Emerging Asia's Growth and Integration: How Autonomous Are Business Cycles? [1]

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Abstract

Intra-regional economic integration within Emerging Asia has progressed rapidly over the recent decade coupled with very high growth rates and productivity increases feeding through to stronger regional incomes. At the same time, inter-regional linkages have also strengthened considerably, with particularly strong ties with advanced economies (including Japan and the US), while at the same time being influenced by global commodity and equity prices. In addition, domestic country-specific developments at the country level are often regarded to be gaining importance in a number of countries. While the first two "external" developments suggest that Emerging Asian countries might have become more integrated into the world economy – either via intra- or inter-regional links - the latter one implies that developments at the country level might have become a more important driver of business cycle fluctuations in the region. This paper investigates the role of these three effects. We estimate VAR models for individual countries in the region controlling for developments outside the region by including G7 growth, world interest rates, commodities prices and a global equity index. We use sign restrictions to identify structural domestic shocks through an algorithm involving cross-products of impulse responses. We separate extra-regional and domestic impacts on country-level developments, and then study links across Asian countries by looking at correlations between country-specific identified shocks. We find that the role of extra-regional developments in growth dynamics remains considerable in most countries. However, domestic developments tend to dominate the impact on output. In particular, domestic demand and supply shocks tend to exert a large influence in output and price dynamics, while monetary shocks also play a role in determining real exchange rates. Interaction across Emerging Asia is also found to be intense in many dimensions and across many countries. The links between the largest countries in Asia, including Japan, appears to be however rather muted. Turning to changes over the last ten to fifteen years, we find evidence that extra-regional developments seem to have become more important at the expense of country-specific and especially domestic demand shocks. Finally, the pattern of correlations across Emerging Asia may have changed, especially in the case of demand shocks. However, in light of the reduced sample sizes, the latter results must be handled with care.

1. Introduction

Emerging countries in Asia have experienced rapid economic growth over the last quarter of a century. This has been largely the result of an outward-oriented strategy sustained on a very strong expansion of trade within and outside the region. The fast pace of economic growth exhibited by the region since the 1980s came suddenly to a halt at the time of the Asian financial crisis of 1997-1998. This crisis was characterised by sizeable exchange-rate depreciations in most countries in the region, with the notable exception of China whose 1994 depreciation seems to have acted somewhat as a buffer. The strong intra-regional trade linkages transmitted negative shocks experienced in one country all over the area. However, the economic slowdown proved temporary, and Emerging Asia's (EA) expansion eventually resumed, having in recent years outperformed the rest of the world. The strength shown by these countries before and after the Asian crisis has overcome the constraint posed by the relatively weak performance of the Japanese economy – one of EA countries' largest trading partners - over the last fifteen years.

There are three geographical dimensions that are of considerable importance for macroeconomic performance in EA. First, intra-regional economic integration within EA has progressed rapidly over the recent decade coupled with very high growth rates and productivity increases feeding through to stronger regional incomes. Second, inter-regional linkages have also strengthened considerably, with particularly strong ties with Japan and the US. Third, domestic country-specific developments at the country level are often regarded to be gaining importance in a number of countries. While the first two "external" developments suggest that Emerging Asian countries might have become more integrated into the world economy – either via intra- or inter-regional links - the latter one implies that developments at the country level might have become a more important driver of business cycle fluctuations in the region. The present paper investigates the role of these three effects.

Motivating our interest in the decomposition of the afore-mentioned three geographical dimensions is the key question how much of the strong growth momentum currently evidenced by EA countries is driven by external factors (both regional and outside the region) as opposed to the autonomous strength of domestic demand. This question is connected to the assessment of the sustainability of the expansion of EA countries, were the global economy to slow down markedly. Several studies point to the idea that, while EA – and, in particular, Chinese – domestic

demand helps buffer regional exports from global developments,[3] this autonomous regional component is constrained by several factors. The latter include, for instance, the high degree of reprocessing in exports,[4] the still relatively small size of EA economies compared to the world economy, and the region's dependence on global demand of some products – and especially US demand for IT goods.[5]

The idea of separating the contribution of domestic and external factors to macroeconomic behaviour is not new and has already been applied in the related empirical literature. Most relevant to the present paper, Canova (2003) studies how US shocks are transmitted to eight Latin American economies. He uses the procedure of Canova and De Nicolò (2002) to identify US structural shocks by means of sign-restricted vector autoregressive (VAR) models, then following a Bayesian VAR approach to estimate their impact on Latin America. He finds evidence of a significant role of the US in affecting Latin American macroeconomic performance. This role is entirely driven by a financial transmission channel, with a large contribution of US monetary shocks, while US demand and supply shocks do not appear to have a significant impact. In their comparative study of Asian and Latin American countries, Hoffmaister and Roldós (1997) use a panel structural VAR for a number of domestic and eternal variables with both short-run and long-run identifying restrictions. They report that overall a single domestic shock (namely, the supply shock) dominates the macroeconomic behaviour of both Asia and Latin America, with the latter being however somewhat more affected by external shocks. Among Asian country studies, Genberg (2003) uses a semi-structural VAR to analyse macroeconomic behaviour in Hong Kong. He finds that external factors account for around half of macroeconomic fluctuations in the short-run and become dominant in the medium to long run. In addition, Moon and Jian (1995), in their cointegrated VAR study about South Korea, analyse the behaviour of a series of domestic macroeconomic variables controlling for external variables such as foreign interest rates, prices and output on. Both domestic and external shocks are found to have an impact on the Korean economy, with the authors stressing that world interest rates play a significantly larger role than domestic rates.

[3] In this regard, the Asian Development Bank (2003) describes how, at the time of the latest global slowdown in the second half of 2002, EA exports continued to grow based on strong intra-regional trade. The Monetary Authority of Singapore (2003) estimates that, in the case of East Asia, 36% of total exports are directed to the own region, and 22% of the total satisfy domestic demand of the subregion.

[4] Estimates of the degree of export reprocessing vary. For China, they range from 50% (Rumbaugh and Blancher, 2004) to 80% (Goldman Sachs, 2003).

[5] US purchases of IT software and equipment is particularly important for countries such as South Korea, Taiwan, Singapore and Malaysia. Zebregs (2004) calculates that the electronics sector has overall accounted for around half of NJA export growth in the period 1998-2001.

The present paper also relates to the literature analysing cross-country interdependencies. Using a Bayesian dynamic latent factor model, Kose *et al.* (2003) address separate world, regional and country-specific determinants of macroeconomic behaviour for 60 countries. In particular, they find that world factors are important determinants of business cycles, while regional effects appear to play a limited role. Their approach is powerful to uncover distinct but comparable geographical characteristics in one same step, although the methodology cannot attach a structural interpretation to the decompositions involved. Ahearne *et al.* (2003) use a panel VAR analysis of export growth for several Asian countries. They find that foreign demand (measured by an average of major trading partners' GDP growth) dominates real exchange rate developments in explaining export dynamics. In addition, they show that Chinese exports have a positive contribution to other Asian countries' exports. Abeysinghe and Forbes (2001) and Abeysinghe and Lu (2003) employ a structural VAR model to study the interrelation between real GDP in Asian countries and foreign demand computed by using trade-weighted foreign GDP. This allows the authors to estimate direct and indirect impacts across countries. They find that China has a larger impact on its neighbours than all other Asian economies except Japan.[6] Using unobserved factor analysis, Zebregs (2004) finds that the common factor in Emerging Asian business cycles dominates the country-specific factor, and that this common factor is more correlated with Japan than with the US and EU countries. Pesaran *et al.* (2003) propose a cointegrated VAR model for 26 countries grouped into 11 regions including domestic and foreign variables. These separate models are then linked in a global model identifying "historical" shocks by using generalised impulse responses as proposed by Pesaran and Shin (1998). The authors show how the model could be used in the analysis of the transmission of shocks from one country/region to the rest of the world economy.

Our paper extends the existing literature by using an integrated approach to identifying the role played in Asia by external factors (both regional and outside the region) as opposed to impulses originating at the domestic level. We identify VAR models for eleven Asian countries and identify supply, real demand and monetary shocks.[7] The identification restrictions used are consistent with a large number of macroeconomic models. Our approach draw from previous work using "informal" sign identification restrictions by faust (1998) and Canova and De Nicolò (2002) for

[6] Abeysinghe and Lu (2003) also show that the impacts across Asian countries have broadly increased over the period 1986-2000, with propagation from China intensifying the most.

[7] Our analysis incorporates four domestic macroeconomic variables and control for a set of external variables including measures of advanced economies' economic activity, world interest rates and stock prices, and oil and non-oil commodity prices. By estimating models for individual Asian countries, we relax the constraint of "common slopes" found in the panel VAR studies reviewed above.

advanced economies. In particular, we follow the former in allowing sign restrictions to hold for cross-products of impulse responses, instead of fulfilling cross-correlations of impulse responses as proposed by the latter authors. We use variance decomposition analysis to disentangle for each Asian country between different types of domestic shocks, on the one hand, and a set of global variables, on the other. In order to assess the degree of complementarity between Asian economies, we compute correlations between domestic shocks across the latter. Moreover, we also explore changes in patterns in the relative contribution of different domestic and external factors over the last ten to fifteen years by estimating the models over a sample period starting at a more recent date.

Our results can be summarised as follows. We find that the role of extra-regional developments in growth dynamics remains considerable in most Emerging Asian countries. However, domestic developments tend to dominate. In particular, domestic demand and supply shocks tend to exert a large influence in output and price dynamics, while monetary shocks also play a role in determining real exchange rates. Supply shocks are also important for understanding real exchange rate dynamics, while monetary shocks particularly help explain the behaviour of prices and real exchange rates. Interaction across Emerging Asia is also found to be intense in many dimensions and across many countries. Strong links seem to be however missing in many instances among the largest players in intra-regional trade. Turning to changes over the last ten to fifteen years, we find evidence that extra-regional developments seem to have become more important at the expense of country-specific and especially domestic demand shocks. Moreover, we capture changes in the pattern of correlations of shocks across Emerging Asia. Such changes appear to have been large only in the case of demand shocks. In light of the reduced sample sizes, the latter results must naturally be handled with care.

The remainder of the paper is organised as follows. Section 2 presents the methodology used, examining the identification restrictions employed in the empirical part, the set-up of the vector autoregressive models and the approach to identification. Section 3 briefly describes the data. Section 4 discusses the results of the paper, distinguishing between full sample results and those produced for a sample starting at a more recent date to detect possible changes over time. Finally, section 5 contains some concluding remarks.

2. Methodology

This section consists of three parts. The first one outlines the identification restrictions used in the empirical part of the paper. The second one formulates the vector autoregressive models, describing the way variance decompositions are computed. The third one describes our approach to identification, examining the algorithm used to achieve decompositions of the relationship between reduced form and structural form errors.

2.1. Sign restrictions

We characterise the dynamics of the economy in terms of responses to global variables as well as three domestic structural shocks: a supply (or technology) shock, a real demand shock (henceforth simply "demand" shock) and a monetary policy shock. The domestic economic variables that we consider are output, prices, real money balances and real effective exchange rate, the latter used as a measure of competitiveness. In our four-variable model, in addition to the three afore-mentioned domestic shocks, we also allow for one other shock be left unidentified.[8]

We set up sign restrictions for cross-products of responses in endogenous variables to candidate identified shocks, as previously done in Faust (1998). These restrictions are in line with standard macroeconomic models.[9] A domestic supply shock yields negative comovements between domestic output and domestic inflation while domestic demand and monetary shocks produce positive comovements in domestic output and domestic inflation. We disentangle demand from monetary shocks by requiring that they produce negative and positive comovements between real money balances and inflation, respectively.

The use of such sign restrictions appears to be more reasonable than imposing contemporaneous constraints that are normally not supported by economic models, nor easy to justify on the basis of institutional or informational considerations. On a different note, notice that we define sign restrictions on all domestic variables but the real exchange rate. The latter is allowed to move freely following changes in the three specified shocks, and for that matter also the unidentified one. The success of our strategy would consist of finding meaningful estimated models and identification

[8] Our treatment of shocks follows that of Canova and De Nicolò (2002).

[9] See, for example, the dynamic general equilibrium models discussed in Canova and De Nicolò (2002) and (2003), who discuss them focusing on their implications for cross-correlations of endogenous variables.

schemes that impose only a minimal set of plausible economic assumptions on the way the economy behaves.

2.2. Vector autoregressive model set-up

In order to estimate the theoretical model outlined in the previous section, we proceed in two steps. First, we set up a vector autoregressive (VAR) model on quarterly series for eleven Asian countries. In addition to a set of domestic macroeconomic variables used as endogenous variables, we control for the impact of exogenous variables characterising global developments. Second, we use the sign restrictions derived from our theoretical model in order to identify supply, real demand and monetary shocks. To do so, we employ a variant of the approach of Canova and De Nicolò (2002) which allows the sign restrictions to be fulfilled for cross-products of impulse responses, instead of holding for cross-correlations of impulse responses as originally proposed. The rationale for this preference is that the former are less sensitive to the presence of outliers, and allow for identification under a smaller number of sign mismatches. Third, we use identified errors to obtain substantive econometric results in terms of: 1) variance decomposition analysis, with a focus on computing the contribution of each domestic shock as well as external factors to macroeconomic fluctuations; and 2) assessment of interdependencies across Asian economies in term of correlations between country-specific domestic shocks. The entire set of results is reported in section 4.

The first step for estimating the theoretical model presented in section 2 consists in setting up a VAR model for each of the eleven Asian economies in our sample. We use a set of domestic macroeconomic variables as endogenous variables, while also controlling for the impact of exogenous variables characterising global developments. We can write the reduced form model as follows:

$$A(L)y_t = G(L)x_t + \varepsilon_t \quad \text{with } \varepsilon_t \overset{D}{\sim} WN(0,\Sigma) \tag{1}$$

where y_t is a $n \times 1$ vector of domestic variables, x_t is a $k \times 1$ vector of exogenous global variables, ε_t is a vector of white noise errors, and $A(L)$ and $B(L)$ are polynomials of orders *p* and *q*, respectively. Following Canova (2003), we detrend and seasonally-adjust all variables in vectors y_t and x_t. In this paper, we are only interested in cases where $n = 4$. Model (1) can be estimated by OLS equation by equation.

We devote attention to the characterisation of the Asian crisis in terms of dummy variables. We choose from a set of five consecutive dummy variables starting in 1997Q3. In order not to remove too much information, we allow for (at most) the two dummies to enter the model most significantly.

Selection of *p* and *q* as well as the set of Asian crisis dummies (if any) entering the VAR model is based on the value of the Akaike information criterion (AIC). In practice, the decisions reached would not have changed if we had followed the Schwartz information criterion. Due to data limitations, we in principle constrain the largest values of *p* and *q* to be equal to two.

The VAR model in (1) can be rewritten in the Wold form:

$$y_t = H(L)x_t + B(L)\varepsilon_t$$

where $H(L) = A(L)^{-1}G(L)$. We are interested in recovering the structural form of the system in order to express endogenous variables in terms of exogenous variables economically interpretable disturbances. The latter can be represented by a vector ω_t of structural shocks that satisfies:

$$\omega_t \overset{D}{\sim} WN(0, I_n) \text{ and } \varepsilon_t = C\omega_t . \qquad (2)$$

This implies that $CC' = \Sigma$. The Wold representation for the structural form allowing for exogenous variables becomes:

$$y_t = H(L)x_t + B(L)C\omega_t \qquad (3)$$

This paper employs impulse responses for identification purposes. The orthogonalised impulse response of the *i*-th variable to one unit deviation of the *j*-th shock after *s* periods can be expressed as:

$$\frac{\partial y_{t+s|t}}{\partial \omega_{jt}'} = B_s c_j \qquad (4)$$

where $B_s = \frac{\partial y_{t+s|t}}{\partial \varepsilon_{jt}'}$ can be obtained from *B(L)*, and c_j is the *j*-th column of C.

We use variance decomposition to separate the part of the mean square error (MSE) of forecasts of each endogenous variable due to domestic shocks to the VAR from that determined by exogenous external variables. We can make use of an adding up

property since identified shocks are orthogonal to each other, and also orthogonal to exogenous variables. From (3), we find the MSE of the forecast at time *t* of y due to the *j*-th structural shock ω_j after *s* periods:[10]

$$\frac{\partial MSE(\hat{y}_{t+s|t})}{\partial \omega_{jt}'} = B_s c_j c_j' B_s'$$

where $B_s = \frac{\partial y_{t+s|t}}{\partial \varepsilon_{jt}'}$ can be obtained from *B(L)*, and c_j is the *j*-th column of C.

The corresponding expression that obtains for the whole set of exogenous variables is:

$$\sum_{j=1}^{k} \frac{\partial MSE(\hat{y}_{t+s|t})}{\partial x_{jt}'} = H_s H_s'$$

where $H_s = \frac{\partial y_{t+s|t}}{\partial x_t'}$ can be obtained from $\mathrm{B(L)}$.

2.3. Identification algorithm and decomposition choice

We describe here how we employ the sign restrictions derived from our theoretical model in order to identify supply, real demand and monetary shocks. As mentioned before, we use a modified version of Canova and De Nicolò's (2002) procedure which allows the sign restrictions to be hold for cross-products of impulse responses.

One common way is to identify model (1) is by choosing C to be lower triangular. The resulting decomposition is unique and is called Choleski decomposition. This imposes $n(n-1)/2$ zero restrictions on C, such that y_j has no contemporaneous impact on y_i as long as $j > i$. Other popular decompositions employ other types of short-run restrictions on C, or a set of long run restrictions on the system, or a combination of both. Existing dynamic macroeconomic theory provides a wealth of restrictions that can be used to identify shocks. Rarely, however, do these restrictions take the form of zero constraints either on the impact or the long run multipliers. In

[10] See Hamilton (1994) for the case of no exogenous variables. In (3), the fraction of the MSE of the forecast of any endogenous variable due to the *entire* set of external variables, and therefore the remaining fraction explained by the *entire* set of shocks, are independent of the chosen decomposition C. Instead, the properties of C are crucial for decomposing the MSE among *each* individual shock.

particular, the dynamic stochastic model presented in section 2 involves conditional restrictions on the sign of the responses of certain variables to shocks. This motivates the identification algorithm used in this paper, which we describe in the rest of this subsection.

We explore the space of all possible decompositions C of Σ in (2). Let C_{start} be a particular decomposition of Σ, then any other possible decomposition C verifies:

$$CC' = \Sigma = C_{start}\left(C_{start}\right)'$$

This implies:

$$\left(C_{start}\right)^{-1} CC'\left(C_{start}'\right)^{-1} = \left(C_{start}\right)^{-1} C\left(\left(C_{start}\right)^{-1} C\right)' = I_n$$

Let J be an orthogonal matrix such that $C = C_{start}.J$. This turns the exploration of all possible decompositions into an exploration of the space of orthogonal matrices. We can then use Press' (1997) exploration algorithm for our purpose. Define $J_{ab}(\theta)$ as:

$$J_{ab}(\theta) = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ 0 & 0 & 0 & \cos\theta & 0 & -\sin\theta & 0 & 0 \\ \dots & \dots & \dots & \dots & 1 & \dots & \dots & \dots \\ 0 & 0 & 0 & \sin\theta & 0 & \cos\theta & 0 & 0 \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

where (a,b) can be any couple of integer numbers (each of them no longer than *n*) and $\theta \in [0;2\pi[$. In the four-variable context of our interest, there are 6 different such matrixes for each angle θ:

$$J_{12}(\theta), J_{13}(\theta), J_{14}(\theta), J_{23}(\theta), J_{24}(\theta), J_{34}(\theta)$$

and the three combinations of matrices:

$$J_{12}(\theta) o J_{34}(\theta), J_{13}(\theta) o J_{24}(\theta), J_{14}(\theta) o J_{23}(\theta)$$

We use an angle grid to divide $]0;2\pi[$ into 400 intervals. Moreover, we consider $J_{ab}(0) = I_4$.

Let P be a matrix of eigenvectors and D a diagonal matrix of eigenvalues. We can then write $PDP' = \Sigma$. Given that Σ is real symmetric positive definite, there exist a unique P and a unique matrix D with positive entries along the principal diagonal. D defines a unique diagonalisation of Σ into an orthonormal base of eigenvectors. A further step produces $PD^{1/2}D^{1/2}P' = PD^{1/2}\left(D^{1/2}\right)'P' = PD^{1/2}\left(PD^{1/2}\right)' = \Sigma$, where decomposition $C_{start} = PD^{1/2}$ yields uncorrelated shocks without imposing any zero restrictions. We take this decomposition as our starting decomposition, that is, $C_{start} = C_{eigen}$.

The algorithm used here explores all matrices of the shape $C_{eigen}J_{ab}(\theta)$, to which we add C_{eigen} itself. This gives us 3601 decompositions of Σ. Once all candidate decompositions are computed, the second step in our procedure consists of choosing among them. We identify the shocks using economically meaningful sign restrictions on cross-products of impulse responses over a window set equal to 12 quarters. An identifying decomposition is a decomposition for which one shock is a supply shock, a second one is a real demand shock and a third one is a monetary shock.[11] As the behaviour of impulse responses can be slightly different from sign restrictions for a given quarter, we allow for (a limited number of) mismatching values.

In doing so, we deviate from Canova and De Nicolò's (2002) procedure in one important way. Indeed, we do not try to match sign restrictions with impulse response correlations but with cross-products of impulse responses. The latter have the advantage of being much less influenced by outliers which, even if taken out of the computation by the handling of mismatches, would anyway influence correlations indirectly by their impact of the mean over a given window.[12]

3. Data description

Our database consists of quarterly series for eleven Asian countries over the period 1979Q1-2003Q4. Appendix A provides the reader with a description of the data sources. Our sample includes one advanced economy, namely Japan, and ten EA countries. The latter are China, Hong Kong, India, Indonesia, Korea, Malaysia,

[11] We allow the fourth shock to be either a repetition of the former three shocks or one that follows a different pattern.

[12] We compute cross-products of impulse responses by running Monte Carlo simulations. This involves drawing underlying parameters in a random fashion from the corresponding population distributions, and then computing values and cross-products of impulse responses for each random draw.

Philippines, Singapore, Taiwan and Thailand. Due to data availability constraints, these countries have different maximum sample periods (see Appendix B).

As mentioned in section 2, we use the following endogenous variables for each Asian country: industrial production as a measure of economic activity, CPI as a measure of domestic prices, real money balances (defined as M1/CPI), and the real effective exchange rate. The exogenous variables that we use to capture global effects outside the EA region include indicators of world economic activity and interest rates, the MSCI global equity price index, as well as (Brent) crude oil prices and an index for non-oil commodity prices (obtained from HWWA). For global economic activity and interest rates, our preferred measures are the G7 real GDP index computed by OECD and US Treasury bill rates, respectively. We transform the series just described in a way similar to Canova (2003). This means that all series are linearly detrended and seasonally adjusted using a simple linear regression on seasonal dummies.

4. Empirical results

We start by estimating the reduced form of the VAR model in (1) for each Asian economy. We then identify structural shocks using the approach outlined in section 3. Finally, we perform variance decomposition analysis and calculate cross-country correlations between structural shocks.

With regard to estimation, the lag selection tests done leads us to optimal values of p and q equal to 2 and 0, respectively. This means that, in all cases, we use 2 lags of the endogenous variables, while only the contemporaneous level of the exogenous variables enters the model significantly.[13] Moreover, an impulse dummy for 1997Q3 is found to be significant in the cases of India, Malaysia and Taiwan. The number of sign mismatches that is needed over a time horizon of 12 quarters to achieve identification looks overall reasonable: 2 for Indonesia and Japan; 3 for Thailand; 4 for China, Hong Kong, India, Korea, Malaysia, and the Philippines; 5 for Taiwan; and 7 for Singapore.

In the rest of the subsection, we discuss the results obtained in terms of variance decomposition analysis and cross-country correlations for two different estimation sample periods. The first sample period simply consists of the maximum available for

[13] In three cases, namely China, the Philippines and Singapore, our procedure does not allow us to identify the system using two lags for endogenous variables. We instead use 3 lags, given that AIC is increasing in p for those countries. Moreover, in the case of China, we also use seasonal dummies in the VAR model to remove residual seasonality detected in the original set of residuals.

each country (see Appendix B). In this case, when we compute cross-country correlations between structural shocks, we use different reference periods as determined by data availability but also lags used in model specifications. More specifically, correlations for series of structural errors are grouped in three periods as follows: 1980Q3-2003Q4 for India, Japan, Korea, Malaysia, and Taiwan; 1986Q3-2003Q4, adding Hong Kong, Indonesia, and the Philippines; and 1991Q4-2003Q4 with all countries. The second sample period is as follows: 1989Q3-2003Q4 for Hong Kong, India, Japan, Korea, Malaysia, the Philippines and Taiwan; and 1995Q2-2003Q4 for the remaining countries. In this case, we group correlations for series of structural errors as follows: 1991Q1-2003Q4 for the former countries, and 1996Q1-2003Q4 with all countries.

4.1. Full sample results

For the entire sample, variance decomposition results are reported in Table 1, while calculations of cross-country correlations between the three identified structural shocks appear in Tables 2 through 7.

Variance decomposition analysis shows that economies in EA are considerably driven by external variables, which capture developments in advanced economies as well as global commodity and equity prices. These external variables normally represent some 10-30% of the variation in industrial output, and even more in the cases of consumer prices, real money balances and real effective exchange rates. However, on balance, EA countries are still dominated by domestic factors. In particular with respect to output and price dynamics, domestic demand and supply shocks play a key role. Supply shocks are also important for understanding real exchange rate dynamics, while monetary shocks particularly help explain the behaviour of prices and real exchange rates.

With regard to cross-country correlations of structural shocks, looking at the results for links between demand, supply and monetary shocks suggests that there is considerable macroeconomic interaction among Emerging Asian countries in many structural dimensions, although strong links seem to be missing in many instances among Asia's largest players in intra-regional trade (Japan, China, Korea and Taiwan).

Correlations between demand shocks in Table 2 reveals relatively large interaction between Korea and both Indonesia and Japan, and Taiwan and both India and

Singapore. In addition, for a more recent period, China appears to interact largely with Singapore and Taiwan, and Thailand with India and Taiwan. These results seem to indicate that Taiwan stands as the country exhibiting the largest number of positive demand-demand interactions in the region. Positive links are normally missing among the countries contributing to large fractions of intra-regional trade, with the exception of China-Taiwan correlations.

In Table 3, correlations between supply shocks indicate a number of interactions between Korea and other EA countries, namely, India, Indonesia, Hong Kong, Singapore, and Thailand. Again, large players in regional trade do not exhibit considerable links. In particular, Japan appears to be little related to other economies in the region, perhaps due to the differences in Japanese production structure with respect to the other countries. These differences include a normally larger share of capital-goods production in the former country, as well as its specificities related to the reduced availability of loans from the banking sector over the last fifteen years. In contrast, Japan seems to interact much more, including links with large countries such as China, Korea and Taiwan, when it comes to correlations between its demand shocks and supply shocks in the latter countries– perhaps capturing a number of trade and FDI links between the two sides (see Table 5).[14]

Correlations between monetary shocks in Table 4 particularly uncover links of Taiwan with India, Japan and Korea, and of the latter country with Malaysia. Over a shorter sample, we also see considerable relation between China and both Malaysia and Singapore, perhaps pointing to monetary policies in all cases operating over long periods in time under conditions of limited exchange rate fluctuations. Overall, monetary shocks also point to little interaction between economies engaged in large shares of intra-regional trade.

4.2. Recent sample results

Results for the more recent sample periods are reported as follows: variance decompositions in Table 8, and cross-country correlations between the three identified structural shocks in Tables 9 through 14.

Variance decompositions in Table 8 indicate that EA economies may have been driven by global variables beyond the region even more in the last ten to fifteen years

[14] Such demand-supply interaction of Japan with EA appears to be robust to the use of an estimation sample reduced to more recent years, as shown by the comparison of Table 5 with Table 12.

than in an earlier period. Indeed, variables capturing movements in advanced economies' activity levels as well as global commodity and equity prices are often dominant in all cases but EA industrial output behaviour. Among domestic factors driving EA economies, we also notice considerable changes. The role of domestic demand appears to go down with the exception of its role in affecting real money balances, which was already rather low before. Also supply shocks lose some importance over recent years, as is noticeable with regard to output and consumer prices. Finally, monetary and unidentified shocks exhibit a larger share than in the earlier sample period.

Inspection of cross-country correlations of structural shocks in Tables 9 through 12 shows that the links between demand shocks seem to have changed considerably over the last years, while the interaction between supply and especially monetary shocks have remained more similar. As before, the results overall suggest that there is large EA macroeconomic links in many structural dimensions even as strong interaction appears to be missing in many instances among the countries contributing to large fractions of intra-regional trade.

Correlations between demand shocks in Table 9 still indicate that positive interaction is normally missing among the region's largest players in intra-regional trade. Other than that, demand-demand links seem to have changed dramatically with respect to the longer sample. In particular, we observe an increase in the interactions between India and Korea, Hong Kong and Taiwan, and more recently China and Hong Kong.

Unlike the case of demand shocks, correlations between supply shocks in Table 10 show that the picture has not changed considerably from the earlier sample results. While many links already existing remain rather unchanged, others strengthen or decline somewhat. In particular, there seems to be a decrease in the interaction of Korea with other countries, namely, Hong Kong, India, Indonesia and Japan. Finally, new links between Japan with both China and India, as well as those between Hong Kong and Indonesia, seem to emerge.

In Table 11, correlations between monetary shocks appear to have been the least altered by the reduction in estimation sample periods. The few exceptions of disappearing considerable relations are those of Taiwan with Japan and Korea, and that of China with Thailand.

In sum, the recent sample evidence shows that global factors may have played a more prominent role and that the pattern of correlations between structural – and especially

demand – shocks may have changed. In ant case, this evidence should be used with caution in light of shorter estimation sample sizes and thus reduced degrees of freedom involved.

5. Concluding remarks

The analysis in the present paper shows that Emerging Asian economies are considerably driven by developments in advanced economies as well as global commodity and equity prices, but are still dominated by domestic factors in particular with respect to output dynamics. Moreover, there is considerable macroeconomic interaction among Emerging Asian countries in many structural dimensions, although strong links seem to be missing in many instances among the region's largest players. Finally, we find evidence that global factors may have played a more prominent role over the last ten to fifteen years, although the use of shorter samples means that the latter results should be handled cautiously.

Our results rely on a new approach which addresses all these different geographical aspects within an integrated estimation and identification framework. Further research is however needed to further assess the robustness of our results, at least in the three following ways. First, at a rather general level, other measures of domestic and global macroeconomic behaviour could be used. For example, it would be worth employing alternative measures of domestic economic activity, including real GDP developments in those countries for which data availability over a reasonably long period is not an issue. Still at the domestic level, other monetary aggregates and interest rate data could be used to alternatively gauge the characteristics of the monetary transmission process. At the global level, alternative measures of economic activity could be employed, including trade-weighted real GDP using country-specific and time-varying weights in the computation. Second, decompositions could be pursued utilising alternative procedures, focusing for instance not on point estimates of impulse responses but also involving confidence bands, thereby attaching a more probabilistic flavour to our identification approach. Finally, macroeconomic interactions among Asian countries could be evaluated in different ways, including: 1) common factor analysis of structural shocks in an attempt to uncover pan-Asian business cycle characteristics, and 2) the use of correlations of impulse responses to shocks, in addition to those between the shocks themselves.

Appendix A. Data sources

We measure Asian economic activity by using industrial production data, which is available for all countries and obtained from IFS except for China, Hong Kong and Taiwan (national statistics). CPI is from IFS except for China, Hong Kong and Taiwan (national statistics). Real effective exchange rate series are from IFS for China, Japan, Malaysia, Philippines, and Singapore. For the other countries they are not available in IFS, so we take them from JP Morgan. For money supply, we use M1 series from IFS except for China where we use OECD MEI. We do not consider M1 data for Hong Kong and Taiwan because they are not available for a long enough period. Moreover, we employ M2 data from national statistics. Concerning global variables, world economic activity is measured in terms of G7 real GDP index from OECD quarterly national accounts. Brent oil prices in US dollars are from IFS. Non-oil commodity prices in US dollars are from the Hamburg Institute of International Economics (HWWA), and are computed using OECD countries' weights. The MSCI equity price index is provided by Morgan Stanley Capital International.

Appendix B. Samples used for different countries

Given that not all countries offer the same data availability over the period 1979Q1-2003Q4, we work with a shorter full sample size for many countries (see Table B below).

Table B. Maximum sample periods for each Asian country

Country	Sample starting quarter
China	1991Q1
Hong Kong	1982Q1
India	1979Q1
Indonesia	1986Q1
Japan	1980Q1
Korea	1980Q1
Malaysia	1979Q1
Philippines	1981Q1
Singapore	1980Q1
Taiwan	1979Q1
Thailand	1987Q1

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Table 1. Variance decompositions (full sample results)

A. Variance decomposition of real GDP (in %)

	Demand shock	Supply shock	Monetary shock	Unidentified	External	Total
China	49.6	0.0	1.2	14.4	34.8	100.0
Hong Kong	0.6	37.0	21.5	22.8	18.1	100.0
India	0.1	91.1	7.4	0.1	1.3	100.0
Indonesia	64.0	17.9	16.4	0.0	1.7	100.0
Japan	19.4	0.3	6.2	41.1	33.0	100.0
Korea	65.6	12.4	3.1	13.8	5.1	100.0
Malaysia	15.7	36.8	12.9	23.7	10.9	100.0
Philippines	0.5	80.0	0.2	6.6	12.7	100.0
Singapore	39.1	0.2	14.3	20.3	26.1	100.0
Taiwan	11.4	0.4	40.7	5.7	41.8	100.0
Thailand	11.4	19.8	37.0	17.9	13.9	100.0

B. Variance decomposition of consumer prices (in %)

	Demand shock	Supply shock	Monetary shock	Unidentified	External	Total
China	49.3	0.0	1.1	14.6	35.0	100.0
Hong Kong	1.2	66.1	1.8	20.5	10.4	100.0
India	20.3	43.7	9.3	12.5	14.2	100.0
Indonesia	4.8	36.7	50.6	2.5	5.4	100.0
Japan	26.1	4.0	0.5	46.0	23.4	100.0
Korea	37.5	28.4	3.6	22.6	7.9	100.0
Malaysia	16.2	6.8	13.0	53.2	10.8	100.0
Philippines	1.7	66.3	22.2	0.0	9.8	100.0
Singapore	16.7	0.6	17.8	42.1	22.8	100.0
Taiwan	39.7	1.0	8.6	19.6	31.1	100.0
Thailand	26.8	26.8	29.0	3.1	14.3	100.0

C. Variance decomposition of real money balances (in %)

	Demand shock	Supply shock	Monetary shock	Unidentified	External	Total
China	50.0	0.0	1.0	14.2	34.8	100.0
Hong Kong	2.9	29.5	8.6	14.8	44.2	100.0
India	7.4	4.5	4.3	81.7	2.1	100.0
Indonesia	5.2	34.8	53.0	3.8	3.2	100.0
Japan	36.0	0.7	2.6	45.1	15.6	100.0
Korea	3.0	71.1	9.5	5.9	10.5	100.0
Malaysia	47.9	22.0	11.5	7.1	11.5	100.0
Philippines	0.5	73.0	11.6	1.6	13.3	100.0
Singapore	2.7	55.6	5.8	9.1	26.8	100.0
Taiwan	17.3	48.0	0.7	2.5	31.5	100.0
Thailand	9.0	67.3	0.5	6.8	16.4	100.0

D. Variance decomposition of real effective exchange rates (in %)

	Demand shock	Supply shock	Monetary shock	Unidentified	External	Total
China	44.5	0.1	2.1	13.5	39.8	100.0
Hong Kong	16.4	77.2	0.6	0.0	5.8	100.0
India	1.1	26.9	59.7	0.2	12.1	100.0
Indonesia	34.0	13.8	49.1	0.2	2.9	100.0
Japan	6.4	81.3	1.6	3.1	7.6	100.0
Korea	2.7	5.2	83.1	1.3	7.7	100.0
Malaysia	2.7	1.0	0.0	84.3	12.0	100.0
Philippines	0.5	73.0	11.6	2.3	12.6	100.0
Singapore	3.0	11.3	11.8	0.0	73.9	100.0
Taiwan	8.2	37.4	11.5	31.7	11.2	100.0
Thailand	9.3	69.1	0.3	9.2	12.1	100.0

Table 2. Cross-country correlation coefficients for demand shocks (full sample results)

A. Period 1980:3 - 2003:4

	India	Japan	Korea	Malaysia	Taiwan
India	1.000				
Japan	-0.016	1.000			
Korea	-0.253	0.199	1.000		
Malaysia	-0.004	0.118	0.025	1.000	
Taiwan	0.099	-0.307	0.088	-0.253	1.000

B. Period 1986:3 - 2003:4

	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Taiwan
Hong Kong	1.000							
India	-0.111	1.000						
Indonesia	0.118	0.070	1.000					
Japan	-0.040	-0.059	-0.121	1.000				
Korea	-0.263	-0.079	0.158	0.296	1.000			
Malaysia	0.027	-0.036	-0.042	0.048	0.051	1.000		
Philippines	0.118	-0.136	-0.395	0.199	-0.254	0.431	1.000	
Taiwan	-0.013	0.271	0.035	-0.295	-0.094	-0.249	-0.057	1.000

C. Period 1991:4 - 2003:4

	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
China	1.000										
Hong Kong	-0.043	1.000									
India	-0.002	-0.137	1.000								
Indonesia	-0.165	0.161	-0.005	1.000							
Japan	-0.115	-0.034	0.017	-0.043	1.000						
Korea	-0.108	-0.415	0.007	0.302	0.265	1.000					
Malaysia	-0.226	0.015	-0.094	-0.047	0.030	-0.017	1.000				
Philippines	-0.110	0.099	-0.180	-0.458	0.271	-0.360	0.435	1.000			
Singapore	0.422	0.013	-0.029	0.413	-0.295	0.037	-0.329	-0.418	1.000		
Taiwan	0.334	-0.042	0.114	-0.010	-0.318	-0.026	-0.385	-0.175	0.388	1.000	
Thailand	0.100	-0.012	0.372	-0.173	-0.103	-0.164	-0.124	0.113	0.119	0.251	1.000

Table 3. Cross-country correlation coefficients for supply shocks (full sample results)

A. Period 1980:3 - 2003:4

	India	Japan	Korea	Malaysia	Taiwan
India	1.000				
Japan	0.005	1.000			
Korea	0.268	0.143	1.000		
Malaysia	-0.001	-0.118	0.069	1.000	
Taiwan	-0.029	-0.194	-0.046	0.228	1.000

B. Period 1986:3 - 2003:4

	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Taiwan
Hong Kong	1.000							
India	0.027	1.000						
Indonesia	0.209	0.040	1.000					
Japan	-0.010	0.036	0.108	1.000				
Korea	0.201	0.317	0.336	0.075	1.000			
Malaysia	0.181	0.008	0.051	-0.140	0.129	1.000		
Philippines	-0.047	0.087	-0.020	-0.068	-0.024	-0.057	1.000	
Taiwan	-0.198	-0.126	-0.120	-0.224	-0.030	0.291	-0.144	1.000

C. Period 1991:4 - 2003:4

	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
China	1.000										
Hong Kong	0.041	1.000									
India	-0.031	0.011	1.000								
Indonesia	0.009	0.307	0.022	1.000							
Japan	0.094	-0.006	0.024	0.145	1.000						
Korea	-0.003	0.176	0.335	0.401	0.020	1.000					
Malaysia	-0.003	0.125	0.021	0.068	-0.196	0.148	1.000				
Philippines	-0.315	-0.172	0.066	0.044	-0.248	-0.073	-0.124	1.000			
Singapore	0.017	0.065	0.117	-0.144	-0.029	0.132	0.030	0.324	1.000		
Taiwan	0.078	-0.190	-0.159	-0.188	-0.201	0.102	0.362	-0.042	0.242	1.000	
Thailand	-0.138	0.091	0.027	0.082	0.019	0.242	-0.212	-0.186	0.089	0.065	1.000

Table 4. Cross-country correlation coefficients for monetary shocks (full sample results)

A. Period 1980:3 - 2003:4

	India	Japan	Korea	Malaysia	Taiwan
India	1.000				
Japan	0.093	1.000			
Korea	0.041	0.061	1.000		
Malaysia	-0.193	0.071	0.128	1.000	
Taiwan	0.153	0.370	0.263	0.101	1.000

B. Period 1986:3 - 2003:4

	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Taiwan
Hong Kong	1.000							
India	-0.157	1.000						
Indonesia	0.128	-0.044	1.000					
Japan	0.057	-0.006	0.051	1.000				
Korea	-0.263	-0.034	0.057	-0.037	1.000			
Malaysia	0.004	-0.130	0.048	0.037	0.234	1.000		
Philippines	0.013	-0.076	0.043	-0.100	-0.183	0.019	1.000	
Taiwan	-0.206	0.131	0.048	0.282	0.219	0.102	-0.031	1.000

C. Period 1991:4 - 2003:4

	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
China	1.000										
Hong Kong	-0.140	1.000									
India	-0.106	-0.129	1.000								
Indonesia	-0.074	0.068	0.063	1.000							
Japan	0.017	-0.056	0.045	0.003	1.000						
Korea	-0.049	-0.410	0.030	0.169	-0.015	1.000					
Malaysia	0.143	-0.015	-0.020	-0.043	0.116	0.298	1.000				
Philippines	0.042	-0.045	-0.109	-0.103	-0.204	-0.198	-0.088	1.000			
Singapore	0.203	-0.153	-0.110	0.204	-0.018	0.211	0.026	-0.105	1.000		
Taiwan	0.083	-0.276	0.113	0.083	0.276	0.423	0.136	-0.097	0.203	1.000	
Thailand	0.071	-0.097	-0.355	0.083	0.016	0.024	-0.078	0.185	-0.016	0.095	1.000

Table 5. Cross-country correlation coefficients for demand and supply shocks (full sample results)

(demand shocks in rows, supply shocks in columns)

A. Period 1980:3 - 2003:4

	India	Japan	Korea	Malaysia	Taiwan
India	---	0.032	0.146	-0.034	0.136
Japan	0.098	---	0.194	-0.059	0.050
Korea	-0.104	-0.226	---	0.011	0.066
Malaysia	0.292	0.247	0.135	---	0.004
Taiwan	-0.157	-0.140	-0.256	-0.087	---

B. Period 1986:3 - 2003:4

	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Taiwan
Hong Kong	---	0.128	0.021	0.235	-0.184	-0.122	-0.100	-0.034
India	-0.050	---	-0.054	-0.197	0.060	-0.022	0.120	0.092
Indonesia	-0.038	-0.002	---	0.035	0.062	-0.047	-0.135	0.097
Japan	-0.260	0.057	-0.059	---	0.184	-0.078	-0.166	0.056
Korea	-0.477	0.037	-0.191	-0.217	---	-0.002	-0.125	0.116
Malaysia	-0.205	0.298	-0.027	0.140	0.196	---	-0.207	-0.023
Philippines	0.031	0.212	0.154	0.184	-0.065	-0.290	---	0.035
Taiwan	0.241	-0.102	-0.093	0.017	-0.273	0.048	0.235	---

C. Period 1991:4 - 2003:4

	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
China	---	0.271	-0.316	-0.100	-0.084	0.019	0.069	-0.048	-0.018	-0.122	0.151
Hong Kong	-0.071	---	0.115	0.025	0.179	-0.263	-0.124	-0.153	-0.038	-0.079	0.117
India	0.143	-0.038	---	0.012	-0.374	0.114	0.032	0.218	0.215	-0.020	0.390
Indonesia	0.084	-0.055	0.062	---	0.028	-0.044	-0.048	-0.185	0.078	0.115	0.052
Japan	0.164	-0.244	0.081	-0.099	---	0.245	-0.159	-0.124	0.082	0.217	0.205
Korea	-0.011	-0.599	-0.029	-0.177	-0.201	---	-0.159	-0.124	0.082	0.217	0.205
Malaysia	-0.023	-0.145	0.271	0.062	0.168	0.243	---	-0.159	0.168	-0.102	-0.039
Philippines	-0.094	0.082	0.213	0.258	0.176	0.058	-0.290	---	0.137	-0.009	0.055
Singapore	-0.068	0.166	-0.185	-0.079	-0.139	-0.093	0.029	-0.002	---	0.021	0.003
Taiwan	-0.231	0.360	-0.268	-0.176	-0.172	-0.312	-0.123	0.226	0.028	---	0.022
Thailand	0.111	0.251	-0.148	0.134	-0.260	-0.116	0.142	0.329	0.224	-0.088	---

Table 6. Cross-country correlation coefficients for demand and monetary shocks (full sample results)

(demand shocks in rows, monetary shocks in columns)

A. Period 1980:3 - 2003:4

	India	Japan	Korea	Malaysia	Taiwan
India	---	0.032	0.146	-0.034	0.136
Japan	0.098	---	0.194	-0.059	0.050
Korea	-0.104	-0.226	---	0.011	0.066
Malaysia	0.292	0.247	0.135	---	0.004
Taiwan	-0.157	-0.140	-0.256	-0.087	---

B. Period 1986:3 - 2003:4

	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Taiwan
Hong Kong	---	0.128	0.021	0.235	-0.184	-0.122	-0.100	-0.034
India	-0.050	---	-0.054	-0.197	0.060	-0.022	0.120	0.092
Indonesia	-0.038	-0.002	---	0.035	0.062	-0.047	-0.135	0.097
Japan	-0.260	0.057	-0.059	---	0.184	-0.078	-0.166	0.056
Korea	-0.477	0.037	-0.191	-0.217	---	-0.002	-0.125	0.116
Malaysia	-0.205	0.298	-0.027	0.140	0.196	---	-0.207	-0.023
Philippines	0.031	0.212	0.154	0.184	-0.065	-0.290	---	0.035
Taiwan	0.241	-0.102	-0.093	0.017	-0.273	0.048	0.235	---

C. Period 1991:4 - 2003:4

	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
China	---	0.271	-0.316	-0.100	-0.084	0.019	0.069	-0.048	-0.018	-0.122	0.151
Hong Kong	-0.071	---	0.115	0.025	0.179	-0.263	-0.124	-0.153	-0.038	-0.079	0.117
India	0.143	-0.038	---	0.012	-0.374	0.114	0.032	0.218	0.215	-0.020	0.390
Indonesia	0.084	-0.055	0.062	---	0.028	-0.044	-0.048	-0.185	0.078	0.115	0.052
Japan	0.164	-0.244	0.081	-0.099	---	0.245	-0.159	-0.124	0.082	0.217	0.205
Korea	-0.011	-0.599	-0.029	-0.177	-0.201	---	-0.159	-0.124	0.082	0.217	0.205
Malaysia	-0.023	-0.145	0.271	0.062	0.168	0.243	---	-0.159	0.168	-0.102	-0.039
Philippines	-0.094	0.082	0.213	0.258	0.176	0.058	-0.290	---	0.137	-0.009	0.055
Singapore	-0.068	0.166	-0.185	-0.079	-0.139	-0.093	0.029	-0.002	---	0.021	0.003
Taiwan	-0.231	0.360	-0.268	-0.176	-0.172	-0.312	-0.123	0.226	0.028	---	0.022
Thailand	0.111	0.251	-0.148	0.134	-0.260	-0.116	0.142	0.329	0.224	-0.088	---

Table 7. Cross-country correlation coefficients for supply and monetary shocks (full sample results)

(supply shocks in rows, monetary shocks in columns)

A. Period 1980:3 - 2003:4

	India	Japan	Korea	Malaysia	Taiwan
India	---	-0.002	-0.115	-0.028	-0.133
Japan	0.077	---	0.138	0.087	-0.092
Korea	-0.005	-0.203	---	0.090	-0.009
Malaysia	-0.003	0.054	-0.034	---	0.263
Taiwan	0.215	0.124	0.133	0.057	---

B. Period 1986:3 - 2003:4

	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Taiwan
Hong Kong	---	-0.162	-0.037	0.123	0.232	-0.093	0.019	0.211
India	0.148	---	0.106	-0.183	-0.330	0.063	0.042	-0.277
Indonesia	-0.102	-0.141	---	-0.258	0.221	0.192	0.114	0.306
Japan	0.265	0.089	-0.055	---	0.084	0.085	-0.121	-0.122
Korea	-0.150	-0.056	0.057	-0.247	---	0.156	0.106	0.029
Malaysia	-0.209	-0.002	-0.201	0.062	0.024	---	-0.166	0.344
Philippines	0.075	-0.179	0.185	-0.035	-0.119	-0.142	---	-0.243
Taiwan	-0.218	0.332	-0.005	0.081	0.035	0.044	-0.052	---

C. Period 1991:4 - 2003:4

	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
China	---	-0.060	-0.140	-0.165	0.074	0.176	0.191	0.155	0.009	0.114	0.053
Hong Kong	-0.191	---	-0.119	-0.031	0.019	0.230	-0.099	-0.061	0.194	0.222	0.207
India	0.263	0.094	---	0.010	-0.277	-0.325	0.051	0.032	0.008	-0.292	-0.124
Indonesia	0.060	-0.072	-0.247	---	-0.271	0.366	0.234	0.233	0.183	0.313	0.301
Japan	-0.204	0.396	0.062	-0.035	---	0.125	0.143	-0.262	0.123	-0.107	-0.181
Korea	0.260	-0.228	-0.031	0.040	-0.285	---	0.143	-0.262	0.123	-0.107	-0.181
Malaysia	-0.021	-0.222	0.027	-0.229	0.037	0.040	---	-0.221	-0.019	0.380	0.241
Philippines	0.138	-0.023	-0.083	0.153	-0.179	-0.184	-0.131	---	0.218	-0.222	0.167
Singapore	0.181	-0.155	0.024	0.149	-0.086	0.045	-0.036	-0.181	---	0.119	-0.159
Taiwan	0.036	-0.302	0.292	-0.049	0.106	0.196	0.019	-0.142	0.006	---	-0.235
Thailand	-0.087	-0.121	0.296	0.151	-0.157	0.310	0.135	-0.009	0.074	0.045	---

Table 8. Variance decompositions (recent sample results)

A. Variance decomposition of real GDP (in %)

	Demand shock	Supply shock	Monetary shock	Unidentified	External	Total
China	4.2	7.1	5.3	47.5	35.9	100.0
Hong Kong	0.3	1.2	8.3	56.2	34.0	100.0
India	1.8	0.3	13.6	83.2	1.1	100.0
Indonesia	29.3	4.7	31.8	2.1	32.1	100.0
Japan	0.6	34.5	25.7	10.3	28.9	100.0
Korea	26.2	32.8	22.0	9.8	9.2	100.0
Malaysia	7.5	54.3	27.3	5.8	5.1	100.0
Philippines	4.6	53.8	17.8	6.2	17.6	100.0
Singapore	15.1	14.5	0.9	0.8	68.7	100.0
Taiwan	2.5	34.1	32.7	13.2	17.5	100.0
Thailand	2.7	11.4	6.8	2.0	77.1	100.0

B. Variance decomposition of consumer prices (in %)

	Demand shock	Supply shock	Monetary shock	Unidentified	External	Total
China	2.7	10.1	1.8	52.9	32.5	100.0
Hong Kong	1.3	3.7	10.2	64.9	19.9	100.0
India	6.3	1.8	27.5	53.3	11.1	100.0
Indonesia	0.8	11.5	1.3	7.5	78.9	100.0
Japan	28.6	15.6	2.4	10.5	42.9	100.0
Korea	29.3	27.0	7.0	21.0	15.7	100.0
Malaysia	11.8	36.5	9.1	16.4	26.2	100.0
Philippines	0.0	17.6	10.6	25.6	46.2	100.0
Singapore	24.8	22.1	0.7	17.4	35.0	100.0
Taiwan	8.6	37.5	29.8	14.8	9.3	100.0
Thailand	2.4	7.7	3.0	3.1	83.8	100.0

C. Variance decomposition of real money balances (in %)

	Demand shock	Supply shock	Monetary shock	Unidentified	External	Total
China	41.0	1.1	0.7	17.9	39.3	100.0
Hong Kong	27.2	8.8	0.3	7.3	56.4	100.0
India	1.7	2.1	66.1	26.7	3.4	100.0
Indonesia	3.7	0.9	0.7	27.1	67.6	100.0
Japan	7.8	20.7	10.5	24.0	37.0	100.0
Korea	7.7	50.2	31.3	1.0	9.8	100.0
Malaysia	13.4	21.1	8.2	31.7	25.6	100.0
Philippines	1.3	17.9	2.1	43.8	34.9	100.0
Singapore	21.7	23.5	0.4	20.7	33.7	100.0
Taiwan	4.4	47.5	24.2	11.9	12.0	100.0
Thailand	2.2	8.5	6.0	6.0	77.3	100.0

D. Variance decomposition of real effective exchange rates (in %)

	Demand shock	Supply shock	Monetary shock	Unidentified	External	Total
China	1.5	7.0	1.0	73.2	17.3	100.0
Hong Kong	0.1	0.5	7.7	54.5	37.2	100.0
India	4.4	21.2	12.8	58.4	3.2	100.0
Indonesia	2.0	26.0	4.8	1.6	65.6	100.0
Japan	0.6	34.5	25.7	10.3	28.9	100.0
Korea	42.7	14.2	30.0	1.2	11.9	100.0
Malaysia	6.2	3.5	1.5	80.6	8.2	100.0
Philippines	0.6	19.2	3.2	42.3	34.7	100.0
Singapore	21.0	26.8	0.3	20.3	31.6	100.0
Taiwan	18.3	0.2	49.9	14.9	16.7	100.0
Thailand	2.4	7.8	3.2	3.5	83.1	100.0

Note: The sample period is shortened to 1990:1-2003:4 in all cases but China, Indonesia, Singapore and Thailand, where the sample period is shortened to 1996:1-2003:4.

Table 9. Cross-country correlation coefficients for demand shocks (recent sample results)

A. Period 1990:1 - 2003:4

	Hong Kong	India	Japan	Korea	Malaysia	Philippines	Taiwan
Hong Kong	1.000						
India	-0.136	1.000					
Japan	-0.023	-0.081	1.000				
Korea	-0.100	0.182	-0.155	1.000			
Malaysia	-0.124	-0.213	-0.014	-0.129	1.000		
Philippines	0.082	-0.309	-0.112	0.030	-0.206	1.000	
Taiwan	0.233	-0.095	-0.081	-0.225	-0.221	0.010	1.000

B. Period 1996:1 - 2003:4

	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
China	1.000										
Hong Kong	0.196	1.000									
India	0.023	-0.093	1.000								
Indonesia	-0.074	-0.059	-0.003	1.000							
Japan	-0.134	-0.048	0.284	0.220	1.000						
Korea	0.285	-0.106	0.247	-0.182	0.053	1.000					
Malaysia	-0.166	-0.059	-0.067	-0.015	-0.116	-0.216	1.000				
Philippines	0.028	-0.024	-0.346	0.063	-0.100	-0.006	-0.225	1.000			
Singapore	-0.018	-0.068	-0.262	0.258	0.028	-0.140	0.141	0.205	1.000		
Taiwan	-0.150	0.346	0.000	-0.261	-0.199	-0.066	-0.181	0.009	-0.205	1.000	
Thailand	0.190	-0.056	-0.181	0.169	-0.298	-0.009	-0.170	0.220	-0.189	0.047	1.000

Table 10. Cross-country correlation coefficients for supply shocks (recent sample results)

A. Period 1990:1 - 2003:4

	Hong Kong	India	Japan	Korea	Malaysia	Philippines	Taiwan
Hong Kong	1.000						
India	-0.093	1.000					
Japan	0.489	-0.165	1.000				
Korea	0.103	-0.243	0.148	1.000			
Malaysia	-0.158	-0.078	-0.097	0.079	1.000		
Philippines	-0.215	-0.095	-0.210	-0.118	-0.344	1.000	
Taiwan	-0.174	0.208	-0.021	-0.102	-0.322	0.021	1.000

B. Period 1996:1 - 2003:4

	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
China	1.000										
Hong Kong	-0.013	1.000									
India	-0.065	-0.245	1.000								
Indonesia	-0.096	0.703	-0.231	1.000							
Japan	0.213	0.574	-0.088	0.379	1.000						
Korea	-0.186	0.122	-0.313	0.082	0.003	1.000					
Malaysia	-0.224	-0.113	0.020	-0.046	-0.187	0.378	1.000				
Philippines	-0.066	-0.181	-0.287	-0.017	-0.231	-0.296	-0.548	1.000			
Singapore	0.153	-0.295	-0.121	-0.281	-0.122	0.052	0.102	-0.132	1.000		
Taiwan	-0.002	-0.133	0.175	-0.157	-0.005	-0.212	-0.375	0.116	-0.054	1.000	
Thailand	-0.275	-0.055	-0.356	-0.043	-0.027	0.055	0.158	0.158	0.166	-0.343	1.000

Table 11. Cross-country correlation coefficients for monetary shocks (recent sample results)

A. Period 1990:1 - 2003:4

	Hong Kong	India	Japan	Korea	Malaysia	Philippines	Taiwan
Hong Kong	1.000						
India	-0.341	1.000					
Japan	-0.185	0.115	1.000				
Korea	0.262	-0.338	0.090	1.000			
Malaysia	-0.041	0.053	0.284	0.231	1.000		
Philippines	0.157	0.187	0.196	-0.150	0.196	1.000	
Taiwan	0.373	-0.304	-0.180	0.070	0.061	-0.052	1.000

B. Period 1996:1 - 2003:4

	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
China	1.000										
Hong Kong	0.022	1.000									
India	0.255	-0.457	1.000								
Indonesia	-0.056	-0.154	-0.166	1.000							
Japan	-0.046	-0.163	0.117	0.100	1.000						
Korea	-0.242	0.208	-0.492	0.128	-0.044	1.000					
Malaysia	-0.322	-0.051	0.037	-0.393	0.090	0.226	1.000				
Philippines	-0.188	0.057	0.088	-0.151	0.241	-0.180	0.263	1.000			
Singapore	0.254	-0.239	0.197	0.194	0.002	0.084	-0.181	0.019	1.000		
Taiwan	-0.430	0.317	-0.299	-0.232	-0.173	0.042	0.263	0.159	-0.333	1.000	
Thailand	0.015	0.354	-0.097	0.078	-0.211	0.253	-0.150	-0.208	-0.012	0.359	1.000

Table 12. Cross-country correlation coefficients for demand and supply shocks (recent sample results)

(demand shocks in rows, supply shocks in columns)

A. Period 1990:1 - 2003:4

	Hong Kong	India	Japan	Korea	Malaysia	Philippines	Taiwan
Hong Kong	---	-0.230	-0.010	0.366	0.043	0.088	0.326
India	0.029	---	-0.058	-0.172	-0.330	-0.070	0.158
Japan	0.079	-0.024	---	0.195	0.132	-0.184	-0.040
Korea	-0.105	-0.057	-0.136	---	-0.090	0.060	-0.025
Malaysia	-0.156	0.210	0.096	-0.309	---	0.282	0.099
Philippines	-0.018	0.073	-0.158	0.160	0.275	---	-0.056
Taiwan	0.240	-0.151	0.124	0.346	0.224	0.077	---

B. Period 1996:1 - 2003:4

	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
China	---	0.208	0.161	-0.313	0.071	0.084	-0.152	0.101	0.310	-0.155	0.228
Hong Kong	-0.183	---	-0.248	-0.042	0.158	0.227	0.044	0.077	-0.098	0.260	0.292
India	0.011	-0.002	---	0.255	-0.155	0.118	-0.203	-0.306	-0.062	0.155	0.532
Indonesia	0.274	-0.045	0.219	---	0.132	-0.406	-0.109	-0.043	0.079	-0.108	-0.401
Japan	0.090	0.079	-0.008	-0.099	---	0.222	0.080	-0.285	-0.221	0.161	0.117
Korea	-0.155	-0.109	-0.280	-0.057	0.020	---	0.080	-0.285	-0.221	0.161	0.117
Malaysia	-0.417	-0.063	0.129	-0.091	0.055	-0.355	---	0.433	-0.364	0.376	-0.149
Philippines	0.186	-0.092	0.136	-0.188	-0.197	0.059	0.342	---	0.277	-0.089	-0.273
Singapore	-0.131	-0.025	0.065	-0.330	0.298	-0.164	0.321	0.225	---	0.089	-0.388
Taiwan	0.076	0.455	-0.337	-0.005	-0.120	0.069	0.169	0.070	-0.220	---	0.353
Thailand	0.316	0.103	-0.051	-0.196	-0.428	-0.078	-0.040	-0.272	0.054	-0.084	---

Table 13. Cross-country correlation coefficients for demand and monetary shocks (recent sample results)

(demand shocks in rows, monetary shocks in columns)

A. Period 1990:1 - 2003:4

	Hong Kong	India	Japan	Korea	Malaysia	Philippines	Taiwan
Hong Kong	---	-0.230	-0.010	0.366	0.043	0.088	0.326
India	0.029	---	-0.058	-0.172	-0.330	-0.070	0.158
Japan	0.079	-0.024	---	0.195	0.132	-0.184	-0.040
Korea	-0.105	-0.057	-0.136	---	-0.090	0.060	-0.025
Malaysia	-0.156	0.210	0.096	-0.309	---	0.282	0.099
Philippines	-0.018	0.073	-0.158	0.160	0.275	---	-0.056
Taiwan	0.240	-0.151	0.124	0.346	0.224	0.077	---

B. Period 1996:1 - 2003:4

	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
China	---	0.208	0.161	-0.313	0.071	0.084	-0.152	0.101	0.310	-0.155	0.228
Hong Kong	-0.183	---	-0.248	-0.042	0.158	0.227	0.044	0.077	-0.098	0.260	0.292
India	0.011	-0.002	---	0.255	-0.155	0.118	-0.203	-0.306	-0.062	0.155	0.532
Indonesia	0.274	-0.045	0.219	---	0.132	-0.406	-0.109	-0.043	0.079	-0.108	-0.401
Japan	0.090	0.079	-0.008	-0.099	---	0.222	0.080	-0.285	-0.221	0.161	0.117
Korea	-0.155	-0.109	-0.280	-0.057	0.020	---	0.080	-0.285	-0.221	0.161	0.117
Malaysia	-0.417	-0.063	0.129	-0.091	0.055	-0.355	---	0.433	-0.364	0.376	-0.149
Philippines	0.186	-0.092	0.136	-0.188	-0.197	0.059	0.342	---	0.277	-0.089	-0.273
Singapore	-0.131	-0.025	0.065	-0.330	0.298	-0.164	0.321	0.225	---	0.089	-0.388
Taiwan	0.076	0.455	-0.337	-0.005	-0.120	0.069	0.169	0.070	-0.220	---	0.353
Thailand	0.316	0.103	-0.051	-0.196	-0.428	-0.078	-0.040	-0.272	0.054	-0.084	---

Table 14. Cross-country correlation coefficients for supply and monetary shocks (recent sample results)

(supply shocks in rows, monetary shocks in columns)

A. Period 1990:1 - 2003:4

	Hong Kong	India	Japan	Korea	Malaysia	Philippines	Taiwan
Hong Kong	---	-0.077	0.101	-0.122	-0.324	0.017	0.102
India	0.196	---	-0.175	0.191	0.010	-0.169	0.186
Japan	0.062	-0.011	---	0.050	-0.184	0.101	0.062
Korea	0.020	-0.210	0.219	---	0.035	0.166	-0.071
Malaysia	-0.127	-0.076	0.012	0.119	---	0.003	-0.481
Philippines	-0.069	0.316	0.333	-0.156	0.292	---	-0.089
Taiwan	0.327	-0.313	-0.110	0.201	0.226	-0.020	---

B. Period 1996:1 - 2003:4

	China	Hong Kong	India	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand
China	---	-0.094	0.307	-0.300	0.164	-0.160	0.261	0.212	0.242	0.036	0.100
Hong Kong	-0.122	---	-0.060	0.290	0.312	-0.076	-0.356	0.189	-0.056	0.170	0.396
India	-0.027	0.029	---	0.083	-0.423	0.240	0.108	-0.227	-0.156	0.130	0.228
Indonesia	-0.070	0.057	0.026	---	0.085	-0.102	-0.210	0.157	-0.142	0.076	0.179
Japan	-0.197	0.068	0.205	0.254	---	-0.083	-0.152	0.231	-0.033	0.185	0.585
Korea	-0.081	-0.096	-0.070	0.032	0.287	---	-0.152	0.231	-0.033	0.185	0.585
Malaysia	0.049	-0.031	-0.186	0.257	-0.089	0.241	---	0.052	0.099	-0.495	-0.267
Philippines	0.111	-0.088	0.380	-0.296	0.042	-0.538	0.215	---	-0.120	0.080	-0.277
Singapore	0.249	-0.233	0.197	0.174	-0.057	0.237	0.008	-0.019	---	-0.263	-0.138
Taiwan	-0.371	0.231	-0.301	-0.250	-0.127	0.170	0.474	0.233	-0.300	---	0.136
Thailand	0.112	-0.235	0.135	0.358	0.197	-0.316	-0.280	-0.114	0.217	-0.307	---