | 22102 | 7.906 |
| 2008Q3 | 1.505 | 30604 | 7.799 | 3.400 | 109.233 | 160,557 | 18016 | 5.527 |
| 2008Q4 | (2.641) | 29354 | 7.754 | 4.100 | 109.233 | 182,539 | 14387 | (2.111) |
| 2009Q1 | (7.791) | -- | 7.754 | 5.200 | 109.567 | 186,287 | 13576 | (21.922) |
| 2009Q2 | (5.100) | -- | 7.751 | 5.400 | 109.333 | 206,996 | 18379 | (12.899) |
| 2009Q3 | (2.200) | -- | 7.751 | 5.300 | 108.267 | 222,757 | 20417 | (14.300) |
| 2009Q4 | 2.600 | -- | 7.751 | 4.900 | 110.700 | 250,718 | 21815 | (2.000) |

Sources: Annual data are mainly from World Development Indicators (WDI) Online Databases of the World Bank (at http://www.worldbank.org/). The quarterly data have been compiled from various government official websites, such as the Hong Kong Monetary Authority (at http://www.info.gov.hk/hkma/) and the Hong Kong Census and Statistics Department (at http://www.censtatd.gov.hk/).

Notes: UE rate = unemployment rate; CPI = Consumer Price Index; Stock price indexes are end of season or year data.

## 2.2 Republic of Korea

After the 1997 Asian financial crisis, the Republic of Korea, with the help of the IMF's US$58 billion support package, successfully bounced back from a large amount of short-term foreign debt, a dramatic drop in the value of the Korean won, and a general deterioration in financial conditions. However, the severe effects of the present global downturn and the weakening of domestic demand have made the current crisis much fiercer than that of 1997 (Nanto 2009). GDP growth contracted to –4.25% in the first quarter of 2009 and leveled out in the second quarter at –2.51%, on a year-on-year basis (Table 2), well below the 2003–2008 average of 4.79%. Throughout the 2008 economic recession, price pressures have

mainly been due to a weaker won and higher prices for oil and other commodities. In 2008, year-average inflation accelerated to 4.7%, well above the Bank of Korea's 2.5–3.5% target band. A reflection of poor economic performance, the Republic of Korea's labor market has been sluggish, with an unemployment rate that peaked at 3.833% in the first and second quarters of 2009 (Park 2008). As compared with other OECD countries, public social expenditure remains extremely low and has resulted in an underdeveloped welfare services sector.

**Table 2: Economic Performance—Republic of Korea**

| Period | GDP growth rate (%) | GDP per capita (US$) | Exchange rate (to US$) | U/E rate (%) | CPI | Foreign exchange reserves (US$ million) | Stock price index (Republic of Korea Composite Stock Price Index) | Export growth rate (%) |
|---|---|---|---|---|---|---|---|---|
| 1995 | 9.169 | 10770 | 771.273 | 2.060 | 69.873 | 32,712 | 883 | 24.385 |
| 1996 | 6.999 | 12070 | 804.453 | 2.040 | 73.314 | 33,237 | 651 | 12.165 |
| 1997 | 4.651 | 12190 | 951.289 | 2.600 | 76.569 | 20,405 | 376 | 21.626 |
| 1998 | (6.854) | 9200 | 1401.440 | 6.960 | 82.322 | 52,041 | 562 | 12.652 |
| 1999 | 9.486 | 9220 | 1188.820 | 5.686 | 82.991 | 74,055 | 1028 | 14.622 |
| 2000 | 8.486 | 9800 | 1130.960 | 4.425 | 84.866 | 96,198 | 505 | 19.144 |
| 2001 | 3.837 | 10580 | 1290.990 | 4.017 | 88.317 | 102,821 | 694 | (2.729) |
| 2002 | 6.970 | 11280 | 1251.090 | 3.283 | 90.757 | 121,413 | 628 | 13.256 |
| 2003 | 3.097 | 12060 | 1191.610 | 3.567 | 93.946 | 155,352 | 811 | 15.604 |
| 2004 | 4.730 | 14040 | 1145.320 | 3.683 | 97.320 | 199,066 | 896 | 19.575 |
| 2005 | 4.198 | 15930 | 1024.120 | 3.733 | 100.000 | 210,391 | 1379 | 8.544 |
| 2006 | 5.134 | 17780 | 954.790 | 3.467 | 102.242 | 238,956 | 1434 | 11.830 |
| 2007 | 4.973 | 19730 | 929.260 | 3.250 | 104.833 | 262,224 | 1897 | 12.105 |
| 2008 | 2.224 | 19115 | 1102.020 | 3.175 | 109.733 | 201,223 | 1124 | 13.599 |
| Average 1995–2008 | 4.793 | 12665 | 1081.245 | 3.710 | 89.792 | 128,578 | 919 | 14.027 |
| 2008Q1 | 5.463 | 19721 | 982.51 | 3.400 | 107.400 | 264,246 | 1704 | 17.403 |
| 2008Q2 | 4.346 | 19512 | 1018.840 | 3.100 | 109.633 | 258,098 | 1675 | 23.130 |
| 2008Q3 | 3.114 | 19281 | 1067.310 | 3.067 | 111.100 | 239,672 | 1448 | 27.031 |
| 2008Q4 | (3.400) | 18063 | 1365.487 | 3.133 | 110.800 | 201,223 | 1124 | (9.878) |
| 2009Q1 | (4.249) | -- | 1416.073 | 3.833 | 111.600 | 206,340 | 1206 | (25.019 |
| 2009Q2 | (2.514) | -- | 1285.893 | 3.833 | 112.667 | 231,735 | 1390 | (20.428) |
| 2009Q3 | 1.000 | -- | 1238.887 | 3.600 | 113.300 | 245,738 | 1607 | 17.582 |
| 2009Q4 | 6.000 | -- | 1168.033 | 3.330 | 113.467 | 268,358 | 1606 | 11.712 |

Sources: Annual data are mainly from the World Development Indicators (WDI) Online Databases of the World Bank (at http://www.worldbank.org/). The quarterly data have been compiled from various official websites of the Government of the Republic of Korea, such as the Republic of Korea Ministry of Finance and Economy (at http://finance.mapsofworld.com/finance/ministry/korea.html) and the Bank of Korea (at http://ecos.bok.or.kr/).

Notes: U/E rate = unemployment rate; CPI = Consumer Price Index; Stock price indexes are end of season or year data.

## 2.3 Singapore

Singapore was the first Asian country to fall into a recession following the current global economic crisis in July 2008 (Thangavelu and Toh 2005). GDP growth was just 1.15% per annum on average in 2008, far short of the five-year average of 7.30% in 2003–2007 and the slowest since 2001. This reflects the high correlation between the global business cycle and Singapore's economic performance. The 1997 Asian financial crisis saw Singapore face the impact of adverse spillover effects on exporting for a short period. As shown in Table 3, Singapore's GDP growth slumped from a positive 8.34% in 1997 to a negative 1.38% in 1998. To ensure the long-term competitiveness of its economy, Singapore decided not to tinker with the nominal exchange rate and pressed ahead with financial reforms (Fock and Wong 2001).

The global downturn that commenced in 2008 hit this exceptionally open economy with full force. GDP growth slowed continuously from 6.66% in the first quarter of 2008, year-on-year, until the economy contracted by –4.23% in the fourth quarter (Table 3). The impact of the global downturn was most evident in exports, which slumped from growth of 11.43% in the third quarter to –11.99% in the fourth quarter of 2008, dropping further to –25.32% in the second quarter of 2009. As shown by these figures, Singapore was among the hardest hit economies.

**Table 3: Economic Performance—Singapore**

| Period | GDP growth rate (%) | GDP per capita (US$) | Exchange rate (to US$) | U/E rate (%) | CPI | Foreign exchange reserves (US$ million) | Stock price index (Singapore Straits Times Stock Index) | Export growth rate (%) |
|---|---|---|---|---|---|---|---|---|
| 1995 | 8.155 | 23260 | 1.417 | 1.700 | 93.001 | 68,819 | 1917 | 10.400 |
| 1996 | 7.790 | 25130 | 1.410 | 1.625 | 94.283 | 76,968 | 1992 | 9.100 |
| 1997 | 8.341 | 27160 | 1.485 | 1.425 | 96.191 | 71,378 | 1508 | 8.800 |
| 1998 | (1.377) | 23490 | 1.674 | 2.500 | 95.930 | 75,021 | 1393 | (11.800) |
| 1999 | 7.202 | 22880 | 1.695 | 2.800 | 95.953 | 77,048 | 2480 | 5.500 |
| 2000 | 10.060 | 22970 | 1.724 | 2.625 | 97.246 | 80,170 | 1927 | 11.800 |
| 2001 | (2.374) | 21090 | 1.792 | 2.625 | 98.232 | 75,677 | 1624 | (7.400) |
| 2002 | 4.107 | 20870 | 1.791 | 3.550 | 97.849 | 82,219 | 1341 | 2.400 |
| 2003 | 3.771 | 22180 | 1.742 | 4.000 | 98.325 | 96,244 | 1765 | 16.344 |
| 2004 | 9.299 | 24330 | 1.690 | 3.400 | 99.968 | 112,575 | 2066 | 24.328 |
| 2005 | 7.307 | 26210 | 1.664 | 3.125 | 100.440 | 116,173 | 2347 | 16.084 |
| 2006 | 8.352 | 28930 | 1.589 | 2.675 | 101.418 | 136,261 | 2986 | 17.676 |
| 2007 | 7.766 | 32340 | 1.507 | 2.100 | 103.543 | 162,957 | 3482 | 10.828 |
| 2008 | 1.149 | 37597 | 1.414 | 2.225 | 110.287 | 174,196 | 1762 | 5.800 |
| Average 1995–2008 | 5.682 | 24680 | 1.614 | 2.598 | 98.762 | 100,407 | 2042 | 8.561 |
| 2008Q1 | 6.659 | 39645 | 1.409 | 1.900 | 108.358 | 177,462 | 3007 | 11.519 |
| 2008Q2 | 2.514 | 38104 | 1.366 | 2.200 | 109.845 | 176,650 | 2948 | 13.230 |
| 2008Q3 | 0.043 | 37186 | 1.397 | 2.300 | 111.103 | 168,802 | 2359 | 11.427 |
| 2008Q4 | (4.226) | 35599 | 1.487 | 2.500 | 111.844 | 174,196 | 1762 | (11.999) |
| 2009Q1 | (10.140) | -- | 1.512 | 3.300 | 110.659 | 166,251 | 1700 | (27.766) |
| 2009Q2 | (2.800) | -- | 1.472 | 3.300 | 109.310 | 173,191 | 2333 | (25.321) |
| 2009Q3 | 0.600 | -- | 1.439 | 3.400 | 100.09 | 177,476 | 2641 | (19.994) |
| 2009Q4 | 4.000 | -- | 1.394 | 2.100 | 100.410 | 187,015 | 2760 | 4.885 |

Sources: Annual data are mainly from World Development Indicators (WDI) Online Databases of the World Bank (at http://www.worldbank.org/). The quarterly data have been compiled from various official government websites, such as the Singapore Ministry of Manpower (at http://www.mom.gov.sg/Pages/default.aspx), and the Monetary Authority of Singapore (at http://www.mas.gov.sg/).

Notes: U/E rate = unemployment rate; CPI = Consumer Price Index; Stock price indexes are end of season or year data.

## 2.4 Taipei,China

Among the four dragons, Taipei,China was the only one to remain relatively intact following the severe damage arising from the 1997 Asian financial crisis, as shown in Table 4. The fact that its financial market was conservative, with only partially deregulated international capital flows, kept the economy relatively secure from the regional financial crisis. The economy had undergone a successful economic restructuring in the early 1990s, and the construction industry as a driver of growth had been replaced by information processing, semiconductors, and electronics (Hsu 2001).

In late 2009, external demand for this economy's manufactured products, including its vital electronics exports, slumped. Following a hard blow to electronics exports in the fourth-quarter of 2008, Taipei,China suffered a severe economic downturn that was unmitigated

until the third quarter of 2009. Heavily dependent on external trade, this economy has suffered more than most of the Asian economies since the second half of 2008, as the global slowdown has cut into world trade. The global effects of the slowdown, combined with a contraction in domestic demand, saw GDP growth average at only 0.058% in 2008 and contract to –10.24% (year-on-year) in the first quarter of 2009 (Table 4). Even though substantial fiscal stimulus was initiated in the beginning of 2009 and interest rates were lowered, the economy shrank by about another 4.00% before a mild rebound occurred in the following year.

**Table 4: Economic Performance—Taipei,China**

| Period | GDP growth rate (%) | GDP per capita (US$) | Exchange rate (to US$) | U/E rate (%) | CPI | Foreign exchange reserves (US$ million) | Stock price index (TAIEX) | Export growth rate (%) |
|---|---|---|---|---|---|---|---|---|
| 1995 | 6.490 | 12906 | 26.476 | 1.791 | 89.578 | 90,310 | 5174 | 12.580 |
| 1996 | 6.300 | 13527 | 27.458 | 2.603 | 92.333 | 88,038 | 6934 | 6.750 |
| 1997 | 6.590 | 13904 | 28.662 | 2.717 | 93.166 | 83,502 | 8187 | 9.230 |
| 1998 | 4.550 | 12679 | 33.445 | 2.691 | 94.733 | 90,341 | 6418 | 2.770 |
| 1999 | 5.750 | 13609 | 32.266 | 2.924 | 94.900 | 106,200 | 8449 | 11.710 |
| 2000 | 5.770 | 14519 | 31.225 | 2.991 | 96.088 | 106,742 | 4739 | 18.860 |
| 2001 | (2.170) | 13093 | 33.800 | 4.570 | 96.083 | 122,211 | 5551 | (7.760) |
| 2002 | 4.640 | 13291 | 34.575 | 5.167 | 95.888 | 161,656 | 4452 | 10.630 |
| 2003 | 3.500 | 13587 | 34.418 | 4.992 | 95.623 | 206,632 | 5891 | 10.380 |
| 2004 | 6.150 | 14663 | 33.422 | 4.436 | 97.166 | 241,738 | 6140 | 14.400 |
| 2005 | 4.160 | 15714 | 32.167 | 4.128 | 99.406 | 253,290 | 6548 | 7.620 |
| 2006 | 4.800 | 16111 | 32.531 | 3.905 | 100.000 | 266,148 | 7824 | 10.260 |
| 2007 | 5.700 | 16855 | 32.842 | 3.908 | 101.798 | 270,311 | 8506 | 8.820 |
| 2008 | 0.058 | 17083 | 31.517 | 4.143 | 105.388 | 291,707 | 4591 | 3.629 |
| Average 1995–2008 | 4.449 | 14396 | 31.772 | 3.640 | 96.582 | 169,916 | 6386 | 8.563 |
| 2008Q1 | 6.247 | 18140 | 31.529 | 3.867 | 103.413 | 286,860 | 8573 | 17.544 |
| 2008Q2 | 4.557 | 17851 | 30.439 | 3.867 | 104.890 | 291,405 | 7524 | 18.548 |
| 2008Q3 | (1.047) | 16894 | 31.185 | 4.157 | 106.737 | 281,130 | 5719 | 8.034 |
| 2008Q4 | (8.610) | 15603 | 32.983 | 4.680 | 106.513 | 291,707 | 4591 | (24.740) |
| 2009Q1 | (10.241) | -- | 33.982 | 5.623 | 103.407 | 300,122 | 5211 | (36.683) |
| 2009Q2 | (6.850) | -- | 33.131 | 5.840 | 104.007 | 317,564 | 6432 | (31.979) |
| 2009Q3 | (1.000) | -- | 32.797 | 6.080 | 105.300 | 326,250 | 7137 | (20.869) |
| 2009Q4 | 9.200 | -- | 32.315 | 5.850 | 105.170 | 345,536 | 7703 | 16.933 |

Sources: Annual data are mainly from the Directorate-General of Budget, Accounting and Statistics (DGBAS), Taipei,China (at http://eng.dgbas.gov.tw/). The quarterly data have been compiled from various official government websites, such as the Ministry of Finance (at http://www.mof.gov.tw/).

U/E rate = unemployment rate; CPI = Consumer Price Index

Note: Stock price indexes are end of season or year data.

The economic performances reviewed above have motivated the utilization of a fixed-effects model, incorporating the growth rates of service sectors, manufacturing sectors, exports, and gross fixed capital formation in these economies, in the next section. Through empirical investigation, we may observe the process through which the main driving force for GDP growth gradually shifts from manufacturing sectors toward service sectors, which, in turn,

could explain the causes of the excessive dependence on exports witnessed in these four economies during the crises in 1997 and 2001, and again in 2008.

# 3. ANALYSIS OF INDUSTRIAL STRUCTURES

As discussed, the four Asian dragons were noted for their outward-oriented development strategies and associated high growth rates from the early 1960s to the 1980s. However, before achieving such rapid growth each of the four was a developing economy dependent, in the main, on primary industries. They seized the opportunity when advanced economies began moving their labor-intensive industries to less developed economies. Taking advantage of the superiority of their local labor forces, these four economies attracted external capital and technology and, in turn, were transformed into advanced, high-income economies within two to three decades. Moreover, they became examples of successful economic development. In the following Tables 5 and 6, we can observe the progression of changes in the industrial structures of the four dragons during the period of 1995–2008. For example, in Singapore and Hong Kong, China, the shares of value-added in GDP for the manufacturing sectors decrease, while the shares for the service sectors increase. As for the Republic of Korea and Taipei,China, as GDP increases, the shares for the manufacturing sectors remain more or less stable while the shares for the service sectors increase slightly. Hence, there is a consistent trend of increasing shares of service sectors in their respective GDPs and, almost overall, changes in industrial structures took place in the four Asian dragons.

The process of development for the four Asian dragons has become the role model for other developing economies around the world. However, this development pattern has many drawbacks such as over-reliance on international capital—a danger which explains the heavy losses of the 1997 Asian financial crisis. Therefore, we discuss the role of service sector since 1997 Asian financial crisis to shed the light for 2008 global economic recession and, in turn, the structural changes in these four economies. As seen in Tables 1 to 4, the Asian dragons were hit hard during the 1997 Asian financial crisis and all, excepting Taipei,China, suffered from negative GDP growth rates. The subprime loan crisis in 2008 deadened the US economy, which resulted in decreasing demand for the exports of its trading partners, as reflected in the figures pertaining to GDP growth rates. In order to assess the potential impacts of industrial structural changes on economic growth during the crisis periods, we first review the industrial structures in terms of share of value-added in GDP, for the service and manufacturing sectors respectively, for each of the four economies (Tables 5 and 6).

**Table 5: Shares of Value-Added in GDP for Service Sectors**

**(%)**

| Year | Hong Kong, China | Republic of Korea | Singapore | Taipei,China |
|---|---|---|---|---|
| 1995 | 84.69 | 51.80 | 64.69 | 63.89 |
| 1996 | 85.19 | 52.77 | 64.96 | 64.53 |
| 1997 | 85.86 | 53.42 | 65.28 | 65.70 |
| 1998 | 85.67 | 54.22 | 64.66 | 66.42 |
| 1999 | 86.08 | 54.51 | 65.89 | 67.66 |
| 2000 | 86.52 | 54.39 | 64.27 | 68.93 |
| 2001 | 87.34 | 56.29 | 66.87 | 70.53 |
| 2002 | 88.25 | 57.46 | 67.02 | 69.98 |
| 2003 | 89.17 | 57.22 | 67.83 | 70.38 |
| 2004 | 89.92 | 55.56 | 66.29 | 70.79 |
| 2005 | 90.62 | 56.32 | 67.17 | 71.29 |
| 2006 | 91.16 | 57.10 | 66.96 | 71.36 |
| 2007 | 92.24 | 59.99 | 69.41 | 70.71 |
| 2008 | 94.88 | 60.31 | 72.15 | 69.26 |

Source: The data for Taipei,China are from the Directorate-General of Budget, Accounting, and Statistics (DGBAS), Taipei,China (at http://eng.dgbas.gov.tw/) while the data for the other three economies are from the World Bank World Development Indicators (WDI) Online Databases (at http://www.worldbank.org/).

The great importance of the service sector in the economic activities of most industrialized countries has increased the range of statistical information collected in this area (Mansell 1996). There has been controversial debate over structural change as a source of economic growth, which has centered upon long-term structural shifts from the manufacturing sector towards the service sector. As for the four dragons, technological progress from abroad helped them to develop the infrastructure of their manufacturing sectors and the superiority of their local labor forces helped upgrade their service industries, which indirectly supported the service of manufacturing industries. The lack of adequate data with which to properly measure performance have made, argue Landefeld, Seskin, and Fraumeni (2008), some areas of the economy, like services, perpetually difficult to measure and to categorize. For this reason, Triplett and Bosworth (2004) have argued that measurements of productivity underestimate the overall contribution of the service sector.

The calculation for the labor productivity of manufacturing sector and service sector is very different. First, there are many more job opportunities offered by the service sector, as compared to the manufacturing sector, for high-income economies, and these have various skill requirements and are open to roughly half of the labor force. On average, the real value-added income per worker in service sector is showed lower than that in manufacturing (Besley 2007). While some studies question that the demand for skilled labor has risen, the demand for unskilled labor has undoubtedly fallen greatly in the service sector. Besley (2007) demonstrated that not all service sector production is low value-added or deploys workers with less productivity than that of the manufacturing sector, and confirmed the service sector's significance and contribution to productivity and overall economic growth. Second, the service sector may not directly benefit from technical innovation. Malgorzata and Marcin (2009) argue that the impulse from technological progress initially enhanced labor productivity in the manufacturing sector and consequently resulted in an increase in capital formation. The impulse from technological progress only shows the relationship between the

rate of GDP growth and the manufacturing sector. However, the role of the service sector in supporting manufacturing industries, for example through technical consulting and professional services, has been greatly neglected for a long time. Third, there are difficulties in measuring the productivity of the service sector. To prove that productivity has been rising in services, Besley (2007) measured changes in the level of real value-added income per worker between 1985 and 2004. However, Besley (2007) thought that there were inherently more difficult aspects to the measurement of services—in terms of both price and quantity—than is the case with goods. Francesco and Mario (2008) investigated the relationships between innovation, demand, and productivity in both the manufacturing and service sectors. Their article presents the data on innovation in services, with an emphasis on the services that represent the largest components of modern economies, in an effort to fuel the recent systematic attempt to achieve fair recognition for services.

**Table 6: Shares of Value-Added in GDP for Manufacturing Sectors (%)**

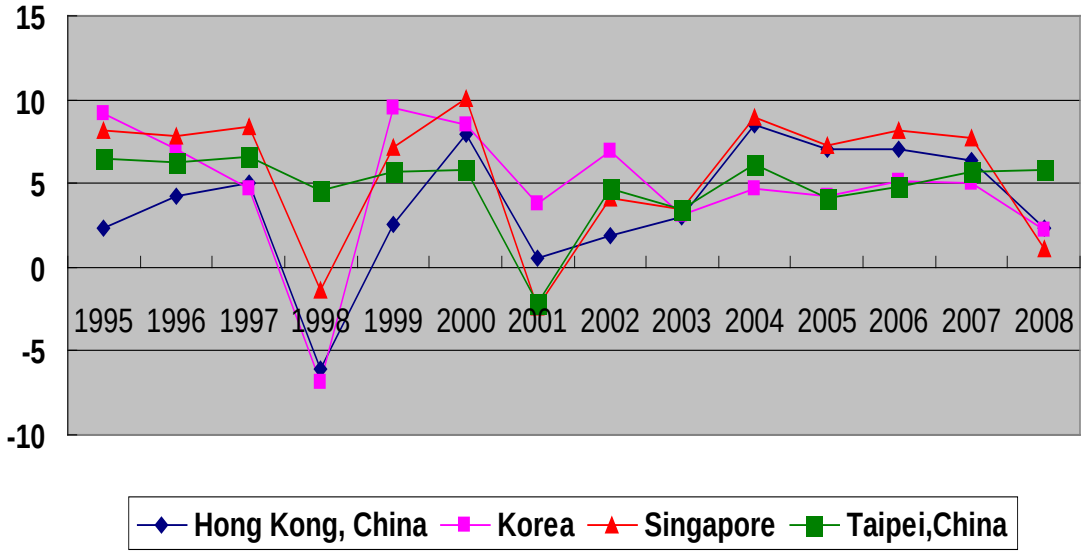
| Year | Hong Kong, China | Republic of Korea | Singapore | Taipei,China |
|---|---|---|---|---|
| 1995 | 7.68 | 27.63 | 26.54 | 25.32 |
| 1996 | 6.75 | 26.69 | 25.17 | 25.47 |
| 1997 | 6.04 | 26.33 | 24.05 | 25.18 |
| 1998 | 5.64 | 27.34 | 24.14 | 24.81 |
| 1999 | 5.30 | 28.13 | 24.27 | 24.02 |
| 2000 | 5.43 | 29.42 | 27.69 | 23.76 |
| 2001 | 4.85 | 27.59 | 24.49 | 22.73 |
| 2002 | 4.20 | 26.90 | 25.64 | 23.68 |
| 2003 | 3.73 | 26.44 | 25.37 | 23.69 |
| 2004 | 3.57 | 28.60 | 27.67 | 23.72 |
| 2005 | 3.42 | 28.37 | 27.13 | 23.21 |
| 2006 | 3.22 | 27.12 | 26.94 | 23.04 |
| 2007 | 2.54 | 27.28 | 24.91 | 24.01 |
| 2008 | 2.37 | 28.10 | 20.76 | 27.33 |

Sources: The data for Taipei,China are from the Directorate-General of Budget, Accounting, and Statistics (DGBAS), Taipei,China (at http://eng.dgbas.gov.tw/) while the data for the other three economies are from the World Bank World Development Indicators (WDI) Online Databases (at http://www.worldbank.org/).

As shown in Table 5 above, the shares of the service sectors in GDP were increasing continually throughout most of the period 1995–2008. The trend of globalization and accelerating technological progress have enabled services, which have predominated in the economies of most developed countries, to be assimilated into economies such as the four Asian NIEs. Obviously, the growth of these economies was interrupted by the onset of Asian financial crisis in 1997 and the bursting of the US high-tech bubble in 2001. As Figure 1 and Table 7 demonstrate, over the period 1995–2008, the average growth rates of GDP in the four Asian dragons ranged from 3.76% to 5.62% and experienced high volatility. The development strategy since then has shifted the emphasis of production from labor-intensive to more capital-intensive technologies and, therefore, fewer jobs have been created. These recent economic structural changes have made the question of how to create more jobs from the increasingly important service sectors in these outward-orientated economies a critical issue.

**Figure 1: Growth Rates of GDP in the Four Asian Dragons 1995–2008**

**(%)**




Sources: The data for Taipei,China are from the Directorate-General of Budget, Accounting, and Statistics (DGBAS), Taipei,China (at http://eng.dgbas.gov.tw/) while the data for the other three economies are from the World Bank World Development Indicators (WDI) Online Databases(at http://www.worldbank.org/).

Note: Korea=The Republic of Korea

**Table 7: Summaries of GDP Growth Rates in the Four Asian Dragons 1995–2008**

| | Hong Kong, China | Republic of Korea | Singapore | Taipei,China |
|---|---|---|---|---|
| Average | 3.76 | 4.79 | 5.62 | 4.86 |
| C.V. | 1.01 | 0.84 | 0.71 | 0.46 |
| Max | 8.47 | 9.49 | 10.06 | 6.59 |
| Min | (6.03) | (6.85) | (2.40) | (2.17) |

Source: Figure 1.

Note: C.V. = Coefficient of Variation

Some economists have even stated that the economies of Singapore and Hong Kong, China rely too much on the PRC when the PRC becomes the world's second largest economy.[3] This results in over-reliance on international capital and/or international markets, and especially on the international markets' relationship with the PRC. A myriad of reasons have been offered to account for the variety in impact of 1997's financial turmoil on the Asian economies. The most often quoted reason for difference has been the degree of openness of the economy to foreign investment and especially the extent of liberalization of financial markets to global capital (Chiu 2006). The PRC's manufacturing industries market provided Singapore and Hong Kong, China with an attractive base from which to develop their international trade relationships with other countries. The four Asian dragons all adopted an export-oriented development pattern in order to gain access to international markets, obtain advanced technology, attract inflows of capital, and even make the domestic import –

[3] The PRC has risen to become the world's second largest economy and the third largest trading nation. The global economic crisis of 2008 has weakened the US and significantly strengthened the PRC's international status (Sally 2009).

substitution industries also more competitive. In the process of emerging economic power, the further improvement of infrastructure in PRC may need the professional and financial services support of Hong Kong, China and/or Singapore.[4] Gross fixed capital formation is the basic element in the construction of a country's infrastructure, but its share in GDP decreases (Table 8) when GDP grows enormously (Hsieh, 2000). As a result, the sources of economic growth gradually shift from the manufacturing sector towards the service sector and thus the latter is gaining importance in the economies of the four Asian dragons.

**Table 8: Share of Gross Fixed Capital Formation in *GDP***

**(%)**

| Year | Hong Kong, China | Republic of Korea | Singapore | Taipei,China |
|---|---|---|---|---|
| 1995 | 29.96785 | 37.31330 | 33.75659 | 22.71877 |
| 1996 | 30.78413 | 37.48514 | 38.32585 | 21.75788 |
| 1997 | 33.10496 | 35.62383 | 38.97374 | 22.62790 |
| 1998 | 30.06971 | 30.34777 | 37.85415 | 23.57814 |
| 1999 | 25.68374 | 29.72758 | 34.14702 | 22.95221 |
| 2000 | 26.36320 | 31.09016 | 30.59059 | 23.65750 |
| 2001 | 25.63421 | 29.54271 | 29.97106 | 19.36713 |
| 2002 | 22.39271 | 29.08929 | 25.45825 | 18.70679 |
| 2003 | 21.18434 | 29.91783 | 23.94139 | 18.38523 |
| 2004 | 21.28873 | 29.53842 | 23.36592 | 20.68954 |
| 2005 | 20.91509 | 29.27019 | 21.64202 | 20.09887 |
| 2006 | 21.84319 | 29.04305 | 22.68496 | 19.34559 |
| 2007 | 20.33374 | 28.77903 | 24.92310 | 18.64937 |
| 2008 | 20.36495 | 31.40837 | 30.89127 | 18.41222 |

Sources: The data for Taipei,China are from the Directorate-General of Budget, Accounting, and Statistics (DGBAS), Taipei,China (at http://eng.dgbas.gov.tw/) while the data for the other three economies are from the World Bank World Development Indicators (WDI) Online Databases(at http://www.worldbank.org/).

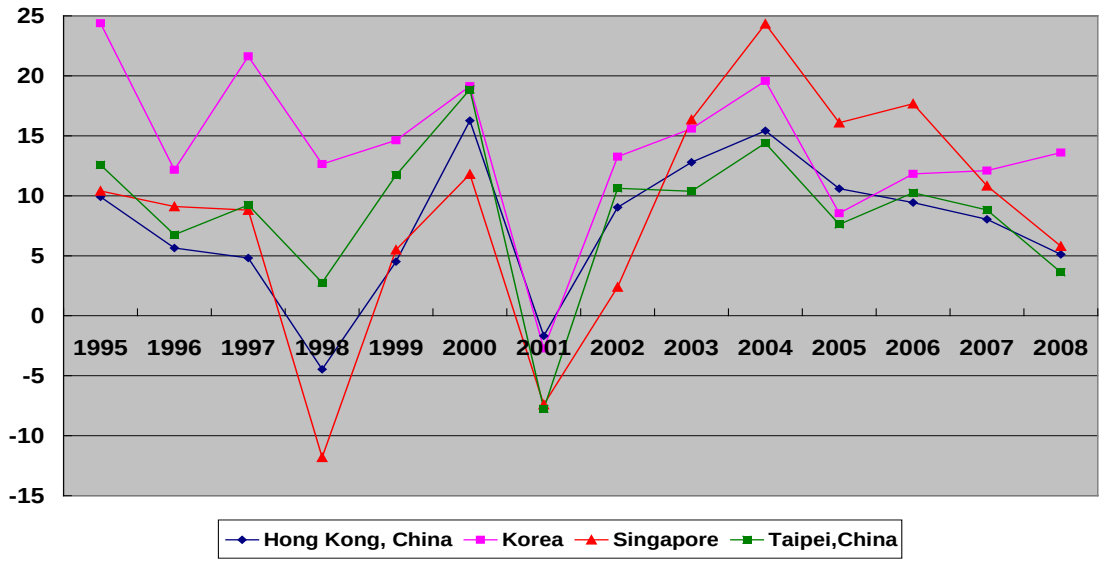
Note: Gross fixed capital formation is defined as expenditures by government and the business sector on buildings, engineering, construction, and machinery and equipment.

The main impact deriving from all of these crises was the lowering of demand for raw materials and primary commodities and this had a strong direct impact on economic growth. The decline in exports of primary commodities resulted, in turn, in a dive in volumes of manufacturing exports (Khalafalla and Webb 2001; Hussain, Mlambo, and Oshikoya 1999). The current crisis has resulted in decreased demand for commodity exports and trade-related services, especially in the outward-oriented emerging economies (Borchert and Mattoo 2009). As presented in Figure 1, the growth rates in GDP for these four economies are correlated with exports (Figure 2), while the more severe fluctuation in the growth rates for exports are depicted in Figure 2.

[4] East Asia became vulnerable to external financial shocks in part because it attempted to reform its financial markets in the 1990s in a market-oriented manner. These reforms led to a drastic increase in both the number of banks as well as their linkages to international markets, which, in turn, increased the exposure of these economies to international financial shocks, mainly through the remarkable buildup of short-term debts. East Asian economies with stronger financial systems (e.g., Singapore and Hong Kong, China) had taken steps to redress inadequate regulations and poor supervision, and thus were less prone to a crisis (Radelet and Sachs 1998).

**Figure 2: Growth Rates of Exports 1995–2008**

**(%)**




Sources: The data for Taipei,China are from the Directorate-General of Budget, Accounting, and Statistics (DGBAS), Taipei,China (at http://eng.dgbas.gov.tw/) while the data for the other three economies are from the World Bank World Development Indicators (WDI) Online Databases (at http://www.worldbank.org/).

Note: Korea=The Republic of Korea

To investigate the effects of changes in industrial structure, the growth rates of the service sector, manufacturing sector, exports as a proportion of GDP, and gross fixed capital formation, among others, have been incorporated into a fixed-effects model in order to investigate the determinants of the growth of the four economies for the period 1995–2008 (from the 1997 financial crisis to the subprime crisis in 2008).

## 3.1 Materials and Methods

To examine the possible effects of industrial structural changes, a panel data set for the four Asian dragons has been collected for regression analysis. The fixed-effects model has been utilized mainly because of the specificity of the characteristics of each individual economy. For example, the individual specific effects arising from elements such as institutional and policy settings may be highly correlated with the independent variables. The fixed-effects model employed is shown below:

$$GDP_G_{it} = C + MFG_G_{it} + SVC_G_{it} + EXPORT_G_{it} + GFCF_G_{it} + \varepsilon_{it} \quad (1)$$

Where:

i refers to the $i^{th}$ economy and t represents the $t^{th}$ time point;

C is the constant;

$GDP_G_{it}$ is the growth rate of GDP;

$MFG_G_{it}$ is the growth rate of the manufacturing sector;

$SVC_G_{it}$ is the growth rate of the service sector;

$EXPORT_G_{it}$ is the growth rate of exports;

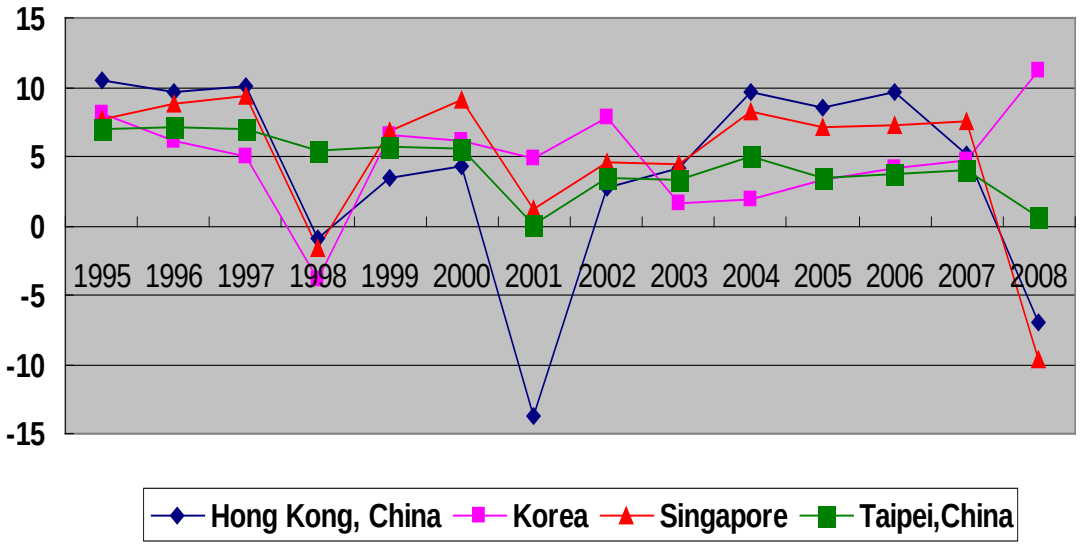
$GFCF_G_{it}$ is the growth rate of gross fixed capital formation; and

$\varepsilon_{it}$ is the error term.

The fixed-effects model represents the overall impact of explanatory variables on the GDP growth rates of the economies, while their non-random differences will be captured in the economy-specific constant term. The data have been gathered from the World Development Indicators (WDI) Online Databases of the World Bank for the period 1995–2008, however the data for Taipei,China is from the Directorate-General of Budget, Accounting, and Statistics (DGBAS), Taipei,China. For the panel analysis, the variables of the growth rates for the manufacturing sector, the service sector, exports, and gross fixed capital formation have been chosen in order to investigate the relationship between the growth of the service sectors and the overall growth of the economies for these four dragons in Asia. The average growth rates of the service sectors of the four dragons ranged from 4.01% to 5.06% in the period under study, with some volatility in Singapore and Hong Kong, China as indicated by Figure 3 and Table 9.

**Figure 3: Growth Rates of Service Sectors 1995–2008**

**(%)**




Sources: The data for Taipei,China are from the Directorate-General of Budget, Accounting, and Statistics (DGBAS), Taipei,China (at http://eng.dgbas.gov.tw/) while the data of the other three dragons are from World Bank World Development Indicators (WDI) Online Databases (at http://www.worldbank.org).

Note: Korea=The Republic of Korea

**Table 9: Growth Rates of Service Sectors in the Four Asian Dragons, 1995–2008**

**(%)**

| | Hong Kong, China | Republic of Korea | Singapore | Taipei,China |
|---|---|---|---|---|
| Average | 4.01 | 4.84 | 5.06 | 4.39 |
| C.V. | 1.77 | 0.74 | 1.04 | 0.49 |
| Max | 10.54 | 11.21 | 9.33 | 7.09 |
| Min | (13.79) | (3.94) | (9.66) | 0.08 |

Source: Figure 3.

C.V. = Coefficient of Variation

The estimated impacts of the growth of the manufacturing sector, the service sector, exports, and gross fixed capital formation on economic growth in the four Asian NIEs are presented in Table 10. Please note that the estimated results of the fixed-effects model are only the indication of an average trend observed in these four Asian dragons due to the data limitation for the overall period 1995–2008. The coefficients of the independent variables indicate the relationships between the growth rates of the determinants and the growth rates of the economies (as measured by GDP). For example, an increase in the growth rate of the service sector by 1% raises the growth rate of GDP by 0.3959%, on average, among the four Asian dragons. The estimated results suggest that the impacts of growth in the service sectors, exports, and gross fixed capital formation, as major determinants of the GDP growth rate, are positive and statistically significant at a level of at least 2%. Although the manufacturing sector is still very important, the service sector has demonstrated its increasingly important contribution to GDP by contributing the highest percentage from within the domestic industrial structure for the group of four dragons. The results suggest the significant contributions of the growth of the service sectors to the growth of GDP, while the importance of the manufacturing sector is observed as insignificant in the model. This can be taken as a symptom of the structural changes that have taken place in the Asian dragons. The values of R-squared and the adjusted R-squared[5], 0.7429 and 0.7011 respectively, imply that the estimated fixed-effects model is equipped with reasonable explanatory power. The empirical results reflect the economic structural changes that have taken place in each of the four dragons, and lend weight to the assertion that their sources of economic growth have indeed gradually shifted away from their manufacturing sectors and toward their service sectors.

**Table 10: Empirical Results of the Fixed-Effects Model**

| Variable | Coefficient | Std. Error | t value | Pr > \|t\| |
|---|---|---|---|---|
| Constant | 0.8481* | 0.4641 | 1.8275 | 0.0746 |
| Manufacturing sector growth rate | 0.0336 | 0.0510 | 0.6579 | 0.5141 |
| Service sector growth rate | 0.3959*** | 0.0745 | 5.3133 | 0.0000 |
| Export growth rate | 0.1878*** | 0.0499 | 3.7609 | 0.0005 |
| Gross fixed capital formation growth rate | 0.0610** | 0.0241 | 2.5313 | 0.0151 |
| | | | R-squared | 0.7429 |
| | | | Adjusted R-squared | 0.7011 |

Source: Author's calculations.

Notes: (1) The dependent variable is the GDP growth rate; (2) ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively.

The estimated results are not surprising, given the fact of the increasingly stronger impacts of exports and the service sectors on the growth rates of GDP in the export-led four dragons. The results deriving from the fixed-effects model indicate economic structural changes consistent with the growing emphasis on the service sector observed in each of the four Asian dragons over the past two to three decades (Froehle et al. 2000).

The growth of the service sector also directly promotes the employment of labor and this, along with the technological progress and relatively low labor costs that characterize each of the four economies, contributes to GDP growth. As discussed earlier, not all service sector production is low value-added or deploys workers with less productivity than in manufacturing (Besley 2007; Malgorzata and Marcin 2009). As suggested by most of the literature, the contribution from an increase in gross fixed capital formation to the growth of GDP is not surprising and helps explain the overall growth of the economies.

[5] R-squared (the coefficient of determination) provides a measure of how well the variations of the dependent variable are likely to be explained or predicted by the model, the estimated value ranges from 0 – 1 with 0 indicating no predictive power and 1 indicating perfect prediction. The adjusted R-squared takes the reduced degrees of freedom into consideration.

The positive but statistically insignificant effect of the growth rate of manufacturing sector on GDP growth again indicates that the driving force of economic growth has shifted away from the manufacturing sector. Traditionally, total factor measures of productivity have included human labor, energy, materials, and capital (Eloranta and Holmstrom 1998). The significant impact of service sector growth rates and the insignificant impact of manufacturing sector growth rates found in the above application of the fixed-effects model support the finding of Bottazzi, Secchi, and Tamagni (2008). This further supports the argument offered by Triplett and Bosworth (2004) regarding the contribution of the service sector to productivity.

# 4. THE RELEVANCE OF ECONOMIC SHOCKS FOR NEW SERVICE DEVELOPMENT

The economic and financial infrastructure of the four Asian dragons was seriously compromised by both the 1997 Asian financial crisis and the 2008 global economic recession. Before the onset of the subprime loan crisis in 2008, it appeared that the service sector was becoming increasingly important to the economies of these economies. The trends of globalization and accelerating technological progress have led to the predomination of services in most developed economies (Froehle et al. 2000). For example, enterprises such as GE (capital services), IBM (consulting services), and Amazon (online services) have pioneered new service development (NSD)[6] to obtain a competitive edge over their competitors and this has changed the landscape of the service industry. If this kind of industrial advantage were to support the economic growth of emerging economies, which amounts to half of all global economic growth in a given year, a global meltdown could be avoided (Carrasco 2009).

Nowadays, manufacturing industries integrate service operations. Even the retailing industries (Peterson and Balasubramanian 2002) and after-sales services (Johansson and Olhager 2004) are very different to those of the late 20th century. Development of new service industries is therefore strongly encouraged in many countries because industrial development and computer science promote innovation, which, in turn, contribute as major drivers of economic growth. However, NSD is very often attributed to the manufacturing sector, rather than the service sector. NSD can strengthen the value-added connection between manufacturing industries and the service sector, and this could become the focal point of future economic growth. Due to the different factors contributing to the recent crisis, we discuss the economic shocks these four economies experienced during this period below.

## 4.1 Hong Kong, China

In terms of its degree of openness, Hong Kong, China is one of the most open economies in the world. Growth in this open economy was hit by a heavy blow at the end of 2008, which was followed by the global economic recession and the trade slump indicated in Table 1. For the year, consumption and fixed investment did not grow at their usual rates. The important financial markets and real estate service industries were constricted in the second half of 2008. In 2009, exports fell and both private consumption and investment shrank when global trade slumped. In Table 1, a slump in both GDP and export growth rates is observed, while the exchange rate remains relatively stable. The deterioration in both external and domestic demand has seen businesses reduce investments in machinery and equipment since the fourth quarter of 2008. The global economic recession happened during the development of

[6] NSD is the overall process of developing new service offerings in response to customers' expectations. It is concerned with all stages of development from idea to launch (Edvardsson 1997; Goldstein et al. 2002). It involves developing service offerings such as information services, consulting services, telecommunications services, health care, and financial services (Johne and Storey 1998). The new service offering may be a re-design of an existing service or be created from a new idea. The proliferation of NSD means that investment in services R&D is important for modern organizations to stay competitive.

the standard marketplace for new service while Hong Kong, China was undergoing internal structural changes of its base. It included both the operational activities and the linkages among different activities of the service organization that deliver intensified level of service quality. Though the NSD that was taking place in Hong Kong, China at that time is now receiving increased attention, the NSD process has been interrupted by the recent economic shock and associated global recession. A recovered support from the government of Hong Kong, China in 2009 may help set the basis of another stage for new services to develop with a commercial focus.

Real exports of goods and trade-related services were weak in 2009 compared with 2008. For this service-based economy, the lengthy global economic recession and the slump in both trade and tourism have further damaged service exports, while, in the meantime, merchandise re-exports have remained sluggish. Imports have also contracted, given the decline in domestic demand. The service sector is responsible for virtually all of GDP, and its overall growth has slowed to 2.5% since 2001. Although the development of new services are an important source of revenue for most companies in Hong Kong, China, the finance, insurance, and real estate subsectors were hit even harder. Both the manufacturing sector and the service sector contracted in both the third and fourth quarters of 2009. Nevertheless, the service sector was the only sector that contributed to GDP growth in 2009. On the whole, the performance of service companies did reflect the potential for the stimulus of economy behind the slow development in 2009.

Moreover, production in the small manufacturing and agricultural sectors also fell in 2008 (Alam 2002). The Government of the Hong Kong Special Administrative Region adjusted for contractions through fiscal concessions which lowered the prices of some of the commodities underlying inflation, yet it unfortunately may miss the precious opportunity to develop the base for NSD.

## 4.2 Republic of Korea

Severely affected by the global downturn and weakened domestic demand, the Republic of Korea's GDP growth fell in 2008 to less than half of the almost 5% rate recorded in 2007. Notwithstanding the fact of weakened external demand, net exports still accounted for over 90% of total GDP growth, a fact reflecting the even greater fragility of domestic demand. While the global downturn caused the Republic of Korea's economy to slow down, reduced private consumption and investment have enlarged its effects. It is obvious that the Republic of Korea's economic performance is highly sensitive to the global business cycle, especially when it is observed that the growth rates of exports and GDP plunged to –25% and –4.25% respectively in the first quarter of 2009 (see Table 2). The recession and associated lower disposable incomes, which result in poor sales for items such as automobiles, electronics, and other durable goods, explain much of the decrease in imports and exports of domestic consumer goods. The same applies to the reduction in imports of capital goods, which will result in lower levels of production in next period.

Over the past few years, the electronics industry in the Republic of Korea has developed rapidly. Korean electronics companies—themselves promising enterprises for the practice of NSD—occupy a significant place in the world electronics market. As a result of its steady emphasis on research and development, the Korean electronics industry has narrowed the gap in technological expertise with advanced countries to a greater degree than the other Asian dragons. It was for this reason that the Republic of Korea's electronics exports grew in the first three quarters of 2008, before experiencing a slowdown in the fourth quarter and a further slump in the first two quarters in 2009 when the impact of the global downturn struck Korean exporters with full force. All major export products faced weaker demand in all major markets. For the full year, the trade surplus fell sharply and the current account moved into deficit (estimated at a modest 0.7% of GDP) for the first time since 1997. Private

consumption rose by a mere 0.5% in 2008, down sharply from 4.5% growth in 2007. Fixed capital investment fell by 1.9% in 2008, compared with robust growth of 4.0% in 2007.

In 1993, the Republic of Korea was one of the six largest electronics production countries in the world. At that time, production exceeded US$36 billion and total exports topped US$22 billion. As a result, the Republic of Korea's electronics industry emerged as its largest export sector. Despite its rapid progress and economic recovery since 2008, the Korean electronics industry faces serious challenges due to growing protectionism abroad coupled with decreasing profitability. Having contributed greatly to the Korean economy's development, the Republic of Korea's electronics industry has been at the core of the country's manufacturing sector in terms of new service development and has pushed the Republic of Korea to be evenly matched in terms of the international competitiveness of its economy with the major advanced economies.

## 4.3 Singapore

Singapore is more highly dependent on trade than the other Asian economies and this gap has increased in recent years. A wide range of Singapore's services also depend on trade. As a financial center, Singapore will suffer more than other economies from the global economic recession. Moreover, it is a sub-regional headquarters for multinational companies, many of which are trimming their operations. The government realizes that new service-oriented industries or knowledge-based service industries may stimulate an economic boost in the future and so have devised policy instruments that support NSD within industries that offer technology-related services (Skogli 1998).

Singapore has been one of the Asian export-oriented economies most badly hit by the global economic crisis. This is demonstrated by the drop in export growth rates to –27.77% and –25.32% respectively for the first and second quarters of 2009. For the same periods, GDP growth also fell to –10.14% and –2.8% (see Table 3). After the manufacturing sector suffered the heaviest blow, Singapore made strategic efforts to support manufacturing and IT-related services to help develop new industries effectively. At that time, the base of new service development has been established. However, growth in manufacturing continued to fall—to 10.7% in the fourth quarter of 2008 and to 4.1% for the entire year of 2009. Weakening global demand drove the manufacturing slump in Singapore, which was greatest in the electronics and biomedical industries. Non-oil exports declined from the first quarter of 2008 to the third quarter of 2009—among them electronics exports (largely components of computers and computer-related equipment such as hard disk drives) fell by about 30% in the first two months of 2009 and non-electronic exports dropped by almost 20%.

Moving closely with the global business cycle, growth decelerated during 2008 on a year-on-year basis and declined in the fourth quarter. The economy shrank in 2008. The global downturn struck this open economy with full force in 2008 when GDP contracted as a result of the global slump in information technology-related goods. Reflecting the high correlation between the global business cycle and Singapore's economic performance, GDP growth slowed from 6.7% in the first quarter of 2008 to 2.5% in the second quarter. There was a 4.2% contraction in the fourth quarter of 2008 and a 10.1% contraction in the first quarter of 2009 (see Table 3). These conditions created great difficulties for the international businesses in Singapore trying to make progress on NSD. Singapore commenced a mild rebound in the third quarter of 2009 as the global economic situation started to improve.

## 4.4 Taipei,China

Seriously reliant on external trade, Taipei,China suffered more than most other economies in the second half of 2008, as the global slowdown cut into world trade. An important reason for this is that the economy's high-tech industries in the manufacturing sector occupy a significant place in global goods markets. After growing by an average of 5.4% in the first

two quarters of 2008, GDP started to decline in the third quarter of 2008 and continued to do so until its rebound in the fourth quarter of 2009. GDP contracted by 8.5%, 10.2%, and 6.9% respectively in the fourth quarter of 2008 and the first two quarters of 2009. The slowdown over 2008 stemmed from a slump in exports of machinery and electronics products and the sluggishness of fixed investment over the same period. The weakness in domestic demand was offset by some growth in net exports, this being the main reason for the expansion of GDP in the final quarter of 2009. Domestic demand contracted and inflation increased over its previous 14-year level but had declined by the end of 2008.

Due to Taipei,China's heavy dependence on external demand, the government formulated a national initiative for the strategic support of NSD in order to promote new and high value-added services in the manufacturing sector. Exports and imports of goods and services were equivalent to about 70% of GDP in 2008. This reflects the extension of manufacturing production chains with neighboring economies, particularly the PRC. Moreover, the US is the final destination for much of the output from these production chains. Nevertheless in 2008, Taipei,China's exports of merchandise goods to the PRC grew by 7.2% while exports to the US fell by 4.0%. Meanwhile, the Industrial Technology Research Institute (ITRI) in Taipei,China has made significant contributions to NSD by providing various industries with knowledge and prototypes in manufacturing-oriented technology development. The NSD initiative being funded by this non-profit organization enhances core competencies and helps transfer successful NSD experiences to other industries while service-based technology development is still evolving. Since more than 97% of companies on the island are small and medium-sized enterprises (SMEs), the funding incentives provided by various NSD programs may help these companies speed up the process of transformation and enlarge their capacities for innovation.

The NSD model would also help to enhance the productivity of the traditional service sectors and thereby raise wages for workers and create more jobs than would be the case solely in the capital-intensive electronics industry. Owing to the intangibility of services, as well as the uncertainty and complexity inherent in the integration of the manufacturing and service sectors, the development of service-oriented products may confront unexpected challenges.

Although the NSD development process has not turned out any great successes thus far, the high-end services driven by high-technology and generally strong manufacturing bases in both the Republic of Korea and Taipei,China could still be crucial for future development. In contrast, the service sector has been a core pillar of economic growth in both Singapore and Hong Kong, China. Strongly connected with worldwide financial markets, companies in Singapore and Hong Kong, China can take full advantage of global capital convergence and the high value-added services created by NSD. Given the globalizing trend, world-leading companies in the four Asian dragons need to pursue their respective models of NSD in order to mitigate the volatility that arises from over-reliance on exports.

For the four Asian dragons, the recent economic crisis could turn out to be an opportunity to boost financial integration within Asia as well as the region's global economic status. It also reveals that the four economies should not only rely on their manufacturing sectors, but also on their service sectors. The raging global economic recession has removed the main objections that were raised against the establishment of the Asian Monetary Fund in 1997, and has made Asians better able to appreciate the importance and benefits of self-insurance (Woo 2010). Further, the PRC is already one of the most important exporting and importing nations worldwide (Fidrmuc and Korhonen 2009).

# 5. MACROECONOMIC STABILIZATION POLICIES FOR THE GLOBAL ECONOMIC RECESSION

The four Asian dragon economies went into a slump in 2008 and unemployment rates rose as the impact of the global economic recession spread all over the world. The policies adopted by the governments of these four economies during the period of crisis will influence their recovery of export-led growth in the future. In this section, the major macroeconomic stabilization policies of the four Asian dragons are briefly discussed.

## 5.1 Hong Kong, China

Although its free and open economy makes Hong Kong, China a unique development model, it was nevertheless, to some extent, also a victim of the recent global economic crisis stemming from the US subprime loan crisis. In light of the Lehman Brothers' bankruptcy, the Government of the Hong Kong Special Administrative Region conducted a full and comprehensive review of the regulatory framework for the securities and futures markets, in order to determine how best to further improve the framework and enhance protections for investors. With its enhanced regulatory framework, established production base, and market in the PRC, the economy is well-equipped to withstand the downturn. The government has endeavored to turn this crisis into an opportunity by sustaining economic development in sectors such as financial services, infrastructure, and scientific research.

To assure liquidity in the banking sector, the Hong Kong Monetary Authority (HKMA) has been injecting substantial capital into the interbank market. Two preemptive measures have been introduced to strengthen confidence in Hong Kong, China's banking system: (i) the use of the Exchange Fund to guarantee repayment of the US dollar and foreign-currency deposits held within all authorized institutions in Hong Kong, China, including branches of overseas institutions; and (ii) the establishment of a Contingent Bank Capital Facility to both make available to and ensure sufficient capital for locally incorporated banks. These measures will be in place until the end of 2010.

The Government has also supported SMEs, which have been greatly affected by the credit crunch. A Loan Guarantee Scheme and Export Marketing Fund for SMEs have been established. A US$100 billion Special Loan Guarantee Scheme (SpGS) has been launched to provide an up-to-70% guarantee to commercial-financing companies that extend loans to local companies. The maximum loan that each enterprise may obtain under the SpGS is US$6 million, and US$3 million of that amount can be used for debt and letters of credit. All companies except listed companies may apply. In spite of the economic downturn, the government has not cut its public expenditure, and this includes the budgets for healthcare, social welfare, education, and environmental protection. To add to the 60,000 job opportunities created by infrastructure projects in 2009, advanced recruitment of citizens and the creation of part-time jobs have been promoted in the 18 administrative districts.

## 5.2 Republic of Korea

The Government of the Republic of Korea learned its lesson from the Asian financial crisis and responded swiftly to the economic downturn that attended the 2008–2009 economic crisis. To stabilize the financial system and foreign investment, the government preemptively removes uncertainty in the currency and financial markets stemming from the global economic recession (Republic of Korea's Ministry of Strategy and Finance 2009). The Republic of Korea has implemented the largest project among the Asian dragons to rescue stock market investors. The government spent US$240 billion to stabilize the stock market, the volatility of which had caused all banks and financial departments to suffer. The Korea Development Bank and the Foreign Trade Bank of Korea provided a three-year W100 billion guarantee for local banks in the foreign exchange market. To ensure that there is a sufficient

supply of liquidity in the banking sector, the authority is injecting a further W300 billion into the main banks.

The government has endeavored to proceed with the reform of the industrial structure by formulating its monetary policies. It has provided a W9 billion credit-loan for SMEs and, moreover, an additional W1.2 trillion bonds will be expected to support enterprises. The government has also developed finance policies to stimulate domestic consumption. For example, to revitalize the economy the government has proposed legislating a five-year W20.7 trillion tax cut to stimulate domestic consumption and investment.

The government has provided a budget of W14 trillion to create more job opportunities. These are short-term job opportunities, provided for those who are in need. The budget is estimated to generate 880,000 job opportunities, which will help some people to return to the labor market when economic conditions have improved. With these stabilization measures, the government aims to make sure of sufficient liquidity in the foreign exchange market by stabilizing exchange rates. More supplies of liquidity will be provided for banks, securities firms, and asset management firms, which seek stability in the domestic financial market. The requirements for issuing bonds will also be improved in order to maintain lower levels of interest rates. Moreover, more investment decisions will be made by state-owned banks, i.e., the Korea Development Bank and the Industrial Bank of Korea, so as to provide financial support for SMEs.

## 5.3 Singapore

The demand for exports manufactured in Asia has slowed dramatically as a result of the global economic downturn. The highly open economy of Singapore has suffered from plunging GDP and exports since the fourth quarter of 2008. The policymakers of Singapore made a number of responses to the global economic recession. To sustain banking systems, the authorities emulated the responses of the US and Europe, i.e., they guaranteed the repayment of deposits in authorized institutions, and rescinded regulatory accounting rules so that declines in net asset values—such as prices of equity held by the banks—would not cause a severe credit crunch. The Monetary Authority of Singapore has tried to convince the public that its banking system is sound, with the promise that the government will intervene if necessary. The Foreign Exchange Rate Policy has been shifted from “modest and gradual appreciation” to “nil appreciation” in order to boost the competitiveness of manufactured exports. Further, policymakers have guaranteed to compensate investors who bought structured notes linked to Lehman Aggregate Bonds. In an attempt to stabilize the financial system in the context of a global economic recession, the government has fully guaranteed deposit withdrawals for a certain period of time.

The authority has also provided about S$20.5 billion to stimulate investment in public infrastructure. Unlike other countries in Asia, the Government of Singapore does not borrow money from any other country. It has taken S$4.9 billion from its central bank to support two temporary subsidy and tax discount initiatives. The government is also developing financing policies to further stimulate domestic demand and has budgeted S$2.3 billion to help SMEs. By providing liquidity in the market, the government has made it easier for those enterprises to go through the global economic recession. About 124,000 companies will benefit from this project. The government also took SGD$1.8 billion and distributed it to citizens of 21-years of age and above.. Everyone on average could get at least SGD$100.

## 5.4 Taipei,China

In response to the depression of domestic demand brought on by the economic downturn, the Government of Taipei,China has adopted various measures to ensure economic growth and stimulate demand. An “Economic Revitalization Policy” has been instigated to stimulate investment in public works. The authorities hope that the implementation of 20 key public

work projects and 64 special local investment plans will help to mitigate the prevailing economic hardship. A governmental program to distribute consumption vouchers to all nationals was also promptly implemented with a total value of NT$3,600 in vouchers being made available to each person. The NT$82.9 billion (about US$2.55 billion at the exchange rate of NT$32.5 = USD$1) program is expected, at least to some extent, to promote domestic economic growth by stimulating domestic consumption. Second, the authority has created more than NT$560 billion worth of infrastructure projects in order to inject funds into the economy and thereby stimulate domestic demand. Furthermore, the authority has initiated negotiations with the PRC on an Economic Cooperation Framework Agreement (ECFA) for trade liberalization and this may drive additional economic growth.

The government is also developing monetary policies with the aim of reforming the industrial structure. A credit-loan of NT$300 billion has been provided for SMEs, in addition to a further budget allotment of NT$300 billion for enterprise financing. Under the supervision of the financial supervisory commission, a government security fund has been injected into the stock market and short-selling has been forbidden. The government has also introduced a series of employment measures which may generate between 190,000 and 220,000 job opportunities. By planning employment promotion measures to revitalize the economy, the government aims to respond appropriately to the unemployment triggered by the global economic recession and make good use of human resources and physical infrastructure to boost national competitiveness. However, the effectiveness of these measures for achieving the multiple objectives of creating new jobs, stimulating domestic demand, and caring for the disadvantaged will need to be evaluated in the future.

The governments of four Asian dragons all implemented some timely policies to mitigate the harsh impacts of the global economic recession. Due to the financial meltdown of US markets in the last quarter of 2008, each government was compelled to stimulate domestic demand in the face of the unexpected slump in exports. In addition, the measures implemented to deal with the unemployment and fiscal deficits that have emerged from the global economic recession have also attracted the attention of the public in these economies. The major remaining concern is whether the expensive rescue packages will only generate jobless recoveries. If government policies are effective and efficient, this represents an opportunity to rebalance the economy-wide environment, especially in terms of enhancing social welfare and national competitiveness, which might, in turn, create opportunities for industrial restructuring as well as new service development.

# 6. CONCLUDING REMARKS

Although the global crisis that erupted in 2008 was largely limited to the financial sector in its initial stages, by 2009 it had become clear that the world was witnessing a full-blown economic crisis—the worst since the Great Depression (Carrasco 2009). To formulate a plausible future path of development leading out of the global economic recession for the four outward-oriented economies of Hong Kong, China; the Republic of Korea; Singapore; and Taipei,China, the determinants of economic growth rates during the previous crises in 1997 and 2001 were examined. The panel data for the four Asian dragons for the period 1995–2008 was constructed and a fixed-effects model was applied. The empirical findings indicated that the impacts on the growth of GDP from the growth rates of the service sector, exports, and gross fixed capital formation are positive and statistically significant; while the effect of growth in the manufacturing sector is also positive but not significant. This also suggests that the shift away from the manufacturing sector and toward the service sector as a major factor in economic growth deserves special attention, in the light of the collapse of exports that has taken place in these four outward-oriented growth economies. It is clear that the 1997 Asian financial crisis, the 2001 bursting of the US high-tech bubble, and then the 2008–09 global economic crisis each led to a decline in the growth rates of exports for each of the four economies. New service development (NSD), which integrates high-tech or more

sophisticated manufacturing products with information technology, telecommunications, and consulting functions to offer high value-added services, may serve as an engine to facilitate future economic growth and deserves more attention, especially in the policymaking circles of the four Asian dragons.

Efficiency analyses based on value-added and cost measures are appropriate when studying industrial competitiveness (Eloranta and Holmstrom 1998). Traditionally, total factor measures of productivity include labor and capital, materials, and intermediate inputs. However, the classical measure of productivity, defined as physical volumes per capita, may underestimate the productivity of the service sector as discussed in this paper. The social welfare and employment generated by one dollar invested in the manufacturing sector could be much less than that in the service sector. Comparing the manufacturing and service sectors, Bottazzi, Secchi, and Tamagni (2008) found that although labor productivity is slightly more persistent in the manufacturing sector when compared to the service sector, the opposite holds for capital productivity.

With the importance of the service sectors to the economies of four Asian dragons increasing since the subprime loan crisis in 2008, the concept of NSD has also gained increasing importance. NSD has changed the landscape of the service industries by creating new levels of competitiveness and it is strongly emphasized in many countries. The development opportunities offered by NSD and the experience of industrial innovation within the four Asian dragons, are worthy of further discussion with regard to the role they will play in future economic growth.

With regard to Hong Kong, China, the higher productivity growth of manufacturing than services could be the result of the movement of production jobs abroad or the outsourcing of service-related activities. Service industries in Hong Kong, China have been consistently more profitable than manufacturing since 1989 (Brook 2009). Take Table 5 for example, the share of value-added in GDP for the service sector in Hong Kong, China was 94.88. Relative small portion of productivity growth in the service sector contributes more to the overall economy than the same percentage in the manufacturing sector. Both the Republic of Korea and Taipei,China, on the other hand, with their strong bases in the electronics subsector of the manufacturing sector, have developed different models of NSD as the new engines to help them grow out of the global economic recession. Singapore, to a lesser extent, is focusing on its role as a financial center although the government has realized that new service-oriented industries or knowledge-based service industries may help to stimulate an economic boost in the future. The competitiveness-based niche of the four Asian dragons represents a potentially fruitful environment for NSD and, in turn, a promising opportunity for both labor and capital.

Although there is hardship ahead for the four Asian dragons as they make their way through the period of global economic recession arising from the 2008 crisis, this time also represents an opportunity to endow these economies with the unique competitive edge that results from integrating the manufacturing and service sectors. As long as government policies are effective and efficient, now is the best time to rebalance the economy-wide environment and create good opportunities for these four export-led economies to proceed with NSD for industrial restructuring.

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