Discussion Paper No. 571

A CURRENCY UNION IN EAST ASIA

Jong-Wha Lee
Yung Chul Park
and
Kwanho Shin

March 2003

The Institute of Social and Economic Research
Osaka University
6-1 Mihogaoka, Ibaraki, Osaka 567-0047, Japan

A Currency Union in East Asia*

Jong-Wha Lee

Yung Chul Park

and

Kwanho Shin

Korea University

May 2002

Preliminary draft

Abstract

This paper investigates prospects of a currency union in East Asia, focusing on trade and financial integration occurring in the region. We find, based on a dynamic factor model, regional common shocks have been quantitatively important for output variations in the Asian economies. We expect that continuing trade integration in the region will lead to further synchronization of business cycles, thereby encouraging East Asian countries to create a currency union in the region. In contrast to trade, however, financial liberalization in East Asia tends to lead to more global integration, rather than regional integration, of the financial systems, and thereby is not likely to develop favorable conditions for forming a regional currency union among East Asian countries.

*This paper was prepared as a background paper for the Asian Development Bank's "Study on Monetary and Financial Cooperation in East Asia" (TA6000-REG). We are grateful for research assistance from Woongjai Baek.

1. Introduction

This paper assesses the feasibility and desirability of a common currency arrangement in East Asia. We examine empirically whether East Asia satisfies preconditions for an optimum currency area, and then discuss prospects of forming a successful currency union among East Asian countries in the near future, especially focusing on trade and financial integration occurring in the region.

A number of studies have shown that the *de facto* currency pegs against the US dollar was one of the major causes of recent financial crises in East Asia. After the eruption of the crises, East Asian countries were forced to abandon the dollar peg system and adopt a floating exchange rate. An important question is whether the new exchange rate system gives enough confidence to these economies, and thus in the long run it can serve as a permanent choice to them. Although it is too early to judge the role of the flexible exchange rate in the post-crisis performance of the East Asian economies, much concern has raised on the undesirable aspects of increased instability in the foreign exchange market. Further, critics say that contrary to expectations, the free-floating system has not clearly enabled East Asian countries to retain their monetary autonomy.

This post-crisis experience has led many researchers to advocate alternative exchange rate arrangements that can enhance stability and credibility in the exchange rate. Williamson (1999) and Dornbusch and Park (2000) advocate a common-basket exchange rate peg for the East Asian region. They argue that East Asian countries can expect to stabilize the overall export competitiveness by pegging their currencies to a basket of the yen, dollar and euro. This proposal seems to receive supports from many

Japanese government officials and economists. Other prominent U.S. economists such as Barro (2001) and McKinnon (1999) also proposed a currency union adopting the US dollar as a common currency.

This paper makes an assessment of the feasibility and desirability of a currency union in East Asia. The theory of common currency area (OCA) lists many important criteria for a common currency area in a region. They include the symmetry of shocks across countries, trade and financial integration, and labor mobility and wage flexibility. Bayoumi and Eichengreen (1999), and Baek and Song (2001) argue that on pure OCA grounds East Asia is a plausible candidate for a common currency area, as the Euro area. We extend their work by improving the methodology of assessing the symmetry of shocks. We consider a model in which output of an economy is influenced by three different shocks- global, regional, and country-specific. The importance of a common regional shock would provide a case for a regional common currency.

After decomposing shocks among the world common, the region common and the country-specific shocks for each economy, we will evaluate the feasibility of a common currency area in East Asia by comparing the estimates between Asian and European countries. The greater the size of the region common shocks is, the more desirable it will be for that area to form a common currency arrangement. This paper then investigates the determinants of the relative size of the region common shocks across countries. We investigate how variables such as intra-region trade, industrial and trade structure, and income difference have effects on the size of common shocks among countries.

Given the extent to which the East Asian countries have managed to liberalize their current and capital account transactions over the last decades, an interesting

question is whether the continuing trade and financial integration would increase market pressures for forming a common currency arrangement in the region. We assess the recent development of trade and financial integration in East Asia and discuss the perspectives for a currency union.

The paper is organized as follows. Section 2 develops the empirical model that we use to analyze output co-movements across countries. Section 3 presents the estimates of each economy's output variances decomposed by the world common, the region common and the country-specific shocks. We use these estimates to compare the size of regional common shocks in East Asia to that in European countries. Section 4 investigates the determinants of output co-movements in the region. We discuss perspectives for an Asian currency union in relation to trade integration among East Asian countries in Section 5. Section 6 will focus on the implications of capital market integration for a currency union in East Asia. Concluding remarks follow in Section 7.

2. An Empirical Specification of Output Co-Movements

As pointed by Mundell (1961), the major costs of joining a currency union are the loss of independent monetary policy. The costs are, however, significantly lessened if business cycles are synchronized among the member countries, because in this case the common monetary policy can do as good as the individual monetary policy. Hence, to judge the costs of joining a currency union, it has been crucial to measure how asymmetric shocks are across candidate countries.

In the OCA literature the degree of how symmetric shocks is mainly measured by a simple correlation between countries. Usually an anchor country is picked up, and the correlation is calculated between a country and the anchor country. We believe that this approach has some disadvantages in the following reasons. First, since we are eventually interested in the net benefits of adopting a common monetary policy across economies in the region, the degree of region-wide co-movements, rather than bilateral ones, seem to be a more appropriate measure. Second, the simple correlation does not offer the sources of the shocks: it may be the third factor such as the world common shocks that induce a high correlation between countries. Then forming a currency union solely based on the regional context could be misleading, and more globalized arrangement would be desirable. The third problem with using bilateral measures in Asia is that no single country plausibly offers a regional anchor. In Europe, Germany has been playing the pivotal role in acting as a center country in shaping EMU, however, in Asia, it would be difficult to expect Japan to play a similar role.

We set up a model in which the world economy consists of many different regions and each region consists of many different countries. We interpret that the movement of an aggregate output in each country j is decomposed into three components: a world common component, a region common component and a country-specific component. The world common component influences on every country in the world, while the region common component influences only on the countries that belong to the same region. The influence of the country-specific component is restricted to the specific country. For example, the output of Korea fluctuates due to shocks to the world economy, shocks to Asian region or Korea-specific shocks.

The above interpretation of the world economy can be described by a dynamic factor model. The dynamic factor model has been used by many studies, as it was popularized by Stock and Watson (1991). Other studies based on the dynamic factor model include Geweke (1977), Geweke and Singleton (1980), Sargent and Sims (1977) and Gregory, Head and Raynauld (1997).

Let Y_{jt}^{r} denote a measure of aggregate output at time *t* for country *j* belonging to region *r*. There are three regions considered: Asia, Europe and North America regions. If *r*=1, that country belongs to Asia, if *r*=2, it belongs to Europe, and if *r*=3, it belongs to North America. Let W_t be an unobservable component of world economic activity common to all the countries and R_t^r be an unobservable component common to each country belonging to the same region *r*. We will refer to these as the world common and the region common factors. Further we assume that the output series for each country is decomposed into three separate components:

$$Y_{jt}^{r} = \alpha_{wj} W_t + \alpha_{rj} R_t^r + \varepsilon_{jt} \qquad (1)$$

Here ε_{jt} represents a country specific factor to country j. The coefficients, α_{wj} and α_{rj}, are impact coefficients on factors, W_t and R_t^r, for country j. The fact that we allow the impact coefficients to differ across countries implies that the world common and the region common factors influence each country with different degrees of magnitude.

Following Stock and Watson (1991) we assume that the three factors follow a stationary univariate autoregressive process. More specifically we further assume that these processes are all first-order as follows:

$$W_t = \rho_w W_{t-1} + \eta_t^W \qquad (2)$$

$$R_t^r = \rho_r R_{t-1}^r + \eta_{rt}^R \qquad (3)$$

$$\varepsilon_{jt} = \rho_j \varepsilon_{jt-1} + \eta_{jt}^{\varepsilon} \qquad (4)$$

We also assume that all the errors, η_t^W , η_{rt}^R and η_{jt}^{ε} in equations (2), (3) and (4) are uncorrelated both serially and contemporaneously. These are the fundamental sources of the shocks in the economy.

The assumption that the errors are contemporaneously uncorrelated implies that there is no explicit co-movement among factors. This assumption is needed to identify the factors in our model.

Before the raw data are applied to the model, they are detrended to generate cyclical components using a standard method: the raw data are first-differenced in logarithms and then cycles in growth rates are analyzed. We do not adopt another standard method, the Hodrick-Prescott filter, that decomposes each series into trend and cyclical components because the series are annual and rather short.

There are two additional considerations to be made before the actual estimation is performed. First, for all detrended series, the sample mean is removed and the variance is standardized to one. This is necessary for all series to receive the equal weights in estimating the common factors. Since the estimation is obtained by

minimizing the variance of country-specific errors, if the variance of the series is not equalized across countries, those countries with high variances can overly influence the estimation procedure. By standardizing the series, we ensure that all the countries receive equal treatment irrespective of the size.

Second, the variances of the error terms in equation (2) and (3), and the coefficients in equation (1) cannot be separately identified. For example, by setting the variance of η_t^W arbitrarily smaller, the magnitude of the world common factor gets also smaller and this is balanced by a larger estimate of the coefficient, α_{wj} for all countries. We get around this problem by normalizing the variances of η_t^W and η_{rt}^R to unity. Since this assumption affects the magnitude of the estimated coefficients, we rather base our quantitative analyses on variance decompositions.

It is straightforward to transform the dynamic factor model consisting of equation (1), (2), (3) and (4) into the usual state-space/measurement equation form. This is a necessary step to implement the model in the empirical analyses.[1]

Based on this model, we can measure the quantitative influence of the different common factors on fluctuations in aggregate output in each country. Let S_j^f denote the share of the variance of aggregate output for country j accounted for by variation in the factor $f = w, r, \varepsilon$. Under the assumption that the world common, the region common, and the country-specific factors are orthogonal, the variance of aggregate output for country j can be decomposed into three terms:

---

[1] A detailed derivation and a numerical maximization method are explained in appendix A and B respectively.

$$\sigma_j^2 \;=\; \alpha_{wj}^2 \sigma_w^2 \;+\; \alpha_{rj}^2 \sigma_r^2 \;+\; \sigma_\varepsilon^{j2} \qquad (5)$$

where σ_f^2, $f = w, r$ and σ_ε^{j2} are variances of the world, the region common, and the country-specific factors respectively. Further the normalization to unity of the innovations to the world common, the region common, and the country-specific factors enables us to compute estimates of S_j^f as follows:

$$S_j^f = \frac{\alpha_{fj}^2 \sigma_f^2}{\alpha_{wj}^2 \sigma_w^2 + \alpha_{rj}^2 \sigma_r^2 + \sigma_{\varepsilon j}^2} = \frac{\dfrac{\alpha_{fj}^2}{1-\rho_f^2}}{\dfrac{\alpha_{wj}^2}{1-\rho_w^2} + \dfrac{\alpha_{rj}^2}{1-\rho_r^2} + \dfrac{\sigma_\eta^{j2}}{1-\rho_j^2}} \;,\; f = w, r \quad (6)$$

and

$$S_j^\varepsilon = \frac{\dfrac{\sigma_\varepsilon^{j2}}{1-\rho_j^2}}{\dfrac{\alpha_{wj}^2}{1-\rho_w^2} + \dfrac{\alpha_{rj}^2}{1-\rho_r^2} + \dfrac{\sigma_\eta^{j2}}{1-\rho_j^2}} \qquad (7)$$

where σ_η^{j2} is the variance of η_{jt}^ε.

The estimates of the shares accounted for by the world common, the region common and the country-specific factors will play a crucial role in evaluating if countries belonging to the same region are eligible to form a regional currency arrangement. Especially a large value of the share accounted for by the region common

factor – capturing how symmetric shocks are within a region - constitutes a prima facie case for a currency union. For example, if a country exhibits a large value of the share accounted for by the region common factor, then its business cycle movement is largely synchronized to the region, indicating that a regional common monetary policy is more or less capable to respond to the disturbances. On the other hand, if a country possesses a smaller value of the share accounted for by the region common factor and a larger value of that accounted for by the country-specific factor, it needs to rely more heavily on its own independent counter-cyclical monetary policy.

3. Decomposition of Output Variations in East Asian and European Countries

For estimation of the model, annual data on real GDP are collected for 10 East Asian countries, 16 European countries and 2 North American countries over the period 1978-99. The East Asian countries include 5 ASEAN countries (Indonesia, Malaysia, the Philippines, Singapore and Thailand) plus 5 other East Asian countries (Japan, China, Hong Kong, Korea and Taiwan).[2] The European countries are Austria, Belgium, Denmark, France, Ireland, Italy, Netherlands, Finland, Greece, Germany, Norway, Portugal, Spain, Sweden, Switzerland and the U.K. The North American countries are the U.S.A and Canada. All the data are drawn from IFS CD Rom (IMF).

A number of studies in the literature following Bayoumi and Eichengreen (1994) decompose shocks between demand and supply shocks *a la* Blanchard and Quah (1989).

[2] Six other ASEAN countries are excluded due to lack of data.

They argue that, if the structural shocks are not analyzed, information on the disturbances could be conflated with economies' responses. Further, they argue that supply shocks are more crucial disturbances to which independent monetary policy wishes to respond. Our framework does not follow this convention based on the following reasons. First, we see little justification that only supply shocks matter. If supply shocks are permanent shocks, there may not be much room left for the policy maker to react to. Further if demand shocks do not originate from policy implementations, the monetary policy authority may wish to counteract to these disturbances. Second, supply shocks and demand shocks derived from the Blanchard-Quah methodology are innovations that are serially independent. Then we cannot impose any realistic dynamics on the shocks: the AR(1) dynamics imposed to the factors in equation (1) is inconsistent with this property of demand and supply shocks.

Considering that any important steps towards a currency union such as the Maastricht Treaty of 1991 may have influenced on the nature of regional co-movement of output, we have divided the entire sample period into two sub-sample periods: 1978-1990 and 1990-1999.[3] In table 1, shares of variances accounted for by the world common, the region common and the country-specific factors are illustrated for Asian (table 1A) and European (table 1B) countries for both periods. Columns from 2 to 5 correspond to the former period and those from 6 to 9, the latter period. In column 2 and 6, the volatility of growth rates of output for each country is reported for each

[3] Frankel and Rose (1998) have shown that increased international trade induces more tightly correlated business cycles across countries. It follows, then, measures adopted to enhance a currency union, by endogenously increasing international trade among the relevant countries, the share of regional co-movement can be endogenously increased.

period. The volatility of output reported in column 2 and 6 are decomposed into shares of variances in the next three columns. These shares correspond to the measures calculated based on equation (6) in section 2. The negative sign in parentheses implies that the coefficient multiplied to the factors, α_{wj} or α_{rj}, is negative, indicating that the output is moving along the common factor, but in different directions. Note, however, that the absolute values of the shares sum to one for each country. In the last row, the average volatility and the average (absolute) shares of variances accounted for by the three factors are reported for each region.

In terms of volatility, the size is much larger in the Asian region. In the former period the average volatility for the Asian countries (3.113) is about 1.75 times more volatile than that of the European countries (1.770). In the latter period, it increases in both regions, the difference widening in the latter period, so that the average volatility in the Asian region (3.888) is almost twice as large as that in the European region (1.983). This shows that the Asian region consists of more volatile countries and, if this is due to non-policy related shocks, there needs for more active implementation of monetary policies.

In the Asian region, the share of variances in output accounted for by fluctuations in the country-specific factor significantly decreases in the latter period. This decrease is compensated mostly by the increase in the share of variances accounted for by the region common factor, while that accounted for by the world common factor also increases. We can observe qualitatively the same phenomenon for the European region: the shares of variances accounted for by the world common and the region common factors increase at the expense of that accounted for by the country-specific factor. However, the decrease in the share of variances accounted for by the country-

specific factor is relatively more absorbed by the increase in that accounted for by the world common factor rather than by the region common factor.

The finding that the world common factor gets more important in the latter period is consistent with the belief that, as time passes, since the world economy interacts more closely across countries, the importance of the world component becomes larger[4]. Besides, the finding that the share of variances accounted for by the region common factor becomes larger in the latter period can be also understood in a similar manner. However the fact that the importance of the region common factor reveals more distinctively in the Asian region in the latter period is somewhat surprising, because more efforts are believed to have been made in the European region towards integration, which should act to increase the role of the region common factor in the latter period.

We believe that this finding can be explained based on the following two factors. First, the European region was already significantly integrated in 1980s and the marginal increase in integration occurred in the second period was relatively small. Second, more importantly, the Asian crisis that occurred in the late 1990s influenced most Asian countries simultaneously, playing an important role of amplifying the region common factor. Data in Table 1 shows that the most crisis-affected economies, such as Indonesia, Korea, Malaysia, and Thailand show higher degree of co-movements, while the least-affected China and Singapore had very only negligible regional components. .[5]

---

[4] Gregory, A.W., A.C. Head and J. Raynauld (1997) and Kose, Otrok and Whiteman (2001) both find that the world common factor is an importance source of volatility in output.

[5] In order to control for the influence of the Asian crisis, we have also estimated the model based on the sample of two periods – 1978-1987 and 1988-1996- by excluding the crisis period

While somewhat exaggerated by the Asian crisis, if focusing on the latter period, we find that the Asian region is even better prepared for the regional currency union: the share of the region common factor is over .5 on average, indicating that the regional co-movement explains more than a half of the fluctuations in the individual country's output. Especially Indonesia (.888), Malaysia (.845), Korea (.792), Thailand (.604), Philippines (.585), most of them heavily influenced by the Asian crisis, show that their movement of output is closely linked to the region common factor.

Similar findings, if not as strong as ours, have been made by a number of studies in the literature. Bayoumi and Eichengreen (1994), based on a decomposition of shocks between demand and supply shocks, find that there is little difference between Europe and Asia. Eichengreen and Bayoumi (1999), using the OCA index developed in Bayoumi and Eichengreen (1996), find that the economies of East Asia would seem to be more or less as plausible candidates for a currency union as the members of the European Union.[6] Bayoumi and Mauro (1999) also find that, while East Asian countries are less suited for a regional currency arrangement than Europe, the difference is not large.[7]

---

after 1997. We find the share of regional common shocks in output variances decline substantially in the latter period, particularly in the crisis-hit Asian countries.

[6] Eichengreen and Bayoumi (1999) argue, however, that the Asian region lacks important institutions to implement a currency union, such as sound financial systems, political network, and a long history of integrationist tradition.

[7] On the other hand, Wyplosz (2001) and Chow and Kim (2000) argue less positively for the preconditions of East Asia to implement a currency union.

Among 16 European countries, the degree of how tightly a single country belongs institutionally to the region significantly varies. For example, ten countries have successfully joined EMU, three countries (Denmark, Sweden and the U.K) have decided to opt out, Greece was not qualified, and two countries (Switzerland and Norway) are not even EU members. When we divide the European countries into EMU and non-EMU countries, some interesting observations arise. In table 1.B, we can confirm that the six non-EMU countries are those that exhibit a lower share of the region common factor in both periods: Denmark ((-).0015, .0002), Greece (.2381, .2489), Norway (.0128, (-).0747), Sweden (.2472, .1191), Switzerland (.2148, .2718) and the U.K (.0528, (-).1486).[8] Further, the 10 EMU countries generally show that the share of the region common factor is already large in the former period and gets even higher in the latter period: it increases in eight countries.

This pattern seems to show that the decision made by the 6 non-EUM countries, whether voluntary or not, is closely related to the OCA criteria. Also, countries belonging to EMU have endogenously evolved to favor joining the common currency arrangement.

4. Determinants of Output Co-Movements

In the last section we examined output movements for a group of European and Asian countries to distinguish common from idiosyncratic disturbances. The estimation, based

[8] The value appearing first in the parentheses corresponds to the former period and that appearing second, the latter period.

on the dynamic factor model, identified the existence of substantial common shocks across countries in the same region. The region common shocks played a significant role in the fluctuations of national outputs both in the Euro and the Asian regions.

This section investigates the determinants of the synchronization in business cycles of the economies. The decision on whether an economy joins a currency union involves the degree of output co-movements. A difficult question is that the degree of output co-movements will be changed after a common currency is adopted. For instance, as a currency union is formed in a region, intra-region trade will increase, subsequently leading to positive effects on the extent of output co-movements.[9] Hence, the assessment of net benefits from a currency union involves predicting the output co-movements that would apply after an adoption of a common currency in the region.

A number of existing studies attempt to look at the determinants of common movements of business cycles. In the literature of international business cycles, trade is emphasized as the channel of output co-fluctuations.[10] The spillover of aggregate demand shocks will tend to make business cycles correlated internationally since an increase in domestic spending will increase demand for both domestic and foreign goods. Greater integration in trade can also stimulate the spread of technology shocks across economies. Kraay and Ventra (2000) present another channel of spillovers through the change in relative prices of factors and products. A capital-augmenting

---

[9] Rose (2000) finds that a currency union increases intra-regional trade. Further, Frankel and Rose (1998) show that increased trade strengthens the extent of output co-movements across trading parties.

[10] Imbs (1999) provides a survey of the literature.

shock in one country results in relative scarcity of labor-intensive goods and thus, as much as they trade freely, leads to higher wage and employment throughout the world. Empirically, Canova and Dellas (1993) and Frankel and Rose (1998) find that more trade interdependence increases the extent of output co-movements.

It is, however, ambiguous that the degree of output synchronization will always increase as countries trade more. If more trade leads to specialization in different industries, industry-specific shocks will make the outputs of two economies move in different directions, leading to less synchronization of business cycles (Eichengreen, 1992 and Frankel and Rose, 1998). In this context, not just the size of trade but also the similarity of trade structure is considered to be important in explaining output co-fluctuations. We expect that, when bilateral trade concentrates more on intra-industry trade than inter-industry trade, the tendency of synchronizing output fluctuations strengthens.

On the other hand, several studies emphasize the similarity in production structure as an important determinant of co-movements of output. Industry-specific shocks can cause more business cycle synchronization among countries with similar production structures. Imbs (2001) provides evidence that the extent of specialization in industry structure has strong explanatory power for output co-movements in a sample of 49 countries. Clark and van Wincoop (1999) find that for the US and EU regions more similarity in industry structure is associated with higher co-movement of employment.

In this section we attempt to find what are the significant factors for the extent of synchronized business cycles in the European and Asian economies. We consider the role of the level of intra-region trade, the similarity of trade structure and industry structure on output co-movements.

We estimate the following regression:

$$S^R_{jt} = a_0 + a_1 * ln(\text{Intra-region trade})_{jt} + a_2 * ln(\text{Trade structure similarity})_{jt} + a_3 * ln(\text{Industry structure similarity})_{j,t} + a_4 * ln(\text{difference in per capita GDP})_{j,t} + a_5 * ln(\text{per capita GDP})_{j,t} + \gamma_{j,t} \quad (8)$$

The dependent variable, S^R_{jt}, is the fraction of an economy j's output variations attributable to regional common shocks over the period t. Hence, this study contrasts other empirical studies that have used bilateral correlations as a measure of output co-movements

Intra-region trade is measured by the share of an economy's trade with the rest of economies in the same region in total trade.[11] To measure similarity in trade structure, we use the export similarity index. The index is defined as

$$1 - \frac{1}{2}\sum_i \left| s^i_a - s^i_b \right|,$$

where s^i_a and s^i_a denote the share of export for commodity i in countries a and b. Thus, the index measures the extent of similitude in the composition of total exports between a pair of economies.[12] In order to measure each country's trade structure similarity

[11] Clark and van Wincoop (2000) use a trade intensity measure, which is the size of bilateral trade relative to per capita GDP. Our regression includes per capita GDP (as a log) separately and thus allows for an interpretation of the trade variable as an intensity measure.

[12] The sectoral classification is based on the three-digit SITC trade data. Total exports data does not include exports of (raw) agricultural products. When we use an alternative measure based on the sectoral classification at a more broad level including agriculture it has less explanatory power in the regressions. This may indicate that more trade dependence through intra-industry trade, rather than inter-industry trade, contributes to output comovements.

relative to the region's average structure, we use an unweighted average of bilateral export similarity indices with the rest of the countries that belong to the same region. The index ranges between 0 (most dissimilar) and 1 (most similar).

Following the same method, we construct an index of the similarity of industry structure, which compares the differences in the sectoral composition of GDP between an economy and the rest of economies in the region. We use data on gross valued added data classified at 10 broad categories (ISIC one digit).[13] We have also constructed another measure based on detailed three digit manufacturing industries, but find it does not have any explanatory power (the results not reported).

The regression includes the difference between an economy's per capita GDP and the region's average per capita GDP (as a log of the absolute value). The difference in per capita GDP can reflect the differences in economic structure including industrial and financial market structure. The log of per capita GDP itself is also included to control for differences in economic development that can affect asymmetry in business cycles.

To minimize reverse-causality problems, all explanatory variables are measured at the beginning of each period (that is, 1980 and 1990). The regression is estimated allowing for random effects, which control for any unobserved country specific factors.

[13] The 10 broad industries are agriculture, forestry and fishing; mining; construction; manufacturing; transportation and communications; electricity; wholesale and retail trade; finance and real estate; government; community and personal services and others. The data come from OECD's National Accounts for European countries and Asian Development Bank's database for Asian countries.

Table 2 displays the result of the basic regression that is applied to a total of 30 observations for 15 European countries over the two ten-year periods from 1979 to 1999.[14]

Column 1 includes the index of industry structure similarity, the difference in per capita GDP, and the log of per capita GDP as explanatory variables. It also adds the period dummy for the 1990s in order to control for shocks that were specific to the second period. The initial industry structure similarity has a positive correlation with output co-movements, which is consistent with the prediction that sharing the similar production structure results in high cycle synchronization. But, the coefficient is not statistically significant (1.681, s.e.=1.099), Given the estimate, an increase in the log of the index of industry structure similarity by one standard-deviation (0.047) increases the regional co-movement by 0.079, which is about 30% of a standard deviation. The coefficient on the difference of per capita GDP has a negative sign. Hence, the larger the difference in per capita income the smaller is the output co-movements. But the coefficient is not statistically significant (-0.075, s.e.=0.075). This result contrasts Imbs (2000) in which differences in per capita income have a strong negative impact on bilateral output correlation in a sample of 49 countries. The log of per capita GDP and a dummy for the 1990s enter positively, but they are statistically insignificant.

Column 2 adds the intra-region trade share and the index of trade structure similarity along with per capita GDP and a dummy for the period of 1990s. Column 3 includes all explanatory variables by adding the index of industry structure similarity and the per capita GDP difference. The result shows a strong and statistically significant

[14] The sample does not include Switzerland because of lack of trade and industry structure data.

relation between initial intra-regional trade share and output co-movements. The coefficient in column 3 implies that an increase in the log of the intra-regional trade by 0.15 (its standard deviation) raises the extent of co-fluctuations by 0.11.

The test also finds a strong positive association between trade structure similarity and output co-movements, implying that countries with more similar trade structure in the initial year tend to have a higher degree of output co-movements in the subsequent period. An increase in the log of the trade structure similarity index by a one-standard deviation, 0.11, increases the extent of co-fluctuations by 0.18.

The coefficient for per capita GDP has a significantly negative sign. Hence, an increase in per capita GDP leads to smaller output co-movement of an economy with the rest of the economies in the region. This result can be interpreted as follows. First, in our sample, relatively higher income countries tended to move more closely with world-wide shocks, rather than region-wide shocks. In addition, when an economy grows faster than the rest of the economies, its business cycle becomes less synchronized than the others. The coefficient implies that an increase in the log of per capita GDP by 0.27 (its standard deviation) decreases co-movements by 0.29.

In Column 3, the inclusion of the industry structure similarity variable does not change the effects of trade variables on output co-movements. The estimated coefficients on the level of intra-region trade and the similarity of trade structure are still positive and statistically significant. On the contrary, the industry structure similarity and per capita income difference variables become statistically insignificant. This result is interesting in light of the findings of Imbs (2000). He argues that industry structure differences are more important than trade size for output co-movements. Our results indicate that trade factors play a more important role for output co-movements. Our

specification differs from his as we use the size of regional common components in national output variations instead of bilateral GDP correlations as a measure of output co-movements.

Column 4 adds all explanatory variables except the dummy for the 1990s. The results are similar to those of column 3. Again, the index of similarity in the sectoral composition of aggregate output is not statistically significant for output co-movements.

Table 3 reports the results of the same type of the regressions using the panel data set of 10 Asian economies over two periods. In columns (1)-(3), we find no statistically significant effects of intra-region trade share, and trade and industry structure similarity on output co-movements. But, the period dummy for the 1990s is highly statistically significant and positive. Thus, shocks that were specific to the 1990s explain a lot of variations of output co-movements in East Asian economies. This reflects the substantial change in the extent of cycle synchronization that occurred between two periods. One problem is that with this small sample size, the period-specific dummy can wash out any effects of other explanatory factors on the over-time variations of the extent of output co-movement. For instance, the extent of intra-region trade and trade structure similarity had increased substantially in East Asian countries between the 1980s and 1990s (see Table 4.1), which could have some positive effects on output co-fluctuations. But, the dummy for the period of 1990s would take away substantial parts of these effects. Confirming this conjecture, in the column (4) where the dummy for the 1990s is excluded, the index of trade structure similarity becomes statistically significant at the 5% level. In column (5) we replace the dependent variable by the estimates of the shares of regional common shocks for the 10 Asian countries that correspond to the periods 1978-1987, and 1988-1996. In this sample that the crisis

years are excluded, trade structure similarity becomes again statistically significant at the 5% significance level.

5. Trade Integration and Currency Union in East Asia

Countries that have more synchronized business cycles can benefit more from joining a currency union. Therefore, whether East Asia is suitable for an optimum currency area depends on how the national outputs would co-vary across economies when they adopt a common currency. The empirical evidence presented in section 4 shows that the level of intra-regional trade, and the similarity of trade structure turn out to be the most important factors for output synchronization.

East Asia looks quite favorable for an OCA criterion in terms of its substantial degree of regional trade integration. Table 4 presents intra-regional trade as a percent of total trade for the Asian and European economies. Intra-Asia trade is substantial. The share of intra-regional trade in total trade was about 51% on average in East Asia in 2000. Hong Kong had the highest intra-region trade share of 64%, while Japan had the lowest of 38%. On average, the intra-region trade in East Asia was somewhat lower than the corresponding value for the Euro area, which was 66% in 2000. One reason for the relatively lower intra-region trade for Asian countries is that they trade relatively more with the United States than Euro countries do. The share of trade with the United States in total trade was about 19% for East Asian economies on average, contrasting to about 8% for Euro countries. In East Asia, the extent of intra-regional trade has shown an upward trend. It increased from 42% in 1980, to 48% in 1990 and 51% in 2000.

Integration of trade in East Asian region is expected to continue, and thus helps to reduce the extent of asymmetric shocks.

The trade structures of East Asian economies have also become more similar over time. Table 5 shows trade structure similarity for East Asian and European countries. In 1980 the average of the similarity indices was 0.45 for 10 East Asian economies, which was far lower than the average for 15 European countries, 0.63. But, the similarity index in East Asia increased to 0.56 in 1990 and 0.64 in 2000. Hence, in terms of the extent of trade structure similarity East Asian countries are no less favorable than that in Euro countries. East Asian economies would benefit more from a currency union as their business cycles become more synchronized with more similar trade structure.

It is likely that regional trade integration taking place in East Asia will increase market pressures for policy coordination for stable exchange rates among regional currencies, and eventually for adopting a common currency.

6. Implications of Capital Market Integration for an Asian Currency Union

In East Asia there has been a rapid increase in capital mobility as more advanced East Asian countries including Thailand, Indonesia, Malaysia and Korea have managed to deregulate and open their financial markets since the early 1990's. A World Bank study (1997) uses three different measures to determinate the extent to which countries are financially integrated. In constructing an overall index of integration the World Bank study uses the access to international financial markets, ability to attract private external financing, and the level of diversification of financing in terms of the

composition of financial flows. According to the World Bank estimation, changes in the degree of financial integration were high in East Asian countries in early 1990s.

The continuing financial integration taking place in East Asia raises a question of whether, like trade integration, it can bring the countries closer to monetary integration in the region. This section will examine whether financial market integration could contribute to formation of a successful OCA in East Asia.

Will a high degree of financial integration among a group of countries be a criterion for membership in an OCA? That is, would countries with close financial linkages benefit from a common currency? As in trade, a common currency brings benefits such as lower transactions costs and elimination of risks of exchange rate changes associated with trading in financial instruments between countries with different moneys. More important, however, is that financial integration among a group of countries could facilitate formation of a common currency area for the group as it reduces the cost of adjustment to shocks to demand and supply through facilitating migration of capital in the long-run and cross-border financing of current account imbalances in the short-run.

An important criterion for an OCA is the speed of adjustments to shocks. Even if disturbances are asymmetric across economies, the faster adjustment to shocks helps an economy to mitigate the costs of relinquishing independent monetary policy. In an economy where factor prices and price are not completely flexible, capital mobility can make real adjustments easier and less costly. In this regard, financial integration would increase the benefits from joining a common currency arrangement. However, there are counterbalancing effects of capital market integration on forming a currency union. As suggested by Kalemli-Ozcam, Sorensen and Yosha (2001), better income insurance

attained through greater capital market integration may induce higher specialization of production and hence larger asymmetric shocks across countries. This lower synchronization of business cycles due to stronger capital integration implies that candidate countries can be less willing to join a currency union

One important aspect is that, unlike trade integration, financial integration it is occurring at more global level rather than at regional level. Given the extent to which the East Asian countries have managed to liberalize their capital account transactions in recent years, one might expect that financial markets of these economies may have become more closely linked with one another among East Asian countries than in the past. However, the available empirical evidence does not provide clear evidence for the tendency that the East Asian countries have been more financially integrated among them. Regionally integrated financial markets are yet to emerge and prospects for further financial integration in East Asia are not promising. Empirical studies show that financial integration among Asian countries has not been substantial (see Park and Song, 2001). In contrast, the financial markets of the East Asian countries became increasingly integrated with the markets of developed countries (Glick and Hutchison, 1990, Cheng and Mak, 1992, Bekaert and Harvey, 1995, and Kuen and Song, 1996).

Considering tremendous evidence of home bias in equities at country level and tighter financial integration within a country, the fact that the same phenomenon does not occur at regional level is puzzling. As recently surveyed by Lewis (1999), there are a number of reasons suggested in the literature to explain home bias at country level. First, domestic equities can provide a better hedge for risks that are specific to the home country. For example, hedges against domestic inflation and hedges against wealth that is not traded in capital markets, such as human capital are better provided through

domestic assets. Further, hedges with foreign returns implicit in equities of domestic firms that have overseas operations are also available. Second, the gains from global diversification can exceed costs involved. If the costs of acquiring and holding foreign equities are sufficiently large, then investors may find it better to keep their savings at home. Third, information is much more easily communicated at a country level. This information superiority enables portfolios solely based on domestic assets to perform better than global portfolios.

The first two arguments do not seem to well generalize to regional level. Further if information sharing is also not easier at regional level than at global level, then it would be more advantageous to directly go to the global markets and form global portfolios. Hence further liberalization of capital account transactions in the East Asian countries is expected to strengthen their financial linkages with developed countries more than with one another in the region. This means that financial liberalization in East Asia may not necessarily produce market pressure or incentives to create regional financial arrangements such as the Asian Monetary Fund for regional financial cooperation and in the long-run a common currency area in East Asia.

There are also several institutional and structural characteristics of the East Asian economies, particularly in the financial systems that have constrained, and are likely to limit the extent of regional financial integration in the future. One of the most important characteristics in East Asia is related to underdevelopment of financial systems that are largely bank-oriented. Except for Japanese banks, most of the banks in other East Asian countries, which are small in size have a limited access to international capital markets relatively limited experience in international corporate banking and a

small branch network in East Asia. By and large, their customer bases are confined to domestic borrowers and lenders.

Bond markets still remain relatively small in size; they are narrow in terms of maturity and issues; and are not easily accessible to foreign investors after a decade of liberalization. And the markets for financial derivatives have only recently begun to develop in these countries. There are few domestic investment banks, securities firms, and mutual funds that are efficient enough to compete against their counterparts from the developed countries.

In the absence of these securities market institutions, underwriting securities in international capital markets, organizing large syndicated loans, and negotiating multinational M&As in East Asia have been dominated by American and European investment banks and more so since East Asian countries took steps to open their financial markets. According to the database of International Financing Review, a major fraction of financing through debt instruments in East Asian countries are undertaken by American and European Investment banks, rather than Asian banks (Table ?). Before the crisis, Japanese banks were active in lending to other East Asian countries and accounted for the bulk of syndicated loans to these countries. Since the crisis, however, Japanese banks have withdrawn their lending to Asian countries so much that it was less than 6 percent of their total external lending in 2001 (See Table 6). The dominance of Western investment banks has become more pronounced in recent year in East Asia as corporations and financial institutions in the region have increasingly sought to raise funds from international capital markets than before with deregulation of external financing.

Another important hurdle to integrating financial systems in East Asia is savings and investment profile that is not matched well within the region. Throughout the 1980's and until the mid-1990's, the ASEAN states and Korea were net borrowers as they were running deficits on their current accounts. China, Taiwan, and Japan were, on the other hand, accumulating huge amounts of current account surpluses, which made East Asia as a whole a net lender financing the bulk of U.S. and European current account deficits. External financing for the East Asia's deficit countries ultimately came from the three East Asia's surpluses countries, but it was arranged and managed in part by Japanese banks, but mostly by western financial institutions. That is, East Asian savers and investors were intermediated by western financial institutions through New York and London markets. Since the outbreak of the crisis in 1997, all of the East Asian crisis countries have become net lenders and are likely to continue to do so. Not surprisingly, they have been relying on western financial institutions in investing their current account surpluses in foreign securities. Together with China, Taiwan, and Japan, the East Asia has become a larger net saver of the global economy than before, financing the bulk of balance of payment deficits of the rest of the world. In investing their surpluses, East Asian countries will continue to rely on international financial markets in New York and London, simply because western financial institutions with global reach and network are likely to be more efficient in allocating East Asian savings.

Hong Kong and Singapore have been two important regional financial centers in East Asia. Have they played any role in driving financial integration in East Asia with the onset of financial liberalization in the region? It should be noted that they were serving East Asian borrowers and lenders well before financial market opening got underway in the region. These two centers were essentially outposts of and hence

tightly linked with major international capital markets in advanced countries. The crisis in 1997, which almost brought Hong Kong to the brink of collapse, has undermined their importance as regional centers as East Asian corporations and banks have increasingly moved directly to New York and London markets for their financial service needs and transactions. Hong Kong and Singapore may have gravitated more toward linking financially East Asian economies with advanced economies than integrating them with one another.

Most of the East Asian countries have managed to open substantially their financial services industries to foreign competitions over the last decade. Foreign financial institutions now receive a national treatment that provides a level playing field when they enter financial markets of East Asian countries. Many western banks have established a wide network of branches and subsidiaries throughout East Asia, and so have western securities firms, investment banks, insurance companies, and other non-bank financial institutions. There are numerous emerging market funds operating out of New York to invest in East Asian securities. There is little doubt that the hold of western financial institutions in East Asian has increased since the early 1990s. This pervasive influence of western financial institutions is likely to expand and strengthen East Asia's financial ties with advanced countries with the continuing financial liberalization in the region.

Overtime, local investment banks and other financial institutions may become more competitive and new markets for financial derivatives may emerge to the extent that they enjoy advantage in collecting and assessing local information for their financial activities compared to western institutions. Such an advantage may disappear as a result of the on-going information and communication technology. On the other

hand, the gap in financial technology and expertise between East Asian and Western financial institutions is likely to persist. As a result, borrowers and lenders from East Asia are likely to go to the New York and London markets because these markets offer low costs of financing and more attractive savings instruments in terms of returns adjusted for risks. Many of the branches and subsidiaries foreign financial institutions have no doubt become indigenous institutions, but they are likely to serve as conduits for integration of East Asian financial markets with the markets of developed countries.

Although the odds are against them, countries in East Asia have been working together to develop regional financial markets as part of their strategy to deepen economic integration in the region. The Chiang Mai Initiative reflects such regional efforts for integration. In contemplating developing regional financial markets and supporting multilateral banks specialized in regional finance in East Asia, East Asian policymakers will be faced with answering many questions related to benefits and costs of regional financial integration. Will regional financial markets help improve allocation of resources in East Asia? Will regional financial markets reduce the likelihood of recurrence of financial crisis in the future?

In recent years there have been discussions on the extent of which East Asian countries would gain by cooperating in establishing an East Asian regional stock exchange and an East Asian regional bond market, focusing more on the latter. However, there is no guarantee that a regional bond market in East Asia will be large and efficient enough to survive competition against Eurobond or Yankee bond markets. Furthermore, a viable East Asian bond market will require establishing beforehand a regional financial infrastructure that includes regional credit agencies, clearing and settlement systems, cross-border securities borrowing and lending mechanisms, credit

enhancement and guarantee agencies, and regional trading mechanisms. Tax treatments for securities transactions will also have to be harmonized at the regional level. It will take many years, if not many decades, for the East countries with diverse legal and regulatory systems and at different stages of financial development to resolve their differences to establish the requisite financial infrastructure. Efficiency of the regional bond market may also require its integration with global markets.

In conclusion, it is not clear, at this stage of development, whether further financial liberalization would encourage countries in East Asia to form a common currency area. In the long-run, financial integration through liberalization facilitates mobility of real capital between countries as evidenced by a large increase in intra-regional foreign direct investment in recent years, in particular Japanese investment in China and ASEAN. As apposed to this development, there have been strong market forces integrating East Asian financial markets into global financial markets. This trend of financial globalization in East Asia has become more noticeable in recent years as a result of growing current account surpluses at the regional level and deeper penetration of western banking and securities institution of East Asian financial markets. Combining these two developments, financial liberalization leaves uncertain as to whether it will generate incentives for the East Asian countries to join and remain in an Asian currency union, whereas it raises pressures for maintaining their currencies stable vis-à-vis global currencies.

As in trade, however, causality may run from currency union to financial integration: that is, a political decision to form a common currency area will unleash market forces for further financial integration, contributing to creation of regional financial markets. However, the formation of currency union will not weaken East

Asia's financial linkages with advanced countries. In deciding whether to form a regional currency union, East Asian countries may have to examine closely whether the currency union would help develop efficient regional financial markets that could survive competition vis-à-vis other global financial markets.

7. Concluding Remarks.

In this paper, we have tried to judge prospects of forming a currency union in East Asia, especially focusing on trade integration and financial liberalization occurring in the area. There are several interesting findings. First, the region common shocks in East Asia in 1990s are at least comparable to those in Europe, implying that the East Asian region is well prepared for a regional currency union. Second, two most important determinants of business cycle synchronization are intra-region trade share and trade structure similarity in the region. In this regard, increasing share of intra-region trade and the pattern of trade structure getting more alike in East Asia are expected to put more pressure on forming a currency arrangement. Third, financial liberalization, which has rapidly occurred in this area, tends to lead to more global integration, rather than regional integration, of the financial systems. Therefore, further financial liberalization is not likely to encourage East Asian countries to form a regional currency union, rather increasing incentives for pegging their currencies to a global currency.

More appropriate criteria for a successful currency union, however, are involved with how the pattern of trade and financial integration would be shaped after the set up of a currency union. There is some evidence that joining a currency union leads to increased trade among member countries, further strengthening the formation of the

currency union. However there is more uncertainty in predicting whether endogenous adjustments of financial systems after forming a currency union will act for or against the currency union. It is more likely, though, that at least the currency union does not hinder further financial integration among member countries.

Other issues are related to the sequence of approaching to the currency union. It has been pointed out that political cooperation and institutionalization are the prerequisites for a successful currency union in East Asia. How the economies in the region can proceed smoothly to transform the current exchange rate arrangements into a common currency peg, if desirable, will be a critical question. The experiences from the European Monetary Union will be especially valuable in this regard. Further analyses in these issues remain to be seen in future research.

Appendix

A. Derivation of the State-Space Model.

The state-space/measurement equation form can be represented in two steps. First, the state-space equation represents a transition of unobserved states that, in our model, correspond to the three factors, W_t, R_t^r and ε_{jt}. For the notational purposes, assume that there are n_1 countries belonging to region r=1 and n_2 countries belonging to region r=2. Further assume that $n = n_1 + n_2$. Then the state-space equation can be represented as follows:

$$F_t = T \cdot F_{t-1} + \omega_t$$

where $F_t = (W_t, R_t^1, R_t^2, \varepsilon_{1t}, ..., \varepsilon_{nt})$ ' and $\omega_t = (\eta_t^W, \eta_1^R, \eta_2^R, \eta_{1t}, ...\eta_{nt})$.

Second, the measurement equations link the observed variable, output in each country, to the states. Let $Y_t = (Y_{1t}^1, ..., Y_{n_1 t}^1, Y_{1t}^2, ..., Y_{n_2 t}^2)$' be an $(n \times 1)$ vector. Then the measurement equations relate the observed series, output, to the unobserved states and can be represented as follows:

$$Y_t = Z \cdot F_t$$

where Z is appropriately defined from equation (1) as follows:

$$Z = \begin{pmatrix} 1 & 1 & 0 & 1 & 0 & ,..., & 0 \\ 1 & 1 & 0 & 0 & 1 & ,..., & 0 \\ & & & & & & \\ 1 & 1 & 0 & 0 & 0 & ,..., & 1 \\ 1 & 0 & 1 & 1 & 0 & ,..., & 0 \\ 1 & 0 & 1 & 0 & 1 & ,..., & 0 \\ & & & & & & \\ 1 & 0 & 1 & 0 & 0 & ,..., & 1 \end{pmatrix}$$

The estimation of the above model is obtained by maximizing the log likelihood function based on the assumption that the errors terms follow normal distribution.

B. Finding the Starting Point for the Numerical Maximization.

The model as specified, even under the assumption that the errors are uncorrelated and the unobserved factors follow AR(1), includes quite a few number of parameters. There are 4 (for the one world and the three region common factors) + 28 (for the errors) parameters for AR(1) coefficients, 28 parameters for the variances of the country-specific shocks, 28 parameters for the sensitivity coefficients to the world common factors and 28 parameters for the sensitivity coefficients to the region common factor, summing up to 116 parameters. Due to the size of the model, it is to the utmost crucial to provide good initial parameter values for the numerical maximization of the log-likelihood function.

We have calculated the initial parameter values by mimicking the original model as closely as possible. For example, the parameter values of the impact coefficients on factors for each country, α_{wj} and α_{rj}, are derived from the following equation:

$$Y_{jt}^{r} = \alpha_{wj} Y_{t}^{w} + \alpha_{rj} Y_{t}^{r} + \varepsilon_{jt} \qquad \text{(B1)}$$

where Y_{jt}^{r} is the cyclical measure (the growth rate) of output at time *t* for country *j* belonging to region *r*, Y_{t}^{w}, the cyclical measure (the growth rate) of output at time *t* for the world economy, and Y_{t}^{r}, the cyclical measure (the growth rate) of output at time *t* for the region. Y_{t}^{w} is calculated by taking the weighted average of the growth rates, with the size of real GDP being used as weights.[15] To preserve the orthogonal property between factors, instead of using a similarly-calculated regional measure, we have used the residuals in the regression of the regional measure on the world measure. In other words, we calculate the weighted average growth rate for a region and, by regressing it to Y_{t}^{w}, the residual is derived to use for Y_{t}^{r}.

The parameter values for AR(1) coefficients are calculated by regressing Y_{t}^{w}, Y_{t}^{r} and the residuals from equation (B1) on the lagged variables:

$$Y_{t}^{w} = \rho_{w} Y_{t-1}^{w} + \eta_{t}^{w} \qquad \text{(B2)}$$

$$Y_{t}^{r} = \rho_{r} Y_{t-1}^{r} + \eta_{rt}^{R} \qquad \text{(B3)}$$

[15] To allow for comparison of the real GDP across countries, we have used the Penn World Table developed by Summers and Heston (1991) data set for the available years, and extended it using the last year's value for the unavailable years.

$$\varepsilon_{jt} = \rho_j \varepsilon_{jt-1} + \eta_{jt} \qquad \text{(B4)}$$

Since, in the original model, the innovations to the world common, region-specific common, and country-specific factors are normalized to unity, Y_t^w and Y_t^r are redefined by normalizing the variances of η_t^W and η_{rt}^R to unity, which essentially adjust the numerical values of the impact coefficients by the factor of normalization. The variance of the idiosyncratic shocks is derived from the residual in equation (B4).

The initial parameter values, while useful for the numerical maximization, are meaningful by themselves as an alternative way of decomposing shocks. Based on the initial parameter values, we have also derived the shares of variances accounted for by the world common, the region common and the country-specific factors in a similar way explained in section 2. Main results in section 4 preserve without significant differences (the results not reported), which confirms that our results are quite robust.

Reference

Alesina, Alberto and Robert J. Barro (2000), "Currency Unions", NBER Working Paper 7927.

Bekaert, G., and Harvey, C.(1995), Time-varying world market integration, *J.Finance* 50, 403-444

Baek, Seung-Gwan and Chi-Young Song (2001), "Is Currency Union a Feasible Option in East Asia?", unpublished manuscript.

Barro, Robert, (2001), "Currency Unions", unpublished manuscript, Harvard University.

Bayoumi T and B. Eichengreen (1994), 'One Money or Many? Analyzing the Prospects of Monetary Unification in Various Parts of the World', Princeton Studies in International Finance No 76.

Bayoumi, T and B. Eichengreen (1997), "Ever Close to Heaven? An Optimum-Currency-Area Index for European Countries, *European Economic Review* 41, 761-770.

Bayoumi, T. and P. Mauro (1999), "The Suitability of ASEAN for a Regional Currency Arrangement," IMF WP/99/162.

Bayoumi, Tamim, Barry Eichengreen and Paolo Mauro (2000), "On Regional Monetary Arrangements for ASEAN", *Journal of the Japanese and International Economics*, 14, 121-148.

Blanchard, Olivier J., and Quah, Danny (1989), "The Dynamic Effects of Aggregate Demand and Supply Disturbances," *American Economic Review*, 655-673.

Canova, Fabio and Harris Dellas (1993), "Trade Interdependence and the International Business Cycle," *Journal of International Economics*, 34, 23-47.

Cheng, Y., and Mak, S. (1992), The international transmission of stock market fluctuation between the developed markets and the Asian-Pacific markets, *Appl, Finan. Econ*. 41, 43-47.

Chow, Hwee Kwan and Yoonbai Kim (2000), "A Common Currency Peg in East Asia? Perspectives from Western Europe", unpublished manuscript.

Clark, Todd, and Eric van Wincoop (1999),"Borders and Business Cycles," *Journal of International Economics*, forthcoming.

Dornbusch, R. and Y. Park (1999), "Flexibility or Nominal Anchors?," in *Exchange Rate Policies in Emerging Asian Countries* eds by S. Collignon, J. Pisani-Ferry, and Y. Park, Routledge, London.

De Brauwer, Gordon (2000), "Does a Formal Common-Basket Peg in East Asia Make Economic Sense?" paper presented at the Financial Markets and Policies in East Asia at ANU, Canberra, Australia.

Eichengreen, Barry and Tamim Bayoumi (1999), "Is Asia An Optimum Currency Area? Can It Become One?: Regional, global and historical perspectives on Asian monetary relations", in S. Collignon, J. Pisani-Ferry, and Y. C. Park(eds.) *Exchange Rate Policies in Emerging Asian Countries*, 347-366.

Frankel, Jeffrey and Andrew Rose (1998), "The Endogeneity of the Optimum Currency Area Criteria," *Economic Journal* 108, 1009-1025.

Geweke, J. (1977), "The Dynamic Factor Analysis of Economic Time Series Models," in D.J. Aigner and A.S. Goldberg, eds., Latent Variables in Socio-economic Models, (Amsterdam: North Holland).

---------- and K. Singleton (1980), “Interpreting the Likelihood Ratio Statistics in Factor Models when the sample size is small,” *Journal of the American Statistical Association* 75, 133-337.

Glick, R, and Hutchinson, M.(1990), Financial liberalization in the Pacific Basin: Implication for real interest rate linkage, *J.Japan.Int.Econ*. 4, 36-48.

Gregory, A.W., A.C. Head and J. Raynauld (1997), “Measuring World Business Cycles,” *International Economic Review*, vol. 38, No. 3, pp.677-701.

Heston, Alan and Robert Summers (1991), "The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1988", *Quarterly Journal of Economics*, pp.327-368.

Imbs, Jean (1999), “Co-Fluctuations,” CEPR Discussion Paper No. 2267.

Kalemli-Ozcam, Sebnem, Bent Sorensen and Oved Yosha (2001), “Economic Integration, Industrial Specialization, and the Asymmetry of Macroeconomic Fluctuations,” *Journal of International Economics*, Vol.33, pp.107-137.

Kose, Otrok and Whiteman (2001), “International Business Cycles: World, Region, and Country-Specific Factors” unpublished manuscript.

Kraay, Aart and Jaume Ventura (2000), “Product Prices and the OECD Cycle,” NBER Working Paper, No. 7788.

Kuen, T.Y., and Song, T.K.(1996), Interest rate parity and dynamic capital mobility: The experience of Singapore, in "Financial Deregulation and Integration in East Asia" (T. Ito and A.Krueger, Eds.), pp.335-354, NBER East Asia Seminar on Economics Vol.5, University of Chicago Press, Chicago

Kwan, C. H. (1998), “The Theory of Optimum Currency Areas and the Possibility of Forming a Yen Bloc in Asia”, *Journal of Asian Economics*, Vol. 9, No. 4, 555-580.

Lewis, Karen K. (1999), “Trying to Explain Home Bias in Equities and Consumption”, *Journal of Economic Literature*, Vol. 37, pp.571-608.

McKinnon, R. (1999) ”The East Asian Dollar Standard, Life after Death?” Working Paper, Stanford University.

Mundell, R. 1961, “A Theory of Optimum Currency Area,” *American Economic Review*, Vol. 60, pp.657-665.

Park, Y.C., and Song, C.Y., (2001), "Managing Capital Account Liberalization: The Experiences of Indonesia, Malaysia, Korea, and Thailand", a paper presented to the high-level Conference on Capital liberalization in Transition Economies hosted by IMF, the National Bank of Ukraine, and the Netherladsche Bank in Kiev, Ukraine on October 21-26, 2001.

Rose, Andrew K. (2000), “One Money, One Market: The Effects of Common Currencies on Trade”, *Economic Policy* 30.

Sargent, T.J. and C. Sims (1977), “Business Cycle Modeling without Pretending to Have Too Much *A Priori* Economic Theory,” in New Methods in Business Cycle Research: Procedures from a Conference (Minneapolis: Federal Reserve Bank of Minneapolis, pp.45-110.

Stock, J.H. and N.W. Watson (1991), “A Probability Model of Coincident Economic Indicators,” in K.Lahiri and G.H. Moore, eds., *Leading Economic Indicators: New Approaches and Forecasting Records*, Cambridge: Cambridge University Press, pp.63-89.

Williamson, J. (1999), "The Case for a Common Basket Peg for East Asian Currencies," in *Exchange Rate Policies in Emerging Asian Countries* eds by S. Collignon, J. Pisani-Ferry, and Y. Park, Routledge, London.

World Bank (1997), *Private Capital Flows to Developing Countries: The Road to Financial Integration*, World Bank

Wyplosz, Charles (2001), "A Monetary Union in Asia? Some European Lessons," unpublished manuscript.

Table 1. Shares of Variances Accounted for by World, Region and Country-Specific Factors

A. Asian Countries

	Period : 1979-1990				Period : 1991-1999			
	Volatility	World	Region	Country	Volatility	World	Region	Country
China	3.6100	0.5758	0.1605	0.2637	2.2957	(-)0.1390	0.0122	0.8488
Hong Kong	3.9816	0.0034	(-)0.9966	0	3.5456	(-)0.1782	0.7376	0.0841
Indonesia	2.1027	(-)0.0012	(-)0.4467	0.5521	7.0028	(-)0.1123	0.8877	0
Japan	1.0333	0.0487	0.0685	0.8827	2.1536	(-)0.1593	0.4029	0.4378
Malaysia	3.2142	(-)0.0026	(-)0.1846	0.8128	5.5176	(-)0.1517	0.8449	0.0033
Philippines	4.7982	(-)0.5088	(-)0.2503	0.2409	2.4575	0.3890	0.5848	0.0262
Singapore	3.5015	(-)0.0297	(-)0.2870	0.6833	3.5393	(-)0.0537	(-)0.0439	0.9024
Taiwan	2.5283	0.1716	(-)0.7084	0.1200	0.9027	(-)0.3369	0.2798	0.3834
Thailand	2.9225	(-)0.0017	(-)0.0020	0.9963	6.3965	(-)0.2804	0.6044	0.1152
Korea	3.4333	0.0706	(-)0.0209	0.9085	5.0675	(-)0.1268	0.7921	0.0811
Average	3.1126	0.1414	0.3126	0.5460	3.8878	0.1927	0.5190	0.2882

B. European Countries

	Period : 1979 – 1990				Period : 1991-1999			
	Volatility	World	Region	Country	Volatility	World	Region	Country
GERMANY	1.8256	0.4589	0.3171	0.2240	3.8391	(-)0.3179	0.5483	0.1338
AUSTRIA	1.5809	0.0011	0.4014	0.5975	0.9526	(-)0.0045	0.6929	0.3027
BELGIUM	1.4922	0.0808	0.5337	0.3855	1.4522	0.2430	0.4471	0.3098
DENMARK	1.8855	0.3919	(-)0.0015	0.6066	1.5585	0.4895	0.0002	0.5103
FRANCE	1.1560	(-)0.0089	0.4064	0.5847	1.2350	0.2857	0.4727	0.2416
IRELAND	1.9091	0.0334	0.1746	0.7920	3.1703	0.8006	0.0869	0.1125
ITALY	1.4322	0.2668	0.7332	0	1.0678	0.3067	0.4070	0.2863
NETHERLANDS	1.9617	0.6040	0.1263	0.2697	2.1248	0.4617	0.2916	0.2467
FINLAND	1.6946	0.0164	0.7232	0.2604	4.3433	0.9971	(-)0.0029	0
GREECE	1.7241	0.2189	0.2381	0.5430	1.5514	0.2670	0.2484	0.4846
NORWAY	2.0168	0.4568	0.0128	0.5304	1.4274	0.1276	(-)0.0747	0.7977
PORTUGAL	2.6879	(-)0.2848	0.4040	0.3112	2.1692	0.2310	0.6399	0.1291
SPAIN	1.8680	(-)0.0198	0.0245	0.9558	1.5810	0.3793	0.6207	0
SWEDEN	1.1410	0.5292	0.2472	0.2236	2.4256	0.7206	0.1191	0.1603
SWITZERLAND	1.7243	0.1720	0.2148	0.6132	1.0602	0.2346	0.2718	0.4936
UNITED KINGDOM	2.2166	0.0432	0.0528	0.9040	1.7657	0.7558	(-)0.1486	0.0956
Average	1.7698	0.1861	0.2882	0.4876	1.9828	0.4139	0.3171	0.2690

Table 2. Determinants of Output Co-Movements among European Countries

	(1)	(2)	(3)	(4)
Log (intra-region trade)		0.7638	0.7380	0.8089
		(0.3716)	(0.3817)	(0.3722)
Log (trade structure similarity)		1.9947	1.5965	1.3739
		(0.6518)	(0.7557)	(0.7350)
Log (industry structure similarity)	1.6814		0.8569	0.8017
	(1.0987)		(1.0868)	(1.0903)
Log (per capita GDP difference	-0.0753		-0.0589	-0.0484
	(0.0753)		(0.0819)	(0.0809)
Log (per capita GDP)	-0.2218	-0.7803	-0.7454	-0.5602
	(0.2326)	(0.3065)	(0.3291)	(0.2819)
Dummy for the 1990s	0.0861	0.0818	0.0966	
	(0.0924)	(0.0904)	(0.0924)	
Constant	1.1482	3.3422	3.2534	2.7697
	(0.5467)	(1.0116)	(1.0388)	(0.9498)
Number of obs.	30	30	30	30
R^2	0.18	0.18	0.24	0.20

Notes: The dependent variable is the fraction of the output variation attributable to regional common shocks for 15 European countries in each of the periods 1979-1989, and 1990-1999. Random effects specification is applied to the panel data for the two ten-year periods. Standard errors of the estimated coefficients are reported in parentheses.

Table 3. Determinants of Output Co-Movements in East Asian Economies

	(1)	(2)	(3)	(4)	(5)
Log (intra-region		-0.4003	-0.3637	0.1245	0.0656
		(0.3448)	(0.7043)	(0.8473)	(0.6563)
Log (trade structure		-0.2323	-0.2042	1.7747	2.0635
similarity)		(0.7257)	(0.9823)	(0.8786)	(0.9153)
Log (industry structure	2.2269		0.3125	3.2847	1.9430
similarity)	(2.2240)		(4.3855)	(5.2828)	(4.0861)
Log (per capita GDP	0.0499		0.1159	0.2087	0.2356
Difference)	(0.0886)		(0.1157)	(0.1162)	(0.1078)
Log (per capita GDP)	-0.0875	-0.1314	-0.1271	-0.0033	0.3772
	(0.1013)	(0.1065)	(0.1275)	(0.1489)	(0.1188)
Dummy for the 1990s	0.7937	0.9341	0.9161		-0.0819
	(0.1747)	(0.2370)	(0.3146)		(0.2931)
Constant	0.4773	-0.6555	-0.5181	2.2743	1.7663
	(0.6661)	(0.4468)	(1.7645)	(1.8346)	(1.6440)
Number of obs.	20	20	20	20	20
R^2	0.62	0.63	0.63	0.39	0.58

Notes In columns (1)-(4) the dependent variable is the fraction of the region-wide common movements in national output variation for 10 Asian countries in each of the periods 1979-1989, and 1990-1999. In column (5) the dependent variable is replaced by the estimates of the shares of regional common shocks corresponding to the periods 1978-1987, and 1988-1996. See the notes to Table 2.

Table 4. Trends of Intra-region Trade in East Asia and Europe

	Intra-region Trade (percentage of total trade)		
	1980	1990	2000
East Asia			
China	42.4	58.9	48.7
Hong Kong	46.7	60.4	64.1
Indonesia	62.6	56.8	54.4
Japan	23.8	28.0	38.1
Korea	32.7	34.2	42.2
Malaysia	49.2	55.1	56.1
Philippines	37.4	40.0	46.5
Singapore	49.4	50.7	57.5
Taiwan	34.9	43.1	50.9
Thailand	40.1	47.5	54.2
Average	*41.9*	*47.5*	*51.3*
Europe			
Austria	69.8	75.6	71.0
Belgium	74.9	80.4	72.5
Denmark	74.4	75.5	74.8
Finland	57.4	66.6	61.7
France	57.8	67.1	66.7
Germany	63.9	67.4	59.1
Greece	48.2	70.1	56.1
Ireland	77.6	76.1	61.3
Italy	56.1	67.3	59.1
Netherlands	70.5	77.0	67.3
Norway	78.6	75.2	73.7
Portugal	58.7	78.5	78.6
Spain	43.2	68.2	67.8
Sweden	73.8	78.9	68.4
Switzerland	69.0	72.1	66.9
United Kingdom	55.8	62.8	57.0
Average	*64.4*	*72.4*	*66.4*

Source: International Monetary Fund, *Direction of Trade Statistics*.

Note: Intra-region trade is measured by the share of an economy's trade with the rest of the economies that belong the same region, in total trade.

Table 5. Trends of Trade Similarity Index among East Asia and European Economies

	Index		
	1980	**1990**	**2000**
East Asia			
China	0.476	0.591	0.629
Hong Kong	0.436	0.603	0.636
Indonesia	0.379	0.442	0.512
Japan	0.357	0.480	0.606
Korea	0.490	0.628	0.662
Malaysia	0.482	0.542	0.651
Philippines	0.438	0.586	0.659
Singapore	0.453	0.523	0.623
Taiwan	0.514	0.620	0.703
Thailand	0.488	0.589	0.686
Average	0.451	0.560	0.637
Europe			
Austria	0.646	0.674	0.703
Belgium	0.664	0.662	---
Denmark	0.613	0.622	0.643
Finland	0.697	0.572	0.559
France	0.706	0.703	0.716
Germany	0.668	0.696	0.706
Greece	0.488	0.438	0.490
Ireland	0.581	0.583	0.518
Italy	0.655	0.651	0.663
Netherlands	0.621	0.668	0.687
Norway	0.609	0.590	0.611
Portugal	0.539	0.523	0.588
Spain	0.669	0.654	0.661
Sweden	0.616	0.647	0.660
Switzerland	---	---	---
United Kingdom	0.664	0.691	0.702
Average	0.629	0.625	0.636

--- Not available.
Source: Constructed from the World Bank Trade and Production Database (which is originally from United Nations' Comtrade Database)

Note: The index measures the extent of similitude in the composition of total merchandise exports excluding agricultural products at the three-digit SITC level between an economy and the rest of the economies in the same region. It is an unweighted average of bilateral similarity indices. The index ranges between 0 and 1 (most similar).

Table 6. Distribution of International Bank Lending

(million US dollars)

	1996.6			1999.12			2001.6		
	European banks	American banks	Japanese banks	European banks	American banks	Japanese banks	European banks	American banks	Japanese banks
Developed Countries	84697	13906	26526	2885881	367998	545636	3377764	497028	728725
	(0.183)	(0.106)	(0.159)	(0.787)	(0.676)	(0.688)	(0.824)	(0.704)	(0.752)
Asia	127682	35594	115471	132817	26793	65050	96156	29042	51934
	(0.276)	(0.272)	(0.693)	(0.036)	(0.049)	(0.082)	(0.023)	(0.041)	(0.054)
Indonesia	18076	3963	21622	20600	4096	12491	15762	4073	9626
	(0.039)	(0.030)	(0.130)	(0.006)	(0.008)	(0.016)	(0.004)	(0.006)	(0.010)
Korea	26859	10451	22512	24449	8829	12592	16953	5988	10110
	(0.058)	(0.080)	(0.135)	(0.007)	(0.016)	(0.016)	(0.004)	(0.008)	(0.010)
Malaysia	7872	1973	8131	8275	1419	6029	7184	2404	5843
	(0.017)	(0.015)	(0.049)	(0.002)	(0.003)	(0.008)	(0.002)	(0.003)	(0.006)
Philippines	4698	3774	1402	8835	3003	2921	6643	1891	3066
	(0.010)	(0.029)	(0.008)	(0.002)	(0.006)	(0.004)	(0.002)	(0.003)	(0.003)
Thailand	18092	5456	37552	11929	826	13075	8091	1358	7979
	(0.039)	(0.042)	(0.225)	(0.003)	(0.002)	(0.016)	(0.002)	(0.002)	(0.008)
Total	462230	130975	166701	3665913	544124	792676	4099965	705569	969425
	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)	(1.000)

Note: American banks are the United States and Canadian banks.