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Masanaga Kumakura
Graduate School of Economics, Osaka City University

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Center for International Trade Studies, Faculty of Economics
Yokohama National University

Fluctuations in the Yen/Dollar Exchange Rate, East Asian Business Cycles, and Asian Financial Crisis

Masanaga Kumakura[*†]

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Abstract

Fluctuations in the yen/dollar exchange rate are widely perceived as a major threat to East Asia's macroeconomic stability. McKinnon and Schnabl (2003), among others, claim that the combination of recurrent swings in the yen/dollar rate and the Asian countries' soft dollar pegs generates synchronized business cycles among the latter countries by upsetting their export competitiveness. This mechanism is, furthermore, often said to have been an important factor behind the Asian financial crisis; during a few years before the crisis, the yen depreciated sharply against the dollar while most Asian countries plunged into a serious export slump. As we will show, however, few Asian countries have in fact pegged their currencies to the dollar as rigidly as to let yen/dollar fluctuations immediately threaten their export competitiveness. For many countries, moreover, real demand shocks arising from the global electronics cycle are far more important than competitiveness shocks as determinant of their short-term export performance. Although we do not directly discuss the optimal currency arrangement in Asia, our findings raise a number of questions about the purported merits of various regional exchange rate targeting schemes currently under discussion.

Keywords: Yen/dollar exchange rate; Business cycles in Asia; Global electronics cycle.

JEL Classification: F1, F3, F4.

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[*] Graduate School of Economics, Osaka City University. E-mail: kumakura@econ.osaka-cu.ac.jp.

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1. Introduction

Six years after the Asian financial crisis, debate still continues about its causes and lessons for the future. While few people deny the complexity of the event, Asian countries' exchange rate policy is often said to have been an important contributing factor. A number of economists also claim that the Asian countries should establish an explicit framework for currency policy coordination to safeguard the region's macroeconomic stability in the future (Williamson 2000; Rajan 2002).

In some respects, the call for a regional exchange rate arrangement in Asia is motivated by similar considerations to what led the European policymakers to set up the Exchange Rate Mechanism (ERM) in the late 1970s and ultimately to form a full-blown European Monetary Union (EMU) in 1999. For those who distrust foreign exchange markets, exchange rate instability arising from the floating regime is as undesirable for Asia's small open economies as for those in Europe. As intra-regional trade in Asia is now as extensive as in Europe, one may also feel that the Asian countries need a common framework with which to stabilize the relative value of their currencies and to prevent competitive devaluation. There is also a perception that collective exchange rate targeting would help promote a sense of community and further economic integration in the region (Ogawa 2002; Wyplosz 2002).

In Asia, however, a common exchange rate regime is often said to be useful in addressing a problem specific to the region: the (alleged) vulnerability of the Asian economies to fluctuations in the yen/dollar exchange rate. According to some observers, recurrent swings in the yen/dollar rate have been and still are the No.1 enemy of the region's macroeconomic stability. In their view, as most Asian currencies (other than the yen) are pegged officially or unofficially to the dollar, fluctuations in the yen/dollar rate alter Japan's industrial competitiveness vis-à-vis the other smaller countries and generate boom-and-bust cycles among the latter (Kwan 2001; McKinnon and Schnabl 2003). These authors also argue that this mechanism was partly responsible for the Asian financial crisis; since mid-1995 until the onset of the crisis, the yen depreciated sharply against the

dollar while many Asian countries sank into a serious export slump (Ito et al. 1998; Ogawa 2002). Some observers further claim that the Asian countries' unofficial dollar pegs have been revived in recent years. In their view, therefore, the state of affairs in which the capricious yen-dollar rate plays havoc with the smaller Asian economies remain intact and need to be rectified (Fukuda 2002).

The foregoing views manifest themselves in numerous regional exchange rate regimes currently discussed in the literature. For example, Williamson (2000, 2001), Kawai and Takagi (2000) and Rajan (2002) propose a common basket peg (CBP), whereby most or all of the Asian countries other than Japan peg their currencies to a weighted basket of the dollar, the yen and the euro. This proposal is predicated on the assumption that the relatively large and closed economy of Japan is unsuited to a fixed exchange rate regime and that the other Asian countries must accept yen/dollar fluctuations as a fact of life. According to Williamson and others, however, by *jointly* pegging their currencies to the same basket of the industrial-country currencies, the Asian countries can at least reduce the destabilizing impact of yen/dollar fluctuations on their economies while keeping the relative value of their own currencies stable.

Some authors, such as Ito et al. (1998) and Kwan (2001), propose a variant of the Asian CBP scheme where the yen is assigned a substantially larger weight in the currency basket than warranted by the Asian countries' overall trade structure. Underlying this proposal is the perception that, given Japan's importance as a major export competitor and source of capital goods, the other Asian countries should benefit by targeting their currencies more closely to the yen than to the dollar and the euro. Adopting such a policy would give rise to a quasi yen bloc in the region; some proponents of this version of CBP consider this as a desirable step toward a full-blown regional monetary union. In contrast, McKinnon and Schnabl (2003) argue that such a policy makes little sense since the current "revealed preference" of most Asian countries --- including relatively large ones such as China and Korea --- is to peg to the dollar. In their opinion, a more natural arrangement is that *all* Asian countries, including Japan, formally peg their currencies to the dollar. McKinnon (2001) argues that, with appropriate assistance from the US monetary

authorities, a formal Asian dollar bloc thus created would be helpful for both eradicating the destabilizing effect of yen/dollar fluctuations and promoting the region's economic integration.

In this paper, we challenge the notion that fluctuations in the yen/dollar exchange rate constitute the primary threat to East Asia's macroeconomic stability. First, although this view rests on the assumption that the East Asian currencies have been pegged to the dollar sufficiently tightly that fluctuations in the yen/dollar rate are largely synonymous to those in the relative manufacturing competitiveness of Japan and the other Asian countries, we show that this has in fact not been the case. Second, while the preceding view implicitly assumes that competitiveness shocks are the main driver of East Asia's export and output fluctuations, we demonstrate that this is simply untrue. As we will see, much of what is widely believed as the effect of yen/dollar fluctuations is in fact that of export demand shocks arising from the global electronics cycle. Although we do not specifically discuss the optimal currency arrangement in Asia, our findings suggest that many of the recent proposals for regional exchange rate targeting stand on wrong premises.

The rest of this paper is organized as follows. In the next section, we first look at the broad historical evidence on the relationship between the yen/dollar exchange rate and the business cycles of East Asian economies. Contrary to what is often claimed, we will find that the global electronics cycle is far more important than the yen/dollar rate as determinant of output fluctuations in Asia, although the impact of the former on individual countries is by no means uniform. Section 3 examines the behavior of the Asian currencies before and after the crisis and demonstrates that the view that the Asian countries have followed and still maintain de facto dollar pegs is, while widespread and often taken as a matter of fact, by no means incontrovertible. In Section 4, we look more closely at the relative impact of yen/dollar fluctuations and the global electronics cycle on the Asian countries' export performance. As we will see, in most countries the contemporaneous effect of yen/dollar fluctuations has been consistently small, including the period immediately before the currency crisis. Section 5 summarizes the findings of the paper and their implications for desirable monetary policy in the region.

2. Yen/Dollar Exchange Rate and East Asian Business Cycle

The view is widespread that fluctuations in the yen/dollar exchange rate constitute a major threat to East Asian countries' macroeconomic stability. For example, McKinnon and Schnabl (2003) note that for the past two decade the business cycles of eight East and Southeast Asian countries (Hong Kong, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan and Thailand) have been closely correlated to one another, and argue that what lies behind their synchronized output cycles are recurrent swings in the yen/dollar rate. Table 1 presents the empirical correlations of the annual real GDP growth rates of the eight Asian countries and other major countries in and outside the region. (In what follows, we refer to the group of the preceding eight Asian countries as EA to save space.) The business cycles of individual EA countries (except for the Philippines) have indeed been correlated strongly with those of the other EA countries. In contrast, their correlation with the cycles of China, the United Sates and the EU countries is generally tenuous, although the correlation with the Japanese business cycle is comparatively strong.

To "prove" that the yen/dollar exchange rate is responsible for the EA countries' business-cycle synchronization, Kwan (2001) and McKinnon and Schnabl (2003) estimate the following single-equation model:

$$\Delta y_{EA}(t) = \alpha_1 + \alpha_2 \Delta y(t) + \alpha_3 \Delta e_{JP/US}(t) + \alpha_4 \Delta e_{JP/US}(t-1) + u(t) \qquad (1)$$

where $\Delta y_{EA}(t)$ denotes the weighted average of the eight EA countries' real GDP growth rates in year *t*, $\Delta y(t)$ is the growth rate of EA's major export partner country/countries, $\Delta e_{JP/US}(t)$ is the proportionate change in the nominal yen/dollar exchange rate (the price of one dollar in yen), and $u(t)$ is the disturbance term. The maintained hypothesis is, of course, that the values of α_3 and/or α_4 are negative and statistically significant, since a yen depreciation should presumably undermine the EA countries' export competitiveness vis-à-vis Japan and dampen their output. Kwan (2001) estimated eq. (1) using annual data for 1982-1997 while McKinnon and Schnabl (2003) used data for 1980-2001.

Before assessing what these authors claim on the basis of the foregoing regression, we first reestimate eq. (1) using updated data for 1980-2002. Both Kwan and McKinnon-Schnabl use the growth rate of the United States as $\Delta y(t)$ on the grounds that for the EA countries as a whole the United States has been the single most important export market. However, as some EA countries trade more extensively with Japan and Europe, we also consider the case of using the weighted average of the growth rates of the United States, Japan and EU countries. Notice also that the EA countries' growth rates during our estimation period have generally been very high, with 1998 being the only year in which their average growth rate fell into negative territory. As the region's output collapse in 1998 was an abnormal event in a number of senses, and as excluding this year from the sample makes a large difference in estimation results, we also consider regressions in which a year dummy is included for 1998.[3]

Table 2 reports our estimation result. In all equations, the coefficients on the yen/dollar exchange rate are indeed all negative and statistically significant. In contrast, the coefficient on $\Delta y(t)$ is either insignificant or of the wrong sign when we use the US growth rate, although it takes on a more expected value when the weighted average for the industrial countries is used. Based on this result, Kwan has claimed that "fluctuations in the yen/dollar rate have replaced the US economic growth rate as the major factor determining short-term macroeconomic performance in Asian countries" (Kwan 2001, pp.39). Similarly, after experimenting with eq. (1) and some of its variants, McKinnon-Schnabl have concluded that "for the past two decades, fluctuations in the yen/dollar rate have generated synchronized business cycles in the smaller East Asian countries" (McKinnon and Schnabl 2003, pp.1068).

The foregoing regression is, however, largely spurious. McKinnon and Schnabl (2003) argue that the EA countries' business-cycle synchronization cannot be explained by

[3] We stress that our aim here is to show that the results of Kwan (2001) and McKinnon and Schnabl (2003) entail considerable degrees of spuriousness, not to rigorously estimate the numerical relationship between the EA business cycle and its underlying factors; for the latter purpose, we would not use a simile one-equation model like eq. (1).

industry-specific shocks since product mix differs across the eight countries, with some countries (e.g. Korea and Taiwan) possess relatively mature and capital-intensive industries but some other countries (e.g. Indonesia and Thailand) still relying heavily on raw materials and labor-intensive products. In their view, therefore, the source of EA-wide output correlations must be found in macroeconomic shocks that affect all countries' aggregate demand and industrial competitiveness across the board, such as fluctuations in the yen/dollar exchange rate (McKinnon and Schnabl 2003, pp.1072). However, if what links yen/dollar fluctuations and the EA business cycle is shocks that the former impart to the EA countries' industrial competitiveness vis-à-vis Japan, it should primarily be countries whose industrial structure is relatively mature and resembles that of Japan that are first affected by changes in the yen/dollar rate.[4] For this to lead to an *EA-wide* business cycle, there must be a channel through which shocks that fall on these countries are propagated to the other countries, perhaps through their trade linkages. If this second effect is numerically important, however, the argument that industry shocks cannot generate an EA-wide business cycle clearly does not hold.

As is widely documented, the EA countries' production and export structures have changed dramatically during the past two decades. Starting in the early 1980s, the "newly" industrializing economies of Hong Kong, Korea, Singapore and Taiwan have emerged as the world's leading assemblers and exporters of electronics goods, and a few other countries in the region (e.g. Malaysia) have followed suit after a short time lag. In more recent years, several EA countries have sharply increased their production and exports of IT goods and components, which account for an increasingly large part of the world electronics industry and are notoriously prone to cyclical demand-supply shocks. Therefore, when the global electronics and IT markets encounter heavy downturns

[4] To their credit, both Kwan and McKinnon-Schnabl refer to other channels through which changes in the yen/dollar exchange rate may affect the economies of the EA countries, such as the effect of the former on Japan's foreign direct investment and the price of goods that the EA countries import from Japan. Nevertheless, they consider these effects as comparatively unimportant, as is clear from the preceding quotes.

because of negative demand shocks or production gluts, such shocks are likely to hit EA countries that depend heavily on these products, and this impact may well be propagated to other countries by reducing the former countries' demand for the latter's exports. As we can see in Figure 1, the business cycle of the aggregate EA region has indeed been correlated closely with the global shipment of semiconductors (which is widely used as a proxy for the global electronics cycle), and *the latter has in fact been correlated fairly strongly with the yen/dollar rate as well*. To the extent that this is the case, there is the legitimate suspicion that the previous regression is indeed spurious.[5]

We also note that the Kwan/McKinnon-Schnabl thesis rests on the assumption that the EA currencies are pegged to the dollar sufficiently rigidly that little difference exists between fluctuations in the yen/dollar rate and those in the exchange rates between the yen and the currencies of the EA countries. As we will discuss in the next section, however, this assumption is not accurate for the eight EA currencies as a group; nor does it hold, in fact, for many of the individual currencies.

We next demonstrate the relevance of what we have argued above by modifying and re-estimating eq. (1). For this purpose, we first generate a time series of a composite real exchange rate between the yen and the eight EA currencies. The formula is simply:

$$\Delta s_{JP/EA}(t) \equiv \sum_{i=1}^{8} \frac{Y_i(t-1)}{\sum_{j=1}^{8} Y_j(t-1)} \left[\Delta e_{JP/i}(t) + \Delta p_i(t) - \Delta p_{JP}(t) \right]. \qquad (2)$$

where Y_i denotes country *i*'s nominal GDP in US dollars, $e_{JP/i}$ is the nominal exchange rate between the yen and country *i*'s currency (price of one unit of currency *i* in yen), and p_i is country *i*'s producer price index (PPI).[6] If $\Delta e_{JP/US}(t)$ and $\Delta e_{JP/US}(t-1)$ in eq. (1)

[5] The correlation between the yen/dollar rate and the world electronics cycle would not invalidate the Kwan/McKinnon-Schnabl regression if the latter were generated by the former; this is, however, unlikely to be the case.

[6] The assumption here is that the PPI-based real exchange rate is more appropriate than the nominal exchange rate as a measure of industrial competitiveness. We used the wholesale price index (WPI) for countries where an appropriate PPI was unavailable.

represent changes in the relative industrial competitiveness of Japan and the EA countries, replacing these variables with $\Delta s_{JP/EA}(t)$ and $\Delta s_{JP/EA}(t-1)$ should have little effect on the estimated values of α_3 and α_4.

If the EA business cycle is influenced by the global electronics cycle, however, the estimated values of α_3 and α_4 are still likely to confound the effects of exchange rate movements and external demand shocks. To address this issue, we generate a proxy variable for global electronics demand and consider regressions that include this variable. To this end, we define $\Delta \mathrm{IT}(t)$ as the annual growth rate of global semiconductor shipments[7] and regress this value on the average GDP growth rate for major industrial countries generated previously:

$$\Delta \mathrm{IT}(t) = \beta_1 + \beta_2 \Delta y(t) + u(t) \tag{3}$$

where $u(t)$ is again a disturbance term. We let $\Delta \mathrm{IT}^*(t)$ denote the residual from the estimated equation and use it as a proxy for the global electronics cycle that is unrelated to the broad-based business cycle of industrial countries.[8]

Table 3 shows the results of our estimation. We find that the coefficients on $\Delta s_{JP/EA}(t)$ and $\Delta s_{JP/EA}(t-1)$ are either statistically insignificant or of the wrong sign in all estimated equations. This observation casts doubt over the presumption that changes in the yen/dollar rate translate directly to the relative competitiveness of Japan and the EA countries. On the other hand, the coefficients on $\Delta \mathrm{IT}^*(t)$ is consistently of the expected sign and all statistically highly significant. We also note that when $\Delta \mathrm{IT}^*(t)$ is added to the equation, the coefficient on $\Delta y(t)$ also generally becomes significant. The estimated

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[7] The original data are from US Semiconductor Industry Association and are in terms of US dollars. We deflated this series by US CPI before conducting the adjustment of eq. (3) Using undeflated data makes little difference for the computed values of $\Delta \mathrm{IT}^*(t)$.

[8] The explanatory power of eq. (3) is fairly modest even when we add lagged values of $\Delta y(t)$ on the right hand side, suggesting that the global electronics cycle contains significant autonomous components. We also note that the residual series $\Delta \mathrm{IT}^*(t)$ remains essentially unchanged even if we use the industrial-country, not global, sales of semiconductors for $\Delta \mathrm{IT}(t)$.

values of the latter range between 0.6 and 0.9, which seem consistent with the standard view of the EA economies being vulnerable to the business cycles of industrial countries.[9] Incidentally, we note that the coefficient of correlation for $\Delta e_{JP/US}(t)$ and $\Delta \mathrm{IT}^{*}(t)$ for 1980-2002 is -0.560 whereas that for $\Delta s_{JP/EA}(t)$ and $\Delta \mathrm{IT}^{*}(t)$ is much more limited -0.174.

Needless to say, the foregoing results do not necessarily mean that the yen/dollar rate is inconsequential for *all* individual EA economies, nor does it necessarily suggest that the world electronics cycle has a homogeneous impact on all EA economies. Table 4 shows the bilateral business-cycle correlations for individual EA countries and Japan, as well as the correlation of each country's business cycle with the global electronics cycle, both computed using seasonally adjusted semi-annual data for 1991-2003. By looking through the rightmost column, we first notice that the relationship between the national business cycle and the world electronics cycle entails significant cross-country variation. Not surprisingly, the correlation between the two is strong for countries that depend heavily on the electronics industry, such as Singapore and Taiwan.[10] By inspecting the other columns, we observe that the correlation of national business cycles also differs significantly from one pair of countries to another. In general, the output cycle is correlated more closely among countries that depend heavily on electronics exports, and also between countries that are geographically close to each other and engage in substantial bilateral trade. While these observations are hardly surprising, they suggest that the EA economies are less homogeneous than one might presume from Table 1.

3. Is Asia a de facto dollar area?

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[9] Note that although the estimated coefficients on $\Delta \mathrm{IT}^{*}(t)$ are much smaller than those on $\Delta y(t)$, the volatility of the former is several time larger than that of the latter.

[10] The Philippines' business cycle bears little relation with the world electronics cycle despite the fact that the country depends heavily on semiconductor and IT-hardware exports (see ADB 2001). This seems to reflect that country-specific factors have been important in its business cycle; see Rodlauer et al. (2000).

In the previous section, we argued that few EA countries had been pegging their currencies to the dollar as rigidly as to justify seeing fluctuations in the yen/dollar exchange rate as synonymous to those in the relative value of the yen and their currencies. In the existing literature, however, the pre-crisis currency regime of the EA countries is widely referred to as a *de fact* dollar peg; some authors also claim that the crisis-affected countries have recently restored their soft dollar pegs (McKinnon 2001; Fukuda 2002).

In Figure 2, we plot the time series of the bilateral exchange rates between the eight EA currencies and the US dollar for the past fifteen years.[11] Two features of the series are worth noting. First, four of the five crisis-hit currencies (the Indonesian rupiah, the Korean won, the Philippine peso and the Thai baht) have become markedly more volatile vis-à-vis the dollar after the financial crisis; at least upon visual inspection, their recent movement hardly reminds us of a dollar peg. Second, the figure indicates that most EA currencies did remain extremely stable vis-à-vis the dollar for about two years between mid-1995 and the onset of the crisis. For many currencies, however, this period does not seem to have been representative of the whole pre-crisis period shown in the figure. As for Hong Kong, Indonesia and Thailand, the dollar value of their currencies remained either stable or depreciated in a near-constant rate throughout the pre-crisis period; it thus seems safe to assume that these countries indeed run dollar peg polices until 1997.[12] However, in all other countries (except perhaps for Korea), the exchange rate between the home currency and the dollar seem to have been less stable before 1995 than in the subsequent two years. This observation begs two questions. First, why had some EA currencies been less stable than the others against the dollar before 1995? Does it just because all EA countries tried to

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[11] All series are in terms of monthly average exchange rates. To facilitate visual inspection, we concealed the plots during the period of the financial crisis and rescaled all series before (after) the crisis so that their June 1996 (January 1999) values equal 100. A rise in the values indicates the EA currencies' depreciation against the US dollar.

[12] Strictly speaking, Thailand is known to have maintained a basket rather than dollar peg, although most observers agree that the weight of the dollar in the basket was very large. See Dornbusch and Park (1999).

keep their currencies pegged to the dollar but some countries were less successful than others? Or can it be that some countries in fact did *not* pursue a dollar peg? Second, why did the dollar value of some currencies become more stable during 1995-1997? Did it reflect the monetary authorities' policy shift or some other factors?

In our view, the second of the preceding two questions is more subtle than it may first appear.[13] As for the Philippines, the stability of the peso/dollar rate after mid-1995 almost certainly resulted from the monetary authorities' deliberate policy change. (By inspecting high-frequency data, we find that the short-run volatility of the peso/dollar rate dropped abruptly to a negligible level during the second and third quarters of 1995; the peso has since remained effectively fixed to the dollar through June 1997 despite the fact that the currency had been one of the least stable among the EA currencies until early 1995.[14]) For countries such as Malaysia and Taiwan, however, the answer is less clear-cut since, at least on daily and weekly bases, there was little visible change in the observed behavior of their currencies before and after 1995. As we will show below, there is some circumstantial evidence that many EA countries in fact paid attention to the home currency's exchange rates with other EA currencies, not just the US dollar. To the extent that this is the case, it is conceivable that one or two countries' switch to a dollar peg had inadvertently helped stabilize other currencies' exchange rates with the dollar. And perhaps more importantly, the years between 1995 and 1997 coincided with the time when serious macroeconomic imbalances started to surface in many countries, due primarily, though not wholly, to accelerating capital inflows from abroad. As is widely documented, the region's monetary authorities were then finding it increasingly difficult to control the internal and external

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[13] Rather curiously, in spite of so much that has been written about the Asian financial crisis, there seem to be few studies that systematically investigated this question.

[14] After experiencing particularly large exchange market volatility in late 1994, the central bank of the Philippines (Bangko Sentral ng Pilipinas, BSP) instituted a daily exchange rate band system in which the peso/dollar rate was allowed to fluctuate by only up to 0.5 percent above or below the weighted average of market rates in the previous business day (BSP 2001). Between the latter half of 1995 and June 1997, however, the day-to-day volatility of the peso/dollar rate generally remained within a much smaller range than this official band.

balances of their economies with their traditional policy tools alone, suggesting the possibility that even countries that consciously switched to a dollar peg may not have done so as a positive policy choice.[15] A thorough analysis of the stability of the regional currencies in 1995-1997 thus requires considerations along a number of dimensions, for which we do not have sufficient space here.[16]

Notice, however, that the previous Kwan/McKinnon-Schnabl thesis rests on the assumption that most or all EA countries have *routinely* pegged their currencies to the dollar since the 1980s, not merely for the two years before the crisis.[17] Similarly, many of the recent proposals for regional exchange rate management are predicated on the assumption that the EA countries *still* continue overt or covert dollar-pegging and that their adherence to the dollar keeps their economies vulnerable to yen/dollar fluctuations.

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[15] According to Athukorala (2001), the Malaysian central bank (Bank Negara Malaysia, BNM) had until 1994 maintained the policy of stabilizing the ringgit vis-à-vis a trade-weighted basket of currencies in the short term while guiding it toward a gradual real effective depreciation in the medium to long terms to assist the country's export-led development. In Athukorala's observation, however, as domestic excess liquidity and asset-price bubbles became increasingly evident in 1995, BNM shifted its policy stance from assisting the export sector to using the exchange rate to contain domestic inflation. While it is not easy to judge whether this was indeed the case, this period coincided with the time when the dollar strengthened sharply against other major currencies. If Athukorala's account is correct, the stability of the ringgit/dollar rate in 1995-1997 may have reflected not so much BNM's sudden enchantment with a dollar peg as its efforts to achieve an orderly real rupiah appreciation to offset the inflationary effects of capital inflows. In the Philippines, BSP's monetary management was also being complicated by a surge in capital inflows during this period. Although its basic policy framework was base money targeting, instability of money demand prompted the central bank to adjust its policy stance several times until the onset of the crisis. In parallel with the switch to the de facto dollar peg in 1995, for example, BSP modified its monetary targeting to incorporate elements of inflation targeting (Rodlauer et al. 2000). In Thailand, which is generally believed to have run a mechanical basket peg until the crisis, there is evidence suggesting that the baht's medium-term link to the dollar strengthened gradually after mid-1995 (Kumakura 2004).

[16] Kumakura (2004) makes a fuller analysis of this issue.

[17] In his 2001 paper, McKinnon states that "(f)or more than a decade before the crisis of June 1997 to December 1998, East Asian currencies were pegged to the dollar" (McKinnon 2001, p.197), although he in fact used data only after 1994 for his empirical analysis.

For our present purposes, therefore, the central questions are on what empirical basis these views stand and whether they are accurate or not.

In the existing literature, that the Asian countries have pegged and still peg their currencies to the dollar is often "proved" by appealing to an empirical method proposed by Frankel and Wei (1994).[18] To refute the (then) lingering suspicion that a yen bloc was emerging in Asia, Frankel and Wei estimated the following simple regression model:

$$\Delta e_{i/k} = \alpha_0 + \alpha_1 \Delta e_{US/k}(t) + \alpha_2 \Delta e_{JP/k}(t) + \alpha_3 \Delta e_{EU/k}(t) + ... + u(t) \quad (4)$$

where $e_{i/k}$ is the price of a unit of Asian currency *i* in terms of currency *k*, and *EU* stands for the ecu or the German mark before 1999 and the euro after 1999. *k* is the numéraire in this equation and chosen from currencies that are floated against all other currencies in eq. (4). As it is known that developing countries' *de facto* exchange rate regime often depart radically from their *de jure* policy (Calvo and Reinhart, 2002), *k* is normally chosen from the currencies of industrial countries that maintain floating exchange rates. Most existing studies use the Swiss franc, following Frankel and Wei's original work.

As an illustration of the kind of results that the above regression model generates, we show in Table 5 what we obtained by estimating eq. (4) for our eight EA currencies. The estimation was performed separately for January 1988 - June 1997 ("pre-crisis period") and July 1999 - June 2003 ("post-crisis period"), by using the Swiss franc as *k* and converting the monthly average values of relevant US dollar exchange rates into the corresponding Swiss-franc rates. For the pre-crisis period, we observe that the coefficient on $\Delta e_{US/k}(t)$ is highly significant statistically for all EA currencies, with its point estimates exceeding 0.8 except for the Singaporean dollar. In contrast, the coefficient on $\Delta e_{JP/k}(t)$ is either small or statistically insignificant, even for countries such as Korea and Taiwan whose economies should (presumably) be vulnerable to changes in the yen/dollar rate. Even for the

[18] Examples include Kawai and Akiyama (2000), Kawai and Takagi (200), McKinnon (2001), Fukuda (2002) and Ogawa (2002).

post-crisis period eq. (4) generally exhibits a respectable explanatory power, with the exception of Indonesia. In most countries, moreover, the estimated coefficient on $\Delta e_{US/k}(t)$ is smaller than its pre-crisis estimate but still looks quite large. For example, even in Thailand and the Philippines (which have officially floated their currencies in the wake of the financial crisis), the estimated coefficients on $\Delta e_{US/k}(t)$ are 0.84 and 0.68 whereas those on $\Delta e_{JP/k}(t)$ are negligible and statistically insignificant. For many authors, the foregoing results are *prima facie* evidence of the presence of an "East Asian dollar standard" --- not only before the crisis but even today (McKinnon 2001).

As we will discuss below, however, the foregoing interpretation is not appropriate. The problem of the Frankel-Wei regression is that it is not designed to explicitly test competing hypotheses about the monetary authorities' policy stance, making it hard to judge which hypothesis is supported or rejected by estimated equations. Although most authors seem to believe that a large value of α_1 and small or statistically insignificant values of α_2 and α_3, combined with a reasonable fit of the equation, are sufficient evidence for a dollar peg, this is in fact not the case. To understand why, suppose that the monetary authorities of an EA country conduct *high-frequency* (e.g. daily or weekly) exchange rate smoothing, either to maintain liquidity in the foreign exchange market or for some other reasons. This short-run volatility management is conducted in terms of the bilateral exchange rate with the dollar, either by pre-specifying the maximum range within which the rate can change in each business day or week, or through more discretionary market intervention. Meanwhile, over sufficiently long time horizons that are relevant to the real economy (e.g. half a year or longer), the monetary authorities are *not* specifically interested in the stability of the bilateral exchange rate with the dollar. They may instead try to keep stable the home currency's (real or nominal) effective exchange rate or aim to strike some balance between exchange rate stability and other policy aims, such as stability of domestic output or the balance of trade. Needless to say, such a policy can hardly be called a dollar peg, notwithstanding the presence of high-frequency smoothing

operation.[19]

When the foregoing policy is followed, estimating eq. (4) with monthly exchange rate data can find a large value of α_1 even if the monetary authorities do not systematically peg the home currency to the dollar at the monthly frequency, because of the influence of their higher-frequency smoothing operation. Similarly, since the monetary authorities do not systematically respond to daily and weekly movements of the yen/dollar and euro/dollar exchange rates, the estimated equation may give us an impression that the monetary authorities pay no attention to their movement even over longer time horizons. Although one may think that this problem can be avoided by regressing the equation on lower-frequency data, this is in practice not feasible. The point here is that there is no *a priori* reason to believe that the monetary authorities pursue the same exchange rate policy over different time horizons. Therefore, if our ultimate aim is, for example, to assess the relationship between the EA countries' exchange rate policy and their business cycle, how these countries manage daily, weekly or even monthly exchange rate volatility is of secondary importance, and we have to look *directly* at the behavior of their currencies over the time horizon that is relevant to the issue on hand. However, estimating eq. (4) using

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[19] Note that this hypothetical exchange rate regime is not very dissimilar to what many EA countries officially maintained until the financial crisis. As one can confirm in country pages of the IMF's *Annual Reports on Exchange Rate Arrangements and Exchange Rate Restrictions*, Indonesia, Korea, Malaysia and Thailand all made high-frequency smoothing an integral part of their exchange rate management (although Malaysia explained that its aim was to moderate daily fluctuations of the home currency relative to a basket of currencies, not the US dollar). Similarly, many countries specifically stated that they monitored the medium-term movement of the effective --- not dollar --- value of their currencies. Even today, some countries (e.g. Thailand and the Philippines) publicly retain measures for moderating short-run exchange rate volatility, while some other countries (e.g. Korea) conduct similar operations on a more discretionary basis (see, for example, Park et al. 2001). Admittedly, the EA countries do not in principle have to use the bilateral dollar exchange rate as reference for short-run volatility management. As most EA currencies are traded actively only with the dollar, however, this appears to be a sensible choice *as long as such a policy does not constrain the home currency's medium- to long-term flexibility*. Although McKinnon (2001) discusses at length why developing countries are *inevitably* driven to engage in high-frequency dollar-pegging and why this in turn *inevitably* leads to a lower-frequency dollar peg, his conjecture is at odds with empirical evidence in Asia; see below.

data recorded at business-cycle frequencies would require a sample that spans an inordinate length of time, during which the monetary authorities may well change their policies.[20] Most existing studies in fact estimate eq. (4) using daily or weekly exchange rate data. Although their results may inform us of the extent to which each EA country regulates short-run exchange rate volatility, they have little to say, at least by themselves, about the policy pursued over the time horizon with which we are concerned here.[21]

We next conduct a simple numerical experiment to show that what we have discussed is more than a theoretical possibility. Secifically, we consider two hypothetical exchange rate regimes as alternatives to a dollar peg, and simulate the exchange rate movements of the EA currencies that would have occurred had such policies been adopted in the past. The aim of this exercise is *not* to rigorously identify the currency regime followed by the EA monetary authorities; our purpose is merely to show that comparing the actual and the simulated exchange rate movements *at a relatively low frequency that matters for the real economy* makes it hard to believe that the EA countries have single-mindedly pegged their currencies to the dollar.

Our first hypothetical regime is nominal effective exchange rate (NEER) targeting. For computational simplicity, we assume here that each EA country trades only with the United States, Japan, Europe, the other EA countries and China and ignore all other countries in the world. With this assumption, we can write the rate of change in the NEER of EA currency *i*, defined in the standard manner, as:

$$\Delta e_i(t) \equiv \alpha^*_{US}\Delta e_{i/US}(t) + \alpha^*_{JP}\Delta e_{i/JP}(t) + \alpha^*_{EU}\Delta e_{i/EU}(t) + \sum_{j\neq i}\alpha^*_j \Delta e_{i/j}(t), \qquad (5)$$

where $j = 1,2,...,9$ corresponds to the eight EA countries and China. The coefficient on the first variable on the right hand side, α^*_{US}, is the share of the United States in country *i*'s

[20] Recall what we saw in Figure 2.

[21] Although estimating eq. (4) with data of different frequencies and systematically comparing their results helps us make inference about the extent to which the monetary authorities' short- and longer-term policy objectives depart from each other, such exercise in fact gives rise to its own statistical difficulties; see Kumakura (2004).

total imports plus exports, and all other coefficients are defined analogously. These coefficients therefore sum to unity. Fixing the NEER means that the monetary authorities maintain the following equality relation:

$$0 \equiv \alpha^*_{US}\Delta e_{i/US}(t) + \alpha^*_{JP}\Delta e_{i/JP}(t) + \alpha^*_{EU}\Delta e_{i/EU}(t) + \sum_{j\neq i}\alpha^*_j \Delta e_{i/j}(t), \quad (6)$$

Rewriting eq. (6) in terms of exchange rates with the US dollar, we find:

$$\Delta e^*_{i/US}(t) = \alpha^*_{JP}\Delta e_{JP/US}(t) + \alpha^*_{EU}\Delta e_{EU/US}(t) + \sum_{j\neq i}\alpha^*_j \Delta e_{j/EU}(t). \quad (7)$$

As only the left hand variable involves currency *i*, this equation can be interpreted as the monetary authorities' reaction function. $\Delta e^*_{i/US}(t)$ corresponds to *the adjustment of currency i's bilateral exchange rate with the US dollar that is necessary to keep its NEER stable.*

Our second hypothetical regime is a common basket peg (CBP). As we noted in Section 1, many authors recommend the Asian countries to peg their currencies to a common basket of the dollar, the yen and the euro, so as to ameliorate the (alleged) destabilizing impact of yen/dollar fluctuations on their economies. It is thus interesting to see how each EA currency would have behaved if such a policy had been adopted in the past. CBP requires all EA countries to maintain the following relation:

$$0 = \hat{\alpha}_{US}\Delta e_{i/US}(t) + \hat{\alpha}_{JP}\Delta e_{i/JP}(t) + \hat{\alpha}_{EU}\Delta e_{i/EU}(t) \quad (8)$$

where $\hat{\alpha}_{US}$, $\hat{\alpha}_{JP}$ and $\hat{\alpha}_{EU}$ correspond to the weights assigned to the dollar, the yen and the euro, which again sum to one. By rewriting eq. (8) in terms of dollar exchange rates, we obtain

$$\Delta\hat{e}_{i/US}(t) = \hat{\alpha}_{JP}\Delta e_{JP/US}(t) + \hat{\alpha}_{EU}\Delta e_{EU/US}(t), \quad (9)$$

As in the previous case, eq. (9) can be regarded as the monetary authorities' reaction function; in each period the monetary authorities must adjust the home currency's bilateral US dollar exchange rate by $\Delta\hat{e}_{i/US}(t)$ to maintain the basket peg. For simplicity, we set the values of $\hat{\alpha}_{JP}$ and $\hat{\alpha}_{EU}$ according to the following formulae:

$$\hat{\alpha}_{JP} \equiv \frac{\alpha_{JP}}{\alpha_{US} + \alpha_{JP} + \alpha_{EU}}, \qquad \hat{\alpha}_{EU} \equiv \frac{\alpha_{EU}}{\alpha_{US} + \alpha_{JP} + \alpha_{EU}} \tag{10}$$

where α_{US}, α_{JP} and α_{EU} are the shares of the United States, Japan and Europe in the eight EA countries' *pooled* imports plus exports.[22]

The coefficients in eqs. (7) and (9), α^*_{JP}, α^*_{EU}, α^*_j, $\hat{\alpha}_{JP}$ and $\hat{\alpha}_{EU}$, can be computed easily from international trade statistics. We assume these coefficients as time-varying and calculate their values using Statistics Canada's World Trade Database (WTD).[23] Although the coefficients for the NEER regime differ substantially across both countries and time, those for the CBP regime (which are by definition identical for all countries) are fairly stable over time. Throughout the past fifteen years their weights remain roughly in the neighborhood of $\hat{\alpha}_{US} : \hat{\alpha}_{JP} : \hat{\alpha}_{EU} \approx 0.40 : 0.35 : 0.25$, which are close to those recommended by Williamson (2000) and Kawai and Akiyama (2000). Once these coefficients are determined, it is then straightforward to calculate the values of $\Delta e^*_{i/US}(t)$ and $\Delta \hat{e}_{i/US}(t)$ that would have been necessary to maintain the respective currency regimes. To repeat, however, the point of this exercise is to compute their values at a sufficiently low frequency that is directly relevant to the workings of the real economy. Here we assume that each *t* is six months.

Figure 3 graphically presents the result of our computation. Two general features stand out. First, except for the few currencies for which mechanical dollar pegs were apparent in Figure 2, there is little evidence that the currencies of the EA countries have been more stable with respect to the dollar than would have been the case had these countries tried to maintain their currencies' NEER. For example, the actual movement of

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[22] As noted in Section 1, some authors recommend a basket peg in which the yen assumes a dominant weight. Ito et al. (1998), for example, estimate the weight of the yen that is required to minimize the volatility of each EA country' net export profit and find values well over 0.5 for many countries. As in Kwan (2002) and McKinnon and Schnabl (2003), however, their estimation does not distinguish the effects of yen/dollar fluctuations and the global electronics cycle.

[23] The WTD draws one the United Nations' COMTRADE database and includes trade in goods only. In computing the coefficients for eq. (7), we included China only after 1994 due to problems associated with the country's dual exchange rate system in the preceding years.

the exchange rate between the Philippine peso and the dollar has been consistently more volatile than those of its simulated values, except for a brief period immediately prior to the financial crisis. After the crisis, moreover, the Indonesian rupiah, the Korean won, the Philippine peso and the Thai baht have remained substantially more unstable vis-à-vis the dollar than the simulated values. This visual impression is borne out in Table 5, which compares the standard deviations of the bilateral exchange rate between each EA currency and the dollar under the alternative currency regimes.[24]

Second, and again except for the few currencies under strict dollar pegs, the time series of the actual exchange rate with the dollar, $\Delta e_{i/US}(t)$, does not appear to be independent of the simulated series, $\Delta e^{*}_{i/US}(t)$ and $\Delta \hat{e}_{i/US}(t)$. As correlation does not necessarily imply causation, we refrain from speculating how much of their correlation has been the result of the monetary authorities' conscious exchange rate targeting and how much has been due to natural market forces.[25] As we noted previously, however, many EA countries had until the crisis officially maintained the policy of monitoring the medium-term movement of the effective --- not dollar –- value of their currencies. At least for Singapore and Taiwan, the paths of $\Delta e_{i/US}(t)$ and $\Delta e^{*}_{i/US}(t)$ are aligned to each other sufficiently tightly that it seems highly unlikely that these countries have single-mindedly pursued a dollar peg.[26]

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[24] This general result holds also for the *real* bilateral exchange rate with the dollar. In Figure 3, we also find that the time series of $\Delta e^{*}_{i}(t)$ and $\Delta \hat{e}_{i}(t)$ generally track each other closely except for a short period during the financial crisis. This means that, at least on average, the EA currencies have responded to changes in the yen/dollar and euro (ecu)/dollar exchange rates in a manner expected from their trade structure.

[25] In Figure 3, sharp upward spikes in $\Delta e^{*}_{i}(t)$ and $\Delta \hat{e}_{i}(t)$ tend to reflect the yen's depreciation against the dollar, as Japan is a major trading partner for most EA countries. As we discussed in Section 2, however, yen depreciations had the tendency of occurring in times of a global electronics recession during the past two decades. Thus, even if the EA monetary authorities did not systematically respond to yen/dollar movements but merely let the home currency slide against the dollar when export demand was weak, the bilateral dollar exchange rate should *ex post* have behaved in a manner that stabilizes the home currency's effective value.

[26] According to its official explanation, the Monetary Authority of Singapore (MAS) had since 1981

A few important points follow from the preceding observation. First, it is now clear that the view of East Asia being a de facto dollar bloc is exaggerated. Even before the crisis, few EA currencies were linked to the dollar sufficiently tightly as to render their effective value overly unstable. Although one may still argue that Figure 3 merely indicates that all EA countries pursue a dollar peg but some countries have been less successful than others , this claim is not very convincing. As we saw in Table 5, the EA monetary authorities clearly possess the power of regulating high-frequency exchange-rate movements with fairly high precision except under special circumstances.[27] There is no reason to believe, therefore, that they cannot do the same in the longer runs *if they are willing to give up all other policy objectives*. The fact that their currencies have been more flexible (or unstable) vis-à-vis the dollar at lower frequencies thus suggests that the authorities had indeed possessed different policy objectives over different time horizons. After the crisis, in particular, the medium-term movement of *all* crisis-hit currencies but the Malaysian ringgit have remained so much more flexible (or unstable) than the simulated paths that it seems safe to conclude that there is no such thing as a "resurrected East Asian dollar standard" (McKinnon 2001).

Second, the preceding observations cast doubt over the assumptions that underlie the recent proposals for regional exchange rate targeting. For example, the fundamental

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maintained the policy of targeting the home currency to an undisclosed basket of foreign currencies. The target exchange rate has, however, continuously been adjusted toward the Singaporean dollar's appreciation in order to accommodate MAS's strong preference for price stability, which is why in Figure 3 the actual path of the Singapore/US dollar exchange rate stayed below those of $\Delta e_i^*(t)$ and $\Delta \hat{e}_i(t)$ during most of the pre-crisis period. Nevertheless, MAS also made it clear that it reviewed its target exchange rate regularly and was ready to adjust the speed of nominal appreciation when such a move was warranted by the country's economic fundamentals. In recent years, such adjustments have been made in the wake of the regional financial crisis and also in 2002 when the Singaporean economy was hit hard by a global electronics recession (MAS 1998, 2001, 2003). The MAS now provides a detailed account of its past and ongoing monetary policy in its Macroeconomic Reviews, and it is difficult to find any major inconsistency between its account and observed exchange rate movements. See also Jin (2000).

[27] This can be confirmed by estimating eq. (4) using daily and weekly exchange rates.

premise of the CBP proposal is that the Asian countries peg their currencies to the dollar and that this dollar peg makes the effective value of their currencies unnecessarily unstable. As is clear from Figure 3, however, if the EA countries adopt CBP now, that would *strengthen* – not weaken – several currencies' medium-term link to the dollar. McKinnon and Schnabl's (2003) formal Asian dollar bloc proposal, predicated on the assumption that the EA monetary authorities' "revealed preference" is to peg to the dollar, seems similarly unconvincing.

Third, Figure 3 corroborates our previous argument that the Frankel-Wei regression can be misleading when the monetary authorities do not pursue the same policy over different time horizons. For example, the figure indicates that at least since the early 1990s, the actual movement of the New Taiwan dollar has tracked fairly closely the hypothetical paths under the NEER-targeting and CBP regimes. As noted previously, the basket weights used to simulate the CBP path were, while time-varying, roughly in the neighborhood of dollar: yen: euro = 0.40: 0.35: 0.25. In Table 5, however, the estimated "weights" of the three currencies were $0.88:0.09:0.18$ (pre-crisis period) and $0.77:0.18:0.31$ (post-crisis period). Similarly, if the estimates in Table 5 were accurate, adopting the CBP today would require the Philippines and Thailand to cut the weight of the dollar in their currency "baskets" roughly by half and raise that of the yen by two to three times from the current level. As noted above, however, the regime would in fact require these countries to *strengthen* their currencies' medium-run link to the dollar, at the expense of the other two currencies.

4. Global electronics cycle, the yen/dollar exchange rate, and East Asia's export performance

What we have seen so far throws doubt on the view that the yen/dollar exchange rate constitutes the main driver of the EA countries' export and output fluctuations. As we noted earlier, however, the nominal exchange rates between the US dollar and most EA currencies did remain conspicuously stable between the latter half of 1995 and mid-1997, during which the dollar strengthened sharply against the yen and, to lesser extents, other

industrial-country currencies as well. On the other hand, the exports of the EA countries, which had previously grown very rapidly, decelerated in late 1995 and in some countries started to contract soon thereafter. This simultaneous unfolding of the yen depreciation and the regional export stagnation has lead some authors to argue that the "yen depreciation after 1995 slowed East Asian export expansion significantly" and that "the sharp yen depreciation of 1996-98 greatly worsened the crisis in other East Asian economies in 1997-1998" (McKinnon and Schnabl 2003, pp.1074). In this section, we examine more closely the relationship between the yen/dollar exchange rate and the EA countries' export performance and show that the foregoing view is mistaken.

As we saw in Table 4, the aggregate economy of the EA countries is quite sensitive to the global electronics cycle, although the extent of sensitivity appears to vary across the countries. The world demand for semiconductors and IT hardware expanded vigorously in 1993-1995 and 1999-2000 while experiencing major downturns in 1996-1998 and 2001-2002 (see Figure 2). The yen, meanwhile, appreciated against the dollar by 47.7 percent in nominal terms between April 1990 and May 1995, after which it depreciated rapidly by about 41.5 percent by July 1997.[28] In Table 7, we show the year-on-year growth rates of ten Asian countries' goods exports during the past decade. The effect of the world electronics cycle is evident in most countries, *including Japan*. Had the yen depreciation been responsible for EA's export slowdown in 1996, Japan should have experienced an export boom in the same year. This was, however, clearly not the case; at least in Table 7 the cyclical pattern of Japan's exports looks similar to those of the other Asian countries.

Nevertheless, the preceding observation does not necessarily suggest that the yen depreciation had *no* role to play in the region's 1996 export slump. Even if the main cause of the slump was the drop in global electronics demand, it is not inconceivable that the yen depreciation had some additional impact on countries whose product mix was relatively close to Japan's (e.g. Korea and Taiwan). Table 7 also indicates that export performance

[28] Therefore, the yen deprecation after 1995 was, while indeed rapid and substantial, largely an unwinding of the previous appreciation.

deteriorated in 1996 even in countries like Indonesia, where the share of electronics in total exports was relatively small. To the extent that the fall in their aggregate export earnings reflected negative repercussions from other countries, it is difficult to judge from Table 7 alone the relative impact of the world electronics recession and other factors. In what follows, we address this question by making use of a simplified version of the standard dynamic shift share analysis (DSSA)

Let us first define $X_{i,t}^{k}$ as country *i*'s exports of good *k* in year *t*, measured in terms of US dollars. Using this expression, we next define the following variables:

$$X_{i,t} \equiv \sum_k X_{i,t}^k, \qquad X_t^k \equiv \sum_i X_{i,t}^k, \qquad X_t \equiv \sum_i \sum_k X_{i,t}^k.$$

In the above, $X_{i,t}$ corresponds to the value of country *i*'s aggregate exports in year *t*, X_t^k is the world exports (imports) of good *k*, and X_t is the world exports (imports) of all goods. In addition, we write the annual growth rate of these values as:

$$r_{i,t} \equiv \Delta X_{i,t} / X_{i,t-1}, \qquad r_t^k \equiv \Delta X_t^k / X_{t-1}^k, \qquad r_{i,t}^k \equiv \Delta X_{i,t}^k / X_{i,t-1}^k.$$

where Δ denotes the first difference.

The rise or fall in country *i*'s aggregate exports from year $t-1$ to t ($\Delta X_{i,t}$) is the sum of the rise or fall in its exports of each good during the same period ($\Delta X_{i,t}^k$). We define *A* as the set of goods produced in the electronics industry and express $\Delta X_{i,t}$ as the sum of the following two components:

$$\begin{aligned} \Delta X_{i,t} &= \sum_{k \in A} \Delta X_{i,t}^k + \sum_{k \notin A} \Delta X_{i,t}^k \\ &= \sum_{k \in A} r_{i,t}^k X_{i,t-1}^k + \sum_{k \notin A} r_{i,t}^k X_{i,t-1}^k. \end{aligned} \tag{11}$$

In eq. (11), the first term on the right-hand side corresponds to the change in electronics exports between $t-1$ and t while the second term is the change in non-electronics exports. We further rewrite eq. (11) as follows:

$$\begin{aligned}\Delta X_{i,t} &= \sum_{k\in A}\left[r_t^k + \left(r_{i,t}^k - r_t^k\right)\right]X_{i,t-1}^k + \sum_{k\notin A}\left[r_t^k + \left(r_{i,t}^k - r_t^k\right)\right]X_{i,t-1}^k \\ &= \sum_{k\in A} r_t^k X_{i,t-1}^k + \sum_{k\notin A} r_t^k X_{i,t-1}^k + \sum_k \left(r_{i,t}^k - r_t^k\right)X_{i,t-1}^k\end{aligned} \tag{12}$$

In eq. (12), $r_{i,t}^k - r_t^k$ corresponds to the difference between the growth rate of country *i's* exports of good *k* and the growth rate of the world import demand for the same good between years *t* - 1 and *t*. Therefore, the last term on the right hand side takes on a positive value when country *i* is expanding its share in the international market and has a negative value when its share is falling. By dividing eq. (12) through by $X_{i,t-1}$, we obtain:

$$r_{i,t} = d_{i,t}^A + d_{i,t}^{A-} + s_{i,t} \tag{13}$$

where

$$d_{i,t}^A \equiv \sum_{k\in A} r_t^k X_{i,t}^k / X_{i,t-1}, \quad d_{i,t}^{A-} \equiv \sum_{k\notin A} r_t^k X_{i,t}^k / X_{i,t-1}, \quad s_{i,t} \equiv \sum_{k\in A}\left(r_{i,t}^k - r_t^k\right)X_{i,t}^k / X_{i,t-1}.$$

Eq. (13) expresses the growth rate of country *i*'s aggregate exports ($r_{i,t}$) as the sum of three components. The first term on the right-hand side ($d_{i,t}^A$) corresponds to what the exports of electronics goods contribute to $r_{i,t}$ if country *i*'s share in the world export market for these products does not change between *t* - 1 and *t*. Similarly, the second term ($d_{i,t}^{A-}$) is what non-electronics exports add to $r_{i,t}$ if the country maintains its market share for these products between *t* - 1 and *t*. We can, therefore, regard the sum of these two terms as the part of $r_{i,t}$ that is broadly attributable to demand shocks. On the other hand, the last term $s_{i,t}^k$ reflects changes in country *i*'s share in the world export market for good $k = 1, 2, 3, \ldots$ and can thus be interpreted as the part of $r_{i,t}$ that can be attributed to supply-side shocks. If exchange rate movement changes country *i*'s competitive position in the international market, such effect should appear in this last term.

Using the foregoing framework, we next examine the factors behind Asia's export slowdown in 1996. As in Section 3, we make use of Statistics Canada's WTD and conduct the preceding decomposition for each country's manufacturing exports, using data

disaggregated according to 3-digit SITC (rev. 2).[29] We define SITC751, 752, 759, 764, 772, 776 and 778 as the elements of set *A*. This set includes IT goods and components but excludes general consumer electronics such as television receivers and sound recorders, and is therefore relatively a narrow definition of electronics goods. As we will soon see, however, demand fluctuations for even this small subset of manufacturing goods exert significant impact on some countries' export performance. To put the 1996 regional export recession into a longer time-series perspective, we conduct our DSSA for each year since 1988 until the most recent year for which data are available.

Figure 4 graphically presents the result of our computation. The first eight panels show the results for individual EA countries,[30] while the two panels in the bottom row show the results for Japan (right) and the pooled exports of the eight EA countries (left).[31] By looking first at the bottom left panel we find that, for the eight EA countries as a group, demand shocks have been responsible for a major part of year-on-year fluctuations in aggregate exports during the last decade and a half, with only modest contributions from supply-side factors. In particular, at least in terms of our decomposition the 1996 export recession is more than entirely explicable by negative demand shocks, of which roughly half have been related to electronics goods. We also observe that in recent years, the importance of the world electronics cycle has increased substantially as a determinant of EA's aggregate export performance.

Let us next examine the results for individual countries. By looking through the upper eight panels we first notice that, while the time-series profile of $r_{i,t}$ is broadly similar across most EA countries, there is substantial cross-country variation in the relative contribution of $d_{i,t}^{A}$, $d_{i,t}^{A-}$ and $s_{i,t}$. In Malaysia, the Philippines and Singapore, for example, fluctuations in $d_{i,t}^{A}$ have consistently played an important role in yearly

[29] Although WTD is available up to the SITC 4-digit classification, 4-digit data are unavailable for some important IT goods. The total number of goods in our sample is 140.

[30] The results for the Philippines should be viewed with caution because of apparent inconsistency in the commodity classification of the country's trade statistics (see Ng and Yeats 2003).

[31] The aggregate exports include trade among the EA countries; see also Figure 5.

fluctuations in $r_{i,t}$, reflecting these countries' heavy reliance on semiconductor and IT-hardware exports. In contrast, the contribution of $d_{i,t}^{A}$ has been fairly limited in Indonesia and Thailand, although in the latter country its influence seems to have risen in recent years. These observations are broadly consistent with what we saw in Table 4.

In all countries but Korea and Thailand, the value of the competitiveness term $s_{i,t}$ was negative in 1995 but turned positive in 1996. For these countries, therefore, our decomposition does not support the view that the yen depreciation was responsible for their 1996 export slump; in fact, the supply-side term $s_{i,t}$ was working to soften the export slowdown in this year. Even in Korea and Thailand, the drop in $r_{i,t}$ in 1996 was due primarily to falls in the two demand components, with relatively minor contributions from $s_{i,t}$.[32] We also observe that in some countries (e.g. Malaysia and Singapore), the drop in the demand for electronics goods was quite decisive in their 1996 export slowdown.

Although our DSSA seems largely to confirm the aggregate evidence in Table 7, there are a few issues that need to be taken into account when interpreting our decomposition results. First, although we have interpreted d_{i}^{A} and $d_{i,t}^{A-}$ as export fluctuations due to demand shocks and $s_{i,t}$ as those relating to supply-side factors, this neat distinction is in practice not as watertight as we would like it to be. In particular, since the geographical distribution of real-world trade flows entails a degree of stickiness, time-series fluctuations in $s_{i,t}$ may represent not just competitiveness shocks arising from supply-side factors but also what should conceptually be regarded as demand shocks. To see why, suppose that country *i* depends heavily on country *j* as its export market. When the import demand of country *j* falls substantially because of, say, a domestic recession, the growth rate of country *i*'s aggregate exports $r_{i,t}$ is likely to fall by a larger proportion than that of the global import demand. Although in our DSSA the gap between the two tends to be

[32] Notice also that unlike other EA currencies, the Korean won depreciated against the dollar by some 18 percent between mid-1995 and the start of the regional currency crisis (see Figure 2). The won's nominal appreciation against the yen during this period was therefore milder than those of the other currencies.

subsumed in $s_{i,t}$, this is not what is normally considered as a supply-side effect. In Figure 4, we notice that in most EA countries the value of $s_{i,t}$ turned negative in 1997 and remained negative in the following year, even though the regional currency crisis should have by then improved the price competitiveness of several countries. While the negative $s_{i,t}$ in this period may have been partly due to exporters' temporary supply constraints under disruptions of domestic financial intermediation, we suspect that severe contraction of intra-EA trade --- which was an inevitable consequence of the region-wide recession that followed the currency crisis --- also played its part.

In our decomposition scheme, moreover, $s_{i,t}$ does not distinguish changes in exports arising from home-grown productivity shocks and those related to other supply-side factors, such as multinational firms' cross-border relocations of manufacturing operations. In Figure 5, during the former 1990s when the yen appreciated progressively and exports increased vigorously in many EA countries, the contribution of $s_{i,t}$ to national export performance was more noticeable in such countries as Malaysia and Thailand, which had received large amounts of FDI from Japan, than in Korea and Taiwan whose exporters should have competed more directly with those of Japan. On the other hand, $s_{i,t}$ contributed negatively to Japan's export performance in most years between 1988 and 2001, including periods of yen depreciation; this has most certainly reflected Japanese firms' outward relocation of manufacturing activity through FDI.[33] In more recent years, similar outward transfers of manufacturing operations have become

[33] Until the 1990s, a large yen depreciation was typically followed by a temporary increase in Japan's manufacturing FDI into Southeast Asia, and this FDI has tended to start contributing the host countries' aggregate exports with a lag of one or two years (see Ito 2000). This suggests that for countries like Thailand and Malaysia, $s_{i,t}$ reflects not only the cotemporaneous, competitiveness effect of changes in the yen/dollar exchange rate but also their lagged impact through FDI. Although this makes it a little difficult to interpret the computed values of $s_{i,t}$, the fact that its size was small in 1996 even for countries like Korea (which received little FDI from Japan in the preceding years and should compete most directly with Japan in the international market) still suggests that the impact of the yen depreciation on the regional export slump of this year was limited.

noticeable in EA's high-income countries, such as Hong Kong and Singapore. As a large fraction of the Asian countries' outward FDI goes to the other countries in the region, and as FDI is known to generate substantial auxiliary trade flows,[34] care is needed when making inference about what was responsible for time-series fluctuations in $s_{i,t}$.

To take account of these complications, we next repeat the previous DSSA using data for each country's exports to countries *outside the Asian region only*. By doing so we should be able to mitigate the effects of the regional business cycle and FDI-induced intra-regional trade on the computed value of $s_{i,t}$; this should also help us assess more accurately the competitiveness impact of yen/dollar fluctuations on Japan and other Asian countries in third markets. For comparison, this time we also conduct the same decomposition for China. Data for analysis were compiled by subtracting from each country's aggregate exports those which went to the other Asian countries (EA, Japan and China).

The result is shown in Figure 5. For the EA countries and Japan the result looks broadly similar to Figure 4, although in most countries the contribution of the competitiveness term $s_{i,t}$ to $r_{i,t}$ tends to be slightly larger now. Similarly, although in many countries the computed value of $s_{i,t}$ for 1996 is a little smaller (or a little more negative) than the corresponding value in Figure 4, its contribution to the aggregate export slowdown is still generally dwarfed by those of $d_{i,t}^{A}$ and $d_{i,t}^{A-}$; in Japan, too, the value of $s_{i,t}$ for 1996 is negative and essentially the same as that for 1995. These observations seem to confirm that the main culprit of the 1996 regional export slowdown was not the yen depreciation but negative demand shocks. As in Figure 4, the role of the external demand

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[34] As is widely documented, substantial part of recent intra-Asia FDI was motivated by firms' desire to minimize their production costs by transferring labor-intensive parts of their production to countries where wage rates are low. If, for example, a producer in country *i* shifts its final assembly operation to country *j* to take advantage of the latter's lower wages while keeping at home the production of capital-/technology-intensive components, this is likely to generate new flows of components exports from country *i* to *j*; if the finished goods are exported, that will add to country *j*'s aggregate exports. During the time when the local manufacturing plant is being built, there may also be exports of capital goods from country *i* to *j*. See Urata (2001) for numerical evidence on such effects in Asia.

for electronics goods in yearly fluctuations of aggregate exports varies considerably from one country to another and has been particularly important in Malaysia, the Philippines and Singapore.

Figure 5 also reveals interesting cross-country variation in the medium-term trend of $s_{i,t}$. In Japan and Taiwan, the contribution of this term to aggregate exports has generally remained negative throughout the past decade and a half. In such countries as Hong Kong, Malaysia, Singapore and Thailand, whereas the contribution of $s_{i,t}$ to $r_{i,t}$ had been positive and numerically large until the mid-1990s, this trend seems to have changed during the latter half of the 1990s. In China, in contrast, the value of $s_{i,t}$ has remained positive in all years since 1988, with its share in $r_{i,t}$ large and rising in recent years. These contrasting trends of $q_{i,t}$ clearly reflect rapid changes in cross-country FDI flows and associated redistributions of manufacturing activity within the Asian region. As is widely documented, China had replaced ASEAN countries by the mid-1990s as the region's leading recipient of manufacturing FDI (Yoshitomi, 2003). Although inward FDI had in the past been the engine of industrialization and export growth in many ASEAN countries, Figure 5 indicates that this mechanism is no longer operative in some countries. In countries with relatively high wage rates (e.g. Malaysia and Singapore), the move is becoming increasingly apparent that both local firms and foreign multinationals transfer labor-intensive assembly operations to China and other low-wage countries such as Indonesia; and the consequent transformation of regional production networks and trade dynamics seems to be already altering the way in which the global electronics cycle influences individual Asian economies.

To illustrate this last point, we show in Figure 6 the growth rates of each EA country's real GDP and its main expenditure components in recent years. The figure indicates that most EA countries' recovery in 1999 from the crisis-induced recession was export-led, thanks in important but varying degrees to a turnaround in the global electronics cycle. In this recovery episode, the expansion of exports was soon followed by a surge in domestic investment, and the latter clearly assisted many countries achieve high income growth in 2000. More recently, the global electronics cycle has again entered into

an expansion phase in the latter half of 2002. In contrast to the previous recovery phase, however, in many countries the response of exports and investment has so far remained modest. Although this seems partly due to the relatively weak recovery of global electronics demand in the current cycle, the recent rise of China as the region's (and the world's) export platform also seems to be an important factor. In fact, in spite of the recent pick-up of the world demand for IT goods and consumer electronics, exports of these goods have barely increased since mid-2001 in Malaysia, Singapore and Taiwan; during the same period, China's exports of these products have risen by more than 100 percent (MAS 2004).[35] In Figure 7, furthermore, although the yearly GDP fluctuations in the eight EA countries are broadly similar, the relative contribution of individual demand components varies considerably across the countries; this observation reinforces our previous point that the economies of the EA countries are less homogeneous than one might presume from the relatively strong synchronization of their business cycles.

5. Conclusion

Fluctuations in the yen/dollar exchange rate are widely blamed for export and output fluctuations in Asian countries. Recurrent swings in the yen/dollar rate are said to upset the relative industrial competitiveness of Japan and other East and Southeast Asian countries and destabilize the economies of the latter countries. Some authors also claim that this destabilizing effect of the yen/dollar exchange rate was an important factor behind the Asian financial crisis and that the region needs to introduce an explicit framework of joint exchange rate management to prevent similar calamities in the future.

The notion that yen/dollar fluctuations constitute the main driver of the Asian countries' export and output instability rests on two assumptions: (1) the Asian countries (other than Japan) peg their currencies to the dollar sufficiently rigidly that changes in the

[35] In Singapore, the robust export growth in 2003 was due mostly to growth in pharmaceutical exports; in Korea, aggregate exports were pushed up by strong growth in exports of automobiles and a narrow range of high-end consumer electronics.

yen/dollar exchange rate directly threaten their industrial competitiveness vis-à-vis Japan; (2) competitiveness shocks dominate other factors as a determinant of the Asian countries' exports and output. As it should be clear now, neither of these assumptions finds support in empirical evidence.

First, although it is widely believed that East Asia (ex Japan) has been and still virtually constitutes a US dollar bloc, this view is exaggerated. Even before the crisis, the dollar exchange rates of many EA currencies were at least as flexible in the medium term as would have been the case if these countries had targeted their currencies' effective value. After the crisis, moreover, the dollar values of all crisis-hit currencies (but the Malaysian ringgit) have remained substantially more volatile than would be permitted under mechanical NEER targeting that we can safely dismiss the view that the "East Asian dollar standard" has been revived recently (McKinnon 2001). As we discussed in Section 3, the apparent gap between the empirical behavior of the EA currencies and that which is depicted in the literature owes partly to the latter's uncritical application of the Frankel/Wei regression method and its failure to properly distinguish short-run exchange rate smoothing and longer-term exchange rate targeting.

Second, for the EA countries *as a whole*, the global electronics cycle --- and not the yen/dollar rate --- has been the main driver of cyclical fluctuations of their exports and output. Even in years between 1995 and 1997, when most EA currencies remained largely fixed to the dollar while the latter strengthened sharply against the yen, the EA countries' export stagnation was due almost entirely to a cyclical downturn in global electronics demand, with little measurable impact from the yen depreciation. It seems inappropriate, therefore, to blame the yen depreciation for the subsequent regional financial crisis, although this is what is often asserted in the literature (Ogawa 2002).

The foregoing, however, does not mean that the EA economies are homogeneous entities that respond to external events in an identical manner. Although many EA countries share broadly similar patterns of output and export fluctuations, this aggregate observation is somewhat deceptive. As we saw in many parts of this paper, the exports and output cycles of some countries are not as strongly correlated as those of the others;

the global electronics cycle also exerts varying impacts on individual economies. In recent years, moreover, there is evidence suggesting that many of the regional economies have been undergoing substantial structure change, thanks in part to China's rise as the region's (and the world's) manufacturing and export platform. This ongoing transformation of the EA economies is in turn expected to change the ways in which the individual economies are influenced by external events and in which such effects are transmitted to other countries in the region.

Although we do not specifically discuss the optimum currency arrangement in Asia, what we have seen in this paper puts question marks on many of the recent proposals for regional exchange rate targeting. Many economists, for example, recommend the EA countries to adopt the CBP under the presumptions that these countries still maintain clandestine dollar pegs and that their dollar pegs let fluctuations in the yen/dollar rate destabilize their output and exports. As we have seen in Section 3, however, the currencies of most crisis-affected countries have in fact been much more variable against the dollar in recent years than would have been permitted under a mechanical CBP; if these countries adopted this regime now, that would strengthen --- rather than weaken --- their currencies' medium-term link to the dollar, quite contrary to the purported aim of the scheme.

Similarly, McKinnon (2001) and McKinnon and Schnabl (2003) recommend an explicit Asia-wide dollar peg on the premise that most East and Southeast Asian countries' "revealed preference" is to peg to the dollar. What we have seen in this paper, however, suggests otherwise. Except for Hong Kong and Malaysia that have so far maintained strict dollar pegs, the EA countries' exchange rate policies have generally been more pragmatic than described by these authors, allowing the home currency to slide when, for example, their exports were hit by downturns in the world electronics cycle. Even in Hong Kong and Malaysia, it is unlikely that their genuine preference is to defend their dollar pegs indefinitely. For example, Abdullah Badawi, Malaysia's new prime minister, has already made it clear that the peg would not last "for ever and ever" and that the country would look for the best timing for a regime change (The Economist, April 7 2004). In Hong Kong, although the monetary authorities officially pledge their resolve to maintain its dollar peg,

a careful reading of their recent statements suggests that this depends very much on what China will do about its exchange rate policy; given Hong Kong's increasing integration into the Chinese economy, it is indeed hard to believe that the former leaves its current regime untouched once a major policy change occurs in the mainland.[36]

Admittedly, the (perceived) destabilizing effect of yen/dollar fluctuations is only one of many reasons behind the recent clamor for joint exchange rate management in Asia. As we noted in Introduction, for example, its proponents often argue that an explicit framework of regional exchange rate targeting guarantees the stability of the relative value of the Asian countries and helps promote intra-regional trade and investment. Although this conjecture may at first seem plausible, empirical evidence is in fact mixed; recent cross-country studies, for example, suggest that whereas a full-blown currency union does have strong trade-creating effects, reductions of exchange rate volatility *per se* have little influence on the volume of trade (Rose 2002; Parsley and Wei 2002). As we have noted repeatedly, moreover, the economies of East and Southeast Asian countries are less homogeneous than they may appear upon a casual observation, and the way in which their economies are linked to the rest of the world is by no means identical. Although this paper has focused on goods production and trade, the importance of services in aggregate output and export also varies considerably across the countries. As has been brought home by the 2002 terrorist attack in Bali, Indonesia, and the recent outbreak of the Sars epidemic in many countries of the region, tourism and business-service exports are quite vulnerable to unpredictable events that are outside the control of individual countries, although the region's monetary authorities do have to respond swiftly to such contingencies to safeguard the stability of their economies. Given evidence that most Asian countries' current exchange rate policies are more flexible and pragmatic than widely presumed, we would be wise to study carefully whether the introduction of an explicit, regional exchange rate arrangement --- which would inevitably constrain individual countries' monetary policy flexibility --- is really a sensible idea.

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[36] See, for example, The Economist (October 31 2002) and Yam (2003).

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Table 1. Business cycle correlations among the Asian and other economies (1980-2002)

	EA		China		Japan		USA		EU	
Hong Kong	0.695	(0.522)	0.154	(0.089)	0.415	(0.212)	0.124	(0.279)	-0.032	(0.055)
Indonesia	0.731	(0.372)	0.055	(-0.191)	0.487	(0.169)	-0.131	(0.082)	-0.112	(0.037)
Korea	0.600	(0.257)	0.147	(0.145)	0.412	(0.266)	0.174	(0.377)	0.275	(0.457)
Malaysia	0.782	(0.584)	0.032	(-0.058)	0.418	(0.211)	-0.032	(0.092)	0.044	(0.147)
Philippines	0.216	(0.110)	-0.546	(-0.584)	0.038	(-0.039)	-0.287	(-0.274)	0.000	(0.012)
Singapore	0.694	(0.670)	-0.032	(-0.093)	0.379	(0.237)	0.102	(0.190)	-0.015	(0.035)
Thailand	0.810	(0.569)	0.092	(-0.010)	0.623	(0.493)	-0.091	(0.055)	0.142	(0.356)
Taiwan	0.455	(0.611)	0.311	(0.289)	0.431	(0.400)	0.446	(0.501)	0.227	(0.269)
China	0.088	(-0.002)			-0.081	(-0.193)	0.375	(0.432)	-0.103	(-0.065)
Japan	0.552	(0.403)					0.009	(0.123)	0.386	(0.549)
USA	0.081	(0.329)							0.265	(0.235)
EU	0.156	(0.383)								

(Notes) Each value indicates the coefficient of correlation between the annual real GDP growth rates of the corresponding row and column countries/regions. Values in parentheses are coeffcients comuputed by excluding the period of the finaicial crisis (1998-1999). EU growth rate is the weighted average of the growth rates of 13 countries. The correlation coefficient between each EA country and EA is that between the growth rate of the former and the weighted average growth rate of the other seven countries. Values larger than 0.5 are highlighted.

(Source) IMF IFS, CEIC Database.

Table 2. Kwan/McKinnon-Schnabl regression (1980-2002)

Constant	Δy (US)	Δy (WLD)	ΔJP/US	ΔJP/US (-1)	D (1998)	R^2 (adj.)	D.W.
0.055***	0.124					-0.041	1.638
(0.012)	(0.332)						
0.058***	-0.068		-0.145**			0.184	1.684
(0.010)	(0.303)		(0.056)				
0.056***	-0.059		-0.120**	-0.099*		0.269	2.010
(0.011)	(0.311)		(0.056)	(0.054)			
0.054***	0.312				-0.118***	0.616	1.358
(0.007)	(0.204)				(0.019)		
0.056***	0.169		-0.093**		-0.107***	0.708	1.269
(0.006)	(0.185)		(0.034)		(0.018)		
0.055***	0.161		-0.082**	-0.055	-0.100***	0.731	1.282
(0.007)	(0.193)		(0.034)	(0.034)	(0.018)		
0.039**		0.739				0.045	1.585
(0.015)		(0.519)					
0.0447***		0.441	-0.129**			0.214	1.560
(0.014)		(0.488)	(0.055)				
0.045***		0.357	-0.110*	-0.094		0.288	1.877
(0.014)		(0.494)	(0.055)	(0.054)			
0.044***		0.737**			-0.114***	0.667	1.441
(0.009)		(0.306)			(0.018)		
0.048***		0.539*	-0.086**		-0.105***	0.746	1.266
(0.008)		(0.278)	(0.032)		(0.016)		
0.048***		0.486	-0.078**	-0.048	-0.099***	0.760	1.248
(0.008)		(0.288)	(0.032)	(0.032)	(0.016)		

(Notes) Standard errors in parentheses. (*), (**) and (***) denote statisitcal significance at 10, 5 and 1 percent confidence levels. y(USA) = real GDP growth rate of the United States; y(WLD) = weighted average for the United States, Japan and 13 EU countries.

(Source) IMF IFS, CEIC Database.

Table 3. Reformulated Kwan/McKinnon-Schnabl regression (1980-2002)

Constant	Δy (WLD)	ΔJP/EA	ΔJP/EA (-1)	ΔIT*	ΔIT* (-1)	D (1998)	R^2 (adj.)	D.W.
0.038**	0.872	0.082					0.100	1.584
(0.014)	(0.512)	(0.054)						
0.040**	0.740	0.087	-0.049				0.080	1.681
(0.016)	(0.565)	(0.057)	(0.059)					
0.039**	0.739			0.088***			0.287	1.700
(0.013)	(0.449)			(0.031)				
0.042**	0.660			0.091***	0.022		0.266	1.632
(0.014)	(0.486)			(0.033)	(0.032)			
0.037***	0.918**	0.110**		0.100***			0.440	1.703
(0.011)	(0.404)	(0.043)		(0.028)				
0.046***	0.676**	-0.037				-0.124***	0.666	1.380
(0.009)	(0.313)	(0.039)				(0.021)		
0.046***	0.620*	-0.034	-0.027			-0.123***	0.655	1.365
(0.010)	(0.347)	(0.041)	(0.036)			(0.022)		
0.044***	0.737***			0.060***		-0.102***	0.784	1.307
(0.007)	(0.247)			(0.017)		(0.015)		
0.045***	0.690**			0.062***	0.005	-0.101***	0.774	1.079
(0.008)	(0.270)			(0.019)	(0.018)	(0.016)		
0.044***	0.740**	0.002		0.060***		-0.101***	0.772	1.312
(0.007)	(0.260)	(0.034)		(0.019)		(0.019)		

(Source) IMF IFS, CEIC Database, US Semiconductor Industry Association.

Table 4. Correlation between EA business cycles and the world electronics cycle (semi-annual basis, 1991:H1 – 2003:H1)

	Indonesia	Korea	Malaysia	Philippines	Singapore	Thailand	Taiwan	Japan	ΔIT*
Hong Kong	0.340	0.421	0.526	0.184	0.586	0.552	0.633	0.144	0.436
	(-0.275)	(0.025)	(0.203)	(-0.095)	(0.478)	(0.294)	(0.765)	(-0.047)	(0.431)
Indonesia		0.779	0.797	0.562	0.505	0.524	0.055	0.419	0.216
		(0.458)	(0.348)	(0.212)	(0.269)	(-0.066)	(-0.07)	(0.339)	(0.148)
Korea			0.771	0.658	0.535	0.585	0.126	0.228	0.248
			(0.603)	(0.655)	(0.347)	(0.098)	(0.016)	(0.039)	(0.160)
Malaysia				0.634	0.617	0.578	0.316	0.355	0.328
				(0.539)	(0.465)	(0.350)	(0.300)	(0.132)	(0.356)
Philippines					0.259	0.380	-0.103	0.240	-0.055
					(0.086)	(-0.053)	(-0.204)	(0.097)	(-0.125)
Singapore						0.353	0.620	0.395	0.583
						(0.191)	(0.632)	(0.292)	(0.599)
Thailand							0.198	0.022	0.349
							(0.451)	(-0.136)	(0.276)
Taiwan								0.196	0.409
								(0.119)	(0.446)
Japan									0.208
									(0.235)

(Notes) Values in parentheses are correlation coefficients computed excluding the period of the financial crisis (1997:H2-1999:H1). Values larger than 0.5 are highlighted.
(Sources) CEIC Database, US Semiconductor Industry Association.

Table 5. Frankel-Wei/McKinnon regression

	Constant		ΔUS/k		ΔJP/k		ΔEU/k		R^2 (adj.)	D.W.
Pre-crisis (1988:1-1997:6)										
Hong Kong	0.000	(0.000)	1.000***	(0.004)	0.000	(0.003)	0.003	(0.009)	0.999	1.876
Indonesia	0.003***	(0.000)	0.963***	(0.023)	0.018	(0.016)	0.071	(0.042)	0.985	1.621
Korea	0.001	(0.001)	0.925***	(0.036)	0.112**	(0.035)	-0.028	(0.066)	0.933	0.656
Malaysia	0.000	(0.000)	0.837***	(0.038)	0.069*	(0.036)	0.221**	(0.091)	0.893	1.158
Philippines	0.000	(0.002)	0.997***	(0.115)	-0.087	(0.083)	0.305*	(0.162)	0.795	1.316
Singapore	-0.003***	(0.001)	0.674***	(0.029)	0.134***	(0.018)	0.230***	(0.056)	0.950	1.862
Taiwan	0.000	(0.001)	0.876***	(0.057)	0.087	(0.060)	0.180*	(0.096)	0.896	1.338
Thailand	0.000	(0.000)	0.804***	(0.014)	0.151***	(0.036)	0.047	(0.033)	0.975	0.904
Post-crisis (1999:7-2003:6)										
Hong Kong	0.000	(0.000)	1.000***	(0.002)	-0.002**	(0.001)	0.001	(0.005)	1.000	1.066
Indonesia	0.004	(0.007)	0.433	(0.452)	0.114	(0.408)	2.313	(0.525)	0.097	1.658
Korea	0.000	(0.003)	0.572***	(0.178)	0.546***	(0.185)	0.249	(0.199)	0.723	1.040
Malaysia	0.000	(0.000)	1.000***	(0.000)	0.000	(0.000)	0.000	(0.000)	1.000	2.138
Philippines	0.007***	(0.003)	0.843***	(0.139)	0.100	(0.132)	0.528	(0.341)	0.618	1.648
Singapore	0.001	(0.001)	0.596***	(0.080)	0.192***	(0.055)	0.271*	(0.149)	0.820	1.954
Taiwan	0.001	(0.002)	0.766***	(0.078)	0.175***	(0.052)	0.311	(0.186)	0.844	1.171
Thailand	0.003	(0.003)	0.679***	(0.151)	0.062	(0.166)	0.523**	(0.225)	0.581	1.276

(Notes) Figures in parentheses are Newy-West standard errors. (*), (**) and (**) denote significance at 10, 5 and 1 percent levels. For the pre-crisis period, ΔEU/k refers to the Euro/Swiss franc exchange rate; for the post crisis period it is the Euro/Swiss franc rate.
(Source) CEIC Database.

Table 6. Standard deviation of the nominal exchange rate with the US dollar under alternative currency regimes (semi-annual basis)

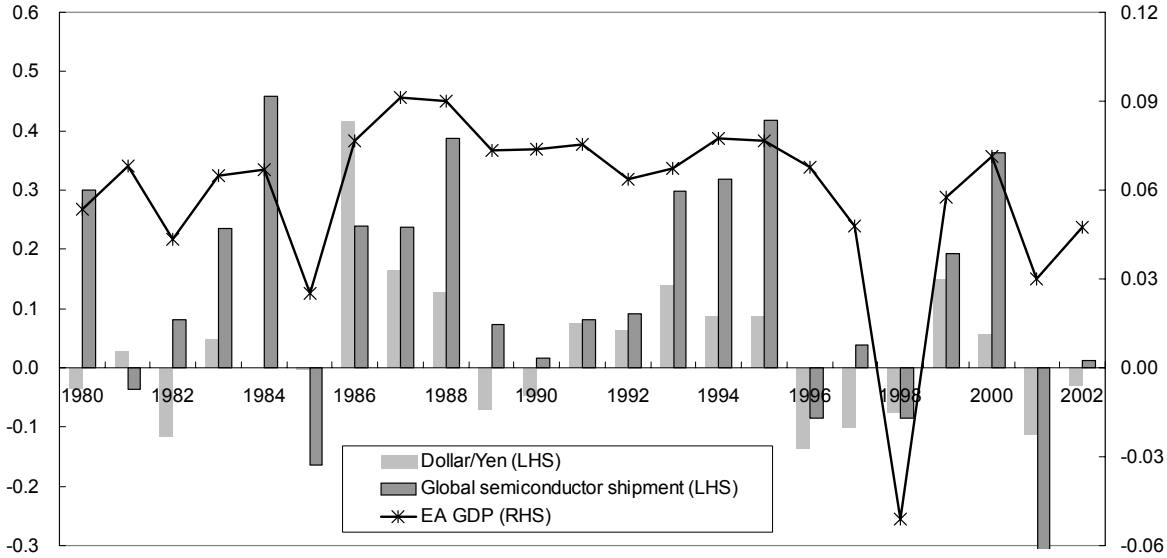
	Hong Kong	Indonesia	Korea	Malaysia	Philippines	Singapore	Thailand	Taiwan
Pre-crisis (1988:H1-1995:H1)								
Actual	0.002	0.007	0.038	0.030	0.066	0.026	0.013	0.031
NEER targetting	0.025	0.039	0.030	0.028	0.026	0.023	0.035	0.027
CBP	0.038	0.038	0.038	0.038	0.038	0.038	0.038	0.038
Pre-crisis (1990:H1-1997:H1)								
Actual	0.001	0.008	0.030	0.028	0.066	0.031	0.014	0.029
NEER targetting	0.027	0.044	0.034	0.034	0.031	0.027	0.040	0.030
CBP	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045
Post-crisis (1999:H1-2003:H1)								
Actual	0.001	0.120	0.056	0.000	0.068	0.025	0.049	0.030
NEER targetting	0.017	0.030	0.024	0.026	0.025	0.021	0.028	0.023
CBP	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032

Table 7. Annual growth rates of Asian countries' goods exports (in US-dollar terms, percent)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Year-on-year growth rate of goods exports										
Hong Kong	-4.7	-0.3	4.2	-8.3	-0.5	-11.0	-9.6	5.7	-15.3	-14.7
Indonesia	8.3	9.9	18.0	5.8	12.2	-10.5	1.7	27.6	-12.3	2.5
Korea	7.7	15.7	31.2	4.3	6.7	-4.7	9.9	21.2	-14.0	7.5
Malaysia	16.1	23.1	26.1	7.3	0.7	-7.3	17.0	17.0	-10.6	6.1
Philippines	15.8	18.5	29.4	17.7	22.8	16.9	16.0	9.0	-16.2	10.1
Singapore	14.4	24.3	19.8	5.9	-1.1	-12.7	8.5	14.8	-16.3	0.8
Taiwan	4.4	9.4	20.0	3.8	5.3	-9.4	10.0	22.0	-17.2	6.3
Thailand	13.4	22.2	24.7	-1.9	4.1	-6.9	7.6	19.6	-6.9	5.7
Japan	6.0	9.4	11.2	-6.6	2.2	-8.6	7.9	13.8	-16.5	3.1
China	8.8	35.6	24.9	17.9	20.9	0.5	6.1	27.9	6.8	22.4
Year-on-year growth rate — Average annual growth rate for 1993-2002										
Hong Kong	0.8	5.2	9.7	-2.9	5.0	-5.6	-4.2	11.2	-9.9	-9.3
Indonesia	2.0	3.6	11.7	-0.5	5.9	-16.8	-4.6	21.3	-18.6	-3.8
Korea	-0.9	7.2	22.7	-4.3	-1.9	-13.3	1.4	12.7	-22.6	-1.1
Malaysia	6.6	13.6	16.6	-2.3	-8.9	-16.9	7.5	7.5	-20.2	-3.5
Philippines	1.8	4.5	15.4	3.7	8.8	2.9	2.0	-5.0	-30.2	-3.9
Singapore	8.6	18.5	14.0	0.1	-6.9	-18.5	2.7	9.0	-22.1	-5.0
Taiwan	-1.1	3.9	14.5	-1.7	-0.2	-14.9	4.5	16.5	-22.7	0.8
Thailand	5.2	14.0	16.5	-10.1	-4.1	-15.1	-0.6	11.4	-15.1	-2.5
Japan	3.8	7.2	9.0	-8.8	0.0	-10.8	5.7	11.6	-18.7	0.9
China	-8.4	18.4	7.7	0.7	3.7	-16.7	-11.1	10.7	-10.4	5.2
Nominal yen/dollar exchange rate										
End of period	-12.2	-8.1	-8.0	15.6	11.2	8.2	-13.0	-5.4	12.8	3.2
Period average	-10.3	-10.8	3.1	12.8	12.0	-11.0	-11.6	12.4	14.7	-9.0

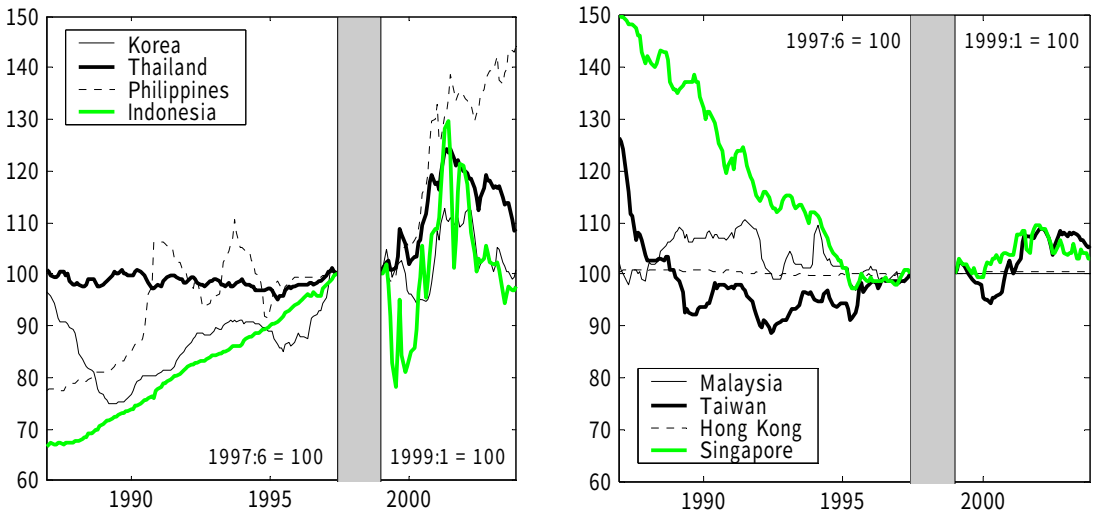
(Note) Shade indicates years in which the world shipment of semiconductors fell below the level of the preceding year. Exports of Hong Kong and Singapore exclude re-exports. For the yen/dollar rate a positive value indicates the yen's depreciation.
(Source) IMF IFS, CEIC Database.

Figure 1. Year-on-year rates of change in EA real GDP, the yen/dollar exchange rate and world semiconductor shipment



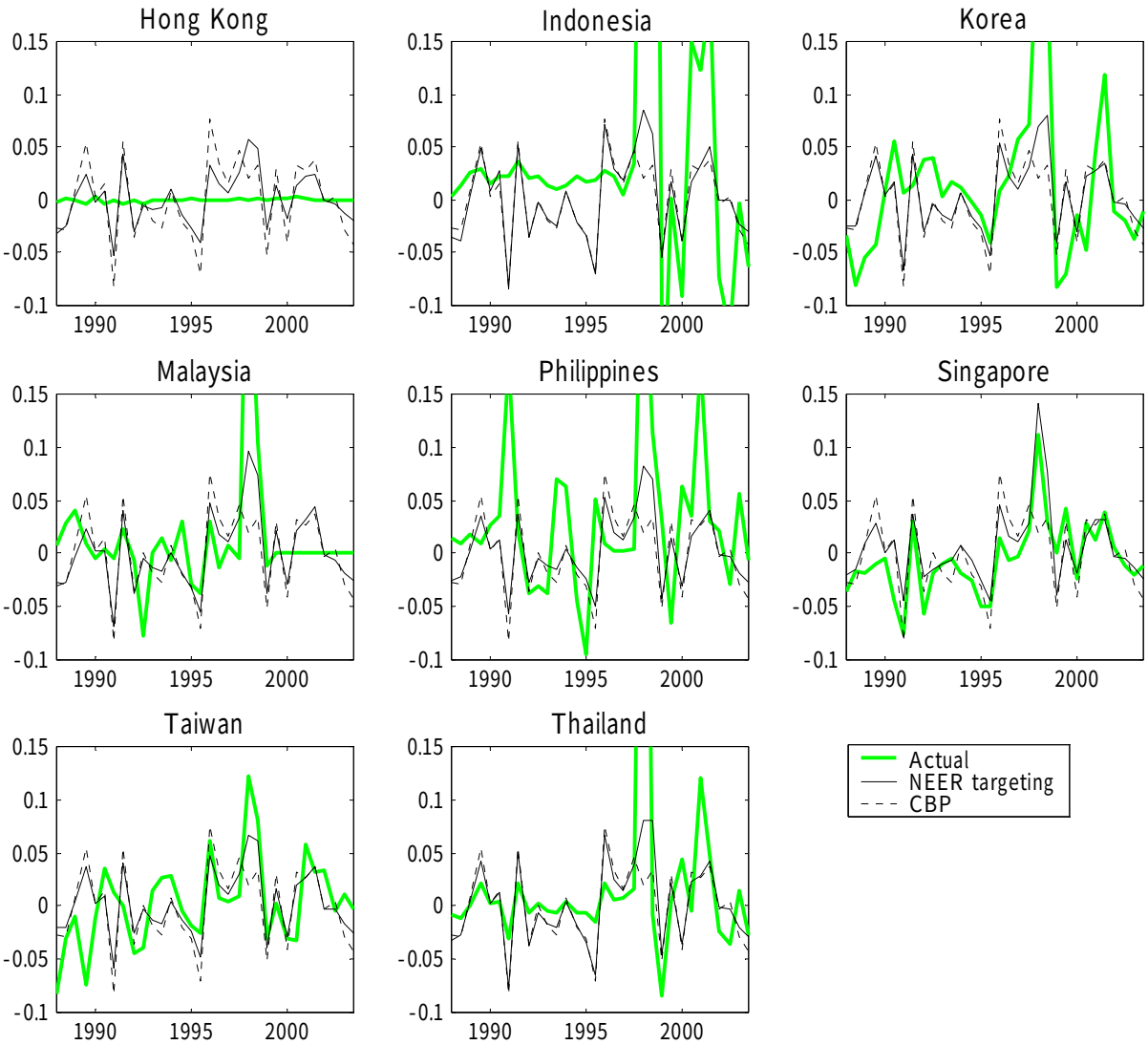
(Note) Semiconductor shipment is valued in terms of US dollars.
(Source) IMF IFS, US Semiconductor Industry Association

Figure 2. Exchange rates between EA currencies and the dollar



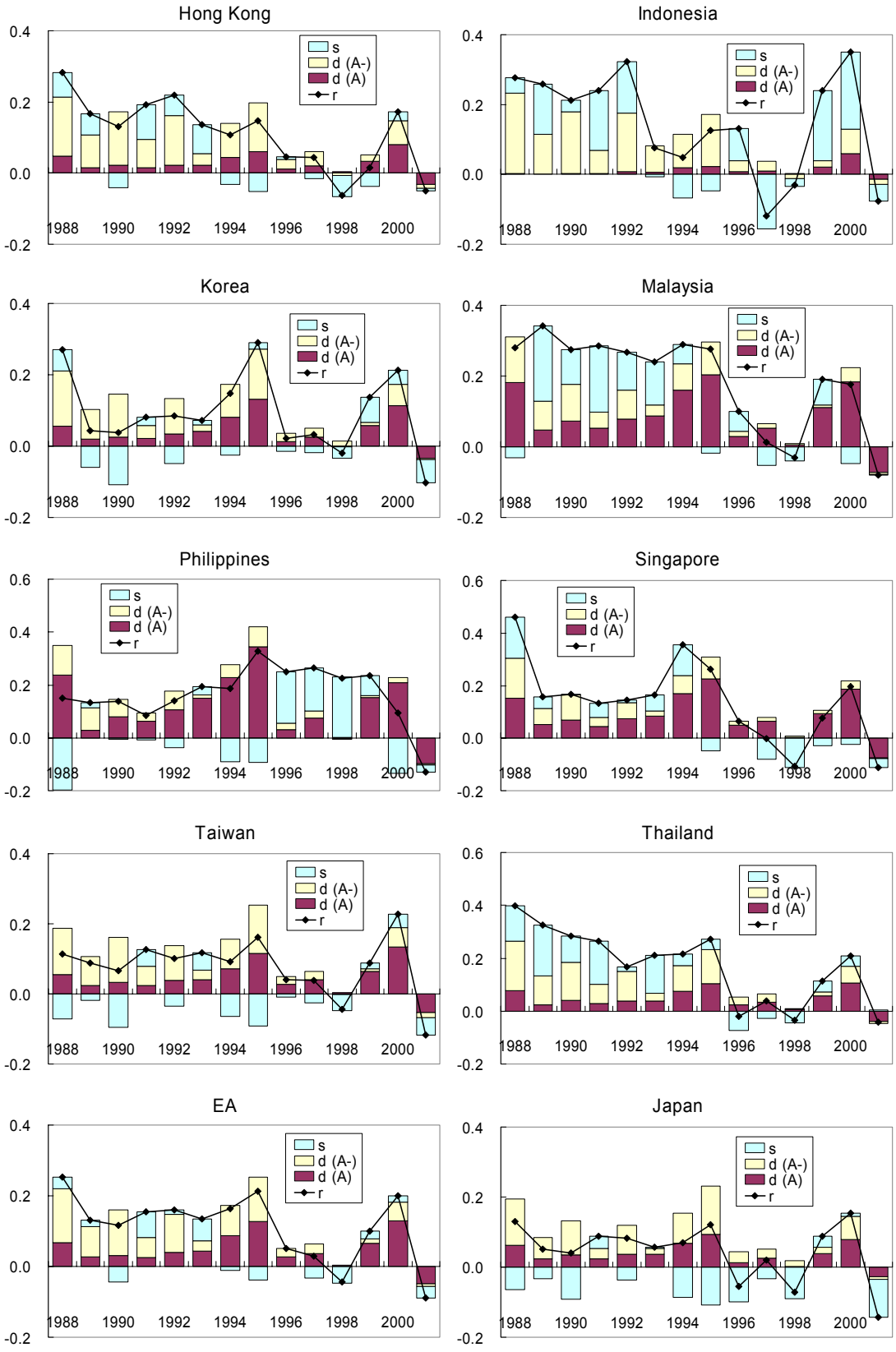
(Source) IMF IFS, CEIC Database

Figure 3. Actual and hypothetical movements of the EA currencies' exchange rates with the US dollar



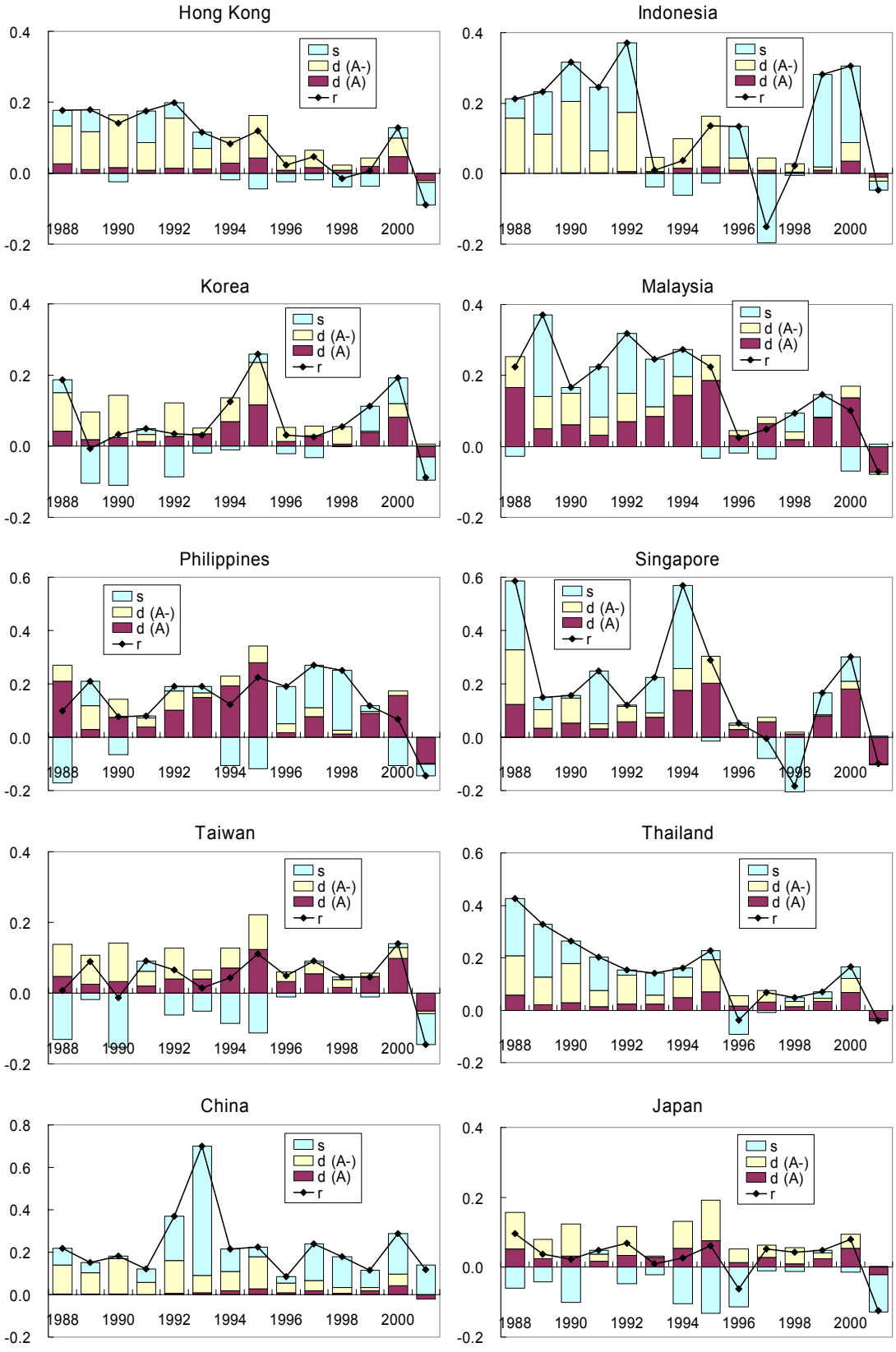
(Note) Actual = Δe(i/US), NEER targeting = Δe*(i/US), CBP = Δê(i/US).
(Source) CEIC database, Statistics Canada World Trade Database.

Figure 4. Factors underlying export growth (total exports)



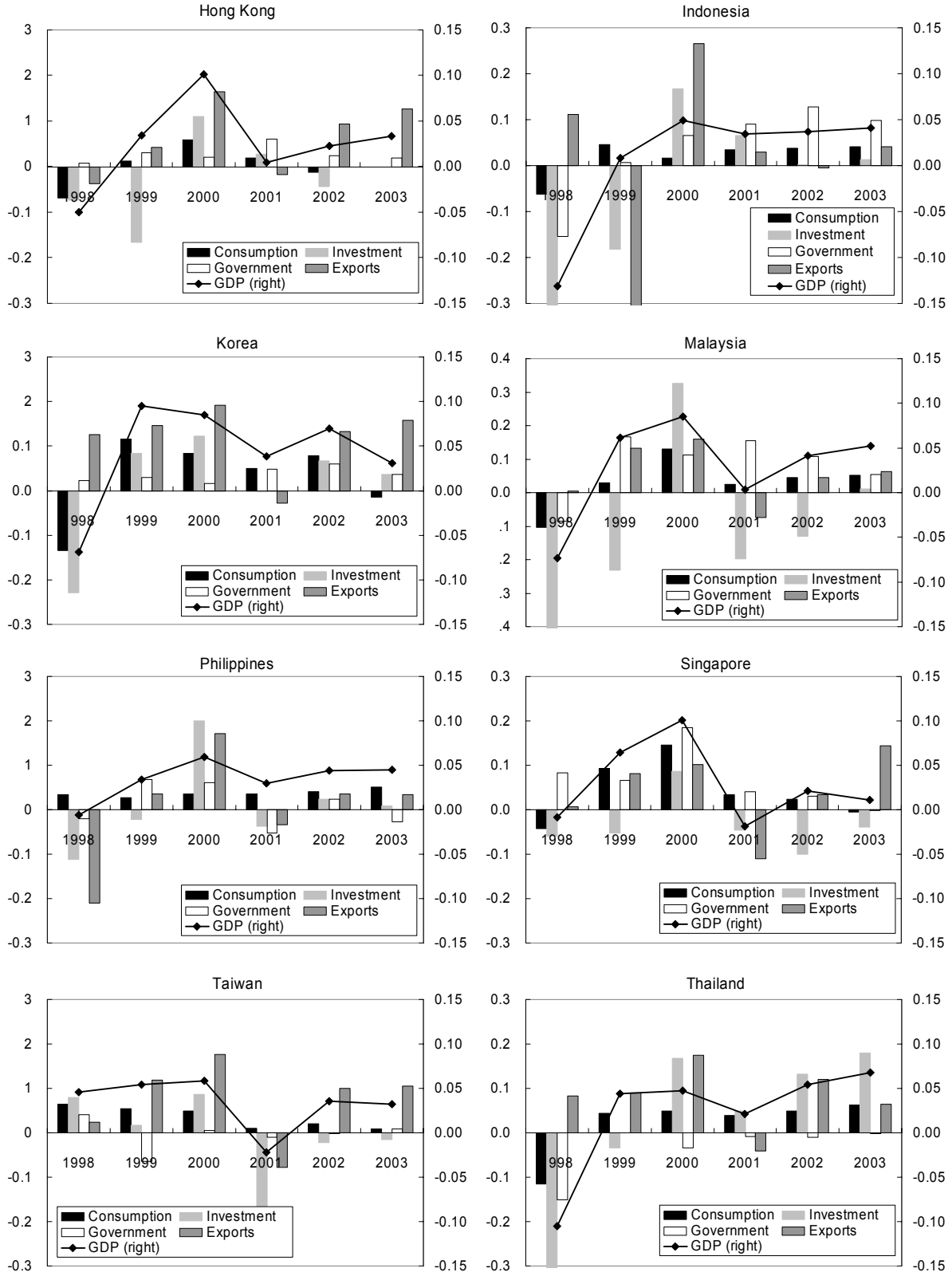
(Source) Statistics Canada, World Trade Database.

Figure 5. Factors underlying export growth (exports to non-Asia)



(Source) See Figure 4.

Figure 6. Contribution of demand components to real GDP growth



(Note) All values are the rate of growth over the previous year.
(Source) CEIC database.