Journal of Contemporary Asia

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/rjoc20

Crisis Effects on the Electronics Industry in Southeast Asia

Rajah Rasiah\textsuperscript{a}, Yap Xiao-Shan\textsuperscript{a} & V.G.R. Chandran Govindaraju\textsuperscript{a}

\textsuperscript{a} Department of Development Studies, Faculty of Economics and Administration, University of Malaya, Kuala Lumpur, Malaysia

Published online: 05 Jun 2014.

To cite this article: Rajah Rasiah, Yap Xiao-Shan & V.G.R. Chandran Govindaraju (2014): Crisis Effects on the Electronics Industry in Southeast Asia, Journal of Contemporary Asia, DOI: 10.1080/00472336.2014.923637

To link to this article: http://dx.doi.org/10.1080/00472336.2014.923637

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the “Content”) contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms & Conditions of access and use can be found at http://www.tandfonline.com/page/terms-and-conditions
Crisis Effects on the Electronics Industry in Southeast Asia

RAJAH RASIAH, YAP XIAO-SHAN & V.G.R. CHANDRAN GOVINDARAJU
Department of Development Studies, Faculty of Economics and Administration, University of Malaya, Kuala Lumpur, Malaysia

ABSTRACT The financial crises of 1997–98 and 2008–09 each had a debilitating effect on Southeast Asian market economies because of the dominance of exports and foreign ownership. However, the 1997–98 financial crisis positively impacted electronics exports, production and employment, due to a booming US economy. The contraction in demand in the US during the 2008–09 crisis reduced electronics exports from Southeast Asia with the exceptions of Indonesia and the Philippines, which were shielded by regional linkages with Singapore, Malaysia and China. Foreign labour repatriation and fiscal stimulus packages helped Malaysia and Thailand rebound quickly from the 2008–09 crisis. In the Philippines, the 2008–09 crisis expanded further the casualisation of labour as retrenched workers from Malaysia and Singapore returned home. State grants encouraged upgrading in Singapore and to some extent in Malaysia, but the liberal approach of Indonesia, the Philippines and Thailand limited them to low-value-added activities. However, Singapore’s and Malaysia’s transnational-based strategy failed to reproduce the technological leapfrogging experience of South Korea and Taiwan. Also, Malaysia’s ethno-patronage policies discouraged upgrading in national firms.

KEY WORDS: Financial crisis, economic recession, electronics, Southeast Asia

Electronics production has grown rapidly to become the leading manufactured export of Singapore, Malaysia and the Philippines since the 1970s. The industry has also become a leading manufactured export of Thailand since the 1980s and Indonesia since the 1990s. Consequently, the industry has been a major generator of employment in all five countries. Giant Japanese and American followed by European transnational corporations (TNCs) were the first to redeploy production operations to Southeast Asia. While the TNCs were already decentralising production to disperse low-end labour-intensive stages of assembly in developing economies endowed with large supplies of literate labour, good infrastructure, at least in the export-processing zones, and political stability and security, national government strategies were instrumental in dismantling trade barriers and offering tax holidays to clinch the relocation of production (Scibberas 1977). Despite fluctuations in prices, shortening product cycles and changes in firms holding technological leadership (Rasiah 1988; Brown and Linden 2010), the electronics industry has remained...
a critical economic pillar in Malaysia, Singapore, the Philippines and Thailand, while it has grown in significance in Indonesia and Vietnam.

Industry-wide crises have continued to shape the electronics industry since its origin (UNCTC 1986; Brown and Linden 2010). The 1984–85 cyclical industry-wide trough impacted severely on the economies of Malaysia, the Philippines and Singapore, the Asian financial crisis of 1997–98 and the global financial crisis of 2008–09 arose from external developments, although soaring balance of payment deficits and non-performing loans had left Indonesia, Malaysia, the Philippines and Thailand vulnerable to currency attacks in 1997. Hence, given the importance of the electronics industry, this article focuses its analysis on the consequences rather than the causes of the two crises on electronics production, exports, trade balance and employment in Southeast Asia. In doing so, this article also offers an explanation of how government policy, exchange rates and foreign ownership played a role during the crisis in these countries. First we attempt to analyse the impact of the 1997–98 Asian financial crisis and the 2008–09 global financial crisis on the electronics industry in Southeast Asia, and second, if any of the electronics firms from these countries managed to achieve technological leapfrogging in the industry. Because electronics production in Vietnam only started in the new millennium we dropped analysis of the country as comparisons with the 2008–09 crisis would be meaningless. The assessment is confined to the Southeast Asian countries where electronics production had evolved by 1997–98, in other words Singapore, Malaysia, the Philippines, Thailand and Indonesia. The rest of the article is organised as follows: the next section provides the justification for selecting the electronics industry for analysis and the role of government policy in promoting the industry. This is followed by a presentation of the critical theoretical considerations essential to analyse the impact of the two crises. The final section examines the impact of the crisis on electronics value added, exports, trade balance and employment, as well as the role of government strategies prior to a presentation of the article’s conclusions.

**Importance of the Electronics Industry**

The electronics industry has its origin in Southeast Asia in the 1960s when Matsushita Electric opened operations to assemble consumer electronics appliances in Shah Alam, Malaysia, in 1965 (Malaysia 1996). However, the massive expansion in production and exports began when component firms relocated assembly operations to Singapore in 1969, and to the Philippines and Malaysia in the early 1970s (Lim 1978). National Semiconductor and Fairchild were the first firms to relocate production to Singapore, while Clarion and National Semiconductor were the first to relocate production to Malaysia in 1971. Intel was the first American semi-conductor firm to start operations in the Philippines in 1974 (Businessweek, 7 April 2008). The electronics industry became important to national exports from the countries of Singapore, Malaysia and the Philippines; Thailand; and Indonesia, since the 1970s, 1980s and 1990s respectively (Henderson 1989; Scott and Angel 1988; WTO 2012). Indonesia, Malaysia, the Philippines, Singapore and Thailand figure prominently in both the share of the electronics industry in total national exports, and as a share of world exports of electronics. Given the impact of both financial crises on exchange rates and demand, export-oriented
industries, such as electronics, are potentially vulnerable to the vicissitudes of such economic fluctuations.

National Exports

The electronics industry has played an important economic role in all of the five economies. As a share of overall exports, electronics exports from Indonesia increased from 1% in 1991 to 15% in 2000 before falling to 7% in 2011 (see Figure 1). Electronics exports from Malaysia contributed 35% to overall exports in 1991, which grew in trend terms to 59% in 2000 before falling gradually to 34% in 2011. The share of electronics exports in total exports from the Philippines rose from 27% in 1991 to its peak of 73% in 2000 before falling to 34% in 2011. Electronics exports’ share in total exports from Singapore rose from 41% in 1991 to its peak of 60% in 2000 before falling to 34% in 2011. Exports of electronics in total exports in Thailand grew from 27% in 1991 to its peak of 34% in 2000 before falling to 21% in 2011.

World Exports

Electronics exports from the five countries have also continued to remain important in world exports (see Figure 2). The share of exports from Singapore in world exports increased from 5.9% in 1991 to 8.3% in 1996 before showing a trend fall to 6.6% in 2009 and 5.7% in 2011. Exports from Malaysia in world exports increased from 2.9% in 1991 to 4.6% in 2000 before falling to 3.1% in 2011. Exports from Thailand in world exports rose from 1.3% in 1991 to 1.9% in 1996, 2000 and 2011. Exports from the Philippines in world exports rose from 0.6% in 1991 to 2.2% in 2000 before fluctuating to 0.7% in 2011. Finally, exports from Indonesia increased from 0.1% in 1991 to 0.7% in 2000 before falling to 0.5% in 2011.

![Figure 1. Share of electronics in national exports, selected countries, 1991–2011.](image-url)
Government Policy

Government policy in the promotion of the electronics industry has been important in all of the five countries, and they can be classified into three types, namely, invitational within a liberal framework, invitational but with some elements of industrial policy, and invitational with strong leveraging industrial policy elements. The approaches taken by the governments of Indonesia, the Philippines and Thailand have been invitational and liberal, by Malaysia invitational with some elements of industrial policy, and by Singapore invitational with strong leveraging aspects of industrial policy.

Governments developed export processing zones equipped with good basic infrastructure and tax holidays when the first electronics firms were attracted from abroad to Singapore (late 1960s), Malaysia (early 1970s), the Philippines (early 1970s), Thailand (1980s) and Indonesia (1990s). The focus was then only on generating investment and employment. Singapore and Malaysia upgraded their focus on the electronics industry to stimulate technological upgrading from 1979 and 1986 respectively. Given the focus on foreign ownership this article also seeks to examine whether government strategies targeted at technological upgrading are possible through the participation of transnational corporations. Hence, the aggressive government promotion of electronics production and the consequent expansion of investment, employment, exports and value added of the industry in Southeast Asia offer the justification for subjecting the industry for appraisal.

Theoretical Considerations

The macro-economic questions important in comprehending the direct consequences of the two financial crises on export-oriented manufactured goods, such as electronics, are whether: one, firms engaged in production are reliant on capitalisation from banks – both local and foreign – as interest rates can affect the capacity of firms to service loans; two,
the crises led to a contraction in export demand; three; exchange rates have been affected in ways that have undermined the export competitiveness of the goods; and finally, whether the crises spurred technological catch-up initiatives among the electronics industry, especially integrated circuit (IC) firms in Southeast Asia. There are, of course, indirect causes, such as a loss in savings and international reserves that may result in increasing budget deficits, increasing external debt, and panic that often drives volatile fluctuations in exchange rates. However, the latter issues are dealt with by Akyuz (2010) and Lim and Lim (2010), and therefore we do not discuss them here.

Ownership and funding sources matter when examining the impact of crises on capitalisation. Foreign capital has dominated ownership in the electronics industry in Southeast Asia since its origins in Singapore, Malaysia and the Philippines in the 1960s, in Thailand since the early 1980s, in Indonesia since the late 1980s and in Vietnam since the late 1990s (Gartner 2013). Export-oriented foreign electronics firms relocated operations in the early 1970s to Malaysia and the Philippines, to Indonesia in the 1990s when first consumer electronics firms from Japan, South Korea and Taiwan relocated low-end operations in Java following growing saturation of the labour market in Malaysia, and total foreign ownership was allowed to firms relocating in Batam. Hence, foreign firms reliant on capital funding from home sites will have little problems arising from a destabilisation of host-site financial institutions in Malaysia, the Philippines, Singapore and Thailand. However, national firms in all these countries could face problems if the financial risks soar from an enlarged balance of payments deficits, soaring non-performing loans and external exposure as market-oriented financial systems will force interest rates up and with that higher loan servicing costs to firms.

Export demand, especially from North America, Europe, China and Japan, has been the critical driver of electronics production in Southeast Asia. Especially, Singapore, Malaysia, the Philippines and Thailand depend heavily on exports to these locations. Hence, a crash in external demand will have a more severe impact on electronics production in these countries than in Indonesia since the 1990s. A boom in export demand will help a quicker recovery in these countries, as not only will it alleviate retrenchment problems but it will also generate additional foreign exchange to lessen the burden of balance of payments deficits. The latter will be the case provided export production is not wholly reliant on imported inputs, and machinery and equipment.

While volatile fluctuations in exchange rates could impact negatively on electronics production and trade, most firms trade in electronics components, parts and final goods in US dollars to ensure a stable macro-economic trading environment. On the one hand, exchange rate depreciations to Southeast Asian currencies will drive down labour and operating costs. On the other hand, appreciating national currencies will raise operating and labour costs, which will lower the export competitiveness of production if there is no commensurate technological upgrading towards higher value-added activities. Governments concerned with the dire consequences of exchange rate fluctuations often abandon flexible exchange rate regimes in the real sectors reminiscent of the Mundell-Fleming model (Fleming 1962; Mundell 1963) to introduce some form of Keynesian-style capital controls through either a managed float based on selected currencies or fixed exchange rates when volatility intensifies (Keynes 1936; Stiglitz 2010). Keynes (1936) cautioned against simultaneously freeing currency and capital markets as wild fluctuations in the former will undermine the latter. Monetary authorities will be able to regulate and check speculative bubbles this way.
It is also important to examine state theory, since governments identified electronics as a strategic sector to spearhead investment and employment generation in Singapore between the late 1960s and the late 1970s, in Malaysia between the early 1970s and late 1980s, in the Philippines since the early 1970s, in Thailand since the 1980s, and in Indonesia since the 1990s. The Indonesian government has even offered full foreign-ownership conditions in the export-processing zone of Batam and Bintan, whereas only joint ventures are allowed in the rest of Indonesia (Hill 1998). Governments introduced strategies to stimulate technological catch-up into high value-added activities in Singapore since the late 1970s and in Malaysia since the late 1980s (Malaysia 1988). Whereas Singapore and Malaysia introduced elements of industrial policy to stimulate upgrading in the electronics industry in 1979 and 1986 respectively, the others have continued to promote investment in the industry through the provision of export-oriented incentives.

The promotion of technological upgrading through industrial policy instruments in Singapore and Malaysia raises the question of whether they have impacted on technological catch-up in the industry. Crises act as important conjunctures as it is during such moments that late-comer firms enjoy the opportunity to dislodge ailing incumbents. Marx (1957) argued that crises force firms to replace old technologies with new ones, which Schumpeter (1961) extended with the concept of “gales of creative destruction.” It was during the 1979–80 oil crisis that Samsung managed to acquire Micron Technology and Zenith to enter the memory production business (Edquist and Jacobsen 1987), while it was during the 1985–87 cyclical downturn in the semi-conductor industry that the Taiwan Semiconductor Manufacturing Corporation (TSMC) established a joint venture with Phillips (Tsai and Wang 2005; Yap 2013). While Samsung leapfrogged all other firms to become the leader in memory chip production since the early 1990s, TSMC has become the lead firm in logic chip production since the late 1990s (Mathews and Cho 2000). Given the emphasis on technological upgrading by the governments of Singapore and Malaysia, it will be interesting to see if the 1997–98 and 2008–09 financial crises have induced technological catch up and leadership by electronics firms located in Southeast Asia.

An assessment of technological upgrading in the electronics industry also requires a review of the global value chain (GVC) approach (Gereffi, Humphrey, and Sturgeon 2005). Electronics firms in Southeast Asia are largely extensions of a transnational division of labour with headquarters located abroad. Sturgeon (2002) and Gereffi, Humphrey, and Sturgeon (2005) show that the strongest upgrading experienced in the electronics industry is due to the evolution of process and production research and development (R&D) at host sites by supplier firms. Foxconn’s (owned by Taiwanese capital) participation in such activities to supply Apple from China is an example. However, while the modularisation process provides the dynamics for technological upgrading at host sites, it also sets the limits for transnational-led upgrading as lead firms continue to keep product R&D and marketing at their headquarters and parent sites.

This limitation of the GVC approach in not transcending technological upgrading to the technology frontier can be overcome by addressing the state’s role in engendering the conditions for technological catch-up and leapfrogging. The state’s role in stimulating technological catch-up and leapfrogging is well documented in the political economy literature. Smith (1776), Hamilton (1791) and List (1841) discuss the role of the government in launching technological catch-ups through the introduction of industrial policy. Veblen (1915), Gerschenkron (1952) and Abramovitz (1956) explain latecomer
advantages and how particular countries quickened the speed of technological catch-up. Johnson (1982), Amsden (1989) and Wade (1990) offer illuminating accounts of state intervention to support technological catch-up in Japan, South Korea and Taiwan, respectively. However, as argued by Evans (1995), the evidence on state interventions in national economies and in particular industries has not produced the same results among developing countries, which led him to posit different types of states. Using the information technology industries of Brazil, India and Korea, Evans (1995) distinguished countries where governments have managed to systematically assist firms to catch up technologically as developmental states. Such a dynamic role by the state also requires that governments insulate firms from destabilising macro-economic disruptions. Katz (2010) advanced the argument on the need to ensure micro–macro coordination to insulate technological catch-up initiatives. Hence, the Asian financial crisis and the global financial crisis offer an opportunity to analyse both the role of the state in supporting technological catch-up in the electronics industry – specifically the IC industry – as well as the state’s role in insulating firms from debilitating waves of destruction.

Impact of the Crises

The crises of 1997–98 and 2008–09 affected the Southeast Asian economies differently. Because the first arose from speculative attacks on economies that had become vulnerable to external pressures, export-oriented industries that handled trade largely in US dollars were not much affected. In addition, a booming US economy that grew by 3.5% in 1998 helped expand the export of electronic goods from Southeast Asia. In fact, some economies, such as Malaysia, recovered faster from the crisis as a consequence of growing demand from the US. In 2008–09, however, external demand for electronics crashed following the sharp contraction in the US economy (Stiglitz 2010). Contagion in Europe and Japan further aggravated the crisis. Hence, electronics exports from Southeast Asia fell sharply in the second half of 2008 and first half of 2009. The experiences of the individual economies were different, though, because of the direction of exports, specialisation within the industry and the composition of the domestic labour markets.

Whereas the Singapore dollar appreciated gradually since the Plaza Accord of 1986, the Baht, Ringgit, Filipino Peso and the Rupiah began to appreciate from 1993 as these currencies were pegged against a basket of currencies. Traded in US dollars, electronics was losing cost-based competitiveness in the mid-1990s until the financial crisis struck. Whereas technological upgrading to higher value-added activities helped maintain the competitiveness of electronics firms in Singapore, firms in Malaysia and Thailand began to rely on imported, cheap foreign labour before the crisis struck. The transformation of electronics production to higher value-added activities was able to support rising wages in Singapore. The foreign labour option offered firms in Malaysia low wages that could offset currency appreciations, but also helped expand domestic labour supply, which had become saturated by 1990 (Jomo 1990). High unemployment and underemployment rates and the casualisation of production ensured that wages hardly rose in Indonesia and the Philippines (Mahi 1998; Ofrene 2013).

While the US dollar gained value against most of the Southeast Asian currencies following the 1997–98 Asian financial crisis, the 2008–09 global financial crisis produced just the opposite effect. The average monthly exchange rate against the US dollar of the Thai baht, Malaysian ringgit, Indonesian rupiah and Singapore dollar depreciated from 22.8, 2.5, 2,342.3 and 1.4 respectively in January 1997 to 36.5, 3.8, 9,477 and 1.7

Crisis Effects on the Electronics Industry
respectively in December 1998 (HER, 2014). A booming US economy was able to absorb more electronics imports from Southeast Asia during 1997–98, while a highly deflationary US economy triggered a contraction in electronics exports from Malaysia, Singapore and Thailand in 2008–09. Overall electronics exports from the Philippines fell because of a contraction in production in its main export destination economies of Malaysia, Taiwan and Japan. Whereas electronics exports to the US from Malaysia, Singapore and Thailand rose from 26.6, 26.8 and 25.9 US billion dollars respectively in 1997 to 30.6, 27.8 and 28 billion in 1998, it fell from 25.4, 11.5 and 15.8 billion respectively in 2008 to 17.4, 10.1 and 15.1 billion respectively in 2009 (Comtrade 2014). With its sound management and strong international reserves Singapore enjoyed relative benefits from the 1997–98 crisis as it became a major destination for capital seeking refuge from crisis-ravaged Indonesia, Malaysia, the Philippines and Thailand (Jomo 2003). Whereas Indonesia, the Philippines and Thailand went to the International Monetary Fund to seek a bailout to shore up their international reserves that had collapsed, Malaysia introduced capital controls on 2 September 1998. Even the political upheavals that resulted in a change in government in Indonesia and Thailand from the Asian financial crisis did not undermine electronics production in these countries. Coming in the wake of previous structural adjustment packages, the Philippines rode the crisis without much political turbulence.

Crippled by the sub-prime mortgage crisis, the US economy contracted in 2008–09, which led to a depreciating US dollar against the Southeast Asian currencies. Economies strongly integrated with the US economy faced additional problems as the gross domestic product of European economies and Japan contracted in 2009. Hence, electronics export demand crashed in Malaysia, the Philippines (through Japan, Taiwan and Malaysia), Singapore and Thailand. With internal demand and supplier chains originating from China, Singapore and Malaysia and dominating production, the electronics industry in Indonesia faced the least negative impact from the global financial crisis as firms were exposed little to the crisis affected economies of the US, Japan and Europe.

Whereas wages in Singapore remained strong when the 1997–98 financial crisis struck, its immediate impact was to lower wages further in Indonesia, Malaysia, the Philippines and Thailand. Volatile fluctuations in exchange rates saw the rupiah, ringgit, peso and baht depreciate against the US dollar. This lowered the cost of labour and domestic transaction costs in these countries. The Singapore dollar maintained its strength against the US dollar as the monetary authorities intervened quickly to stem any exposure to the storm in currency markets. Although Malaysia had introduced capital controls by fixing the exchange rate at 3.8 ringgit to a US dollar, and barring external ringgit accounts from September 1998, export-oriented firms were allowed to trade freely in US dollars. Hence, whereas inward and Southeast Asian market-oriented firms began to shed labour, the electronics industry generally did not face this problem during the Asian financial crisis.

**Exports**

Electronics exports either grew or held up over the years 1996–98 in all of the five countries, suggesting that the financial crisis did not affect external demand (see Figure 3). Electronics exports from Malaysia, Indonesia, Thailand and Singapore remained at US$14 billion, $0.2 billion, $3.2 billion and $20 billion respectively, in 1996. Electronics exports from the Philippines rose from US$6.1 billion in 1996 to US$12.9 billion in 1998. Interviews with the managing directors of Intel, Motorola, Advanced Micro Devices
and National Semiconductor in 1998 showed that the slowdown in exports in Malaysia, Indonesia, Thailand and Singapore was a consequence of an industry-wide slowdown (Interviews by Rasiah, 7–25 October 1998, Penang).

While electronics exports stayed strong over the 1997–98 Asian financial crisis, they crashed in four of the five countries studied during the global financial crisis of 2008–09 (see Figure 3). Electronics exports from Malaysia, Thailand, Singapore and the Philippines fell from US$77.7 billion, $41.9 billion, $135.2 billion and $32.4 billion in 2007 to $64.7 billion, $38.3 billion, $108.4 billion and $23.8 billion respectively in 2009. Only exports from Indonesia rose slightly from US$9 billion in 2007 to $9.5 billion in 2009, largely influenced by demand from Singapore, China and Malaysia.

Within the electronics industry, the global financial crisis badly affected office machine and automatic data processing machine exports, which continued to decline up to 2011 (see Figure 4). Although most of the countries took measures to re-orient their office machine exports to China, electronics exports have continued to fall (see Table 1). Because exports to China are in lower value-added products, while those to developed countries are higher value-added products, the geographical shift has contributed to a decline in the value of overall exports. China became the final assembler by procuring parts and components from East Asia. Total parts and components imports by China from East Asia rose to over 44% in 2007 from 18.5% in 1995 (Chia 2010). Indeed, final demand from China only accounts for 7.2% of value added in Indonesia, Malaysia, Singapore, Thailand and the Philippines (European Central Bank 2009).

*Value Added*

While the electronics industry is characterised by its own boom and bust cycles that have often been affected by over-production and crisis (Brown and Linden 2010), we produce
data to show the consequences of the 1997–98 Asian financial crisis and the 2008–09 global financial crisis. Although electronics exports grew over the Asian financial crisis in all of the five countries, real value-added fell in Malaysia and Thailand over the period 1996–98 owing to a shift towards low value-added activities (see Figure 5). In Malaysia the fall was from 1996 until 1998 with a rise again in 1999. Interviews with an official of the Malaysian Investment Development Authority in 1998 showed that the appreciation of the ringgit against the US dollar until July 1997 and the government’s encouragement for labour-intensive firms to relocate out of Malaysia were instrumental in this dip (Interview by Rasiah, 19 November 1998, Kuala Lumpur). Electronics value-added in Indonesia rose sharply over the period 1998–2000 as a consequence of both a depreciated rupiah, as well as the attractiveness of promotional incentives on Batam Island. Electronics value-added in Singapore rose from 1996 to 1997 before falling in 1998. Nevertheless, real electronics value-added in Singapore showed a trend rise to US$12.8 billion in 2010. Real electronics value-added in the Philippines rose slightly during the crisis-affected years of 1997–98.

**Figure 4.** Exports of office and automatic data processing machines, selected economies, 1990–2011. *Source:* Compiled by the authors from United Nations Statistical Division, COMTRADE (2012).

**Table 1.** Exports of office and data processing machines by destination, 1995 and 2011 (% of total exports)

<table>
<thead>
<tr>
<th>Country</th>
<th>1995</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>China</td>
<td>Japan</td>
</tr>
<tr>
<td>Malaysia</td>
<td>0.3</td>
<td>18.4</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.0</td>
<td>26.5</td>
</tr>
<tr>
<td>Thailand</td>
<td>1.4</td>
<td>28.3</td>
</tr>
<tr>
<td>Singapore</td>
<td>1.2</td>
<td>18.0</td>
</tr>
<tr>
<td>Philippines</td>
<td>0.4</td>
<td>50.0</td>
</tr>
</tbody>
</table>

*Source:* Calculated by the authors from United Nations Statistical Division, COMTRADE (2012).
Real electronics value-added in Thailand rose from 1991 until 1996 before falling over the period 1996–98. In addition, value-added in Malaysia and Thailand also fell in the period 1996–98 because of rising import prices of inputs as the ringgit and baht fell against the US dollar, but exports in US dollars rose in those years.

**Labour Markets**

Employment in the electronics industry in Singapore, Malaysia and Thailand fell over both the 1997–98 and the 2008–09 financial crises (see Figure 6), while it rose in Indonesia (in the second period) and the Philippines (in both periods). Employment continued to fall in Singapore as a consequence of rapid structural change towards higher value-added activities. As labour surplus economies, Indonesia and the Philippines enjoyed a trend increase in employment. The labour market in Malaysia and Thailand faced a reduction in electronics employment in 1996–98. A tightening labour market and a shift in production to China were the main reasons with Malaysia, while the latter was the case with Thailand. Hence, electronics employment in Malaysia and Thailand gradually fell in the second half of the 1990s because of domestic structural conditions and the emergence of more attractive sites abroad rather than because of the Asian financial crisis.

Despite the introduction of fiscal stimulus to assist retrenched national workers, the 2008–09 crisis impacted foreign workers. Both legal and illegal foreign workers were deported from Malaysia (Mahani and Rasiah 2009). In Thailand, the Thailand Development Research Institute estimated that about 330,000 of the 1.8 million foreign workers would lose their jobs by 2009. Manufacturing and agriculture were listed as the most affected sectors. Meanwhile, the Thai government stopped issuing contracts to foreign workers in 2009 while announcing that the contracts of half a million foreign workers would not be renewed in 2010 (Abella and Ducanes 2009, 4; Supang 2009). However, the Philippines and Indonesia experienced an expansion in overall

![Figure 5. Electronics value-added, selected countries, 1990–2010. Source: Calculated from unpublished raw data from respective countries.](image-url)
unemployment and underemployment, though the electronics industry was spared in the latter because of rising exports. The Philippines faced retrenchments as exports contracted in the 2008–09 financial crisis (Ofreneo 2013), though exports to the US increased in 2008–09. Indonesia did not encounter the same problems because the electronics industry continued to enjoy export growth.

The consequences of a decline in exports and with that a drop in production during the 2008–09 global financial crisis were severe on employment in Malaysia, the Philippines, Thailand and Singapore. Indonesia felt little of the crisis because its electronics exports primarily targeted members of ASEAN, China and Japan. Whereas Malaysia, Singapore and Thailand targeted foreign workers first for retrenchment (Abella and Ducanes 2009, 10), the Philippines endured retrenchment of its own national workers. Policies providing a fiscal stimulus were introduced in Malaysia, Indonesia, Thailand and the Philippines to help retrenched workers and to expand domestic demand (Baur and Thant 2010). The lack of direct integration into the American and European value chains for electronics helped Indonesia avoid a crash in exports, value-added and employment during the global financial crisis. Given the mild influence unions have had on wages and working conditions in Indonesia, Malaysia, the Philippines and Thailand (Ofreneo 2013), the asymmetric nature of capital–labour relations on the factory floor has exposed especially unskilled and semi-skilled workers to the vicissitudes of volatile fluctuations in the global economy. Despite being co-opted into government planning, the National Trades Union Congress in Singapore has been an important pillar within the tripartite process that has influenced a rapid wage rise in Singapore, especially since 1979 (Wong 1998, 115). Meanwhile, the casualisation of labour has expanded in the export-oriented sectors in Indonesia, Malaysia, the Philippines and Thailand (Mahi 1998; Pasuk 1998; Ofreneo 1998, 2013; Jomo 2003). However, the governments of Malaysia, Singapore and Thailand encouraged employers to target the retrenchment of foreign workers first during the 2008–

Figure 6. Electronics employment, selected countries, 1990–2010. Source: Calculated from unpublished raw data from respective countries.
09 global financial crisis. The Philippines faced a further casualisation of labour during the global financial crisis (see Ofreneo 2013), while the minimal impact on exports did not change the situation much in Indonesia. Although Indonesia and the Philippines have a regional and provincial minimum wage in place, wages in electronics firms in these countries are lower than wages in Malaysia. Minimum wages were introduced in Malaysia and Thailand in 2012 at US$300 monthly.

Implications for Technological Upgrading

In this section we examine the impacts of the financial crises on the direction of government policy for the electronics industry, and show that the crises were not utilised by firms and governments as opportunities to launch technological catch-up and leapfrogging in the electronics industry in the Schumpeterian sense, as in South Korea and Taiwan. While the electronics industry has encountered contrasting experiences in the countries examined, the two financial crises neither affected policy frameworks nor launched technological innovation or upgrading.

Owing to the political fallout associated with the fall of Soeharto, Indonesia potentially faced the most severe damage from the Asian financial crisis, yet its liberal invitational strategy did not require new investment to maintain the tax holidays and basic infrastructure. Besides, the most export-oriented base of the electronics industry in Batam and Bintan continued to be managed by Temasek Holdings of Singapore. A similar liberal invitational strategy in Indonesia, Thailand and the Philippines was insulated from the Asian financial crisis of 1997–98 as the foreign-dominated electronics industries enjoyed a fall in production costs as a consequence of depreciations in their national currencies. The introduction of capital controls in Malaysia in 1998, did not harm electronics production (Jomo 2003). Not only was the ringgit–US dollar exchange rate fixed at a low MYR3.8 to a dollar, but also exporters were allowed to trade freely in US dollars (Bank Negara Malaysia 1999).

Governments in the Philippines, Thailand and Indonesia retained the invitational liberal approach to the electronics industry to focus on stimulating foreign capital inflows to generate investment and employment, and hence, continued to specialise in low-value-added assembly and test activities. Lacking in the supply of human capital and institutional support for participation in high-tech activities, electronics firms in these countries were wholly engaged in low-end activities. The Malaysian government pursued the liberal invitational approach until 1986 with only minimal elements of an industrial policy. Malaysia’s first industrial policy, that was launched in 1986, only focused on providing tax incentives for participation in training and R&D (Malaysia 1986, 1988). It was only the provision of grants to support high value-added activities since 2005 that attracted chip design, R&D support and wafer fabrication by some firms. Examples include: chip design by Intel; R&D support by Renesas, Motorola, Altera, Advanced Micro Devices and Fairchild; and wafer fabrication by Infineon, Osram, ON semi-conductor and X-Fab. However, these examples are few and there have been few linkages established between these firms and national R&D organisations. Hence, most electronics firms in Malaysia are still engaged in low value-added activities (see Rasiah 2011).

The Malaysian government introduced legislation and launched intermediary organisations to stimulate technological upgrading but this did not enjoy significant progress owing to the lack of human capital and poor coordination of the incentives and grants,
and the management of the intermediary organisations (see Malaysia 1991; Rasiah 2011). Using the semi-conductor industry, which is technologically the most sophisticated component of the electronics industry, we analyse if technological upgrading expanded during the two crises. As shown in Table 2, most semi-conductor firms in Malaysia have remained confined to assembly and test activities, though Malaysia managed to attract some firms into wafer fabrication, chip design and R&D support activities. There were seven national and 28 foreign assembly and test firms in Malaysia in 2012. Malaysia did attempt to assume the South Korea and Taiwan route of acquiring a foreign firm to initiate fabrication, which was undertaken through MIMOS when it acquired VLSI Technology in 1995. This was the route Malaysia took to launch the nationally-owned firms Silterra and 1st Silicon in 2000. The government also began to offer R&D grants after 2005 to foreign-owned firms to start chip design, R&D support and wafer fabrication, which helped attract three such firms into chip design, one foreign firm into R&D support and three foreign firms into wafer fabrication. After 1st Silicon was acquired by the foreign-owned X-Fab in 2012, there was one national and four foreign-owned fabrication plants in Malaysia. The focus on financial yield and a lack of human capital has denied the national fabrication plant from stimulating chip design and R&D support to stimulate cluster synergies, and hence, these initiatives have manifested truncatedly in technological upgrading only in the foreign-owned firms. However, ethno-patronage colouring of upgrading strategies, the lack of human capital, and the lack of effective appraisal mechanisms to reduce rent dissipation, including in the provision of R&D grants, has denied Malaysia an incisive framework to drive technological catch-up (Rasiah 2011).

The Asian financial crisis had limited impacts for Singapore, meaning it continued its leveraging strategy of promoting foreign and national firms to upgrade. Since the introduction of the Skills Development Policy in 1979, the Singapore government has systematically launched new initiatives to stimulate technological upgrading. Through the dynamic role of the Economic Development Board, Singapore has pursued a leveraging strategy by offering grants, equity, R&D labs and factory buildings to stimulate upgrading. The government has also developed its Science Park through three phases. As a consequence, Singapore has managed to attract semi-conductor firms into chip design (all five are foreign-owned), R&D support (one foreign firm) and 13 wafer fabrication firms (three national and ten foreign) (see Table 2). The one national firm engaged in independent R&D has not enjoyed any success in catching up with Korea’s Samsung and Hynix.

### Table 2. Total number of firms at different stages of production activities, 2012

<table>
<thead>
<tr>
<th>Country</th>
<th>R&amp;D</th>
<th>Chip design</th>
<th>R&amp;D support</th>
<th>Wafer fabrication</th>
<th>Assembly &amp; test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>N</td>
<td>F</td>
<td>N</td>
<td>F</td>
<td>N</td>
</tr>
<tr>
<td>Malaysia</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Philippines</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Singapore</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Thailand</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

Notes: N – national; F – foreign; defined by majority equity ownership.
Source: Compiled from Gartner (2013).
or Taiwan’s TSMC, United Microelectronics Corporation, Vanguard and Winbond. Yet, Singapore has enjoyed the financial capacity to acquire foreign firms or bulwark through their national firms, a leapfrogging strategy as several Western semi-conductor firms were derailed by the 2008–09 financial crisis, for example Advanced Micro Devices, Qimonda and Infineon. To a lesser extent, one can also say the same thing about Malaysia. Nevertheless, although government strategy has not given electronics firms in Singapore the opportunity to shape the technology frontier, they have managed to stimulate the movement of firms up the technology ladder to high-tech activities. It may be that the Singapore experience shows the limits of a country’s industrial policy in driving technological upgrading. The same can also be said of Malaysia. The evidence shows that the TNC-driven strategy has stimulated technological upgrading to the point of attracting wafer fabrication, chip design and supporting R&D in Singapore and Malaysia. While the provision of grants has attracted these high value-added stages of IC production, it has failed to attract technological catch-up to the technology frontier, thereby generating knowledge new to the universe by attracting frontier R&D operations.

Overall, we find evidence that the Asian financial crisis of 1997–98 did not affect in any negative way the production and trade of the electronics industry in Southeast Asia. This was because the crisis originated in Southeast Asia while the transnational corporations involved were not linked to the financial system of the host countries. In fact, production costs fell as wages became cheaper owing to falling exchange rates. The steady US dollar, which was the main currency of trade used in the industry, ensured that trade was not affected. However, the global financial crisis of 2008–09 caused a massive contraction in exports of countries dependent on the markets of the US and Europe. Indonesia was the only country that escaped the impact but only because most of its electronics exports went to ASEAN members, especially Singapore and Malaysia, and to China. Singapore and Malaysia alone account for approximately 40% of the total electronics exports of Indonesia (Titiheruw, Soesastro, and Atje 2009). The contraction of 2008–09 led Malaysia and Singapore to repatriate foreign labour, whereas casualisation of labour in the industry increased further in the Philippines. Strong macro-economic fundamentals helped the Southeast Asian countries recover from the global financial crisis fairly quickly. However, none of the countries implemented strategies to use the global financial crisis to support latecomer firms to dislodge incumbents to shape the technology frontier as in South Korea and Taiwan. Yet, Malaysia and Singapore did enjoy the financial capacity to acquire leading foreign firms or drive national firms to stimulate technological catch-up in semi-conductor production as several leading Western firms were derailed by the 2008–09 crisis. While the reliance on transnational corporations may have prevented Singapore from managing leapfrogging strategies, Malaysia was in addition affected by ethno-patronage policies.

Conclusions

It can be seen that the electronics industry in Southeast Asia faced significantly different effects from the two financial crises. Whereas the industry was little affected by the Asian financial crisis as external demand remained strong, it was seriously affected by the global financial crisis as external demand crashed. However, only Singapore, Malaysia, Thailand and the Philippines experienced a fall in exports, value-added and employment from the 2008–09 crisis as electronics value chains link firms in these countries strongly with
demand in developed countries. A number of these firms (for example Fairchild, Advanced Manufacturing Devices and Intel) also have their headquarters and parent firms in the crisis-affected developed countries. Indonesia’s electronics industry did not face a serious problem from the global financial crisis because its external demand has come largely from Singapore, Malaysia and China.

Because heavy integration into global markets can raise the risks associated with dependency as witnessed by the electronics industry in Malaysia, the Philippines, Singapore and Thailand during the 2008–09 crisis, it seems important that governments and firms should seek to reduce export dependence on particular markets or have in place economic instruments that offer exporting firms the alternative of re-orienting production swiftly to either markets that are not volatile or into stable product lines to substitute for a fall in external demand. By pursuing this strategy the countries characterised by low wages, such as Indonesia, Malaysia, the Philippines and Thailand, can also address under-consumption where the profit squeeze and low-wage labour deny national economies the demand to support domestically driven economic growth (Hobson 1965; see also Brewer 1980). Also, highly export-oriented economies may experience severe casualisation with serious consequences for labour, including falling real wages and an erosion in labour standards.

These developments should be placed against the background of production and employment trends. Whereas appreciating domestic currencies along with a saturated labour market had already been driving out labour-intensive electronics production from Singapore since the late 1970s, and from Malaysia and Thailand by the mid-1990s, electronics production in low value-added activities has remained in the low-wage and populous countries of the Philippines and Indonesia. In addition to these countries, the lack of policies to drive technological upgrading has left electronics confined to low value-added production, as in Thailand. Malaysia’s limited upgrading policies have only stimulated upgrading to high value-added activities in a handful of firms so that the bulk of electronics production has remained in low value-added activities. Firms began hiring foreign workers to overcome problems of wage rise and labour shortage in such low value-added activities. Singapore has been the most successful having used its leveraging strategies effectively to promote upgrading into high value-added activities. Also, foreign ownership has continued to dominate electronics production in Southeast Asia.

However, neither Singapore nor Malaysia have managed to stimulate electronics firms to participate in the most sophisticated activity of node miniaturisation and the enlargement of the wafer diameter, or the frontier aspects of R&D, as in South Korea and Taiwan. The 1979–80 and the 1985–87 economic crises enabled Samsung of Korea and TSMC of Taiwan respectively to enter and eventually leapfrog their competitors in memory and logic chips. Indeed, the 2008–09 global financial crisis seriously debilitated electronics firms in the US and Europe thereby giving Singapore and Malaysia the opportunity to acquire ailing Western incumbents, such as Qimonda and Advanced Micro Devices.

**Acknowledgements**

This study was funded by a High Impact Research (HIR) grant from the University of Malaya (Ref No: UM.C/625/1/HIR/ASH/019). We acknowledge constructive comments from two anonymous referees. The usual disclaimer applies.
Note

1 Rasiah (1988) has provided evidence of shortening product cycles, intense competition and overproduction as major causes of crises in integrated circuits which have so far been felt by the entire electronics industry. This also serves as a critical opportunity for new entrants to compete with incumbents.

References


