India's Monetary Integration with East and South-east Asia: A Desirability Study

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"*Does Asia need a common currency? My answer is, yes.*" Robert Mundell (2003)

Abstract: This paper attempts to include India with east and Southeast Asia to study the existence of the economic criteria for a common currency. The analysis in this paper shows that significant complementarities in trade exist among these countries and most of them experience similar shocks. These results point to the fact that the cost of adopting a single currency may be minimal, while huge benefits could accrue from enhanced trade.

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1. Introduction:

While the last decade witnessed a strong trend towards regional trading blocs, the recent success of the euro has also prompted policymakers and academicians to look for other optimum currency areas (OCA). There has been some work done for ASEAN and NAFTA (Bayoumi and Eichengreen, 1994 and Bayoumi and Mauro, 1999), West Africa (Masson and Pattillo, 2001) and South Asia (Saxena, 2005). The growth prospects of free trade agreement for ASEAN + 3 (China, Japan and South Korea) have also been analyzed by Hoa (2002). However, the importance of India's economic integration with the rest of Asia has been conspicuously missing from this literature. The only forum that explicitly talks about this integration as JACIK (Japan, ASEAN, China, India and Korea) is RIS (Research and Information System for the Non-aligned and Other Developing Countries, a think-tank based in New Delhi).[2] Given the geographic location, one would expect more economic cooperation among the South Asian economies. The analysis of South Asia in Saxena (2005) demonstrates that some of the major economies like India, Pakistan and Sri Lanka can form an OCA, using various criteria from the literature on OCA. The paper argues that the benefits of a common currency would accrue from moving trade from the informal to the formal sector and from the peace that economic integration would bring between India and Pakistan. However, the failure in solving the Kashmir issue has forced India to look East for economic cooperation.

The Association of South East Asian Nations (ASEAN) was formed in 1967 with five original members, namely, Indonesia, Malaysia, Philippines, Singapore and Thailand. This was expanded to include Brunei Darussalam (1984), Vietnam (1995), Laos and Myanmar (1997) and Cambodia (1999). The objectives of this association have been to accelerate economic growth, social progress and cultural development in the region and to promote regional peace and stability. Over time, ASEAN has made significant achievements, which includes increased trade among the ASEAN nations.[3]

The integration of India with ASEAN is desirable for the sake of India and the rest of Asia. In 1992, in a move to strengthen its cooperation in an increasingly interdependent world, ASEAN intensified its cooperative relationships with its Dialogue

[2] See http://www.newasiaforum.org/NAF_Statistics_on_Benefits1.htm
[3] See http://www.aseansec.org for details.

Partners, which includes India. This regional cooperation is imperative because attempts at sub-regional cooperation like ASEAN and SAARC have failed to exploit the full potential of the regional economic integration in Asia (Kumar, 2002a). The author argues that this failure is a direct result of limited complementarities at the sub-regional levels, but there exist wide range of complementarities at pan-Asian level, which could provide for extensive and mutually beneficial linkages. In addition, the distinct Asian identity has been shaped by history and cultural exchanges over several centuries.[4] In 1997, ASEAN + 3 signed a joint statement providing for framework for cooperation towards the 21st century.[5] Although there needs to be significant work done for integration of India with ASEAN + 3, the signing of free trade agreement with Singapore and negotiations for free trade with Thailand that are underway are promising, to say the least.[6] The emphasis by the government of India to revive the *Silk Route* is testimony to the commitment of India to integrate with the East (Ved, 2003).

Asia has lately been working towards demonstrating its own identity to the world. In the aftermath of the Asian crisis in 1997, Indonesia, Thailand and South Korea resorted to the IMF for loans. However, the problems with the IMF conditionalities led Japan and other Asian countries to propose the formation of the Asian Monetary Fund. While this proposal did not materialize, ASEAN + 3 nonetheless have gone ahead with a regional swap agreement (Chiang Mai Initiative) system to deal with regional currency crises. The new wave of regionalism (the EU, the NAFTA, MERCOSUR, etc) is likely to encourage more economic integration in Asia. On the international political level, some recent events (like the disagreement within the Security Council at the UN regarding war with Iraq) have brought out the urgency to give a unified front to the United States, which dominates all the international political and economic negotiations.[7]

Due to the recent success of Euro, Asia can even venture to go as far as Europe to adopt a single currency. This process requires tremendous amount of political will and economic readiness. The aim of this paper is to see if ASEAN + 4 satisfy the economic

[4] Refer to Kumar (2002a) for specific examples.
[5] Throughout the paper, the term ASEAN + 3 refers to ASEAN, China, Japan and Korea and ASEAN + 4 refers to ASEAN + 3 + India, unless otherwise specified.
[6] Refer to Kumar (2002b) for details on institutional framework for India's economic links with East Asia.
[7] Refer to Agarwala (2003) for the case for a single currency in Asia, so that we can move to a multipolar world of international finance from the current unipolar system dominated by the US dollar.

criteria for OCA. Since Mundell's (1961) and McKinnon's (1963) seminal work on OCA, researchers have focused on four inter-relationships between the countries that would impinge on the benefits of adopting a common currency, namely:

1. Extent of trade: If potential members of a union trade a lot with each other, monetary union would reduce transaction costs.
2. Nature of disturbances: If the countries experience similar shocks, the cost of giving up monetary policy independence would decrease.
3. Degree of labor mobility: High labor mobility across borders can be a useful mechanism for adjusting to asymmetric shocks that lead to high unemployment in a subset of the members of the union.
4. Fiscal transfers: If region-specific shocks prevail, a federal fiscal system would provide regional insurance (in the form of federally funded unemployment insurance benefits), thereby attenuating the impact of regional shocks on interregional income differentials.

Since no formal labor mobility laws and fiscal transfer rules exist, this paper concentrates on only two criteria (i.e., trade and shocks) to look at the possibility of an OCA for the ASEAN+4 region. The rest of the paper is organized as follows. Section 2 compares the ASEAN+4 with other geographic regions. Section 3 discusses the potential of a currency union for ASEAN+4 using the criteria listed above. Section 4 concludes.

Section 2: Comparing ASEAN + 4 with other geographic regions

Table 1 illustrates the mean and standard deviation of growth and inflation. ASEAN has an average growth rate of 5.8% and inflation of 15%. This high average inflation is mainly due to high inflation in Lao People's Democratic Republic (37%) and Indonesia (63%).[8] When we exclude these countries, the average inflation declines to 6.3%. The average growth rate for China, India, Japan and Korea is 6.4% (mainly due to high rates of growth in China (8.7%) and Korea (7.8%)), while the average inflation is 8%. The average growth rate is higher for ASEAN+4 and inflation lower than for ASEAN. In addition, the variability in inflation rates is also reduced. While ASEAN+4

[8] This high inflation rate in Indonesia is a result of the hyperinflation in the 1960s.

show much higher growth and inflation rates than Western Europe, the variability is also higher.

Although stability of growth and inflation is important, a positive correlation of growth and inflation for the ASEAN5+4 nations (Table 2) would suggest that the countries may be cyclically synchronized. Bayoumi and Eichengreen (1994) find some country groups with positive correlation for output but not inflation in case of Western Europe. According to these correlations, 72% of the correlations in output growth rates and 75% of the inflation correlations are positive for ASEAN5 + 4. For India, in particular, 38% of the growth correlations and 88% of the inflation correlations are positive. These positive correlations may suggest synchronized business cycles. However, we will analyze the correlation of demand and supply shocks to explore this matter further in the next section.

3. Is ASEAN+4 an Optimal Currency Area?

Criterion 1: Trade

The literature on OCA emphasizes trade as the main channel through which benefits from a common currency will be enjoyed (Frankel and Rose, 2000). Hence, if countries trade a lot with each other, they are likely to benefit from low transaction costs and elimination of exchange rate risks. Rose (1999) finds that two countries that share the same currency trade three times as much as they would with different currencies. Glick and Rose (2001) find that bilateral trade rises/falls by about 100% as a pair of countries forms/dissolves a currency union, *ceteris paribus*. Rose and Engel (2002) find that members of international currency unions tend to experience more trade and less volatile exchange rates. It is not clear if trade is a pre-requisite for forming a currency union or vice versa. The two are endogenous decisions and hence, suffer from the famous *Lucas Critique* (Frankel and Rose, 1996, 1997). Nonetheless, it would be helpful to see if these countries could potentially gain from lower transaction costs if they were to move to a single currency.

Figure 1 shows that Chinese, Japanese, Korean and Indian trade with ASEAN has gone up from 1950s to 2000. The average trade with ASEAN during 1991-2000 is about

7% for China, 8% for India, 11% for Korea and 15% for Japan.[9] In 2003-4, ASEAN + 3 countries have emerged as India's dominant trading partners, accounting for 19.9% of India's merchandise trade, compared with EU's (19%) and North America's (12.9).[10] In addition, there exists more potential for trade among the ASEAN + 4 countries, which is calculated using the *COS* measure, developed by Linnemann (1966). This index measures the degree of commodity correspondence between the exports of a country and the imports of another country. It varies between zero (no similarity or correspondence at all) and one (perfect similarity) and is the cosine of the angle between the vector of country i exports and the vector of country j imports in an n-dimensional commodity space. If the subscripts i, j and k refer to the exporting country, importing country and commodity class, respectively, the measure is defined as (Beers and Linnemann, 1992):

$$(1) \qquad COS_{ij} = \frac{\sum_k E_{ik}.M_{jk}}{\sqrt{(\sum_k E_{ik}^2 . \sum_k M_{jk}^2}}$$

This measure has been estimated for SAARC countries in Panchmukhi (1990) and for various developing and developed countries in Beers and Linnemann (1992). Tables 3a and 3b depict the COS measures for India from 1996 through 1999 for 5-digit SITC codes.[11] The data is taken from PC-TAS.[12] Indian primary exports (industries 0-4) exhibit significant complementarity with all the countries (Table 3a), while goods similar to the Indian manufactured exports (industries 5-8) are imported by all countries except Korea. Indian manufactured imports (Table 3b) are complementary to all the countries' exports, while Indian imports of primary products are similar to the exports of Japan, Korea, Indonesia, Malaysia and Philippines. Hence, India can export goods that the rest of Asia imports and import the goods that these countries export.

The existence of significant complementarities but relatively low current bilateral trade testifies to the gains that can accrue from free trade zones and the eventual use of a

[9] Elliott and Ikemoto (2003) find that the Asian crisis generated a stronger desire to source imports from within the ASEAN region.
[10] Source: http://www.economywatch.com/indianeconomy/india-external-sector.html
[11] To conserve space, we have eliminated the tables on COS measure for China, Japan and Korea. Interested readers can refer to Saxena (2003).
[12] Data on Cambodia, Lao People's Democratic Republic, Myanmar and Vietnam is not available. Complementarity is assumed if the COS measure is higher than 0.4. It may be noted that a COS measure of 0.4 is high because the measure is estimated at 5-digit SITC code.

common currency. When country A exports good *k* to the world and country B imports the same good from a third country, even when the unit cost of this good from importing it from country A is lower, is termed as *cost of non-cooperation*. According to Das (2002), if the existing trade complementarities are exploited between India and Thailand, India could save around $4.6b and Thailand $7.9b in imports expenditures, which represent about 10% and 14% of the total import expenditures, respectively. These are enormous costs that can be eliminated through free trade and common currency.

This emphasis on trade is worthwhile because trade enhances growth. Frankel and Romer (1999) show that trade has a quantitatively large and robust positive effect on income. Frankel and Rose (2000) argue that currency unions stimulate trade, which in turn boosts output. Frankel, Romer and Cyrus (1996) suggest strong growth effects of trade on East Asian economies. All the papers that study the impact of trade on growth use gravity model. Hoa (2002) extends the gravity model to time series and estimates the effects of ASEAN trade with China, Japan and Korea on ASEAN growth using two-stage least squares. He finds that trade between ASEAN and each of the three East Asian economies has significant and positive effect on ASEAN growth. If trade between India and ASEAN enhances the ASEAN growth rate, then it would support our view to encourage more economic integration of India with Southeast Asia. We estimate the same model as Hoa (2002) for the impact of India's trade with ASEAN on ASEAN growth for the period 1960-2000 using a two-stage least square regression. We use India's trade to GDP, growth rate, budget deficit, broad money to GDP, inflation, nominal exchange rate, terms of trade, labor, population growth rate, and the dummies for several years as the instruments. The results obtained are:

$$ASEAN\_growth = 0.04 + 3.38 * ASEAN\_India\_trade + 0.03 * DUM67 - 0.03 * DUM79 - 0.06 * DUM97 \quad (2)$$

where all the coefficients are significant at 1% level of significance. The adjusted R-squared for this regression is 30%. The estimates indicate positive and highly significant effect of ASEAN trade with India and the formation of ASEAN (DUM67) on ASEAN output growth. The results also show negative impacts of the second oil shock (DUM79) and the Asian crisis (DUM97) on ASEAN output growth. Hence, these results along with Hoa (2002) results reveal the positive impact of Chinese, Indian, Japanese and Korean

trade with ASEAN on ASEAN growth. Since trade has positive impact on growth and common currency encourages trade, hence there is a strong case for a common currency for this region.

Criterion 2: Patterns of Shocks

Using the methodology outlined by Blanchard and Quah (1989) and Clarida and Gali (1994) (described in Appendix 1), we estimate the structural vector autoregression (VAR) model on annual data for ASEAN7 plus China, India, Japan and Korea (see Appendix 2 for data sources).[13] The estimated results are presented in tables 4 and 5.[14]

Our main interest in this empirical exercise is to extract the supply and demand shocks. A positive correlation of supply shocks signals that countries would require a synchronous policy response, which is crucial as the countries entering the union have to accept a common monetary policy. Highly related demand shocks may be less important, as they may stem from divergent monetary policies, which would no longer occur after the monetary union. Tables 4a and 4b report the correlation of supply and demand shocks among the ASEAN + 4 countries. While the estimated correlation coefficients of supply shocks ranged between –0.39 and 0.68 for Western Europe, –0.59 and 0.72 for the Americas (Bayoumi and Eichengreen (1994)) and –0.41 and 0.29 for South Asia (Saxena 2005), the correlation coefficients for ASEAN + 4 range between-0.64 and 0.81. Indeed, 70% of the correlations for supply shocks are positive, indicating that they might be suitable candidates for an OCA.

The correlation coefficients for demand shocks ranged from -0.21 to 0.65 for Western Europe, –0.45 to 0.7 for the Americas (Bayoumi and Eichengreen (1994)) and –0.3 to 0.57 for South Asia (Saxena 2005). The range for ASEAN+4 is –0.58 and 0.70 and 64% of the correlations are positive.

Size of disturbances and speed of adjustment: The typical size of disturbances is another important economic characteristic since larger disturbances can have very disruptive effects, and may require policy independence (e.g., monetary policy) to offset

[13] Annual data is used in order to make this study comparable to Bayoumi and Eichengreen (1994) and Saxena (2005). There was not enough data to estimate the model for Cambodia and Vietnam.
[14] In order to conserve space, variance decompositions and impulse response functions are not shown here and their discussion omitted since they are not directly relevant for the analysis.

them. Similarly, if the speed with which the economies adjust to disturbances is slow, then the cost of fixing the exchange rate and losing policy autonomy increases (Saxena, 2005).

In order to assess the size of disturbances, we use the long-run effect on output and real exchange rate from the impulse response functions for the size of supply shocks and the sum of the first year's impact on output, real exchange rate and prices for the demand shocks. For the speed of adjustment, we estimate the response after two years as a share of the long run effect (following Bayoumi and Eichengreen (1994), which was based on a bivariate structural VAR).

Table 5 displays the size and the speed of adjustment for supply and demand disturbances for different geographic regions. We must keep in mind that the size of the shocks and the adjustment from the shocks for the ASEAN countries comes from a 3-variable structural VAR, unlike the other estimates in the table that come from a 2-variable structural VAR. Hence, there is no way of comparing the size of the shocks across regions. Within the ASEAN + 4 region, Singapore has the smallest supply and demand disturbances, while Myanmar has the largest. At least 50% of the adjustment from supply shock is completed within two years for all countries, except Brunei and Indonesia. All countries adjust at least about 60% from demand disturbances in the first two years, except Brunei and Singapore. The adjustment to both the supply and demand shocks is fastest for ASEAN+4 as compared with any other region. For India, in particular, about 70% of the adjustment from supply disturbance and 100% from the demand disturbance take place in the first two years.

4. Conclusions

This paper is an attempt to include India with east and Southeast Asia to study the existence of the economic criteria for a currency union in Asia. The analysis in this paper shows that the Chinese, Japanese, Indian and Korean trade with ASEAN has grown in the recent decades, especially ASEAN has become a dominant trading partner for India in the recent years. Trade has a positive impact on ASEAN growth. There are significant complementarities in the trade structure too, which suggest that these countries should work towards a Common Market. The positive correlations for supply shocks show that

the loss from giving up independent monetary policy would be minimal. The speed of adjustment from shocks is fast for most countries. Since there are significant complementarities that exist among economies, they are likely to adjust even faster after integration. For example, if Japan's idle capacity in construction industry can be utilized by other countries, say like India, Japan could easily recover from its decade and a half long recession. These complementarities can be quickly exploited if Asia decides to deepen its monetary and financial cooperation.

How easy is it to follow the European model? It must be noted that Asia is more culturally diverse than Europe and it does not yet have any supranational institutional framework (like a Parliament, Court of Justice as in Europe) that embody some transfer of national sovereignty, hence it becomes harder to see a move to a common currency sometime soon. However, the relationships are changing. India is establishing bilateral links with countries in Asia while China is providing the vertical trade integration for other Asian countries (now commonly known as the "Asian production networks). These economies are becoming a lot more economically connected now than before. For now, Asia can integrate economically without a political integration, such as the one that exists between the US and Canada or between the EU and Switzerland. It should be recognized that the move to a common currency requires political will, which is absent right now, but the situation may change over time. Hence, the paper takes the view that Asia should not wait for the political will to deepen its economic integration.

Suppose Asia should consider moving to a common currency, then what should the new currency look like? Against which currency should Asian nations peg their exchange rates? It was not until the 1980s that the Deutschemark was acknowledged as the anchor currency. While Europe had institutional, economic and political groundwork already laid out, like the Common Market and later the Economic Community, which facilitated the move to a single currency, Asia lacks this foundation. However, Mundell (2003) argues that Asia could leap frog to a currency area if the potential members are willing to use an internal or external currency anchors. Internal anchor in the form of yen is one possibility but large fluctuations in the yen-dollar exchange rates would have adverse effects on the other economies. Hence, a stable yen-dollar exchange rate can go a long way in promoting the idea of a common currency in Asia. But Japan has been

reluctant in providing the role of an anchor to Asia. On the other hand, given that China and India have gained considerable economic importance in the region and the world, perhaps a new currency could be created, which could be weighted by each country's economic significance. Alternatively, an Asian Currency Unit along the lines of ECU can be created. However, technical and political difficulties have prevented this idea to foster so far. Ito (2003) provides an example of creating an Asian Basket Currency (ABC) bonds, whereby the ABC corporation creates and issues basket currency bonds (weighted combination of regional currencies of the underlying national bonds) backed by regional sovereign bonds. This kind of a basket bond can be regarded as (i) a currency board where the issue of ABC unit currency is backed 100 percent by the foreign reserve; (ii) a closed-end mutual fund where the underlying assets are fixed; or (iii) asset backed securities where assets happened to be government bonds. If successful, ABC could provide a fillip for the eventual creation of an Asian Currency Unit (ACU).

As mentioned above, the Asian production networks have been fostering intra-Asian trade and research on such networks between the US and Mexico shows that exports and imports become insensitive to exchange rate when trade associated with such production network rises (see Arndt and Huemer (2004)). If this holds for Asia, then the role of exchange rate in stabilizing the economy reduces. In general, such production networks encourage intra-industry trade, which in turn increases real integration. In such a scenario, the role played by the exchange rate flexibility in stabilizing against country-specific shocks diminishes. Hence, if production networks make the exchange rate choice irrelevant, this might present the Asian economies an opportunity to lock their exchange rates as a start towards some form of economic convergence.[15]

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[15] See Arndt (2005) for specific theoretical argument for East Asia.

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Appendix 1: Empirical methodology to study shocks

Although structural vector autogressions are very standard in the literature, yet we will describe this methodology. In order to examine the nature of the shocks affecting the ASEAN, China, India, Japan and Korea, we employ the procedure developed by Blanchard and Quah (1989) to identify demand and supply shocks affecting real GNP. In Blanchard-Quah's model, demand side shocks have no long run effect on output, due to the natural rate hypothesis, while productivity shocks have a permanent effect on output. Since there is no unique way to decompose the series in a univariate framework, Blanchard and Quah use output and unemployment in their VAR to decompose real GNP. Clarida and Gali (1994) use this approach to estimate the effects of demand, supply and nominal shocks on relative output, real exchange rate and relative prices in an open economy model.

The basic framework is as follows.[16] Suppose the true model can be represented by an infinite moving average of a (vector) of variables X_t and an equal number of shocks ε_t (where L is the lag operator and A represents a matrix of impulse response functions of the shocks to the elements of X).

$$(1) \qquad X_t = A_0\varepsilon_t + A_1\varepsilon_{t-1} + A_2\varepsilon_{t-2} + \ldots\ldots = \sum_{i=0}^{\infty} L^i A_i \varepsilon_t$$

Clarida-Gali use relative output, real effective exchange rate and relative prices to estimate supply, demand and nominal shocks, based on a Keynesian-Dornbusch model of an open economy. The framework implies that while supply shocks have permanent effects on the relative output, real exchange rate and relative prices, demand shocks have permanent effect only on exchange rate and relative prices. Nominal shocks only affect relative prices. Let X_t consist of a change in relative real output, a change in real effective exchange rate and a change in relative prices. Let ε_t represent the three shocks. The model can be written as:

$$(2) \qquad \begin{bmatrix} \Delta y_t \\ \Delta r_t \\ \Delta p_t \end{bmatrix} = \sum_{i=0}^{\infty} L^i \begin{bmatrix} a_{11i} & a_{12i} & a_{13i} \\ a_{21i} & a_{22i} & a_{23i} \\ a_{31i} & a_{32i} & a_{33i} \end{bmatrix} \begin{bmatrix} \varepsilon_{st} \\ \varepsilon_{dt} \\ \varepsilon_{nt} \end{bmatrix}$$

where $\varepsilon_{st}, \varepsilon_{dt}$ and ε_{nt} are independent supply, demand and nominal shocks. In theory, supply shocks affect relative output, real effective exchange rate and relative prices in the long run, while demand shocks affect only the real effective exchange rate and relative prices. Since real output is written in first-difference form, the cumulative effect of demand and nominal shocks on the change in real output must be zero. This puts the following restriction on the model:

$$(3) \qquad \sum_{i=0}^{\infty} a_{12i} + \sum_{i=0}^{\infty} a_{13i} = 0$$

Since the elements of X are covariance stationary (represented by the infinite moving average process in 1), they can be represented by an autoregressive process by inverting the MA operator. Hence, this model can be estimated using a vector auto regression (VAR), where all the variables are potentially endogenous and hence are

[16] See Blanchard and Quah (1989) and Enders (1995) for details on this framework.

regressed on their lags. Let B represent the estimated coefficients, the VAR can be written as:

$$X_t = B_1 X_{t-1} + B_2 X_{t-2} + \ldots\ldots\ldots + B_n X_{t-n} + e_t = [I - B(L)]^{-1} e_t$$
$$= [I + B(L) + B(L)^2 + \ldots\ldots] e_t = e_t + D_1 e_{t-1} + D_2 e_{t-2} + \ldots\ldots\ldots \quad (4)$$

where e_t represents the residuals from the equations in the VAR.

In order to transform equation (4) into the model defined by (2) and (3), we need to transform the residuals from VAR (e_t) into supply, demand and nominal shocks (ε_t). Writing $e_t = C\,\varepsilon_t$, in this three by three case, we require the following restrictions:

$$\sum \begin{bmatrix} d_{11i} & d_{12i} & d_{13i} \\ d_{21i} & d_{22i} & d_{23i} \\ d_{31i} & d_{32i} & d_{33i} \end{bmatrix} \begin{bmatrix} c_{11} & c_{12} & c_{13} \\ c_{21} & c_{22} & c_{23} \\ c_{31} & c_{32} & c_{33} \end{bmatrix} = \begin{bmatrix} . & 0 & 0 \\ . & . & 0 \\ . & . & . \end{bmatrix} \quad (5)$$

This restriction allows the matrix C to be uniquely defined and the supply, demand and nominal shocks to be identified.

Intuitively, we expect that:

1. A positive supply shock leads to an excess supply of home goods, which depreciates the real exchange rate. Over time, output increases to its long run level, while exchange rate remains depreciated.
2. A positive demand shock creates an excess demand for home goods that appreciates the real exchange rate and increases the output in the short run. Over time, output returns to its long run value, while the real exchange rate remains appreciated.
3. A positive nominal shock decreases the home interest rate, which depreciates the real exchange rate and increases the output in the short-run. However, over time, both the real exchange rate and the output return to their initial levels.

This econometric methodology is used to estimate supply, demand and nominal shocks. For estimation purposes, output and inflation are taken relative to the world output and inflation. The real exchange rate is an effective (trade-weighted) measure. We use 2 lags to estimate the VAR to capture the dynamics and to optimize on the degrees of freedom. Then, a pair-wise correlation matrix is computed for supply and demand shock to examine their symmetry across countries, which is essential in determining the readiness of a country to enter the union. A positive correlation of supply shocks signals that countries would require a synchronous policy response, which is crucial as the countries entering the union have to accept a common monetary policy. Highly related demand shocks may be less important, as they may stem from divergent monetary policies, which would no longer occur after monetary union.

Appendix 2: Data Source for Estimating Structural Vector Autoregressions

Country	Source		Series	No. of Obs.	Time period
Brunei Darussalam	IFTSTSUB	51664..XZF...	CPI % Change	22	1984-2005
Brunei Darussalam	IFTSTSUB	51699B.PZF...	GDP VOL 1974 PRICES	25	1981-2005
Brunei Darussalam	INS	I516EREER	REAL EFFECTIVE EXCHANGE RATE	14	1992-2005
Cambodia	IFTSTSUB	52264..XZF...	CPI % Change	5	2001-2205
Cambodia	WBWDI	522NYGDPMKTPKDZG	GDP growth (annual %)	6	2000-2005
Cambodia	INS	I522EREER	REAL EFFECTIVE EXCHANGE RATE	14	1992-2005
China,P.R.: Mainland	IFTSTSUB	92464..XZF...	CPI % Change	13	1993-2005
China,P.R.: Mainland	WBWDI	924NYGDPMKTPKDZG	GDP growth (annual %)	35	1971-2005
China,P.R.: Mainland	IFTSTSUB	924..RECZF...	REER BASED ON REL.CP	26	1980-2005
India	IFTSTSUB	53464..XZF...	CPI % Change	40	1966-2005
India	WBWDI	534NYGDPMKTPKDZG	GDP growth (annual %)	35	1971-2005
India	INS	I534EREER	REAL EFFECTIVE EXCHANGE RATE	27	1979-2005
Indonesia	IFTSTSUB	53664..XZF...	CPI % Change	40	1966-2005
Indonesia	WBWDI	536NYGDPMKTPKDZG	GDP growth (annual %)	35	1971-2005
Indonesia	INS	I536EREER	REAL EFFECTIVE EXCHANGE RATE	27	1979-2005
Japan	IFTSTSUB	15864..XZF...	CPI % Change	40	1966-2005
Japan	WBWDI	158NYGDPMKTPKDZG	GDP growth (annual %)	35	1971-2005
Japan	IFTSTSUB	158..RECZF...	REER BASED ON REL.CP	26	1980-2005
Korea	IFTSTSUB	54264..XZF...	CPI % Change	33	1973-2005
Korea	WBWDI	542NYGDPMKTPKDZG	GDP growth (annual %)	35	1971-2005
Korea	INS	I542EREER	REAL EFFECTIVE EXCHANGE RATE	26	1980-2005
Lao People's Dem.Rep	IFTSTSUB	54464..XZF...	CPI % Change	11	1995-2005
Lao People's Dem.Rep	WBWDI	544NYGDPMKTPKDZG	GDP growth (annual %)	15	1991-2005
Lao People's Dem.Rep	INS	I544EREER	REAL EFFECTIVE EXCHANGE RATE	19	1987-2005
Malaysia	IFTSTSUB	54864..XZF...	CPI % Change	40	1966-2005
Malaysia	WBWDI	548NYGDPMKTPKDZG	GDP growth (annual %)	35	1971-2005
Malaysia	IFTSTSUB	548..RECZF...	REER BASED ON REL.CP	31	1975-2005
Myanmar	IFTSTSUB	51864..XZF...	CPI % Change	40	1966-2005
Myanmar	WBWDI	518NYGDPMKTPKDZG	GDP growth (annual %)	35	1971-2005
Myanmar	INS	I518EREER	REAL EFFECTIVE EXCHANGE RATE	27	1979-2005
Philippines	IFTSTSUB	56664..XZF...	CPI % Change	40	1966-2005
Philippines	WBWDI	566NYGDPMKTPKDZG	GDP growth (annual %)	35	1971-2005
Philippines	IFTSTSUB	566..RECZF...	REER BASED ON REL.CP	30	1976-2005
Singapore	IFTSTSUB	57664..XZF...	CPI % Change	39	1967-2005
Singapore	WBWDI	576NYGDPMKTPKDZG	GDP growth (annual %)	35	1971-2005
Singapore	IFTSTSUB	576..RECZF...	REER BASED ON REL.CP	30	1976-2005
Thailand	IFTSTSUB	57864..XZF...	CPI % Change	40	1966-2005
Thailand	WBWDI	578NYGDPMKTPKDZG	GDP growth (annual %)	35	1971-2005
Thailand	INS	I578EREER	REAL EFFECTIVE EXCHANGE RATE	27	1979-2005
Vietnam	IFTSTSUB	58264..XZF...	CPI % Change	4	2002-2005
Vietnam	WBWDI	582NYGDPMKTPKDZG	GDP growth (annual %)	15	1991-2005
Vietnam	INS	I582EREER	REAL EFFECTIVE EXCHANGE RATE	20	1986-2005
World	IFTSTSUB	00164..XZF...	CPI % Change	31	1975-2005
World	WBWDI	001NYGDPMKTPKDZG	GDP growth (annual %)	34	1972-2005

Table 1: Basic Statistics of ASEAN + 4 and Other Geographic Regions

	Growth		Inflation	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
BRN	2.04	7.97	2.97	2.47
KHM	7.37	2.96	6.62	5.67
IDN	6.13	4.31	63.60	183.49
LAO	5.63	3.87	37.53	39.97
MYS	6.88	3.77	3.39	3.38
MMR	3.99	4.93	13.07	13.56
PHL	3.73	3.45	10.71	9.26
SGP	8.76	3.66	3.00	4.74
THA	6.95	4.23	5.25	5.22
VNM	6.46	2.24	5.07	1.79
CHN	8.74	5.51	9.37	8.29
IND	4.58	3.28	8.05	5.70
JPN	4.56	3.67	4.55	4.34
KOR	7.77	3.86	9.93	7.22
Averages				
ASEAN	5.79	4.14	15.12	29.75
ASEAN5	6.49	3.88	17.19	41.22
CHN, IND, JPN, KOR	6.41	4.08	7.97	7.00
ASEAN+4	5.97	4.12	13.08	21.08
European Union 1/	3.44	2.55	7.17	5.22
NAFTA 1/	3.86	2.67	12.02	12.80
SAARC 1/	5.44	3.18	8.70	5.28
Latin America 1/	3.36	4.58	206.33	595.91

Time period and data source are given in the Appendix.
Note: High inflation for ASEAN is due to hyperinflation in Indonesia from 1966 - 1975.
1/ Figures are for 1961 - 2000 from Saxena (2003)

Table 2a: Correlations of Growth Rates Among ASEAN5 + 4 Nations

	CHN	IDN	IND	JPN	KOR	MYS	PHL	SGP	THA
CHN	1								
IDN	-0.037	1							
IND	0.067	0.005	1						
JPN	-0.134	0.247	-0.155	1					
KOR	0.058	0.567	-0.023	0.429	1				
MYS	-0.076	0.697	-0.242	0.123	0.460	1			
PHL	-0.353	0.233	-0.051	0.274	0.211	0.424	1		
SGP	-0.024	0.478	-0.163	0.578	0.357	0.629	0.498	1	
THA	0.049	0.659	0.053	0.438	0.696	0.655	0.315	0.528	1

Table 2b: Correlations of Inflation Rates Among ASEAN5 + 4 Nations

	China	Indonesia	India	Japan	Korea	Malaysia	Phillippines	Singapore	Thailand
CHN	1								
IDN	-0.451	1							
IND	-0.090	0.080	1						
JPN	-0.131	0.082	0.272	1					
KOR	0.070	0.128	0.081	0.680	1				
MYS	-0.102	-0.177	0.690	0.568	0.426	1			
PHL	-0.102	-0.164	0.366	0.309	0.151	0.487	1		
SGP	0.372	-0.059	0.697	0.672	0.366	0.879	0.462	1	
THA	0.017	-0.107	0.588	0.559	0.568	0.836	0.338	0.832	1

Table 3a: COS Measure for India's Exports

Imports from		1996	1997	1998	1999	Average
Thailand	ALL	0.161	0.106	0.085	0.090	0.113
	Ind 0	0.604	0.648	0.620	0.619	0.655
	Ind 2	0.107	0.139	0.262	0.155	0.157
	Ind 5	0.369	0.454	0.360	0.450	0.421
	Ind 6	0.394	0.235	0.178	0.175	0.269
	Ind 7	0.600	0.462	0.208	0.322	0.436
	Ind 8	0.135	0.113	0.093	0.131	0.127
China	ALL	0.090	0.101	0.066	0.057	0.076
	Ind 0	0.678	0.576	0.359	0.500	0.579
	Ind 2	0.113	0.092	0.126	0.201	0.155
	Ind 5	0.107	0.110	0.106	0.178	0.148
	Ind 6	0.107	0.125	0.096	0.100	0.115
	Ind 7	0.423	0.424	0.320	0.347	0.409
	Ind 8	0.108	0.114	0.114	0.150	0.140
Singapore	ALL	0.086	0.070	0.039	0.043	0.055
	Ind 0	0.526	0.522	0.586	0.503	0.550
	Ind 2	0.496	0.476	0.476	0.291	0.338
	Ind 5	0.406	0.388	0.372	0.416	0.403
	Ind 6	0.548	0.493	0.296	0.455	0.480
	Ind 7	0.504	0.342	0.197	0.249	0.324
	Ind 8	0.374	0.426	0.314	0.368	0.401
Japan	ALL	0.252	0.208	0.177	0.162	0.183
	Ind 0	0.478	0.539	0.429	0.536	0.502
	Ind 2	0.294	0.251	0.333	0.291	0.306
	Ind 5	0.523	0.522	0.472	0.515	0.522
	Ind 6	0.478	0.346	0.322	0.370	0.370
	Ind 7	0.452	0.318	0.238	0.274	0.322
	Ind 8	0.444	0.410	0.439	0.459	0.450
Koea	ALL	0.058	0.040	0.019	0.020	0.032
	Ind 0	0.512	0.456	0.350	0.324	0.423
	Ind 2	0.071	0.067	0.040	0.042	0.058
	Ind 5	0.231	0.222	0.216	0.273	0.246
	Ind 6	0.116	0.113	0.071	0.082	0.101
	Ind 7	0.328	0.165	0.100	0.109	0.184
	Ind 8	0.144	0.159	0.110	0.161	0.155
Indonesia	ALL	0.292	0.166	0.485	0.375	0.332
	Ind 0	0.722	0.359	0.810	0.584	0.702
	Ind 2	0.383	0.507	0.182	0.301	0.355
	Ind 5	0.179	0.187	0.137	0.205	0.178
	Ind 6	0.132	0.163	0.211	0.276	0.210
	Ind 7	0.473	0.535	0.442	0.521	0.577
	Ind 8	0.136	0.123	0.094	0.079	0.117
Phillippines	ALL	0.090	0.071	0.093	0.053	0.072
	Ind 0	0.715	0.729	0.931	0.720	0.802
	Ind 2	0.293	0.468	0.212	0.326	0.333
	Ind 5	0.425	0.448	0.596	0.640	0.548
	Ind 6	0.155	0.184	0.225	0.219	0.200
	Ind 7	0.258	0.215	0.122	0.132	0.185
	Ind 8	0.121	0.106	0.093	0.112	0.110
Malaysia	ALL	0.046	0.041	0.023	0.017	0.028
	Ind 0	0.499	0.502	0.533	0.380	0.479
	Ind 2	0.335	0.363	0.327	0.224	0.295
	Ind 5	0.399	0.411	0.340	0.416	0.406
	Ind 6	0.164	0.123	0.083	0.082	0.117
	Ind 7	0.307	0.270	0.136	0.136	0.215
	Ind 8	0.106	0.076	0.071	0.092	0.083
Brunei	ALL	n.a.	0.185	0.075	n.a.	0.163
	Ind 0	n.a.	0.657	0.067	n.a.	0.520
	Ind 5	n.a.	0.435	0.677	n.a.	0.549
	Ind 6	n.a.	0.383	0.329	n.a.	0.386
	Ind 7	n.a.	0.236	0.268	n.a.	0.265
	Ind 8	n.a.	0.203	0.087	n.a.	0.172

Table 3b: COS Measure for India's Imports

Exports of		1996	1997	1998	1999	Average
Thailand	ALL	0.076	0.132	0.110	0.094	0.101
	Ind 0	0.014	0.147	0.147	0.127	0.146
	Ind 2	0.035	0.067	0.080	0.071	0.066
	Ind 5	0.364	0.452	0.527	0.524	0.529
	Ind 6	0.071	0.068	0.069	0.075	0.082
	Ind 7	0.344	0.467	0.549	0.655	0.542
	Ind 8	0.233	0.194	0.228	0.198	0.213
China	ALL	0.092	0.078	0.062	0.073	0.079
	Ind 0	0.101	0.149	0.110	0.088	0.140
	Ind 2	0.116	0.140	0.140	0.118	0.130
	Ind 5	0.232	0.235	0.190	0.188	0.221
	Ind 6	0.050	0.053	0.055	0.053	0.059
	Ind 7	0.430	0.542	0.629	0.663	0.603
	Ind 8	0.198	0.176	0.180	0.196	0.193
Singapore	ALL	0.099	0.105	0.136	0.091	0.099
	Ind 0	0.120	0.095	0.133	0.103	0.111
	Ind 2	0.208	0.292	0.354	0.283	0.300
	Ind 5	0.339	0.416	0.432	0.302	0.422
	Ind 6	0.168	0.127	0.097	0.078	0.112
	Ind 7	0.372	0.491	0.560	0.586	0.514
	Ind 8	0.525	0.548	0.524	0.723	0.669
Japan	ALL	0.262	0.166	0.117	0.147	0.158
	Ind 0	0.687	0.245	0.088	0.104	0.176
	Ind 2	0.457	0.427	0.413	0.433	0.452
	Ind 5	0.299	0.254	0.209	0.185	0.240
	Ind 6	0.298	0.306	0.260	0.230	0.300
	Ind 7	0.556	0.661	0.708	0.731	0.696
	Ind 8	0.184	0.136	0.175	0.125	0.138
Korea	ALL	0.309	0.386	0.395	0.230	0.314
	Ind 0	0.144	0.555	0.804	0.705	0.722
	Ind 2	0.140	0.148	0.126	0.086	0.129
	Ind 5	0.398	0.292	0.244	0.221	0.296
	Ind 6	0.117	0.145	0.184	0.160	0.172
	Ind 7	0.320	0.403	0.394	0.512	0.468
	Ind 8	0.186	0.159	0.142	0.100	0.177
Indonesia	ALL	0.123	0.154	0.224	0.240	0.197
	Ind 0	0.063	0.066	0.078	0.098	0.085
	Ind 2	0.044	0.074	0.080	0.072	0.075
	Ind 4	0.534	0.674	0.750	0.875	0.746
	Ind 5	0.677	0.627	0.342	0.297	0.545
	Ind 6	0.055	0.054	0.101	0.098	0.097
	Ind 7	0.262	0.414	0.567	0.685	0.537
	Ind 8	0.175	0.138	0.166	0.097	0.161
Philippines	ALL	0.140	0.087	0.040	0.041	0.058
	Ind 0	0.018	0.361	0.414	0.329	0.310
	Ind 2	0.388	0.511	0.560	0.546	0.534
	Ind 5	0.125	0.449	0.418	0.390	0.396
	Ind 6	0.690	0.600	0.232	0.191	0.463
	Ind 7	0.196	0.232	0.179	0.172	0.196
	Ind 8	0.171	0.146	0.136	0.133	0.147
Malaysia	ALL	0.119	0.115	0.122	0.116	0.119
	Ind 0	0.209	0.325	0.399	0.423	0.424
	Ind 2	0.220	0.395	0.341	0.512	0.379
	Ind 4	0.968	0.977	0.940	0.955	0.963
	Ind 5	0.376	0.212	0.128	0.121	0.213
	Ind 6	0.012	0.012	0.015	0.012	0.013
	Ind 7	0.230	0.375	0.458	0.619	0.486
	Ind 8	0.187	0.146	0.137	0.161	0.170
Brunei	ALL	n.a.	0.235	0.368	n.a.	0.282

Table 4a: Correlations of Supply Shocks Among ASEAN + 4 Nations

	THA	SGP	IDN	KOR	MYS	CHN	IND	PHL	MMR	BRN	JPN
THA	1										
SGP	0.588	1									
IDN	0.672	0.410	1								
KOR	0.501	0.262	0.560	1							
MYS	0.709	0.812	0.575	0.466	1						
CHN	0.353	0.442	-0.123	0.226	0.249	1					
IND	0.071	0.033	0.113	0.073	-0.115	0.293	1				
PHL	0.380	0.287	0.397	-0.192	0.262	-0.508	0.059	1			
MMR	0.070	0.261	0.125	-0.064	0.133	-0.502	0.025	0.248	1		
BRN	0.102	0.174	-0.086	0.324	0.204	0.382	-0.112	-0.642	-0.274	1	
JPN	0.014	-0.113	0.141	0.056	-0.032	-0.396	-0.123	0.336	-0.141	-0.320	1

Table 4b: Correlations of Demand Shocks Among ASEAN + 4 Nations

	SGP	KOR	MMR	THA	IDN	IND	MYS	PHL	CHN	BRN	JPN
SGP	1										
KOR	0.254	1									
MMR	0.246	0.059	1								
THA	0.376	0.698	0.006	1							
IDN	0.205	0.533	0.411	0.593	1						
IND	0.180	0.002	0.122	0.014	0.038	1					
MYS	0.206	0.422	0.201	0.502	0.654	0.153	1				
PHL	0.385	0.390	0.166	0.302	0.493	-0.086	0.300	1			
CHN	0.242	-0.169	0.022	-0.342	-0.167	0.219	-0.190	-0.246	1		
BRN	0.005	0.065	-0.580	-0.025	-0.395	-0.275	-0.069	-0.103	0.517	1	
JPN	-0.548	-0.129	-0.033	-0.430	-0.319	-0.015	-0.248	-0.449	0.147	0.262	1

Table 5: Disturbances and Adjustments across Different Geographic Regions

	Supply Disturbance		Demand Disturbance	
	Size	**Adjustment**	**Size**	**Adjustment**
BRN	1.287	0.221	1.294	0.300
IDN	11.284	0.108	12.112	0.962
MYS	0.682	2.299	8.007	0.696
MMR	15.784	0.766	18.303	0.575
PHL	1.710	0.471	8.564	1.104
SGP	0.167	4.165	0.928	0.132
THA	12.223	0.530	2.481	0.590
CHN	4.481	0.600	1.954	0.640
IND	3.970	0.676	6.343	1.063
JPN	3.849	1.653	7.784	0.773
KOR	3.101	1.416	5.537	2.223
Averages for Different Geographic Regions				
ASEAN + 4	5.321	1.173	6.664	0.823
ASEAN + 4 1,2/	0.055	0.859	0.103	0.798
W. Europe 1,3/	0.030	0.684	0.022	0.417
Americas 1,3/	0.062	0.801	0.145	0.820
SAARC 1,4/	0.023	0.826	0.037	1.106

1/ Figures are from estimation of bivariate Structual VAR
2/ Figures from Saxena (2003)
3/ Figures are from Bayoumi and Eichengreen (1994)
4/ Figures are from Saxena (2005)

Figure 1: Share of Trade with ASEAN: China, Korea, Japan and India
(as a % of total trade; Source: Direction of Trade Statistics)