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The Linkages between Trade and Financial Integration and Output Volatility in East Asia

by

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Abstract

This study attempts to assess the effects of trade and financial variables and others generally seen as affecting the degree of integration on movements in industrial production growth among countries in East Asia. The common component of movements in industrial production growth in the ASEAN 5+ 3 countries is used as a business cycle benchmark for the region. Briefly, the results of the study show the dominance of trade-related variables, such as the average export growth of countries in the study and the import to export prices index of commodities from the Asian NICs, as well as the world price of oil in affecting regional industrial production growth. Financial variables, such as FDI growth in countries included in the study and a dummy variable for the Asian Financial Crisis, while important as well, are not as robust. The results also show the heavy weight on China's industrial output in the construction of the regional benchmark and thus, the increasingly important role that China that China plays in regional growth.

JEL Classification Numbers: E32, F42, F43

Keywords: common component, trade integration, financial integration, regional business cycle

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The Linkages between Trade and Financial Integration
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Maria Socorro Gochoco-Bautista and Dennis Mapa*

I. Introduction

It is generally accepted that the degree of economic integration among the East Asian (ASEAN 5 + 3) countries has been rising in the past decades. Although various initiatives at the official level continue to be undertaken to promote trade and financial integration, this increased economic integration is seen as being largely market-driven.

Economic integration is associated with certain processes and outcomes. Greater trade and capital flows among countries may give rise to greater similarities in the pattern of aggregate economic behavior, including increased business cycle synchronization. The same processes that heighten the economic interaction among countries, however, may also serve as the channels that transmit shocks more easily across national borders. These shocks tend to disturb the evolution of an economy along its long-run path and produce or intensify business cycle effects.

The shocks that could hit countries are diverse, and include “sudden stops” of capital flows, changes in technology, terms of trade shocks, productivity shocks, shifts in demand, monetary and fiscal policy changes etc. Shocks also differ based on their origin and could be country-specific, regional, or global. Some of the shocks that have hit Asia include global shocks such as changes in external demand and the bursting of the IT bubble, regional shocks such as the Asian Financial Crisis and SARS, and country-specific shocks elsewhere that spread globally such as Russia’s default and the LCTM crisis. Indeed, even as trade and financial integration have been increasing in East Asia, the Asian Crisis showed that a financial crisis in one country can quickly became a regional crisis, spill over to the real sector, and lead to a large decline in output growth across countries.

Economic theory posits that greater economic integration increases efficiency and is therefore welfare-improving. However, it does not provide an unambiguous answer to the question regarding the effects of increased trade and financial integration on output volatility across countries. According to the literature, trade and financial integration may each have different effects on the business cycle. Trade integration is typically seen as having beneficial, growth-promoting effects, and usually has a perceptible positive impact on the co-movement of output across countries. The latter, in particular, evidently depends on the nature of shocks and the pattern of trade specialization rather than on

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the volume of bilateral trade or trade intensity between countries *per se*. If trade integration results in greater intra-industry specialization, as is believed to be the case in East Asia, the degree of business cycle synchronization across countries is expected to increase. However, greater inter-industry trade is expected to lead to greater specialization in production and less synchronization among business cycles.

In contrast, there is less evidence on the degree and effects of greater financial integration. Certain structural features of developing countries, such as shallow markets, the uncertainty of capital flows and the possibility of "sudden" stops, the small size of a country and the importance of world shocks, etc., in tandem with greater capital/mobility, may give rise to undesirable outcomes.

This study attempts to assess the effects of trade and financial variables and others generally seen as affecting the degree of integration on movements in industrial production growth among countries in East Asia. The common component of movements in industrial production growth in the ASEAN 5+ 3 countries is used as a business cycle benchmark for the region. Trade-related and financial variables as well as the global price of oil and a measure of global output growth are used to explain movements in the common component of output growth. This may help answer questions as to whether and to what degree these variables facilitate the transmission of shocks, the possible channels of these effects, and their effects on regional output.

The findings of the study have potentially important implications on the desirability of pursuing greater trade and/or financial integration in the region. If desirable, the study hopes to shed light on the important channels through which such integration takes place. These may have important implications on the need to coordinate policy across countries and on the feasibility and desirability of pursuing the dream of a currency area in the future.

The empirical methodology consists of several parts. First, an empirical measure of the common component of output fluctuations with time-varying weights among the countries in East Asia included in the study is used following a methodology due to Lumsdaine and Prasad [2003].[1] The assumption underlying the model is that the relative conditional standard deviation is a measure of the degree of commonality among fluctuations across countries. The use of a single measure of output fluctuations across countries allows the discovery of certain stylized facts about the timing and severity of such fluctuations at the regional level. Second, variables that are identified in the literature as indicators of the degree of trade and financial integration and others that could affect the common component of output growth are tested for robustness using a modified Extreme Bound Analysis (EBA) procedure due to Levine and Renelt [1992]. Third, using variables found to be robust from the EBA, both autoregressive (AR) and autoregressive distributed lag (ARDL) models are used to determine the dynamic relationship of these on the common component of industrial production growth.

The countries included in the study are the original 5 ASEAN countries, namely, Indonesia, Malaysia, Thailand, Singapore, and the Philippines plus the East Asian 3, namely, Japan, the People's Republic of China, and Republic of South Korea. Monthly data for the period 1995 to 2004 from the IFS CD-ROM, the Asian Development Bank's

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[1] See Gochoco-Bautista [2005].

ARIC database, UN Trade Statistics, and other sources will be used. Apart from the industrial production indices of the 8 countries, variables such as the US industrial production index, an oil price index, financial variables such as changes in LIBOR, FDI growth, and a dummy variable for the financial crisis in 1997, and trade-related variables such as the average export growth rate for countries in the study, the import/export price index of all commodities from Asian NICs, the price of electronic capacitors, and the price of semi-conductors are used. Monthly year-on-year (y-o-y) values of the variables are obtained from the raw monthly data.

The study is divided into the following sections. Section 2 presents a review of the literature on the role of trade and financial integration in business cycle movements and presents a list of some of the variables that have been used to measure trade and financial integration in the literature. Section 3 discusses the empirical methodology. Section 4 describes the data used and presents the results. Section 5 presents the summary and conclusions of the study. Briefly, the results of the study show the dominance of trade-related variables, such as the average export growth of countries in the study and the import to export prices index of commodities from the Asian NICs, as well as the world price of oil in affecting regional industrial production growth. Financial variables, such as FDI growth in countries included in the study and a dummy variable for the Asian Financial Crisis, while important as well, are not as robust. The results also show the heavy weight on China's industrial output in the construction of the regional benchmark and thus, the increasingly important role that China plays in regional growth.

2. Review of Literature

Rand and Tarp [2002] point out the nature and characteristics of business cycles in developing countries are quite different from those in industrialized countries. Business cycles in developing countries tend to be shorter and have a wider range of stylized facts compared with those in industrialized countries.

Output fluctuations across countries occur or are intensified by shocks that may be specific to countries initially and are transmitted across countries or because countries are hit by common shocks. Shocks may be transmitted across countries in many ways.[2] Current account transactions or transactions in international capital markets may transmit shocks that start as country-specific shocks as well as intensify the effects of a common shock that hits countries. There is no consensus on whether the transmission of shocks internationally tends to result in greater co-movement and similarities in the pattern of aggregate economic behavior, including increased business cycle synchronization, or not. Razin and Rose [1994], for example, find no consistent link between trade and financial openness and volatility in output, consumption, and investment in a sample of 138 countries in 1950-88.

a. Trade Integration

The literature on the relationship of the role of trade and output growth and volatility is complex and diverse. Static gains from comparative advantage, knowledge spillovers, and indirect effects on productivity and growth are some of the channels through which trade aids growth. Numerous studies, such as those of Canova and Dellas [1993],

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[2] See Loayza, Lopez, and Ubide, 2001, pp. 367-368.

Frankel and Rose [1998], Clark and van Wincoop [2001], Gruben et al. [2002], find that the extent of bilateral trade is positively correlated with bilateral business cycle correlation. However, the measures used to quantify the extent of the trading relationship between or among countries in these studies vary, and include the total volume of trade, the degree of trade intensity, trade openness, and the extent of inter- versus intra-industry trade.

The effects of greater trade integration on macro volatility evidently depend on the nature of shocks and the degree of specialization rather than the volume of trade *per se*. Common demand shocks and productivity spillovers would tend to increase the degree of business cycle co-movement while greater specialization in production would tend to do the opposite. If greater trade gives rise to specialization, then following the Ricardian theory of comparative advantage, structural differences between economies would be larger, and sector-specific shocks in one economy would be less likely to affect other economies. Business cycles would be less synchronized across countries.

On the other hand, if intra-industry trade is more pronounced than inter-industry trade, Frankel and Rose [1998] posit that business cycles will become more synchronized via demand shock or productivity spillovers. The findings in Fidrmuc [2001], Crosby [2003], and Shin and Wang [2003] tend to confirm this hypothesis. Frankel and Rose thus see a greater need for coordinated fiscal and monetary policies with greater trade. Greater synchronization of business cycles across countries implies that unilateral beggar-thy-neighbor policies will not generally work to raise output or reduce its volatility, unless the countries are also linked via a third country.

However, Gruben, Koo, and Millis [2002] point out that even specialized trade can give rise to greater output correlation because of possible links between specialization and common demand shocks and productivity spillovers. In other words, even with greater specialization, trade may act as a transmitter of shocks from common demand shocks and productivity spillovers which could lead to greater business cycle synchronization.

Whether or not trade acts as a transmitter of shocks either across countries or industries is an unsettled issue. Even in the presence of greater intra-industry trade, if trade is a transmitter of shocks, Correia, Neves, and Rebelo [1995] posit that business cycles would tend to be less synchronized across countries. This possibility cannot be ruled out as they show that the balance of trade exhibits high cyclical volatility and hence, suggests that fluctuations could be transmitted across countries or industries.

In contrast, Canova and Dellas [1993] find only weak evidence that trade acts to transmit shocks. Kouparitsas [2002] finds no evidence to show a positive relationship between the degree of output co-movement and trade nor does trade act as a transmitter of shocks. He finds that the strong degree output co-movement in the US in the last 40 years is due to common shocks and similar responses to them rather than spillover effects in which trade may act as a transmitter. This finding, despite strong interregional trade links across US regions, casts doubt on the idea that strong trade links act as a conduit of spillover effects since the industry mix is different across regions in the US.

Loayza et al. [2001] generalize this latter point and posit that the similarity of trade structures across countries matter for business cycle co-movement across countries. Even if countries trade with each other, if they have very different industries (or become more specialized in production a la Ricardo), their business cycles will tend to be less synchronized. This is compatible with the idea that the level of development of countries matters for output co-movement. Hence, trade between industrial and developing countries may result in lower business cycle correlation as this is likely to happen across different industries.

The literature on the effect of trade openness on growth generally finds a positive relationship between them. These include Sachs and Warner [1995], Frankel and Romer [1999], Dollar and Kraay [2002], and Wacziarg and Welch [2003]. However, some of the results of these previous studies have also been challenged on the grounds of model misspecification and the use of variables for trade openness that may be capturing other institutional or policy features.

Some studies do find that trade openness leads to greater output volatility, especially in developing countries. These include Karras and Song [1996], Easterly, Islam, and Stiglitz [2001], and Kose, Prasad, and Terrones [2003c]. Others like Buch, Dopke, and Pierdzioch [2002] either find no significant relationship between increased trade interdependence and output volatility or a low effect of trade on business cycles as in Imbs [2004].

b. Financial Integration

Increased capital flows can directly or indirectly enhance growth.[3] The direct channels include the augmentation of domestic savings to increase consumption, investment, or to finance trade imbalances, a reduction in the cost of capital, the development of the financial sector, and the transfer of technological know how. The indirect channels include either the promotion of specialization or the diversification of the production base and even the inducement for better policies through, for example, pressures engendered by market forces or greater policy coordination.

Unlike the case of trade integration, however, the literature on the effects of greater financial integration on economic growth cannot easily establish a positive relationship between them. One reason for this, as Prasad et al. [2003] point out, is that in contrast to trade openness, financial integration requires several prerequisites to be in place in order for it to be beneficial. These prerequisites include a fairly high level or degree of financial development of a country. Countries with less developed capital markets or capital markets that are shallow and small are less able to cope with “sudden stops”. Other measures include a low or reasonable degree of country risk, a certain degree of absorptive capacity, sound macroeconomic policies, good governance and strong institutions.

Other reasons for this weak link between financial integration and growth include low total factor productivity in developing countries and costly banking crises experienced by these countries in the process of financial integration. Prasad et al. [2003] cite studies in which only 3 of 14 reports a positive effect of financial integration on growth. Majority of the studies find that financial integration either has no effect, a mixed effect, or only a modest effect on growth.

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[3] See Kose, Prasad, and Terrones [2004].

A number of standard models suggest that under general conditions, financial integration would be expected to lead to a decline in macroeconomic volatility. Obstfeld's [1994] study shows that if capital is mobile internationally, consumption risks should be efficiently allocated, and the marginal utility of consumption should be equal in each country. Consumption correlations and capital mobility, the latter typically taken to imply greater financial integration, would be positively related.

It is remains a puzzle, therefore, why many of the earlier studies obtain results showing that the correlation of consumption appears to have declined in periods when countries were opening up their capital accounts and were apparently becoming more financially integrated. Kose, Prasad, and Terrones [2003a] point out that the volatility of consumption growth relative to income growth increased for countries considered to be in the middle range of financial integration (MFIEs) in the 1990s, at the same time that financial flows to and from these countries increased tremendously.[4] In contrast, the volatility of output growth declined in this period. However, there appear to be threshold effects, with the opposite effect occurring once the level of capital flows reaches a particular level. Likewise, the level of financial development of countries appears to be important as less developed countries tend to have shallower financial markets and are less able to deal with "sudden stops" and reversals in capital flows. O'Donnell [2001], cited in Prasad et al. [2003], finds that a higher degree of financial integration is associated with lower output volatility in OECD countries but the reverse is true in the case of non-OECD countries

Other studies explain why it is that while consumption correlations and co-movement may be low, the degree of business cycle synchronization may increase. Kose, Prasad, and Terrones [2003b] posit that financial linkages could lead to a higher degree of business cycle synchronization by generating large demand side effects. Heathcote and Perri [2002] likewise show that the extent of international borrowing and lending is important for reducing business cycle effects by ensuring continued access to international capital markets.

The nature of shocks may also affect the relationship between the degree of financial integration and output volatility. Mendoza [1994] finds that when shocks are large and persistent, output volatility increases with financial integration. Buch, Dopke, and Pierdzioch [2002] show that monetary policy shocks increase the volatility of output but lower the volatility of consumption. In contrast, fiscal policy shocks give rise to opposite results.

Whether foreign or world interest rates have an effect on business cycle synchronization in emerging countries is likewise unsettled. Mendoza [1991] conjectures that world interest rates only have a minor impact on business cycle fluctuations except in highly-indebted developing countries. As foreign interest rate payments as a fraction of output increase, world real interest rate shocks tend to explain a larger fraction of output fluctuations. In general, however, world interest rate shocks explain only 1 percent of output volatility, according to Kose's [2002] results. The same general result is obtained by Correia et al. [1995], and Schmitt-Grohe [1998].

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[4] Kose, Prasad, and Terrones, 2003, p. 3.

In contrast, Neumeyer and Perri [2005], find a strong relationship between interest rates and business cycles in emerging economies. The relationship works through country risk which in turn is driven by factors such as foreign interest rates, contagion, political factors or changes in domestic fundamentals. They also estimate that eliminating country risk lowers output volatility by 27 percent in Argentina. Uribe and Yue [2003] likewise find that US interest rates and country spreads explain about 20 percent and 12 percent, respectively, of business cycle movements in emerging economies. They find that country spreads respond to changes in US interest rates, and this effect is large in emerging markets because the latter's borrowing costs in international financial markets rise when US interest rates rise.

c. Other Factors

Other factors not previously mentioned that could also affect output movements. These include common world price shocks, country specific shocks, currency unions, gravity variables such as distance between countries and a common language, the degree of industrialization, productivity shocks, terms of trade shocks, etc.

Kose [2002] analyzes the effect of world price shocks, such as changes in the prices of capital, intermediate, and primary goods, and in the world real interest rate, in the generation and propagation of business cycles in small, open economies. He finds that 90 percent of the volatility of aggregate investment is explained by world price disturbances, specifically, the prices of primary capital goods. Blankenau, Kose, and Yi [1999] estimate that up to 23 percent of fluctuations in output in Canada (and more than half of the fluctuations in the trade balance) are explained by world real interest rate shocks. However, their model predicts only low negative correlation between the lead world real interest rate and current output.

Similarly, Mendoza [1988] and Backus, Kehoe, and Kydland [1989] show the dominance of world shocks, such as two great oil price shocks, and the integration of financial markets in driving business cycles. These studies give empirical content to the notion of an imported business cycle to real business cycle theories. The extent to which small open economies can undertake stabilization policy when world shocks dominate may be limited and thus lead to the greater volatility of output growth.

Gregory, Allen, and Raynaud [1997] study the G7 countries and find that both worldwide and country specific factors play major roles in a country's aggregate fluctuations. Worldwide shocks include technology shocks and oil prices. Country specific factors include domestic policy changes, terms of trade shocks, and other disturbances that are country-specific in origin.

Kose, Otrok, and Whiteman [2003] find that a common world factor is an important source of volatility for aggregates in most countries. In Asia, however, country factors play a dominant role in the volatility of output and consumption. Norrbin and Schagenhauf [1996] also find that nation-specific shocks are the dominant factor explaining variations in industry output in a country.

Terms of trade shocks may also increase output volatility. Mendoza [1995] finds that terms of trade shocks explain about 56 percent of GDP variability. In developing countries, this is due to these countries' dependence on imported capital goods and specialization in commodity exports. Baxter and Kouparitsas [2000] find that the volatility of terms of trade for developing countries as a group of 18.85 percent per year is much larger than the 8.89 percent for developed countries as a group.

Kouparitsas [1997] finds that productivity shocks explain almost 20 percent of output variation in developing Southern countries. Kose [2002] shows that productivity shocks generate larger responses than relative price shocks on impact. However, relative price shocks explain a much larger fraction of business cycle fluctuations than productivity shocks since the former are much larger than the latter. Ingram, Kocherlakota, and Savin [1994], however, argue that a productivity shock has an indeterminate effect on the variance of output.

Factors Affecting Volatility of Output

LIBOR deflated by changes in the export unit value index of non-fuel commodity exporting developing countries	Kose 2002
Relative price of capital goods to primary goods or the ratio of the US PPI of capital equipment to export unit values of each country	Kose 2002
Relative prices of non-fuel commodities to manufactured goods	Kose 2002
Bilateral trade between countries measured as total trade from beginning to end of a period	Baxter and Kouparitsas 2005
Composition of trade	Gruben, Koo, and Millis 2002
Gross capital flows across national borders as a measure of financial integration	Kose, Prasad, and Terrones 2004
Composition of capital flows	Reisen and Soto 2001
Patterns of specialization	
Sources of shocks	
Ratio of imports and exports to GDP as a measure of trade openness	Kose, Prasad, and Terrones 2004
Ratio of gross capital flows to GDP as a measure of financial integration	Kose, Prasad, and Terrones 2004
Financial market development using ratio of broad money to GDP or the ratio of total credit to private sector GDP	

Intra-industry trade measure versus trade intensity measure	Shin and Wang 2005
Country risk and domestic fundamentals	Neumayer and Perri 2005
Domestic policy changes and other disturbances that are country-specific in origin	Gregory, Head, and Raynaud 1997
Balance of Trade	Correia, Neves, and Rebelo 1995
Terms of trade measured as the ratio of import to export deflators	Mendoza 1995
Accessibility to world financial markets	Mendoza 1995
US interest rates, country spreads	Uribe and Yue 2003
World technology shocks, oil prices	Gregory, Head, and Raynaud 1997
World shocks	Kose, Otrok, and Whiteman 2003

3. Empirical Methodology

a. Measuring the Common Component of Fluctuations in Output Growth

A measure of the common component of fluctuations in output growth using Lumsdaine and Prasad's [2003] methodology is first derived. The aim of the methodology is to estimate the cumulated common component in fluctuations across countries to obtain a regional business cycle benchmark and examine its properties, rather than distinguish among different kinds of shocks. The methodology presumes that there is a "regional" business cycle if a substantial fraction of fluctuations in output growth are in some sense common or similar across countries in the region.

Following Lumsdaine and Prasad, the following model is estimated.

For each country i:

$$y_{it} = c_i + \varepsilon_{it}, \qquad \varepsilon_{it} / \mathrm{I}_{t-1} \approx \mathrm{N}\,(0, h_{it}) \qquad (1)$$

$$h_{it} = w_i + \alpha_i\, \varepsilon^2_{it-1} + \beta_i\, h_{it-1} \qquad (2)$$

where y_{it} represents industrial production growth in country i at time t, c_i is a country specific mean, and I_t denotes information available at time t. h_{it}, or the conditional variance, is computed for each country series using a univariate GARCH (1,1) model of output growth for the country's aggregate series. The parameters w_i, $\alpha_{i,}$, and β_i are constrained to be positive; the likelihood is also penalized to ensure that $\alpha_i + \beta i \le 1$, a constraint that never binds in the estimation. The residuals from a regression of each country variable with twelve lags are obtained to test for time-varying volatility. The Ljung-Box test is used to test for autocorrelation in the squared residuals.[5]

The time varying weight for the output growth of a country W_{it} is constructed in the following manner:

$$W_{it} = \frac{1}{\sqrt{h_{it+1}}} \Big/ \sum_{i=1}^{8} \frac{1}{\sqrt{h_{it+1}}} \qquad (3)$$

where h_{it+1} is in the information set I_t. The square root of the estimated conditional variance yields the estimated conditional standard deviation in output growth. Hence, note that (3) is essentially the ratio of the inverse of the standard deviation for a single country to the average for the entire group of countries.

Intuitively, this weighting scheme is such that if a large, specific shock hits a country but is not transmitted to other countries so that output growth in other countries is unaffected, output growth in the country that is hit will exhibit a large fluctuation, i.e., its conditional volatility measured by its conditional standard deviation will be large relative to the average conditional standard deviation in output growth for all countries. The weight assigned to such an idiosyncratic country-specific shock in the construction of the common component should be small. The methodology employed here, by taking the inverse of the conditional standard deviation of fluctuations in a single country relative to the average of the inverse of fluctuations in all countries as seen in (3), down weights such outliers in computing the weight for the common component.

In contrast, if the shock is common to all countries or if a country-specific shock is transmitted so that all countries are similarly affected, then any individual country's estimated conditional standard deviation will not be too different from the average for the group of countries as countries are similarly affected by the shock. The similarity in the response of countries to the shock is captured by the relative weights remaining unchanged in the construction of the common component rather than down weighted as in the previous case. Lumsdaine and Prasad point out that in their methodology, a country-specific shock that propagates to other countries is observationally equivalent to a common shock that influences output growth in all countries but with varying lags. If the time-varying country weights for each country are multiplied by the respective actual country output growth series and summed across all countries, the "common component" of output growth for the region Z_t^R is obtained. In other words, Z_t^R is constructed as:

$$Z_t^R = \sum_{i=1}^{8} W_{it} Y_{it} \qquad (4)$$

[5] Lumsdaine and Prasad used the Box-Pierce Q test.

The common component of output growth for the region Z_t^R may be summed over time to obtain its "cumulated common component." The cumulated common component is therefore defined as:

$$\sum_{t=1}^{n} Z_t^R \qquad (5)$$

b. Extreme Bound Analysis

The EBA analysis seeks to determine the statistical significance and consistency in coefficient signs or ''robustness'' of different explanatory variables using a contemporaneous relationship. Suppose that there are a total of n variables presumed to be related to the common component. The first step in identifying whether variable z is robust using the Extreme Bound Analysis (EBA) test proposed by Levine and Renelt [1992], is to estimate regressions of the form

$$\gamma = \alpha_j + \beta_{yj} y + \beta_{zj} z + \beta_{xj} x_j + \varepsilon \qquad (1)$$

where *y* is a vector of fixed variables that appear in all the regressions, *z* is the variable of interest, and $x_j \in X$ is a vector of variables taken from the pool *X* of n variables available. One needs to estimate this regression or model for the M possible combinations of $x_j \in X$. For each model *j*, one finds and estimates, β_{zj}, and the corresponding standard deviation, σ_{zj}. The lower extreme bound for variable *z* is defined to be the lowest value of $\beta_{zj} - 2\sigma_{zj}$ while the upper extreme bound for *z* is defined to be the largest value of $\beta_{zj} + 2\sigma_{zj}$.

The extreme bound test for variable z states that if the lower extreme bound is negative and the upper extreme bound is positive, then variable z is not robust. This means that the variable is not considered robust if one finds at least one regression for which the sign of the coefficient, β_z, changes or becomes insignificant. For the EBA in the regression for the common component, no variable was considered fixed in the model and the number of variables are made to vary from 1 (minimum) to 7 (maximum) explanatory variables.

4. Data and Empirical Results

Table 1 is the list of the variables used in the study. Variables related to trade integration include IE, the ratio of the import price to export price of all commodities from the ASIAN NICs to the US, the average rate of export growth (y-o-y) of the 8 countries in the study, ELECTRIC, the producer price index of electronic capacitors, and PPI, the producer price index of semi-conductor and related devices.[6]

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[6] An earlier version of the study used the common component of the real exchange rate of the 8 countries, constructed using the same methodology here, but this variable was never significant in the earlier regression models and has been excluded here. The earlier version also included the common component of

Variables related to financial integration include the average monthly growth rate (y-o-y) of FDI in the 8 countries in the study which measures the growth of long-term capital flows to the region, LIBOR, the 3-month London inter-bank offer rate and a dummy variable for the Asian financial crisis, CRISIS, whose value is 1 from July 1997 to July 1998, and zero otherwise.

The dollar price of Dubai-crude oil, OIL, is included as previous studies, such as Kose [2002], find that world prices of inputs are important in explaining business cycle fluctuations in open economies. US_IP, or the industrial production index of the US, is used as a proxy for world demand shocks, as the US is typically the single most important market for the exports of East Asian countries.

Table 2 presents the summary statistics of the variables used in the study. As can be seen from the table, both changes in the price of Dubai-crude oil and export growth have the highest mean values of 12.9 percent and 10.14 percent, respectively, among the variables.

Table 3 presents descriptive statistics of the growth rates of y-o-y industrial production in the 8 countries in the sample as well as the common component. Looking at the top row of the table, China, Korea, and Malaysia have average monthly y-o-y rates of growth in industrial production higher than that in the common component. China, in particular, has a very high mean rate of 12.04 percent versus only 5.69 in the common component. Note also the extreme maximum and minimum values of monthly y-o-y growth rates for countries like Indonesia (34.09 percent vs. -25.42 percent), for example, with the minimum values occurring during the Asian Financial Crisis.

Table 4 is the correlation matrix of the different variables. The top row of the table shows that the common component of industrial production growth is highly correlated with the growth rate of exports (0.74), the growth rate in IE, or the ratio of the import price to export price index of all commodities from ASIAN NICs (0.74), and to changes in the price of Dubai-crude oil (0.62). Aside from the common component of industrial production in the 8 countries, the average export growth rate is also highly correlated with the growth rate in IE (0.63), changes in the price of oil (0.62), and to a lesser extent, to changes in the LIBOR rate (0.44) and the growth rate in US industrial production (0.33).

Table 5 shows the weights of the different countries in the construction of the common component of industrial production growth, calculated as in equation (3) in the empirical methodology. The top row in the table shows the mean values of the weights of each country. As is apparent, the two largest economies in the region matter the most. China has the largest weight, 0.23, followed by Japan, 0.16. Singapore, better known as a financial center in the region, has the lowest weight of 0.06 in the construction of the regional benchmark for industrial production growth, even lower than Indonesia’s 0.09.

The graph on the next page shows the common component of industrial production growth using monthly y-o-y data from September 1996 to September 2004, while Figures 1 through 8 compare this with the actual rates of monthly y-o-y industrial

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interest rate differentials of the countries included in the study but was also never significant in earlier regression models.

production rates of growth in each of the 8 countries. The graph of the common component of industrial production growth shows two distinctly large declines in industrial production growth in the region. These are 1997-1998 during the Asian Financial Crisis, and during the bursting of the IT bubble in 2001-2002. As the peak in the common component of industrial production growth occurs in late 2000, it appears that the bursting of the IT bubble was of a bigger magnitude than the decline experienced during the Asian Financial Crisis.

Turning to Figures 1 to 8, it is worth noting from Figure 3 that Japan's industrial production growth is the one that appears to be most similar to that of the common component for the region, but Japan's industrial production growth rates are, unlike those in the other countries, typically below the common component. In contrast, China's industrial production growth rates, especially in more recent years, has been very much above the regional average, and the same is true to a lesser extent also for Malaysia, Singapore, and Thailand.

Table 6 summarizes the results of regression of each country's actual industrial production growth rate against the common component of industrial output growth for the region. In all countries, the coefficient of the common component of industrial output growth is statistically significant. Note that only two countries, namely, China and the Philippines, have coefficients on the common component that are below 1.

All in all, the results show that the growth in industrial production in individual countries in the region depends on growth in the region as a whole to fuel their individual economies. China is very important in the region. Apart from its large weight in the construction of the common component for the region, its industrial production growth rate is impressive relative to the regional benchmark. It appears to act not only as center of regional growth but presumably also as a buffer against adverse shocks.

Turning now to the EBA results, note first that each of the explanatory variables appears 64 times in an EBA regression model in which it is included.[7] Various combinations of the different variables are used in the different regression models. The EBA results for different regression models are given in Tables 7 and 8.

In Table 7, both the average growth in exports and the growth rate in ELECTRIC, or the producer price index of electronic capacitors, are used to capture the effects of trade. The other variables in the regression include the change in the price of OIL, the growth in US industrial production, the first difference in the LIBOR rate, the growth in FDI, and the CRISIS variable. The change in the price of OIL and the average export growth of the 8 countries are the only robust variables. This means that the sign on these coefficients did not change nor become statistically insignificant in the 64 regression models used.

That the average growth in exports contributes positively to the common component of industrial production growth for the region is intuitively-appealing and as expected. It

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[7] Either PPI, the producer price index for semiconductors and similar devices or ELECTRIC, the producer price index for electric capacitors, is used in the different sets of regressions together with LIBOR, OIL, IE, US_IP, and CRISIS. Similarly, either IE or the average growth rate of exports is used in the regressions.

suggests that trade integration within the region is important and significant. Note, however, that the sign on the other robust variable, the change in the price of oil is contrary to what one would normally expect, as oil is generally regarded as a supply side variable. With the exception of oil-producing countries like Indonesia and Malaysia, one would expect the price of oil to have a negative effect on output growth. Since most of the countries in the region are oil importers, this finding is surprising.

One possible explanation for the positive effect of the price of oil on industrial production growth is a demand side, one possibly involving the role of China. China has been growing phenomenally in the past decade, and this growth has increased its demand for inputs such as oil to keep its industries humming along. China bought up 7.5 percent of the world's crude oil in 2003, for example, helping drive up world oil prices.[8] At the same time, studies such as Eichengreen, Rhee, and Tong [2004] and Heferker and Nabor [2004], have found that countries in the region tend to grow alongside the Chinese economy. Hence, perhaps it is not surprising to find a positive relationship between the price of oil and industrial production growth.

The results in Table 7 also show that while financial variables such as the CRISIS variable and the growth in FDI are not robust in the strict sense of the EBA, they are nevertheless statistically significant in 56 of 64 and 50 of 64 regressions, respectively, and have the expected signs. Note, however, that the change in the LIBOR rate is not robust and does not have the expected sign. As some studies point out, world interest rates only seem to matter for countries that are heavily-indebted. As the countries in the region, such as the Philippines, have graduated from the ranks of the heavily-indebted, this result should not be surprising. In general, these results suggest that while important, financial variables appear to be less important than trade variables for regional industrial production growth.

In Table 8, a different specification of the EBA is used. IE, the ratio of the import to export price index of all commodities from Asian NICS, is used in place of average export growth, and PPI, the producer price index of semi-conductors and related devices, is used in place of ELECTRIC, the producer price index of electronic capacitors. The other explanatory variables used in the regression model in Table 7 are retained.

The results show that only the growth in IE is robust in the strict sense used in the EBA analysis here and its coefficient is positive. IE is the price ratio of imports to exports from the Asian NICs or equivalently, the price ratio of exports to imports from the perspective of the Asian countries, and it is positive as expected. Better terms of trade for the countries' exports have a positive effect on industrial output growth in the region. Note that the change in the price of OIL, while no longer robust in the strict sense, is still statistically significant in 61 of 64 regressions or more than 95 percent of the regressions. The growth rate in US industrial production is also statistically significant in 55 of 64 regressions, suggesting that external demand conditions are also important.

As the EBA detects only contemporaneous relationships, two specifications are used for the dynamic specification of the regression using variables earlier found to be robust. One of these is the regression with autoregressive errors (AR model), in which past values of the error term are included in the regression, in addition to the variables

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[8] Statement of Mr. Stephen Roach at the 2004 IMF Economic Forum.

previously found to be robust. The results presented in Table 9. Model 1 in the table show the significant lags of the error term to be the first, second, and eighth. The results imply that the current value of the common component of industrial production growth is affected by contemporaneous changes in the price of oil and the average growth of exports, and by past values of the common component of industrial production growth itself, oil price changes, and average export growth.

Model 2 in Table 9 uses an autoregressive distributed lag (ARDL) model in which the specific variable which yielded the significant lag previously is included. While the AR model of Model 1 shows us which lags of the error term are significant, it does not tell us which specific variable accounts for this. The ARDL model used in Model 2 shows that only lags of the common component affect its current value. Lagged changes in the price of oil and average export growth do not, even though a significant contemporaneous effect exists. Thus, the dynamic pattern from changes in the price of oil and average export growth to the common component of industrial production growth is not direct. Lagged changes in the price of oil, for example, work through the lag of the common component to affect the current value of the common component.

Table 10 has a specification similar to Table 9, except that the other robust variable, IE, or the ratio of the import to export price index of commodities from Asian NICs, is used in place of average export growth. The results obtained have a similar interpretation to those in Table 9.

In general, therefore, the results show that trade-related variables, such as the average growth of exports of the 8 countries in the study and the growth rate of IE, the ratio of import to export prices of goods from Asian NICs, as well as changes in the price of oil are the robust variables. Two financial variables, namely, the CRISIS variable and FDI growth in the 8 countries, as well as the growth in US industrial production, are almost robust. This suggests that financial channels and external demand conditions also have important effects on regional industrial production growth.

The results obtained are similar to those obtained in other studies. These include Mendoza [1988], Backus, Kehoe, and Kydland [1989] and Kose [2002] on the importance of oil prices in driving business cycles, Mendoza [1995] on the importance of terms of trade shocks in explaining output variability in developing countries, and the results in Mendoza [1991], Schmitt-Grohe [1998], Correia et al. [1995], and Kose [2002] on the relatively unimportant role of world interest rates in explaining output fluctuations and volatility.

5. Summary and Conclusions

This study attempts to assess the importance of regional trade and financial integration on the common component of industrial production growth in ASEAN 5+ 3 countries, the regional business cycle benchmark used. The latter is derived using a methodology due to Lumsdaine and Prasad [2003]. Aside from trade and financial variables, the global price of oil and a measure of global output growth are also used.

Different empirical methodologies are used to examine the importance or significance of the different explanatory variables in explaining movements in the common component of output growth. These include the Extreme Bound Analysis (EBA) test to identify robust explanatory variables, and two specifications to examine the dynamic relationship between the common component and the robust explanatory variables. Monthly y-o-y data from 1995 to 2004 are used.

Overall, the findings show the dominance of trade-related variables and changes in the world price of oil rather than finance-related variables in driving regional industrial production growth. Specifically, the results obtained show that changes in the world price of oil, average export growth, and the growth in IE, or the ratio of the import to export price index of all commodities from Asian newly-industrialized countries, are robust based on the EBA results in different regression models. Trade openness among the Asian countries allows and fosters higher export growth rates. Along with better terms of trade, there is a positive regional industrial production growth. This finding is compatible with the general one in the literature regarding the effect of trade on growth. From the descriptive statistics, we note that changes in the price of oil and the average growth of exports have the highest mean values among the variables. Together with the growth in IE, they are also the variables most correlated bilaterally with the common component in industrial production growth. Average export growth is likewise highly correlated with both IE and the world price of oil.

Some of the signs on the significant explanatory variables in the EBA analysis are not as expected. In particular, the price of oil is positively related with the common component of output growth. One possible explanation for this is a demand side channel involving China. As China grows, its huge demand for inputs, such as oil, drives up the prices of these inputs in the world market. Since some studies suggest that growth in China has a positive spillover effect on its neighbors, as China buys more goods from them as she grows, it may not be too surprising to find a positive relationship between the price of oil and the common component of industrial output growth for the region. All of these may be seen as evidence of the importance of China in the region as a regional center of growth and as a buffer for adverse shocks that hit the region. This is supported by the finding in this study that the weight attached on China's industrial output growth in the construction of the common component for the region is the largest among the countries, followed by Japan. China's continued growth is important for regional growth. The region should realize that its economic fortunes are becoming more and more closely tied to China's, and that to benefit from this relationship, must find ways of becoming more economically integrated with China.

The study also finds that financial variables, such as the growth in FDI in the region and the CRISIS variable, while significant in the majority of regressions estimated, are not robust based on the strict sense in which it is used under the EBA. The change in the LIBOR rate is significant in even fewer regressions, compatible with findings in the literature that suggest that as countries graduate from the ranks of the heavily-indebted, world interest rates will not matter as much. In general, this finding is compatible with the weak empirical evidence found for the link between financial integration and growth in the literature. The finding obtained in this study show that under normal circumstances, long-term capital inflows or FDI benefit the region. Therefore, not only should FDI be encouraged, countries should be wary about adopting measures that would stop or hinder capital flows and reverse capital account liberalization.

On the other hand, volatile and short-term capital flows and the ease with which capital flows can reverse when capital is mobile internationally, and which tend to happen when perceptions regarding a country or countries in the region turn for the worse, can lead to a financial crisis as it did in 1997, and have adverse real effects. While China's capital account remains closed, the region's excess savings have gone not only to developed countries but have also recently flooded the region's equity and property markets and contributed to the appreciation experienced by domestic currencies in the region. To a certain extent, therefore, the opening up of China's capital account will have important ramifications on the regional economy. Hopefully, for the region, China's overall growth will remain robust.

While the ambiguity surrounding the beneficial effect on growth of greater financial integration remains unresolved, it is clear that closer regional trade integration and more trade openness among countries in the region is beneficial and should be encouraged. This may not necessitate policy coordination among countries in the region. Rather, it means that in the face of shocks and challenges facing countries in the region, policymakers should not become paranoid and revert to protectionism.

Table 1
List of Variables and Data Sources

VARIABLE NAME	DEFINITION	SOURCE OF BASIC DATA
Common Component IP	Common Component of Industrial Production (IP) of 8 Countries (ASEAN 5 +3) : Indonesia, Malaysia, Philippines, Singapore, Thailand, China, Korea, Japan	ADB; 1995:01 to 2004:08 (Authors' Computation)
LIBOR	3-month London Inter Bank Offer Rate	IFS; 1995:01 to 2004:08
OIL	Dubai Crude (US$ per barrel)	BSP; 1995:01 to 2004:08
IE	Import/Export Price Index of All Commodities from ASIAN Newly Industrialized Countries (2000=100)	US BLS; 1995:01 to 2004:08
US_IP	US Industrial Production (IP) Index (2000=100)	IFS; 1995:01 to 2004:08
Export Growth	Average Export Growth (y-o-y) of the 8 countries (ASEAN 5+3); Indonesia, Malaysia, Philippines, Singapore, Thailand, China, Korea, Japan	IFS; 1995:01 to 2004:08
ELECTRIC	Producer Price Index of Electronic Capacitors	US BLS; 1995:01 to 2004:08
FDI Growth	Growth Rate (y-o-y) of Foreign Direct Investment in the 8 countries (ASEAN 5+3); Indonesia, Malaysia, Philippines, Singapore, Thailand, China, Korea, Japan	IFS; 1995:01 to 2004:08
PPI	Producer Price Index of Semi-Conductor and Related Devices (1998=100)	US BLS; 1995:01 to 2004:08
CRISIS	An indicator variable with value 1 during the Asian financial crisis, July 1997 to July 1998 and 0 otherwise.	Authors' supplied

Table 2
Summary Statistics of Variables, 1996-2004, monthly y-o-y

Variables	Mean	Maximum	Minimum	Std. Dev.	N
Common Component IP; (%)	5.69	11.78	-4.19	3.75	104
Change in Price of OIL (in %)	12.90	149.65	-44.65	35.97	105
Growth in US_IP (in %)	2.98	8.60	-6.04	3.59	105
D(LIBOR); (in %)	-0.04	0.70	-1.03	0.20	116
Growth in PPI (in %)	-6.62	-1.88	-12.69	2.64	105
Growth in Electric (in %)	2.39	37.99	-13.01	12.23	105
Growth in Exports (in %)	10.14	65.85	-18.86	13.76	117
Growth in FDI (in %)	4.78	25.60	-31.93	11.84	117
Growth in IE (in %)	-3.20	0.33	-9.60	2.48	105

Table 3
Growth Rates (in %) of Industrial Production of Selected East Asian Countries, monthly y-o-y, and the Common Component

	COMMON	CHINA	INDO	JAPAN	KOREA	MAL	PHIL	SING	THAI
Mean	**5.691370**	**12.04571**	**-1.081333**	**0.674952**	**8.131238**	**7.185714**	**-0.138857**	**5.723905**	**4.853048**
Median	6.860002	11.90000	0.840000	2.790000	6.950000	9.070000	-0.160000	6.930000	5.430000
Maximum	11.78025	23.20000	34.09000	9.800000	35.06000	25.47000	22.93000	29.24000	25.05000
Minimum	-4.189002	2.100000	-25.42000	-14.86000	-13.48000	-12.33000	-15.76000	-22.18000	-18.28000
Std. Dev.	3.754416	3.780441	9.965552	5.899269	10.09100	9.178477	6.992728	11.50520	8.051567
Skewness	-1.182688	0.160461	-0.006852	-0.692255	0.459459	-0.495572	0.357101	-0.363963	-0.522333
Kurtosis	3.467993	3.364918	4.230943	2.446842	3.490050	2.563448	3.400321	2.621186	3.171576
Jarque-Bera	25.19410	1.033182	6.629909	9.724988	4.744942	5.131627	2.932748	2.946016	4.903351
Probability	0.000003	0.596551	0.036336	0.007731	0.093250	0.076857	0.230761	0.229235	0.086149
Sum	591.9024	1264.800	-113.5400	70.87000	853.7800	754.5000	-14.58000	601.0100	509.5700
Sum Sq. Dev.	1451.851	1486.341	10328.47	3619.343	10590.14	8761.421	5085.417	13766.45	6742.084
Observations	104	105	105	105	105	105	105	105	105

Table 4
Correlation Matrix of Variables

	Common Component	Growth in Electric	Growth in Exports	Growth in FDI	Growth in IE	D(LIBOR)	Change in Price of OIL	Growth in PPI	Growth in US_IP	CRISIS
Common Component	1.00	0.04	0.74	0.15	0.74	0.34	0.62	-0.02	0.28	-0.32
Growth in Electric	0.04	1.00	0.03	-0.35	0.19	-0.28	0.13	0.20	-0.04	-0.09
Growth in Exports	0.74	0.03	1.00	0.06	0.63	0.44	0.62	-0.06	0.33	-0.16
Growth in FDI	0.15	-0.35	0.06	1.00	0.13	0.13	-0.21	-0.19	0.03	0.12
Growth in IE	0.74	0.19	0.63	0.13	1.00	0.17	0.56	-0.08	-0.07	-0.41
D(LIBOR)	0.34	-0.28	0.44	0.13	0.17	1.00	0.29	-0.19	0.42	0.06
Change in Price of OIL	0.62	0.13	0.62	-0.21	0.56	0.29	1.00	0.18	0.19	-0.37
Growth in PPI	-0.02	0.20	-0.06	-0.19	-0.08	-0.19	0.18	1.00	-0.46	-0.48
Growth in US_IP	0.28	-0.04	0.33	0.03	-0.07	0.42	0.19	-0.46	1.00	0.45
CRISIS	-0.32	-0.09	-0.16	0.12	-0.41	0.06	-0.37	-0.48	0.45	1.00

Table 5
Weights of Individual Countries in the Construction of the Common Component

	W_CHINA	W_INDO	W_JAPAN	W_KOREA	W_MAL	W_PHIL	W_SING	W_THAI
Mean	0.233752	0.090831	0.160622	0.104867	0.119537	0.108687	0.065377	0.116327
Median	0.230865	0.079078	0.160301	0.110190	0.122157	0.100982	0.061683	0.114519
Maximum	0.924611	0.949510	0.295943	0.172304	0.240078	0.225701	0.143757	0.208215
Minimum	0.006855	0.007204	0.007436	0.007263	0.006179	0.007243	0.004247	0.007425
Std. Dev.	0.110675	0.089411	0.060247	0.042307	0.054181	0.041641	0.021483	0.045922
Skewness	2.365308	8.630521	0.019692	-0.383087	0.106474	0.671275	1.046817	-0.070981
Kurtosis	16.05108	83.42760	2.622741	2.129843	2.011038	4.108121	5.915411	2.167334
Jarque-Bera	835.0740	29321.68	0.623461	5.824847	4.434702	13.13161	55.82601	3.091774
Probability	0.000000	0.000000	0.732179	0.054344	0.108897	0.001408	0.000000	0.213123
Sum	24.31019	9.446381	16.70469	10.90622	12.43187	11.30346	6.799183	12.09800
Sum Sq. Dev.	1.261634	0.823422	0.373857	0.184355	0.302368	0.178598	0.047539	0.217208
Observations	104	104	104	104	104	104	104	104

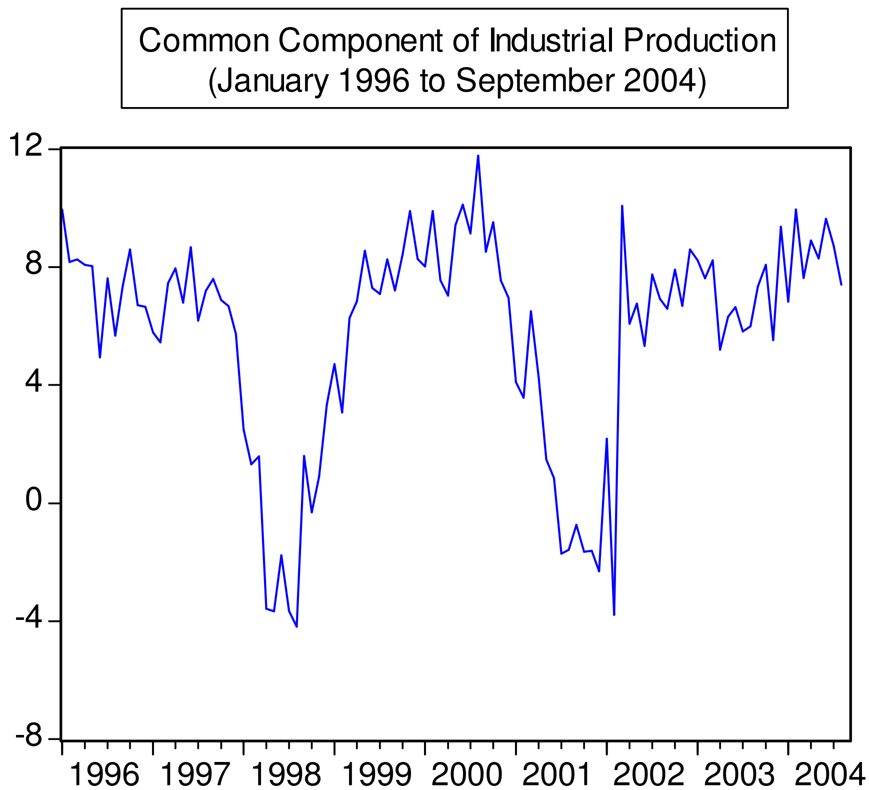
Common Component of Industrial Production
(January 1996 to September 2004)
12
8
4
0
-4
-8
1996
1997
1998
1999
2000
2001
2002
2003
2004

Figure 1. China Growth of Industrial Production and Common Component of Industrial Production

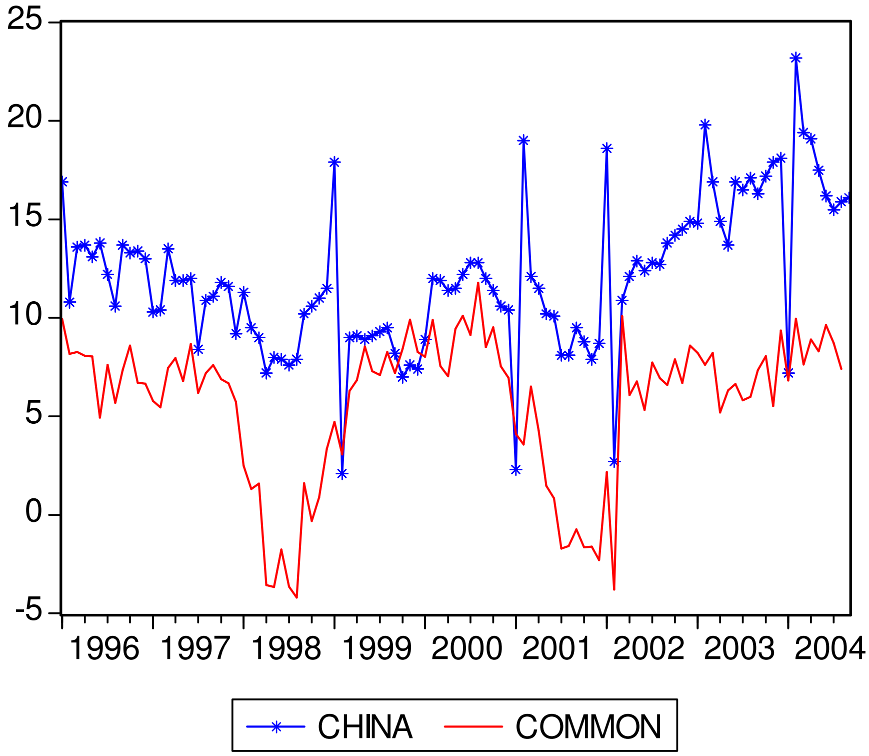

Figure 2. Indonesia Growth of Industrial Production and Common Component of Industrial Production

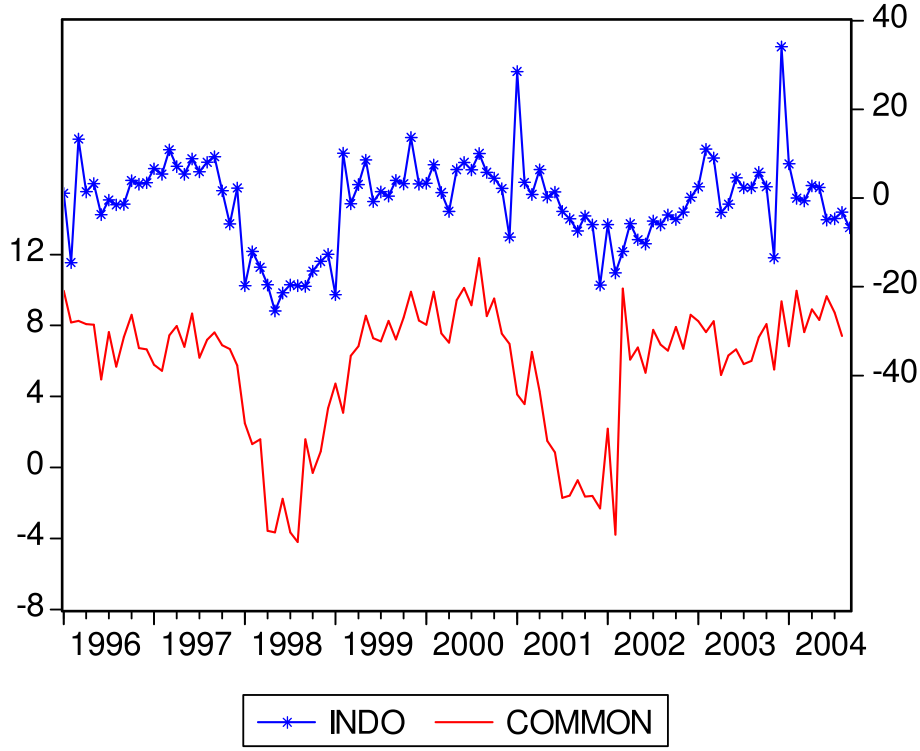

Figure 3. Japan Growth of Industrial Production and Common Component of Industrial Production

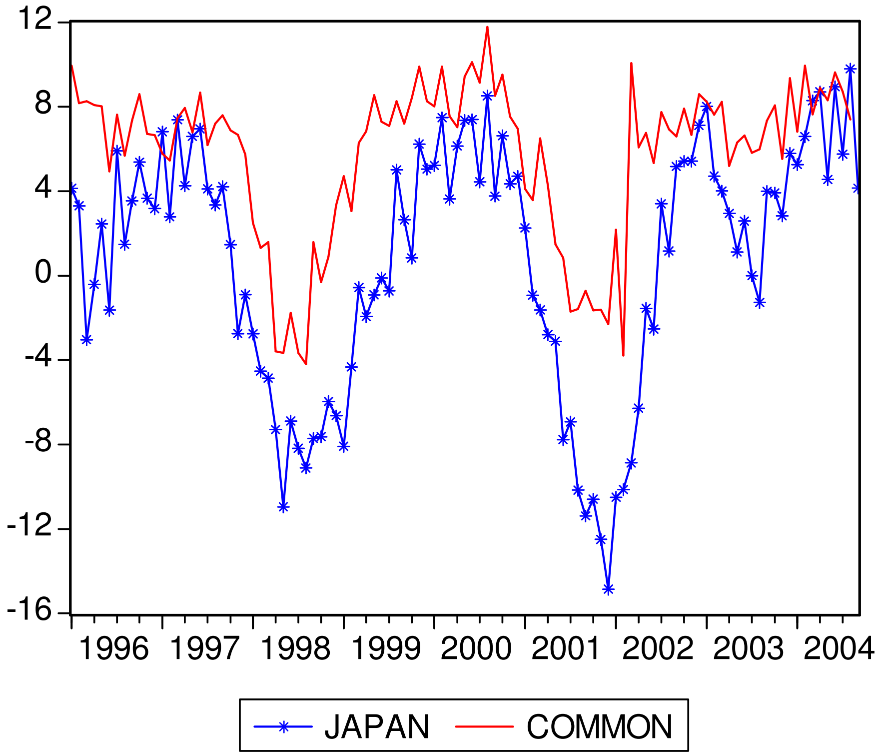

Figure 4. Korea Growth of Industrial Production and Common Component of Industrial Production

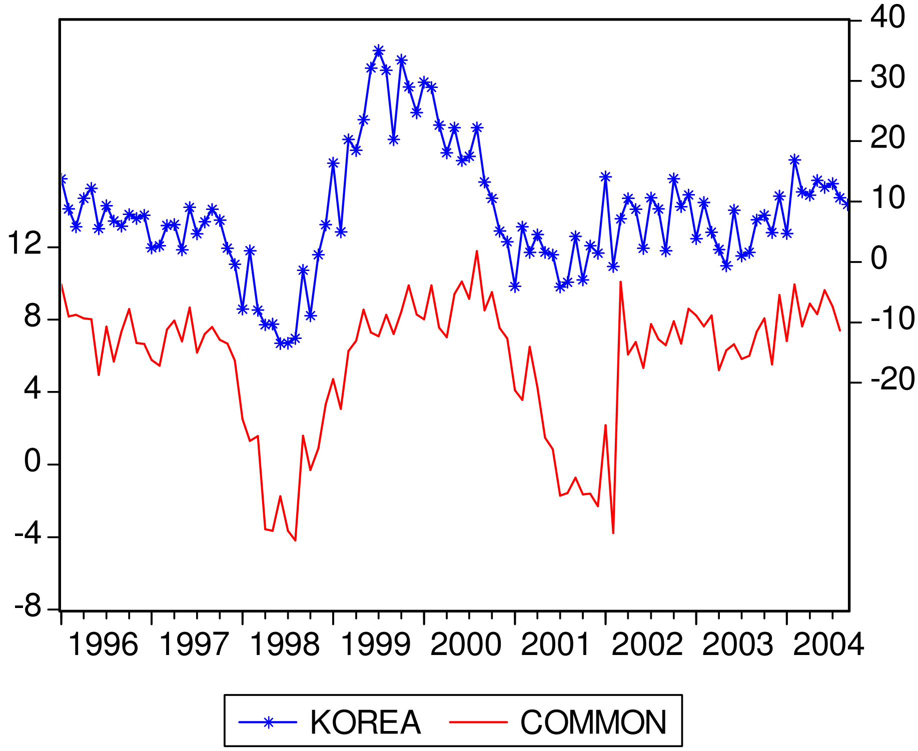

Figure 5. Malaysia Growth of Industrial Production and Common Component of Industrial Production

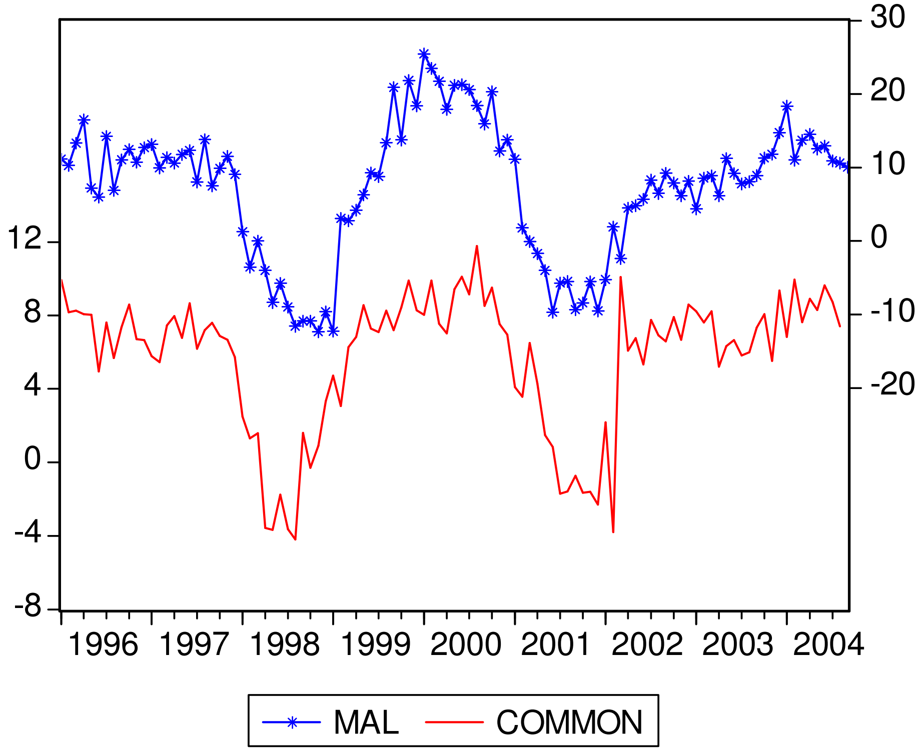

Figure 6. Philippines Growth of Industrial Production and Common Component of Industrial Production

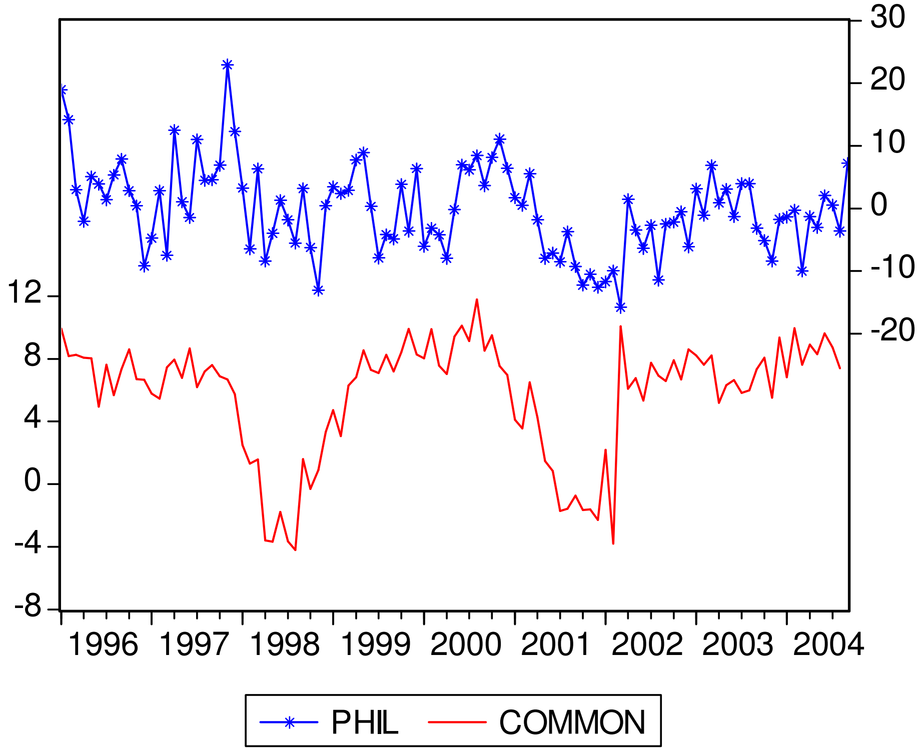

Figure 7. Singapore Growth of Industrial Production and Common Component of Industrial Production

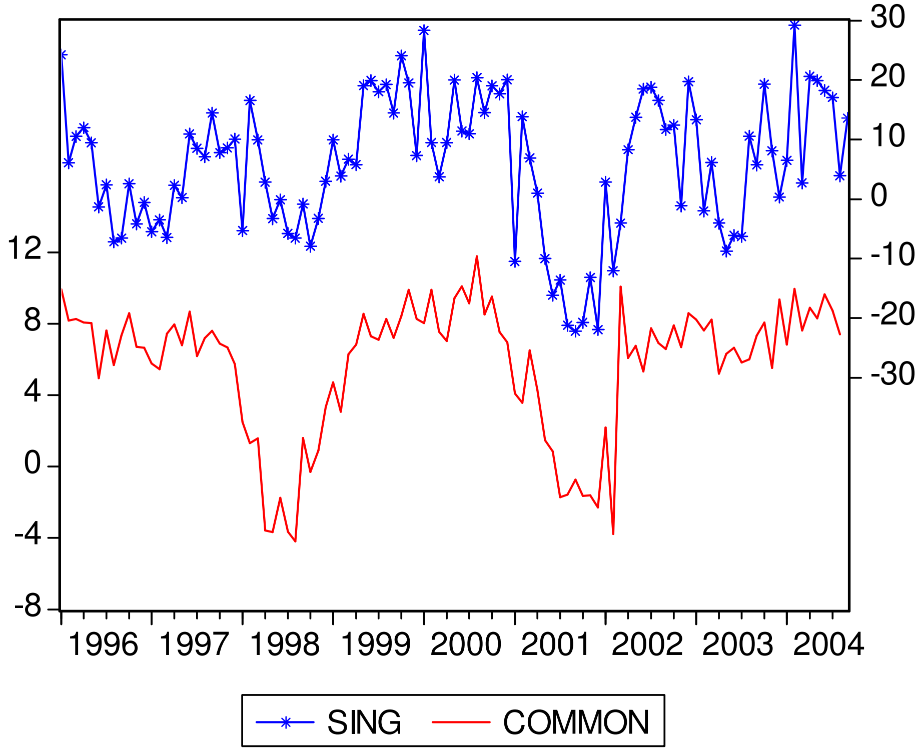

Figure 8. Thailand Growth of Industrial Production and Common Component of Industrial Production

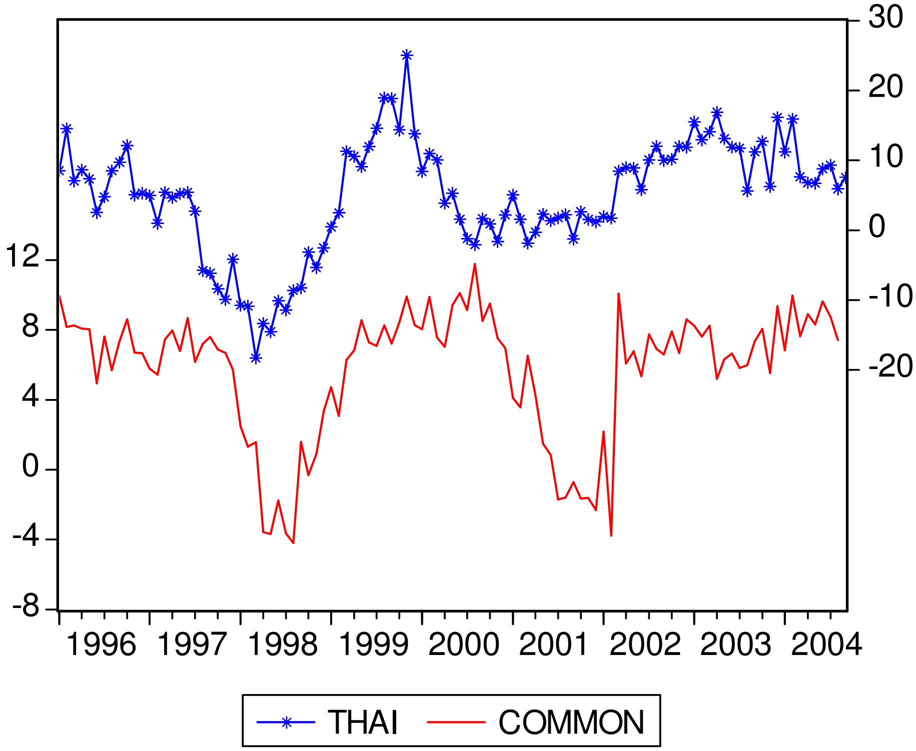

Table 6
Summary of Regression Results
Individual Country Industrial Production Growth Rates against the Common Component of Industrial Production Growth

	China	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Thailand
Coefficient on Common Component	0.46	1.64	1.31	1.85	1.99	0.74	2.03	1.29
t-Statistic	5.20	7.92	15.31	9.56	14.04	4.38	8.94	7.63

Table 7
Results of Extreme Bound Analysis
Dependent Variable: Common Component of Industrial Production

Variable	No of	Sign	Significance		Extreme Bound		Comments
	Models		Count	%	Lower	Upper	
Change in Price of OIL (in %)	64	+	64	100.00	0.0010	0.0870	Robust
Growth in US_IP (in %)	64	+	37	57.81	-0.1346	0.7318	not robust
D(LIBOR); (in %)	64	+	26	40.625	-3.4221	9.4776	not robust
Growth in Electric (in %)	64	mixed	9	14.06	-0.0446	0.1012	not robust
Growth in Exports (in %)	64	+	64	100.00	0.0750	0.2642	Robust
Growth in FDI (in %)	64	+	50	78.12	-0.0119	0.1383	not robust
Crisis	64	-	56	87.50	-8.55	0.80	not robust

Table 8
Results of Extreme Bound Analysis
Dependent Variable: Common Component of Industrial Production

Variable	No of	Sign	Significance		Extreme Bound		Comments
	Models		Count	%	Lower	Upper	
Change in Price of OIL (in %)	64	+	61	95.31	-0.0029	0.0890	not robust
Growth in US_IP (in %)	64	+	55	85.94	-0.0966	0.7318	not robust
D(LIBOR); (in %)	64	+	40	62.50	-1.1357	9.0369	not robust
Growth in PPI (in %)	64	mixed	29	45.31	-0.5016	0.5218	not robust
Growth in IE (in %)	64	+	64	100.00	0.5668	1.3616	Robust
Growth in FDI (in %)	64	+	40	62.50	-0.0218	0.1289	not robust
Crisis	64	-	41	64.06	-8.7431	1.8654	not robust

Table 9
Dynamic Specification: AR Model
Dependent Variable: Common Component of Industrial Production

Variable	Model 1 +		Model 2 ++	
	coefficient	s.e.	coefficient	s.e.
Change in Price of OIL (in %)	0.0336 *	0.0068	0.0143 **	0.0068
Growth in Export (in %)	0.0751 **	0.0305	0.0659 *	0.0214
AR (1)	0.3065 **	0.1505	-	-
AR (2)	0.4778 *	0.1128	-	-
AR (8)	-0.2211 *	0.0793	-	-
Common Component (lag 1)	-	-	0.2634 *	0.0890
Common Component (lag 2)	-	-	0.4048 *	0.0892
Common Component (lag 8)	-	-	-0.1957 *	0.0531
Constant	4.4582 *	0.4702	2.1595 *	0.4240

+ Regression with AutoRegressive Errors; ++ AutoRegressive Distributed Lag (ARDL)

* significant at 1% level; ** significant at the 5% level

Table 10
Dynamic Specification
Dependent Variable: Common Component of Industrial Production

Variable	Model 3+		Model 4++	
	coefficient	s.e.	coefficient	s.e.
Change in Price of OIL (in %)	0.0303 *	0.0087	0.0158 **	0.0067
Growth in IE (in %)	0.7737 *	0.1697	0.4032 *	0.1422
AR (1)	0.2632 *	0.0910	-	-
AR (2)	0.4516 *	0.0908	-	-
AR (8)	-0.2705 *	0.0775	-	-
Common Component (lag 1)	-	-	0.2452 *	0.0924
Common Component (lag 2)	-	-	0.3993 *	0.0909
Common Component (lag 8)	-	-	-0.2598 *	0.0569
Constant	7.7666 *	0.7042	4.5721 *	1.0373

+ Regression with AutoRegressive Errors; ++ AutoRegressive Distributed Lag (ARDL)

* significant at 1% level; ** significant at the 5% level

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