Deepening Interdependence or Decoupling Hypothesis In East Asia through Trade Transmission:

An Empirical Study Using Dynamic Factor Models and Standard Approaches

by

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Abstract

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"Decoupling" refers to the divergence of business cycles among different countries, and "Re-coupling" corresponds to convergence. "Decoupling" is just a fancy word for "separation". The aim of this study is to discover whether there has been decoupling or convergence of business cycles through the trade channel.

As trade integration increased among Asian countries, business cycle synchronization among these countries was expected to increase through trade transmission. Theoretically, however, increased trade can lead to business cycles synchronization either rising or falling. Inter-industry trade resulting in higher specialization will induce less synchronized business cycles, while intra-industry trade could lead to increased business cycle synchronization. Thus, it is important to distinguish between intra- and inter-industry trade flows. A major part of the dissertation involved the calculation of inter-industry trade indices and intra-industry trade indices at the aggregate and industry levels based on the original data from IMF and WB.

I use both correlation analysis and dynamic factor models to study the evolution of global business cycle linkages. I find that the world factor has become less important

in explaining the macroeconomic fluctuations from sub-period 1961-1984 to sub-period 1985-2007, while the regional factors do not play an important role in explaining aggregate volatility except for consumption. The explanatory power of country factors increase, on the whole. Domestic consumption and domestic investment variances are driven more by country and idiosyncratic factors than by the world factor, contrary to the output growth fluctuations. Regional factors and country factors also play a more important role in explaining gross import fluctuations than in explaining gross exports. Our results cast doubt on the strong forms of both the decoupling and the re-coupling hypotheses.

DEDICATION

I would like to dedicate this dissertation to my family and all others who have provided me the encouragement and the support during my PhD in Economics with M.B.A.

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Chapter 1 Introduction

1.1 Background of the Study

Over the past decades, there has been considerable debate about how the U.S. economy could affect other countries through spillovers and business cycle transmission in the global economy. The old adage that when the US sneezes the rest of the world catches a cold vividly indicates the importance of the spillovers from US fluctuations, although, in recent years, the spillovers from US fluctuations are "generally moderate in magnitude"(IMF, 2007). However, the performance of emerging economies such as China and India, during the global financial crisis, has shaken the role of the US as a locomotive in the world economy. The decoupling debate has become popular again.

"Decoupling" refers to the divergence of business cycles from different countries, and "Re-coupling" corresponds to convergence. "Decoupling" is just a fancy word for "separation". The aim of this study is to discover whether there has been decoupling or convergence of business cycles through the trade channel. This contributes to further understanding of the sources of macroeconomic fluctuations and changes in the nature of world business cycles for making policy.

Emerging market economies such as China and India have been able to insulate their economies from the Great Recession in the advanced economies such as the EU and the US better than most countries (Willett et al. 2010). Different versions of decoupling[1] emerge for different contexts. Under the background of East Asia exports in the global economic crisis, the concept of "decoupling" refers to "the notion that

[1] Generally speaking, there are two versions of decoupling hypothesis. One version is that emerging markets, such as China, India, and Malaysia, could be decoupled from the advanced economies, such as the United States, the EU and Japan. The other is that Asian economies including Japan could be decoupled from the United States.

the East Asia region had become a self-contained economic entity with potential for maintaining its own growth dynamism independent of the economic outlook for the traditional developed market economies" (Athukorala and Kohpaiboon, 2009). In fact, the switching between decoupling and re-coupling views is highly disturbing, because it is based on the time horizon and the patterns of shocks (Willett, 2010).

1.2 Leading Questions for the Study

For the East Asian economies, export-oriented growth path highlights trade as a leading candidate of transmission. Could Asian emerging economies be decoupled from the EU and the US? How much does international trade transmission affect business cycle synchronization? Would greater trade flows between two countries cause greater business cycle synchronization? To further analyze these questions, both standard approaches and dynamic factor models are employed. The data from eleven Asian countries, the Euro zone, and the US are used to discuss trade integration and business cycle synchronization.

Originally, the discussion of business cycle co-movement started with a series of correlation studies. The basic measure of co-movement between time series is classical correlation, which is also commonly used in business cycle correlations. At the same time, there is a longstanding concern about the transmission channels through which business cycle fluctuations in one country are transmitted to other countries. The issue of business cycle synchronization is also relevant in the context of the possibility of forming a feasible currency union within East Asia, which have been revived in the wake of the Asia Crisis. Taking the OCA[2] (optimal currency area)

[2] OCA: optimal currency area. According to optimal currency area criteria, trade openness, asymmetry of shocks, factor mobility, wage and price flexibility, financial market integration, product diversification, inflation rates, credibility, fiscal transfers and political considerations are major criteria, in terms of the costs and benefits of joining a currency union.

argument of Mundell (1961) as the origin, the empirical research of this study will start with the test of one strong and striking empirical finding uncovered by Frankel and Rose (1998), that is, countries with closer trade links tend to have more tightly correlated business cycles. A great deal of literature has been motivated by the implementation of optimum currency area criteria in the context of the pros and cons of regional monetary union or greater regional policy coordination (Willett, 2010).

As vertical specialization increases in East Asia, it is expected that the links in business cycles among East Asian countries will become much closer due to sector-specific shocks, although inter-industry trade and intra-industry trade lead business cycles across trading countries to move in opposite directions. The selected East Asian countries include nine emerging economies and one industrial economy. They are China (Mainland), Hong Kong, Taiwan, Singapore, Korea (South Korea), the Philippines, Thailand, Malaysia, Indonesia and Japan. In addition, India is included due to its impressive growth rate. The criteria for selecting this set were data availability and the uncertainty of these countries in other studies as major representatives of Asian emerging economies.

1.3 Purpose of the Study

A major purpose of the study is to quantitatively analyze how business cycle fluctuations in one country are transmitted to others through trade channels. The previous literature on empirical economics did research of this topic for certain regions, such as East Asia, Europe, G7 or OECD, but few of them gave sufficient relevance to both the trade integration in East Asia and the degree of business cycle synchronization with the EU and the US. For this reason, the study of my dissertation will cover the gap.

A second purpose of the study is to compare the results of standard approaches which involve a series of bivariate correlations with that of dynamic factor models, and then let these two different methodologies complement each other, with possible extension based on the previous studies and methodologies, as part of my contribution. Another important contribution is to calculate Intra-Industry Trade Index (IIT) for different country pairs in my model. In addition, my work is also useful for the ongoing discussion of the suitability of a common currency for the Asia-Pacific region.

The structure of this dissertation is organized as followed. Section 2 presents theoretical norms. Section 3 briefly revisits the literature as the foundation of my contribution. Section 4 states the results of my research and interpretation. Section 5 is conclusion, followed by references and appendix.

Chapter 2 Theoretical Norms

Why do countries trade? Classical Ricardian Theory explains trade as resulting from the fact that "trade permits exploitation of gains from greater specialization". The gains from trade arise from increasing returns to scale are summarized in Helpman and Krugman (1985). Therefore, "increased trade results in increased sectoral specialization". Next, what's the implication of increases in trade and specialization for international business cycles? If primary disturbances are sector-specific, then specialization should lead to decreased business-cycle correlation. On the other hand, trade may act as a conduit for the transmission of shocks that affect all industries (e.g., raw material trade may affect many other related industries). In this case, increased trade would lead to increased business cycle synchronization[3].

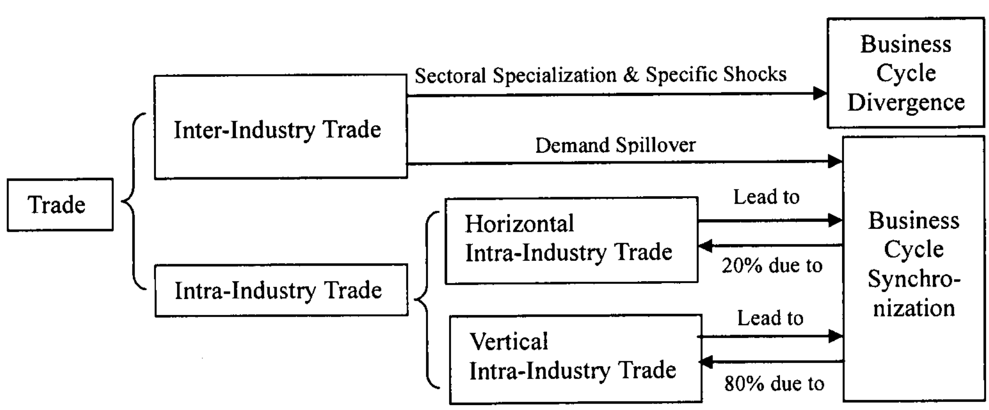

Figure 2.0 the Mechanism of Trade Transmission to Business Cycle Synchronization

Theoretically, increased trade can lead business cycles across trading partners to shift in opposite directions (Shin and Wang, 2003). In terms of international trade and cross-country convergence, intra-industry trade, especially vertical intra-industry trade,

[3] See Baxter and Kouparitsas (2004)

is the major source contributing to the convergence of business cycles, statistically, 80% convergence due to vertical intra-industry trade and 20% due to horizontal intra-industry trade (Luis and Maria, 2008). On the one hand, intra-industry trade (within sector) would lead to more synchronization of business cycles; on the other hand, inter-industry trade (cross-sector) resulting in higher specialization of production would induce less synchronization of business cycles. Furthermore, if sector-specific shocks are dominant, then the degree of co-movement of output could fall or rise, depending on the nature of the trade (intra-industry trade or inter-industry trade).

2.1 Explanations for Intra-industry Trade

In traditional trade theory, such as the Heckscher-Ohlin-Samuelson (H-O-S) postulate, countries will export the goods that use relatively intensively their relatively abundant factors. i.e., "Capital abundant-countries export capital-intensive goods; labor-abundant countries export labor-intensive goods." In other words, trade will be generated by supply side differences (Senoglu, 2003). However, comparative advantage based on factor endowments is little help in explaining horizontal intra-industry trade, although traditional trade theory could deal with explaining inter-industry trade and vertical intra-industry trade.

In the early 1960s, some trade theorists, such as Verdoorn (1960), Linder (1961), Posner (1961), Michaely (1962) and Kojima (1964), have noticed that most of the world trade actually took place among developed countries with similar income structure and moreover, much of the trade involves two-way exchange of goods produced with similar factor endowments (Memis 2001 and Senoglu 2003). Therefore, different countries can not only specialized in different products but also specialize in different types of a given commodity. Intra-industry trade occurs when a country's exports and imports are in the same statistical product classification category. The characteristic of a country's trade appeared first in European countries, such as France, Germany and other developed countries, in manufacturing industry. Typically, the more sophisticated manufactured goods, such as chemicals, electronics and machinery, where scale economies and product differentiation can be important, the higher the ratio of manufacturing intra-industry trade to total manufacturing trade is (OECD Economic Outlook, 2009). In fact, when the capital and labor endowments of two countries are similar, horizontal intra-industry trade will be relatively larger than inter-industry trade.

Considering the limited applicability of either the Heckscher-Ohlin-Samuelson (H-O-S) model or the Richardian model, several possible explanations and theories for the occurrence of intra-industry trade emerge[4], as a complement to the traditional inter-industry trade theory.

Broadly speaking, the explanations for Intra-Industry Trade can be classified into two categories: demand side perspective and supply side perspective. Six influential explanations are listed as the following. The first and the last two explanations belong to demand side spectrum perspective and the others in the middle are supply side perspective.

2.1.1 Different Income Distributions

Even if two countries have similar income per capita, different distributions of total income in the two countries can lead to intra-industry trade[5]. The source of the following figure for intra-industry trade generated from different income distributions is Linder (1961)[6] and Lancaster (1970).

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[4] Please see Appleyard, Field and Cobb (2008), for more detailed analysis.
[5] Please see Herbert Grubel (1970).
[6] Linder Hypothesis (1961): a country's ability to export depends on domestic demand, so that countries that

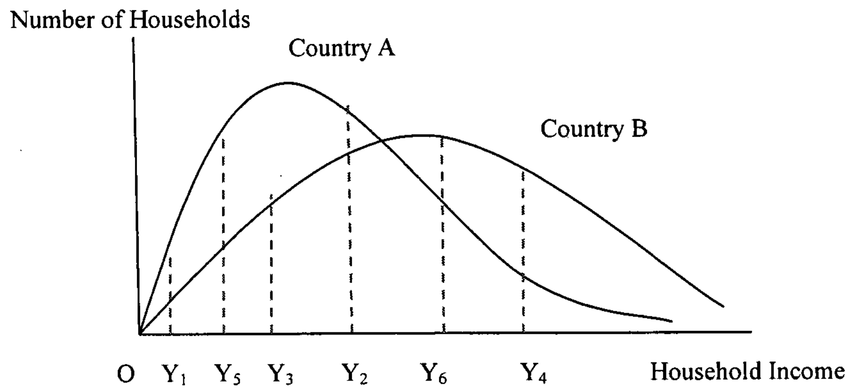

Figure 2.1.1 Intra-industry Trade from Different Income Distributions
Source: Linder (1961) and Lancaster (1970)

Suppose country A has a heavy concentration of households with lower incomes, while country B has a normal distribution of income. Producers in country A will produce a variety of the product that caters to consumers in home country A with incomes between Y_1 and Y_2, and at the same time, producers in country B will cater to the bulk of country B's households with income between Y_3 and Y_4. But for a household in country A with a high income such as Y_6 and a household in country B with a low income such as Y_5, they will purchase the good from the producers in the other country because their own home countries are not producing a variety of the good that satisfies these consumers. Therefore, horizontal intra-industry trade in the product happens between these two countries.

2.1.2 Production Differentiation

There exist many varieties of some types of products because producers attempt to distinguish their products to achieve broad loyalty. For example, U.S. firms may produce large cars and other firms may produce smaller cars. Some foreign buyers who prefer a larger car may buy a U.S. product while some U.S. consumers may purchase a smaller imported car. Therefore, intra-industry trade occurs because

demand similar goods will trade more with each other than will countries with dissimilar demands.

consumer tastes differ in innumerable ways.

2.1.3 Different Factor Endowments and Product Variety

To marry intra-industry trade with the Heckscher-Ohlin approach, Falvey (1981) and Falvey and Kierzkowski (1987) developed a model in which countries with different relative factor endowments export different varieties of a good. The model produces the result that capital-abundant countries export higher quality varieties and labor-abundant countries export lower quality varieties, by assuming that more capital-intensive techniques are required by the higher quality varieties of a good and labor-abundant countries export lower-quality varieties (Lancaster, 1980). In this framework, Heckscher-Ohlin can yield intra-industry trade. For instance, a labor-abundant country China may export capital-intensive varieties of a good to high-income countries, such as the United States, and just keep the lower-quality, labor-intensive varieties for the home market.

2.1.4 Dynamic Economies of Scales

When intra-industry trade is established in two countries for a product, one in the home country and the other in the foreign country, each producing firm may experience "learning by doing" or so-called "dynamic economies of scales". Due to experience in producing a particular good, the per-unit cost will decrease and sales of each version of the product will increase over time. Thus, intra-industry trade is enhanced gradually because one version was an export and the other an import for each country. At the same time, trade increases because their prices fall relative to other goods.

2.1.5 Transportation Costs Barrier

In a large country, such as the United States, transportation costs of a product may play an important role in causing intra-industry trade, especially when the transportation costs are significant. Therefore, if a given product is manufactured both in the Southern part of Canada and in California, a buyer in Buffalo will purchase the Canadian product due to the lower transportation costs. Similarly, a buyer in Mexico will buy the California product. In this scenario, the United States is both exporting and importing this good. Additionally, in the reciprocal dumping model, transportation cost can lead to intra-industry trade through another mechanism. Nevertheless, some studies also show that crossing the border is still a substantial cause of reduced trade for reasons, such as individual country's cultural characteristics.

2.1.6 Degree of Product Aggregation

It is observed that intra-industry trade can occur merely due to the way of recording trade data. If the category is broad, say, beverage and tobacco [a category in the widely used Standard International Trade Classification (SITC)], for instance, greater intra-industry trade will appear than that in the case of a narrower category. Thus, if a country is exporting tobacco and importing beverage, the broad category of "beverage and tobacco" will show intra-industry trade, but the narrower category of "beverage" will not. So, some economists consider that the existence of intra-industry trade in the real world may be just a statistical artifact due to the degree of product aggregation (Appleyard, Field and Cobb, 2008). As the industries are further disaggregated, the portion of intra-industry trade will shrink and eventually go to nil (Shin and Wang, 2003). However, most trade analysts judge the existence of an intra-industry trade as an economic characteristic of trade, not as a result of applying aggregative classification categories. Accordingly, Grubel and Lloyd (1975) argued that each statistical class of traded goods, regardless of the level of aggregation, is considered to represent the trade of an 'industry' and the criteria of aggregation are the extent of commodities' substitutability in consumption and the similarity of input requirements in production.

2.2 Models and Measures of Intra-Industry Trade

The limited applicability of the traditional Heckscher-Ohlin-Samuelson (H-O-S) paradigm in explaining two-way reciprocal trade of products belonging to the same industry was the starting point of the development of intra-industry trade (IIT) theory. The existing literature on IIT theory could be distinguished to horizontal IIT (HIIT) theory and vertical IIT (VIIT) theory.

In general, HIIT is more likely to occur between countries with high and similar per capita incomes, while VIIT is more likely to occur between countries at different levels of per capita incomes. HIIT models are usually applied to explain IIT flows between developed countries, while VIIT models are expected to explain IIT flows between developed and developing countries.

The distinction between HIIT models and VIIT models is that the vertical models can explain IIT without recourse to economies of scale and hence compatible to the H-O-S theorem, but for horizontal product differentiation, economies of scale is essential (Tharakan and Kersens, 1995). The following models are able to explain the different sources and determinants of IIT with the different market structure that allow the emergence of IIT.

2.2.1 Horizontal Intra-Industry Trade Models

Horizontal intra-industry trade (HIIT) can be defined as a two-way trade in products of similar quality with different attributes, i.e., horizontally differentiated products. In HIIT models, IIT arises in monopolistically competitive markets with increasing returns to scale on the supply side and diverse consumer preferences on the demand side (Mora 2002 and Senoglu 2003). The theoretical basis for HIIT was developed by Lancaster (1980), Krugman (1981), Helpman (1981 and 1987) and Bergstrand (1990) (Senoglu, 2003).

HIIT models can be categorized as Neo-Chamberlinian models, Neo-Hotelling models and Eaton and Kierzkowski model. These three sets of models are different in terms of market structure on which they are based. Neo-Chamberlinian model and Neo-Hotelling model are based on monopolistically competitive markets, while Eaton and Kierzkowski model is based on oligopolistic markets. Neo-Chamberlinian models mainly founded by Dixit (1977), Stiglitz (1977) and Krugman (1979, 1980) consider monopolistic competition and horizontally differentiated goods on the supply side, and 'love of variety' approach on the demand side. Neo-Hotelling models mainly established by Lancaster (1980) consider monopolistic competition and horizontally differentiated products on the supply side, which is similar to the Neo-Chamberlinian models, but 'ideal variety' approach on the demand side, instead of 'love of variety' approach. Under 'ideal variety' approach, individuals gain utility from being able to consume preferable variety, rather than gain utility from consuming more varieties. An alternative market structure under which HIIT can take place is an oligopolistic market. Eaton and Kierzkowski (1984) have developed an HIIT model for horizontally differentiated products in oligopolistic markets.

2.2.2 Vertical Intra-Industry Trade Models

Vertical intra-industry trade (VIIT) could be defined as two-way trade in varieties of products characterized by different qualities, i.e., vertically differentiated products with no increasing returns to scales in production (Mora, 2002). Greater the difference in the level of factor endowments between countries, the greater will be the share of VIIT. The theoretical basis for VIIT was developed by Falvey (1981) and Falvey and

Kierzkowski (1987) (Senoglu 2003).

An innovative element in VIIT models is the application of vertical product differentiation by quality as the crucial determinant in IIT between developed and developing countries, where quality is measured by unit value. Two sets of VIIT can be distinguished depending on the market structure on which they are based on. The Neo-Hecksher-Ohlin model is based on 'perfect competitive' market structure, while the Shaked and Suttan model is based on 'natural oligopoly' market structure (Senoglu, 2003).

In Neo-Hecksher-Ohlin models, Falvey (1981) modified the standard framework of the traditional H-O-S theorem in a minor fashion and retained the assumption of differences in relative factor endowments and constant return to scales. The extension of this work done by Falvey and Kierzkowski (1981) is that capital-abundant country has a comparative advantage in higher quality goods. The Falvey and Kierzkowski model is important since many international markets are characterized by IIT in vertically differentiated goods (Senoglu, 2003).

In the Shaked and Suttan Model, 'natural oligopoly' and 'fixed R&D costs' are emphasized on the situation in which the number of firms that can enter a market with new, higher-quality varieties is bounded by the supply and demand characteristics of the market. Shaked and Suttan (1984) argue that large numbers of qualities will be available if the income range is wide, fixed R&D costs for quality improvements are low and average costs rise dramatically as a result of quality improvements.

2.2.3 Intra-Industry Trade Measure 1: Balassa Index (1966)

For the measures of IIT in the sixties, one of the important measures was proposed by Balassa (1966). He used several indices to question whether the EEC (European Economic Community) led to intra- or inter-industry specialization (Vona,

1991) through the following formulas:

$$B_i = \frac{|x_i - m_i|}{x_i + m_i} \qquad \text{(eqn. 2-1)}$$

$$B = \frac{1}{n}\sum_{i=1}^{n} B_i \qquad \text{(eqn. 2-2)}$$

where x_i and m_i indicate the exports and imports of a certain country's industry i. B measures the degree of this country's inter-industry specialization, while (1-B) measures the degree of intra-industry specialization.

When B approaches zero, it means that exports and imports match each other in each country. In this case, a low degree of inter-industry specialization corresponds to a high degree of intra-industry trade. In contrast, when B approaches unity, it means that exports and imports differ widely with high inter-industry specialization and low intra-industry specialization.

2.2.4 Intra-Industry Trade Measure 2: Grubel and Lloyd Index (1971)

Grubel and Lloyd (1971) modified Balassa's (1966) index and introduced their own indices --- GL index. GL index for all trading industries at an elementary industry level (GL_i), the i^{th} industry is given by:

$$GL_i = (1 - B_i) = \left(1 - \frac{|x_i - m_i|}{x_i + m_i}\right) = \frac{(x_i + m_i) - |x_i - m_i|}{(x_i + m_i)} \qquad \text{(eqn. 2-3)}$$

where i = the i^{th} of n industries at a given level of statistical aggregation, the value of GL_i ranges between zero and one. When either x_i or m_i is zero, GL_i will equal zero, indicating that there is no intra-industry trade in commodity i. When $x_i = m_i$, GL_i will equal 1, meaning that all trade in commodity i belong to intra-industry trade.

The second dimension of GL index for an elementary industry, at a particular level of aggregation, say x_i and m_i, involves the exports and imports of the included industries defined at a more disaggregated level, called x_{ij} and m_{ij}, respectively. In this case, the percentage of IIT for the i^{th} industry is calculated by using the sums $\sum_j x_{ij}$ and $\sum_j m_{ij}$, then the GL index for i^{th} industry at an aggregate level can be calculated by the following formula:

$$GL_{i,A} = \frac{\sum_j (x_{ij} + m_{ij}) - \left| \sum_j x_{ij} - \sum_j m_{ij} \right|}{\sum_j (x_{ij} + m_{ij})} \qquad \text{(eqn. 2-4)}$$

where i = i^{th} of n industries at a particular given level of aggregation, j = the included sub-group categories at the (i – 1) level of aggregation. However, the $GL_{i,A}$ index is likely to be distorted as a result of categorical aggregation. Because 'opposite sign effect' arises when sub-group trade imbalances have opposite sign. For example, suppose industry i comprises sub-industries a and b,

$$GL_{i,A} = \left[1 - \frac{|x_a + x_b - m_a - m_b|}{(x_a + x_b + m_a + m_b)} \right] \qquad \text{(eqn. 2-5)}$$

If $(x_a - m_a) > 0$ and $(x_b - m_b) < 0$, GL for aggregation will result in them offsetting each other. If the limit $|x_a - m_a| = |x_b - m_b|$, GL_i will be one, indicating that all trade in the product group was of an intra-industry type.

To avoid the above issue in the interpretation of the results, an adjustment has been made for categorical aggregation as the following:

$$C_i = \left[1 - \frac{\sum |x_{ij} - m_{ij}|}{\sum (x_{ij} + m_{ij})} \right] \qquad \text{(eqn. 2-6)}$$

where the value of C_i is also in the range between zero and one, but not more than

GL_i. If all sub-category level industry imbalances (x_{ij} - m_{ij}) have the same signs, $GL_i = C_i$ and $GL_i > C_i$, if these imbalances have different signs.

For GL at the country level, Grubel and Lloyd (1971) proposed a weighted average of GL_i value, where the weights are given by the relative size of each country's exports plus imports in the total value of exports plus imports of the N industries by the following widely used formula:

$$GL = \sum_{i=1}^{N} GL_i (x_i + m_i) / \sum_{i=1}^{N} (x_i + m_i) = \frac{\sum_{i=1}^{N} \left[(x_i + m_i) - |x_i - m_i| \right]}{\sum_{i=1}^{N} (x_i + m_i)}$$

(eqn. 2-7)

2.2.5 Vertical and Horizontal Intra-Industry Trade Measures

To assess the relative importance of HIIT and VIIT, several different methods for measuring quality differences in trade were proposed. The most important of them was the one proposed by Abd-el-Rahman (1991) who was also the first to decompose IIT by using unit value measures.

Unit value (UV) indexes measure the average price of a bundle of items from a given product grouping. Relative unit values of exports and imports are utilized to decompose IIT into HIIT and VIIT (Greenway, Hine and Milner, 1994). More formally, Greenway, Hine and Milner defined HIIT as the simultaneous exports and imports of a 5-digit SITC product where the UV of exports relative to imports lies in the range of $\alpha = 15\%$ and defined VIIT when the UV lie outside this range.

For horizontally (H) differentiated products:

$$1 - \alpha \leq \frac{UV_{ij}^{x}}{UV_{ij}^{m}} \leq 1 + \alpha$$

(eqn. 2-8)

For low quality vertically (V) differentiated products:

$$\frac{UV_{ij}^{x}}{UV_{ij}^{m}} \langle 1-\alpha \qquad \text{(eqn. 2-9)}$$

For high quality vertically (V) differentiated products:

$$\frac{UV_{ij}^{x}}{UV_{ij}^{m}} \rangle 1+\alpha \qquad \text{(eqn. 2-10)}$$

where UV_{ij}^{m} denote the unit values of imports at the 5-digit level (j) and UV_{ij}^{x} denote the unit value of exports at the 5-digit level. α is usually taken to be 0.15 and 0.25.

To obtain GL index for the 3-digit sector, a weighted average of the i-digit sector B_i could be expressed as

$$B_i = HB_i + VB_i \qquad \text{(eqn. 2-11)}$$

$$HB_i = \frac{\sum_{i=1}^{n_1}\left((x_{ij}+m_{ij}\right) - \sum_{i=1}^{n_1}\left|x_{ij}-m_{ij}\right|}{\sum_{i=1}^{n}\left(x_{ij}+m_{ij}\right)} \qquad \text{(eqn. 2-12)}$$

$$VB_i = \frac{\sum_{i=1}^{n_2}\left((x_{ij}+m_{ij}\right) - \sum_{i=1}^{n_2}\left|x_{ij}-m_{ij}\right|}{\sum_{i=1}^{n}\left(x_{ij}+m_{ij}\right)} \qquad \text{(eqn. 2-13)}$$

where n is the total number of 5-digit sector in the 3-digit sector, assume that n_1 of them exhibit HIIT and n_2 of them exhibit VIIT.

To construct the HIIT and VIIT measures at country level, take the total number of 3-digit industries as N in which N_1 of them belong to HIIT and N_2 of them belong to VIIT by assumption. Then the following formula will be used:

$$HB = \frac{\sum_{i=1}^{N_1} \left[(x_i + m_i) - |x_i - m_i| \right]}{\sum_{i=1}^{N} (x_i + m_i)} \quad \text{(eqn. 2-14)}$$

$$VB = \frac{\sum_{i=1}^{N_2} \left[(x_i + m_i) - |x_i - m_i| \right]}{\sum_{i=1}^{N} (x_i + m_i)} \quad \text{(eqn. 2-15)}$$

In my analysis, I did not break down IIT into HIIT and VIIT, because what I focus on is the total effects of IIT on business cycle synchronization, instead of the components HIIT and VIIT. Even if I calculate the effects of HIIT and VIIT respectively, finally, I still need to get the total effect from IIT. On the other hand, the data available for me to calculate IIT is classified by using ISIC revision 2, which disaggregates industries into 4-digit categories, instead of 5-digit categories.

2.3 Studies on Endogenous OCA Criteria related to Trade Transmission

Put simply, an optimal currency area is a region for which it is optimal to have a common currency and a common monetary policy. Recent literature has emphasized that the formation of a currency may itself influence some of the major OCA criteria (Frankel and Romer, 1996). This is called endogenous OCA analysis. Directly relevant to this dissertation is the analysis of how increased trade flows influence the degree of synchronization of macroeconomic fluctuations.

Empirically, a number of recent studies evaluate the endogeneity of OCA criteria within the Eurozone as a reference to consider the regional integration in East Asia. The top two areas of the studies in this field are trade flows and business cycle synchronization (Willett, Permpoon and Wihlborg, 2008). For the area of trade flows, there is widespread consensus that the fixing of exchange rates should increase intra-area trade, although theoretically the fixing of exchange rates can have a positive as well as a negative impact on intra-area trade (Glick and Wihlborg, 1997). As the openness of an economy increases, the economy is more likely to experience spillover and transmission effects. For the area of business cycle synchronization, both the magnitude of changes in trade flows and the composition between intra-industry trade and inter-industry trade can influence the dynamics of business cycle synchronization.

2.4 IS – LM - BP Framework (Mundell Fleming's View)

To explain how a foreign boom affects domestic GDP, the following analysis starts with equilibrium status. At initial equilibrium point A, the balance of payment equals to zero. Algebraically, for flexible exchange rate, balance of payment (BOP) is the sum of current account (CA) and capital account (KA), i.e., BOP = CA + KA = 0, while for fixed exchange rate, BOP = CA + KA + dR, in both the unsterilized and sterilized cases, where dR is the change of international reserves for official settlement. But in the absence of sterilization, dR = 0 in equilibrium. That is the important feature of "automatic" adjustment under fixed rates: R is endogenous and changes until the new equilibrium is reached, but in equilibrium there are no further changes in reserves. When sterilization takes place, reserves continue to change in equilibrium because the central bank shuts down the adjustment mechanism. In the graph, IS curve, LM curve and BP curve intersect at one point A. Symbols without an asterisk denote domestic terms, and with an asterisk for foreign terms.

IS – LM – BP Framework (Price P assumed constant):
For foreign country, add star to all notations in the framework.

IS curve equation: (Injections = Leakages)

$$\mathbf{I\ (i) + G + X\ (Y^*, e) = S\ (Y) + T + M\ (Y, e)} \qquad \text{(eqn. 2-16)}$$

LM curve equation: (Money Supply Ms = Money Demand Md)

$$\mathbf{H/P = L\ (Y, i)} \qquad \text{(eqn. 2-17)}$$

$$\mathbf{Ms = mm^*H = mm^*(D + R)} \qquad \text{(eqn. 2-18)}$$

BOP curve equation:

$$\mathbf{BOP = CA + KA = (X - M) + KA = X\ (Y^*, e) - M\ (Y, e) + KA\ (i - i^*)} \qquad \text{(eqn. 2-19)}$$

Under fixed exchange rate,

BOP will extend to **BOP = CA + KA + *d*R** (eqn. 2-20)

with sterilization, ***d*R** = 0, **BOP = CA + KA**

Notations:

I (i): domestic investment is a function of domestic interest rate.
G: government expenditure
X (Y*, e): gross exports expenditure is a function of foreign output and exchange rate.
S (Y): domestic saving is a function of domestic output.
M (Y, e): gross imports expenditure is a function of domestic output and exchange rate.
T: taxes.
H: high powered money = international reserves R + domestic credit D.
Ms: money supply=monetary multiplier*high powered money=mm*H=mm*(R + D)
Md: money demand is a function of domestic output and interest rate = L (Y, i)
CA: current account = exports – imports = X (Y*, e) – M (Y, e)
KA: capital account is a function of the difference between domestic interest rate and foreign interest rate.
e: real exchange rate.
Nominal exchange rate = real exchange rate*(foreign price divided by domestic price) = real exchange rate = e, given that the prices are constant.

2.4.1 Foreign Fiscal Expansion (F.P.*)

Foreign government expenditure G* increases (or T* decreases, or both G* increases and T* decreases), IS* curve shifts to the right, generating increased Y* and increased i*. IS* curve shifts to the right, when injections on the left hand side of IS* curve equation increase or leakages on the right hand side of the IS* curve equation decrease. This is because an increase in these injections requires a higher level of income to induce a matching increase in leakages in the form of increased savings and imports, while an autonomous fall in savings and imports will also require a rightward shift of the IS* schedule since a higher level of income is required to induce more savings and import expenditure to maintain the equality of leakages and injections (Pilbeam, 2003).

As we know, foreign fiscal expansion will increase foreign output Y* and foreign interest rate i*. On the one hand, as foreign output Y* increases, domestic gross exports will increase due to the function X = f (Y*, e), so domestic current account CA = X – M will improve, then *d*CA > 0. On the other hand, as foreign interest rates i* increase from i_0* to i_1*, domestic capital KA outflow will increase. Since net domestic KA inflow is positively related to (i – i*), *d*KA (i – i*) < 0.

Under low capital mobility, *d*CA>0 dominates *d*KA<0, then *d*BOP>0, while *d*BOP*<0. Domestic currency will be under pressure of appreciation. The change of domestic output Y and domestic interest rate i also depends on the foreign exchange rate policy. In Figure 2.4.1, the IS curve moves from IS_0 to IS_1, and BOP moves from BOP_0 to BOP_1 (Note that the shift of BOP curve is relatively larger than that of the IS curve, given constant interest rate i, which will be proved later in this section 2.4.1). At point C, the intersection of IS curve and LM curve, domestic interest rate is too high to meet the equilibrium level of BOP = 0. The intersection of IS_1 and LM_0 is on the left hand side of BOP_1 curve, indicating that BOP > 0.

With fixed exchange rate, BOP = CA + KA + dR, international reserve R increases, without sterilization, dR = 0, BOP = CA + KA. During the adjustment process, reserves are accumulated, money stock rises. Money supply Ms = mm*(R + D) increases, too, LM shifts to the right from LM_0 to LM_1 to meet the intersection of IS_1 curve and BOP_1 curve for new equilibrium point B. LM shifts rightward from LM_0 to LM_1 when money supply increases, because for a given interest rate, the increased money supply will only be willingly held if there is an increase in income leading to a rise in the transactionary demand for money. Domestic output Y will increase from Y_0 to Y_1, and domestic interest rate i will decrease from i_0 to i_1. In this case, increased Y* results in increased Y. Y* and Y will be positively correlated.

Thus, on the condition of low capital mobility and fixed exchange rate, foreign fiscal policy expansion will generate increased domestic output, promoting business cycle synchronization.

With and without Sterilization[7]:

Sterilized intervention and non-sterilized intervention in foreign exchange market, under the condition of fixed exchange rate policy and low capital mobility in domestic market, could make a difference in terms of the magnitude of the effects from foreign fiscal expansion (F.P.*) on the domestic economy.

For the domestic economy, the domestic currency will have the pressure to appreciate due to BOP>0. Under fixed exchange rate policy, to maintain fixed exchange rate, authorities will buy the surplus of international reserve R from foreign exchange market with domestic bonds or domestic currency, then international reserve

[7] Sterilization is an intervention policy in foreign exchange market to use offsetting open market operations in order to prevent an act of exchange market intervention from changing the monetary base. With sterilization, any purchase of foreign exchange is accompanied by an equal-value sale of domestic bonds, and vice versa (See Deardorff, 2006).

R will increase.

Without sterilization, the authorities allow the reserve R changes resulting from the interventions to affect the monetary base. In this case, money base will increase as international reserve R increases. At the same time, money supply Ms[8] will increase, too. In Figure 2.4.1, curve LM_0 will move to LM_1 and stay there. At new equilibrium point B, Y will increase from Y_0 to Y_1, and i will also decrease from i_0 to i_1.

With sterilized intervention, the authorities will offset the monetary base implications of their interventions in foreign exchange market to ensure that the increase in reserves R due to intervention do not affect the domestic monetary base, LM_1 will move back to LM_0. Therefore, with sterilization, the imbalance in autonomous transactions lasts and is offset by official reserve transactions. In Figure 2.4.1, at new equilibrium point C, Y will increase from Y_0 to Y_2, and i will increase from i_0 to i_2.

Therefore, on the condition of low capital mobility and fixed exchange rate, with or without sterilization, foreign fiscal policy expansion will generates increased domestic output, promoting business cycle synchronization.

With floating foreign exchange rate, LM curve will be stationary and domestic currency will appreciate due to BOP>0. At point B, in Figure 2.4.2, the domestic interest i_1, determined by the intersection of stationary LM_0 and IS_1 is too high to meet the equilibrium level for BOP=0, that is, BOP>0 at point B. As the foreign exchange rate appreciates, exports X will decrease and imports M will increase. The IS curve shifts to the left from IS_1 to IS_2, at the same time, the BOP curve also moves to the left from BOP_1 to BOP_2. At new equilibrium point C, domestic output Y will increase from Y_0 to Y_2. Correspondingly, the domestic interest rate will increase from

[8] Ms = mm*B=mm*H, B=H = R + D, where Ms denotes money supply. B denotes monetary base. H denotes high powered money. R denotes foreign international reserves and D denotes domestic components of Money supply.

i_0 to i_2. Thus, increased Y* leads to increased Y, Y* and Y are positively correlated to each other.

Therefore, on the condition of low capital mobility and floating rate, foreign fiscal policy expansion generates increased domestic output, promoting a synchronized business cycle.

Under high capital mobility, dKA<0 dominates dCA>0, then dBOP<0. The domestic currency will have pressure to depreciate. The change of domestic output Y also depends on the foreign exchange rate policy. In Figure 2.4.3, the IS curve moves from IS_0 to IS_1, and BOP curve moves from BOP_0 to BOP_1. The intersection of IS_1 and LM_0 is on the right hand side of BOP_1, indicating that BOP<0. At point B, the domestic interest rate determined by the intersection of IS_1 and LM_0 is too low to maintain balance of payment equilibrium (BOP=0), thus, BOP<0 at point B.

With a fixed foreign exchange rate, BOP = CA + KA + dR, without sterilization, dR = 0, BOP = CA + KA. Reserves R drop to a lower level in the absence of sterilization and the level of reserves does not affect the BOP curve. Money supply Ms = mm*(D + R) decreases, LM shifts to the left from LM_0 to LM_1, domestic output Y will increase from Y_0 to Y_2, correspondingly, domestic interest rate increases from i_0 to i_2, at new equilibrium point C. In this case, increased Y* leads to increased Y. Y* and Y are positively correlated to each other.

Therefore, on the condition of high capital mobility and fixed exchange rate, with no sterilization, foreign fiscal policy expansion generates increased domestic output, promoting synchronized business cycle.

For the domestic economy, foreign exchange will have pressure to depreciate due to BOP<0. Under fixed exchange rate policy, to maintain the fixed exchange rate, the authorities will sell international reserves R and buy the home currency, then international reserve R will decrease, as well as high powered money H.

With and without Sterilization:

Without sterilization, the authorities allow the reserve changes resulting from the intervention to affect the monetary base. In this case, the money base will decrease as international reserves R decrease, as well as high powered money H. At the same time, money supply Ms will decrease, too. In Figure 2.4.3, LM_0 curve will move to LM_1 and stay there. Point C is the new equilibrium status. At the new equilibrium point C, Y will increase from Y_0 to Y_2; correspondingly, i will increase from i_0 to i_2.

With sterilized intervention, the level of reserves falls continually (dR < 0) and the authorities will offset the monetary-base effects of their interventions in foreign exchange market to ensure that the decrease in reserves R due to intervention does not affect the domestic monetary base. LM_1 will go back to LM_0. At the new equilibrium point B, Y will increase from Y_0 to Y_1, and correspondingly, i will also increase from i_0 to i_1.

Thus, on the condition of high capital mobility and fixed exchange rate, with or without sterilization, foreign fiscal policy expansion generates increased domestic output and promotes a synchronized business cycle.

Under a floating foreign exchange rate, the LM curve is stationary and domestic currency will depreciate because of BOP<0, assuming that there isn't a large feedback effects from exchange rate changes to domestic prices that causes a major change for the real money supply. Then, exports X will increase and imports M will decrease. The IS curve will shift further to the right from IS_1 to IS_2, in Figure 2.4.4. At the same time, the BOP curve shifts to the right. Domestic output Y will increase from Y_0 to Y_2 and domestic interest rate i will increase from i_0 to i_2, correspondingly. In this case, increased Y* leads to increased Y. Y* and Y are positively correlated to each other.

Therefore, on the condition of high capital mobility and floating exchange rate, foreign fiscal policy expansion generates increased domestic output and promotes synchronized business cycle.

To discuss the relative shifts of BOP and IS:

Take the first derivative of BOP curve equation and IS curve equation, respectively:

For IS curve: $dX - dM - dS = 0$

$$X_{Y^*} (dY^*) - M_Y (dY) - S_Y (dY) = 0, \text{ where } X_{Y^*} = \partial X / \partial Y^*$$

$$(M_Y + S_Y)\, dY = X_{Y^*} (dY^*)$$

$$dY/dY^* = X_{Y^*} / (M_Y + S_Y)$$

For BOP curve: $dX - dM = 0$

$$X_{Y^*} (dY^*) = M_Y (dY)$$

$$dY/dY^* = X_{Y^*} / M_Y$$

By assumption, the marginal propensity to save is positive, i.e., $S_Y > 0$.

Thus, $X_{Y^*} / (M_Y + S_Y) < X_{Y^*} / M_Y$. Then, the shift of BOP is relatively larger than that of the IS curve.

Domestic Economy with Low Capital Mobility and Fixed Rate
(With and Without Sterilization)

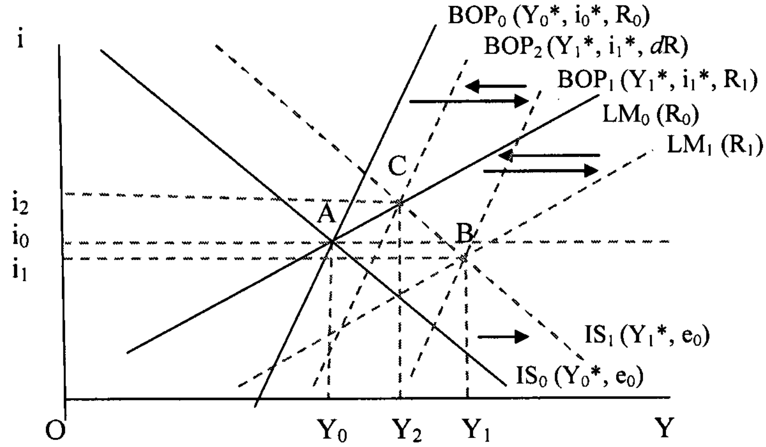

Figure 2.4.1 IS-LM Model for Foreign F. P.* Mechanism in Domestic Market with Low Capital Mobility and Fixed Rate

Domestic Economy with Low Capital Mobility and Floating Rate

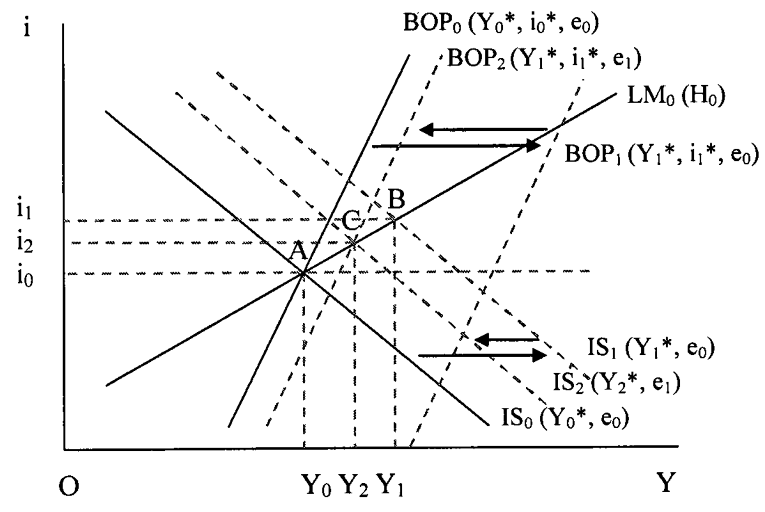

Figure 2.4.2 IS-LM Model for Foreign F. P.* Mechanism in Domestic Market with Low Capital Mobility and Floating Rate

Domestic Economy with High Capital Mobility and Fixed Rate
(With and Without Sterilization)

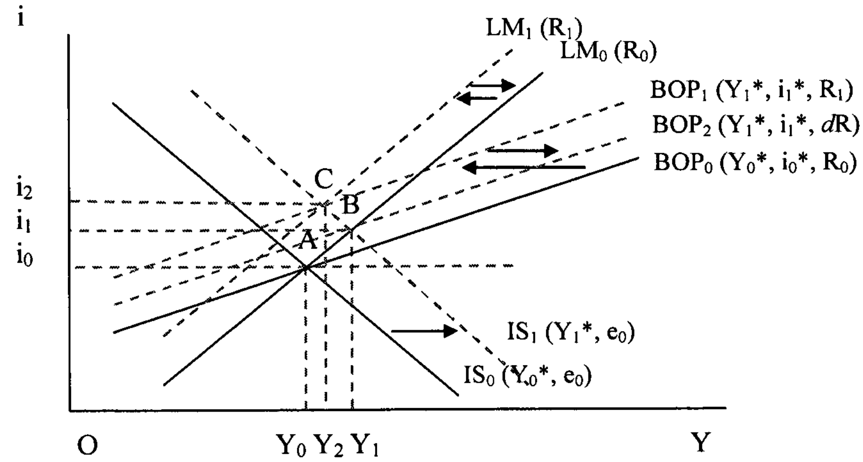

Figure 2.4.3 IS-LM Model for Foreign F.P.* Mechanism in Domestic Economy with High Capital Mobility and Fixed Rate

Domestic Economy with High Capital Mobility and Floating Rate

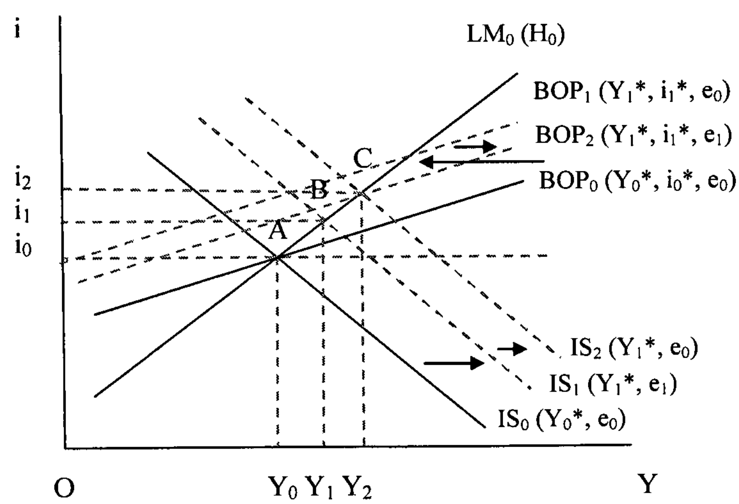

Figure 2.4.4 IS-LM Model for Foreign F.P.* Mechanism in Domestic Economy with High Capital Mobility and Floating Rate

2.4.2 Foreign Monetary Expansion (M.P.*)

Foreign money supply Ms* increases, LM* curve will shift to the right, generating increased Y* and decreased i*. On the one hand, as foreign output Y* increases from Y_0* to Y_1*, domestic exports will increase due to the function X = f (Y*, e), so domestic current account *d*CA>0. On the other hand, as foreign interest rates i* decreases from i_0* to i_1*, domestic capital KA inflow will increase, where KA = KA (i – i*), so *d*KA>0.

Regardless of the degree of capital mobility, BOP>0, the foreign exchange rate is under pressure to appreciate. For the domestic economy, in Figure 2.4.5 and Figure 2.4.6, the IS curve moves to the right from IS_0 to IS_1, due to *d*CA>0, and BOP moves from BOP_0 to BOP_1, at the same time. The intersection of IS_1 and LM_0 is on the left hand side of BOP_1 curve, indicating that BOP>0.

Under a fixed exchange rate, with no sterilization, authorities will buy international reserves R from the foreign exchange market to maintain the fixed exchange rate. As international reserves R increase, money supply Ms = mm*H = mm*(R + D) will increase, too. The LM curve shifts rightward from LM_0 to LM_1, then domestic output Y increases from Y_0 to Y_1. In this case, Y* and Y will be positively correlated.

Therefore, on the condition of a fixed exchange rate, regardless of the degree of capital mobility, with no sterilization, foreign monetary policy expansion generates increased domestic output and promotes synchronized business cycle.

With and Without Sterilization:

Sterilized intervention and non-sterilized intervention in foreign exchange market, under fixed exchange rate policy in domestic market, could make a difference in terms of the magnitude of foreign monetary expansionary (M.P.*)

effects.

The surplus of domestic BOP indicates that there is an excess demand of domestic currency in the foreign exchange market and exchange rate is under pressure of appreciation. To maintain fixed exchange rate, the authorities have to purchase international reserves R with domestic bonds or domestic currency.

Without sterilization, the authorities allow the reserve R changes resulting from the interventions to affect the monetary base. In this case, monetary base will increase as international reserve R increases. At the same time, money supply Ms will increase, too, since Ms = mm*H = mm*(R + D). In Figure 2.4.5 and Figure 2.4.6, the LM_0 curve will move to LM_1. Y will increase from Y_0 to Y_1, and i will also decrease from i_0 to i_1. Without sterilization, the new equilibrium point is B.

With sterilized intervention, the authorities will offset the monetary base implications of their interventions in foreign exchange market to ensure that the increase in reserves R due to intervention do not affect the domestic monetary base. LM curve will move back to LM_0. At new equilibrium point C, Y will increase from Y_0 to Y_2, and i will increase from i_0 to i_2.

Thus, regardless of capital mobility, under fixed exchange rate, with or without sterilization, foreign monetary policy expansion generates increased domestic output and promotes synchronized business cycle.

With floating exchange rate, regardless of the degree of capital mobility, domestic currency will appreciate because of BOP>0. Then, domestic exports will decrease and domestic imports will rise. IS curve will shift to the left from IS_1 to IS_2, and output will fall. At the same time, BOP curve will shift to the left from BOP_1 to BOP_2 (See Figures 2.4.7 & 2.4.8). At new equilibrium point C, domestic output Y will decrease from Y_0 to Y_2. Similarly, domestic interest rate i will decrease from i_0 to i_2.

Thus, in pure IS-LM model, under floating exchange rate, foreign monetary expansion will generate contractionary effects in domestic economy by causing the appreciation of domestic currency, shifting in the domestic IS curve and lowering domestic output. This is the only case where the effects are opposite in the two countries.

To sum up, under fixed exchange rate, with or without sterilization, a foreign expansionary policy (including fiscal policy expansion and monetary policy expansion) will generate expansionary effect in domestic economy, further promoting the business cycle synchronization. However, under flexible exchange rate, foreign monetary policy expansion will generate contractionary effect in domestic economy while foreign fiscal policy expansion will still generate expansionary effect in domestic economy. Therefore, foreign monetary policy expansion, under floating exchange rate, is the only case where the effects are opposite in the two countries. If foreign country does fiscal policy expansion and monetary policy expansion at the same time, the effects from fiscal policy expansion and monetary policy expansion will reinforce each other, except the case under floating exchange rate ------ the net effects on this case could go either way, depending on the relative magnitudes.

Domestic Economy with Low Capital Mobility and Fixed Rate
(With and Without Sterilization)

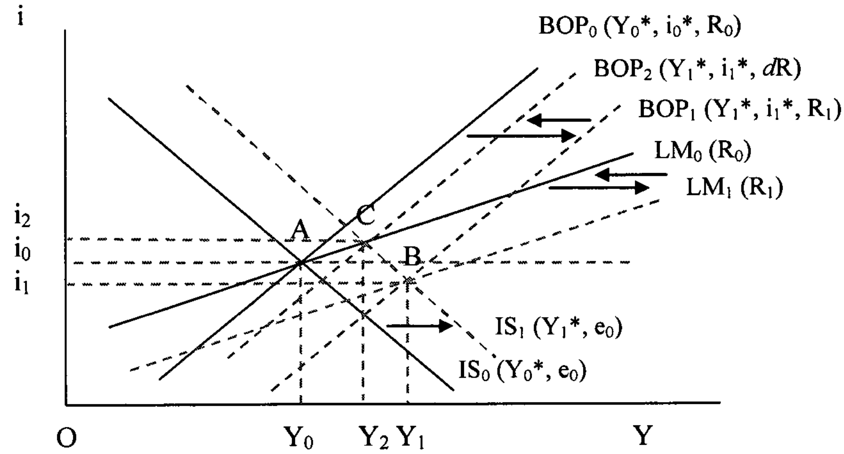

Figure 2.4.5 IS-LM Model for Foreign M.P.* Mechanism in Domestic Economy with Low Capital Mobility and Fixed Rate

Domestic Economy with High Capital Mobility and Fixed Rate
(With and Without Sterilization)

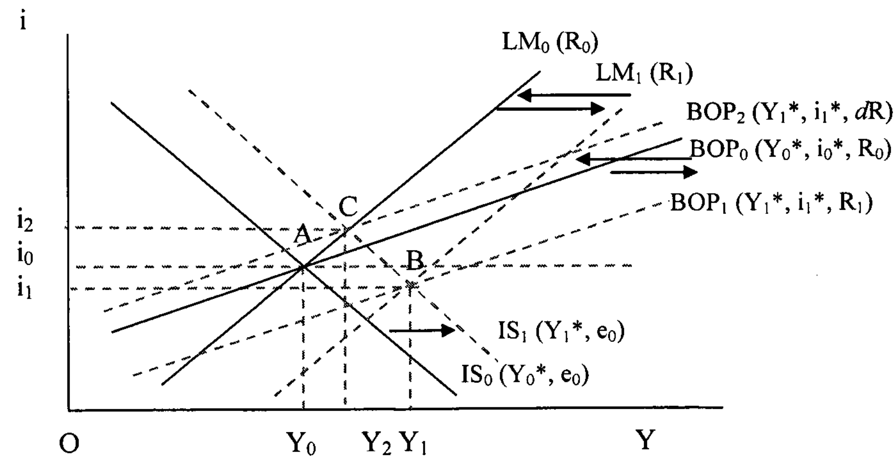

Figure 2.4.6 IS-LM Model for Foreign M.P.* Mechanism in Domestic Economy with High Capital Mobility and Fixed Rate

Domestic Economy with Low Capital Mobility and Floating Rate

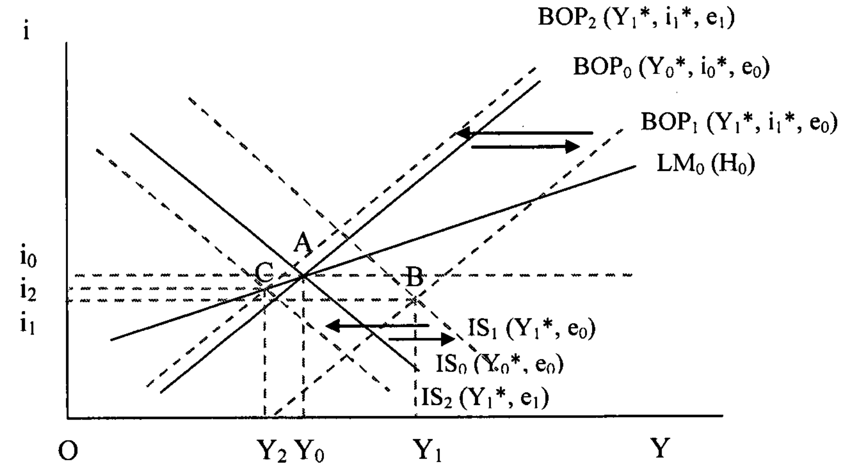

Figure 2.4.7 IS-LM Model for Foreign M.P.* Mechanism in Domestic Economy with Low Capital Mobility and Floating Rate

Domestic Economy with High Capital Mobility and Floating Rate

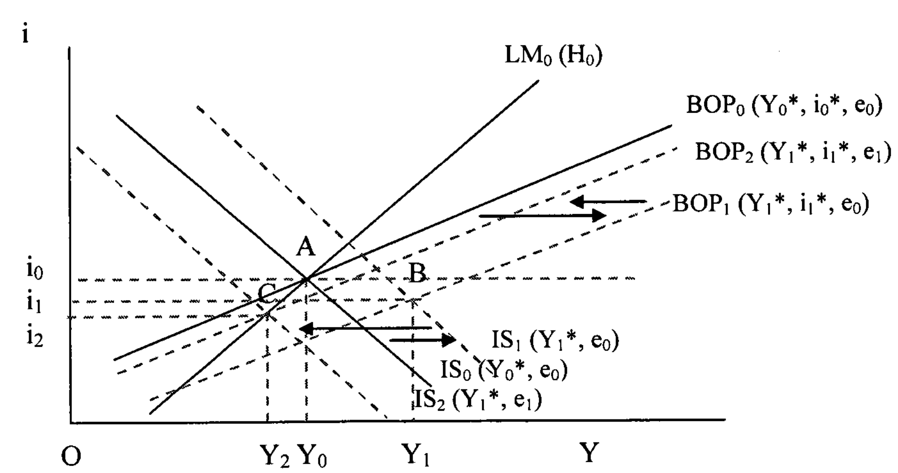

Figure 2.4.8 IS-LM Model for Foreign M.P.* Mechanism in Domestic Economy with High Capital Mobility and Floating Rate

Chapter 3 Literature Review

Due to the importance of trade linkages between countries, many researchers have conjectured that trade must play a crucial role in transmitting disturbances across countries, influencing business cycle comovement. However, there is no consensus on the question of whether increased trade leads more or less correlation of business cycles across countries, and there is no consensus on the correct methodology to use, either.

One debate is about whether the estimation results of Frankel-Rose are truly about trade's role in the transmission of shocks, or are they instead driven by omitted variables, such as common shocks that happen to be stronger for countries that trade more with each other (Giovanni and Levchenko, 2009). A competing hypothesis is that countries comove simply due to their correlated shocks. The common shock view argue that it cannot be just due to international trade: if industries are truly hit by common global technology or demand shocks, comovement will occur even in the complete absence of trade transmission.

What is troubling about this debate is that it is very difficult to sort out the relative importance of the transmission and common shock channels within country-level data, or indeed estimate either one of them reliably. For instance, the positive relationship between overall bilateral trade and comovement (Frankel and Rose, 1998) or between intra-industry trade and comovement (Koo and Gruben, 2006) is not conclusive evidence of transmission, since it could be driven by the omitted common shocks (Giovanni and Levchenko, 2009). That is where dynamic factor models evolved to fit the gap.

Generally speaking, the existing literature is mainly based on five types of methodologies: correlation approaches, dynamic factor models, cointegration approach, structural macro econometric models and vector autocorrelation (VAR) impulse response functions. Correlation approaches usually do a series of bivariate correlations, while dynamic factor models distinguish global factors, region-specific factors, country factors and idiosyncratic factors.

Table 3.0 Comparison of Correlation Approaches and Dynamic Factor Models

Correlation Approaches	Advantages	Good at investigating bilateral co-movements between concerned countries and good at static[9] analysis for the pair-by-pair vertical and horizontal comparison at some certain time point
	Disadvantages	Do not allow for a separation of idiosyncratic components and common co-movement. Not suited to study the issue of cross country spillover effects and common shocks. Static analysis has limited ability to capture any dynamics[10] in the co-movement (Do not look at lags)
Dynamic Factor Models	Advantages	Allow for the separation of idiosyncratic components and common co-movement: global factor, region-specific factors, country-specific factors and idiosyncratic factors. Good at investigating the degree of region-wide co-movement. Suited to study the joint properties of fluctuations in output and its components
	Disadvantages	Need relatively long time series and it is easy to lose degrees of freedom Cannot be used to analyze bilateral co-movements between concerned countries

[9] Static here means contemporaneous, no interaction and no effects of propagation and spillovers from shocks.
[10] Dynamics here means inter-temporal cross correlations with interaction and allow for the effects of propagation and spillovers from shocks to be picked up.

3.1 Standard Approaches (Correlation Analysis)

3.1.1 The Frankel and Rose Model

In the first group, Eichengreen (1992), Kenen (1969), and Krugman (1993) argued that as trade linkages increased, greater specialization of inter-industry trade would occur, resulting in less synchronization of business cycles. However, Frankel and Rose (1998) argue that if intra-industry trade was more pronounced than inter-industry trade, business cycles would become more positively correlated as trade become more integrated. They use thirty years of data for twenty industrialized countries and the following regression framework, to test whether countries with closer trade links tend to have more tightly correlated business cycles.

$$Corr(v,s)_{i,j,t} = \alpha + \beta \; Trade\;(w)_{i,j,t} + \varepsilon_{\,i,j,t} \qquad \text{(eqn. 3-1)}$$

Corr $(v,s)_{i,j,t}$ denotes the correlation between country i and country j over time span t for activity concept v (corresponding to real GDP; industrial production; employment; or the unemployment rate) de-trended with methods s (corresponding to: fourth-differencing; quadratic de-trending; HP-filtering; or HP-filtering on the seasonally adjusted residual).

Trade $(w)_{i,j,t}$ denotes the natural logarithm of the average bilateral trade intensity between country i and country j over time span t using trade intensity concept w (corresponding to: total bilateral trade normalized by either total trade or GDP).

$$WT_{ijt} = (X_{ijt} + M_{ijt})/(X_{i,t} + X_{j,t} + M_{i,t} + M_{j,t}) \qquad \text{(eqn. 3-2)}$$

$$WY_{ijt} = (X_{ijt} + M_{ijt})/(Y_{i,t} + Y_{j,t}) \qquad \text{(eqn. 3-3)}$$

where X_{ijt} denotes total nominal exports from country i to country j during year t, M_{ijt} denotes the total nominal imports from country j to country i during year t; X and M denote total global exports and imports for the corresponding country; Y denotes nominal GDP for the corresponding country.

As pointed out by Frankel and Rose (1998), a simple OLS regression would generate a biased estimation due to an endogeneity problem, trading partners are likely to lose the ability to set policies independently of their neighbors and this resulting policy coordination could result in a spurious association between trade intensity and business cycle co-movements (Shin and Wang, 2003). To resolve this issue, instead of using OLS, Frankel and Rose use exogenous determinants of bilateral trade as instrumental variables motivated by a "gravity model" to identify the effect of bilateral trade patterns on income correlations.

3.1.2 The Shin and Wang Model

Shin and Wang (2003) extended Frankel and Rose's important contribution, to further identify the channels through which increased trade affects business cycle co-movements by including a large set of explanatory variables such as monetary coordination measured by the correlations of M_2 growth rates and fiscal policy coordination measured by the correlations of government budget over GDP ratio, for 12 Asian countries. They call the four different channels affecting business cycle co-movements 1) inter-industry trade 2) intra-industry trade (Vertical v.s. Horizontal) 3) demand spillovers, and 4) policy coordination channels.

$$\text{Corr}\ (i,j)_t = \alpha_0 + \alpha_1 * \text{Trade Intensity}\ (i,j)_t + \alpha_2 * \text{Intra-industry}\ (i,j)_t + \alpha_3 * \text{Fiscal Policy Coordination}\ (i,j)_t + \alpha_4 * \text{Monetary Policy Coordination}\ (i,j)_t + \varepsilon_{ijt} \quad \text{(eqn. 3-4)}$$

To measure trade intensity, three measures are used:

$$WX_t(i,j) = X_{ijt}/(X_{it} + X_{jt}) \quad \text{(eqn. 3-5)}$$

$$WM_t(i,j) = M_{ijt}/(M_{it} + M_{jt}) \quad \text{(eqn. 3-6)}$$

$$WT_t(i,j) = (X_{ijt} + M_{ijt})/(X_{it} + M_{it} + X_{jt} + M_{jt}) \quad \text{(eqn. 3-7)}$$

For intra-industry trade, $$IIT = 1 - \frac{\sum_i \left| x^i_{kjt} - m^i_{kjt} \right|}{\sum_i (x^i_{kjt} + m^i_{kjt})}$$ (eqn. 3-8)

Fiscal Policy Coordination $(i,j)_t$ = Corr $[(G_{it} - T_{it})/Y_{it}, (G_{jt} - T_{jt})/Y_{jt}]$, that is, the correlation of the ratio of budget deficit to GDP between country i and country j.

Monetary Policy Coordination $(i,j)_t$ = Correlation Coefficient of the M_2 growth rates across each pair of countries

To conclude, increasing trade among Asian countries induces a higher degree of economic integration within the region, in the sense that the business cycle of a country is expected to be continuously influenced by other economies in Asia, especially as trade within this region grows relatively more important. Shin and Wang found that intra-industry trade has become the major channel through which the business cycles of East Asian economies have become more synchronized, although increased trade itself does not necessarily lead to business cycle synchronization. This finding has very important implications for considering the adoption of a currency union in this region. Especially, increased trade can affect the nature of co-movements among different member countries, which is one of the important elements in gauging the costs of joining a currency union. The costs of adopting a monetary union are expected to decrease by lowering asymmetric shocks through increased trade.

3.1.3. The Work of Gruben, Koo and Millis

Gruben, Koo and Millis (2002) developed an OLS-based procedure to separate the effects of intra- and inter- industry trade and to include a number of omitted variables for the countries. Their findings are consistent with Frankel and Rose's conclusion that specialization does not reduce the synchronization of business cycles between the OECD countries.

Since their study of intra-industry and business cycle synchronicity is an attempt to refine Frankel and Rose's econometric approach, they start with applying diagnostics to Frankel and Rose's results and then raise questions about the details of their arguments. One problematic detail is that the coefficient estimates of instrumental variables (IV) are as much as three times the size of the corresponding ordinary least squares (OLS) estimates. A likely cause of the large difference between the coefficients estimated by OLS and IV is a statistical association between the instrumental and omitted variables which would be part of the error term. This statistical association can result in a bias much greater than that from OLS[11].

As Rodrik (2000) pointed out, for an instrument to be valid, it must be not only exogenous, but also affect the outcome variable ***only*** through the variable that is instrumented. But in Frankel and Rose's model, the instruments they used to capture the influences of trade may ultimately be seen as capturing the effects of all three influences (trade intensity, a common approach to monetary policy and factor mobility), further upwardly biasing the estimated impact of trade alone. Therefore, their instruments simply reflect more factors than trade. A test for over-identifying restrictions is presented for statistical justification. For that reason, Gruben, Koo and Millis abandon IV estimation in favor of OLS and incorporate Frankel and Rose's three instruments into the system as independent variables, hoping that these will serve as adequate proxies for the other difficult-to-measure factors.

A second issue concerning Frankel and Rose's work is that they estimate the relationship between business cycle synchronicity and trade by using total trade, instead of intra-industry trade, which is a stronger foundation for business cycle synchronicity, theoretically. Using a total trade independent variable, instead of

[11] Please see, for example, Anderson and van Wincoop, (2001).

separating intra-industry trade variable and inter-industry trade variable, assumes that the coefficients of intra- and inter-industry trade variables are the same, which will result in estimation bias due to misspecification. To further discuss the effects of inter-industry trade and intra-industry trade, Gruben, Koo and Millis (2002) separated these two different kinds of trade as in Shin and Wang's empirical framework. The sign of inter-industry trade intensity is calculated by using the coefficient of trade intensity minus the coefficient of intra-industry trade intensity, because by definition from (eqn. 3-11) and (eqn. 3-12), intra-industry trade + inter-industry trade = trade intensity.

$$\begin{aligned}
\text{Corr}(i,j)_t &= \alpha_0 + \alpha_1{*}\text{Trade Intensity}(i,j)_t + \alpha_2{*}\text{Intra-Industry Trade}(i,j)_t \\
&\quad +\gamma_1{*}\text{Dist}_{i,j} + \gamma_2{*}\text{Adjacent}_{i,j} + \gamma_3{*}\text{Language}_{i,j} + \varepsilon_{i,j,t} \\
&= \alpha_0 + \beta_1{*}\text{IntraTrade Intensity}(w)_{i,j,t} + \beta_2{*}\text{InterTrade Intensity}(w)_{i,j,t} + \\
&\quad +\gamma_1{*}\text{Dist}_{i,j} + \gamma_2{*}\text{Adjacent}_{i,j} + \gamma_3{*}\text{Language}_{i,j} + \varepsilon_{i,j,t} \\
&= \alpha_0 + \beta_1{*}\text{IntraTrade Intensity}(w)_{i,j,t} + \beta_2{*}(\text{Trade Intensity}(i,j)_t - \\
&\quad \text{IntraTrade Intensity}(w)_{i,j,t}) + +\gamma_1{*}\text{Dist}_{i,j} + \gamma_2{*}\text{Adjacent}_{i,j} + \gamma_3{*}\text{Language}_{i,j} + \varepsilon_{i,j,t} \\
&= \alpha_0 + (\beta_1 - \beta_2){*}\text{IntraTrade Intensity}(w)_{i,j,t} + \beta_2{*}\text{Trade Intensity}(i,j)_t + \\
&\quad +\gamma_1{*}\text{Dist}_{i,j} + \gamma_2{*}\text{Adjacent}_{i,j} + \gamma_3{*}\text{Language}_{i,j} + \varepsilon_{i,j,t}
\end{aligned} \qquad \text{(eqn. 3-9)}$$

$$\text{IIT}_{i,j} = \frac{\sum_k (X_{i,j} + M_{i,j}) - \sum_k |X_{i,j} - M_{i,j}|}{\sum_k (X_{i,j} + M_{i,j})} = 1 - \frac{\sum_k |X_{i,j} - M_{i,j}|}{\sum_k (X_{i,j} + M_{i,j})} \qquad \text{(eqn. 3-10)}$$

$$\text{IntraTrade }(w)_{i,j} = \text{IIT}_{i,j}{*}\text{Trade }(w)_{i,j} \qquad \text{(eqn. 3-11)}$$

$$\text{InterTrade }(w)_{i,j} = (1 - \text{IIT}_{i,j}){*}\text{Trade }(w)_{i,j} \qquad \text{(eqn. 3-12)}$$

Their results suggest that Frankel and Rose's general conclusion holds, but the estimation biases due to the instrumental variables and the omission of some variables caused Frankel and Rose's model to overstate the effects of international trade on business cycle synchronization. Moreover, Gruben, Koo and Millis's model provides a better framework to test whether specialization reduces business cycle correlations by splitting trade data into intra- and inter-industry trade, in which the implicit null hypothesis $\beta_1 - \beta_2 = 0$ is often rejected. Their estimates do not support in general that specialization has a negative effect on business cycle correlations. With a high share of intra-industry trade in total trade, industry-specific shocks will not, through specialization, dominate common demand shocks and productivity spillovers.

3.1.4. The Giovanni and Levchenko Model

Giovanni and Levchenko (2009) provide additional evidence of transmission by focusing on a particular identifiable channel: the use of intermediate inputs in production. Input-Output tables are employed to gauge the intensity with which individual sectors use each other as intermediate inputs in production. To study the mechanisms behind the well-known empirical regularity: country pairs that trade more with each other experience higher business cycle synchronization, Giovanni and Levchenko estimated the impact of trade on comovements, not just for each pair of countries, but also for each pair of sectors[12] within each pair of countries.

They showed that sector pairs experiencing more bilateral trade exhibit stronger comovements. The robust finding is that bilateral international trade increases comovements significantly more in cross-border industry pairs that use each other as intermediate inputs. The estimation results also imply that vertical production linkages account for around 32% of the total impact of bilateral trade on the business cycle correlations.

3.1.5. ADB Working Paper on Regional Economic Integration

Soyoung Kim, Jong-Wha Lee, and Cyn-Young Park (2009) investigate the

[12] The sectors are three-digit classification by using ISIC (International Standard Industry Classification), including 28 manufacturing industries.

degree of real economic interdependence between 9 emerging Asian countries and major industrial countries including Japan and the US to shed light on the heated debate over the "decoupling" of emerging Asia. They first document the evolution of macroeconomic interdependence for emerging Asian economies through changing trade and financial linkages at both the regional level and the global level. After that, a panel vector-auto-regression (VAR) model is used to estimate the degree of real economic interdependence measured by aggregate output growth rate before and after the 1997-1998 Asian Crisis.

Their empirical findings show that real economic interdependence increased significantly in the post-crisis period, indicating "recoupling", rather than decoupling. Business cycle comovements between Asia and Japan have increased substantially more than comovements between Asia and the US, which suggests that Japan's integration with the regional economy is an important driver behind the increase in inter-regional business cycle correlations. The level and composition of international trade reflects changing economic and industrial structures in emerging Asian economies with respect to their position in the world economy. The rapid economic and structural transformation in emerging Asia will spur competition in trade and investment, further affecting global business cycles. Conventionally, output shocks from major industrial economies will have a significant positive effect on emerging Asian economies. However, more interestingly, output shocks from emerging Asia also have a significant positive effect on output dynamics in major industrial economies. This result suggests that macroeconomic interdependence between emerging Asia and industrial countries has become "bi-directional", rather than "uni-directional" as traditional theory indicated.

Moreover, the increasing influence from Asia, especially China, tightening intra-industry trade and inter-regional trade linkages and the globalization of financial markets are jointly making fundamental changes to the nature of macroeconomic interdependence as well as growth spillovers between emerging Asia and the industrial countries. At the global level, greater integration will necessitate closer policy cooperation to respond more effectively to shocks and crises in global and regional markets. Meanwhile, the growing influence from China and other Asia emerging economies has amplified Asia's voice in global forums and institutions.

3.1.6. The Volz Model

The latest study related to the business cycle transmission through the trade channel by using correlation approaches is done by Ulrich Volz (2010)[13]. Based on previous studies, most model specifications take a similar form as the following

$$\rho_{ijt} = \alpha_0 + \alpha_1 T_{ijt} + \alpha_2 F_{ijt} + \alpha_3 S_{ijt} + \alpha_4 C_{ijt} + \varepsilon_{ijt} \qquad \text{(eqn. 3-13)}$$

where ρ_{ijt} represents bilateral GDP correlations between country i and country j, T_{ijt} denotes bilateral trade integration usually measured by trade intensity or intra-industry trade index, F_{ijt} denotes bilateral financial integration calculated by FDI measure, S_{ijt} stands for specialization, C_{ijt} for some other control variables and, ε_{ijt} for error terms.

However, these single equation models can only estimate reduced from effects of trade integration, financial integration, specialization and so forth, but such single equation models cannot distinguish between direct effects and indirect effects[14]. To account for the various indirect effects, such as the effects of financial integration on business cycles through trade and specialization, a simultaneous equations approach,

[13] This study is from the chapter of "A Reconsideration of Costs and Benefits", in the book "Prospects of Monetary Cooperation and Integration in East Asia" by Ulrich Volz (2010).
[14] Volz argued that the existence of indirect effects in different directions may cause the direct effects to appear small, as they may cancel each other out, in single equation regressions.

following Imbs (2004, 2006) is chosen as the estimation framework. At the same time, the endogeneity problem due to several variables on the right hand side of the single equation models can be addressed by using the simultaneous equations approach. In order to control a potential world business cycle, a new variable is added as a regressor. It is calculated by the natural logarithm of the average US growth (USG) rate over the representative periods, which is their way to deal with global factor.

Volz et al. concluded that both trade and FDI integration have a positive direct impact on output fluctuations in East Asia and the overall effects are also positive, as trade integration tends to stimulate FDI integration. Furthermore, if correct, their results suggest that further economic integration will make business cycle more synchronous in East Asia. For intra-regional exchange rate stabilization, the similarity of exchange rate regimes has a significant positive effect on trade integration in East Asia, since exchange rate policy spillover effects from one country to another are of great importance, for a region as economically intertwined as East Asia.

3.2 Dynamic Factor Models

In this group, Kose et al. (2008) distinguish the roles played by global cycles from cycles common to specific groups of countries---industrial economies, emerging markets and other developing countries. They decompose macroeconomic fluctuations in national output, consumption, and investment into the following factors: 1). Global factor, which picks up fluctuations that are common across all variables and countries. 2). Group specific factors, which capture fluctuations that are common to all variables and all countries in a given group 3). Country specific factors, which are common across all variables in a given country and

4). Idiosyncratic factors specific to each time series, which is in fact the residual, not explained by other factors.

The dynamic factor model is particularly useful for characterizing the degree and evolution of synchronization in various dimensions without making strong identifying assumptions to disentangle different types of common shocks. The dynamic relationships in the model are captured by modeling each factor and idiosyncratic component as an autoregressive process (autoregressive correlation with three lags AR (3) for simplicity and parsimony) to simultaneously pick up the contemporaneous spillovers of shocks as well as the dynamic propagation of business cycles in a flexible manner, without a priori restrictions on the structure of the propagation mechanism or the directions of spillovers[15].

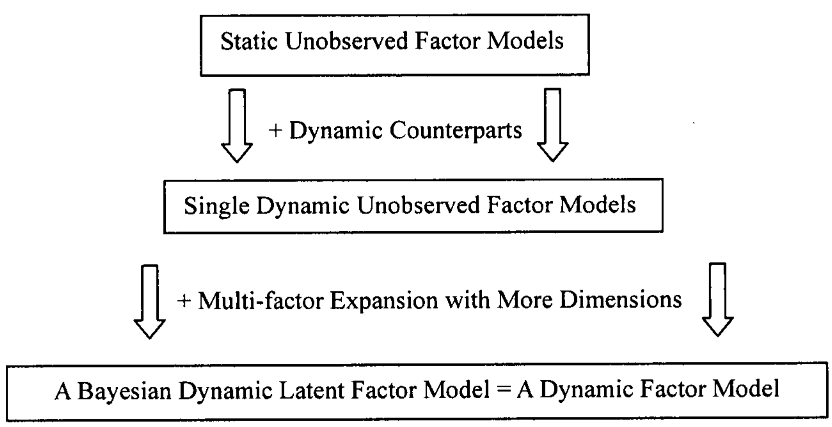

Figure 3.2 the Evolution of Dynamic Factor Models

The econometric model used in their paper is a multi-factor extension of the single dynamic unobserved factor model in Otrok and Whiteman (1998). Such kind of models could be considered as the dynamic counterparts to static unobserved factor models that are common in psychology and other social sciences. A static factor model provides a description of the variance-covariance matrix of a set of random variables, while a dynamic factor model provides a description of the spectral density matrix of a set of time series. Therefore, the dynamic factors could describe contemporaneous and temporal covariance among the variables (Kose et al., 2008). To

[15] See Kose et al. 2008.

explain the essence of the static factor models and the transformation mechanism from static factor models to dynamic factor models, the following description is quoted from Kose's papers (1998, 2003 and 2008).

"For static factor model, to be specific, suppose x_i is a vector of Q measurements for person i's academic achievement, for example, GPA, scores on SAT, GER, GMAT, etc. and Σ is the related covariance matrix. Then, x_i could be considered to have factor structure if Σ can be written in the following form

$$\Sigma = \Gamma \Gamma' + U \qquad \text{(eqn. 3-14)}$$

where Γ is Q x K (K << Q), and U is diagonal with positive entries on the diagonal. This structure indicates that x_i can be considered as being explained by a set of K common factors and idiosyncratic noise in the following form;

$$x_i = a^*f + u_i \qquad \text{(eqn. 3-15)}$$

where f is a K x 1 vector of factors, a is called "factor loadings" with Q x K vector, and u_i is the person-specific noise. Typically, the identification assumptions employed for the factors are independent and have variance 1.0, with uncorrelated u_i's across individuals, or rows. If no other information is posted on the factors f and they are "unobservable", their "unobservable" characteristics must be obtained by indirectly via the pattern of correlation in the x_i's. To be specific, it might be thought that the vector of person i's scores which are observable would be determined by a small number of factors, such as test-taking ability, intelligence and other abstract aspects. However, there is seldom direct way to identify what these factors are, only indirect ones through factor loadings.

In the time series context, suppose y_t is a Q-dimensional vector of the covariance stationary time series at time t, for example, growth rates of GDP, domestic consumption and domestic investment in a set of countries, and S_{yy} is the associated spectral density matrix for the stationary time series. Then, this time series y_t could be considered as having dynamic factor structure, if S_{yy} can be written in the following form:

$$S_{yy} = LL' + V \qquad \text{(eqn. 3-16)}$$

Where L is Q x K (Q >> K), and V is a diagonal matrix with positive entries on the diagonal. The structure of S_{yy} implies that all of the comovement amongst the observable variables is controlled by the M-dimensional set of the abstract "dynamic factors". In the time domain, y_t can be represented as

$$y_t = a(L)^*f_t + u_i \qquad \text{(eqn. 3-17)}$$

where a(L) is a Q x K dimensional matrix of polynomials in the lag operator, f_t is a K-dimensional process of the factors, and u_t is the error terms which may be serially but not cross-sectional correlated. In general, the factors are serially correlated and unobservable."

"In their implementation, the dynamic relationships in the model are captured by modeling each factor and idiosyncratic component as an autoregressive process.

The model can be written as the following:

$$Y_t^{i,j,k} = \beta_{global}^{i,j,k} f_t^{global} + \beta_{economy\,k}^{i,j,k} f_t^{economy\,k} + \beta_{country\,j}^{i,j,k} f_t^{country\,j} + \varepsilon_t^{i,j,k} \quad \text{(eqn. 3-18)}$$

$$f_t^m = \phi^m(L) f_{t-1}^m + \mu_t^m \text{ for } m = 1\ldots(1+K+J) \quad \text{(eqn. 3-19)}$$

$$\varepsilon_t^{i,j,k} = \phi^{i,j,k}(L)\varepsilon_{t-1}^{i,j,k} + v_t^{i,j,k} \quad \text{(eqn. 3-20)}$$

where $\phi^{i,j,k}(L)$ and $\phi^m(L)$ are lag polynomial operators, the error terms μ_t^m and $v_t^{i,j,k}$ are normal distributed with zero mean and constant variances. Specifically, $Y_t^{i,j,k}$ denote the growth rate of the ith observable variable in the jth country of economy type k. Here, they have three variables per country: GDP growth rate, domestic consumption growth rate and domestic investment growth rate (indexed by i), three economy types: industrial economies, emerging market economies and other developing economies (indexed by k), and 106 countries (indexed by j).

The factor loading β can capture the sensitivity of each observable variable to the latent factors and quantify the extent to which that variable moves with the global factor, the factor for its economy type and the country-specific factor, respectively. To identify the signs of the factors, they require one of the factor loadings to be positive for each of the factors by imposing the conditions that the factor loading for the global factor is positive for the U.S. output, that country factors positive for the output of each country and the factors for each country group have positive loadings for the output of the first country listed in each economy group. To identify the scales of the factor loadings, they assume that the variance for μ_t^m is a constant and the constant is based on the scales of the data so that the innovation variance for μ_t^m is equal to the average innovation variance for a set of univariate autoregressions on each time series. In addition, they found that the results are not sensitive to this normalization, based on the technical tests.

The dynamic factor models are based on a Bayesian approach that exploits Gibbs sampling[16] techniques and these techniques make it computationally feasible to draw from the exact finite sample distribution of the parameters and factors of interest in the model (Kose et al., 2008). In fact, the dynamic factor model is a decomposition of the entire joint spectral density matrix of the data. There are several advantages of dynamic factor models over standard approaches, reflected in the following aspects.

Firstly, they obviate problems that could be caused by studying a subset of factors, which could lead to a mischaracterization of commonality (Kose et al., 2008). For example, group-specific factors estimated in a smaller model may simply reflect

[16] Gibbs sampling is applicable when the joint distribution is difficult to sample from directly, or is not explicitly known, but the conditional distribution of each variable is known and is easy to sample from. It can be shown that the sequence of samples constitutes a Markov chain, and the stationary distribution of that Markov chain is just the sought-after joint distribution (see Gelman et al. 1995). In addition, the Gibbs sampling algorithm could generate an instance from the distribution of each variable in turn, conditional on the current values of the other variables. Furthermore, Gibbs sampling is particularly well adapted to sampling the posterior distribution of a Bayesian network, since Bayesian networks are typically specified as a collection of conditional distributions.

global factors that are misidentified as being specific to a particular group.

Secondly, a standard approach to measuring co-movement is to calculate sets of bivariate correlations often after de-trending. One way to reduce the number of bivariate correlations is to specify a country or weighted average of the concerned countries to serve as the reference against which other countries' correlations are computed. However, changes in the reference group often lead to significantly different results. Such weighting schemes also inevitably give rise to questions about the weights and concerns that a large country may dominate the global business cycle by virtue of its size when, in fact, that country may be disengaged from the rest of the world (Kose et al., 2008). Moreover, static correlations cannot capture the dynamic properties of the data, such as autocorrelations and cross-autocorrelations across variables. Factor models obviate these problems by identifying the common components and detecting how each country responds to the common components, instead of defining a "numeraire" country.

Thirdly, the factor model is also well suited to studying the joint properties (e.g. calculating the contribution of global factor and region-specific factor by adding them up) of fluctuations in output, consumption, and investment. The empirical model is quite flexible in capturing the degree of and changes in the patterns of co-movement across different countries, groups of countries, and macroeconomic aggregates. It can also handle dynamic propagation of shocks from various sources.

Various decompositions are used to measure the relative contributions of the global, group-specific and country-specific factors to business cycle fluctuations in each country."

In summary, Kose et al.'s paper provides a valuable analysis of the evolution of the degree of global business cycle linkages over the period 1960-2005, by using a dynamic factor model. The major finding is that there has been some convergence of business cycle fluctuations among the group of emerging market economies and among the group of industrial economies, during the period of globalization (1985-2005). Surprisingly, as globalization deepens, there has been a concomitant decline in the relative importance of the global factor in explaining the macroeconomic fluctuations of output, domestic consumption and domestic investment. In other words, there is evidence of business cycle convergence within each of the group of emerging market economies and the group of industrial economies but simultaneous divergence between these two groups of countries.

Chapter 4 Estimation Framework

4.1 Data Description

There are at least four different channels affecting business cycle co-movements: inter-industry trade, intra-industry trade (horizontal-commodity trade v.s. vertical-fragmentation trade), demand spillovers, and policy correlations. In addition, capital flow can also be relevant. The first channel implies that increased trade leads to less synchronization of business cycle fluctuations, while the other three channels indicate increased trade would induce more synchronization of business cycle fluctuations.

Table 4.1 Data Description

Variables	Description	Sources	Frequency	Estimated Period
X_{ijt}	Bilateral Exports	DOT,CEPD	Annual	1980 - 2008
M_{ijt}	Bilateral Imports	DOT,CEPD	Annual	1980 - 2008
X_{it}, X_{jt}	Multiple Exports	DOT,CEPD	Annual	1980 - 2008
M_{it}, M_{jt}	Multiple Imports	DOT,CEPD	Annual	1980 - 2008
$Govspending_{it}$, $Govspending_{jt}$	General Government Final Consumption Expenditure	World Development Indicator 2009	Annual	1976 - 2007
T_{it}, T_{jt}	Tax Revenue	IFS	Annual	1980 - 2008
M_2%	Money Growth Rate	IFS	Annual	1980 - 2008
C_{it}	Domestic Consumption	PWT	Annual	1960 - 2007
I_{it}	Domestic Investment	PWT	Annual	1960 - 2007
IIT By calculation	Intra-Industry Trade Grubel & Lloyd	WB,CEPD,UN Statistical Yearbook	Annual	1976-2004

Note: CEPD (Council for Economic and Planning Development) is for the data of Taiwan.

I will estimate my empirical framework with annual data (panel structure) in the three sub-periods: 1976-1984, 1985-1996 (Some use 1989 or 1990 instead of 1985, but for better comparison with Kose et al.'s work, I chose 1985.), and 1997-2007 or 1999-2007 (leaving out 97-98 Asian Crisis for an ideal long term trend without abnormal shocks), considering that the Asian Crisis in 1997-1998 and ICT (Information and Communication Technology) bubble burst in 2000-2001 which could be another break point to test hypothesis will distort the data and exaggerate the conventional measure of business cycle co-movement. Other possible testing point could be 1992 the year for the establishment of AFTA (Asia Free Trade Area). The reason to choose the year 1985, similar to what Kose et al. did, as the first dividing point is that global trade and financial flows have increased markedly since the mid-1980s and the beginning of the globalization[17] period coincides with a structural decline in the volatility of business cycles in both industrial and non-industrial countries, while the reason to choose the year 1997 as the second dividing point is the occurrence of the Asian Crisis.

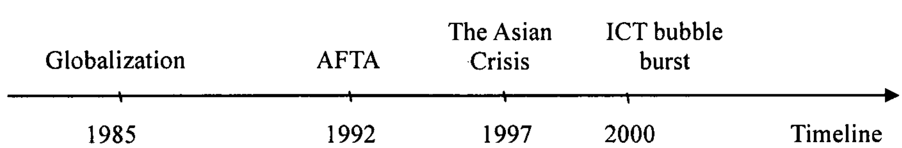

Figure 4.1 Possible Break Points of Years based on Big Events

As to the data for the Eurozone, to calculate intra-industry trade index for three different time periods, I choose eight major countries as representatives, if no aggregate data available and considering the changing members of the Eurozone over

[17] This demarcation is referenced from the paper "Global Business Cycle: Convergence or Decoupling?" by Kose et al. (2008).

time. These eight countries are Austria, Finland[18], France, Germany, Ireland, Italy, Netherland and Spain and they are originally joined Eurozone in 1999. The reason is that deepening trade history and relatively big market size let these original eight countries dominate in Euro zone. Another reason is that other small regions or countries will not make much difference, compared with the major eight countries.

In this study, fixed and flexible exchange rate regimes will not be separated, for two reasons. As mentioned by Kose et al. (1998), first, there is no conclusive evidence about whether the sample should be split in this way. For instance, Baxter and Stockman (1989), Baxter (1991), and Ahmet et al. (1993) found that different types of exchange rate regimes do not result in significant changes in the behavior of the main macroeconomic aggregates, though Gerlach (1988) concluded that exchange rate regime has a significant impact on the stylized business cycle facts. Second, the available measures of exchange rate regimes have been subject to considerable controversy. This is a topic for future research.

The empirical models will be framed by using both standard approaches and dynamic factor models. The part of standard approaches is mainly based on Shin and Wang's work (2003), while the part of dynamic factor models are mainly based on the work of Kose et al. (1998, 2002, and 2008).

4.2 Measures of Business Cycles and Business Cycle Synchronization

The term business cycle (or economic cycle) refers to economy-wide fluctuations in production or economic activity, such as GDP, domestic consumption, domestic investment, gross exports, gross imports and net exports, over several months or years. These fluctuations are often measured using GDP growth rates.

[18] Finland is quite small compared with Austria, France, Germany, Ireland, Italy, Netherland and Spain, and doesn't seem a natural choice, but considering its geographical position in Eurozone, it is representative to be included.

Traditional BCs undergo four stages: expansion, prosperity, contraction and recession. Despite being termed cycles, most of these fluctuations in economic activity do not follow a mechanical or predictable periodic pattern. In recent years economic theory has moved towards the study of economic fluctuation rather than a 'business cycle' and some economists use the phrase 'business cycle' as a convenient shorthand.

In econometric models, quantitatively, business cycle could be measured by using the following four real activity measures as in Frankel and Rose model: Real GDP, an index of industrial production, total employment and the unemployment rate. The analysis of business cycles could be further decomposed to two parts: the trend part and the cyclical part.

4.2.1 The Trend Part of Business Cycles (Not de-trended)

There usually exists a time trend or other forms of trend in the components of business cycles, either linear or non-linear. In most cases, the trend part of business cycles can be captured by a linear function in the slope-intercept form:

$y = a + b*t$, where y is the time trend series; "a" is constant and denotes the intercept of the trend; b is the slope of the trend and denotes the speed of y varying with time t. The slope b can be either positive or negative, but in most cases, b is positive.

For long-run business cycles, a single linear function $y = a + b*t$ cannot capture the whole trend, if there exists structural breaks. In time series, structural breaks can be detected through the econometric tool of Z-Andrew Test.

4.2.2 The Cyclical Part of Business Cycle (De-trended)

To measure the cyclical part of business cycles, one method is to calculate the correlations of deviations from trend in which I use first differenced natural logarithm of the value for domestic output GDP, domestic consumption, domestic investment, gross exports, gross imports and net exports. Figure 1 reports the growth rates of these macroeconomic aggregates for four selected countries (China, the United States, Japan, and Thailand) as representatives.

For real GDP growth rate comparisons, most Asian emerging economies, especially Singapore and Thailand, experienced greater fluctuations than the US, the Eurozone and Japan. The big drop during the Asian Crisis is captured in 1998. China and India keep relatively high and sustained growth rates during the past decades. So, some observers have even conjectured that emerging markets, especially China and India, have "decoupled" from industrial economies, in the sense that their business cycle dynamics are no longer tightly linked to industrial country business cycles.

Then, I decompose real GDP growth into domestic consumption, domestic investment growth, gross exports, and gross imports growth, as well as net exports growth.

The comovements among different countries increased to some extent and several overlapping parts can be found, especially for gross exports growth.

For domestic consumption growth, the comovements among different countries are increased and the fluctuations are reduced, comparing with the previous graph, similar to domestic investment growth.

For gross exports growth, the comovement rhythm among different countries increased a lot and several overlapped parts can be found.

For gross imports growth, the comovements mainly concentrated in the period of 1998 --- 2008, the period after the Asia Crisis.

For net exports growth, most countries keep nearly zero growth rate and with little fluctuation, except China and Taiwan.

4.2.3 Technique 1: Simple Correlations for the Short Run (Not de-trended)

If both countries have the same comovements, there may be a perfect short run correlation. For instance, one year after the starting point, their GDPs drop by the same amount, which can be true for year-to-year movements, and then annual correlation will be high (Permpoon and Willett, 2007). However, for a longer time horizon such as seven years, the accumulated differences in growth which are not clearly visible on the annual basis can be significant in the long run growth, due to the different slopes and intercepts of trends for different business cycles of both countries. Thus, simple correlation techniques limit the analysis only to short run growth.

4.2.4 Technique 2: Correlations of Deviations from Hodrick-Prescott Filter

To avoid the limitation of simple correlations, the key is to remove the effects from different trends of business cycles. One method that is often used in the literature is to do correlations of deviations from trend. The information in correlations of deviations from trend could reflect both the degree of similarity of trends for countries and how much their GDP fluctuations around the trend line (Permpoon and Willett, 2007).

Generally speaking, there are two categories of de-trending methods, linear de-trending techniques and non-linear de-trending techniques. For non-linear de-trending technique, the Hodrick-Prescott filter is often selected to generate non-linear trend line. Because it is less sensitive to short run fluctuations, the data-smoothing technique of the Hodrick-Prescott filter can reveal long-term trends by removing short-term fluctuations. Compared with the linear trend, the Hodrick-Prescott high pass filter (HP method) with dampening parameter of 100 could produce a non-linear presentation with a procedure of squared error minimization. The trend component for this method is the value τ that can minimizes the following equation:

$$\sum_{t=1}^{T}(y_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1}[(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2. \quad \text{(eqn. 4-1)}$$

where y is the real GDP series and λ is a multiplier that can adjust the sensitivity of second differences of the trend component to short run fluctuations. Empirically, for annual series, the conventional value of λ is 100.

However, the Hodrick-Prescott filter is not perfect, it has some disadvantages. For instance, the determinants of the variance of the trend of the level of smoothness are arbitrary, and the end-point problem in the calculation will put more weight on the observations in the end of the series (Marinheiro, 2004 and Willett et al. 2010). Although the Hodrick-Prescott filter may be only suitable for some special series, none of these disadvantages and undesirable properties is particularly fatal (Ravn and Uhlig, 1997 and Willett et al. 2010). The above considerations could serve as good reasons for why the Hodrick-Prescott Filter technique is so popular despite its drawbacks.

4.2.5 Techniques 3: Correlations of Deviations from Linear Trend

Similarly, to avoid the limitation of simple correlations, linear de-trending techniques can be applied to remove the effects from different trends of business cycles. The information in correlations of deviations from trend could reflect both the extent of the similarity of trends for countries and how much their GDP fluctuates around the trend line (Permpoon and Willett, 2007).

4.2.6 Other Techniques used for the Measures of Business Cycle Synchronization[19]

Based on the above three basic techniques, other techniques are developed to

[19] Please see Permpoon and Willett (2007).

measure business cycle synchronization. Zarnowitz (1991) used growth cycles to analyze the changing process of business cycles. He determined the duration of each cycle by peaks and troughs of the graph with slowdowns occurring in the late stage of expansion or interrupting expansion. Shin and Sohn (2006) took the residuals from the second order autoregressive difference in GDP growth of two countries to remove serial correlations, and then multiplied the negative of their absolute values by 100.

4.3 Empirical Framework

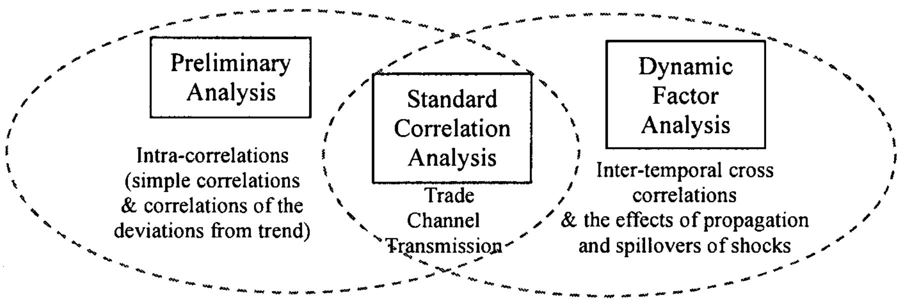

Figure 4.3 Research Design and Thinking Mechanism

For the research design in this dissertation, the analysis will start with conventional correlations of real GDP growth rates for each pair of countries by using simple correlations without de-trending and correlations of the deviations from trend. Increasing correlations among ASEAN and decreasing correlations of Asian countries to the US or to the Eurozone are expected, in the process of business cycle evolution. However, conventional correlations are static, contemporaneous and cannot capture interactive effects of propagation and spillovers from shocks, compared with a dynamic factor model, on the one hand; on the other hand, simple before-and-after comparisons cannot give an accurate picture of the degree of convergence or decoupling of business cycles, because similar increases or decreases could occur for other pairs of countries due to common factors for which conventional correlations cannot control.

For more formal analysis, standard correlation analysis built on the previous studies will be employed to investigate the effects of trade channel on the transmission of business cycles. After that, dynamic factor models will be applied to analyze the underlying sources of macroeconomic fluctuations of key macroeconomic aggregates --- output, domestic consumption, domestic investment, gross exports and gross imports, by decomposing their variances into world factor, regional factors, and country factors.

4.3.1 Correlation Approach Estimation Framework

For the standard approaches, I construct my empirical estimation framework mainly based on Shin and Wang's work. Their empirical framework clearly identifies the four channels they regarded as major transmission channels of business cycle comovements. I extend their analysis by adding exchange rate movement as a control, because monetary coordination with large trade partners, such as might occur under pegged exchange rates, could cause a spurious correlation between trade and business cycle correlation[20]. For accuracy, I will use the term "policy correlations" instead of "policy coordination", since there may be policy correlations even when there is actually no direct macro policy coordination between these countries. In addition, as Shin and Wang (2003) mentioned, it is problematic to adopt the instrumental variable method as Frankel and Rose did. First, the instrumental variables are expected to be highly correlated to trade intensity, but not intra-industry trade. However, it is very difficult to find appropriate instrumental variables for intra-industry trade. Secondly, the regression results are based on a panel data including time series variations and cross-section variations, but instrumental variables do not change over time.

Based on previous studies, it is expected that intra-industry trade plays an

[20] Please see Gruben, Koo and Millis (2003).

important role in the transmission of business cycles from one country to another. Meanwhile, Gruben, Koo and Millis (2003) showed that the null hypothesis of insignificant coefficients for intra-industry trade is often rejected. Therefore, an intra-industry trade variable is an essential regressor in explaining the transmission of business cycles through the trade channel. Trade intensity is also directly related to business cycle synchronization, but the significance and direction of its coefficient may differ from that of intra-industry trade. Since total trade consists of intra-industry trade and inter-industry trade, these two types of trade can generate opposite effects on business cycle synchronization.

For the other explanatory variables in the estimation equations, different papers frame them in various ways, based on their different perspective of studying this issue. There is no consensus in choosing other explanatory variables or controls except trade intensity and intra-industry trade to add in the model. The key of choosing other explanatory variables is to let the framed estimation model work well for explaining the results and testing hypothesis.

For my estimation framework, I chose fiscal policy correlation, monetary policy correlation and exchange rate movement, as controls, based on OCA criteria. At the first glance, there may exist correlation relationships among fiscal policy variables measured by the correlation of de-trended ratio of general government final consumption expenditure to GDP ratio between country i and country j, monetary policy variables measured by the correlation coefficient of the M_2 annual growth rate for each country pair and exchange rate movement variables measured by the standard deviation of nominal bilateral exchange rates scaled by its mean. If these three policy variables are correlated, for the estimation equation, the problem of multicollinearity is hard to avoid. Therefore, before I run regressions for the whole estimation equation, it is necessary to check the correlations among these three policy variables quantitatively by using econometric techniques. However, due to the complexity of policy operation in practice, the correlations of these three policy variables may not be that high. The following box shows that the pairwise correlations for these three policy variables are very low; therefore, the three policy variables will not generate major multicollinearity problems.

Box 4.3 Correlations of F.P., M.P. and Exchange Rate Co-movement

Linear De-trended					*Hodrick-Prescott Filter De-trended*				
76-84	obs=55	F.P.	M.P.	NER	76-84	obs=55	F.P.	M.P.	NER
F.P.		1.000			F.P.		1.000		
M.P.		0.089	1.000		M.P.		-0.034	1.000	
NER		-0.150	0.131	1.000	NER		0.105	0.134	1.000
85-96	obs=66	F.P.	M.P.	NER	85-96	obs=66	F.P.	M.P.	NER
F.P.		1.000			F.P.		1.000		
M.P.		-0.097	1.000		M.P.		-0.111	1.000	
NER		0.093	-0.021	1.000	NER		0.041	-0.021	1.000
97-07	obs=78	F.P.	M.P.	NER	97-07	obs=78	F.P.	M.P.	NER
F.P.		1.000			F.P.		1.000		
M.P.		0.156	1.000		M.P.		0.019	1.000	
NER		-0.165	-0.281	1.000	NER		-0.293	-0.033	1.000
99-07	obs=78	F.P.	M.P.	NER	99-07	obs=78	F.P.	M.P.	NER
F.P.		1.000			F.P.		1.000		
M.P.		0.158	1.000		M.P.		0.110	1.000	
NER		0.010	-0.259	1.000	NER		-0.141	-0.066	1.000

$$\text{Syn}(i,j)_t = \alpha_0 + \alpha_1 * \text{Trade Intensity}(i,j)_t + \alpha_2 * \text{Intra-Industry Trade}(i,j)_t + \alpha_3 * \text{Fiscal Policy Correlations}(i,j)_t + \alpha_4 * \text{Monetary Policy Correlations}(i,j)_t + \alpha_5 * \text{Exchange Rate Movement}(i,j)_t + \varepsilon_{ijt} \quad \text{(eqn. 4-2)}$$

$$\text{IntraTrade Intensity} = \text{IIT} * \text{Trade Intensity} \quad \text{(eqn. 4-3)}$$

$$\text{InterTrade Intensity} = (1-\text{IIT}) * \text{Trade Intensity} \quad \text{(eqn. 4-4)}$$

where Business cycle synchronization is measured by the simple contemporaneous bilateral correlation coefficient of the cyclical components of GDP between two countries:

$$\text{Corr}(i, j)_t = \text{Corr}(GDP_{it}, GDP_{jt}) = \text{cov}(GDP_{it}, GDP_{jt}) / [\text{var}(GDP_{it})*\text{var}(GDP_{jt})]^{1/2}$$

(eqn. 4-5)

However, since the correlation coefficient is bounded in the [-1, 1] interval, it is unlikely that the error term in a regression model with those correlation coefficients as dependent variable is normally distributed (Nguyen, 2007), resulting in biased estimation. To remedy, the Fisher's z-transformation on the correlation coefficients will be applied, following Inklaar et al. (2005) to ensure the transformed values are normally distributed (David, 1949).

$$\text{Syn}(i,j)_t = \text{Corr}_{trans,\ ijt} = (1/2)*\text{In}[(1+\text{corr}(i,j)_t)/(1-\text{corr}(i,j)_t)] \qquad \text{(eqn. 4-6)}$$

Fiscal Policy Correlations $(i,j)_t$ = Corr [$Govspending_{it}$ / GDP_{it}, $Govspending_{jt}$ / GDP_{jt}], that is, the correlation of de-trended ratio of general government final consumption expenditure to GDP ratio between country i and country j, instead of Fiscal Policy Correlations $(i,j)_t$ = Corr [$(G_{it}-T_{it}) / Y_{it}$, $(G_{jt}-T_{jt}) / Y_{jt}$] used by Shin and Wang's measure of Fiscal Policy Coordination, because it estimates the active part of changes in the fiscal variable which is what is relevant.

Monetary Policy Correlations $(i,j)_t$ = Correlation Coefficient of the broad money or M_2 annual growth rates across each pair of countries. For Eurozone, the broad money annual growth rates are calculated by using simple average of its members (including Austria, Belgium, Cyprus, Finland, Greece, Germany, Italy, Ireland, Malta, Netherlands, Portugal, Slovak Republic, Slovenia, and Spain). The estimated coefficients are expected to be positive, since countries with similar monetary policies will experience similar business cycles.

Exchange Rate movement is measured by nominal bilateral exchange rate stability using its standard deviation scaled by its mean (Nguyen, 2007):

Exchange Rate Movement = Standard Deviation (NER_{ijt}) / Mean (NER_{ijt})

(eqn. 4-7)

where NER_{ij} is the nominal bilateral exchange rate between country i and country j. The bilateral exchange rates are computed via cross rates against the US dollar. As exchange rate movement is measured by its standard deviation, a negative coefficient is expected because more stable (less volatile) exchange rate probably induces greater synchronization.

Frankel and Rose's measures of trade intensity: (Take natural log of the followings)

$$WT_{ijt} = (X_{ijt} + M_{ijt})/(X_{i,t} + X_{j,t} + M_{i,t} + M_{j,t}) \qquad \text{(eqn. 4-8)}$$

$$WY_{ijt} = (X_{ijt} + M_{ijt})/(Y_{i,t} + Y_{j,t}) \qquad \text{(eqn. 4-9)}$$

Shin and Wang add: (Take natural log of the following terms)

$$WX_t(i,j) = X_{ijt}/(X_{it} + X_{jt}) \qquad \text{(eqn. 4-10)}$$

$$WM_t(i,j) = M_{ijt}/(M_{it} + M_{jt}) \qquad \text{(eqn. 4-11)}$$

Following the above two sets of methods, three different proxies for bilateral trade intensity will be used. They use exports, imports and both as base, respectively. T denotes the number of years in each period.

$$wx(i,j,T) = \ln\left(\frac{1}{|T|}\sum_{t\in T}\frac{x_{ijt}}{X_{it} + X_{jt}}\right) \qquad \text{(eqn. 4-12)}$$

$$wm(i,j,T) = \ln\left(\frac{1}{|T|}\sum_{t\in T}\frac{m_{ijt}}{M_{it} + M_{jt}}\right) \qquad \text{(eqn. 4-13)}$$

$$wt(i,j,T) = \ln\left(\frac{1}{|T|}\sum_{t\in T}\frac{x_{ijt} + m_{ijt}}{(X_{it} + X_{jt}) + (M_{it} + M_{jt})}\right) \qquad \text{(eqn. 4-14)}$$

For intra-industry trade intensity, the measure derived form Grubel and Lloyd (1975) will be used as the following with two, three and four-digit level classification (See Boxes 1-3 in Appendix) from the International Standard Industrial Classification (ISIC) for manufacturing industry.

$$IIT(i,j,T) = \frac{1}{|T|}\sum_{t\in T}\left(\frac{\sum_k\left(x_{ijt}^k + m_{ijt}^k\right) - \sum_k\left|x_{ijt}^k - m_{ijt}^k\right|}{\sum_k\left(x_{ijt}^k + m_{ijt}^k\right)}\right) \quad \text{(eqn. 4-15)}$$

Table 6-1 reports the average measures of trade intensity and intra-industry trade for each country. The simple average is based on a simple arithmetic mean for the trade intensity measures of each country with the other countries in the model. The weighted average is calculated by using the share of bilateral trade for each country. Three different proxies for bilateral trade intensity are used, wx_t, wm_t and wt_t. The first two are following Shin and Wang (2003) and the third one is following Frankel and Rose (1998) as well as Shin and Wang (2003).

On the whole, trade intensity, whether based on exports, imports or total trade, has experienced continuous increases, which implies that Asian countries, the US and Euro Area are all becoming more important trading partners to each other, as time passes. For the intra-industry measure, the changing pattern is also continuous increase, regardless of IIT_2, IIT_3 or IIT_4.

4.3.2 Dynamic Factor Model Estimation Framework

To employ a Bayesian Dynamic Latent Model, I will start with the Asian Region of 11 countries: the 10 major emerging economies in Asia: China (Mainland), Taiwan, Hong Kong, Singapore, South Korea, India, Indonesia, Malaysia, the Philippines, Thailand and 1 industrial economy: Japan (2 versions for advanced economies are considered: How advanced economies including Japan affect Asian emerging economies and how the EU and the US affect Asian economies?)

Similar to the work done by Kose et al., I decompose macroeconomic fluctuations[21] into domestic output measured by GDP growth, domestic consumption growth, domestic investment growth, gross exports growth and gross imports growth into the following factors:

① Global factor, which picks up fluctuations that are common across all variables and countries

② Group-specific factors, which capture fluctuations that are common to all variables and all countries in a given group

Group-specific factors are used for decoupling version 2 (See footnotes 1) --- decoupling emerging Asian economies from industrialized economies, such as the EU, the US and Japan. Or Regional factors will be used, instead of group-specific factors, for decoupling version 1 (See footnotes 1) --- decoupling Asian economies from the EU and the US, or further considering decoupling hypothesis in intra-Asia region.

③ Country specific factors, which are common across all variables in a given country

④ Idiosyncratic factors specific to each time series, which is in fact the residual, not explained by other factors

$$Y_{it} = \alpha_i + b_i^{Region} f_t^{Region} + b_i^{Country} f_{it}^{Country} + \varepsilon_{it} \qquad \text{(eqn. 4-16)}$$

$$E\, \varepsilon_{i,t}\, \varepsilon_{j,t-s} = 0 \text{ for } i =/= j$$

where Y_{it} is a Q-dimensional vector of covariance stationary time series at time t ($t = 1,2,3,\ldots,T$) for country i ($i = 1,2,3,\ldots,M*N$). M is the number of time series per country (e.g. If growth rate of output, consumption, and investment in a set of countries are 3 dimensional vector of Y_{it}, M = 3.); N is the number of the countries.

In practice, each series was log 1st - differenced and demeaned by Hodrick-Prescott filter or simple average (as in Otrok and Whiteman, 1998).

[21] According to National Bureau of Economic Research (NBER), the evolution of five indicators is mainly focused on: Real GDP, real income, employment, industrial production, and wholesale-retails sales.

Observable variables are denoted by Y_{it}, for i = 1, 2, 3,…, M*N, t = 1,2,3,…,T

Two types of factors: N country-specific factors and the single regional factor. The unexplained idiosyncratic errors ε_{it} are assumed to be normally distributed, but may be serially correlated.

Then I add Eurozone and US in, where Eurozone is treated as an entire entity.

$$Y_{it} = \alpha_i + b_i^{World} f_t^{World} + b_i^{Region} f_{rt}^{Region} + b_i^{Country} f_{it}^{Country} + \varepsilon_{it} \qquad \text{(eqn. 4-17)}$$

$E\, \varepsilon_{i,t}\, \varepsilon_{j,t-s} = 0$ for i /= j; r=1,2,3 (3 regions); 28 countries

$$Var(Y_{it}) = (b_i^{World})^2 Var(f_t^{World}) + (b_i^{Region})^2 Var(f_{r,t}^{Region})$$

$$+ (b_i^{Country})^2 Var(f_{it}^{Country}) + Var(\varepsilon_{it}) \qquad \text{(eqn. 4-18)}$$

Where f_t^{World} denotes world factor for all countries in this equation, f_{rt}^{Region} denotes region-specific factors or regional factors for each region and $f_{it}^{Country}$ denotes country-specific factors for each country. To identify the regional factor of the US, two contingent countries, Canada and Mexico were added in the system. The results of Canada and Mexico are not reported, because they are not the focus here.

The fraction due to the region-specific factor, for example, would be:

$[(b_i^{Region})^2 Var(f_{r,t}^{Region})]/ Var(Y_{it})$, similar to the case of Asian countries.

Since the recent studies using dynamic factor models only focus on domestic macroeconomic variables representing the real side of the domestic economy, but leave out trade, I will add exports and imports in Y_{it} vector, to find out the contributions of each factor to the fluctuations through trade transmission.

Chapter 5 Results for Correlation Analysis

5.1 Preliminary Analysis

Generally speaking, business cycle correlations are heavily influenced by the patterns of shocks which can vary a great deal over time and then affect the correlations again through various channels of transmissions. Tables representing the correlations of real GDP growth for intra-Asia or Asia versus the US and versus the Eurozone quantitatively reflect the instability and potential linkages.

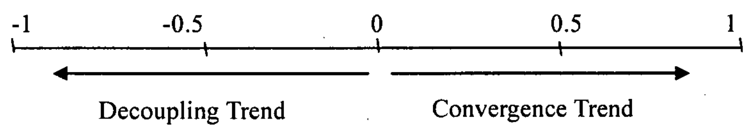

Figure 5.1 Interpretation of the correlation values for Decoupling Hypothesis

Box 5.1 the Corresponding Meaning of Different Correlation Values

Correlation Values	*The Explanation of the Correlations*
-1	Perfectly negatively correlated --- Fully Decoupled
(-1, -0.5) & -0.5	Heavily negatively correlated --- Decoupled to large extent
(-0.5, 0)	Lightly negatively correlated --- Decoupled to less extent
0	No Correlations between the Two Countries
(0, 0.5) & 0.5	Lightly positively correlated --- Convergence to less extent
(0.5, 1)	Heavily positively correlated --- Convergence to large extent
1	Perfectly positively correlated --- Fully Convergence

As mentioned before, non-detrended simple correlations of real GDP growth in the short run such as one year growth rate serve as relatively reasonable measure to judge whether there is convergence or decoupling, since for a long time horizon such as six years, the accumulated differences in growth that are not clearly visible on the annual basis will become prominent in the long run growth. Therefore, it is not sensible to use simple correlations of real GDP growth in five-year intervals or more-than-five-year intervals alone for analysis without comparing with the related correlations of the deviations from trend.

Based on the above statement, I calculated simple correlations of real GDP growth for each country pair in five-year intervals or less-than-five-year intervals. The break points of different years are selected by big events, such as 1985 for globalization, 1992 for AFTA establishment, 2001 for ICT bubble burst and 1997-1998 the Asian Crisis.

< Insert Table 1a - 1h Here>

Tables from 1a to 1h did reflect some acclaimed facts to a large extent, mainly from the following three aspects.

First of all, there exists evidence for the convergence of business cycles in ASEAN[22]-5 countries, which will echo other founding in Chapter 6. For instance, during 1976-1980, the simple correlations for the country pairs of Indonesia versus Singapore, Malaysia versus Thailand, the Philippines versus Thailand and Malaysia versus the Philippines were approaching 1, when rounding to three-digit numbers. Each of the ASEAN-5 countries kept very high correlations with others in ASEAN-5, 0.889 for Indonesia versus Malaysia, 0.891 for Indonesia versus the Philippines and Indonesia versus Thailand, 0.898 for Malaysia versus Singapore and 0.900 for Singapore versus Thailand. During 1981-1984, although the strong correlations among ASEAN-5 countries were weakened to some extent, the country pair of Indonesia versus Malaysia, Indonesia versus Singapore, Indonesia versus Thailand, Malaysia versus Singapore, Malaysia versus Thailand and Singapore versus Thailand still kept very high correlations, such as 0.526 for Singapore versus Malaysia and 0.987 for Indonesia versus Thailand.

[22] ASEAN: The Association of Southeast Asian Nations, commonly abbreviated ASEAN (generally pronounced /' ɑ:si.ɑ:n/ in English, the official language of the bloc), is a geo-political and economic organization of 10 countries located in Southeast Asia, which was formed on 8 August 1967 by Indonesia, Malaysia, the Philippines, Singapore and Thailand.
In addition, ASEAN+3: ASEAN plus Three (APT) is a coordinator of cooperation between the ASEAN and three East Asian Nations: China, Japan and South Korea.

However, during 1985-1988, the number of ASEAN-5 country pair correlations above 0.55 bounced again from six cases in the previous period up to ten. So, the business cycles of ASEAN-5 countries further converged during this period. During the next period 1989-1991, the number of correlations above 0.5 for ASEAN-5 declined, indicating there was divergence during this period. But, after the establishment of AFTA in 1992, especially after the Asian Crisis in 1997-1998, the business cycles of ASEAN-5 countries converged again, especially after the years of the Asian Crisis and the recent global financial crisis.

Secondly, during 1997-2000, ASEAN-5 countries had very high correlations with each other in the range from 0.769 to 0.996, but the correlations of Asian countries with the US and with the Eurozone became very low, except the India versus the US pair, indicating that the impact of the Asian Crisis did not spread to the US and the Eurozone. The low correlations of Asian countries with the US and with the Eurozone signaled the decoupling of Asian countries from the US and the Eurozone, because of their own large shock. Nevertheless, the evidence is not strong enough to support the hypothesis of decoupling Asian Economies from that of the US and the Eurozone. During the following time period 2001-2005 and 2006-2009, high correlations of Asian countries with the US in 2001-2005 and with both the US and the Eurozone in 2006-2009 can be found. The correlations of each Asian country with the US and with the Eurozone will be further analyzed in Table 2a – Table 2f.

Thirdly, in the early stage, before the 1997-1998 Asian Crisis, China did not play a very important role for the economy growth among Asian countries, the US and the Eurozone, which can be reflected in the low correlations with other countries in the system. But after the 1997-1998 Asian Crisis, China has become more and more important due to the vertical integration as a center of component assembler for manufacturing. The importance of China gradually catches up to the importance of Japan. China and Japan provide sustainable power to support the growth of the Asian Region as well as the US and the Eurozone. Therefore, some economists argue that Asian economies have been less importantly tied to the US.

< Insert Tables 2a - 2f Here>

Tables from 2a to 2f can be classified into two sets. The set of Tables 2a, 2c, and 2d calculate the correlations of annual growth rates against the United States by applying simple correlations, correlations of deviations from linear trends and correlations of deviations from Hodrick-Prescott filter trend, respectively. The other set of tables 2b, 2e and 2f calculate the corresponding correlations of annual growth rates against the Eurozone.

The correlations of the sets of calculations are extremely variable over the different time periods, for both the correlations with the United States and the correlations with the Eurozone. Most of the numbers from different types of measures are quite similar, however, the calculation difference between simple correlations and the correlations of deviations from Hodrick-Prescott trend are less than 0.15 in 70 % of the calculations for the US and 52 % for the Eurozone, while the calculation difference between simple correlations and correlations of deviations from linear trend are less than 0.15 in 80 % of the calculations from the US and 75 % for the Eurozone. The calculation differences between simple correlations and the correlations of deviations from Hodrick-Prescott trend are greater than 0.25 in 12.5 % of the calculations for the US and 20.83 % for the Eurozone, while the calculation differences between simple correlations and correlations of deviations from linear trend are greater than 0.25 in 10.42 % of the calculations for the US and 8.33 % for the Eurozone. The maximum differences appear in the country pair of Korea versus the United States during 1976-1980, with 0.723 for the difference between simple correlations and the correlations of deviations from the Hodrick-Prescott trend, and with 0.734 for the difference between simple correlations and the correlations of deviations from linear trend.

As mentioned before in 4.2, the Hodrick-Prescott (HP) filter is a data-smoothing technique widely applied to remove short term fluctuations and reveal long term trends. Compared with the linear trend, the HP filter generates a non-linear presentation with a procedure of squared error minimization. The differences of the correlations of deviations from the two different types of trends are not statistically significant in most cases. Linear trends are more sensitive to short-run fluctuations than the HP filter trends.

However, the difference between the absolute values of the simple correlations and the corresponding de-trended correlations can sometimes be very big. For instance, the differences between the simple correlations and the related linear-detrended correlations are 0.723 for Korea versus the United States during 1976-1980, 0.672 for Malaysia versus the United States during the same period, 0.567 for Thailand versus the United States during 1981-1984, 0.676 for Malaysia versus the United States during 1989-1991 and 0.731 for Taiwan versus the Eurozone during 1992-1996. The differences between the simple correlations and the corresponding Hodrick-Prescott filter detrended correlations are 0.732 for Korea versus the United States during 1976-1980, 0.692 for Malaysia versus the United States during the same period, and 0.527 for Taiwan versus the United States during 1992-1996. The differences between simple correlations and the correlations of deviations from linear trend are less than 0.15, 80 % of the time for the US and 75 % for the Eurozone, while the proportions of the same differences greater than 0.25 are 10.42% for the US and

8.33% for the Eurozone. Meanwhile, the frequency of differences between simple correlations and the correlations of deviations from the Hodrick-Prescott trend that are less than 0.15 are 70 % for the US and 52 % for the Eurozone, while the proportions of the same differences greater than 0.25 are 12.5 % for the US and 20.83 % for the Eurozone.

The values of real GDP correlations echo the expected results based on structural characteristics. China, Taiwan, Hong Kong, Singapore and Thailand display relatively high average correlations with the United States and the Eurozone, during the different time periods, consistent with their export-led growth strategy, especially Thailand and Singapore. China, as the Asian center for assembly, has made great contributions to promoting the growth of other Asian countries, such as Malaysia, Philippines and India, by importing intermediate goods from these countries for exports to the United States and the Eurozone. In the 2000s, as trade barriers gradually decreased for most Asian economies, the correlations with the United States became positive and increased by various degrees. Japan, Singapore, Malaysia, Indonesia, Hong Kong and Taiwan experienced dramatic increases in the first half of the 2000s. Japan, the only industrialized economy in Asia, is able to quickly absorb the information in the world market and then take first-mover advantage to enjoy the benefits from globalization and trade liberalization. This may explain high correlations with the United States during 1985-1988 and 2001-2005. China's entry into the World Trade Organization (WTO) also was followed by an increase of the comovement with the United States. During 2000s, the high correlations with the United States and the Eurozone, in general, indicate the increased interdependence of Asian economies with United States and Europe, rather than decoupling, although evidence of low correlations can be found during some time frames.

To assess the intra-correlations of business cycles over longer time frames, four sub-periods contemporaneous correlations for the cyclical parts are presented in Tables 3a - 3d for linear detrended correlations and Tables 4a – 4d for Hodrick-Prescott filter detrended correlations. The cyclical parts are derived by applying the linear-de-trending technique and the Hodrick-Prescott Filter de-trending technique. Highlighted columns in shade show the correlations no less than 0.50 for the corresponding country pairs. From Tables 3c to 3d, the pairwise correlations decline generally, when excluding the data of 1997-1998 Asian Crisis.

< Insert Tables 3a - 3d Here>

Using the linear de-trending technique, during the first sub-period (1976-1984), countries such as China and India record very low and even negative correlations with the others except Taiwan and the US for China, which indicates some degree of divergence in real output fluctuations. This result is robust on the whole when the Hodrick-Prescott filter detrended technique is used. China has 5 negative signs out of 11 and India has 8 negative signs out of 11 during 1976-1984. But in the second sub-period (1985-1996), India has only 3 negative correlations with other countries out of 11, while Japan has 7 negative correlations out of 11, as does China. Hong Kong has the most correlations above 0.50 with other countries in the period 1976-1984, however, in the period 1985-1996, the number of correlations above 0.50 with other countries decreases from 5 to 2 out of 11. In contrast, during the period 1997-2007 and 1999-2007 the statistics for correlations have increased considerably after the 1997-1998 Asian Crisis. In the post crisis period, 33 out of 78 cases of intra-correlations above 0.50 are found as compared to only 14 out of 66 cases prior to the crisis. China, Hong Kong, Japan, Singapore, Malaysia, Thailand and Taiwan increased their correlations with other countries in the periods 1997-2007 and

1999-2007. Furthermore, East Asian countries, especially ASEAN[23], seem to be more integrated among themselves and with Japan since 1997.

To investigate the decoupling hypothesis, the correlations with the United States and the Eurozone on these four different sub-periods will be compared. From the first sub-period (1976-1984) to the second sub-period (1985-1996), most of the Asian economies other than India experienced decreased correlations with the United States, signaling the possibility of decoupling. During the third sub-period (1997-2007), most of the Asian countries display increased correlations with the United States, except China, India, Indonesia and the Philippines. This could serve as the evidence of decoupling for China and India from the United States. However, during the fourth sub-period (1999-2007), all of the Asian countries have increased correlations with the United States and the Eurozone, indicating recoupling for these Asian Economies to the United States and the Eurozone rather than the decoupling hypothesis.

< Insert Tables 4a-4d Here>

For robustness, the Hodrick-Prescott Filter de-trending technique is also used. Generally speaking, similar results are obtained. By comparing the results of Tables 3a-3d with the results of Tables 4a-4d, the major differences show up in the later sub-periods (the sub-period 1997-2007 and the sub-period 1999-2007). This could reflect the end-point issue of the Hodrick-Prescott filter detrending technique in which the calculation puts more weight on the observations in the end of the series. To be specific, one of the differences is that China only has 1 to 2 cases of intra-correlations above 0.50 with other countries, after the Asian crisis, far less than the case using the linear de-trending technique. Another different result by using Hodrick-Prescott

[23] ASEAN: The Association of Southeast Asian Nations, commonly abbreviated ASEAN is a geo-political and economic organization of 10 countries located in Southeast Asia, which was formed on 8 August 1967 by Indonesia, Malaysia, the Philippines, Singapore and Thailand. For here, ASEAN include Indonesia, Malaysia, the Philippines, Singapore and Thailand in the system.

de-trending technique is that more Asian countries' business cycles are correlated with the United States and the Eurozone with high correlations than the case using the linear de-trending technology. One more difference is that in Tables 4c to 4d, when excluding the data of 1997-1998 Asian Crises, the pairwise correlations increase generally, rather than decrease in the case of linear de-trending.

Based on the above analysis, it is not reliable to place a great deal of weight on using correlations over short periods to either support or reject the decoupling hypothesis. Besides being variable, short run correlations are generally not statistically significant. Theoretically, the increased globalization and economic interdependence will facilitate the growth of international trade flows and substantial increase of international capital mobility. However, the high variability in correlations over time suggests that the expected results have been muted by the variability in patterns of shocks.

5.2 Standard Approaches Analysis

The results of regressions with cyclical components generated by the linear de-trending technique are summarized in Tables 5a – 5c for the complete dataset, and in Tables 7a – 7c for the data excluding 1997 – 1998. Three types of regressions are used: they are pooling regression, panel regression with random effects and panel regression with fixed effects. Similarly, Tables 6a – 6c report the results generated from the Hodrick-Prescott (HP) filter de-trending technique and Tables 8a-8c report the results of HP de-trended data excluding 1997 – 1998.

From column 1 to column 6, either a trade intensity or intra-industry trade measure is applied as a regressor. From column 7 to column 12, both trade intensity and intra-industry trade intensity measures are used as regressors. Since the results for intra-industry trade in column 4 to column 6 are basically similar, the results of three-digit or four-digit classification intra-industry trade measure regressed with one of the trade intensity measure in the regression are reported from column 7 to column 12.

Generally speaking, the coefficients for intra-industry trade stay positive and significant at the 5% significance level in most cases. For the trade intensity measures, in most cases, the coefficients of trade intensity remain positive and significant at the 5% significance level, except for the case of panel regression with fixed effects. The coefficients for the control variables --- fiscal policy correlation measure, monetary policy correlation measure and exchange rate movement measure, on the whole, they have the expected signs. The fiscal policy correlation measure keeps a positive coefficient, consistently and it is significant on average at the 5% significance level in the pooling regressions and the panel regressions with random effects. At the same time, the coefficient for the exchange rate movement keeps a negative sign, as expected, consistently and it is significant at the 5% significance level, indicating that the exchange rate stability (less variability) makes an important contribution to the business cycle synchronization. The coefficient for the monetary policy measure is not stably positive, although in most cases, it is positive. However, negative coefficients for the monetary policy correlation measure appear, in some cases, but they are never statistically significant and the sizes of the negative coefficients are relatively small.

For the magnitudes of coefficients, only the exchange rate movement measure and the intra-industry trade measure calculated by using 4-digit SITC classification (IIT4) have coefficients which are greater than the coefficients for other variables. It means that, ceteris paribus, increased degrees of intra-industry trade and exchange rate stability take more weight in explaining business cycle synchronization across different countries than other independent variables in the model. And at the same time, business cycle synchronization, the dependent variable, is more sensitive to the change of the intra-industry trade index and to exchange rate stability than the change of other explanatory variables in the model. The size of the coefficient for the intra-industry trade index is usually 3 to 6 times of the size of other variables except for exchange rate movement, while the size of the coefficient for exchange rate movement is usually 5 to 10 times of the size of other variables except for the intra-industry trade index.

5.2.1 Linear De-trending Results with and without 9798 (Tables 5a-5c & 7a-7c)

<Insert Table 5a Here>

By using the linear de-trending technique for pooling regressions of the completed dataset, in Table 5a, the estimated coefficients for trade intensity are consistently positive and statistically significant at the 5% significance level, as expected. The coefficients for the intra-industry trade measure are also positive and statistically significant, indicating a significantly positive relationship between intra-industry trade and real GDP growth synchronization. The intra-industry trade measures have greater coefficients than that for trade intensity, about 4.5 times on average, indicating that intra-industry trade measure has greater weight in explaining the output correlations than trade intensity measure. Meanwhile, when intra-industry trade measures are included in the pooling regression equations, the sizes of the coefficients for the trade intensity measure and the constant term decrease. This phenomenon suggests that intra-industry trade measure can effectively capture part of the weights of the estimation from the constant term and the trade intensity measure.

The coefficients for the fiscal policy measure, monetary policy measure and exchange rate movement measure as control variables are of the expected signs, and they are statistically significant at the 5% significance level, except the coefficient for the monetary policy measure in Table 5a. Theoretically, the more correlated monetary policy and fiscal policy and the higher the level of exchange rate stability (less variability), the more business cycle synchronization will be promoted. Positive coefficients for the fiscal policy measure and the monetary policy measure and the negative coefficient for exchange rate movement measured by the standard deviation of nominal bilateral exchange rate scaled by the mean are consistent with the above theoretical meaning. The sizes of the coefficients for the fiscal policy measure are in the range between 0.132 and 0.165. The sizes of the coefficients for the monetary policy measure are about 0.07, smaller than that of the fiscal policy measure. The magnitudes of the coefficients for the exchange rate movement measure are usually above 1, except for the cases when the trade intensity measures and IIT4 are regressed together in the same equations, given that the coefficients for the different policy variables are comparable. However, from the perspective of the meaning of the control variables, fiscal policy measure and monetary policy measure are more comparable than each of them versus the exchange rate comovement measure, because the fiscal policy measure and monetary policy measure are calculated by using correlations of related ratios or growth rates, while the exchange rate movement measure is calculated with no correlations but only the ratio of standard deviation of nominal bilateral exchange rate with its mean.

<Insert Table 5b – 5c Here>

Table 5b and Table 5c report the results for panel regression with random effects and fixed effects, respectively. Notably, the results in Table 5a are basically the same as the results in Table 5b. Based on the Hausman Test, the panel regression with random effects is a better fit for my model and more appropriate for analyzing the time series patterns of trade. The results of this panel regression with random effects are consistent with that of the pooling regression. In the case of panel regression with fixed effect (See Table 5c), the trade intensity measures are not significant at the 10% significance level, regardless of including intra-industry trade (IIT) variable or not, although intra-industry measure still keeps significantly positive coefficient, all the time. Furthermore, the sizes of the coefficients for the intra-industry trade measure increase a lot, and especially when the 4-digit SITC intra-industry trade measure is applied, the size of the coefficients for intra-industry trade IIT4 is in the range between 1.045 and 1.053. Notably, once the intra-industry trade measure is included in the regression, the sizes of the coefficients for the constant term and the corresponding trade intensity measure decrease more than 0.1, on average, from the level in the case without including the intra-industry trade index. This phenomenon echoes the indication in Table 5a, that is, intra-industry trade measure can effectively capture part of the weights of the estimation from the constant term and the trade intensity measure.

Compared with Tables 5a - 5b, in Table 5c, the signs for monetary policy correlations, fiscal policy correlations and exchange rate movement measure are still consistent with those in Tables 5a – 5b, but the significance for each control variable changes a lot. To be specific, the coefficients for the monetary policy measure and the exchange rate movement measure become not significant at the 10% significance level, while the coefficient for the fiscal policy measure appears significant in some cases only when the intra-industry measure is included as a regressor. The size of the coefficient for the exchange rate movement measure declines to the range between 0.369 and 0.82, while the sizes of the coefficients for the other two policy measures do not change that much.

<Insert Table 7a – 7c Here>

Tables 7a - 7c report the results of the linear detrended data excluding 1997-1998. The coefficients for intra-industry trade measures remain positive and statistically significant at the 5% significance level. Similar to the results in Tables 5a - 5b, the results in Table 7a are basically the same as the results in Table 7b. Comparing the results in Tables 5a – 5b with the results in Tables 7a – 7b, we find that, after the data of 1997 - 1998 are excluded, the sizes of coefficients for the trade intensity measure and intra-industry trade measures decrease by 0.1, on average, when only one of them is included in the regression; meanwhile, the sizes of the coefficients for policy variable measures generally increase by 0.08, on average. However, when both the trade intensity measure and the intra-industry trade measure are included in the regression equation, the size of the coefficients for the trade intensity increases by 0.01, on average, while that of the intra-industry trade decreases by 0.1, on average. In the case of both the trade intensity measure and the intra-industry trade measure being included, the sizes of the coefficients for the monetary policy measure and the exchange rate movement measure increase, but the sizes of the coefficients for the fiscal policy measure decrease. A possible explanation for this phenomenon is that increased trade integration could facilitate the effects from monetary policy and exchange rate movements.

For the panel regression with fixed effects in Table 7c, in which unobservable country-specific components are eliminated, trade intensity measures become insignificant at the 10% significance level. One negative coefficient for the trade intensity appears in Column 7. The intra-industry trade measures are consistently significant at 1% significance level. The fiscal policy measure appears significant at the 10% significance level, in some cases only when the intra-industry trade measure is included, indicating that increased trade integration could promote the effects from the fiscal policy. The monetary policy measure becomes significant at the 10% significance level in most cases, but the coefficients for the exchange rate movement measure become not significant at 10% significance level except the first case presenting in Column 1. The constant term is significant only in the first three cases shown from Column 1 to Column 3.

Similar to the results of the comparison between Table 5a and Table 5c, compared with the results in Table 7a, the sizes of the coefficients for the trade intensity measure decrease, while that of the intra-industry trade measure increases in Table 7c. The size of the coefficient for the exchange rate movement measure declines to less than 1, while the sizes of the coefficients for the other two policy measures still remain less than 1. When only one of the trade intensity measure and the intra-industry trade measure is included, the size of the coefficient for the fiscal policy measure decreases but it increases when both the trade intensity measure and the intra-industry trade measure are included in the regressions. The size of the coefficient for monetary policy measure is increased for all cases and it becomes significant at the 10% significance level in most cases. In addition, the constant term is significant only in the cases of excluding the intra-industry trade measure in the regressions, presenting in the first three columns.

5.2.2 HP De-trending Results with and without 1997-1998 (Table 6a-6c & 8a-8c)

<Insert Table 6a – 6c Here>

Tables 6a – 6c report the results of the Hodrick-Prescott filter detrended data for the completed dataset, which could serve as a robustness check for Tables 5a – 5c. Similar to the results in Tables 5a – 5b, the results in Table 6a are the same as the results in Table 6b. In Tables 6a – 6b, the coefficients for trade intensity measures are positive and statistically significant at the 10% significance level, with the sizes in the range between 0.146 and 0.219. The coefficients for intra-industry trade measures are consistently positive and statistically significant at the 5% significance level on average, except for the cases in Columns 7 – 9 when IIT3 is regressed with trade intensity measures. The fiscal policy measure has consistently positive and statistically significant coefficients at the 1% significance level with the sizes in the range between 0.221 and 0.258. Negative coefficients for the monetary policy measure appear when the intra-industry trade measure is included except the case in Column 7, but they are not significant at the 10% significance level and the sizes for the monetary policy coefficients are very small, usually around 0.001. The coefficients for the exchange rate movement measure are consistently negative and statistically significant at 1% significance level. The magnitudes of the coefficients for the exchange rate movement measure are usually above 1, except the cases in Columns 10 – 12 when IIT4 and trade intensity measures are included together in the same regressions.

In Table 6c, by using panel regression with fixed effects, trade intensity measures lose significance and the sizes of the coefficients for trade intensity measures decrease by 0.09 on average, compared with the results in Tables 6a – 6b. Negative coefficients for trade intensity measures appear when intra-industry trade measures are included. The coefficients for the intra-industry trade measures are consistently positive and statistically significant at the 5% significance level and the sizes of the coefficients for the intra-industry trade measures increase by 0.35 on average, compared with the results in Tables 6a – 6b. The fiscal policy measure loses significance at the 10% significance level and the sizes of the coefficients for the fiscal policy measure decrease by 0.1 on average, compared with the results in Tables 6a – 6b. Negative coefficients for the monetary policy measure appear when intra-industry trade measures are included in the same regression equations except the case in Column 8. The coefficients for the exchange rate movement measure become insignificant at the 10% significance level and the sizes of the coefficients for the exchange rate movement measure decrease by 0.85 on average.

<Insert Table 8a – 8c Here>

Tables 8a - 8c report the results of the Hodrick-Prescott filter de-trended data excluding 1997-1998, which could serve as a robustness check for Tables 7a-7c (linear de-trended data excluding 1997-1998). Similar to the results in Tables 7a – 7b, the results in Table 8a are the same as the results in Table 8b. In Tables 8a - 8b, the coefficients for the trade intensity measures are consistently positive and statistically significant at the 1% significance level, with the sizes in the range around 0.210. The coefficients for intra-industry trade are consistently positive and statistically significant at the 5% significance level, with the sizes in the range between 0.152 and 0.779. The coefficients for the fiscal policy measure are consistently positive and statistically significant at the 10% significance level, with the sizes around 0.190. The coefficients for the monetary policy measure are not significant at the 10% significance level and negative coefficients appear when intra-industry trade measures are included. The sizes of the coefficients for the monetary policy measure are around 0.012. The coefficients for the exchange rate movement measure are consistently negative and statistically significant at the 1% significance level.

In Table 8c, by using panel regression with fixed effects, trade intensity measures lose significance and the sizes of the coefficients for trade intensity measures decrease by 0.09 on average, compared with the results in Tables 8a – 8b. Negative coefficients for trade intensity measures appear when intra-industry trade measures are included. The coefficients for the intra-industry trade measures are consistently positive and statistically significant at the 1% significance level and the sizes of the coefficients for the intra-industry trade measures increase by 0.35 on average, compared with the results in Tables 8a – 8b. The fiscal policy measure loses significance at the 10% significance level and the sizes of the coefficients for the fiscal policy measure decrease to 0.07 on average, compared with the results in Tables 8a – 8b. Negative coefficients for the monetary policy measure appear when intra-industry trade measures are included in the same regression equations. The coefficients for the exchange rate movement measure are consistently negative but only significant at the 10% significance level when the intra-industry trade measures are not included. The sizes of the coefficients for the exchange rate movement measure decrease to less than 1. In addition, the constant terms are consistently positive but only significant at the 10% significance level when the intra-industry trade measures are excluded in the regression equations.

Similarly, in Table 6c and Table 7c, negative coefficients for trade intensity also show up in some cases. As mentioned by Shin and Wang (2003), trade intensity can be used as a proxy of demand spillovers, since demand spillovers increases as trade intensity increases. If increased trade is generated mainly through inter-industry trade and if this channel dominates the other channels, the coefficient for trade intensity should be negative. Thus, the negative coefficients of trade intensity in Table 6c, Table 7c and Table 8c indicate that increased trade is mainly generated through the channel of inter-industry trade and this channel dominates the other channels.

5.2.3 Comparison with Shin and Wang's Work (2003)

Comparing my results with that of Shin and Wang's work (2003), the major conclusion that the intra-industry trade channel plays a very important role in explaining the business cycle synchronization is strongly confirmed, although some different conclusions are also found. The following two paragraphs will summarize the main points for the consistent parts and different parts.

For the consistent parts, there are three main points. First of all, the intra-industry trade does serve as the major channel through which business cycles become synchronized, although increased trade measured by trade intensity itself does not necessarily lead to the business cycle synchronization. Secondly, the coefficients of intra-industry trade are statistically more significant than those of trade intensity and the sizes of the coefficients for intra-industry trade are usually 3 to 4 times of that of the coefficients for trade intensity, which indicates that the business cycle comovements are influenced more by intra-industry trade than the total volume of trade. Thirdly, by using panel regression with fixed effects, the trade intensity measures become insignificant.

Compared with Shin and Wang's framework, my estimation framework adds in exchange rate movements as control, based on the Mundell - Fleming model and the coefficient for exchange rate movement is significant with expected negative sign. According to statistical indices, the overall fitness of my model measured by R^2 and adjusted- R^2 which are around 0.15 for R^2 and around 0.14 for adjusted- R^2 is better than that of Shin and Wang with R^2 around 0.12 and the adjusted-R^2 around 0.11 by approximation.

Furthermore, I add the data of the US and Euro Area to my sample. The number of observations in my sample is in the range between 193 and 198, while the number of observations in Shin and Wang's estimation framework is 163. The world factor can be controlled in my model, but in Shin and Wang's sample, only Asian countries are included which may generate biased results without controlling the common factor from the world factor.

In addition, with respect to break points for each time period, I choose big events as major break points, such as 1985 for globalization (since most of the trade integration and financial integration occurs in the mid-1980s, as mentioned in Kose et al. (2008)) and 1997 for the Asian Crisis, while Shin and Wang choose break points mainly based on the equalization of the number of the years in each period and data after 1997 have been excluded.

One more difference between my estimation framework and Shin & Wang's framework is the use of the de-trended ratio of general government final consumption expenditure over GDP. Shin & Wang use non-de-trended ratio of government budget deficit over GDP. It is better to use de-trended ratio because de-trending is a method to distinguish exogenous and endogenous elements.

For the differences regarding to the estimation results, there are five points, in general. First of all, the magnitude of the coefficients for trade intensity measures in Shin and Wang's work are much larger than that of my estimation results. This may be because they used nominal exports and imports value during some periods including seven or eight years for the calculation of trade intensity measure, while I used annual data to calculate trade intensity measure for each year and then took unweighted simple averages to calculate trade intensity for the certain period.

Secondly, for the panel regression, fixed effects fit Shin and Wang's estimation model better than random effects, while random effects fit my estimation model better than fixed effects, due to different characteristics of the datasets. Shin and Wang's dataset mainly focused on East Asian economies, without including the data from the US and the Eurozone. My dataset for the estimation model include the data from the US and the Eurozone and random effects can work better than fixed effects based on the result of Hausman Test.

The third difference is that in Shin and Wang's estimation model, when both trade intensity and intra-industry trade measure are included as regressors, the significance and the sizes of the coefficients for intra-industry trade declines. However, in my estimation model, the coefficients for intra-industry trade keep positive and statistically significant, in almost all cases.

Fourthly, the coefficients for the two policy proxies stay positive in Shin and Wang's model. But in my estimation model, only the coefficient for the fiscal policy proxy stays positive all the time, while the coefficients for the monetary policy measure are positive in most cases but not as stable as that of the fiscal policy measure.

Last but not least, the way of checking robustness in Shin and Wang's work is quite different from what I did for my estimation model. Considering that Japan is the only industrialized economy in Asian countries and it is also the most heavily involved country in trade integration in Asian region, Shin and Wang excluded Japan from the sample to check robustness of their results and the same regression results are reached. Similarly, Shin and Wang further excluded Hong Kong and Singapore from the sample and the results lead to generally the same conclusion.

5.2.4 Robustness Checks and Summary for Standard Approach

Various robustness checks have been performed by excluding the exchange rate movement measure or using different combinations for any two of the three policy correlation proxies as control variables or any one of the three policy correlation proxies as a control. In addition, as mentioned before, Hodrick-Prescott filter de-trending results could serve as one type of robustness checks for linear de-trending results.

To summarize, the results of robustness checks lead to the same major conclusion.

That is, the coefficients for intra-industry trade are consistently positive and statistically significant at the 5% significance level, in almost all cases, indicating that intra-industry trade has positive and significant weight in explaining business cycle synchronization. In most cases, the coefficients of trade intensity remain positive and significant at the 5% significance level, except for the case of panel regression with fixed effects. Furthermore, the coefficients for intra-industry trade are generally greater and more statistically significant at 5% significance level than those for trade intensity. In this sense, it can be concluded that comovements of business cycles are influenced more through the intra-industry trade channel than the total volume of the trade itself.

The control variables --- fiscal policy correlation measure, monetary policy correlation measure and exchange rate movement measure, on the whole, have expected signs. The fiscal policy correlation measure keeps a positive coefficient, consistently and it is significant on average at the 5% significance level in the pooling regressions and the panel regressions with random effects. At the same time, the coefficient for the exchange rate movement keeps a negative sign, as expected, consistently and it is significant at the 5% significance level, indicating that exchange rate stability (less variability) makes important contribution to the business cycle synchronization. The coefficient for the monetary policy measure is not stably positive, although in most cases, it is positive. While negative coefficients for the monetary policy correlation measure appear in some cases, they are never statistically significant and the sizes of the negative coefficients are relatively small.

For the magnitudes of coefficients, only exchange rate movement measure and Intra-industry trade measure calculated by using 4-digit SITC classification (IIT4) have coefficients which are 3 to 4 times greater than the coefficients for other variables, indicating that business synchronization is more sensitive to the changes from intra-industry trade measure and exchange rate movement measure. On the other hand, intra-industry trade measure and exchange rate measure take more weight in explaining the business cycle synchronization. Comparing the magnitudes of the coefficients for the trade intensity measures and that of the intra-industry trade measures, we find that the intra-industry trade measures are often greater and more statistically significant at the 5% significance level than the trade intensity measures. For the comparison of the coefficients for the three policy correlation measures, the rank for the sizes and the significance level of the three coefficients is the exchange rate movement measure > the fiscal policy correlation measure > the monetary policy correlation measure.

Chapter 6 the Calculation of Trade Intensity and Intra-Industry Trade

6.1 Trade Intensity Measures

Table 6-1 reports the average measures of trade intensity and intra-industry trade for each country. At first, bilateral trade intensity and bilateral intra-industry trade of one country with each of the other trading partners are calculated, and then the simple arithmetic mean and the weighted average are used respectively, as the average measures for this country. The weights for three different trade intensity measures are the corresponding shares of bilateral trade of the host country to the other trading partners in the model, measured by exports, imports and both, respectively. The weights for the intra-industry trade measure are determined by using trade intensity measure WT.

In Table 6-1, from Column 1 to Column 6, the simple average and the weighted average of trade intensity measures for each country are calculated. Three different proxies for trade intensity measures are used WX_t, WM_t and WT_t. The first and the second measures follow Shin and Wang (2003) and the third measure follows Frankel and Rose (1998) as well as Shin and Wang (2003). They are using exports, imports and both as base, respectively.

$$WX_t\,(i, j) = x_{ijt} / (X_{it} + X_{jt}) \qquad \text{(eqn. 6-1)}$$

$$WM_t\,(i, j) = m_{ijt} / (M_{it} + M_{jt}) \qquad \text{(eqn. 6-2)}$$

$$WT_t\,(i, j) = x_{ijt} + m_{ijt} / (X_{it} + X_{jt} + M_{it} + M_{jt}) \qquad \text{(eqn. 6-3)}$$

where x_{ijt} denotes bilateral nominal gross exports from country i to country j during period t. m_{ijt} denotes bilateral nominal gross imports from country j to country i during period t. X_{it} and M_{it} denote total gross exports and imports to the world for country i during period t, similar to X_{jt} and M_{jt}. As the value of any of these indices increases, the trade intensity between country i and country j will become greater. After monotonic transformation to the forms in equations (eqn. 4-12), (eqn. 4-13) and (eqn. 4-14), a larger value for each measure also indicates higher trade intensity between country i and country j.

Strictly speaking, it is more proper to call the above three measures "trade concentration" measures than "trade intensity" measures. But, in order to keep consistency with previous studies, "trade intensity" is still used in the dissertation. To identify these three different measures, the first one could be called export intensity, the second one import intensity and the third one trade intensity.

Comparing the three different trade intensity measures WX_t, WM_t and WT_t, they are moving differently in their changing patterns. Based on economic theory, the third measure WT_t which includes both exports and imports makes the most sense, because it can capture the dynamics of exports and imports reflecting both sides of trade, the actual "trade intensity". The first and the second trade intensity measures WX_t and WM_t only focus on one side of trade activity and may generate biased results in terms of describing the dynamics of actual trade intensity.

To further explore various changing patterns of the three different trade intensity measures for each country, I chose China (the largest Asian economy), US (industrial economy), Japan (industrialized Asian economy) and Thailand (one of the ASEAN countries) to analyze more closely. The results are reported in Table 6.1.1 (in Appendix), Table 6.1.2 (in Appendix), Table 6.1.3 (in Appendix) and Table 6.1.4 (in

Appendix) for each country.

The simple average and the weighted average of the trade intensity measures are generally low for all countries in the model, indicating that on average the bilateral trade intensity for each country with other trading partners in the sample is small, although the mean of Asian regional trade over world trade ratio is high for each country in three sub-periods (please see Table 6-2, column 4). However, there is a range for each country's bilateral trade intensity measure. For example, China's simple average of export intensity (WX_t) in Period 1 (1976 - 1984) is 0.0196, with the range between 0.0011 for China-Indonesia and 0.1214 for China-Hong Kong. In Period 2 (1985-1996), China's simple average of export intensity (WX_t) is 0.0236, with the range between 0.0026 for China-India and 0.1462 for China-Hong Kong. In Period 3 (1997-2007), China's simple average of export intensity (WX_t) is 0.0320, with the range between 0.0060 for China-the Philippines and 0.1113 for China-Hong Kong. Similarly, ranges exist for the other two trade intensity measures WM_t and WT_t. I highlight the maximum and minimum in different sub-periods by using different trade intensity measures for the four selected countries.

On the whole, trade intensity whether based on exports, imports or total trade, has experienced continuous increases for the samples from Period 1 to Period 3, which implies that Asian countries, the US and Euro Area are all becoming more important trading partners with each other, as time passes. However, it is possible that the bilateral trade has deepened for all country pairs in absolute terms, but not for relative terms by doing the ratio of GDP (X/GDP, M/GDP and T/GDP). Therefore, one of the further research directions for trade intensity analysis is to replace absolute terms with relative terms.

Based on my calculations, in Table 6.1.1, China has the highest export intensity ratio (WX_t) with Hong Kong for the three sub-periods, the highest import intensity ratio (WM_t) and trade intensity ratio (WT_t) with Hong Kong in Period 1 and Period 2, with Japan in Period 3, and the lowest ratio with Indonesia for WX_t in Period 1, with India for WX_t in Period 2, for WM_t in Period 1 and Period 3, and for WT_t in Period 1 and Period 2, with the Philippines for WX_t and WT_t in Period 3, and with Thailand for WM_t in Period 2.

The US (in Table 6.1.2) has the highest ratio with Japan for WX_t and WT_t in three sub-periods, for WM_t in Period 2, with Korea for WM_t in Period 1 and with Euro Area for WM_t in Period 3, and the lowest ratio with Thailand for three trade intensity measures in Period 1, with India for three trade intensity measures in Period 2 and with Indonesia for three trade intensity measures in Period 3.

Japan (in Table 6.1.3) has the highest ratio with the US for WX_t in three sub-periods and for WT_t in Period 1 and Period 2, with China for WM_t in three sub-periods and for WT_t in Period 3, and the lowest ratio with India for WX_t in three sub-periods, for WM_t in Period 2 and for WT_t in Period 3, with Taiwan for WM_t in Period 1, with Euro Area for WM_t for Period 3 and with Hong Kong for WT_t in Period 1 and Period 2.

Thailand (in Table 6.1.4) has the highest ratio with Singapore for WX_t and WT_t in three sub-periods, with Taiwan for WM_t in Period 1, with Japan for WM_t in Period 2 and with China for WM_t in Period 3, and the lowest ratio with India for WX_t in Period 2 and Period 3, for WM_t in three sub-periods and for WT_t in Period 2, with the Philippines for WX_t and WT_t in Period 1 and with Euro Area for WT_t in Period 3.

In general, the average of trade intensity (WT_t) is usually in the range between the averages of export intensity (WX_t) and import intensity (WM_t), regardless of the simple average or the weighted average.

The changing patterns of WX_t, WM_t and WT_t vary for different countries. For example, in Table 6.1.1, China has higher export intensity (WX_t) than import intensity (WM_t) and trade intensity (WT_t) is in the middle, indicating that China export more than import with each of the other trading partners in the model, when Japan, the United States and Euro Area are included, regardless of the simple average or the weighted average. In Table 6.1.1 (2), when emerging Asia region is focused on, China still has higher export intensity (WX_t) than import intensity (WM_t) with the other 10 emerging Asian economies and trade intensity (WT_t) is still in the middle for the three periods. But for China's trade intensity with ASEAN, in the third period (1997-2007), China's import intensity (WM_t) becomes higher than export intensity (WX_t) and trade intensity (WT_t) is in the middle, echoing China's role in assembly, although China's export intensity is higher than import intensity in the first and the second periods. In addition, based on Table 6.1.1, the accumulated increase of China's import intensity (WM_t) from Period 1 to Period 3 is 0.018, based on simple average, higher than that of China's export intensity (WX_t) 0.012 and that of China's trade intensity (WT_t) 0.015. In terms of business cycle transmission through trade intensity, for China, trade intensity measured by import intensity (WM_t) tends to generate higher increase in business cycle synchronization than trade intensity measured by WX_t and WT_t.

In the case of Japan (in Table 6.1.3), the average of export intensity (WX_t) is higher than the average of import intensity (WM_t) and the average of trade intensity (WT_t). Similar to China, based on simple average, the accumulated increase of Japan's import intensity (WM_t) is 0.006, higher than that of Japan's export intensity (WX_t) 0.004 and that of Japan's trade intensity (WT_t) 0.002, but the magnitude of each trade intensity measure is small relative to China. In terms of business cycle transmission through trade intensity, for Japan, trade intensity measured by import intensity (WM_t) tends to generate higher increase in business cycle synchronization than trade intensity measured by WX_t and WT_t.

In the case of the US (in Table 6.1.2), the average of export intensity (WX_t) is also higher than the average of import intensity (WM_t) and the average of trade intensity (WT_t). The average of trade intensity (WT_t) is also in the middle, regardless of simple average or the weighted average. The accumulated increase of US's export intensity (WX_t) from Period 1 to Period 3 is 0.013, based on the simple average results, higher than that of US's import intensity (WM_t) 0.007 and that of US's trade intensity (WT_t) 0.003, indicating that, for the US, trade intensity measured by export intensity (WX_t) tends to generate higher increase in business cycle synchronization than trade intensity measured by WM_t and WT_t, different from the case of China and Japan.

In the case of Thailand (in Table 6.1.4), the average of import intensity (WM_t) is greater than the average of export intensity (WX_t) and the average of trade intensity (WT_t). The average of trade intensity (WT_t) is still in the middle, regardless of simple average or the weighted average. The accumulated increase of Thailand's trade intensity (WT_t) from Period 1 to Period 3 is 0.007, based on simple average results, higher than that of Thailand's export intensity (WX_t) 0.005 and that of Thailand's import intensity (WM_t) 0.006, indicating that, for Thailand, trade intensity (WT_t) tends to generate higher increase in business cycle transmission than trade intensity measured by WX_t and WM_t.

6.2 Intra-Industry Trade Measure

In Table 6-1, Column 7 and Column 8 are the simple average and the weighted average of the intra-industry trade measure (IIT3) for each country against the other trading partners in the model. Since the changing patterns for 2-digit level, 3-digit level and 4-digit level industry classifications are generally the same, 3-digit level measure IIT3 is reported as the representative for IIT. On the whole, for the intra-industry trade measure, the changing pattern is also a continuous increase, regardless of IIT2, IIT3 or IIT4.

For the components of IIT --- horizontal IIT (HIIT) and vertical IIT (VIIT), Grubel and Lloyd (1975) is mainly about horizontal IIT (HIIT), because at that time (1960s to 1970s), most of the intra-industry trade occurred in advanced countries. Finished products with similar quality go back and forth between two countries in which technologies and tastes are very similar. The difference among varieties is minor. Linder (1961) and Lancaster (1975, 1979) modeled IIT among emerging economies and advanced economies, by considering different quality levels of products. In their models, end products in the same industry go in both directions between emerging countries and advanced countries. For example, China exports simple cars to the United States and imports fancy cars from the United States, while the United States exports fancy cars to China and imports simple cars from China. However, in 1990s, a new form of vertical IIT (VIIT) has emerged, that is, components and input products appear in production networks. In the modern vertical IIT model, it is US – Mexico type trade in which the components of cars are exported to Mexico from the United States for assembly and then finished cars will be exported back to the United States from Mexico. It is the relationship between upstream and downstream production, starting from the bottom of the products to the top of the products. A direction for further research is to get the share rates for the new model of vertical IIT to discuss the business cycle transmission and the relative importance of different components in Intra-industry trade.

Table 6-1 Averages of Trade Intensity Variables and IIT3 on Different Periods

Column		1	2	3	4	5	6	7	8
		WX (simpl aver)	WX (weig aver)	WM (simpl aver)	WM (weig aver)	WT (simpl aver)	WT (weig aver)	IIT3 (simpl aver)	IIT3 (weig aver)
CHN	P1	0.020	0.016	0.010	0.003	0.014	0.007	0.122	0.171
	P2	0.024	0.023	0.019	0.009	0.022	0.014	0.338	0.344
	P3	0.032	0.024	0.028	0.014	0.029	0.014	0.474	0.596
	P1-P3	0.027	0.022	0.023	0.009	0.024	0.012	0.324	0.478
HKG	P1	0.021	0.040	0.017	0.033	0.019	0.036	0.295	0.261
	P2	0.025	0.063	0.026	0.066	0.025	0.062	0.424	0.532
	P3	0.020	0.042	0.023	0.048	0.021	0.043	0.467	0.581
	P1-P3	0.022	0.046	0.023	0.048	0.021	0.044	0.401	0.542
IDN	P1	0.003	0.001	0.005	0.002	0.004	0.002	0.076	0.030
	P2	0.004	0.002	0.004	0.002	0.004	0.002	0.219	0.188
	P3	0.007	0.005	0.008	0.006	0.007	0.005	0.354	0.248
	P1-P3	0.005	0.003	0.006	0.003	0.005	0.003	0.219	0.110
IND	P1	0.017	0.024	0.010	0.014	0.014	0.020	0.077	0.108
	P2	0.011	0.011	0.007	0.007	0.010	0.010	0.232	0.232
	P3	0.013	0.014	0.006	0.006	0.011	0.012	0.388	0.427
	P1-P3	0.013	0.014	0.007	0.007	0.011	0.012	0.236	0.260
JPN	P1	0.032	0.021	0.019	0.005	0.026	0.013	0.094	0.244
	P2	0.036	0.029	0.027	0.010	0.031	0.018	0.245	0.460
	P3	0.036	0.023	0.025	0.012	0.028	0.014	0.482	0.676
	P1-P3	0.035	0.024	0.023	0.010	0.028	0.015	0.266	0.545
KOR	P1	0.085	0.417	0.010	0.048	0.049	0.242	0.086	0.121
	P2	0.017	0.027	0.014	0.023	0.016	0.025	0.303	0.485
	P3	0.020	0.038	0.019	0.036	0.019	0.036	0.523	0.594
	P1-P3	0.028	0.062	0.015	0.034	0.022	0.048	0.299	0.358
MYS	P1	0.014	0.018	0.012	0.015	0.013	0.017	0.111	0.144
	P2	0.015	0.023	0.014	0.020	0.015	0.022	0.227	0.341
	P3	0.018	0.032	0.018	0.033	0.018	0.032	0.490	0.682
	P1-P3	0.017	0.027	0.016	0.025	0.016	0.025	0.271	0.334
PHL	P1	0.007	0.004	0.009	0.005	0.006	0.004	0.115	0.069
	P2	0.007	0.004	0.009	0.005	0.006	0.003	0.227	0.136
	P3	0.010	0.009	0.012	0.011	0.009	0.008	0.472	0.425
	P1-P3	0.008	0.006	0.010	0.007	0.007	0.005	0.264	0.185
SGP	P1	0.023	0.044	0.016	0.030	0.019	0.037	0.092	0.175
	P2	0.023	0.046	0.016	0.031	0.020	0.039	0.247	0.394
	P3	0.022	0.044	0.019	0.037	0.020	0.040	0.457	0.414
	P1-P3	0.023	0.046	0.017	0.035	0.020	0.040	0.268	0.336
THA	P1	0.008	0.002	0.010	0.002	0.007	0.001	0.113	0.179
	P2	0.012	0.003	0.013	0.003	0.010	0.002	0.239	0.279
	P3	0.013	0.003	0.016	0.004	0.014	0.003	0.502	0.703
	P1-P3	0.012	0.003	0.015	0.004	0.012	0.002	0.271	0.325

Table 6-1 Averages of Trade Intensity Variables and IIT3 on Different Periods (Continued)

Column		*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
		WX (simpl aver)	WX (weig aver)	WM (simpl aver)	WM (weig aver)	WT (simpl aver)	WT (weig aver)	IIT3 (simpl aver)	IIT3 (weig aver)
TWN	P1	0.078	0.359	0.010	0.046	0.046	0.212	0.102	0.169
	P2	0.266	0.532	0.014	0.029	0.020	0.039	0.261	0.422
	P3	0.017	0.034	0.017	0.034	0.020	0.041	0.499	0.698
	P1-P3	0.127	0.318	0.015	0.037	0.025	0.063	0.287	0.218
USA	P1	0.023	0.017	0.010	0.001	0.018	0.009	0.130	0.134
	P2	0.030	0.026	0.012	0.003	0.023	0.014	0.238	0.347
	P3	0.036	0.024	0.017	0.007	0.021	0.008	0.422	0.486
	P1-P3	0.032	0.024	0.017	0.008	0.021	0.010	0.261	0.348
EUA	P1	NA	NA	NA	NA	NA	NA	0.058	0.104
	P2	NA	NA	NA	NA	NA	NA	0.164	0.177
	P3	0.020	0.016	0.014	0.011	0.008	0.006	0.486	0.389
	P1-P3	0.020	0.016	0.014	0.011	0.008	0.006	0.232	0.186
Average for all	P1	0.028	0.082	0.011	0.022	0.020	0.053	0.113	0.216
	P2	0.060	0.118	0.015	0.027	0.017	0.032	0.259	0.338
	P3	0.020	0.040	0.017	0.033	0.017	0.035	0.463	0.348
	P1-P3	0.036	0.077	0.015	0.029	0.017	0.034	0.277	0.386
Develop-ed Asia	P1	0.028	0.082	0.011	0.022	0.020	0.053	0.113	0.216
	P2	0.020	0.040	0.015	0.027	0.017	0.032	0.259	0.338
	P3	0.060	0.118	0.017	0.033	0.017	0.035	0.463	0.348
	P1-P3	0.036	0.077	0.015	0.029	0.017	0.034	0.277	0.386
Develop-ing Asia	P1	0.033	0.102	0.012	0.029	0.022	0.036	0.112	0.262
	P2	0.018	0.122	0.016	0.033	0.017	0.037	0.243	0.347
	P3	0.049	0.039	0.017	0.035	0.018	0.077	0.428	0.406
	P1-P3	0.033	0.087	0.015	0.032	0.019	0.050	0.261	0.305
Average Asia	P1	0.012	0.014	0.009	0.009	0.010	0.012	0.098	0.095
	P2	0.012	0.018	0.010	0.014	0.011	0.016	0.254	0.201
	P3	0.016	0.030	0.014	0.026	0.014	0.027	0.422	0.499
	P1-P3	0.013	0.021	0.011	0.016	0.011	0.018	0.258	0.298

Notes:

1. "simpl aver" denotes simple average. "Weig aver" denotes weighted average.
2. P1 is from 1980-1984, P2 is from 1985-1996 and P3 from 1997-2008.
3. The weight for the weighted average is calculated by using the share of the bilateral trade of the host country to the other country in the model.
4. The difference between simple average and weighted average is large in some cases, but the major changing pattern from P1 to P3 generally keeps consistent.
5. Developed Asia includes Hong Kong, Japan, Singapore, Korea, Malaysia, Taiwan, Thailand; Developing Asia includes China, India, Indonesia, and the Philippines.

Table 6-2 Real GDP Growth, Trade Volume/GDP Ratio and Regional-World Trade Ratio on Different Periods

Column		1	2	3	4	5
		Real GDP growth (%)	Trade/GDP mean (%)	Trade/GDP growth (%)	R/W mean (%)	R/W growth (%)
CHN	P1	9.393	29.382	5.213	45.123	4.460
	P2	10.323	45.730	4.256	52.814	0.286
	P3	9.871	72.239	8.647	45.459	-1.899
	P1-P3	9.956	52.300	6.120	48.444	-0.054
HKG	P1	9.619	25.012	3.391	44.370	3.077
	P2	5.838	53.251	8.531	55.657	3.018
	P3	3.833	90.126	2.441	70.555	0.878
	P1-P3	6.140	58.959	4.962	59.875	2.109
IDN	P1	4.170	39.786	3.334	15.351	3.045
	P2	5.077	45.198	3.418	18.731	2.761
	P3	6.879	73.639	6.123	21.873	1.761
	P1-P3	5.485	54.064	4.356	19.448	2.373
IND	P1	6.774	50.767	-0.236	60.527	-2.223
	P2	6.436	56.241	2.332	56.843	-0.430
	P3	3.232	58.430	6.639	58.830	1.682
	P1-P3	5.363	55.544	2.960	58.300	0.219
JPN	P1	4.359	55.034	0.860	24.810	0.685
	P2	3.424	61.687	2.077	31.694	3.896
	P3	0.988	91.975	3.639	41.649	0.789
	P1-P3	2.793	70.886	2.359	34.626	2.106
KOR	P1	7.502	34.191	4.402	31.453	-0.229
	P2	8.431	47.248	4.443	37.780	2.058
	P3	4.368	87.787	5.064	45.190	0.975
	P1-P3	6.700	58.429	4.666	53.786	1.267
MLS	P1	7.740	36.089	1.472	56.098	3.113
	P2	7.566	73.262	8.123	57.030	-0.025
	P3	4.651	90.410	0.694	58.211	0.280
	P1-P3	6.553	69.359	3.770	57.358	0.554
PHL	P1	3.551	31.208	1.938	37.690	0.290
	P2	2.767	36.544	6.635	43.724	1.961
	P3	5.413	94.228	8.988	56.137	1.857
	P1-P3	3.943	52.249	6.069	47.820	1.678
SGP	P1	8.422	51.067	-0.845	44.361	1.924
	P2	7.669	67.850	4.712	49.954	1.280
	P3	5.470	88.435	2.438	56.267	0.772
	P1-P3	7.075	70.758	2.470	51.602	1.154
THA	P1	6.934	59.678	1.006	42.757	2.414
	P2	8.780	76.908	1.434	47.009	0.803
	P3	2.952	94.299	3.580	50.606	0.479
	P1-P3	6.157	78.533	2.132	47.764	0.894

Table 6-2 Real GDP Growth, Trade Volume/GDP Ratio and Regional-World Trade Ratio on Different Periods (Continued)

Column		1	2	3	4	5
		Real GDP growth	Trade/GDP mean	Trade/GDP growth	R/W mean	R/W growth
		(%)	(%)	(%)	(%)	(%)
TWN	P1	9.166	47.841	-2.390	29.013	-0.479
	P2	7.822	73.358	7.016	38.478	3.938
	P3	4.125	84.570	2.451	53.162	1.609
	P1-P3	6.844	70.476	2.953	42.922	2.309
USA	P1	3.410	52.423	0.776	26.783	6.590
	P2	3.059	64.239	3.115	34.086	1.102
	P3	2.867	94.479	2.580	31.298	-1.240
	P1-P3	3.085	72.013	2.330	31.673	0.882
EUA	P1	NA	NA	NA	4.763	3.657
	P2	1.338	NA	NA	7.335	4.644
	P3	2.126	97.120	6.120	8.354	0.151
	P1-P3	2.066	97.120	6.120	7.313	2.577
Average	P1	6.753	42.706	1.577	35.623	2.025
	P2	6.041	58.460	4.674	40.857	1.946
	P3	4.367	85.980	4.569	45.969	0.623
	P1-P3	5.551	66.207	3.944	43.149	1.390

Notes:

1. P1 is from 1976-1984, P2 is from 1985-1996 and P3 is from 1997-2008. Since bilateral trade data from IFS are available from 1980, P1 for Trade/GDP and R/W is from 1980-1984.

2. Trade/GDP ratio is calculated by using the trade volume divided by GDP volume.

3. For one of the Asian countries in the model, Regional Trade value is the sum of this Asian country's bilateral trade value to other 10 Asian countries.

For USA or EUA, Regional Trade value is the sum of its bilateral trade value to 11 Asian countries. World Trade value is the sum of the host country's bilateral trade value with other countries in the world.

Chapter 7 Results for Dynamic Factor Analysis

7.1 Interpretation for the results of the dynamic factor model

Tables 9a - 9d report the results of variance decompositions by using dynamic factor models for real GDP growth, domestic consumption growth, domestic investment growth, gross exports and gross imports. Table 9a-9b present the results for sub-period 1976-1984 and Table 9c-9d for sub-period 1985-2006. The results for the Euro Area are calculated by simple average of the results from 8 representative countries joined in January, 1999. They are Austria, Finland, France, Germany, Ireland, Italy, Netherland and Spain.

To discuss in more detail what happens to the Asian regional factor when the world factor is left out, Tables 9e-9h present the corresponding results of variance decompositions for Tables 9a-9d, after suppressing the world factor in the Gauss program.

<Insert Table 9a-9d Here>

Figures 2a, 3a, 4a, 5a and 6a show the results of variance decomposition for output, domestic consumption, domestic investment, gross exports and gross imports explained by the world factor, regional factors and country factors, respectively for each country in the dataset. Correspondingly, Figures 2b, 3b, 4b, 5b and 6b report the results of variance decomposition for the growth rates of output measured by GDP, domestic consumption, domestic investment, gross exports and gross imports, when the world factor is suppressed. The results of excluding the world factor will be discussed in the section of robustness checks and summary.

<Insert Figure 2a Here>

For the output variance decomposition, in Figure 2a, the world factor plays an important role in explaining output variance, especially for industrialized economies and developed Asian economies, such as the United States, Hong Kong, Singapore, Thailand, Taiwan and Japan, compared with other Asian emerging market economies, although the explanatory power of the world factor declines to various degrees from the pre-1985 period to post-1985 period, except for South Korea, Malaysia and the Philippines. Surprisingly, the regional factor of North America accounts for 13.13% in explaining the output fluctuations of the United States. The possible explanation for this phenomenon could be the increasing trade integration between the United States and Canada, mainly through intra-industry trade. Compared with other countries in the dataset, the explanatory power of regional factors to output variance in Indonesia, Japan, the Philippines, Taiwan, Singapore and the United States increases with different magnitudes for each country in the sample: from 1.97% to 3.03% for Indonesia, from 1.82% to 3.17% for Japan, from 2.30% to 3.05% for the Philippines, from 0.67% to 1.48% for Taiwan, from 0.93% to 1.86% for Singapore and from 13.13% to 15.69% for the United States. However, the regional effects remain quite small for all Asian countries. Country factors contribute to a large portion in explaining output variance in Asian emerging market economies in pre-globalization period, especially for China, Hong Kong, Indonesia and Malaysia which have their explanatory proportions of country factors above 40%. On the whole, the explanatory power of country factors for output variance increases for most of the countries in the sample in the second sub-period, except for Japan and the Euro Area.

<Insert Figure 3a Here>

For the domestic consumption variance decomposition for each country, in Figure 3a, the world factor also plays an increasingly important role in explaining domestic consumption variance for most of the economies in the system, except for Japan, Malaysia and Thailand. At the same time, the share of domestic consumption variance attributable to the world factor goes up on the whole in post-1985 globalization period, compared with that in pre-1985 globalization period. The substantial increases happen in the Philippines, the United States and Singapore, from 1.53% to 25.06% for the Philippines, from 2.30% to 19.35% for the United States and from 0.31% to 1.87% for Singapore. Compared with the world factor, regional factors play a relatively less important role in explaining domestic consumption fluctuations on average (Also see Figures 13a and 13b). The share of regional factors in explaining domestic consumption increases for China, Hong Kong, Malaysia, India, Singapore, Thailand, Taiwan and the United States from the first sub-period to the second sub-period, especially for China and Thailand, from 2.31% to 8.19% for China and from 1.29% to 8.12% for Thailand. Compared with the world factor, in general, the share of domestic consumption variance attributable to country factors is larger than that of the world factor. The importance of the country factors attributable to consumption variance decreases in the second sub-period for China, Hong Kong, India, South Korea, Malaysia, Singapore, Thailand and the United States to different magnitudes, from 23.66% to 8.58% for China, from 33.72% to 19.34% for Hong Kong, from 8.45% to 7.07% for India, from 54.29% to 14.19% for South Korea, from 30.43% to 22.65% for Malaysia, from 57.94% to 25.17% for Singapore, from 18.19% to 10.29% for Thailand and from 43.46% to 38.14% for the United States, while the importance of country factors increases for Indonesia, Japan, the Philippines and Taiwan. Japan got 60% fraction of variance in consumption attributable to country factors, which is the highest in the system.

<Insert Figure 4a Here>

For the domestic investment variance decomposition for individual countries, in Figure 4a, the share of investment variance attributable to the global factor declines in the post-1985 globalization period for most of the countries, except for China, Hong Kong, India and South Korea, for example, from 9.69% to 0.34% for Taiwan, from 3.79% to 0.76% for Japan, from 2.53% to 0.20% for Malaysia and from 13.05% to 0.80% for Singapore. However, the unweighted simple average variance of investment explained by the world factor does not change from the pre-1985 globalization period to the post-1985 globalization period (See Figure 9). On average, the share of investment variance attributable to regional factors decreases from 4% to 3.5% (See Figure 10a), and from 31% to 18% (Figure 11a) for country factors. This is consistent with the conclusion in the standard stochastic dynamic business cycle models that generally speaking, as trade and financial linkages become much stronger, lower investment correlations across countries will be induced. Since reduced restrictions on capital and current account transactions should lead to more "resource shift" through which capital and other resources could rapidly move to different countries with more favorable technology shocks (Kose et al., 2008).

<Insert Figure 5a and 6a Here>

For the variance decomposition of gross exports and gross imports at the country level, the share of gross exports variance attributable to the world factor declines in most countries, except for Indonesia, South Korea, the Philippines, Singapore and Taiwan, for example, from 7.69% to 0.29% for China, from 10.94% to 1.60% for the United States and from 17.19% to 1.71% for the Euro Area. The explanation for the decreases in the United States and the Euro Area from the pre-1985 globalization period to post-1985 globalization period could be related to increased regional integration in the North America and the Euro Area, respectively. The world factor takes a larger proportion in explaining the gross export variance in Hong Kong, Japan, South Korea and Malaysia than other countries in the system, on average, 25% in pre-1985 globalization period and 15% in post-1985 globalization period. Regional factors become less important in explaining the gross exports fluctuations for most of the countries, except for Hong Kong, Singapore and Taiwan. On the whole, in Figure 15a, the importance of regional factors in explaining the gross exports is decreasing for the United States, the Eurozone, Developed Asian economies (including Hong Kong, Japan, Korea, Malaysia, Singapore, Thailand and Taiwan) and Developing Asian economies (including China, India, Indonesia and the Philippines).The decreased share of gross exports attributable to regional factors is relatively larger in the United States and Developing Asian group than that in the Eurozone and Developed Asia, indicating that the process of trade and financial integration weakens the role of regional factors in explaining the gross exports fluctuations. In addition, the country factors become more important in post-1985 globalization period for the United State and 11 Asian economies in the system.

The explanatory power of the world factor for gross imports decreases for most of the countries, for instance, from 10.39% to 0.47% for China, from 4.59% to 0.30% for Hong Kong and from 9.43% to 0.23% for Indonesia, while the share of gross imports variance attributable to the world factor increases for India, Malaysia, Japan, Thailand and the United States to different magnitudes, from 0.97% to 1.11% for India, from 0.52% to 4.59% for Japan, from 0.31% to 1.51% for Malaysia, from 1.02% to 1.85 for the United States. On the whole, the explanatory power of the world factor for gross imports is increasing in the United States, decreasing in the Euro Area and developing Asia, and almost constant in developed Asia from the pre-1985 globalization period to the post-1985 globalization period. In general, the regional factors become less important in explaining the variance of gross imports in different regions (See Figure 16a). For the individual countries, the shares of the regional factors attributable to gross imports decrease in post-1985 globalization period, for most of the countries, for example, from 3.73% to 0.59% for Hong Kong, from 12.52% to 1.15% for India and from 14.72% to 0.78% for Japan. In addition, country factors become more important in explaining gross imports fluctuations for most of the countries except for India, Malaysia and Thailand, in the post-1985 globalization period. From the perspective of the different regions, the explanatory power of country factors increase for the United States, the Euro Area, developed Asia and developing Asia (Figure 17a).

7.2 Comparison with the Work of Kose et al. (2008)

Comparing the above results with the ones of Kose et al. (2008), the major findings can be confirmed in my summary for dynamic factor analysis. That is, contrary to the convergence hypothesis, increasing globalization characterized by the rising trade and financial integration are not reflected in global convergence of business cycles, as evidenced by the decreasing importance of the global factor (the world factor in my estimation framework).

One difference between the work of Kose et al. (2008) and mine is that they chose a longer time horizon (1960-2005) with a larger sample size (106 countries) than mine. They classified the factors into the global factor, group-specific factors, country factors and idiosyncratic components, while I classified them into the world factor, regional factors, country factors and idiosyncratic components. The major difference between these two classifications is the position of Japan, for my estimation system. For the first type of classification, Japan is considered as an industrial economy and grouped with the United States and the Euro Area, but for the second classification, Japan is grouped with other Asian emerging economies. Therefore, the study of Kose et al. mainly focused on one version of the decoupling hypotheses, that is, emerging market economies could be decoupled from the United States, while mine focuses on the decoupling of Asia economies from the United States and the Eurozone.

Secondly, as to the dynamics of investment, for industrial countries and emerging market economies, the share of investment variance attributable to the global and group-specific factors goes up in Kose's results, rather than goes down during the post-globalization period, which contradicts to the expectation of Kose et al., since stronger trade and financial linkages in globalization period generally lead to lower investment correlations across countries, according to standard stochastic dynamic business cycle models. However, in my estimation model, the share of investment variance attributable to the world factor goes down for the United States and developed Asia, but goes up for the Euro Area and developing Asia, while the share of investment variance attributable to the regional factor goes down for the Euro Area, developed Asia and developing Asia, except for the United States.

Thirdly, at the individual country level, Kose et al. got increased explanatory power of the global factor in explaining output variance for some countries in the group of emerging market economies, such as China, Indonesia, and Japan. However, in my estimation framework, for China, Indonesia and Japan, the explanatory power of the world factor to output variance decreases a lot (Figure 2a-1).

7.3 Robustness Checks for Dynamic Factor Analysis

To check the robustness of my results, two different types of methods have been performed. The first one is to choose different break points, such as 1984, 1986, 1992 and 1997, instead of 1985, and then redo the whole process of the dynamic factor models to make comparison with the results of 1985 as break point, where 1985 is just a logic cutoff. For the comparison with the results of Kose et al., I chose 1985 as the break point as they did. Generally speaking, this does not substantially affect the major results and nearly identical results are reached, indicating that the results are neither sensitive nor crucially dependent on the exact year as the break point. In addition, I also separated the whole estimation period into three sub-periods (1961-1975, 1976-1990 and 1991-2007) to do a robustness check. The results of the three sub-periods separation are generally consistent with that of two sub-periods with 1985 as break point for globalization.

The second robustness check is to exclude the world factor by suppressing the world factor in the program and then compare the results with the former results of including world factor. After excluding the world factor, regional factors (Asian countries v.s. the US v.s. the Eurozone) are expected to capture the world factor to a large extent. However, for the output variance (Figure 2b-1 and 2a-2), the share of output variance attributable to regional factors does not increase, but decreases for most of the countries, except for the United States. For the United States, the explanatory power of the regional factor declines from 13.6% to 0.77% when the world factor is suppressed, but it increases from 13.13% to 15.69% when the world factor is included. India, Malaysia, Singapore and Taiwan also experienced the opposite changes after excluding the world factor. For domestic consumption variance (Figures 3b-1 and 3a-2), in general, the difference of the fraction of variance attributable to regional factors has been reduced a lot from pre-1985 globalization period to post-1985 globalization period, except for China and the United States. For China, the fraction of domestic consumption variance attributable to the regional factor increased from 0.52% to 12.54%, twice as much as that when the world factor is included. For the United States, the difference between the two sub-periods increased when the world factor is excluded in the system and the importance of the regional factor increases more than nearly twice when the world factor is not included, rather than decreases when the world factor is included. From the perspective of different regions (Figure 16a and 16b), when the world factor is included, regional factors become increasingly important in explaining the domestic investment variance in the United States, but less important in the Eurozone and Asia. However, after the world factor is suppressed, the explanatory power of regional factors increases for the United States, developed Asia and developing Asia, except for the Euro Area. As to the gross exports and imports, before the world factor is suppressed, the share of gross exports or gross imports attributable to regional factors decreases for all regions in my system, but increases when the world factor is excluded.

There exists a world factor to capture the dynamics for all time series in the dataset. To get relatively valid results without the world factor, the dataset restricted in some certain region may work. However, as mentioned by Kose et al., the importance of studying all of these factors together in one model is that these factors can avoid the problems caused by studying a subset of factors, which could lead to a mischaracterization of commonality. For example, regional factors estimated in a smaller model may simply reflect global factors that are misidentified as being specific to a particular group.

7.4 Summary for Dynamic Factor Analysis

To summarize the results for variance decompositions using dynamic factor models for 11 Asian economies, plus the United States and the Euro Area, there are three major findings for sub-period 1961-1984 (pre-globalization period) and sub-period 1985-2007 (post-globalization period).

First of all, a world factor of business cycle exists, since there is a significant common world component in the fluctuations for almost all of the countries in the sample system. According to the results of previous studies, a substantial fraction of economic fluctuations is explained by the world factor in developed economies, such as the United States and the Eurozone, while the country factors and idiosyncratic components account for more of the volatility in most of the developing economies, such as China and India. Based on my results, this world factor accounts for a modest but significant share of macroeconomic fluctuations in terms of first differenced logarithms of output growth, consumption growth, investment growth, export growth and import growth, although the world factor is more important in explaining business cycles in developed countries, such as the United States and Eurozone. But the explanatory power of world factor decreases from the first sub-period 1961-1984 to the second sub-period 1985-2006. At average level, as globalization and regional integration increases, the explanatory power of the world factor and regional factors is expected to increase in explaining macroeconomic aggregate fluctuations from the pre-globalization period to the post-globalization period. However, only domestic consumption confirmed this expectation. This is a puzzle since the correlations for these countries are high in recent years. To explore this puzzle requires further research. For other aggregates, country factors are still taking a relatively large portion in explaining aggregate fluctuations.

Second, given the world factor, regional factors for Asian countries and the Euro Area do not play an important role in explaining the macroeconomic aggregate volatility, except for the North America region. For the United States, the regional factor accounts for a substantial share of the variances from gross exports and gross imports. Furthermore, the explanatory power of regional factors decreases from pre-globalization period to post-globalization period. However, when the world factor is excluded, the share of macroeconomic variance attributable to regional factors becomes increasingly important, on the whole. The purpose of suppressing the world factor is to check the existence and the importance of the world factor by comparing the difference between the results with the world factor and the results without the world factor, on the one hand; on the other hand, the results of suppressing the world factor serve as the robustness check for the regional factor as well as the discussion whether regional factors could capture variances when the world factor is excluded. At the average level, regional factors and country factors play a more important role in explaining gross imports fluctuations than in explaining gross exports fluctuations. This result is as expected, since gross import is a function of domestic income, while gross export is a function of foreign country income.

Third, domestic consumption and domestic investment variances are mainly driven more by country and idiosyncratic factors (Figures 9, 10a and 11a). Particularly, the country dynamic factors play a more important role in explaining consumption fluctuations than the world and regional factors, which is consistent with imperfect risk sharing among countries. Output fluctuations are expected to be explained by increasing country factors in post-globalization period. Based on my results, on average, the fraction of output variance attributable to country factors increased. Considering the components of output Y = C + I + G + (X - M), the explanatory power of country factors to domestic investment decreases, while the explanatory power of country factors to gross exports and gross import increases and the explanatory power of country factors to domestic consumption generally keeps constant. The net effects of country factors on output variance depend on the relative magnitudes of the increase and decrease on the components of output.

It is natural that the world factor seems to be important and the world factor could reflect economic activities in the developed countries. In contrast, developing economies are more likely to experience country cycles.

Chapter 8 Conclusion and Policy Implications

This dissertation explores the decoupling hypothesis in East Asia by using standard correlation approaches and dynamic factor models to complement each other, considering that both methods have their own advantages and disadvantages. As trade integration deepens among Asian countries, business cycle synchronization among these countries is expected to increase through trade transmission. Based on previous estimation frameworks, I add in the data of the United States and the Eurozone to avoid bias from the world factor. The results for standard correlation approaches indicate that intra-industry trade serves as the major channel through which business cycles become synchronized among selected countries, although increased trade measured by trade intensity does not necessarily lead to more correlated business cycles. This result is consistent with the previous studies.

Based on the correlation analysis, there does exist some evidence for the convergence of ASEAN and ASEAN + 3 in intra-Asian and decoupling of Asian economies from the United Stated and the Eurozone. However, it is not reliable to place a great deal of weight on using correlations over short periods to either support or reject decoupling hypothesis, because the results of correlations have high variability, depending on the length of the period and the patterns of shocks. In addition, short run correlations are typically not statistically significant, either. Theoretically, the increased globalization and economic interdependence will facilitate the growth of international trade flows and substantial increase of international capital mobility. Moreover, the high variability in correlations over time suggests that the expected results have been muted by the variability in patterns of shocks, which may be decomposed into a global factor, group-specific factors or regional factors, country factors and idiosyncratic factors. But there also may be different patterns of shocks coming from each of these factors.

By using standard correlation approaches, the important role played by intra-industry trade has been strongly confirmed. That is, the coefficients for intra-industry trade are consistently positive and statistically significant at the 5% significance level, in almost all cases, indicating that intra-industry trade has a positive and significant weight in explaining business cycle synchronization. For the trade intensity measures, in most cases, the coefficients of trade intensity remain positive and significant at the 5% significance level, except for the case of panel regression with fixed effects. Furthermore, the coefficients for intra-industry trade are generally greater and more statistically significant at 5% significance level than those for trade intensity. In this sense, it can be concluded that comovements of business cycles are influenced more through the intra-industry trade channel than the total volume of the trade itself.

As to the coefficients for control variables --- the fiscal policy correlation measure, monetary policy correlation measure and exchange rate movement measure, on the whole, have the expected signs. The fiscal policy correlation measure keeps a positive coefficient, consistently and it is significant on average at the 5% significance level in the pooling regressions and the panel regressions with random effects. At the same time, the coefficient for the exchange rate movement keeps a negative sign, as expected, consistently and it is significant at the 5% significance level, indicating that the exchange rate stability (less variability) makes an important contribution to the business cycle synchronization. The coefficient for the monetary policy measure is not stably positive, although in most cases, it is positive. However, negative coefficients for the monetary policy correlation measure appear, in some cases, but they are never statistically significant and the sizes of the negative coefficients are relatively small.

For the magnitudes of coefficients, only the exchange rate movement measure and intra-industry trade measure calculated by using 4-digit SITC classification (IIT4) have coefficients which are 3 to 4 times greater than the coefficients for other variables, indicating that the business cycle synchronization is more sensitive to the change from intra-industry trade measure than from other variables, except exchange rate movement variables. Comparing the magnitudes of the coefficients for the trade intensity measures and that of the intra-industry trade measures, we can find that the intra-industry trade measures are usually greater and more statistically significant at the 5% significance level than the trade intensity measures. For the comparison of the coefficients for the three policy correlation measures, the rank for the sizes and the significance level of the three coefficients is the exchange rate movement measure > the fiscal policy correlation measure > the monetary policy correlation measure.

According to dynamic factor models for the evolution of global business cycle linkages, the world factor has become less important in explaining the macroeconomic fluctuations from sub-period 1961-1984 to sub-period 1985-2007. The regional factors do not play a more important role in explaining aggregate volatility during the latter sub-period than the former sub-period, except for the North America region, which is contrary to the popular view of increased regional macroeconomic interdependence in Asia. Domestic consumption variances are often attributable to country factors and regional factors and domestic investment variances are mainly driven more by country and idiosyncratic factors than by the world factor. The increasing explanatory power of regional factors for consumption echoes the common perception that is Asia has become much more integrated at the macroeconomic level in recent years, but this does not hold for other macroeconomic aggregates, such as domestic output, domestic investment, gross exports and gross imports. At the same time, regional factors and country factors also play a more important role in explaining gross imports fluctuations than in explaining gross exports. This result is as expected, since gross import is a function of domestic income, while gross export is a function of foreign country income. It is also found that the country factors and idiosyncratic factors account for a great portion of investment volatility.

As mentioned by Kose, et al (2005), from a policy perspective, understanding changes in the nature of world business cycles is of considerable interest in a number of respects. If Asian integration is more substantial than the globalization, regional factors should be focused on. However, if the influence from the United States is substantial in explaining the dynamics of business cycles, the world factor should be focused on more. The need for regional coordination and global coordination is derived from spillover effects associated with interdependence. The trade channel is an important source of these spillovers. Regional coordination refers to coordination between different countries which are not necessarily important at the global level but that have a high degree of structural interdependence with each other (Pilbeam, 2006). In the case of Asia region, regional interdependence in East Asia is deepening mainly through structural vertical intra-industry trade channel. World coordination involves countries from different regions of the world that have a significant impact on the global economy, such as the United States, China, Japan and Germany (Pilbeam, 2006).

In my model, three macroeconomic policy measures are applied --- fiscal policy correlations, monetary policy correlations and exchange rate movement. The fiscal policy variable is measured by the ratio of general government final expenditure over GDP, the monetary policy variable is measured by M_2 growth rate and exchange rate movements are measured by the standard deviation of the nominal bilateral exchange rate scaled by the mean during the period. Policy coordination is mainly measured by correlations of related policy variables, although there may be little or no policy coordination in the real world. Coordination at the level of mutually consistent policies means that authorities pursue mutually compatible target values and adjust the selection of policy instruments, their magnitude and timing to avoid conflict with other countries (Pilbeam, 2006). Coordination on exchange rate policy, at the level of joint action, means that not only an agreement on the appropriate exchange rate value, but also concerted action to achieve that rate (Pilbeam, 2006). For instance, some proposals for policy coordination combine fiscal and monetary policies with some form of exchange rate targeting to achieve external and internal balance simultaneously. However, in practice, when international policy coordination is hard to realize, domestic macroeconomic policies will be taken into account, given external shocks from the rest of the world. On the one hand, the coordination of own policies will help to reduce the effects from external shocks to achieve external balance; on the other hand, the coordination of own policies will promote more rapid growth without inflation to achieve internal balance. The targets for external balance and internal balance must fit together. One country may need to spend more due to the balance of payment surplus, while some country may need to spend less due to the balance of payment deficit. In the case of a large group of deficit countries, when all countries spend at the same time, they won't have big deficit because the spillover effects generated via trade flows among different countries may offset each other. Thus, they may be able to expand without running into balance of payment difficulties.

However, it is not necessary to coordinate macroeconomic and exchange rate policies when exchange rate changes truly insulate one country from another. Furthermore, it is not always beneficial to coordinate policies between different countries if desynchronized GDP growth could provide the mechanism of automatic stabilization. Last but not least, increased business cycle synchronization, as one of the OCA criteria, is overemphasized. Stronger business cycle transmission through trade channels do not lead to direct implications for international policy coordination, since it is possible that there has already been some international policy coordination established between different countries, resulting in such a high degree of business cycle synchronization, or they may need more policy coordination, if the degree of business cycle synchronization is relatively low.

There is a puzzle that the substantial increase in intra-industry trade in Asia should increase the importance of the regional factor in Asia, on average. However, that isn't found in my dynamic factor estimation, although it is found in the correlation analysis. Therefore, the results from both methods are not consistent with each other. To explore this puzzle requires further study.

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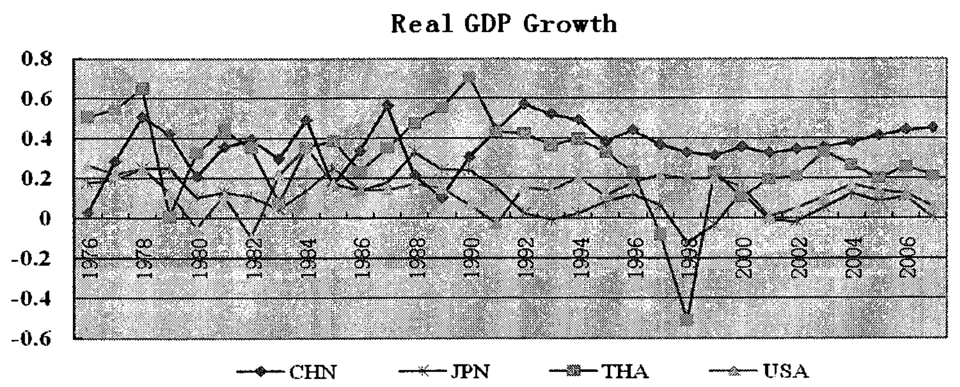
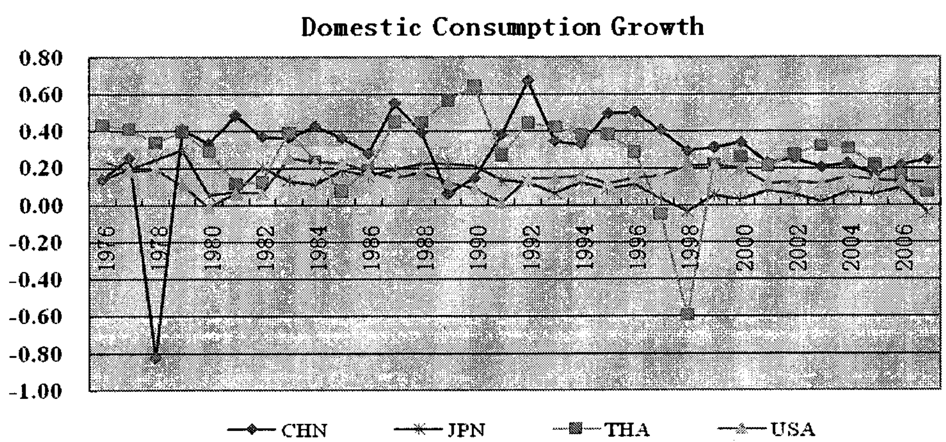
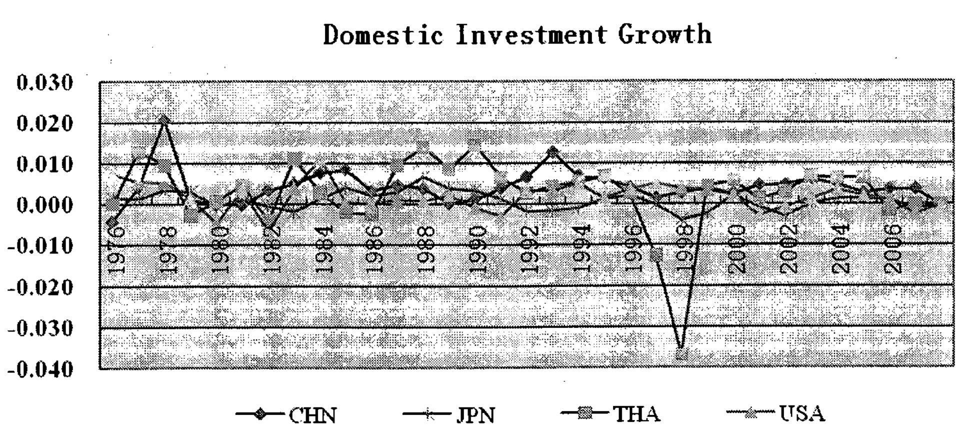
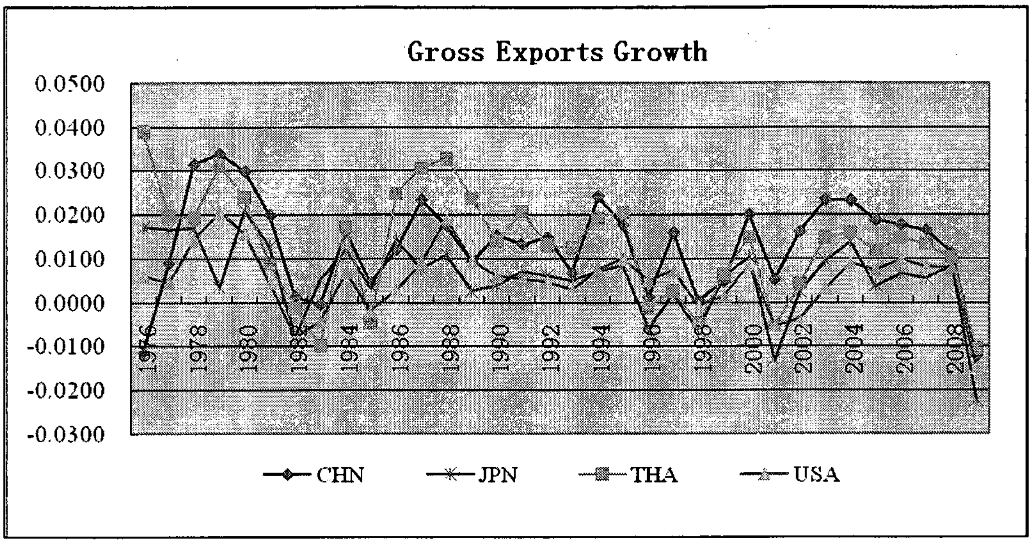
Appendix

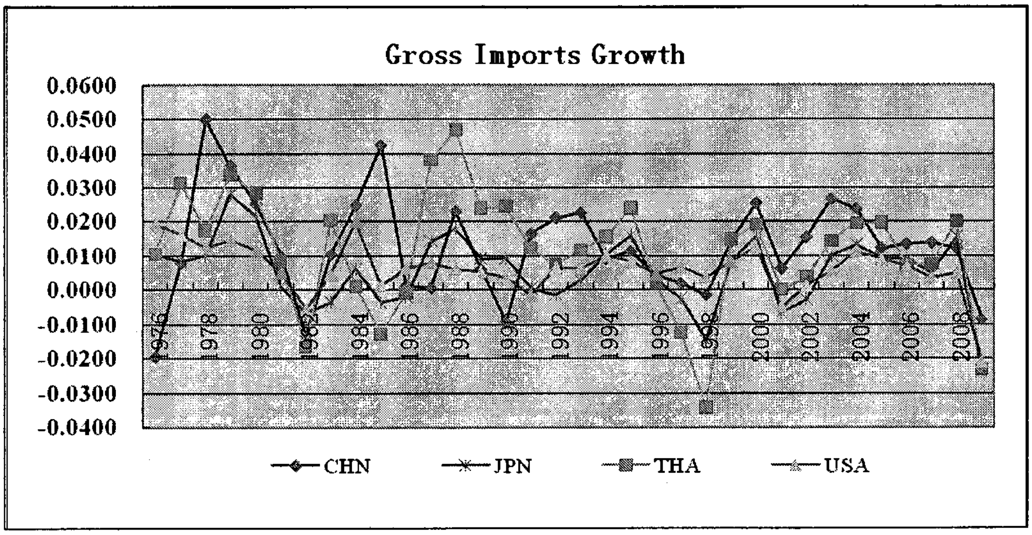
Figure 1 De-trended Growth Rates in terms of Y, C, I, X, M and NX

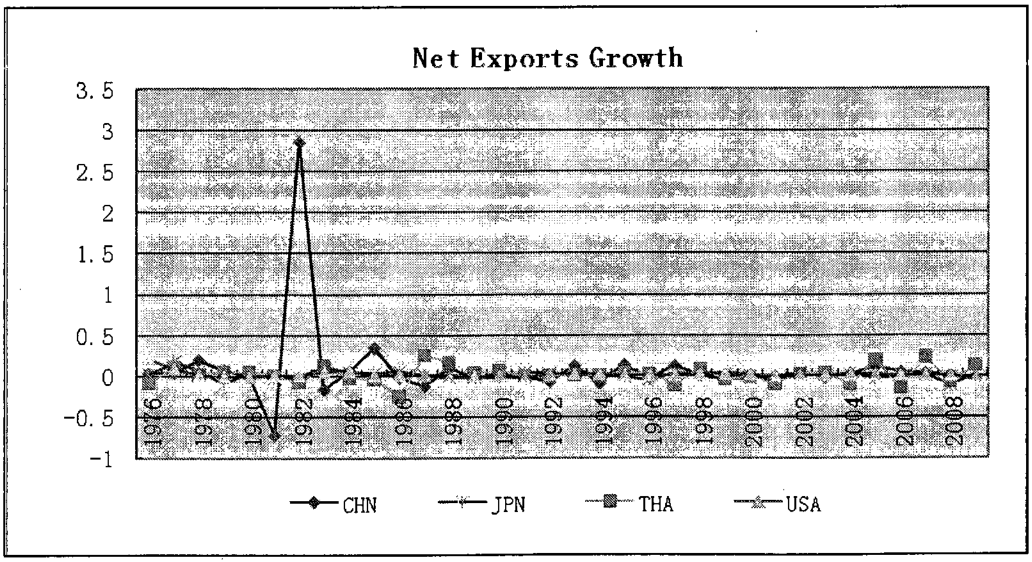







Gross Exports Growth
0.0500
0.0400
0.0300
0.0200
0.0100
0.0000
-0.0100
-0.0200
-0.0300
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
CHN
JPN
THA
USA


Gross Imports Growth
0.0600
0.0500
0.0400
0.0300
0.0200
0.0100
0.0000
-0.0100
-0.0200
-0.0300
-0.0400
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
CHN
JPN
THA
USA


Net Exports Growth
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
CHN
JPN
THA
USA

Box 1 ISIC_2-digit Code and Manufacturing Industry Description
(ISIC rev2: International Standard Industry Classification revision 2)

ISIC_revision2	*Description for the Manufacturing Industry Code*
31	Manufacture of Food Beverages and Tobacco
32	Textile, Wearing Apparel and Leather Industries
33	Manufacture of Wood and Wood Products, Including Furniture
34	Manufacture of Paper and Paper Products, Printing and Publishing
35	Manufacture of Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products
36	Manufacture of Non-Metallic Mineral Products, except Products of Petroleum and Coal
37	Basic Metal Industries
38	Manufacture of Fabricated Metal Products, Machinery and Equipment
39	Other Manufacturing Industries

Note: ISIC code starting with number 3 belongs to manufacturing industry.

Total number of ISIC_2-digit classification: 9 industries

Box 2 ISIC_3-digit Code and Manufacturing Industry Description

(ISIC rev2: International Standard Industry Classification revision 2)

ISIC_revision2	*Description for the Manufacturing Industry Code*
311	Food products
313	Beverages
314	Tobacco
321	Textiles
322	Wearing apparel except footwear
323	Leather products
324	Footwear except rubber or plastic
331	Wood products except furniture
332	Furniture except metal
341	Paper and products
342	Printing and publishing
351	Industrial chemicals
352	Other chemicals
353	Petroleum refineries
354	Miscellaneous petroleum and coal products
355	Rubber products
356	Plastic products
361	Pottery china earthenware
362	Glass and products
369	Other non-metallic mineral products
371	Iron and steel
372	Non-ferrous metals
381	Fabricated metal products
382	Machinery except electrical
383	Machinery electric
384	Transport equipment
385	Professional and scientific equipment
390	Other manufactured products

Note: ISIC code starting with number 3 belongs to manufacturing industry.

Total number of ISIC_3-digit classification: 28 industries

Box 3 ISIC_4-digit Code and Manufacturing Industry Description
(ISIC rev2: International Standard Industry Classification revision 2)

ISIC_revision2	*Description for the Manufacturing Industry Code*
3111	Slaughtering, preparing and preserving meat
3112	Manufacture of dairy products
3113	Canning and preserving of fruits and vegetables
3114	Canning, preserving and processing of fish, crust aces and similar foods
3115	Manufacture of vegetable and animal oils and fats
3116	Grain mill products
3117	Manufacture of bakery products
3118	Sugar factories and refineries
3119	Manufacture of cocoa, chocolate and sugar confectionery
3121	Manufacture of food products not elsewhere classified
3122	Manufacture of prepared animal feeds
3131	Distilling, rectifying and blending spirits
3132	Wine industries
3133	Malt liquors and malt
3134	Soft drinks and carbonated waters industries
3140	Tobacco manufactures
3211	Spinning, weaving and finishing textiles
3212	Manufacture of made-up textile goods except wearing apparel
3213	Knitting mills
3214	Manufacture of carpets and rugs
3215	Cordage, rope and twine industries
3219	Manufacture of textiles not elsewhere classified
3220	Manufacture of wearing apparel except footwear
3231	Tanneries and leather finishing
3232	Fur dressing and dyeing industries
3233	Manufacture of products of leather and leather substitutes, except footwear and wearing apparel
3240	Manufacture of footwear except vulcanized or molded rubber or plastic footwear
3311	Sawmills, planing and other wood mills
3312	Manufacture of wooden and cane containers and small cane ware
3319	Manufacture of wood and cork products not elsewhere classified
3320	Manufacture of furniture and fixtures, except primarily of metal
3411	Manufacture of pulp, paper and paperboard
3412	Manufacture of containers and boxes of paper and paperboard
3419	Manufacture of pulp, paper and paperboard articles not elsewhere classified
3420	Printing, publishing and allied industries
3511	Manufacture of basic industrial chemicals except fertilizers
3512	Manufacture of fertilizers and pesticides
3513	Manufacture of synthetic resins, plastic materials and man-made fibers except glass
3521	Manufacture of paints, varnishes and lacquers
3522	Manufacture of drugs and medicines
3523	Manufacture of soap and cleaning preparations, perfumes, cosmetics and other toilet preparations
3529	Manufacture of chemical products not elsewhere classified
3530	Petroleum refineries
3540	Manufacture of miscellaneous products of petroleum and coal

Box 3 ISIC_4-digit Code and Manufacturing Industry Description (Continue)
(ISIC rev2: International Standard Industry Classification revision 2)

ISIC_revision2	*Description for the Manufacturing Industry Code*
3551	Tyre and tube industries
3559	Manufacture of rubber products not elsewhere classified
3560	Manufacture of plastic products not elsewhere classified
3610	Manufacture of pottery, china and earthenware
3620	Manufacture of glass and glass products
3691	Manufacture of structural clay products
3692	Manufacture of cement, lime and plaster
3699	Manufacture of non-metallic mineral products not elsewhere classified
3710	Iron and steel basic industries
3720	Non-ferrous metal basic industries
3811	Manufacture of cutlery, hand tools and general hardware
3812	Manufacture of furniture and fixtures primarily of metal
3813	Manufacture of structural metal products
3819	Manufacture of fabricated metal products except machinery and equipment not elsewhere classified
3821	Manufacture of engines and turbines
3822	Manufacture of agricultural machinery and equipment
3823	Manufacture of metal and wood working machinery
3824	Manufacture of special industrial machinery and equipment except metal and wood working machinery
3825	Manufacture of office, computing and accounting machinery
3829	Machinery and equipment except electrical not elsewhere classified
3831	Manufacture of electrical industrial machinery and apparatus
3832	Manufacture of radio, television and communication equipment and apparatus
3833	Manufacture of electrical appliances and house wares
3839	Manufacture of electrical apparatus and supplies not elsewhere classified
3841	Ship building and repairing
3842	Manufacture of railroad equipment
3843	Manufacture of motor vehicles
3844	Manufacture of motorcycles and bicycles
3845	Manufacture of aircraft
3849	Manufacture of transport equipment not elsewhere classified
3851	Manufacture of professional and scientific, and measuring and controlling equipment not elsewhere classified
3852	Manufacture of photographic and optical goods
3853	Manufacture of watches and clocks
3901	Manufacture of jewellery and related articles
3902	Manufacture of musical instruments
3903	Manufacture of sporting and athletic goods
3909	Manufacturing industries not elsewhere classified

Note: ISIC code starting with number 3 belongs to manufacturing industry.

Total number of ISIC_4-digit classification: 81 industries

Table 1a: Simple Correlations of Real GDP Growth[24] 1976-1980

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA
CHN	1.000											
HKG	-0.625	1.000										
INDIA	0.999	-0.666	1.000									
INDO	-0.704	0.994	-0.742	1.000								
JPN	-0.524	0.992	-0.569	0.974	1.000							
KOR	1.000	-0.622	0.998	-0.701	-0.520	1.000						
MLS	-0.301	0.933	-0.353	0.889	0.970	-0.297	1.000					
PHL	-0.304	0.934	-0.356	0.891	0.971	-0.300	1.000	1.000				
SGP	-0.691	0.996	-0.729	1.000	0.978	-0.688	0.898	0.899	1.000			
THA	-0.306	0.934	-0.357	0.891	0.971	-0.302	1.000	1.000	0.900	1.000		
TWN	-0.697	0.995	-0.735	1.000	0.976	-0.694	0.894	0.895	1.000	0.896	1.000	
USA	0.236	0.612	0.183	0.524	0.704	0.240	0.856	0.854	0.540	0.853	0.532	1.000

Table 1b: Simple Correlations of Real GDP Growth 1981-1984

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA
CHN	1.000											
HKG	0.184	1.000										
INDIA	-0.480	0.109	1.000									
INDO	-0.037	0.975	0.188	1.000								
JPN	0.229	0.828	-0.424	0.810	1.000							
KOR	0.482	-0.231	0.398	-0.372	-0.602	1.000						
MLS	0.489	0.907	-0.294	0.821	0.924	-0.251	1.000					
PHL	-0.885	-0.588	0.485	-0.406	-0.644	-0.144	-0.838	1.000				
SGP	-0.338	0.831	0.552	0.912	0.515	-0.261	0.526	-0.052	1.000			
THA	-0.140	0.944	0.340	0.987	0.708	-0.317	0.728	-0.287	0.965	1.000		
TWN	0.825	0.648	-0.077	0.464	0.451	0.440	0.755	-0.904	0.241	0.404	1.000	
USA	0.633	0.783	0.152	0.640	0.478	0.389	0.773	-0.788	0.493	0.612	0.959	1.000

[24] Data sources: International Monetary Fund (IFS), World Economic Outlook (WEO) and Council for Economic and Development Planning for Taiwan data. Data for Eurozone from 1976 to 1991 are not available.

Table 1c: Simple Correlations of Real GDP Growth 1985-1988

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA
CHN	1.000											
HKG	-0.621	1.000										
INDIA	0.023	-0.115	1.000									
INDO	-0.792	0.817	-0.516	1.000								
JPN	0.679	-0.594	-0.650	-0.315	1.000							
KOR	-0.635	0.958	-0.386	0.927	-0.392	1.000						
MLS	-0.042	0.485	-0.879	0.639	0.410	0.675	1.000					
PHL	-0.568	0.845	-0.621	0.949	-0.152	0.962	0.822	1.000				
SGP	-0.118	0.586	-0.827	0.699	0.299	0.756	0.993	0.875	1.000			
THA	0.057	0.413	-0.884	0.559	0.486	0.605	0.995	0.762	0.979	1.000		
TWN	-0.765	0.947	0.132	0.753	-0.812	0.855	0.199	0.692	0.314	0.113	1.000	
USA	0.479	-0.832	-0.449	-0.415	0.861	-0.640	0.028	-0.408	-0.091	0.089	-0.903	1.000

Table 1d: Simple Correlations of Real GDP Growth 1989-1991

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA
CHN	1.000											
HKG	0.857	1.000										
INDIA	-0.995	-0.905	1.000									
INDO	-0.888	-0.998	0.931	1.000								
JPN	-0.996	-0.807	0.982	0.844	1.000							
KOR	0.537	0.895	-0.620	-0.864	-0.459	1.000						
MLS	0.999	0.834	-0.990	-0.868	-0.999	0.500	1.000					
PHL	-0.866	-1.000	0.912	0.999	0.818	-0.887	-0.844	1.000				
SGP	-1.000	-0.871	0.997	0.901	0.993	-0.560	-0.997	0.880	1.000			
THA	-0.951	-0.974	0.977	0.987	0.919	-0.772	-0.937	0.978	0.959	1.000		
TWN	0.309	-0.226	-0.210	0.163	-0.392	-0.637	0.349	0.209	-0.282	0.002	1.000	
USA	-0.878	-0.999	0.922	1.000	0.832	-0.875	-0.857	1.000	0.891	0.983	0.185	1.000

Table 1e: Simple Correlations of Real GDP Growth 1992-1996

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA	EUA
CHN	1.000												
HKG	0.813	1.000											
INDIA	-0.882	-0.606	1.000										
INDO	-0.874	-0.829	0.901	1.000									
JPN	-0.931	-0.696	0.747	0.762	1.000								
KOR	-0.513	-0.646	0.686	0.862	0.351	1.000							
MLS	-0.658	-0.556	0.587	0.444	0.396	0.178	1.000						
PHL	-0.883	-0.612	0.999	0.893	0.732	0.676	0.628	1.000					
SGP	0.321	0.417	0.061	-0.188	-0.585	0.061	0.252	0.089	1.000				
THA	0.444	-0.030	-0.272	0.003	-0.570	0.486	-0.355	-0.273	0.271	1.000			
TWN	0.790	0.641	-0.743	-0.611	-0.548	-0.323	-0.977	-0.775	-0.181	0.376	1.000		
USA	0.023	0.514	0.234	-0.013	0.152	-0.069	-0.400	0.200	0.091	-0.371	0.284	1.000	
EUA	-0.415	-0.475	0.480	0.715	0.501	0.777	-0.307	0.440	-0.426	0.296	0.115	0.253	1.000

Table 1f: Simple Correlations of Real GDP Growth 1997-2000

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA	EUA
CHN	1.000												
HKG	0.531	1.000											
INDIA	-0.869	-0.828	1.000										
INDO	0.571	0.978	-0.793	1.000									
JPN	0.606	0.979	-0.905	0.929	1.000								
KOR	0.103	0.849	-0.416	0.872	0.732	1.000							
MLS	0.464	0.975	-0.724	0.992	0.911	0.925	1.000						
PHL	0.662	0.921	-0.786	0.979	0.865	0.808	0.956	1.000					
SGP	0.480	0.990	-0.761	0.991	0.941	0.906	0.996	0.945	1.000				
THA	0.072	0.868	-0.440	0.859	0.769	0.989	0.916	0.769	0.909	1.000			
TWN	0.520	0.962	-0.737	0.996	0.896	0.903	0.995	0.979	0.988	0.882	1.000		
USA	-0.371	-0.164	0.529	0.004	-0.356	0.307	0.060	0.089	-0.021	0.190	0.092	1.000	
EUA	-0.272	0.408	-0.216	0.223	0.464	0.348	0.282	0.023	0.341	0.482	0.192	-0.530	1.000

Table 1g: Simple Correlations of Real GDP Growth 2001-2005

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA	EUA
CHN	1.000												
HKG	0.830	1.000											
INDIA	0.779	0.624	1.000										
INDO	0.951	0.831	0.688	1.000									
JPN	0.858	0.951	0.724	0.764	1.000								
KOR	-0.316	-0.150	-0.800	-0.126	-0.368	1.000							
MLS	0.829	0.693	0.319	0.773	0.707	0.132	1.000						
PHL	0.532	0.113	0.429	0.288	0.361	-0.466	0.564	1.000					
SGP	0.878	0.915	0.455	0.891	0.852	0.095	0.907	0.265	1.000				
THA	0.690	0.419	0.278	0.524	0.557	-0.056	0.898	0.846	0.655	1.000			
TWN	0.691	0.617	0.115	0.644	0.613	0.304	0.976	0.486	0.859	0.877	1.000		
USA	0.917	0.962	0.648	0.863	0.970	-0.192	0.837	0.367	0.951	0.646	0.755	1.000	
EUA	-0.033	0.449	0.241	0.049	0.343	-0.177	-0.309	-0.644	0.094	-0.565	-0.330	0.209	1.000

Table 1h: Simple Correlations of Real GDP Growth 2006-2009

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA	EUA
CHN	1.000												
HKG	0.865	1.000											
INDIA	0.915	0.972	1.000										
INDO	0.609	0.736	0.585	1.000									
JPN	0.880	0.995	0.957	0.790	1.000								
KOR	0.911	0.995	0.986	0.711	0.992	1.000							
MLS	0.724	0.944	0.841	0.889	0.957	0.915	1.000						
PHL	0.657	0.827	0.687	0.986	0.867	0.798	0.952	1.000					
SGP	0.929	0.982	0.997	0.645	0.975	0.995	0.871	0.738	1.000				
THA	0.808	0.993	0.938	0.780	0.990	0.976	0.974	0.868	0.952	1.000			
TWN	0.971	0.958	0.981	0.663	0.960	0.982	0.841	0.737	0.990	0.919	1.000		
USA	0.799	0.993	0.947	0.740	0.984	0.976	0.961	0.837	0.956	0.998	0.917	1.000	
EUA	0.810	0.991	0.931	0.802	0.991	0.974	0.980	0.885	0.948	0.999	0.918	0.995	1.000

Table 2a: Simple Correlations of Real GDP Growth (vs. the US) in Short Run

	1976-1980	1981-1984	1985-1988	1989-1991	1992-1996	1997-2000	2001-2005	2006-2009
CHN	0.236	0.633	0.479	-0.878	0.023	-0.371	0.917	0.799
HKG	0.612	0.783	-0.832	-0.999	0.514	-0.164	0.962	0.993
INDIA	0.183	0.152	-0.449	0.922	0.234	0.529	0.648	0.947
INDO	0.524	0.640	-0.415	1.000	-0.013	0.004	0.863	0.740
JPN	0.704	0.478	0.861	0.832	0.152	-0.356	0.970	0.984
KOR	0.240	0.389	-0.64	-0.875	-0.069	0.307	-0.192	0.976
MLS	0.856	0.773	0.028	-0.857	-0.400	0.060	0.837	0.961
PHL	0.854	-0.788	-0.408	1.000	0.200	0.089	0.367	0.837
SGP	0.54	0.493	-0.091	0.891	0.091	-0.021	0.951	0.956
THA	0.853	0.612	0.089	0.983	-0.371	0.190	0.646	0.998
TWN	0.532	0.959	-0.903	0.185	0.284	0.092	0.755	0.917
EUA	NA	NA	NA	NA	0.253	-0.530	0.209	0.995

Table 2b: Simple Correlations of Real GDP Growth (vs. the EUA) in Short Run

	1992-1996	1997-2000	2001-2005	2006-2009
CHN	-0.415	-0.272	-0.033	0.810
HKG	-0.475	0.408	0.449	0.991
INDIA	0.480	-0.216	0.241	0.931
INDO	0.715	0.223	0.049	0.802
JPN	0.501	0.464	0.343	0.991
KOR	0.777	0.348	-0.177	0.974
MLS	-0.307	0.282	-0.309	0.980
PHL	0.440	0.023	-0.644	0.885
SGP	-0.426	0.341	0.094	0.948
THA	0.296	0.482	-0.565	0.999
TWN	0.115	0.192	-0.330	0.918
USA	0.253	-0.530	0.209	0.995

Table 2c: Correlations of Deviations from GDP Growth Trend (vs. the US) (Hodrick-Prescott Trend)

	1976-1980	1981-1984	1985-1988	1989-1991	1992-1996	1997-2000	2001-2005	2006-2009
CHN	-0.377	0.630	0.488	-0.879	0.284	-0.450	0.909	0.791
HKG	-0.275	0.869	-0.772	-0.999	0.797	0.052	0.961	0.985
INDIA	-0.052	0.125	-0.503	0.933	0.051	0.427	0.627	0.914
INDO	-0.719	0.708	-0.400	0.996	-0.208	0.190	0.629	0.956
JPN	0.771	0.493	0.866	0.696	-0.109	-0.146	0.971	0.980
KOR	0.963	0.310	-0.608	-0.904	-0.225	0.537	0.026	0.956
MLS	-0.184	0.857	0.084	0.181	-0.396	0.263	0.835	0.966
PHL	-0.512	-0.782	-0.378	0.999	-0.022	0.204	0.241	0.849
SGP	-0.739	0.683	-0.041	0.916	0.100	0.190	0.951	0.926
THA	0.835	0.045	0.181	0.985	-0.411	0.452	0.568	1.000
TWN	0.827	0.950	-0.879	-0.038	0.645	0.258	0.770	0.865
EUA	NA	NA	NA	NA	0.206	-0.314	0.608	0.997

Table 2d: Correlations of Deviations from GDP Growth Trend (vs. the US) (Linear Trend)

	1976-1980	1981-1984	1985-1988	1989-1991	1992-1996	1997-2000	2001-2005	2006-2009
CHN	-0.441	0.644	0.448	-0.877	-0.127	-0.511	0.924	0.803
HKG	0.121	0.827	-0.700	-0.999	0.534	-0.056	0.969	0.992
INDIA	-0.025	0.077	-0.567	0.931	0.401	0.524	0.620	0.948
INDO	-0.631	0.663	-0.268	0.997	0.142	0.069	0.890	0.644
JPN	0.571	0.644	0.885	0.774	0.275	-0.243	0.982	0.981
KOR	0.974	0.442	-0.460	-0.895	0.056	0.451	-0.047	0.972
MLS	0.164	0.824	0.194	-0.933	-0.148	0.152	0.855	0.957
PHL	0.446	-0.795	-0.260	1.000	0.347	0.095	0.331	0.855
SGP	-0.795	0.598	0.080	0.875	0.095	0.080	0.955	0.953
THA	0.863	0.981	0.246	0.978	-0.397	0.362	0.721	0.997
TWN	0.869	0.950	-0.806	-0.039	0.572	0.160	0.804	0.902
EUA	NA	NA	NA	NA	0.315	-0.231	0.402	0.995

Table 2e: Correlations of Deviations from GDP Growth Trend (vs. EUA) (Hodrick-Prescott Trend)

	1992-1996	1997-2000	2001-2005	2006-2009
CHN	-0.188	-0.038	0.280	0.805
HKG	-0.329	0.441	0.761	0.983
INDIA	0.279	-0.393	0.500	0.902
INDO	0.350	0.275	-0.017	0.974
JPN	0.268	0.541	0.677	0.987
KOR	0.568	0.369	-0.085	0.960
MLS	-0.252	0.354	0.108	0.976
PHL	0.214	-0.091	-0.474	0.880
SGP	-0.443	0.434	0.465	0.923
THA	0.539	0.506	-0.283	0.998
TWN	0.846	0.517	0.060	0.875
USA	0.206	-0.314	0.608	0.997

Table 2f: Correlations of Deviations from GDP Growth Trend (vs. EUA) (Linear Trend)

	1992-1996	1997-2000	2001-2005	2006-2009
CHN	-0.489	-0.335	0.167	0.813
HKG	-0.486	0.449	0.603	0.991
INDIA	0.566	-0.318	0.380	0.929
INDO	0.731	0.237	0.290	0.716
JPN	0.552	0.535	0.504	0.990
KOR	0.793	0.389	-0.152	0.972
MLS	-0.040	0.305	-0.091	0.978
PHL	0.515	-0.013	-0.561	0.901
SGP	-0.381	0.369	0.290	0.945
THA	0.375	0.522	-0.327	1.000
TWN	0.642	0.478	-0.109	0.906
USA	0.315	-0.231	0.402	0.995

Table 3a: Correlations of Real GDP (Linear De-trended) 1976-1984

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA
CHN	1.000											
HKG	-0.056	1.000										
INDIA	0.001	-0.383	1.000									
INDO	-0.194	0.813	0.155	1.000								
JPN	0.207	0.687	-0.702	0.257	1.000							
KOR	0.390	-0.387	-0.133	-0.713	0.152	1.000						
MLS	-0.004	0.846	-0.811	0.429	0.806	-0.203	1.000					
PHL	-0.853	-0.087	-0.152	-0.022	-0.393	-0.401	0.036	1.000				
SGP	-0.506	0.853	-0.137	0.859	0.310	-0.586	0.607	0.342	1.000			
THA	0.425	-0.231	0.260	-0.313	0.205	0.788	-0.343	-0.708	-0.433	1.000		
TWN	0.642	0.639	-0.144	0.399	0.527	0.186	0.497	-0.653	0.277	0.290	1.000	
USA	0.590	0.467	-0.106	0.178	0.567	0.515	0.337	-0.726	0.115	0.632	0.907	1.000

Table 3b: Correlations of Real GDP (Linear De-trended) 1985-1996

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA
CHN	1.000											
HKG	0.213	1.000										
INDIA	0.087	-0.067	1.000									
INDO	-0.387	0.104	-0.035	1.000								
JPN	-0.433	-0.357	0.327	-0.356	1.000							
KOR	-0.141	0.649	0.035	0.045	0.187	1.000						
MLS	-0.224	0.113	0.025	0.837	-0.144	-0.011	1.000					
PHL	-0.406	0.492	0.391	0.672	-0.001	0.443	0.627	1.000				
SGP	-0.205	0.284	0.226	0.718	-0.125	0.110	0.908	0.754	1.000			
THA	-0.425	0.108	0.252	0.439	0.351	0.242	0.717	0.668	0.800	1.000		
TWN	0.028	0.876	-0.124	0.175	-0.384	0.552	0.051	0.557	0.187	0.096	1.000	
USA	0.324	-0.011	0.836	-0.243	0.057	-0.207	-0.251	0.154	-0.045	-0.091	0.024	1.000

Table 3c: Correlations of Real GDP (Linear De-trended) 1997-2007

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA	EUA
CHN	1.000												
HKG	0.605	1.000											
INDIA	0.536	0.301	1.000										
INDO	0.864	0.643	0.175	1.000									
JPN	0.700	0.948	0.307	0.786	1.000								
KOR	-0.641	-0.021	-0.535	-0.556	-0.258	1.000							
MLS	0.232	0.708	0.004	0.242	0.623	0.450	1.000						
PHL	0.734	0.361	-0.037	0.677	0.421	-0.194	0.409	1.000					
SGP	0.246	0.813	0.122	0.207	0.655	0.478	0.940	0.296	1.000				
THA	0.741	0.522	0.362	0.532	0.590	-0.248	0.634	0.793	0.522	1.000			
TWN	0.402	0.705	0.150	0.254	0.566	0.385	0.911	0.565	0.928	0.732	1.000		
USA	-0.197	0.478	0.195	-0.322	0.271	0.640	0.739	-0.205	0.830	0.191	0.688	1.000	
EUA	-0.519	0.349	-0.216	-0.304	0.205	0.617	0.386	-0.587	0.496	-0.395	0.160	0.690	1.000

Table 3d: Correlations of Real GDP (Linear De-trended) 1999-2007

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA	EUA
CHN	1.000												
HKG	0.594	1.000											
INDIA	0.532	0.292	1.000										
INDO	0.848	0.633	0.147	1.000									
JPN	0.691	0.947	0.297	0.781	1.000								
KOR	-0.662	-0.031	-0.540	-0.563	-0.267	1.000							
MLS	0.204	0.698	-0.013	0.223	0.611	0.456	1.000						
PHL	0.723	0.344	-0.056	0.661	0.404	-0.202	0.394	1.000					
SGP	0.238	0.814	0.116	0.198	0.654	0.466	0.939	0.291	1.000				
THA	0.702	0.496	0.335	0.483	0.564	-0.227	0.639	0.777	0.527	1			
TWN	0.401	0.706	0.148	0.246	0.565	0.364	0.904	0.566	0.926	0.740	1.000		
USA	-0.185	0.495	0.204	-0.315	0.287	0.627	0.751	-0.195	0.838	0.225	0.694	1.000	
EUA	-0.519	0.362	-0.214	-0.288	0.217	0.622	0.403	-0.583	0.502	-0.373	0.161	0.686	1.000

Table 4a: Correlations of Real GDP (Hodrick-Prescott De-trended) 1976-1984

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA
CHN	1.000											
HKG	0.217	1.000										
INDIA	-0.120	-0.226	1.000									
INDO	-0.074	0.796	0.270	1.000								
JPN	0.125	0.691	-0.753	0.258	1.000							
KOR	0.285	-0.268	-0.171	-0.678	0.042	1.000						
MLS	0.512	0.785	-0.690	0.286	0.867	0.098	1.000					
PHL	-0.811	-0.507	0.020	-0.241	-0.407	-0.260	-0.607	1.000				
SGP	-0.251	0.841	0.080	0.890	0.372	-0.454	0.374	-0.065	1.000			
THA	0.131	-0.202	0.425	-0.261	-0.156	0.708	-0.214	-0.406	-0.244	1.000		
TWN	0.734	0.697	-0.017	0.384	0.320	0.242	0.681	-0.796	0.395	0.199	1.000	
USA	0.585	0.642	-0.096	0.235	0.430	0.499	0.674	-0.763	0.355	0.431	0.928	1.000

Table 4b: Correlations of Real GDP (Hodrick-Prescott De-trended) 1985-1996

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA
CHN	1.000											
HKG	0.221	1.000										
INDIA	0.116	-0.071	1.000									
INDO	-0.248	0.168	0.184	1.000								
JPN	-0.430	-0.473	0.359	-0.135	1.000							
KOR	-0.057	0.623	0.076	0.219	0.067	1.000						
MLS	-0.172	0.204	0.191	0.742	0.122	0.099	1.000					
PHL	-0.411	0.540	0.415	0.536	0.112	0.488	0.584	1.000				
SGP	-0.150	0.358	0.350	0.615	0.038	0.168	0.900	0.719	1.000			
THA	-0.299	0.112	0.457	0.498	0.401	0.229	0.830	0.721	0.862	1.000		
TWN	0.032	0.860	-0.138	0.137	-0.486	0.531	0.026	0.576	0.163	0.037	1.000	
USA	0.268	-0.033	0.767	-0.251	0.091	-0.191	-0.265	0.167	-0.033	0.028	0.050	1.000

Table 4c: Correlations of Real GDP (Hodrick-Prescott De-trended) 1997-2007

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA	EUA
CHN	1.000												
HKG	0.106	1.000											
INDIA	0.248	-0.044	1.000										
INDO	0.604	0.343	-0.369	1.000									
JPN	0.336	0.915	-0.031	0.605	1.000								
KOR	-0.740	0.282	-0.522	-0.337	0.004	1.000							
MLS	0.138	0.776	-0.138	0.219	0.693	0.475	1.000						
PHL	0.492	0.009	-0.483	0.387	0.066	0.097	0.458	1.000					
SGP	0.062	0.872	-0.029	0.075	0.691	0.488	0.936	0.270	1.000				
THA	0.312	0.234	-0.030	0.080	0.314	0.168	0.719	0.649	0.507	1.000			
TWN	0.170	0.654	-0.055	-0.013	0.478	0.459	0.917	0.530	0.930	0.687	1.000		
USA	-0.195	0.727	0.283	-0.324	0.482	0.507	0.760	-0.092	0.886	0.382	0.791	1.000	
EUA	-0.542	0.749	-0.180	-0.002	0.593	0.603	0.457	-0.424	0.573	-0.101	0.273	0.621	1.000

Table 4d: Correlations of Real GDP (Hodrick-Prescott De-trended) 1999-2007

	CHN	HKG	INDIA	INDO	JPN	KOR	MLS	PHL	SGP	THA	TWN	USA	EUA
CHN	1.000												
HKG	0.175	1.000											
INDIA	-0.058	-0.038	1.000										
INDO	0.259	0.404	-0.568	1.000									
JPN	0.362	0.927	-0.073	0.616	1.000								
KOR	0.215	0.457	-0.325	-0.093	0.202	1.000							
MLS	0.551	0.783	-0.090	0.284	0.718	0.638	1.000						
PHL	0.441	-0.019	-0.650	0.269	-0.005	0.431	0.478	1.000					
SGP	0.328	0.870	-0.006	0.126	0.710	0.730	0.943	0.273	1.000				
THA	0.610	0.278	0.047	0.058	0.333	0.189	0.725	0.639	0.539	1.000			
TWN	0.394	0.655	-0.067	-0.020	0.483	0.771	0.932	0.523	0.934	0.712	1.000		
USA	0.187	0.772	0.383	-0.186	0.575	0.573	0.794	-0.026	0.913	0.472	0.835	1.000	
EUA	0.238	0.772	0.021	0.185	0.692	0.523	0.476	-0.302	0.631	-0.146	0.374	0.582	1.000

Table 5a: The Effects of Trade on Business Cycle Co-movement among 11 Asian Countries & US & Eurozone (Linear De-trended & Pool Regression)

	1	2	3	4	5	6	7	8	9	10	11	12
wx	0.226***						0.192**			0.183**		
	(2.62)						(2.22)			(2.11)		
wm		0.231***						0.194**			0.185**	
		(2.65)						(2.20)			(2.10)	
wt			0.281***						0.237**			0.229**
			(2.99)						(2.49)			(2.41)
IIT_2				0.412***								
				(2.54)								
IIT_3					0.542***		0.483**	0.468**	0.450**			
					(2.71)		(2.37)	(2.28)	(2.19)			
IIT_4						0.669***				0.628**	0.614**	0.595**
						(2.84)				(2.55)	(2.48)	(2.41)
FP corr	0.137**	0.146**	0.132*	0.154**	0.160**	0.165**	0.151**	0.156**	0.146**	0.156**	0.162**	0.152**
	(1.98)	(2.11)	(1.90)	(2.27)	(2.34)	(2.42)	(2.20)	(2.26)	(2.11)	(2.27)	(2.34)	(2.19)
MP corr	0.123	0.090	0.115	0.052	0.07	0.078	0.081	0.052	0.077	0.091	0.062	0.086
	(1.38)	(1.01)	(1.29)	(0.69)	(0.79)	(0.89)	(0.91)	(0.57)	(0.86)	(1.03)	(0.70)	(0.97)
NER	-1.212***	-1.182***	-1.152***	-1.243***	-1.179***	-1.099***	-1.064***	-1.050***	-1.027***	-0.982***	-0.969***	-0.947***
movement	(-3.42)	(-3.31)	(-3.24)	(-3.56)	(-3.34)	(-3.15)	(-2.99)	(-2.93)	(-2.88)	(-2.72)	(-2.67)	(-2.62)
constant	0.444***	0.461***	0.431***	0.296***	0.289***	0.273***	0.279***	0.299***	0.281***	0.255**	0.273***	0.255**
	(5.96)	(6.28)	(5.75)	(2.96)	(2.88)	(2.68)	(2.76)	(2.94)	(2.77)	(2.45)	(2.61)	(2.45)
# of obs.	193	193	192	197	197	198	193	192	192	193	192	192
R^2	0.1439	0.1447	0.1526	0.1437	0.1456	0.1478	0.1689	0.1681	0.1739	0.1728	0.1722	0.1782
Adjusted R^2	0.1257	0.1265	0.1345	0.1165	0.1278	0.1302	0.1467	0.1457	0.1517	0.1506	0.1499	0.1561
Root MSE	0.52823	0.52888	0.52681	0.52579	0.52366	0.52171	0.52185	0.52336	0.52153	0.52064	0.52207	0.52019

Note: (i) The dependent variable is real GDP correlation between any two countries (Eurozone is treated as a whole.) for the three sub-periods, 1976-1984 (Period 1), 1985-1996 (Period 2) and 1999-2007 (Period 3). Three trade intensity measures, wx, wm, and wt are defined as in equations (1), (2) and (3) based on exports, imports and total trade respectively. The intra-industry trade measures, IIT2, IIT3 and IIT4 are defined as in equation (4) based on SITC two-, three- and four-digit classifications.

(ii) Three added control regressors, FP corr, MP corr and NER (RER) comovement are measures of the fiscal policy correlation, monetary policy correlation and nominal (real) exchange rate comovement.

(iii) The values in parentheses are t-ratios. *, ** and *** are the significance at 10%, 5% and 1% of the estimated coefficients, respectively.

Table 5b: The Effects of Trade on Business Cycle Co-movement among 11 Asian Countries & US & Eurozone (Linear De-trended & Panel Regression: Random Effects)

	1	2	3	4	5	6	7	8	9	10	11	12
wx	0.226***						0.192**			0.183**		
	(2.62)						(2.22)			(2.11)		
wm		0.231***						0.194**			0.185**	
		(2.65)						(2.20)			(2.10)	
wt			0.281***						0.237**			0.229**
			(2.99)						(2.49)			(2.41)
IIT_2				0.462***								
				(2.67)								
IIT_3					0.542***		0.483**	0.468**	0.450**			
					(2.71)		(2.37)	(2.28)	(2.19)			
IIT_4						0.669***				0.628**	0.614**	0.595**
						(2.84)				(2.55)	(2.48)	(2.41)
FP corr	0.137**	0.146**	0.132*	0.154**	0.160**	0.165**	0.151**	0.156**	0.146**	0.156**	0.162**	0.152**
	(1.89)	(2.11)	(1.90)	(2.21)	(2.34)	(2.42)	(2.20)	(2.26)	(2.11)	(2.27)	(2.34)	(2.09)
MP corr	0.123	0.090	0.115	0.059	0.070	0.077	0.081	0.052	0.077	0.091	0.062	0.086
	(1.38)	(1.01)	(1.29)	(0.62)	(0.79)	(0.89)	(0.91)	(0.57)	(0.86)	(1.03)	(0.70)	(0.97)
NER movement	-1.212***	-1.182***	-1.152***	-1.192***	-1.179***	-1.099***	-1.064***	-1.050***	-1.027***	-0.982***	-0.969***	-0.947**
	(-3.42)	(-3.31)	(-3.24)	(-3.58)	(-3.43)	(-3.15)	(-2.99)	(-2.93)	(-2.88)	(-2.72)	(-2.67)	(-2.62)
constant	0.444***	0.461***	0.431***	0.297***	0.289***	0.273***	0.279***	0.299***	0.281***	0.255**	0.273***	0.255**
	(5.96)	(6.28)	(5.75)	(2.97)	(2.88)	(2.68)	(2.76)	(2.94)	(2.77)	(2.45)	(2.61)	(2.45)
# of observation	193	193	192	197	197	198	193	192	192	193	192	192
R^2_within	0.0798	0.0801	0.0807	0.1481	0.1325	0.1284	0.1347	0.1347	0.1333	0.1379	0.1358	0.1364
R^2_between	0.2759	0.2900	0.2985	0.1954	0.1737	0.1541	0.2325	0.2408	0.2499	0.2130	0.2267	0.2328
R^2_overall	0.1439	0.1447	0.1526	0.1432	0.1456	0.1478	0.1689	0.1681	0.1739	0.1728	0.1722	0.1782
Sigma_e	0.5525	0.5532	0.5546	0.5124	0.5261	0.5307	0.5325	0.5340	0.5342	0.5326	0.5352	0.5349
Sigma_u	0	0	0	0	0	0	0	0	0	0	0	0
rho	0	0	0	0	0	0	0	0	0	0	0	0

Note: See the note to Table 5a.

Table 5c: The Effects of Trade on Business Cycle Co-movement among 11 Asian Countries & US & Eurozone (Linear De-trended & Panel Regression: Fixed Effects)

	1	2	3	4	5	6	7	8	9	10	11	12
wx	0.267						0.059			0.089		
	(1.26)						(0.27)			(0.42)		
wm		0.267						0.100			0.068	
		(1.30)						(0.48)			(0.32)	
wt			0.295						0.093			0.114
			(1.30)						(0.41)			(0.50)
IIT_2				0.612***								
				(3.68)								
IIT_3					0.862***		0.843***	0.842***	0.847***			
					(3.40)		(3.11)	(3.11)	(3.12)			
IIT_4						1.019***				1.051***	1.053***	1.045***
						(3.17)				(3.09)	(3.03)	(3.07)
FP corr	0.142	0.140	0.142	0.143*	0.157*	0.165*	0.163*	0.157	0.157	0.168*	0.168	0.168*
	(1.42)	(1.38)	(1.40)	(1.58)	(1.67)	(1.74)	(1.69)	(1.61)	(1.60)	(1.74)	(1.71)	(1.71)
MP corr	0.183	0.174	0.171	0.132	0.123	0.112	0.131	0.131	0.133	0.131	0.126	0.126
	(1.50)	(1.41)	(1.38)	(1.27)	(1.07)	(0.96)	(1.10)	(1.09)	(1.11)	(1.10)	(1.05)	(1.05)
NER	-0.691	-0.670	-0.650	-0.82	-0.430	-0.444	-0.426	-0.378	-0.379	-0.365	-0.369	-0.345
movement	(-1.40)	(-1.35)	(-1.29)	(-0.94)	(-0.95)	(-0.96)	(-0.88)	(-0.77)	(-0.77)	(-0.75)	(-0.75)	(-0.70)
constant	0.346***	0.368***	0.338***	0.036	0.059	0.072	0.066	0.063	0.054	0.048	0.055	0.045
	(3.46)	(3.80)	(3.31)	(0.32)	(0.47)	(0.54)	(0.50)	(0.47)	(0.41)	(0.35)	(0.40)	(0.33)
# of observation	193	193	192	197	197	198	193	192	192	193	192	192
R^2_within	0.0867	0.0882	0.0870	0.1687	0.1586	0.1473	0.1592	0.1613	0.1608	0.1586	0.1575	0.1586
R^2_between	0.2404	0.2556	0.2726	0.0807	0.0814	0.0811	0.1113	0.1217	0.1184	0.1123	0.1094	0.1220
R^2_overall	0.1329	0.1323	0.1429	0.1092	0.1181	0.1281	0.1317	0.1343	0.1349	0.1465	0.1429	0.1502
Sigma_e	0.5525	0.5532	0.5546	0.5123	0.5261	0.5307	0.5325	0.5340	0.5342	0.5326	0.5352	0.5349
Sigma_u	0.3297	0.3267	0.3237	0.3786	0.3602	0.3576	0.3562	0.3545	0.3550	0.3589	0.3593	0.3567
rho	0.2626	0.2586	0.2542	0.3217	0.3192	0.3122	0.3092	0.3059	0.3063	0.3122	0.3107	0.3078

Note: See the note to Table 5a.

Table 6a: The Effects of Trade on Business Cycle Co-movement among 11 Asian Countries & US & Eurozone (HP filter De-trended & Pool Regression)

	1	2	3	4	5	6	7	8	9	10	11	12
wx	0.187**						0.167**			0.146*		
	(2.26)						(2.00)			(1.75)		
wm		0.199**						0.179**			0.155*	
		(2.38)						(2.10)			(1.83)	
wt			0.219**						0.193**			0.167*
			(2.40)						(2.07)			(1.81)
IIT_2				0.185**								
				(1.76)								
IIT_3					0.346*		0.300	0.275	0.276			
					(1.81)		(1.53)	(1.39)	(1.40)			
IIT_4						0.633***				0.606***	0.588**	0.591**
						(2.84)				(2.59)	(2.49)	(2.50)
FP corr	0.222***	0.229***	0.221***	0.228***	0.247***	0.258***	0.221***	0.228***	0.221***	0.233***	0.239***	0.233***
	(2.76)	(2.38)	(2.73)	(3.05)	(3.14)	(3.32)	(2.74)	(2.83)	(2.73)	(2.93)	(3.01)	(2.92)
MP corr	0.023	0.004	0.016	-0.004	-0.005	-0.006	0.0002	-0.021	-0.005	-0.002	-0.022	-0.008
	(0.26)	(0.05)	(0.18)	(-0.05)	(-0.06)	(-0.07)	0.00	(-0.24)	(-0.06)	(-0.02)	(-0.25)	(-0.09)
NER	-1.190***	-1.153***	-1.159***	-1.213***	-1.183***	-1.045***	-1.090***	-1.07***	-1.08***	-0.957***	-0.941***	-0.945***
movement	(-3.53)	(-3.38)	(-3.41)	(-3.87)	(-3.58)	(-3.15)	(-3.18)	(-3.10)	(-3.12)	(-2.78)	(-2.72)	(-2.73)
constant	0.428***	0.444***	0.423***	0.379***	0.332***	0.256***	0.325	0.345***	0.330***	0.244**	0.260*	0.247**
	(6.03)	(6.30)	(5.90)	(3.88)	(3.44)	(2.63)	(3.32)	(3.52)	(3.37)	(2.44)	(2.60)	(2.46)
# of obs.	193	193	192	197	197	198	193	192	192	193	192	192
R^2	0.1478	0.1501	0.1322	0.1324	0.1414	0.1615	0.1583	0.1615	0.1610	0.1772	0.1801	0.1798
Adjusted R^2	0.1296	0.1320	0.1341	0.1195	0.1235	0.1441	0.1358	0.1390	0.1385	0.1552	0.1581	0.1578
Root MSE	0.50685	0.50814	0.5068	0.5142	0.50487	0.49763	0.50504	0.50536	0.50551	0.49934	0.49974	0.49982

Note: (i) The dependent variable is real GDP correlation between any two countries (Eurozone is treated as a whole.) for the three sub-periods, 1976-1984 (Period 1), 1985-1996 (Period 2) and 1999-2007 (Period 3). Three trade intensity measures, wx, wm, and wt are defined as in equations (1), (2) and (3) based on exports, imports and total trade respectively. The intra-industry trade measures, IIT2, IIT3 and IIT4 are defined as in equation (4) based on SITC two-, three- and four-digit classifications.

(ii) Three added control regressors, FP corr, MP corr and NER (RER) comovement are measures of the fiscal policy correlation, monetary policy correlation and nominal (real) exchange rate comovement.

(iii) The values in parentheses are t-ratios. *, ** and *** are the significance at 10%, 5% and 1% of the estimated coefficients, respectively.

Table 6b: The Effects of Trade on Business Cycle Co-movement among 11 Asian Countries & US & Eurozone (HP filter De-trended & Panel Regression: Random Effects)

	1	2	3	4	5	6	7	8	9	10	11	12
wx	0.187**						0.167**			0.146*		
	(2.25)						(2.00)			(1.75)		
wm		0.199**						0.179**			0.155*	
		(2.38)						(2.10)			(1.83)	
wt			0.219**						0.193**			0.167*
			(2.40)						(2.07)			(1.81)
IIT_2				0.138***								
				(1.03)								
IIT_3					0.346*		0.300	0.275	0.276			
					(1.81)		(1.53)	(1.39)	(1.40)			
IIT_4						0.633***				0.606**	0.588**	0.591**
						(2.84)				(2.59)	(2.49)	(2.50)
FP corr	0.222***	0.229***	0.221***	0.231**	0.247***	0.258*	0.221***	0.228***	0.221***	0.233***	0.239***	0.233***
	(2.76)	(2.83)	(2.73)	(3.06)	(3.14)	(3.32)	(2.74)	(2.83)	(2.73)	(2.39)	(3.01)	(2.92)
MP corr	0.023	0.004	0.016	-0.004	-0.005	-0.006	0.0002	-0.021	-0.005	-0.002	-0.022	-0.008
	(0.26)	(0.05)	(0.18)	(-0.04)	(-0.06)	(-0.07)	0.00	(-0.24)	(-0.06)	(-0.02)	(-0.25)	(-0.09)
NER	-1.19***	-1.153***	-1.159***	-1.251***	-1.183***	-1.045***	-1.09***	-1.07***	-1.08***	-0.957***	-0.941***	-0.945***
movement	(-3.53)	(-3.38)	(-3.41)	(-3.97)	(-3.58)	(-3.15)	(-3.18)	(-3.10)	(-3.12)	(-2.78)	(-2.72)	(-2.73)
constant	0.428***	0.444***	0.423***	0.412***	0.332***	0.256***	0.325***	0.345***	0.330***	0.244**	0.260***	0.247**
	(6.03)	(6.30)	(5.90)	(4.11)	(3.44)	(2.63)	(3.32)	(3.52)	(3.37)	(2.44)	(2.60)	(2.46)
# of observation	193	193	192	197	197	198	193	192	192	193	192	192
R^2_within	0.0217	0.0202	0.0194	0.0331	0.0451	0.0599	0.0431	0.0409	0.0388	0.0631	0.0603	0.0591
R^2_between	0.3931	0.4131	0.4209	0.3675	0.3559	0.3470	0.3694	0.3824	0.3903	0.3589	0.3772	0.3774
R^2_overall	0.1478	0.1501	0.1522	0.1312	0.1414	0.1615	0.1583	0.1615	0.1610	0.1772	0.1801	0.1798
Sigma_e	0.5334	0.5375	0.5362	0.5175	0.5141	0.5124	0.5204	0.5224	0.5218	0.5147	0.5164	0.5163
Sigma_u	0	0	0	0	0	0	0	0	0	0	0	0
rho	0	0	0	0	0	0	0	0	0	0	0	0

Note: See the note to Table 6a.

Table 6c: The Effects of Trade on Business Cycle Co-movement among 11 Asian Countries & US & Eurozone (HP filter De-trended & Panel Regression: Fixed Effects)

	1	2	3	4	5	6	7	8	9	10	11	12
wx	0.095						-0.079			-0.079		
	(0.46)						(-0.37)			(-0.38)		
wm		0.067						-0.065			-0.128	
		(0.33)						(-0.32)			(-0.62)	
wt			0.037						-0.137			-0.147
			(0.17)						(-0.62)			(-0.67)
IIT_2				0.421***								
				(2.26)								
IIT_3					0.646***		0.685**	0.688***	0.712***			
					(2.63)		(2.60)	(2.61)	(2.70)			
IIT_4						0.888***				0.997***	1.032***	1.021***
						(2.89)				(3.06)	(3.10)	(3.13)
FP corr	0.126	0.112	0.124	0.123	0.118	0.111	0.117	0.12	0.116	0.115	0.123	0.117
	(1.11)	(0.98)	(1.08)	(1.12)	(1.08)	(1.02)	(1.06)	(1.07)	(1.05)	(1.05)	(1.12)	(1.06)
MP corr	0.026	0.041	0.024	-0.004	-0.009	-0.025	-0.008	0.002	-0.00002	-0.008	-0.0003	-0.0039
	(0.22)	(0.34)	(0.19)	(-0.06)	(-0.08)	(-0.22)	(-0.07)	(0.02)	0.00	(-0.07)	0.00	(-0.03)
NER	-0.423	-0.430	-0.444	-0.185	-0.169	-0.131	-0.18	-0.162	-0.194	-0.076	-0.094	-0.111
movement	(-0.91)	(-0.91)	(-0.94)	(-0.42)	(-0.39)	(-0.3)	(-0.39)	(-0.35)	(-0.41)	(-0.16)	(-0.20)	(-0.24)
constant	0.311***	0.325***	0.320***	0.083	0.079	0.050	0.08	0.069	0.078	0.023	0.01	0.028
	(3.29)	(3.55)	(3.30)	(0.76)	(0.64)	(0.39)	(0.62)	(0.53)	(0.60)	(0.18)	(0.08)	(0.21)
# of observation	193	193	192	197	197	198	193	192	192	193	192	192
R^2_within	0.0227	0.0213	0.0208	0.0612	0.0763	0.0864	0.0782	0.0788	0.0811	0.0981	0.0998	0.1003
R^2_between	0.3662	0.4170	0.4206	0.1007	0.1103	0.128	0.0539	0.0574	0.0199	0.0748	0.0498	0.0426
R^2_overall	0.1426	0.1426	0.1381	0.0645	0.0821	0.1104	0.0566	0.0599	0.0406	0.0872	0.0729	0.0694
Sigma_e	0.5334	0.5375	0.5362	0.5187	0.5141	0.5124	0.5204	0.5224	0.5218	0.5147	0.5164	0.5163
Sigma_u	0.3342	0.3369	0.3392	0.3653	0.3517	0.3420	0.3653	0.3648	0.3755	0.3621	0.3702	0.3718
rho	0.2819	0.2821	0.2858	0.3267	0.3187	0.3083	0.3301	0.3278	0.3412	0.3311	0.3394	0.3415

Note: See the note to Table 6a.

Table 7a: The Effects of Trade on Business Cycle Co-movement among 11 Asian Countries & US & Eurozone (Excluding 9798 Data & Linear De-trended & Pool Regression)

	1	2	3	4	5	6	7	8	9	10	11	12
wx	0.218**						0.200**			0.188**		
	(2.53)						(2.33)			(2.17)		
wm		0.221***						0.201**			0.189**	
		(2.61)						(2.36)			(2.22)	
wt			0.274***						0.251***			0.239**
			(2.94)						(2.68)			(2.55)
IIT_2				0.369***								
				(2.06)								
IIT_3					0.417**		0.377*	0.359*	0.351*			
					(2.11)		(1.88)	(1.78)	(1.74)			
IIT_4						0.577**				0.544**	0.532**	0.521**
						(2.47)				(2.24)	(2.18)	(2.15)
FP corr	0.140**	0.148**	0.135**	0.151**	0.155**	0.158**	0.149**	0.154**	0.144**	0.153**	0.157**	0.148**
	(2.15)	(2.26)	(2.07)	(2.26)	(2.40)	(2.46)	(2.30)	(2.53)	(2.21)	(2.37)	(2.42)	(2.28)
MP corr	0.163**	0.139*	0.157*	0.142	0.112	0.107	0.13	0.106	0.126	0.127	0.104	0.123
	(1.97)	(1.68)	(1.90)	(1.43)	(1.35)	(1.31)	(1.54)	(1.26)	(1.50)	(1.52)	(1.25)	(1.48)
NER	-1.247***	-1.242***	-1.201***	-1.212***	-1.172***	-1.108***	-1.08***	-1.091***	-1.051***	-1.017***	-1.024***	-0.986***
movement	(-3.62)	(-3.61)	(3.48)	(-3.31)	(-3.42)	(-3.22)	(-3.06)	(-3.08)	(-2.97)	(-2.86)	(-2.87)	(-2.77)
constant	0.427***	0.450***	0.419***	0.327***	0.298***	0.273***	0.291***	0.319***	0.294***	0.261**	0.284***	0.261**
	(6.09)	(6.51)	(5.98)	(3.23)	(3.01)	(2.75)	(2.90)	(3.17)	(2.94)	(2.57)	(2.79)	(2.58)
# of obs.	193	193	192	197	197	198	193	192	192	193	192	192
R^2	0.1538	0.1558	0.1636	0.1372	0.1451	0.1513	0.1695	0.1701	0.177	0.176	0.1771	0.1838
Adjusted R^2	0.1358	0.1379	0.1457	0.1113	0.1273	0.1337	0.1473	0.1478	0.1549	0.1540	0.1550	0.1619
Root MSE	0.52067	0.52107	0.51901	0.52547	0.5193	0.51618	0.5172	0.51836	0.5162	0.51516	0.51617	0.51406

Note: (i) The dependent variable is real GDP correlation between any two countries (Eurozone is treated as a whole.) for the three sub-periods, 1976-1984 (Period 1), 1985-1996 (Period 2) and 1999-2007 (Period 3). Three trade intensity measures, wx, wm, and wt are defined as in equations (1), (2) and (3) based on exports, imports and total trade respectively. The intra-industry trade measures, IIT2, IIT3 and IIT4 are defined as in equation (4) based on SITC two-, three- and four-digit classifications.

(ii) Three added control regressors, FP corr, MP corr and NER (RER) comovement are measures of the fiscal policy correlation, monetary policy correlation and nominal (real) exchange rate comovement.

(iii) The values in parentheses are t-ratios. *, ** and *** are the significance at 10%, 5% and 1% of the estimated coefficients, respectively.

Table 7b: The Effects of Trade on Business Cycle Co-movement among 11 Asian Countries & US & Eurozone (Excluding 9798 Data & Linear De-trended & Panel Regression: Random Effects)

	1	2	3	4	5	6	7	8	9	10	11	12
wx	0.218**						0.200**			0.188**		
	(2.53)						(2.33)			(2.17)		
wm		0.221***						0.201**			0.189**	
		(2.61)						(2.36)			(2.22)	
wt			0.274***						0.251***			0.239**
			(2.94)						(2.68)			(2.55)
IIT_2				0.328***								
				(2.03)								
IIT_3					0.417**		0.377*	0.359*	0.351*			
					(2.11)		(1.88)	(1.78)	(1.74)			
IIT_4						0.577**				0.544**	0.532***	0.521**
						(2.47)				(2.24)	(2.18)	(2.15)
FP corr	0.140**	0.148**	0.135**	0.148**	0.155**	0.158**	0.149**	0.154**	0.144**	0.153**	0.157**	0.148**
	(2.15)	(2.26)	(2.07)	(2.37)	(2.40)	(2.46)	(2.30)	(2.35)	(2.21)	(2.37)	(2.42)	(2.28)
MP corr	0.163**	0.139*	0.157*	0.124	0.112	0.107	0.13	0.106	0.126	0.127	0.104	0.123
	(1.97)	(1.68)	(1.90)	(1.43)	(1.35)	(1.31)	(1.54)	(1.26)	(1.50)	(1.52)	(1.25)	(1.48)
NER	-1.247***	-1.243***	-1.201***	-1.212***	-1.172***	-1.108***	-1.08***	-1.091***	-1.051***	-1.017***	-1.024***	-0.986**
movement	(-3.62)	(-3.61)	(-3.48)	(-3.61)	(-3.42)	(-3.22)	(-3.06)	(-3.08)	(-2.97)	(-2.86)	(-2.87)	(-2.77)
constant	0.427***	0.450***	0.419***	0.317***	0.298***	0.273***	0.291***	0.319***	0.294***	0.261*	0.284***	0.261***
	(6.09)	(6.51)	(5.98)	(4.01)	(3.01)	(2.75)	(2.90)	(3.17)	(2.94)	(2.57)	(2.79)	(2.58)
# of observation	193	193	192	197	197	198	193	192	192	193	192	192
R^2_within	0.0951	0.0953	0.0931	0.1407	0.1395	0.1372	0.137	0.1361	0.1335	0.1417	0.1395	0.1386
R^2_between	0.2819	0.3105	0.3208	0.1942	0.1777	0.1585	0.2322	0.2574	0.2675	0.2130	0.2426	0.2491
R^2_overall	0.1538	0.1558	0.1636	0.1342	0.1451	0.1513	0.1695	0.1701	0.177	0.176	0.1771	0.1838
Sigma_e	0.5377	0.5384	0.5401	0.5085	0.5126	0.5182	0.5189	0.5207	0.5208	0.52003	0.5224	0.5223
Sigma_u	0	0	0	0	0	0	0	0	0	0	0	0
rho	0	0	0	0	0	0	0	0	0	0	0	0

Note: See the note to Table 7a.

Table 7c: The Effects of Trade on Business Cycle Co-movement among 11 Asian Countries & US & Eurozone (Excluding 9798 Data & Linear De-trended & Panel Regression: Fixed Effects)

	1	2	3	4	5	6	7	8	9	10	11	12
wx	0.094						-0.008			0.012		
	(0.44)						(-0.04)			(0.06)		
wm		0.107						0.045			0.036	
		(0.54)						(0.24)			(0.02)	
wt			0.09						0.014			0.021
			(0.39)						(0.06)			(0.09)
IIT_2				0.657***								
				(3.31)								
IIT_3					0.781***		0.788***	0.791***	0.797***			
					(3.12)		(3.05)	(3.05)	(3.08)			
IIT_4						0.899***				0.969***	0.970***	0.968***
						(2.83)				(2.97)	(2.93)	(2.96)
FP corr	0.131	0.129	0.130	0.137*	0.148*	0.155*	0.153*	0.147	0.147	0.157*	0.157*	0.157*
	(1.46)	(1.41)	(1.42)	(1.64)	(1.74)	(1.81)	(1.76)	(1.66)	(1.66)	(1.80)	(1.75)	(1.76)
MP corr	0.232**	0.234**	0.230**	0.194*	0.182*	0.167	0.189*	0.193*	0.194*	0.181*	0.182	0.181
	(2.10)	(2.10)	(2.05)	(1.86)	(1.74)	(1.57)	(1.75)	(1.77)	(1.78)	(1.67)	(1.66)	(1.65)
NER	-0.758*	-0.75	-0.749	-0.308	-0.311	-0.365	-0.317	-0.275	-0.281	-0.308	-0.307	-0.301
movement	(-1.68)	(-2.1)	(-1.63)	(-0.66)	(-0.71)	(-0.83)	(-0.69)	(-0.59)	(-0.60)	(-0.66)	(-0.66)	(-0.64)
constant	0.343***	0.353***	0.343***	0.035	0.04	0.065	0.044	0.038	0.034	0.04	0.04	0.039
	(3.87)	(4.02)	(3.80)	(0.22)	(0.32)	(0.51)	(0.33)	(0.28)	(0.25)	(0.30)	(0.30)	(0.29)
# of observation	193	193	192	197	197	198	193	192	192	193	192	192
R^2_within	0.1045	0.1064	0.1038	0.1865	0.1728	0.1590	0.1732	0.1747	0.1743	0.1697	0.1692	0.1694
R^2_between	0.2337	0.2478	0.2496	0.0432	0.0572	0.0694	0.0547	0.0715	0.058	0.0699	0.0675	0.0740
R^2_overall	0.1322	0.134	0.1336	0.1098	0.1111	0.1274	0.1092	0.1178	0.1117	0.1313	0.1292	0.1330
Sigma_e	0.5377	0.5384	0.5401	0.5112	0.5126	0.5182	0.5189	0.5207	0.5208	0.52	0.5224	0.5223
Sigma_u	0.3395	0.3366	0.3378	0.3698	0.3675	0.3602	0.3720	0.3677	0.3713	0.3701	0.3709	0.3690
rho	0.285	0.281	0.2812	0.3407	0.3395	0.3257	0.3395	0.3328	0.337	0.3362	0.3351	0.3329

Note: See the note to Table 7a.

Table 8a: The Effects of Trade on Business Cycle Co-movement among 11 Asian Countries & US & Eurozone (Excluding 9798 Data & HP filter De-trended & Pool Regression)

	1	2	3	4	5	6	7	8	9	10	11	12
wx	0.238***						0.220***			0.197**		
	(2.83)						(2.63)			(2.37)		
wm		0.237***						0.216**			0.192**	
		(2.86)						(2.60)			(2.34)	
wt			0.281***						0.256***			0.232**
			(3.07)						(2.80)			(2.56)
IIT_2				0.152**								
				(2.28)								
IIT_3					0.447**		0.407**	0.384*	0.385**			
					(2.32)		(2.10)	(1.96)	(1.97)			
IIT_4						0.779***				0.745***	0.732***	0.731***
						(3.49)				(3.22)	(3.15)	(3.16)
FP corr	0.192**	0.199**	0.188*	0.129*	0.219***	0.231***	0.188**	0.197**	0.186**	0.201***	0.209***	0.199**
	(2.46)	(2.55)	(2.41)	(2.55)	(2.87)	(3.08)	(2.44)	(2.55)	(2.40)	(2.65)	(2.75)	(1.61)
MP corr	0.033	0.012	0.023	-0.011	-0.016	-0.021	-0.004	-0.027	-0.012	-0.009	-0.032	-0.018
	(0.39)	(0.14)	(0.27)	(-0.18)	(-0.19)	(-0.25)	(-0.04)	(-0.31)	(-0.14)	(-0.11)	(-0.38)	(-0.22)
NER	-1.383***	-1.373***	-1.352***	-1.32***	-1.29***	-1.143***	-1.187***	-1.201***	-1.173***	-1.045***	-1.054***	-1.028***
movement	(-4.17)	(-4.12)	(-4.06)	(-3.98)	(-3.87)	(-3.46)	(-3.47)	(-3.50)	(-3.42)	(-3.07)	(-3.09)	(-3.01)
constant	0.489***	0.515***	0.486***	0.436***	0.346***	0.264***	0.339***	0.370***	0.346***	0.255***	0.280***	0.258***
	(7.33)	(7.78)	(7.27)	(3.79)	(3.58)	(2.77)	(3.49)	(3.79)	(3.55)	(2.62)	(2.86)	(2.65)
# of obs.	193	193	192	197	197	198	193	192	192	193	192	192
R^2	0.1684	0.1686	0.1758	0.1436	0.1589	0.1865	0.1875	0.1882	0.1927	0.2122	0.2133	0.2178
Adjusted R^2	0.1507	0.1509	0.1582	0.1235	0.1414	0.1696	0.1658	0.1663	0.171	0.1911	0.1921	0.1967
Root MSE	0.50788	0.50956	0.50689	0.52122	0.50721	0.49753	0.50336	0.50443	0.50302	0.49566	0.49657	0.49514

Note: (i) The dependent variable is real GDP correlation between any two countries (Eurozone is treated as a whole.) for the three sub-periods, 1976-1984 (Period 1), 1985-1996 (Period 2) and 1999-2007 (Period 3). Three trade intensity measures, wx, wm, and wt are defined as in equations (1), (2) and (3) based on exports, imports and total trade respectively. The intra-industry trade measures, IIT2, IIT3 and IIT4 are defined as in equation (4) based on SITC two-, three- and four-digit classifications.

(ii) Three added control regressors, FP corr, MP corr and NER (RER) comovement are measures of the fiscal policy correlation, monetary policy correlation and nominal (real) exchange rate comovement.

(iii) The values in parentheses are t-ratios. *, ** and *** are the significance at 10%, 5% and 1% of the estimated coefficients, respectively.

Table 8b: The Effects of Trade on Business Cycle Co-movement among 11 Asian Countries & US & Eurozone (Excluding 9798 Data & HP filter De-trended & Panel Regression: Random Effects)

	1	2	3	4	5	6	7	8	9	10	11	12
wx	0.238***						0.220***			0.197**		
	(2.83)						(2.63)			(2.37)		
wm		0.237***						0.216***			0.192**	
		(2.86)						(2.60)			(2.34)	
wt			0.281***						0.256***			0.232**
			(3.07)						(2.80)			(2.56)
IIT_2				0.221***								
				(2.17)								
IIT_3					0.447**		0.407**	0.384*	0.385**			
					(2.32)		(2.10)	(1.96)	(1.97)			
IIT_4						0.779***				0.745***	0.732***	0.731***
						(3.49)				(3.22)	(3.15)	(3.16)
FP corr	0.192**	0.199**	0.188**	0.191***	0.219***	0.231***	0.188**	0.197**	0.186**	0.201***	0.209***	0.199***
	(2.46)	(2.55)	(2.41)	(1.97)	(2.87)	(3.08)	(2.44)	(2.55)	(2.40)	(2.65)	(2.75)	(2.61)
MP corr	0.033	0.012	0.023	-0.012	-0.016	-0.021	-0.004	-0.027	-0.012	-0.009	-0.032	-0.018
	(0.39)	(0.14)	(0.27)	(-0.13)	(-0.19)	(-0.25)	(-0.04)	(-0.31)	(-0.14)	(-0.11)	(-0.38)	(-0.22)
NER	-1.383***	-1.373***	-1.352***	-1.35***	-1.29***	-1.14***	-1.187***	-1.201***	-1.173***	-1.045***	-1.054***	-1.028***
movement	(-4.17)	(-4.12)	(-4.06)	(-3.95)	(-3.87)	(-3.46)	(-3.47)	(-3.50)	(-3.55)	(-3.07)	(-3.09)	(-3.01)
constant	0.489***	0.525***	0.486***	0.432***	0.346***	0.264***	0.339***	0.370***	0.346***	0.255***	0.280***	0.258***
	(7.33)	(7.78)	(7.27)	(0.92)	(3.58)	(2.77)	(3.49)	(3.79)	(3.55)	(2.62)	(2.86)	(2.65)
# of observation	193	193	192	197	197	198	193	192	192	193	192	192
R^2_within	0.0322	0.035	0.0303	0.0675	0.0754	0.1005	0.0666	0.0684	0.0628	0.0948	0.0955	0.0915
R^2_between	0.4676	0.4678	0.5028	0.3966	0.3787	0.3597	0.4363	0.4352	0.4639	0.4181	0.4314	0.448
R^2_overall	0.1684	0.1686	0.1758	0.1325	0.1589	0.1865	0.1875	0.1882	0.1927	0.2122	0.2133	0.2178
Sigma_e	0.54502	0.5476	0.5472	0.5351	0.5217	0.5119	0.5266	0.5304	0.5289	0.5173	0.5204	0.5194
Sigma_u	0	0	0	0	0	0	0	0	0	0	0	0
rho	0	0	0	0	0	0	0	0	0	0	0	0

Note: See the note to Table 8a.

Table 8c: The Effects of Trade on Business Cycle Co-movement among 11 Asian Countries & US & Eurozone (Excluding 9798 Data & HP filter De-trended & Panel Regression: Fixed Effects)

	1	2	3	4	5	6	7	8	9	10	11	12
wx	-0.072						-0.178			-0.176		
	(-0.33)						(-0.83)			(-0.85)		
wm		0.013						-0.044			-0.116	
		(0.06)						(-0.22)			(-0.60)	
wt			-0.104						-0.182			-0.194
			(-0.45)						(-0.81)			(-0.88)
IIT_2				0.532***								
				(0.98)								
IIT_3					0.741***		0.784***	0.763***	0.780***			
					(2.93)		(3.01)	(2.90)	(2.98)			
IIT_4						1.095***				1.178***	1.180***	1.173***
						(3.54)				(3.67)	(3.61)	(3.65)
FP corr	0.074	0.074	0.077	0.065	0.070	0.071	0.063	0.071	0.066	0.064	0.079	0.07
	(0.66)	(0.65)	(0.69)	(0.62)	(0.66)	(0.68)	(0.58)	(0.65)	(0.61)	(0.60)	(0.74)	(0.66)
MP corr	0.04	0.054	0.042	0.001	0.003	-0.013	0.001	0.012	0.014	-0.006	0.0001	0.002
	(0.33)	(0.44)	(0.34)	(0.02)	(0.03)	(-0.12)	(0.01)	(0.10)	(0.12)	(-0.05)	0.00	(0.01)
NER	-0.86*	-0.833*	-0.883*	-0.413	-0.347	-0.25	-0.377	-0.34	-0.385	-0.242	-0.231	-0.27
movement	(-1.95)	(-1.87)	(-1.96)	(-0.99)	(-0.80)	(-0.59)	(-0.83)	(-0.73)	(-0.83)	(-0.54)	(-0.51)	(-0.59)
constant	0.424***	0.421***	0.429***	0.132	0.115	0.053	0.119	0.111	0.121	0.043	0.028	0.049
	(4.96)	(5.00)	(4.94)	(1.12)	(0.90)	(0.42)	(0.91)	(0.82)	(0.90)	(0.33)	(0.21)	(0.37)
# of observation	193	193	192	197	197	198	193	192	192	193	192	192
R^2_within	0.0403	0.0331	0.0412	0.0923	0.1054	0.1321	0.1119	0.1073	0.1121	0.1432	0.1405	0.1437
R^2_between	0.1958	0.0296	0.1116	0.1197	0.1298	0.1309	0.0070	0.0855	0.0046	0.0292	0.0622	0.0224
R^2_overall	0.0777	0.0192	0.0604	0.0972	0.1059	0.1349	0.0427	0.0901	0.0439	0.0779	0.1029	0.076
Sigma_e	0.545	0.4210	0.5472	0.5342	0.5217	0.5119	0.5266	0.5304	0.5289	0.5173	0.5204	0.5194
Sigma_u	0.3343	0.2645	0.3406	0.3318	0.3314	0.3312	0.3679	0.3412	0.3686	0.3651	0.3523	0.3681
rho	0.2733	0.2829	0.2793	0.2754	0.2875	0.2951	0.328	0.2927	0.3269	0.3325	0.3143	0.3343

Note: See the note to Table 8a.

Table 6.1.1 China's Trade Intensity Measures and Intra-Industry Trade Measure

WX	CHN---HKG	CHN---IDN	CHN---IND	CHN---JPN	CHN---KOR	CHN---MYS	CHN---PHL	CHN---SGP	CHN---THA	CHN---TWN	CHN---USA	CHN---EUA	simple Ave.	weighted Ave.
P1	***0.1214***	0.0017	***0.0011***	0.0275	0.0000	0.0053	0.0083	0.0157	0.0081		0.0068		0.0196	0.0159
P2	***0.1462***	***0.0026***	0.0046	0.0321	0.0101	0.0050	0.0046	0.0180	0.0068	0.0121	0.0186		0.0236	0.0234
P3	***0.1113***	0.0091	0.0087	0.0584	0.0307	0.0100	***0.0060***	0.0160	0.0076	0.0440	0.0717	0.0366	0.0320	0.0241
P	***0.1269***	***0.0052***	0.0058	0.0427	0.0173	0.0072	0.0058	0.0168	0.0074	0.0376	0.0396	0.0366	0.0273	0.0219
WM	**CHN---HKG**	**CHN---IDN**	**CHN---IND**	**CHN---JPN**	**CHN---KOR**	**CHN---MYS**	**CHN---PHL**	**CHN---SGP**	**CHN---THA**	**CHN---TWN**	**CHN---USA**	**CHN---EUA**	**simple Ave.**	**weighted Ave.**
P1	***0.0317***	***0.0011***	0.0031	0.0364	0.0000	0.0054	0.0030	0.0027	0.0000		0.0130		0.0097	0.0026
P2	***0.0723***	0.0017	0.0107	0.0548	0.0141	0.0076	0.0019	0.0100	***0.0016***	0.0133	0.0140		0.0189	0.0089
P3	0.0164	***0.0084***	0.0131	***0.0787***	0.0691	0.0217	0.0116	0.0164	0.0304	0.0505	0.0192	0.0259	0.0283	0.0143
P	0.0413	***0.0045***	0.0105	***0.0621***	0.0356	0.0133	0.0063	0.0115	0.0250	0.0431	0.0161	0.0259	0.0229	0.0089
WT	**CHN---HKG**	**CHN---IDN**	**CHN---IND**	**CHN---JPN**	**CHN---KOR**	**CHN---MYS**	**CHN---PHL**	**CHN---SGP**	**CHN---THA**	**CHN---TWN**	**CHN---USA**	**CHN---EUA**	**simple Ave.**	**weighted Ave.**
P1	***0.0755***	***0.0014***	0.0020	0.0317	0.0000	0.0054	0.0055	0.0088	0.0000		0.0101		0.0140	0.0069
P2	***0.1085***	***0.0021***	0.0076	0.0420	0.0121	0.0062	0.0032	0.0136	0.0045	0.0127	0.0161		0.0216	0.0143
P3	0.0657	0.0088	0.0107	***0.0676***	0.0486	0.0154	***0.0086***	0.0162	0.0197	0.0470	0.0414	0.0176	0.0291	0.0144
P	***0.0845***	***0.0049***	0.0080	0.0514	0.0259	0.0101	0.0059	0.0139	0.0169	0.0401	0.0261	0.0170	0.0240	0.0121

IIT3	CHN---HKG	CHN---IDN	CHN---IND	CHN---JPN	CHN---KOR	CHN---MYS	CHN---PHL	CHN---SGP	CHN---THA	CHN---TWN	CHN---USA	CHN---EUA	simple Ave.	weighted Ave.
P1	0.0439	0.0255	0.0784	0.1229		0.0446	0.1622	0.1617	0.2759		0.2290	0.0754	0.1220	0.0123
P2	0.5097	0.1847	0.3719	0.2832	0.4387	0.3659	0.3328	0.4654	0.4784	0.1418	0.2952	0.1915	0.3383	0.0941
P3	0.3048	0.4929	0.4770	0.5155	0.4661	0.5254	0.3972	0.6724	0.5978	0.2865	0.4427	0.5049	0.4736	0.1618
P	0.3282	0.2348	0.3365	0.2975	0.3689	0.3299	0.3025	0.4590	0.4485	0.2061	0.3217	0.2543	0.3240	0.0965

Table 6.1.2 US's Trade Intensity Measures and Intra-Industry Trade Measure

WX	USA---CHN	USA---HKG	USA---IDN	USA---IND	USA---JPN	USA---KOR	USA---MYS	USA---PHL	USA---SGP	USA---THA	USA---TWN	USA ---EUA	simple Ave.	weighted Ave.
P1	0.0068	0.0276	0.0048	0.0172	***0.1137***	0.0290	0.0078	0.0077	0.0137	***0.0042***	0.0406		0.0228	0.0169
P2	0.0186	0.0453	***0.0081***	0.0105	***0.1418***	0.0422	0.0146	0.0085	0.0260	0.0122	0.0307		0.0299	0.0265
P3	0.0717	0.0419	0.0132	***0.0096***	***0.0983***	0.0337	0.0226	0.0105	0.0230	0.0163	0.0309	0.0597	0.0359	0.0239
P	0.0396	0.0408	0.0097	0.0112	***0.1183***	0.0363	0.0169	***0.0092***	0.0227	0.0127	0.0125	0.0597	0.0325	0.0235
WM	**USA---CHN**	**USA---HKG**	**USA---IDN**	**USA---IND**	**USA---JPN**	**USA---KOR**	**USA---MYS**	**USA---PHL**	**USA---SGP**	**USA---THA**	**USA---TWN**	**USA ---EUA**	**simple Ave.**	**weighted Ave.**
P1	0.0130	0.0089	0.0055	0.0071	0.0147	***0.0197***	0.0068	0.0065	0.0124	***0.0045***	0.0159		0.0096	0.0014
P2	0.0140	0.0116	***0.0039***	0.0045	***0.0283***	0.0263	0.0094	0.0049	0.0164	0.0067	0.0213		0.0123	0.0027
P3	0.0192	0.0093	0.0044	***0.0023***	0.0222	0.0182	0.0095	0.0054	0.0149	0.0055	0.0145	***0.0741***	0.0166	0.0074
P	0.0161	0.0101	0.0044	***0.0040***	0.0234	0.0217	0.0090	0.0054	0.0151	0.0058	0.0175	***0.0741***	0.0172	0.0076
WT	**USA---CHN**	**USA---HKG**	**USA---IDN**	**USA---IND**	**USA---JPN**	**USA---KOR**	**USA---MYS**	**USA---PHL**	**USA---SGP**	**USA---THA**	**USA---TWN**	**USA ---EUA**	**simple Ave.**	**weighted Ave.**
P1	0.0101	0.0171	0.0051	0.0118	***0.0854***	0.0236	0.0072	0.0070	0.0129	***0.0044***	0.0268		0.0176	0.0094
P2	0.0161	0.0261	***0.0057***	0.0072	***0.1013***	0.0328	0.0116	0.0064	0.0205	0.0090	0.0341	0.0101	0.0234	0.0143
P3	0.0414	0.0222	0.0077	***0.0054***	***0.0643***	0.0243	0.0146	0.0073	0.0181	0.0096	0.0210	0.0117	0.0206	0.0083
P	0.0261	0.0229	***0.0065***	0.0072	***0.0826***	0.0276	0.0122	0.0069	0.0182	0.0085	0.0272	0.0113	0.0214	0.0103

IIT3	USA---CHN	USA---HKG	USA---IDN	USA---IND	USA---JPN	USA---KOR	USA---MYS	USA---PHL	USA---SGP	USA---THA	USA---TWN	USA---EUA	simple Ave.	weighted Ave.
P1	0.2290	0.3789	0.0827	0.0005	0.2722	0.1884	0.1739	0.0738	0.0042	0.1280	0.0185	0.0147	0.1304	0.0398
P2	0.2952	0.3406	0.1017	0.1671	0.3512	0.4052	0.1784	0.2988	0.0608	0.1533	0.2921	0.2102	0.2379	0.0830
P3	0.4427	0.3824	0.2090	0.3270	0.5115	0.6299	0.1543	0.6062	0.2825	0.2390	0.4964	0.7783	0.4216	0.1121
P	0.3217	0.3629	0.1286	0.1713	0.3716	0.3999	0.1701	0.3223	0.1118	0.1639	0.2817	0.3278	0.2611	0.0796

Table 6.1.3 Japan's Trade Intensity Measures and Intra-Industry Trade Measure

WX	JPN---CHN	JPN---HKG	JPN---IDN	JPN---IND	JPN---KOR	JPN---MYS	JPN---PHL	JPN---SGP	JPN---THA	JPN---TWN	JPN---USA	JPN---EUA	simple Ave.	weighted Ave.
P1	0.0275	0.0060	***0.0050***	0.0633	0.0342	0.0157	0.0110	0.0259	0.0143	0.0328	***0.1137***		0.0318	0.0213
P2	0.0321	0.0126	***0.0050***	0.0303	0.0473	0.0190	0.0100	0.0311	0.0252	0.0457	***0.1418***		0.0364	0.0286
P3	0.0584	0.0166	***0.0037***	0.0261	0.0475	0.0204	0.0166	0.0268	0.0279	0.0536	***0.0983***	0.0339	0.0358	0.0225
P	0.0427	0.0132	***0.0044***	0.0340	0.0452	0.0190	0.0130	0.0284	0.0245	0.0470	***0.1183***	0.0339	0.0353	0.0245
WM	**JPN---CHN**	**JPN---HKG**	**JPN---IDN**	**JPN---IND**	**JPN---KOR**	**JPN---MYS**	**JPN---PHL**	**JPN---SGP**	**JPN---THA**	**JPN---TWN**	**JPN---USA**	**JPN---EUA**	**simple Ave.**	**weighted Ave.**
P1	***0.0364***	0.0353	0.0070	0.0239	0.0214	0.0229	0.0111	0.0104	0.0175	***0.0068***	0.0147		0.0189	0.0050
P2	***0.0548***	0.0496	***0.0075***	0.0179	0.0378	0.0255	0.0095	0.0116	0.0338	0.0160	0.0283		0.0266	0.0103
P3	***0.0787***	0.0427	0.0059	0.0076	0.0320	0.0263	0.0147	0.0106	0.0276	0.0219	0.0222	***0.0042***	0.0245	0.0119
P	***0.0621***	0.0442	0.0067	0.0144	0.0326	0.0254	0.0120	0.0110	0.0284	0.0170	0.0234	***0.0042***	0.0234	0.0097
WT	**JPN---CHN**	**JPN---HKG**	**JPN---IDN**	**JPN---IND**	**JPN---KOR**	**JPN---MYS**	**JPN---PHL**	**JPN---SGP**	**JPN---THA**	**JPN---TWN**	**JPN---USA**	**JPN---EUA**	**simple Ave.**	**weighted Ave.**
P1	0.0317	***0.0032***	0.0060	0.0453	0.0279	0.0191	0.0110	0.0183	0.0109	0.0249	***0.0854***		0.0258	0.0127
P2	0.0420	***0.0047***	0.0060	0.0267	0.0431	0.0216	0.0097	0.0225	0.0218	0.0392	***0.1013***		0.0308	0.0177
P3	***0.0676***	0.0081	***0.0048***	0.0199	0.0402	0.0231	0.0157	0.0194	0.0263	0.0402	0.0643	0.0073	0.0281	0.0143
P	0.0514	0.0059	***0.0055***	0.0268	0.0393	0.0218	0.0125	0.0204	0.0219	0.0372	***0.0826***	0.0072	0.0277	0.0148

IIT3	JPN---CHN	JPN---HKG	JPN---IDN	JPN---IND	JPN---KOR	JPN---MYS	JPN---PHL	JPN---SGP	JPN---THA	JPN---TWN	JPN---USA	JPN---EUA	simple Ave.	weighted Ave.
P1	0.1229	0.1768	0.1063	0.0674	0.0303	0.0335	0.0787	0.1478	0.0211	0.0458	0.2722	0.0283	0.0943	0.0378
P2	0.2832	0.2788	0.1300	0.0926	0.3386	0.2456	0.2475	0.2181	0.1951	0.3033	0.3512	0.2594	0.2453	0.0954
P3	0.5155	0.4016	0.1997	0.3255	0.5449	0.6570	0.6933	0.4292	0.5458	0.4860	0.5115	0.4774	0.4823	0.1722
P	0.2975	0.2810	0.1419	0.1490	0.2984	0.2950	0.3206	0.2558	0.2394	0.2727	0.3716	0.2641	0.2656	0.0972

Table 6.1.4 Thailand's Trade Intensity Measures and Intra-Industry Trade Measure

WX	THA---CHN	THA---HKG	THA---IDN	THA---IND	THA---JPN	THA---KOR	THA---MYS	THA---PHL	THA---SGP	THA---TWN	THA---USA	THA---EUA	simple Ave.	weighted Ave.
P1	0.0081	0.0077	0.0024	0.0017	0.0143	0.0056	0.0182	***0.0022***	***0.0326***	0.0034	0.0042		0.0084	0.0018
P2	0.0068	0.0073	***0.0039***	0.0049	0.0252	0.0102	0.0189	0.0057	***0.0374***	0.0060	0.0122		0.0115	0.0028
P3	0.0076	0.0073	***0.0050***	0.0097	0.0279	0.0091	0.0242	0.0091	***0.0280***	0.0107	0.0163	0.0068	0.0135	0.0030
P	0.0074	0.0074	***0.0042***	0.0065	0.0245	0.0090	0.0211	0.0066	***0.0325***	0.0076	0.0127	0.0068	0.0122	0.0027
WM	**THA---CHN**	**THA---HKG**	**THA---IDN**	**THA---IND**	**THA---JPN**	**THA---KOR**	**THA---MYS**	**THA---PHL**	**THA---SGP**	**THA---TWN**	**THA---USA**	**THA---EUA**	**simple Ave.**	**weighted Ave.**
P1		0.0093	***0.0021***	0.0135	0.0175	0.0068	0.0094	0.0130	0.0178	***0.0218***	0.0045		0.0096	0.0017
P2	0.0016	0.0093	***0.0015***	0.0093	***0.0338***	0.0108	0.0159	0.0186	0.0243	0.0240	0.0067		0.0130	0.0032
P3	***0.0304***	0.0136	***0.0040***	0.0045	0.0276	0.0157	0.0223	0.0253	0.0252	0.0170	0.0055	0.0050	0.0163	0.0043
P	0.0250	0.0112	0.0027	0.0080	***0.0284***	0.0123	0.0176	0.0205	0.0236	0.0206	0.0058	***0.0050***	0.0150	0.0035
WT	**THA---CHN**	**THA---HKG**	**THA---IDN**	**THA---IND**	**THA---JPN**	**THA---KOR**	**THA---MYS**	**THA---PHL**	**THA---SGP**	**THA---TWN**	**THA---USA**	**THA---EUA**	**simple Ave.**	**weighted Ave.**
P1		0.0085	0.0022	0.0043	0.0109	0.0043	0.0184	***0.0021***	***0.0221***	0.0053	0.0044		0.0069	0.0011
P2	0.0045	0.0084	***0.0026***	0.0047	0.0218	0.0072	0.0167	0.0041	***0.0299***	0.0097	0.0090	0.0040	0.0102	0.0020
P3	0.0197	0.0105	0.0045	0.0116	0.0263	0.0082	0.0242	0.0098	***0.0279***	0.0119	0.0096	***0.0020***	0.0139	0.0031
P	0.0169	0.0093	0.0034	0.0076	0.0219	0.0072	0.0202	0.0063	***0.0277***	0.0099	0.0085	***0.0025***	0.0118	0.0024

IIT3	THA---CHN	THA---HKG	THA---IDN	THA---IND	THA---JPN	THA---KOR	THA---MYS	THA---PHL	THA---SGP	THA---TWN	THA---USA	THA---EUA	simple Ave.	weighted Ave.
P1	0.2759	0.4656	0.0499	0.0402	0.0211	0.1066	0.0052	0.1444	0.0168	0.0958	0.1280	0.0113	0.1134	0.0090
P2	0.4784	0.6418	0.2408	0.2567	0.1951	0.1375	0.1138	0.2055	0.0984	0.2226	0.1533	0.1241	0.2390	0.0243
P3	0.5978	0.6130	0.4710	0.5016	0.5458	0.5097	0.5422	0.5840	0.2422	0.6082	0.2390	0.5656	0.5017	0.0810
P	0.4485	0.5792	0.2451	0.2571	0.2394	0.2306	0.1983	0.2909	0.1128	0.2660	0.1639	0.2257	0.2715	0.0362

Table 6.1.1 (2) China's Trade Intensity Measures with Emerging Asia and ASEAN

WX	CHN---HKG	CHN---IDN	CHN---IND	CHN---KOR	CHN---MYS	CHN---PHL	CHN---SGP	CHN---THA	CHN---TWN	CHN-ASEAN simple Ave.	CHN-ASEAN weigh Ave.	simple Ave.	Weight-ed Ave.
P1	***0.1214***	0.0017	***0.0011***	0.0000	0.0053	0.0083	0.0157	0.0081		0.0077	0.0004	0.0202	0.0151
P2	***0.1462***	***0.0026***	0.0046	0.0101	0.0050	0.0046	0.0180	0.0068	0.0121	0.0078	0.0004	0.0233	0.0221
P3	***0.1113***	0.0091	0.0087	0.0307	0.0100	***0.0060***	0.0160	0.0076	0.0440	0.0097	0.0005	0.0270	0.0159
P	***0.1269***	***0.0052***	0.0058	0.0173	0.0072	0.0058	0.0168	0.0074	0.0376	0.0086	0.0005	0.0256	0.0183
WM	**CHN---HKG**	**CHN---IDN**	**CHN---IND**	**CHN---KOR**	**CHN---MYS**	**CHN---PHL**	**CHN---SGP**	**CHN---THA**	**CHN---TWN**	**CHN-ASEAN simple Ave.**	**CHN-ASEAN weigh Ave.**	**simple Ave.**	**Weight-ed Ave.**
P1	***0.0317***	***0.0011***	0.0031	0.0000	0.0054	0.0030	0.0027	0.0000		0.0029	0.0001	0.0059	0.0011
P2	***0.0723***	0.0017	0.0107	0.0141	0.0076	0.0019	0.0100	***0.0016***	0.0133	0.0063	0.0003	0.0148	0.0059
P3	0.0164	***0.0084***	0.0131	0.0691	0.0217	0.0116	0.0164	0.0304	0.0505	0.0187	0.0020	0.0264	0.0096
P	0.0413	***0.0045***	0.0105	0.0356	0.0133	0.0063	0.0115	0.0250	0.0431	0.0133	0.0011	0.0212	0.0059
WT	**CHN---HKG**	**CHN---IDN**	**CHN---IND**	**CHN---KOR**	**CHN---MYS**	**CHN---PHL**	**CHN---SGP**	**CHN---THA**	**CHN---TWN**	**CHN-ASEAN simple Ave.**	**CHN-ASEAN weigh Ave.**	**simple Ave.**	**Weight-ed Ave.**
P1	***0.0755***	***0.0014***	0.0020	0.0000	0.0054	0.0055	0.0088	0.0000		0.0043	0.0001	0.0123	0.0058
P2	***0.1085***	***0.0021***	0.0076	0.0121	0.0062	0.0032	0.0136	0.0045	0.0127	0.0070	0.0003	0.0190	0.0124
P3	0.0657	0.0088	0.0107	0.0486	0.0154	***0.0086***	0.0162	0.0197	0.0470	0.0141	0.0011	0.0267	0.0100
P	***0.0845***	***0.0049***	0.0080	0.0259	0.0101	0.0059	0.0139	0.0169	0.0401	0.0110	0.0007	0.0234	0.0101

Table 9a: Variance Decompositions Using Dynamic Factor Models (1976-1984)

		World			Region			Country			Idiosyncratic		
		1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3
China	Y	1.06	1.65	2.34	2.14	4.59	8.14	4.9	11	21.74	91.9	82.76	67.78
	C	0.1	0.23	0.48	0.98	2.3	4.48	14.84	23.66	33.95	84.08	73.81	61.09
	I	2.25	3.03	3.92	1.13	2.69	5.24	20.23	30.08	40.76	76.39	64.2	50.08
Hong Kong	Y	22.34	24.84	27.55	3.75	8.1	14.13	2.01	5.65	14.02	71.9	61.41	44.3
	C	9.35	10.97	12.71	0.99	2.36	4.65	30.16	33.72	37.28	59.5	52.95	45.36
	I	0.19	0.44	0.81	2.53	5.9	11.1	70.77	77.21	82.45	26.51	16.45	5.64
India	Y	2.19	3.29	4.58	1.51	3.62	7.42	3.67	8.84	17.59	92.63	84.25	70.41
	C	0.65	1.18	1.87	1.01	2.35	4.5	3.76	8.45	16.56	94.58	88.02	77.07
	I	0.33	0.76	1.46	6.06	12.3	20.16	8.44	16.22	26.5	85.17	70.72	51.88
Indonesia	Y	8.49	10.09	11.84	0.81	1.97	3.89	31.96	40.41	49.37	58.74	47.53	34.9
	C	3.13	4.16	5.31	0.71	1.74	3.66	34.32	41.91	50.13	61.84	52.19	40.9
	I	4.45	5.62	6.98	3.03	6.36	10.74	16.77	21.56	26.92	75.75	66.46	55.36
Japan	Y	26	28.61	31.22	0.78	1.82	3.51	56.57	63.66	70.9	16.65	5.91	-5.63
	C	6.53	7.98	9.47	2.94	6.41	11.25	1.19	3.19	7.43	89.34	82.42	71.85
	I	2.72	3.79	4.95	0.76	1.89	3.93	8.65	17.25	30.34	87.87	77.07	60.78
Korea	Y	0.4	0.91	1.68	2.87	6.08	10.91	18.24	26.96	36.73	78.49	66.05	50.68
	C	0.06	0.12	0.25	1.21	2.99	6.13	47.75	54.29	60.96	50.98	42.6	32.66
	I	0.08	0.2	0.41	1.23	3	6.36	51.71	59.02	66.54	46.98	37.78	26.69
Malaysia	Y	0.08	0.19	0.38	1.24	2.89	5.53	3.29	7.19	12.22	95.39	89.73	81.87
	C	5.46	6.51	7.64	0.74	1.73	3.4	24.84	30.43	36.39	68.96	61.33	52.57
	I	1.68	2.53	3.49	1.6	3.55	6.45	31.89	39.75	48.75	64.83	54.17	41.31
Philippines	Y	0.46	0.87	1.44	0.97	2.3	4.53	2.73	5.94	11.16	95.84	90.89	82.87
	C	0.9	1.53	2.35	1.88	4.3	8.02	0.58	1.57	3.68	96.64	92.6	85.95
	I	0.46	0.87	1.42	0.64	1.61	3.31	22.81	32.27	43.45	76.09	65.25	51.82
Singapore	Y	37.72	41.42	44.99	0.37	0.93	1.92	2.61	6.45	14.07	59.3	51.2	39.02
	C	0.13	0.31	0.61	0.6	1.48	3.12	50.74	57.94	64.97	48.53	40.27	31.3
	I	11.12	13.05	15.06	1.03	2.53	5.17	17.94	22.64	28.24	69.91	61.78	51.53
Thailand	Y	27.6	30.56	33.56	2.45	4.93	8.14	12.6	20.64	30.26	57.35	43.87	28.04
	C	35.34	37.88	40.43	0.52	1.29	2.67	12.62	18.89	25.96	51.52	41.94	30.94
	I	3.33	4.42	5.63	1.24	2.9	5.53	9.59	15.45	23.88	85.84	77.23	64.96
Taiwan	Y	62.18	65.53	68.63	0.27	0.67	1.39	6.58	11.35	18.02	30.97	22.45	11.96
	C	30.41	32.88	35.4	0.7	1.64	3.14	2.5	5.74	10.62	66.39	59.74	50.84
	I	7.7	9.69	11.74	1.12	2.7	5.28	10.49	18.58	28.74	80.69	69.03	54.24
United States	Y	28.07	31.22	34.24	7.73	13.13	19.57	11.01	18.28	26.68	53.19	37.37	19.51
	C	1.5	2.3	3.34	1.94	4.8	9.64	34.01	43.46	53.05	62.55	49.44	33.97
	I	3.8	4.82	5.96	0.92	2.26	4.76	22.55	29.49	37.96	72.73	63.43	51.32
Euro Area	Y	7.27	8.58	10.06	1.56	3.39	6.07	26.46	34.93	44.72	64.71	53.1	39.15
	C	1.1	1.66	2.37	1.53	3.17	5.55	16.25	22.02	29.49	81.12	73.15	62.59
	I	1.09	1.58	2.21	2.11	4.39	7.54	21.19	29.06	38.21	75.61	64.97	52.04

Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Table 9b: Variance Decompositions Using Dynamic Factor Models (1976-1984)

		World			Region			Country			Idiosyncratic		
		1/3	**Med**	**2/3**	**1/3**	**Med**	**2/3**	**1/3**	**Med**	**2/3**	**1/3**	**Med**	**2/3**
China	**Y**	1.06	1.65	2.34	2.14	4.59	8.14	4.9	11	21.74	91.9	82.76	67.78
	X	2.92	7.69	11.86	1.52	2.98	4.81	7.8	13.87	20.26	87.76	75.46	63.07
	M	6.42	10.39	14.98	0.39	0.97	2.05	11.33	5.58	19.46	81.86	83.06	63.51
Hong Kong	**Y**	22.34	24.84	27.55	3.75	8.1	14.13	2.01	5.65	14.02	71.9	61.41	44.3
	X	28.23	34.06	44.28	0.4	0.99	2.05	15.86	19.76	24.09	55.51	45.19	29.58
	M	3.22	4.59	6.23	1.87	3.73	6.32	2.17	0.91	4.59	92.74	90.77	82.86
India	**Y**	2.19	3.29	4.58	1.51	3.62	7.42	3.67	8.84	17.59	92.63	84.25	70.41
	X	0.44	1.19	2.9	1.19	2.41	4.15	19.91	30.72	43.22	78.46	65.68	49.73
	M	0.38	0.97	2.17	8.42	12.52	17.24	55.84	45.05	66.23	35.36	41.46	14.36
Indonesia	**Y**	8.49	10.09	11.84	0.81	1.97	3.89	31.96	40.41	49.37	58.74	47.53	34.9
	X	0.15	0.37	0.75	2.71	4.49	6.52	17.83	23.96	32.02	79.31	71.18	60.71
	M	6.39	9.43	12.22	0.41	1.03	2.11	40.71	32.49	49.81	52.49	57.05	35.86
Japan	**Y**	26	28.61	31.22	0.78	1.82	3.51	56.57	63.66	70.9	16.65	5.91	-5.63
	X	40.02	44.09	48.04	1.86	4.01	6.91	12.87	18.15	23.91	45.25	33.75	21.14
	M	0.22	0.52	1.02	10.7	14.72	18.77	26.41	15.61	39.06	62.67	69.15	41.15
Korea	**Y**	0.4	0.91	1.68	2.87	6.08	10.91	18.24	26.96	36.73	78.49	66.05	50.68
	X	18.15	24.28	36.96	0.37	0.9	1.92	5.83	8.94	12.68	75.65	65.88	48.44
	M	1.68	2.61	3.71	3.18	5.79	9.2	6.26	2.42	13.85	88.88	89.18	73.24
Malaysia	**Y**	0.08	0.19	0.38	1.24	2.89	5.53	3.29	7.19	12.22	95.39	89.73	81.87
	X	24.49	29.63	37.86	0.4	0.97	2.04	31.21	42.2	50.09	43.9	27.2	10.01
	M	0.13	0.31	0.61	1.04	2.27	4.21	21.67	13.9	32.81	77.16	83.52	62.37
Philippines	**Y**	0.46	0.87	1.44	0.97	2.3	4.53	2.73	5.94	11.16	95.84	90.89	82.87
	X	0.36	0.86	1.71	0.68	1.53	2.97	15.02	20.21	26.7	83.94	77.4	68.62
	M	1.21	2.62	4.37	1.41	2.92	5.02	38.02	30.19	46.92	59.36	64.27	43.69
Singapore	**Y**	37.72	41.42	44.99	0.37	0.93	1.92	2.61	6.45	14.07	59.3	51.2	39.02
	X	0.71	1.44	2.38	0.2	0.47	1.02	4.69	8.06	13.45	94.4	90.03	83.15
	M	1.02	1.79	2.76	0.77	1.82	3.7	39.14	28.12	51.59	59.07	68.27	41.95
Thailand	**Y**	27.6	30.56	33.56	2.45	4.93	8.14	12.6	20.64	30.26	57.35	43.87	28.04
	X	1.62	3.51	5.54	2.37	4.13	6.33	3.01	6.55	13.37	93	85.81	74.76
	M	0.1	0.24	0.48	1	2.19	3.94	38.23	28.92	47.52	60.67	68.65	48.06
Taiwan	**Y**	62.18	65.53	68.63	0.27	0.67	1.39	6.58	11.35	18.02	30.97	22.45	11.96
	X	0.66	1.46	2.56	1.95	3.38	5.28	2.04	3.83	6.48	95.35	91.33	85.68
	M	4.83	6.91	8.89	0.52	1.33	2.8	33.22	24.56	42.59	61.43	67.2	45.72
United States	**Y**	28.07	31.22	34.24	7.73	13.13	19.57	11.01	18.28	26.68	53.19	37.37	19.51
	X	4.74	10.94	17.33	39.31	46.46	53.05	1.67	4.29	9.13	54.28	38.31	20.49
	M	0.44	1.02	1.99	42.72	50.86	57.88	11.55	5.47	20.53	45.29	42.65	19.6
Euro Area	**Y**	7.27	8.58	10.06	1.56	3.39	6.07	26.46	34.93	44.72	64.71	53.1	39.15
	X	12	17.19	21.66	0.79	1.77	3.27	15.55	21.02	27.25	71.66	60.02	47.82
	M	4.08	6.03	8.24	1.16	2.19	3.66	20.26	13.02	29.26	74.5	78.76	58.84

Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Table 9c: Variance Decompositions Using Dynamic Factor Models (1985-2006)

		World			Region			Country			Idiosyncratic		
		1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3
China	Y	0.25	0.59	1.13	0.67	1.68	3.5	32.09	41.19	50.97	66.99	56.54	44.4
	C	0.29	0.7	1.41	3.75	8.19	14.3	3.55	8.58	18.26	92.41	82.53	66.03
	I	22.09	24.92	27.9	1.31	3.07	5.77	2.06	5.64	12.8	74.54	66.37	53.53
Hong Kong	Y	10.17	12.49	14.76	0.69	1.69	3.39	45.3	51.08	55.83	43.84	34.74	26.02
	C	11.82	14.29	17.09	1.21	2.81	5.58	9.74	19.34	32.17	77.23	63.56	45.16
	I	1.63	2.65	3.91	0.76	1.85	3.81	7.37	15.87	26.9	90.24	79.63	65.38
India	Y	0.24	0.59	1.25	0.89	2.14	4.31	9.16	17.3	29.11	89.71	79.97	65.33
	C	2.79	4.12	5.59	1.11	2.7	5.57	2.9	7.07	15.31	93.2	86.11	73.53
	I	0.66	1.21	1.94	1.74	4.1	8.04	4.16	10.48	21.81	93.44	84.21	68.21
Indonesia	Y	0.84	1.56	2.56	1.34	3.03	5.72	39.35	47.03	54.95	58.47	48.38	36.77
	C	7.56	9.75	12.57	0.57	1.4	2.92	38.78	46.9	54.94	53.09	41.95	29.57
	I	2.02	3.16	4.65	0.7	1.69	3.36	19.21	24.85	31.32	78.07	70.3	60.67
Japan	Y	0.75	1.64	3.1	1.25	3.17	6.53	6.52	12.53	21.54	91.48	82.66	68.83
	C	1.73	2.87	4.53	1.2	2.92	6.02	55.12	61.89	68.95	41.95	32.32	20.5
	I	0.3	0.76	1.64	1.3	3.15	6.24	0.29	0.74	1.55	98.11	95.35	90.57
Korea	Y	13.35	15.84	18.38	0.68	1.7	3.5	33.97	40.14	47.01	52	42.32	31.11
	C	0.11	0.28	0.57	0.62	1.55	3.21	8.3	14.19	21.7	90.97	83.98	74.52
	I	7.45	9.7	12.58	0.74	1.84	3.8	16.16	24.79	35.34	75.65	63.67	48.28
Malaysia	Y	59.9	63.01	66	0.25	0.63	1.31	39.09	47.38	56.18	0.76	-11.02	-23.49
	C	0.66	1.36	2.28	1.34	3.23	6.27	11.38	22.65	36.55	86.62	72.76	54.9
	I	0.09	0.2	0.42	0.68	1.69	3.47	27.53	38.54	50.86	96.09	91	82.38
Philippines	Y	15	17.85	20.64	1.32	3.05	5.84	2.73	5.94	11.16	80.95	73.16	62.36
	C	21.14	25.06	28.79	0.53	1.3	2.77	26.01	36.09	45.57	52.32	37.55	22.87
	I	0.19	0.46	0.96	1.14	2.79	5.53	14.8	21.32	29.07	83.87	75.43	64.44
Singapore	Y	0.99	1.7	2.61	0.78	1.86	3.81	27.7	32.52	37.44	70.53	63.92	56.14
	C	1.05	1.87	2.96	0.79	1.92	4	15.42	25.17	36.41	82.74	71.04	56.63
	I	0.31	0.8	1.81	1.5	3.57	7.04	17.06	28.62	41.44	81.13	67.01	49.71
Thailand	Y	0.21	0.47	0.93	0.73	1.81	3.77	16.49	23.83	31.58	82.57	73.89	63.72
	C	3.31	4.57	6.17	3.78	8.12	14.27	4.97	10.29	18.83	87.94	77.02	60.73
	I	1.17	1.91	2.87	0.86	2.1	4.25	18.17	28.88	41.12	79.8	67.11	51.76
Taiwan	Y	28.42	32.19	35.66	0.6	1.48	3.06	9.26	14.09	19.25	61.72	52.24	42.03
	C	51.78	57.03	61.56	0.73	1.74	3.49	11.56	16.21	21.33	35.93	25.02	13.62
	I	0.14	0.34	0.72	1.26	2.86	5.62	22.08	31.41	42.09	76.52	65.39	51.57
United States	Y	0.47	1.05	1.91	8.18	15.69	25.63	23.98	30.55	37.15	67.37	52.71	35.31
	C	15.39	19.35	23	1.97	4.58	8.59	29.89	38.14	46.55	52.75	37.93	21.86
	I	1.03	2.14	3.87	5.59	12.55	22.64	24.28	34.93	45.99	69.1	50.38	27.5
Euro Area	Y	2.14	2.85	3.74	1.16	2.76	5.36	23.33	31	39.8	73.37	63.39	51.1
	C	5.22	6.52	7.99	0.87	2.09	4.19	28.59	37.1	46.88	65.32	54.29	40.94
	I	1.67	2.39	3.34	1.25	2.94	5.71	7.14	11.27	17.2	89.94	83.4	73.75

Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Table 9d: Variance Decompositions Using Dynamic Factor Models (1985-2006)

		World			Region			Country			Idiosyncratic		
		1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3
China	Y	0.25	0.59	1.13	0.67	1.68	3.5	32.09	41.19	50.97	66.99	56.54	44.4
	X	0.7	0.29	1.47	2.34	1.04	4.3	13.38	6.1	26.08	83.58	92.57	68.15
	M	1.12	0.47	2.2	3.13	1.39	5.93	35.31	47.88	59.32	60.44	50.26	32.55
Hong Kong	Y	10.17	12.49	14.76	0.69	1.69	3.39	45.3	51.08	55.83	43.84	34.74	26.02
	X	16.86	13.35	20.45	2.57	1.05	5.3	38.04	28.97	47.12	42.53	56.63	27.13
	M	0.72	0.3	1.4	1.38	0.59	2.65	51.19	57.71	64.26	46.71	41.4	31.69
India	Y	0.24	0.59	1.25	0.89	2.14	4.31	9.16	17.3	29.11	89.71	79.97	65.33
	X	1.26	0.57	2.22	0.92	0.38	2	43.57	35.66	53.06	54.25	63.39	42.72
	M	2.15	1.11	3.51	2.61	1.15	4.87	0.84	2.2	5.11	94.4	95.54	86.51
Indonesia	Y	0.84	1.56	2.56	1.34	3.03	5.72	39.35	47.03	54.95	58.47	48.38	36.77
	X	2.28	1.11	3.91	1.93	0.86	3.48	40.53	31.18	51.27	55.26	66.85	41.34
	M	0.57	0.23	1.17	2.18	0.99	3.97	35.51	48.06	60.69	61.74	50.72	34.17
Japan	Y	0.75	1.64	3.1	1.25	3.17	6.53	6.52	12.53	21.54	91.48	82.66	68.83
	X	29.62	23.68	35.11	2.73	1.24	4.95	11.52	6	19.3	56.13	69.08	40.64
	M	6.73	4.59	9.19	1.82	0.78	3.4	22.84	29.96	38.66	68.61	64.67	48.75
Korea	Y	13.35	15.84	18.38	0.68	1.7	3.5	33.97	40.14	47.01	52	42.32	31.11
	X	36.79	30.51	42.8	1.59	0.66	3.25	10.42	3.93	20.86	51.2	64.9	33.09
	M	2.55	1.23	4.28	13.89	9.27	18.58	33.3	41.26	50.5	50.26	48.24	26.64
Malaysia	Y	59.9	63.01	66	0.25	0.63	1.31	39.09	47.38	56.18	0.76	-11.02	-23.49
	X	20.95	16.17	25.88	1.17	0.47	2.39	9.53	5.68	15.15	68.35	77.68	56.58
	M	2.79	1.51	4.48	1.97	0.83	4.02	4.3	7.36	11.46	90.94	90.3	80.04
Philippines	Y	15	17.85	20.64	1.32	3.05	5.84	27.53	38.54	50.86	56.15	40.56	22.66
	X	3.87	2.03	6.14	3.26	1.52	5.92	52.1	41.11	62.23	40.77	55.34	25.71
	M	3.12	1.55	5.31	4.89	2.65	7.76	43.31	54.13	64.53	48.68	41.67	22.4
Singapore	Y	0.99	1.7	2.61	0.78	1.86	3.81	27.7	32.52	37.44	70.53	63.92	56.14
	X	6.6	4.32	9.21	4.03	2.1	6.49	12.74	7.75	19.23	76.63	85.83	65.07
	M	0.9	0.36	1.83	1.65	0.66	3.47	29.16	38.75	49.7	68.29	60.23	45
Thailand	Y	0.21	0.47	0.93	0.73	1.81	3.77	16.49	23.83	31.58	82.57	73.89	63.72
	X	5.64	3.03	8.79	5.65	2.91	9.3	51.84	43.45	59.74	36.87	50.61	22.17
	M	4.95	2.79	7.68	7.53	4.21	11.72	13.72	24.24	38.56	73.8	68.76	42.04
Taiwan	Y	28.42	32.19	35.66	0.6	1.48	3.06	9.26	14.09	19.25	61.72	52.24	42.03
	X	9.49	5.72	13.68	8.58	5.07	12.84	26.34	19.99	33.53	55.59	69.22	39.95
	M	10.12	6.64	14.32	9.05	5.23	13.52	34.03	42.18	52.29	46.8	45.95	19.87
United States	Y	0.47	1.05	1.91	8.18	15.69	25.63	23.98	30.55	37.15	67.37	52.71	35.31
	X	3.1	1.6	5.09	18.78	11.81	25.52	17.39	7.1	33.93	60.73	79.49	35.46
	M	3.85	1.85	6.82	43.42	34.28	51.73	3.59	8.88	17.9	49.14	54.99	23.55
Euro Area	Y	2.14	2.85	3.74	1.16	2.76	5.36	23.33	31	39.8	73.37	63.39	51.1
	X	2.81	1.71	4.34	2.74	1.38	4.83	26.32	18.7	36.03	68.13	78.21	54.8
	M	7.81	5.57	10.51	4.02	2.12	6.55	39.68	49.2	58.61	48.49	43.11	24.33

Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Table9e: Variance Decompositions Using Dynamic Factor Models (1976-1984)

		World (suppressed)			Region			Country			Idiosyncratic		
		1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3
China	Y	NA	NA	NA	2.35	1.01	4.52	9.94	4.09	19.53	87.71	94.9	75.95
	C	NA	NA	NA	1.28	0.52	2.58	10.54	4.26	21.39	88.18	95.22	76.03
	I	NA	NA	NA	2.09	0.87	4.18	18.05	8.39	30.35	79.86	90.74	65.47
Hong Kong	Y	NA	NA	NA	13.35	6.68	21.54	9.94	4.09	19.53	76.71	89.23	58.93
	C	NA	NA	NA	2.93	1.22	5.94	25.03	19.07	30.46	72.04	79.71	63.6
	I	NA	NA	NA	5.15	2.18	10.15	53.76	45.12	61.91	41.09	52.7	27.94
India	Y	NA	NA	NA	3.14	1.29	6.63	10.34	4.71	18.99	86.52	94	74.38
	C	NA	NA	NA	2.11	0.89	4.27	7.89	3.32	16.07	90	95.79	79.66
	I	NA	NA	NA	7.09	3.09	13.02	14.35	7.13	24.5	78.56	89.78	62.48
Indonesia	Y	NA	NA	NA	1.83	0.75	3.85	43.19	34.59	52.04	54.98	64.66	44.11
	C	NA	NA	NA	3.12	1.25	6.54	56.75	49.71	63.95	40.13	49.04	29.51
	I	NA	NA	NA	3.76	1.64	7.05	18.96	15.2	23.19	77.28	83.16	69.76
Japan	Y	NA	NA	NA	3.04	1.39	5.37	4.81	1.83	10.98	92.15	96.78	83.65
	C	NA	NA	NA	9.72	4.72	16.06	6.93	2.92	14.11	83.35	92.36	69.83
	I	NA	NA	NA	2.48	1.03	4.91	6.77	2.88	13.28	90.75	96.09	81.81
Korea	Y	NA	NA	NA	3.79	1.7	7.02	38.88	29.01	49.53	57.33	69.29	43.45
	C	NA	NA	NA	2.45	1.03	4.85	2.45	1.03	4.85	95.1	97.94	90.3
	I	NA	NA	NA	2.32	0.97	4.66	51.34	45.09	58.08	46.34	53.94	37.26
Malaysia	Y	NA	NA	NA	2.19	0.92	4.38	4.49	1.83	10.2	93.32	97.25	85.42
	C	NA	NA	NA	1.51	0.65	2.91	15.53	11.35	20.48	82.96	88	76.61
	I	NA	NA	NA	3.29	1.53	5.95	28.03	20.66	36.63	68.68	77.81	57.42
Philippines	Y	NA	NA	NA	1.67	0.69	3.38	30.53	22.38	39.37	67.8	76.93	57.25
	C	NA	NA	NA	2.59	1.08	5.2	2.37	0.88	5.76	95.04	98.04	89.04
	I	NA	NA	NA	1.43	0.58	2.98	15.05	8.26	22.11	83.52	91.16	74.91
Singapore	Y	NA	NA	NA	1.82	0.78	3.66	3.46	1.21	8.9	94.72	98.01	87.44
	C	NA	NA	NA	1.33	0.53	2.79	38.38	31.64	45.77	60.29	67.83	51.44
	I	NA	NA	NA	2.82	1.15	5.89	30.84	24.27	38.49	66.34	74.58	55.62
Thailand	Y	NA	NA	NA	2.26	0.95	4.44	19.84	12.32	28.03	77.9	86.73	67.53
	C	NA	NA	NA	2.29	0.97	4.6	52.86	45.16	60.65	44.85	53.87	34.75
	I	NA	NA	NA	2.52	1.06	4.86	12.53	9.28	16.61	84.95	89.66	78.53
Taiwan	Y	NA	NA	NA	2.31	1.01	4.39	10.58	6.84	15.61	87.11	92.15	80
	C	NA	NA	NA	1.35	0.56	2.8	36.98	31.13	43.51	61.67	68.31	53.69
	I	NA	NA	NA	3.15	1.38	6.14	10.52	6.72	14.36	86.33	91.9	79.5
United States	Y	NA	NA	NA	22.29	13.6	31.4	6.31	2.51	12.78	71.4	83.89	55.82
	C	NA	NA	NA	6.59	2.81	12.9	38.42	26.7	49.81	54.99	70.49	37.29
	I	NA	NA	NA	2.78	1.15	5.65	13.17	8.26	18.35	84.05	90.59	76
Euro Area	Y	NA	NA	NA	2.83	1.24	5.25	29.66	23.23	36.95	67.51	75.53	57.8
	C	NA	NA	NA	2.2	0.97	4.13	19.99	14.62	27	77.81	84.41	68.87
	I	NA	NA	NA	3.03	1.37	5.57	21.24	15.35	28.42	75.73	83.28	66.01

Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Table9f: Variance Decompositions Using Dynamic Factor Models (1976-1984)

		World (suppressed)			Region			Country			Idiosyncratic		
		1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3
China	Y	NA	NA	NA	2.35	1.01	4.52	9.94	4.09	19.53	87.71	94.9	75.95
	X	NA	NA	NA	3.05	1.73	4.79	14.66	8.07	25.28	82.29	90.2	69.93
	M	NA	NA	NA	1.13	0.48	2.19	6.74	3.07	13.41	92.13	96.45	84.4
Hong Kong	Y	NA	NA	NA	13.35	6.68	21.54	7.11	2.77	16.17	79.54	90.55	62.29
	X	NA	NA	NA	0.79	0.32	1.72	2.73	1.26	4.87	96.48	98.42	93.41
	M	NA	NA	NA	0.53	0.21	1.16	1.88	0.79	4.09	97.59	99	94.75
India	Y	NA	NA	NA	3.14	1.29	6.63	10.34	4.71	18.99	86.52	94	74.38
	X	NA	NA	NA	1.48	0.71	2.68	28.77	17.74	42.66	69.75	81.55	54.66
	M	NA	NA	NA	6.69	4.17	9.87	53.91	43.45	64.3	39.4	52.38	25.83
Indonesia	Y	NA	NA	NA	1.83	0.75	3.85	43.19	34.59	52.04	54.98	64.66	44.11
	X	NA	NA	NA	3.91	2.14	6.18	37.59	29.02	47.5	58.5	68.84	46.32
	M	NA	NA	NA	2.89	1.43	4.96	44.56	35.9	53.81	52.55	62.67	41.23
Japan	Y	NA	NA	NA	3.04	1.39	5.37	4.81	1.83	10.98	92.15	96.78	83.65
	X	NA	NA	NA	1.75	0.74	3.27	28.22	21.85	35.36	70.03	77.41	61.37
	M	NA	NA	NA	10.31	7.34	13.53	30.04	20.69	41.17	59.65	71.97	45.3
Korea	Y	NA	NA	NA	3.79	1.7	7.02	38.88	29.01	49.53	57.33	69.29	43.45
	X	NA	NA	NA	0.92	0.35	1.94	15.8	11.27	21.25	83.28	88.38	76.81
	M	NA	NA	NA	1.76	0.76	3.31	12.74	6.4	22.88	85.5	92.84	73.81
Malaysia	Y	NA	NA	NA	2.19	0.92	4.38	4.49	1.83	10.2	93.32	97.25	85.42
	X	NA	NA	NA	0.93	0.37	2.02	70.73	64.98	76.6	28.34	34.65	21.38
	M	NA	NA	NA	1.04	0.43	2.12	31.15	18.85	46	67.81	80.72	51.88
Philippines	Y	NA	NA	NA	1.67	0.69	3.38	30.53	22.38	39.37	67.8	76.93	57.25
	X	NA	NA	NA	0.89	0.36	1.93	21.86	15.86	29.8	77.25	83.78	68.27
	M	NA	NA	NA	6.95	4.22	9.95	51.33	39.83	62.65	41.72	55.95	27.4
Singapore	Y	NA	NA	NA	1.82	0.78	3.66	3.46	1.21	8.9	94.72	98.01	87.44
	X	NA	NA	NA	0.68	0.29	1.29	6.37	3.5	11.12	92.95	96.21	87.59
	M	NA	NA	NA	1.06	0.44	2.22	39.94	27.91	53.59	59	71.65	44.19
Thailand	Y	NA	NA	NA	2.26	0.95	4.44	19.84	12.32	28.03	77.9	86.73	67.53
	X	NA	NA	NA	5.29	3.45	7.31	10.92	4.94	22.37	83.79	91.61	70.32
	M	NA	NA	NA	1.85	0.86	3.31	24.73	17.64	31.91	73.42	81.5	64.78
Taiwan	Y	NA	NA	NA	2.31	1.01	4.39	10.58	6.84	15.61	87.11	92.15	80
	X	NA	NA	NA	4.09	2.56	5.95	1.45	0.64	2.85	94.46	96.8	91.2
	M	NA	NA	NA	0.9	0.36	1.89	33.26	23.94	44.39	65.84	75.7	53.72
United States	Y	NA	NA	NA	22.29	13.6	31.4	6.31	2.51	12.78	71.4	83.89	55.82
	X	NA	NA	NA	46.87	42.56	51.27	3.82	1.62	7.59	49.31	55.82	41.14
	M	NA	NA	NA	65.62	60.04	71.3	6.3	2.69	12.07	28.08	37.27	16.63
Euro Area	Y	NA	NA	NA	2.83	1.24	5.25	29.66	23.23	36.95	67.51	75.53	57.8
	X	NA	NA	NA	1.28	0.67	2.19	22.12	16.14	29.51	76.6	83.19	68.3
	M	NA	NA	NA	1.54	0.96	2.31	14.79	10.33	20.85	83.67	88.71	76.84

Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Table9g: Variance Decompositions Using Dynamic Factor Models (1985-2005)

		World (suppressed)			Region			Country			Idiosyncratic		
		1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3
China	Y	NA	NA	NA	1.15	0.47	2.37	14.71	8.4	23.58	84.14	91.13	74.05
	C	NA	NA	NA	21.48	15.64	26.91	7.24	2.95	15.08	71.28	81.41	58.01
	I	NA	NA	NA	7.32	4.33	10.92	6.59	2.47	15.36	86.09	93.2	73.72
Hong Kong	Y	NA	NA	NA	1.79	0.73	3.65	42.17	33.79	49.95	56.04	65.48	46.4
	C	NA	NA	NA	1.67	0.68	3.53	21.1	9.79	35.41	77.23	89.53	61.06
	I	NA	NA	NA	2.05	0.84	4.11	12.17	5.38	21.95	85.78	93.78	73.94
India	Y	NA	NA	NA	4.37	2.16	7.46	14.94	7.54	25.71	80.69	90.3	66.83
	C	NA	NA	NA	4.03	1.95	6.92	2.41	0.93	5.46	93.56	97.12	87.62
	I	NA	NA	NA	2.97	1.4	5.46	11.61	4.9	22.12	85.42	93.7	72.42
Indonesia	Y	NA	NA	NA	6.82	3.81	10.31	48.19	42.49	54.09	44.99	53.7	35.6
	C	NA	NA	NA	1.1	0.45	2.25	45.06	37.24	53.08	53.84	62.31	44.67
	I	NA	NA	NA	1.08	0.45	2.18	25.07	19.58	31.52	73.85	79.97	66.3
Japan	Y	NA	NA	NA	3.43	1.65	5.79	8.84	3.97	16	87.73	94.38	78.21
	C	NA	NA	NA	3.81	1.89	6.59	4.18	1.63	8.94	92.01	96.48	84.47
	I	NA	NA	NA	3.19	1.47	5.87	13.16	4.66	30.52	83.65	93.87	63.61
Korea	Y	NA	NA	NA	1.56	0.63	3.38	39.66	33.55	46.47	58.78	65.82	50.15
	C	NA	NA	NA	4.04	2.08	6.57	21.28	14.89	29.84	74.68	83.03	63.59
	I	NA	NA	NA	5.82	3.17	9.09	28.34	19.76	37.91	65.84	77.07	53
Malaysia	Y	NA	NA	NA	3.05	1.27	6.23	39.52	29.93	49.23	57.43	68.8	44.54
	C	NA	NA	NA	1.71	0.71	3.36	20.84	8.73	38.17	77.45	90.56	58.47
	I	NA	NA	NA	1.01	0.41	2.1	7.21	3.1	14.69	91.78	96.49	83.21
Philippines	Y	NA	NA	NA	3.09	1.33	5.95	32.53	18.85	46.65	64.38	79.82	47.4
	C	NA	NA	NA	1.2	0.48	2.56	54.53	44.42	63.04	44.27	55.1	34.4
	I	NA	NA	NA	1.16	0.48	2.39	11.2	8.38	14.36	87.64	91.14	83.25
Singapore	Y	NA	NA	NA	0.92	0.38	1.98	40.83	33.31	48.32	58.25	66.31	49.7
	C	NA	NA	NA	1.32	0.56	2.55	25.98	16.49	36.75	72.7	82.95	60.7
	I	NA	NA	NA	7.93	4.5	11.94	31.47	20.23	43.82	60.6	75.27	44.24
Thailand	Y	NA	NA	NA	0.59	0.24	1.25	46.12	39.65	52.87	53.29	60.11	45.88
	C	NA	NA	NA	4.68	2.21	7.93	11.2	6.12	18.52	84.12	91.67	73.55
	I	NA	NA	NA	0.69	0.27	1.45	27.67	17.85	38.09	71.64	81.88	60.46
Taiwan	Y	NA	NA	NA	1.41	0.56	3.03	52.01	43.66	59.43	46.58	55.78	37.54
	C	NA	NA	NA	1.91	0.76	4.09	40.12	31.34	48.98	57.97	67.9	46.93
	I	NA	NA	NA	4.57	2.49	7.11	7.96	5.03	11.76	87.47	92.48	81.13
United States	Y	NA	NA	NA	1.79	0.77	3.6	21.35	12.55	31.49	76.86	86.68	64.91
	C	NA	NA	NA	10.87	7.55	14.67	8.17	3.45	15.63	80.96	89	69.7
	I	NA	NA	NA	55.37	48.12	62.43	5.35	2.26	10.43	39.28	49.62	27.14
Euro Area	Y	NA	NA	NA	2.63	1.26	4.67	22.81	16.77	29.75	74.56	81.97	65.58
	C	NA	NA	NA	1.44	0.6	2.84	29.67	23.28	36.73	68.89	76.12	60.43
	I	NA	NA	NA	1.49	0.63	2.91	10.03	6.45	14.61	88.48	92.92	82.48

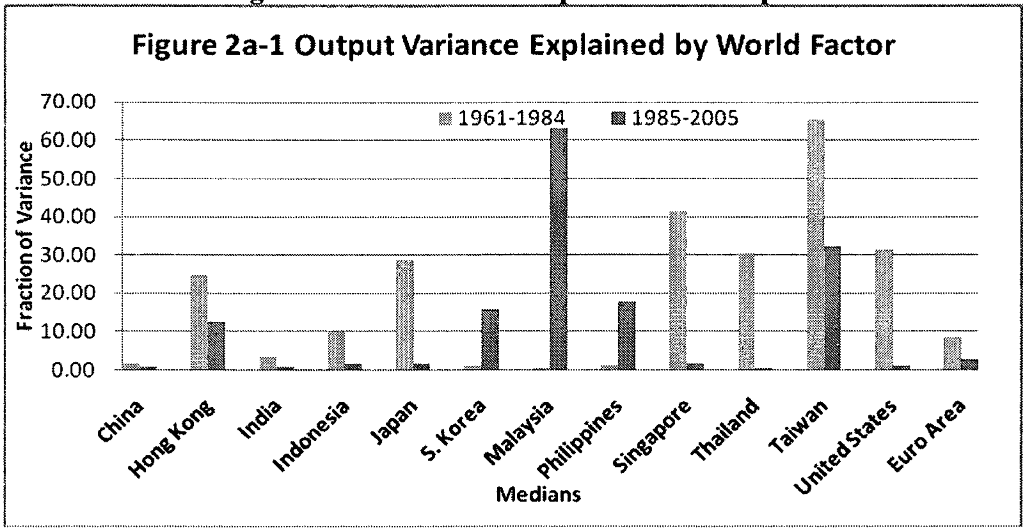
Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

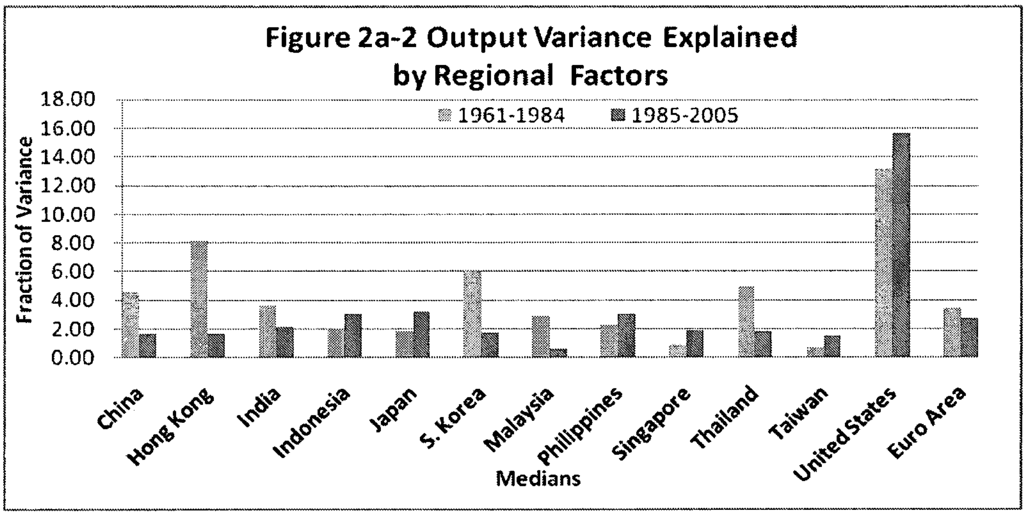
Table9h: Variance Decompositions Using Dynamic Factor Models (1985-2007)

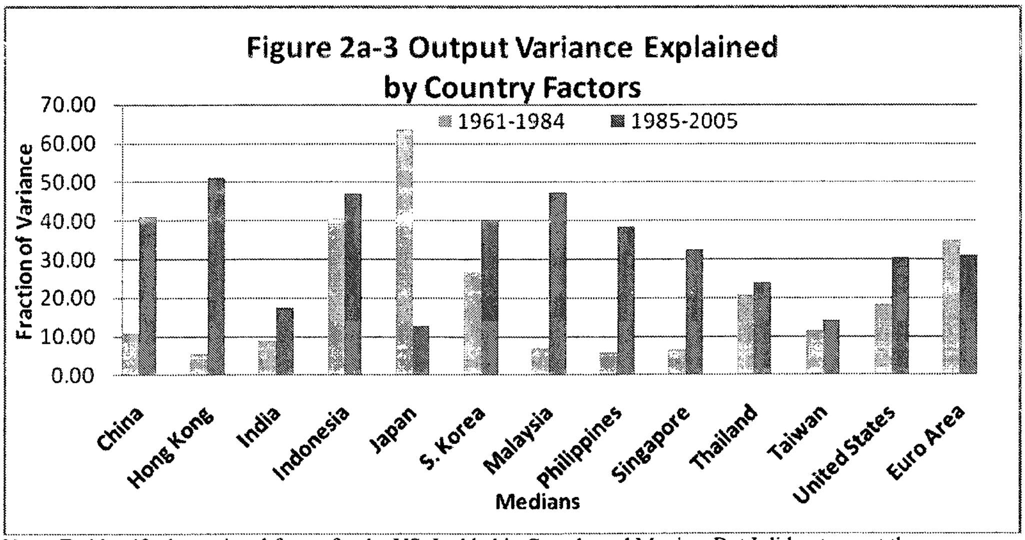
		World (suppressed)			Region			Country			Idiosyncratic		
		1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3	1/3	Med	2/3
China	Y	NA	NA	NA	1.15	0.47	2.37	14.71	8.4	23.58	84.14	91.13	74.05
	X	NA	NA	NA	3.86	2.04	6.26	21.11	11.02	36.91	75.03	86.94	56.83
	M	NA	NA	NA	1.88	0.81	3.62	28.39	16.43	43.42	69.73	82.76	52.96
Hong Kong	Y	NA	NA	NA	1.79	0.73	3.65	42.17	33.79	49.95	56.04	65.48	46.4
	X	NA	NA	NA	2.67	1.01	6.12	38.57	29.21	49.28	58.76	69.78	44.6
	M	NA	NA	NA	1.09	0.44	2.3	38.3	32.91	43.96	60.61	66.65	53.74
India	Y	NA	NA	NA	4.37	2.16	7.46	14.94	7.54	25.71	80.69	90.3	66.83
	X	NA	NA	NA	1.43	0.59	3.04	44.02	35.63	53.61	54.55	63.78	43.35
	M	NA	NA	NA	3.96	1.78	7.16	2.24	0.84	5.43	93.8	97.38	87.41
Indonesia	Y	NA	NA	NA	6.82	3.81	10.31	48.19	42.49	54.09	44.99	53.7	35.6
	X	NA	NA	NA	1.83	0.79	3.56	37.69	29.8	47.2	60.48	69.41	49.24
	M	NA	NA	NA	5.24	2.72	8.62	44.26	34.34	54.57	50.5	62.94	36.81
Japan	Y	NA	NA	NA	3.43	1.65	5.79	8.84	3.97	16	87.73	94.38	78.21
	X	NA	NA	NA	2.94	1.21	5.8	26.5	17.12	38.03	70.56	81.67	56.17
	M	NA	NA	NA	2.67	1.22	5.04	22.67	16.54	30.42	74.66	82.24	64.54
Korea	Y	NA	NA	NA	1.56	0.63	3.38	39.66	33.55	46.47	58.78	65.82	50.15
	X	NA	NA	NA	3.42	1.45	6.51	29.84	17.35	44.61	66.74	81.2	48.88
	M	NA	NA	NA	10.79	7	15.19	23.58	18.73	29.47	65.63	74.27	55.34
Malaysia	Y	NA	NA	NA	3.05	1.27	6.23	39.52	29.93	49.23	57.43	68.8	44.54
	X	NA	NA	NA	1.43	0.58	2.96	8.94	5.04	15.33	89.63	94.38	81.71
	M	NA	NA	NA	1.73	0.76	3.4	4.03	2.53	5.81	94.24	96.71	90.79
Philippines	Y	NA	NA	NA	3.09	1.33	5.95	32.53	18.85	46.65	64.38	79.82	47.4
	X	NA	NA	NA	1.65	0.71	3.22	36.28	27.81	47.26	62.07	71.48	49.52
	M	NA	NA	NA	4.16	2.2	6.97	45.05	34.67	55.13	50.79	63.13	37.9
Singapore	Y	NA	NA	NA	0.92	0.38	1.98	40.83	33.31	48.32	58.25	66.31	49.7
	X	NA	NA	NA	2.72	1.24	4.9	9.79	4.8	16.29	87.49	93.96	78.81
	M	NA	NA	NA	1.72	0.7	3.51	36.16	26.26	47.78	62.12	73.04	48.71
Thailand	Y	NA	NA	NA	0.59	0.24	1.25	46.12	39.65	52.87	53.29	60.11	45.88
	X	NA	NA	NA	7.47	4.38	11.2	58.91	49.18	67.39	33.62	46.44	21.41
	M	NA	NA	NA	8.3	4.46	12.78	23.03	12.99	36.47	68.67	82.55	50.75
Taiwan	Y	NA	NA	NA	1.41	0.56	3.03	52.01	43.66	59.43	46.58	55.78	37.54
	X	NA	NA	NA	5.4	3.04	8.36	18.56	13.49	24.59	76.04	83.47	67.05
	M	NA	NA	NA	11.07	6.14	16.44	53.44	43.91	63.82	35.49	49.95	19.74
United States	Y	NA	NA	NA	1.79	0.77	3.6	21.35	12.55	31.49	76.86	86.68	64.91
	X	NA	NA	NA	26.67	20.34	32.59	9.52	3.68	20.5	63.81	75.98	46.91
	M	NA	NA	NA	53.44	44.54	61.62	2.49	1.03	5.23	44.07	54.43	33.15
Euro Area	Y	NA	NA	NA	2.63	1.26	4.67	22.81	16.77	29.75	74.56	81.97	65.58
	X	NA	NA	NA	2.12	1.06	3.72	22.54	16.33	29.8	75.34	82.61	66.48
	M	NA	NA	NA	2.69	1.35	4.61	33	25.7	40.69	64.31	72.95	54.7

Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 2a Variance Decomposition for Output

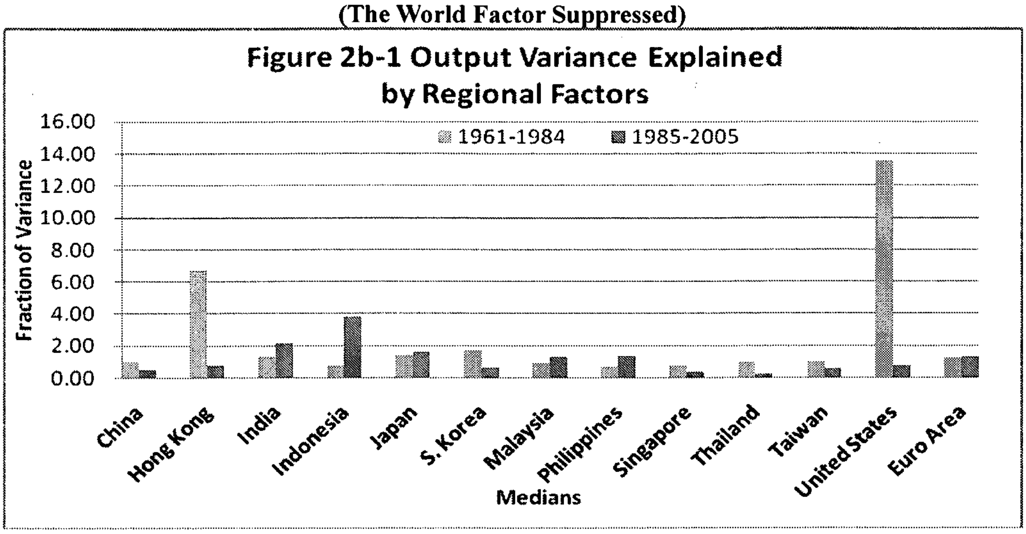


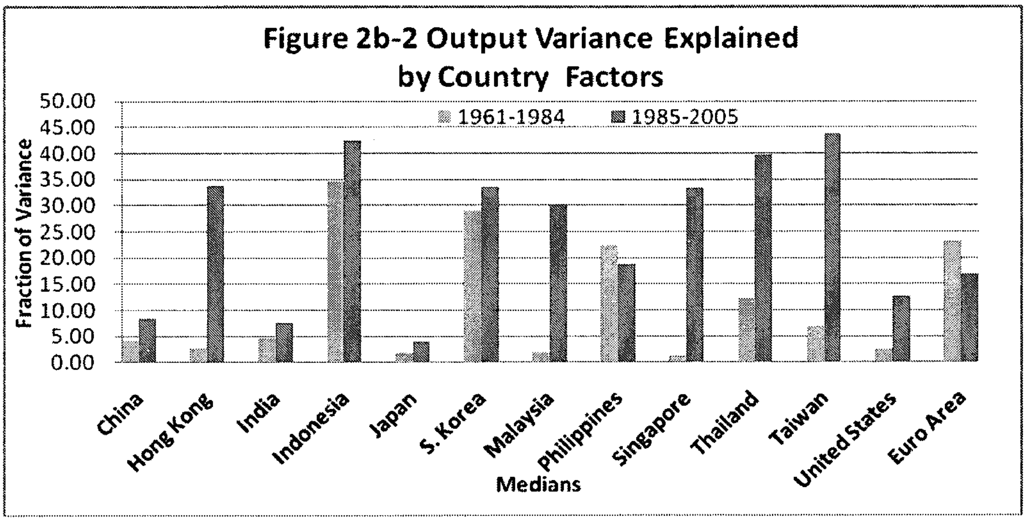


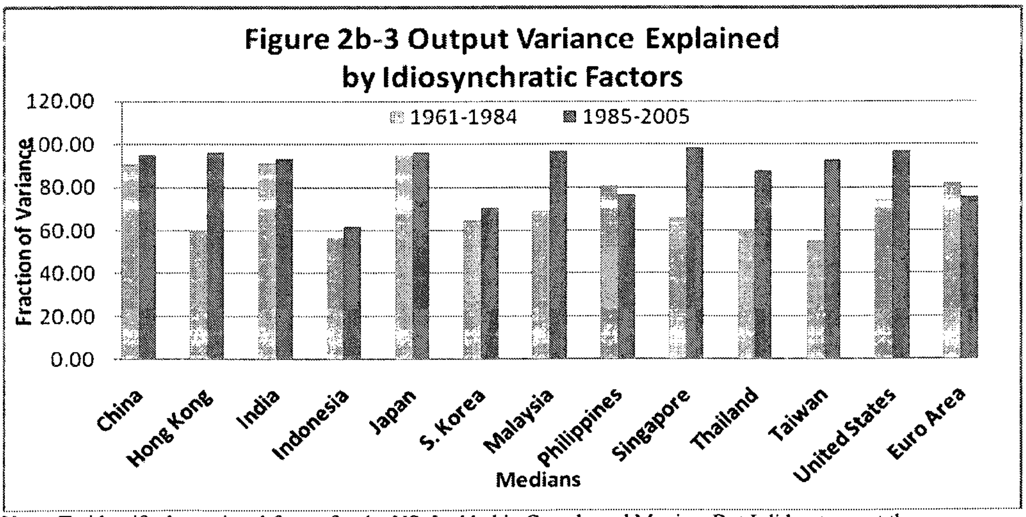


Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 2b Variance Decomposition for Output
(The World Factor Suppressed)

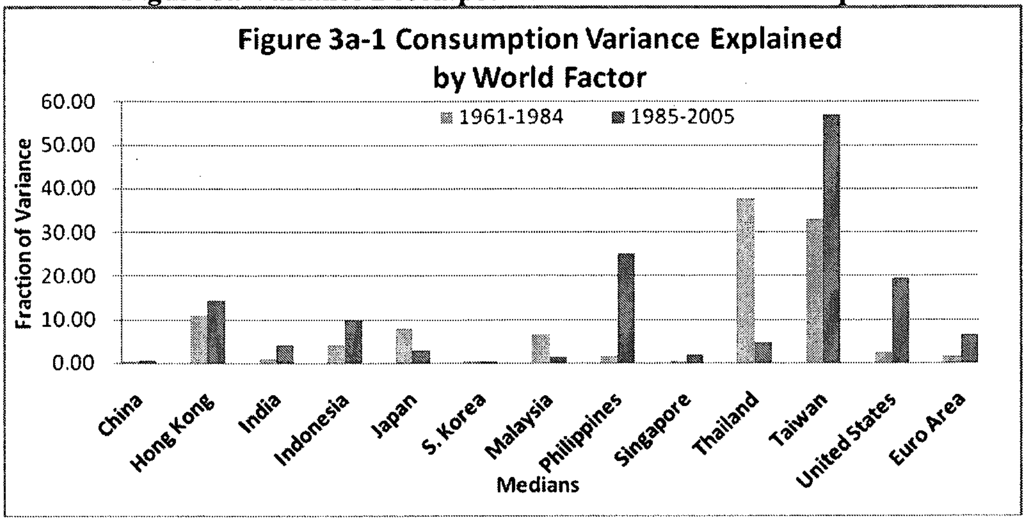


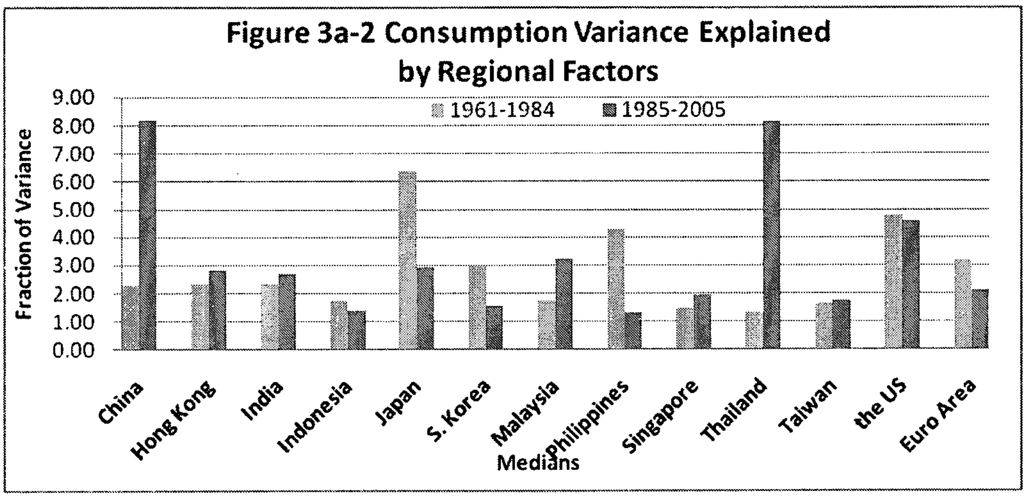


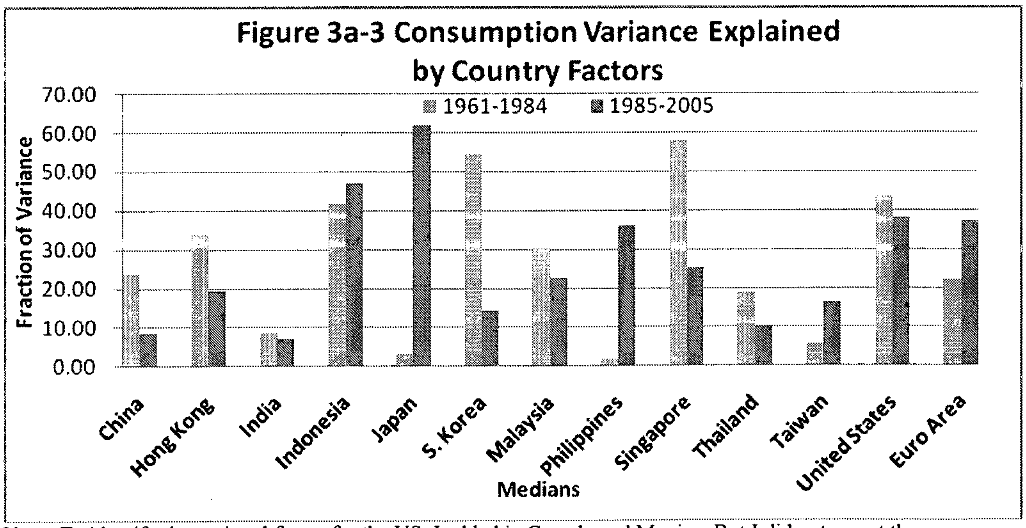


Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 3a Variance Decomposition for Domestic Consumption







Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 3b Variance Decomposition for Domestic Consumption
(The World Factor Suppressed)

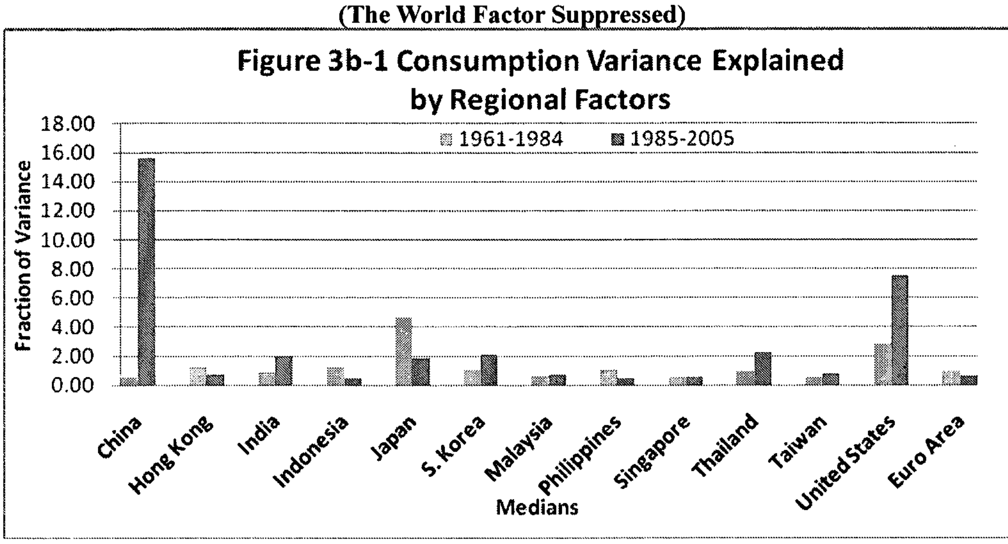


Figure 3b-1 Consumption Variance Explained by Regional Factors

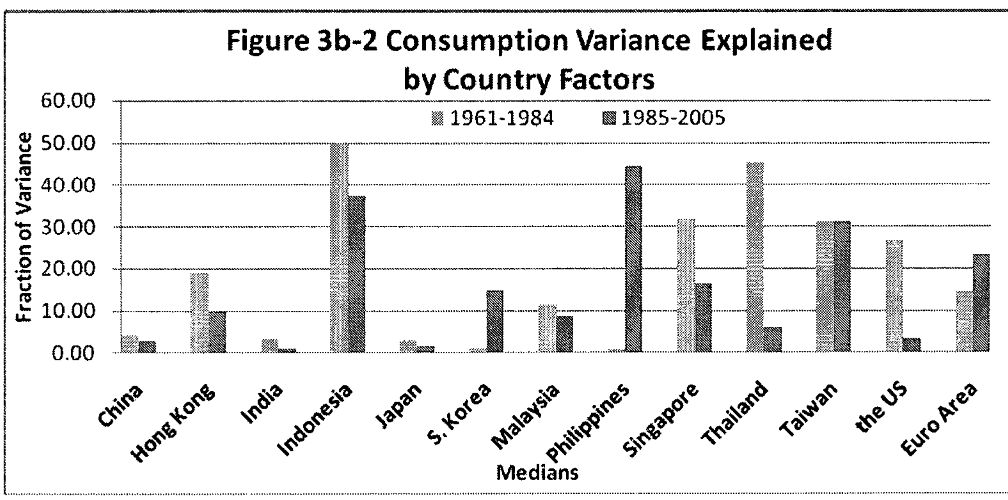


Figure 3b-2 Consumption Variance Explained by Country Factors

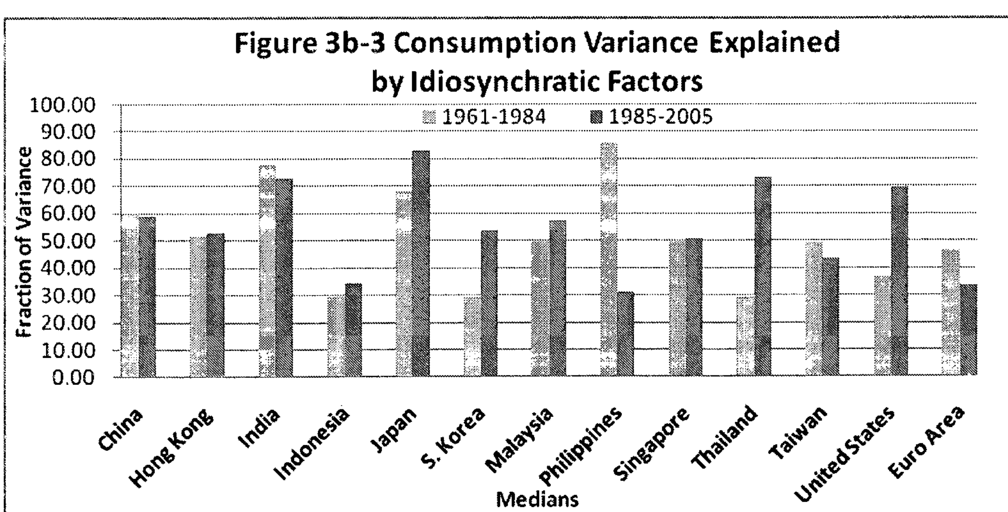
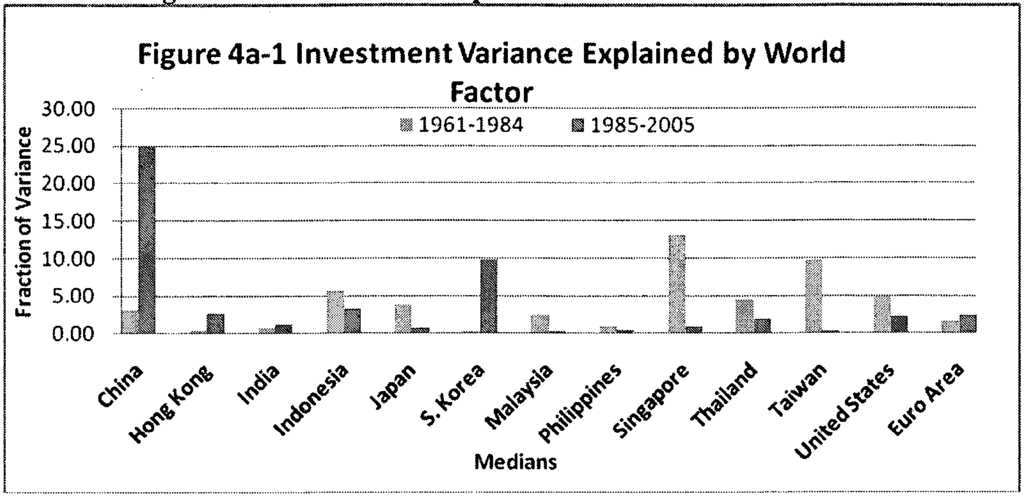
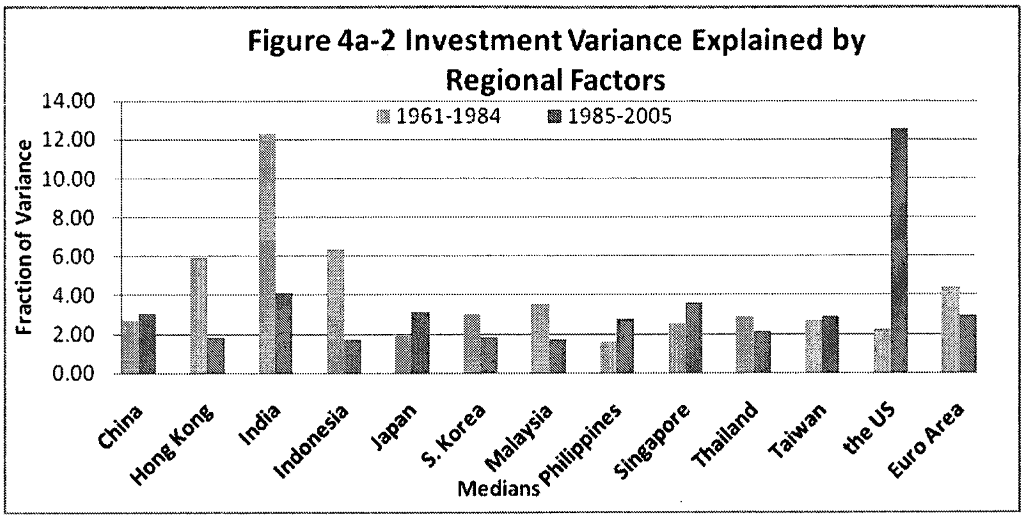


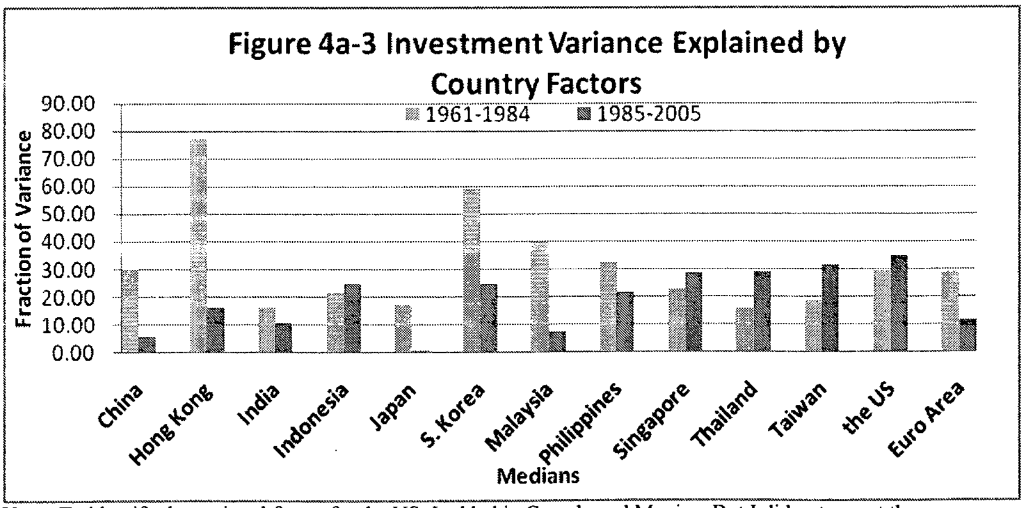
Figure 3b-3 Consumption Variance Explained by Idiosynchratic Factors

Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 4a Variance Decomposition for Domestic Investment

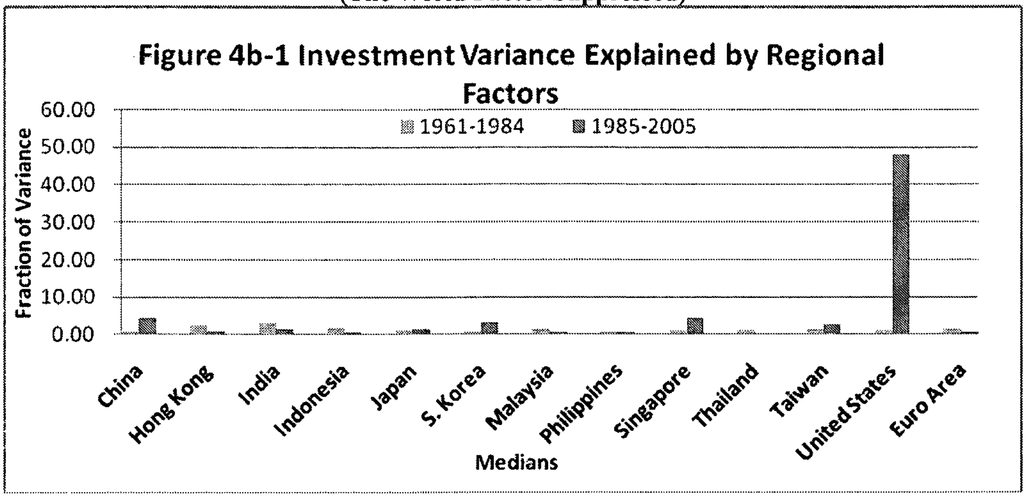


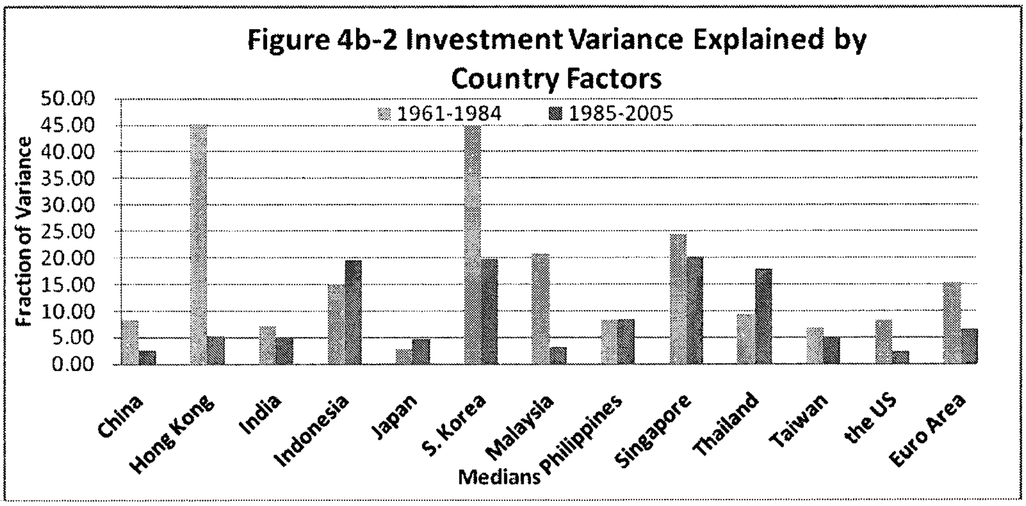


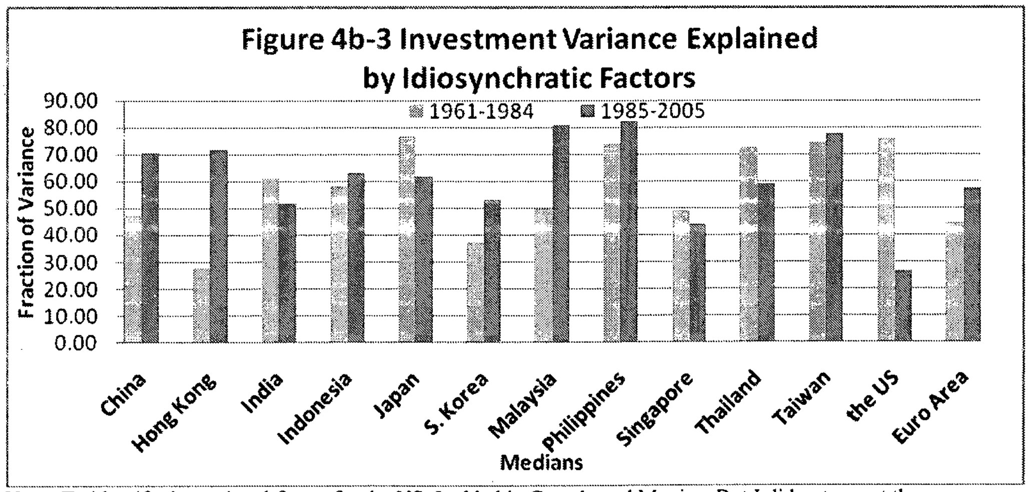


Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 4b Variance Decomposition for Domestic Investment
(The World Factor Suppressed)

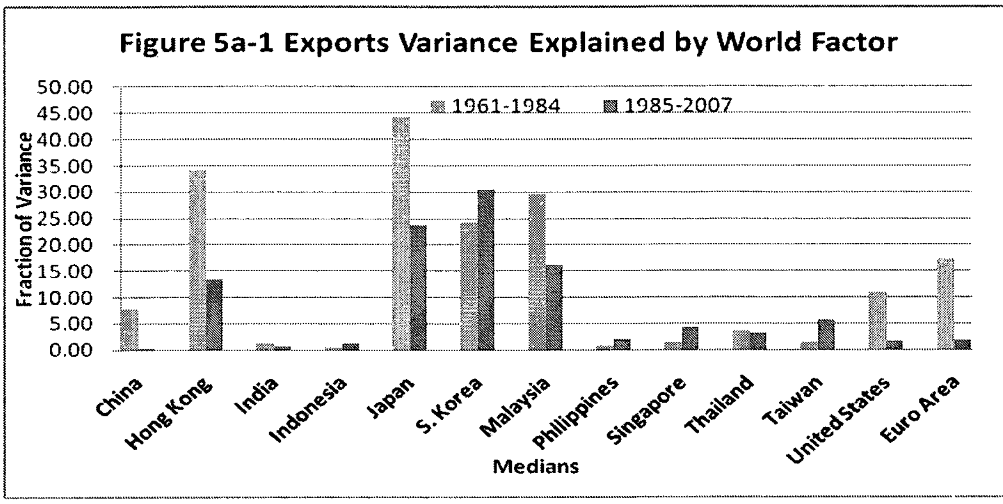


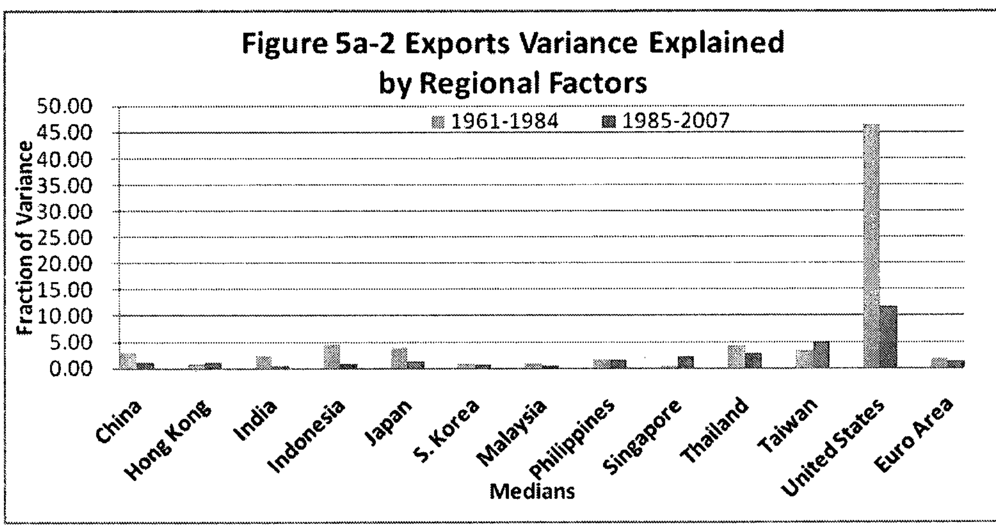


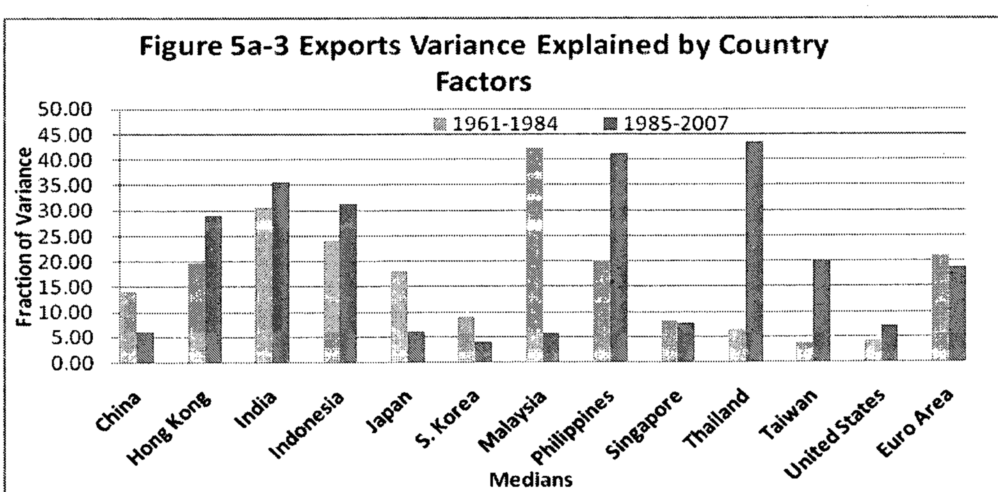


Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 5a Variance Decomposition for Gross Exports

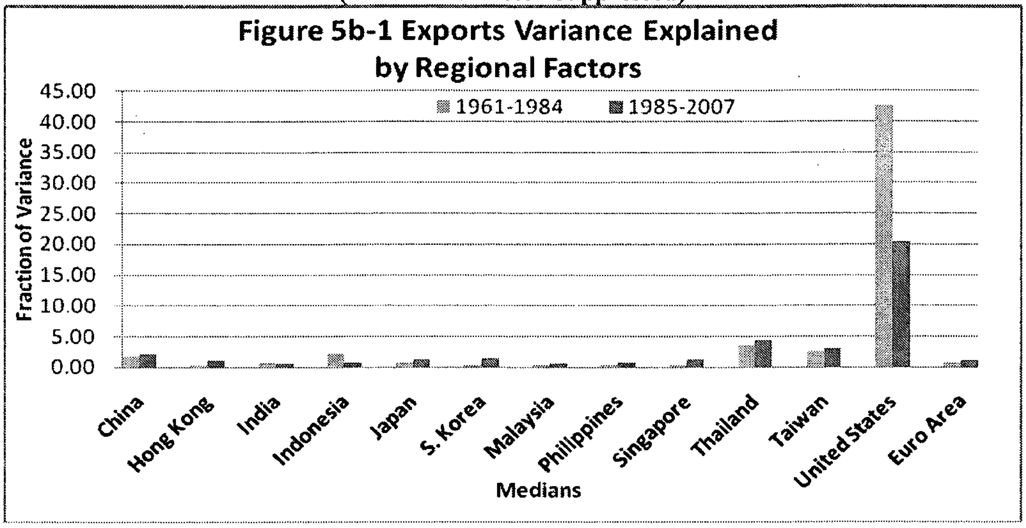


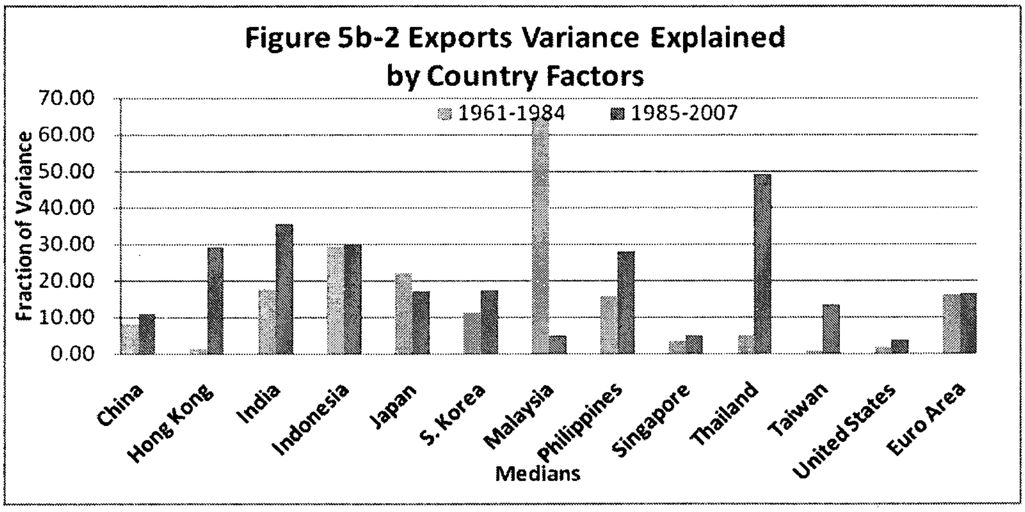


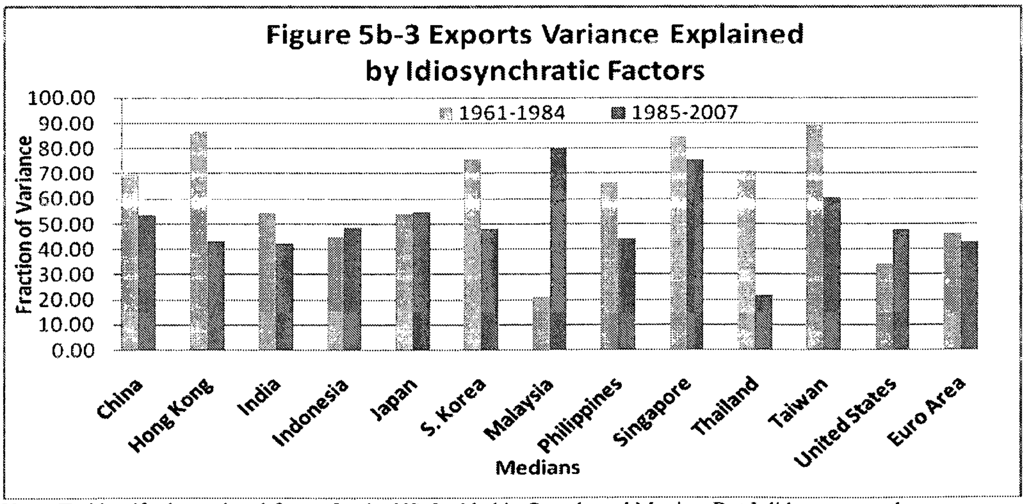


Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 5b Variance Decomposition for Gross Exports
(The World Factor Suppressed)

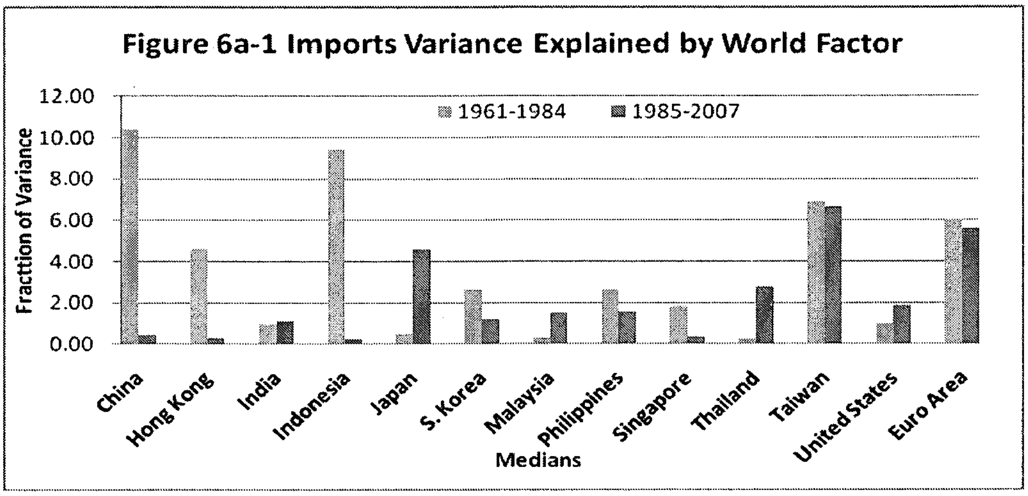


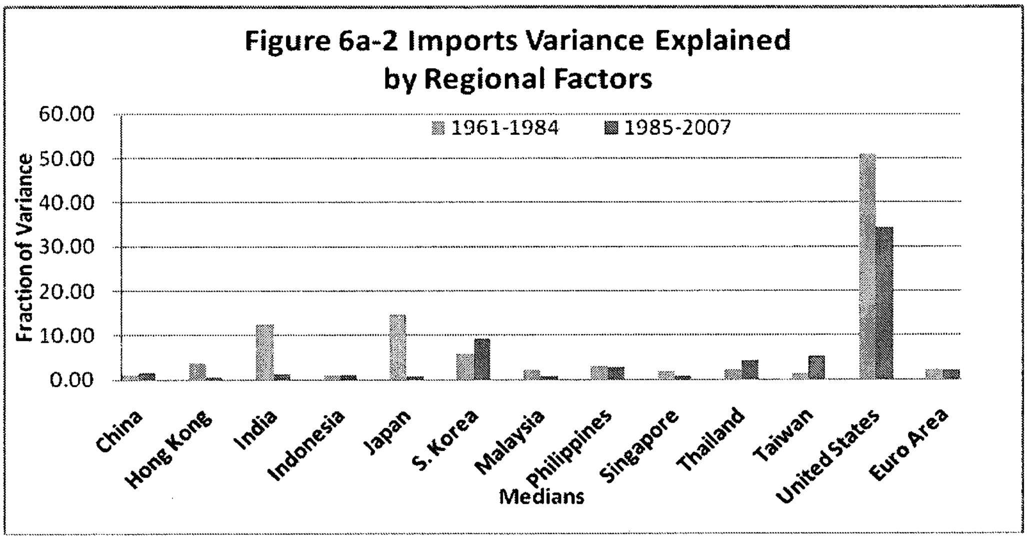


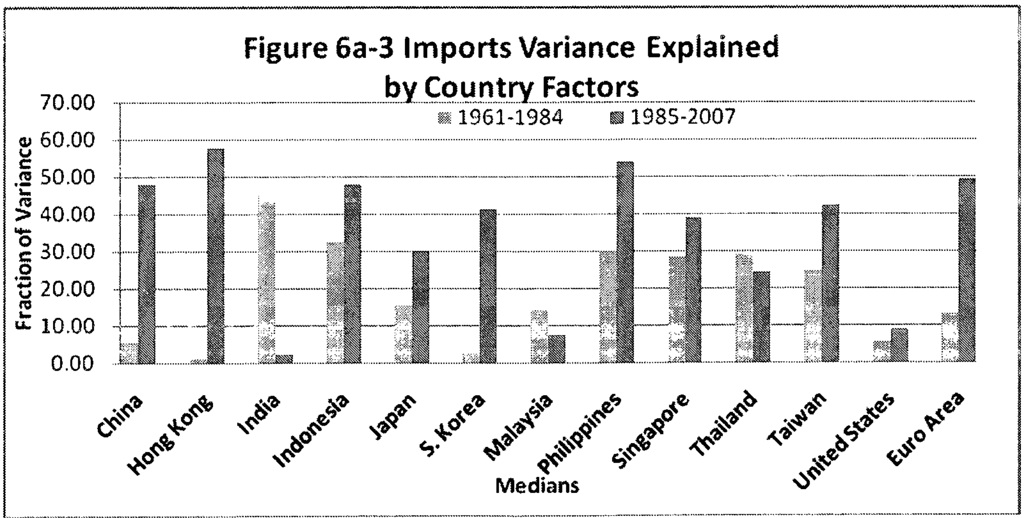


Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 6a Variance Decomposition for Gross Imports

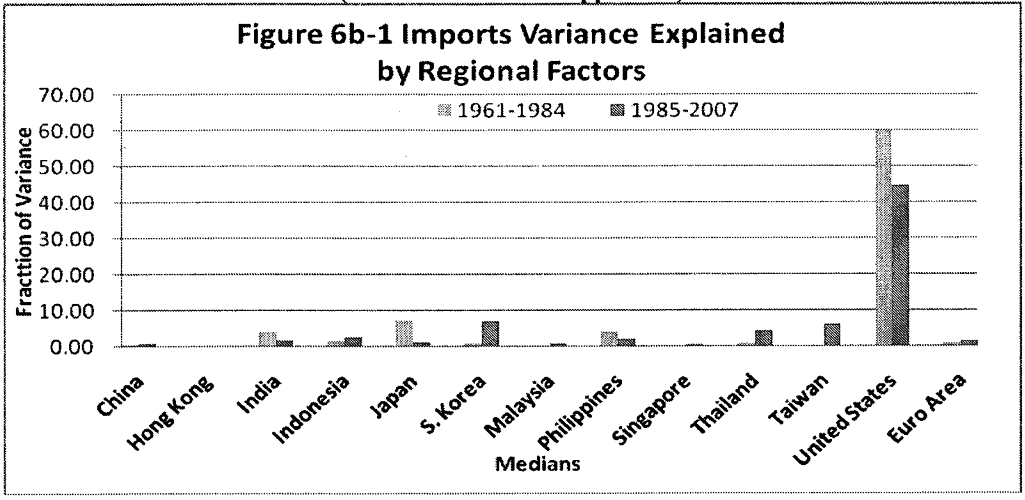


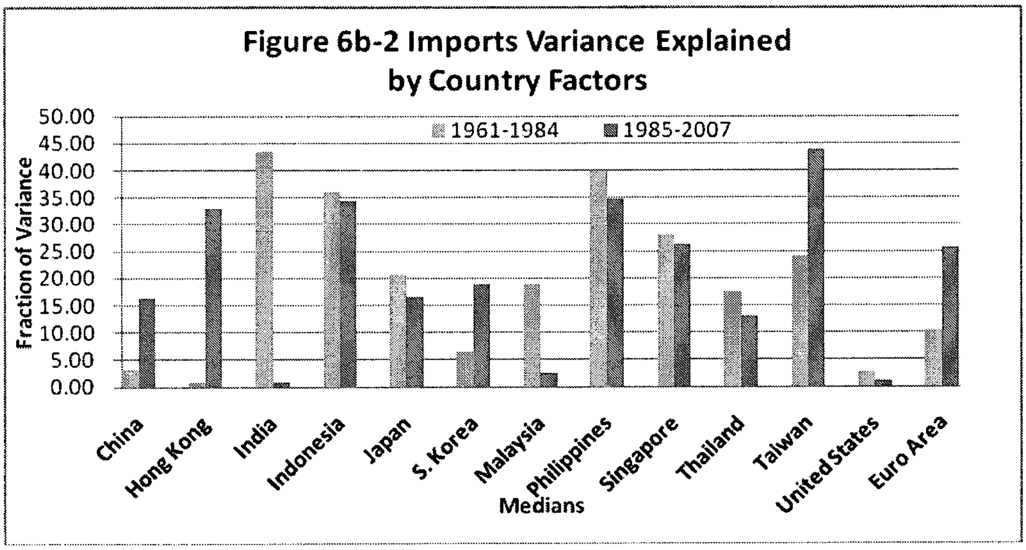


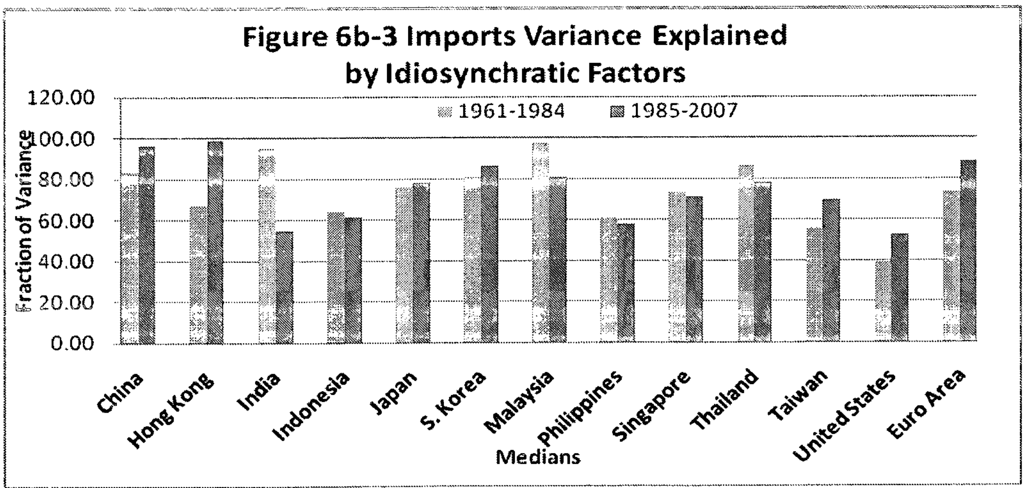


Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 6b Variance Decomposition for Gross Imports
(The World Factor Suppressed)

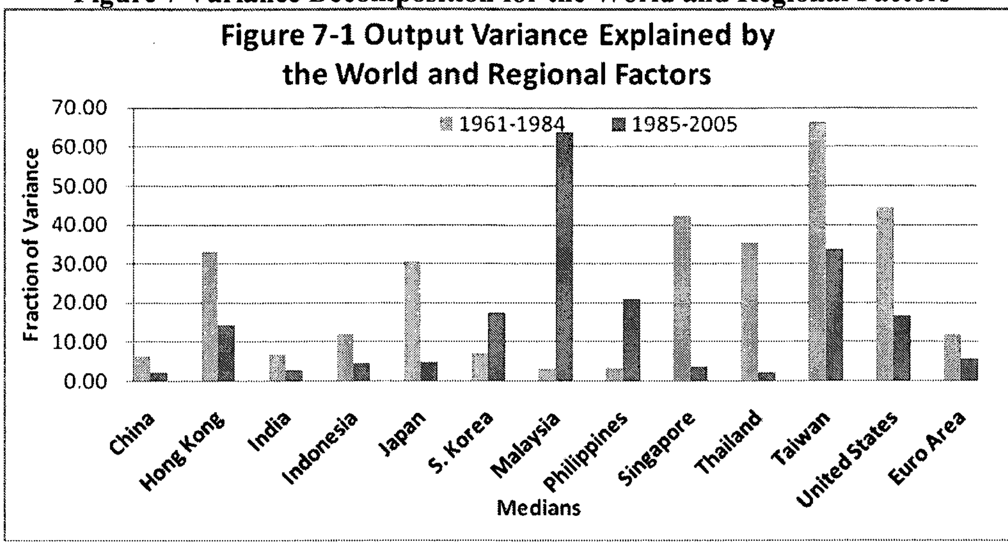


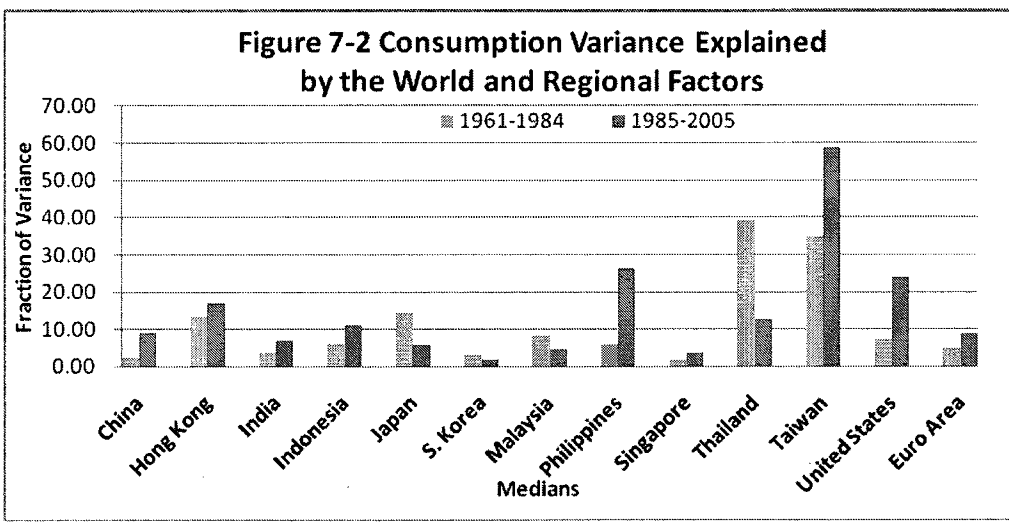


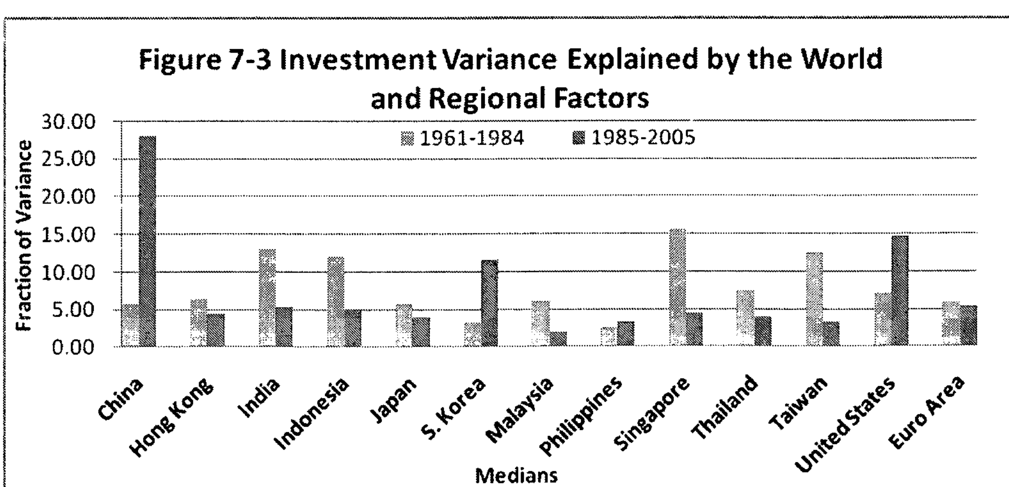


Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 7 Variance Decomposition for the World and Regional Factors

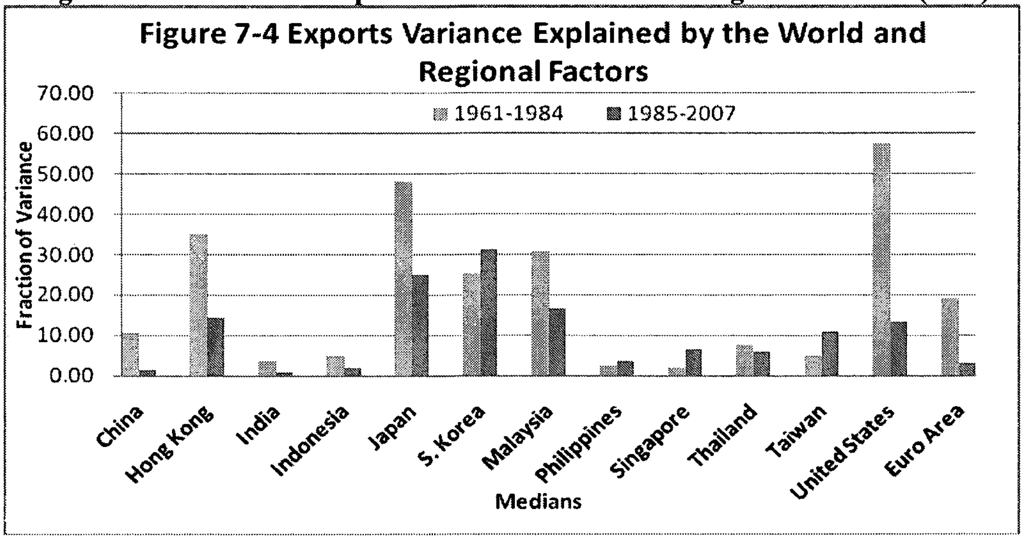






Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 7 Variance Decomposition for the World and Regional Factors (cont)



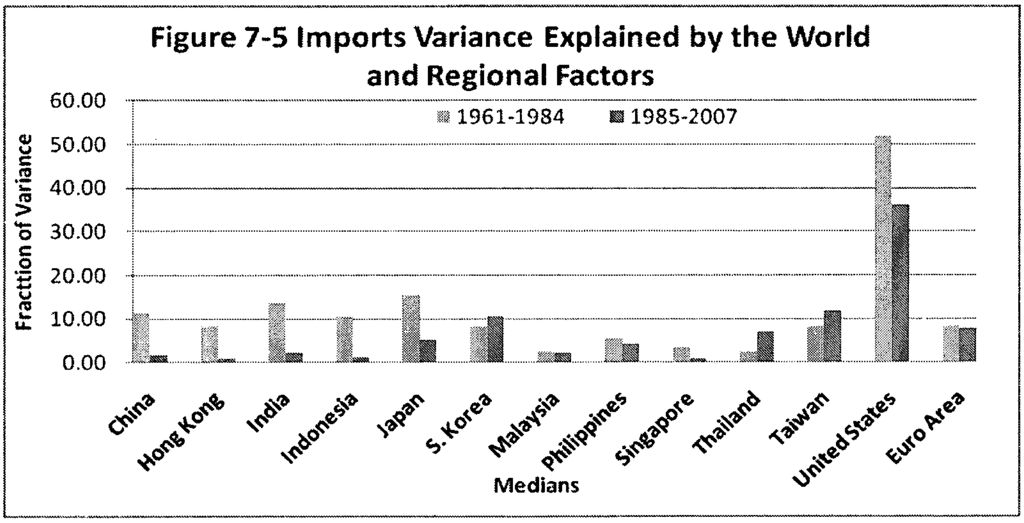
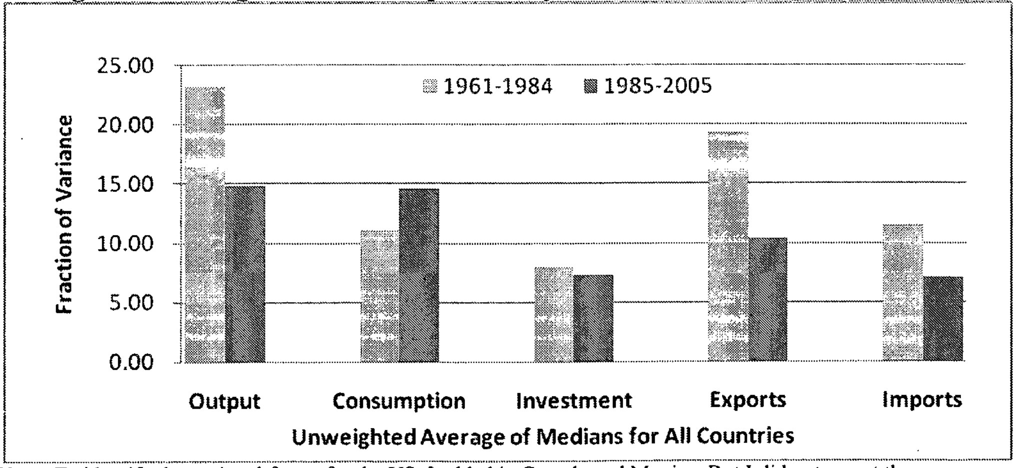


Figure 8 Average Variance Explained by the World and Regional Factors



Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 9 Unweighted Average Variance Explained by the World Factor

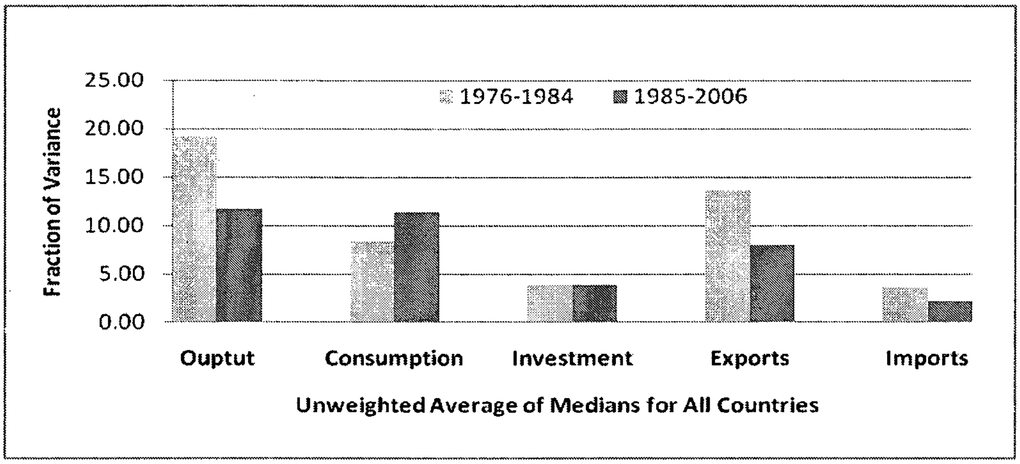


Figure 10a Unweighted Average Variance Explained by Regional Factors

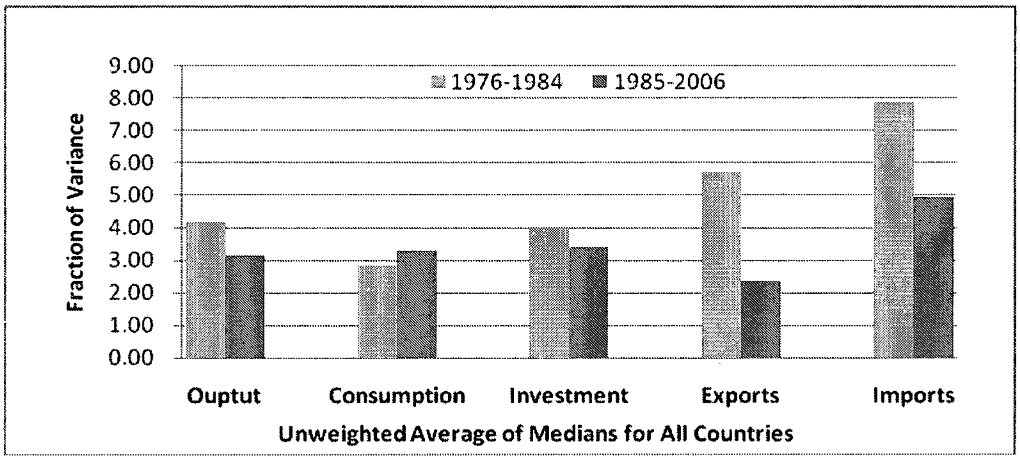
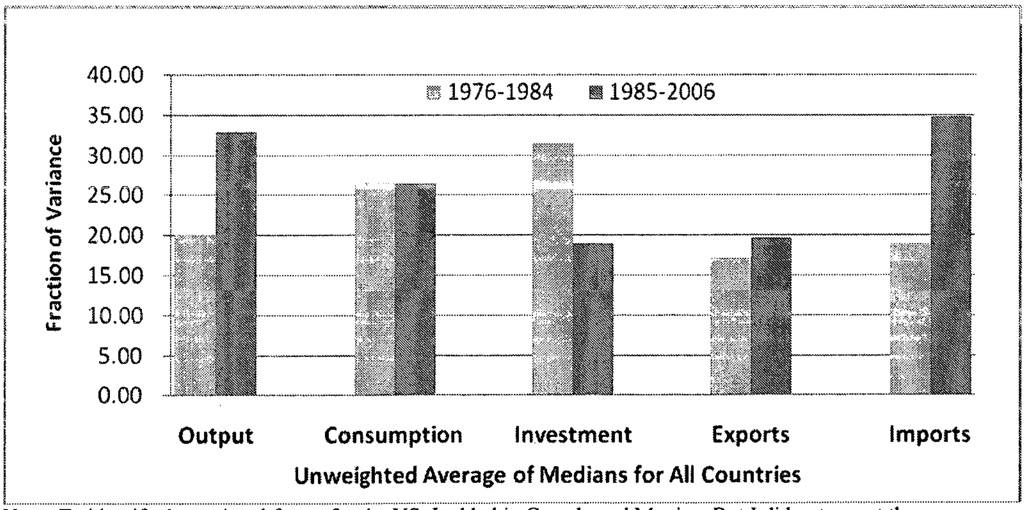


Figure 11a Unweighted Average Variance Explained by Country Factors



Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 10b Unweighted Average Variance Explained Regional Factors
(The World Factor Suppressed)

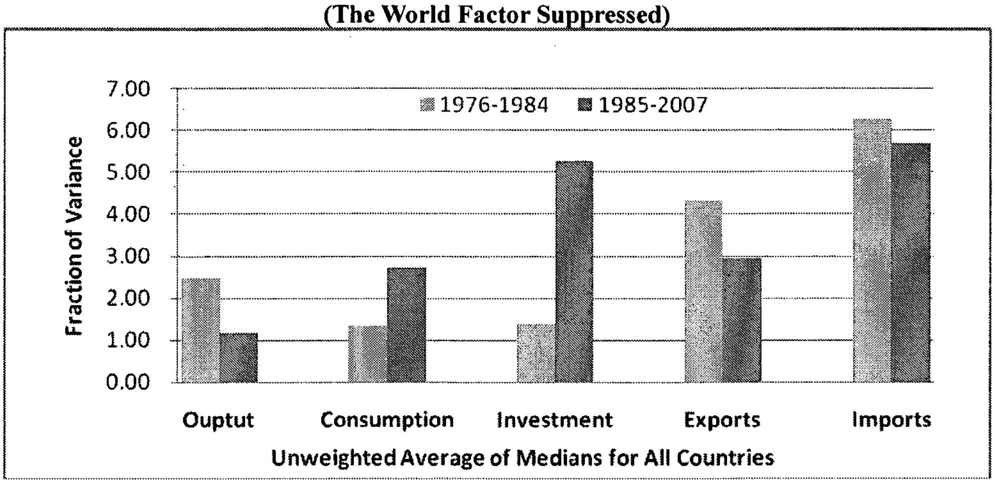


Figure 11b Unweighted Average Variance Explained by Country Factors
(The World Factor Suppressed)

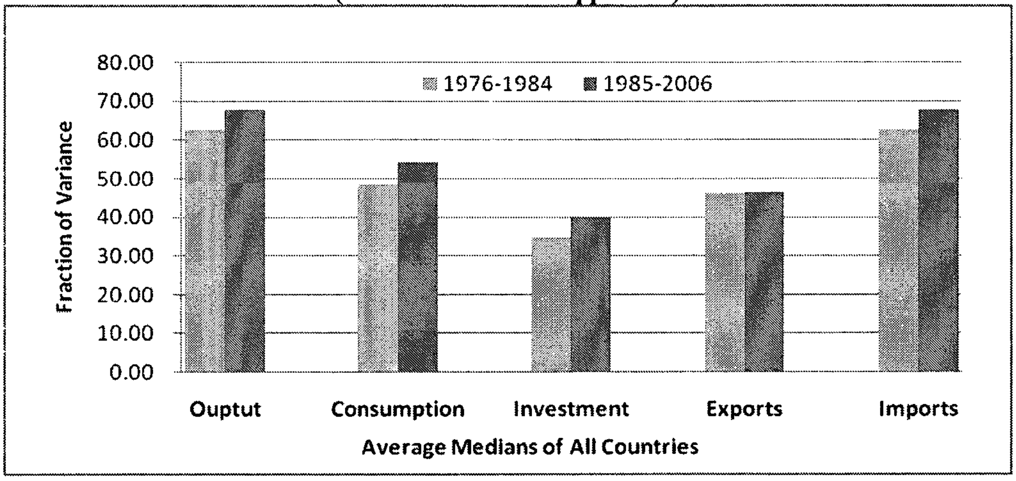
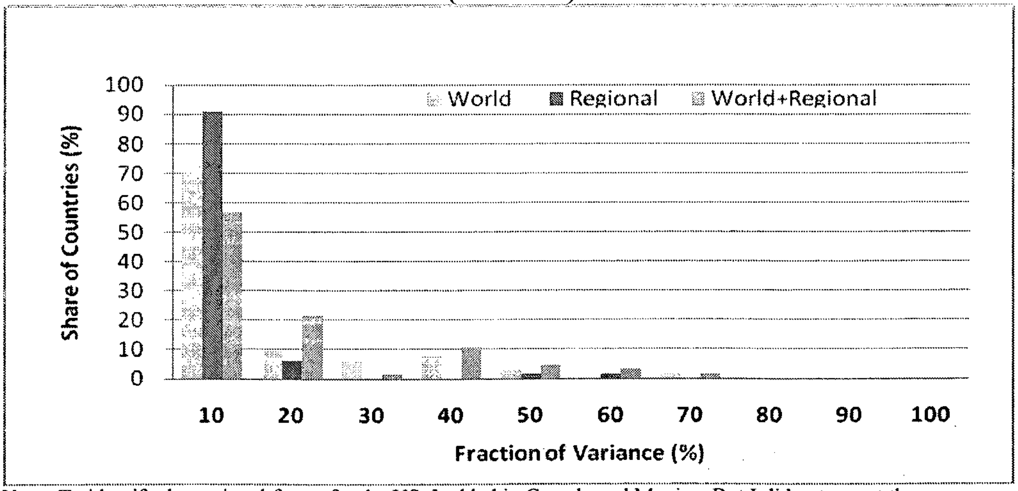


Figure 12a Average Variance Explained by the World and Regional Factors
(1961-1984)



Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

Figure 12b Average Variance Explained by the World and Regional Factors (1985-2007)

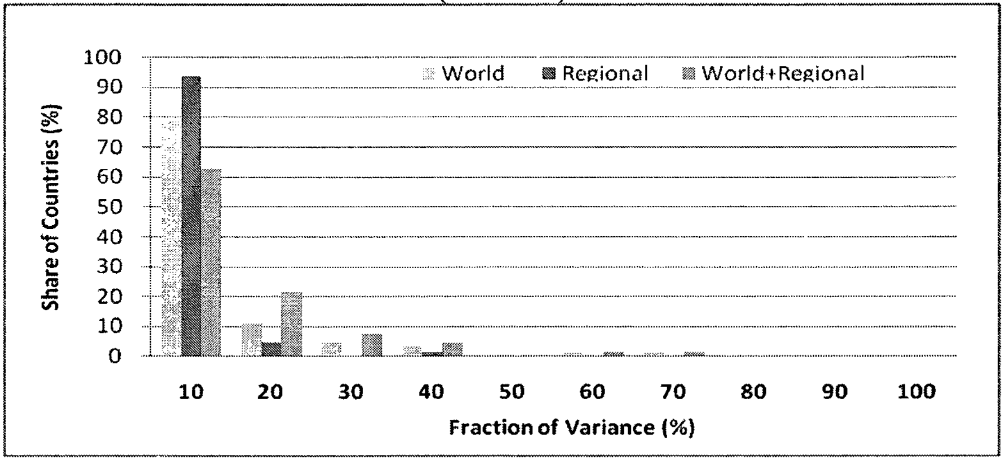


Figure 13a Average Variance Explained by the World and Regional Factors (1961-1984)

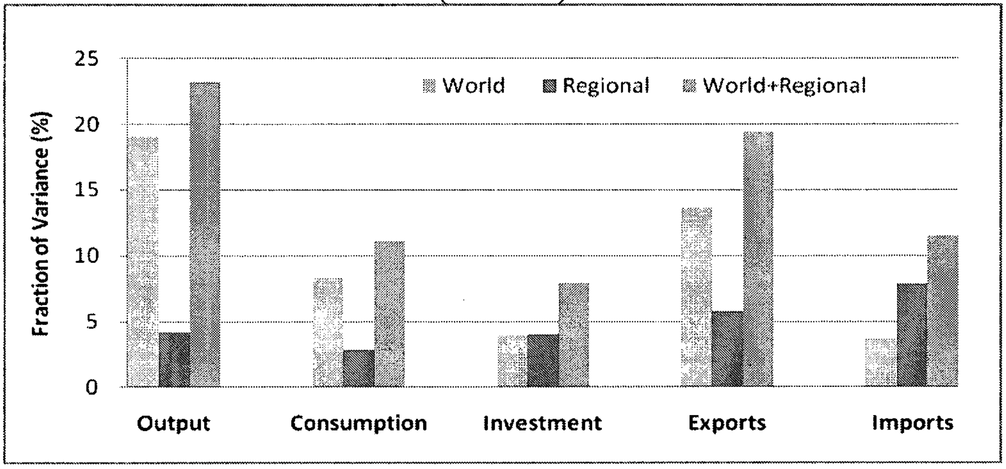
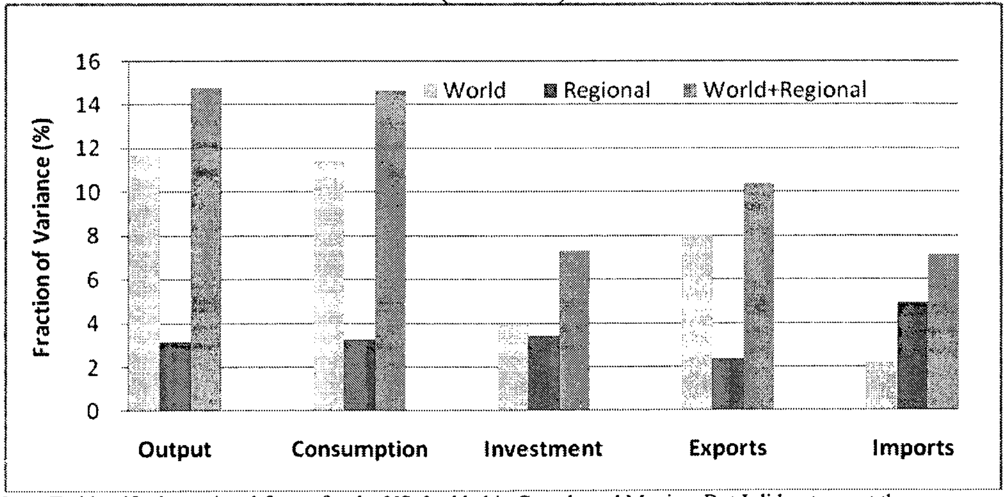
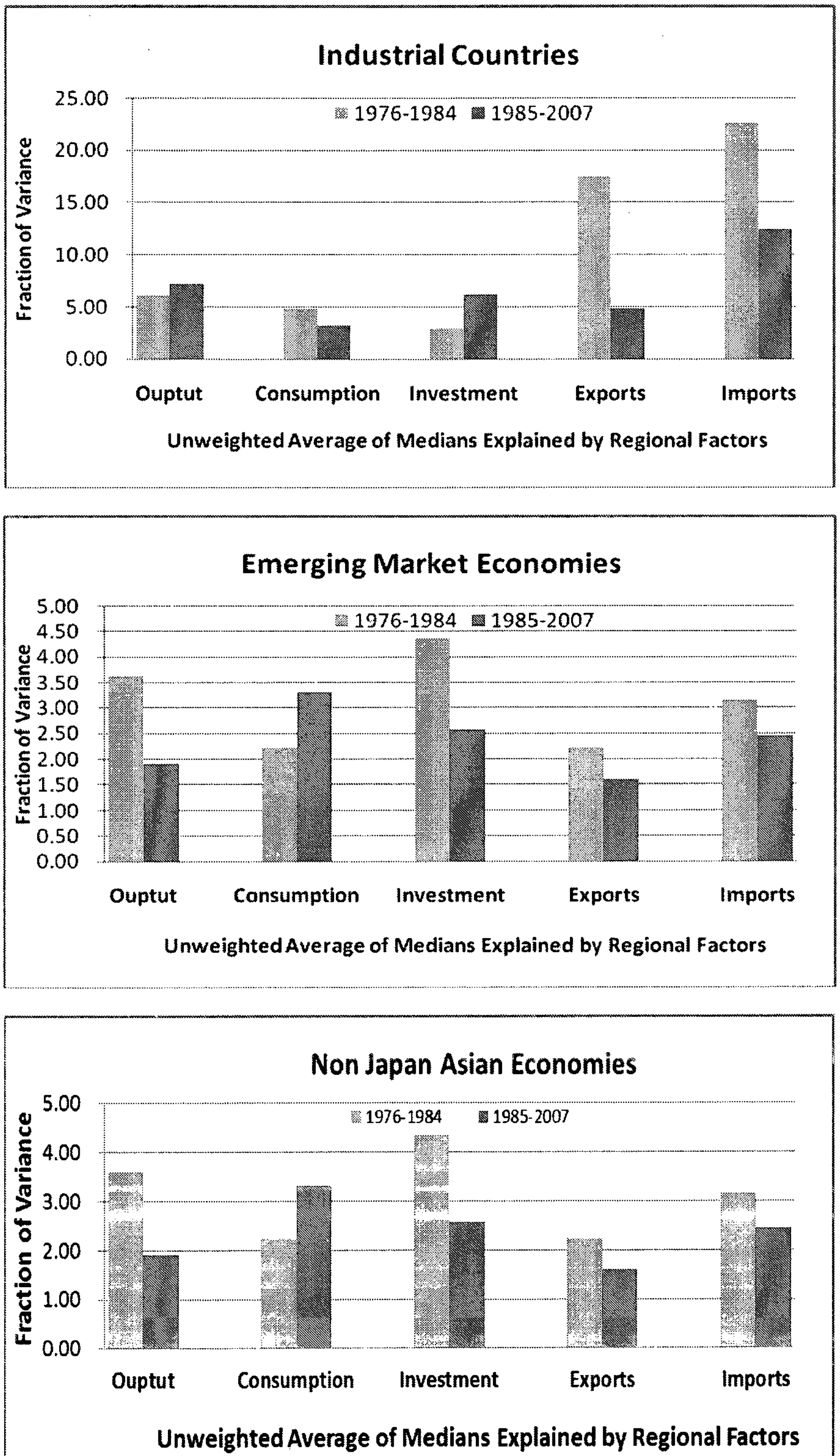


Figure 13b Average Variance Explained by the World and Regional Factors (1985-2007)



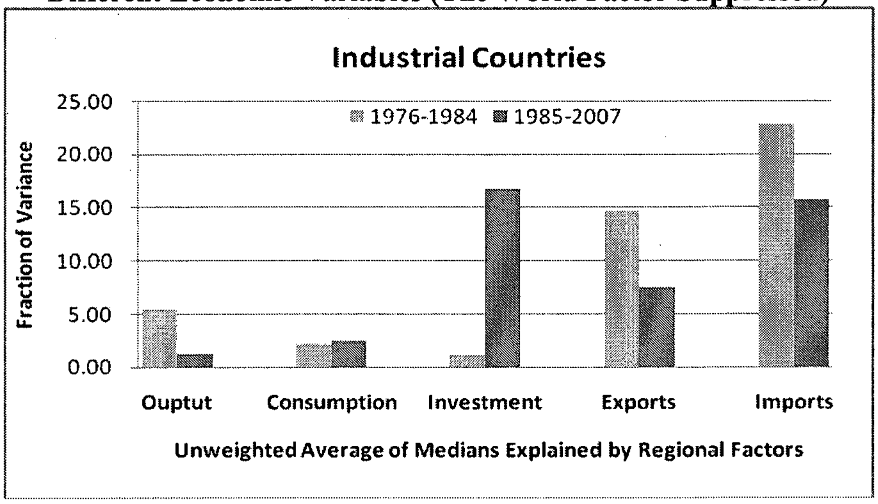
Note: To identify the regional factor for the US, I added in Canada and Mexico. But I did not report them.

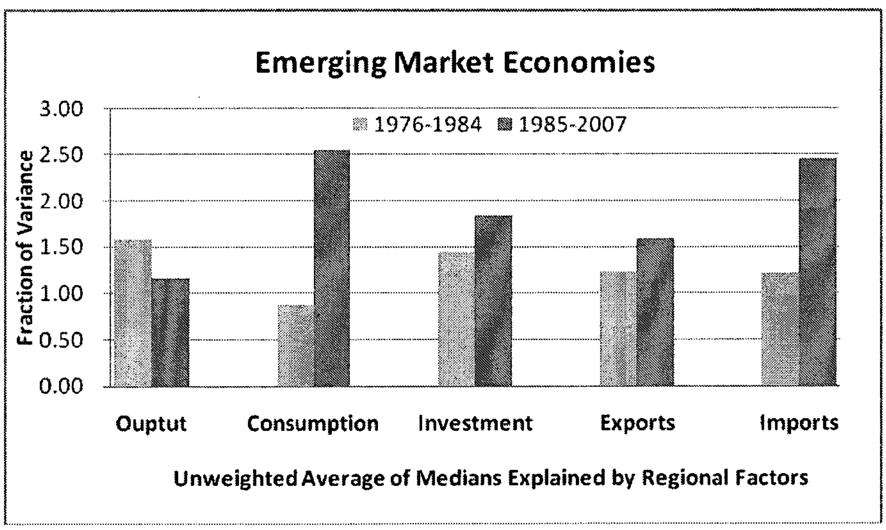
Figure 14a Unweighted Average Variance Explained by Regional Factors for Different Economic Variables

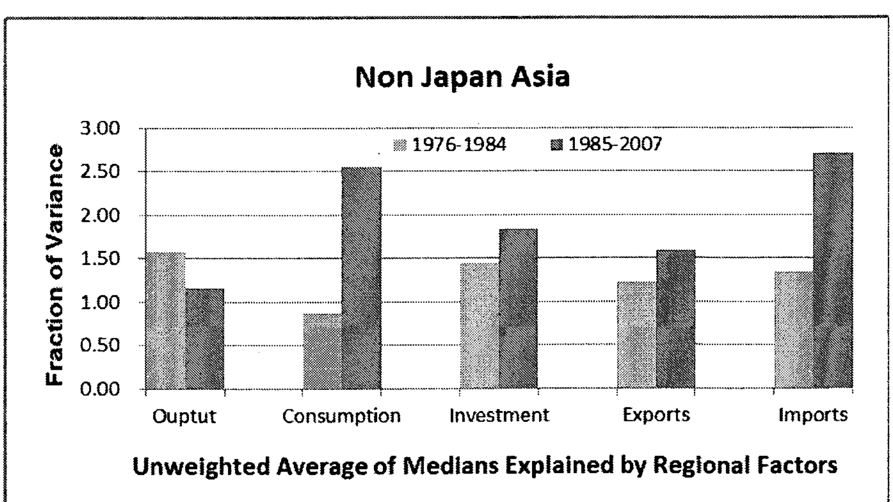


Notes: Industrial countries include Japan, EU and US. Emerging economies include the other 10 Asian countries.

Figure 14b Unweighted Average Variance Explained by Regional Factors for Different Economic Variables (The World Factor Suppressed)

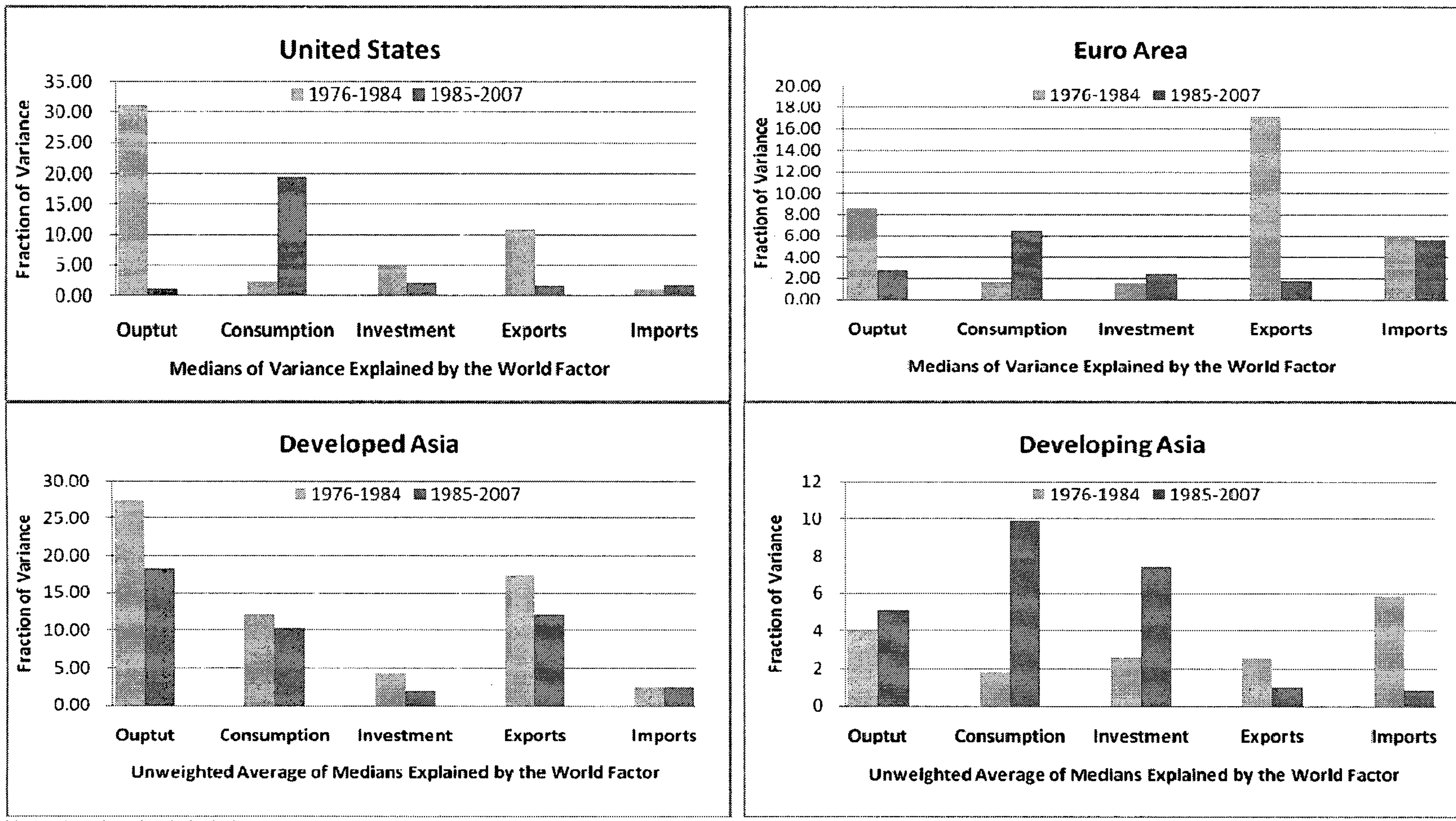






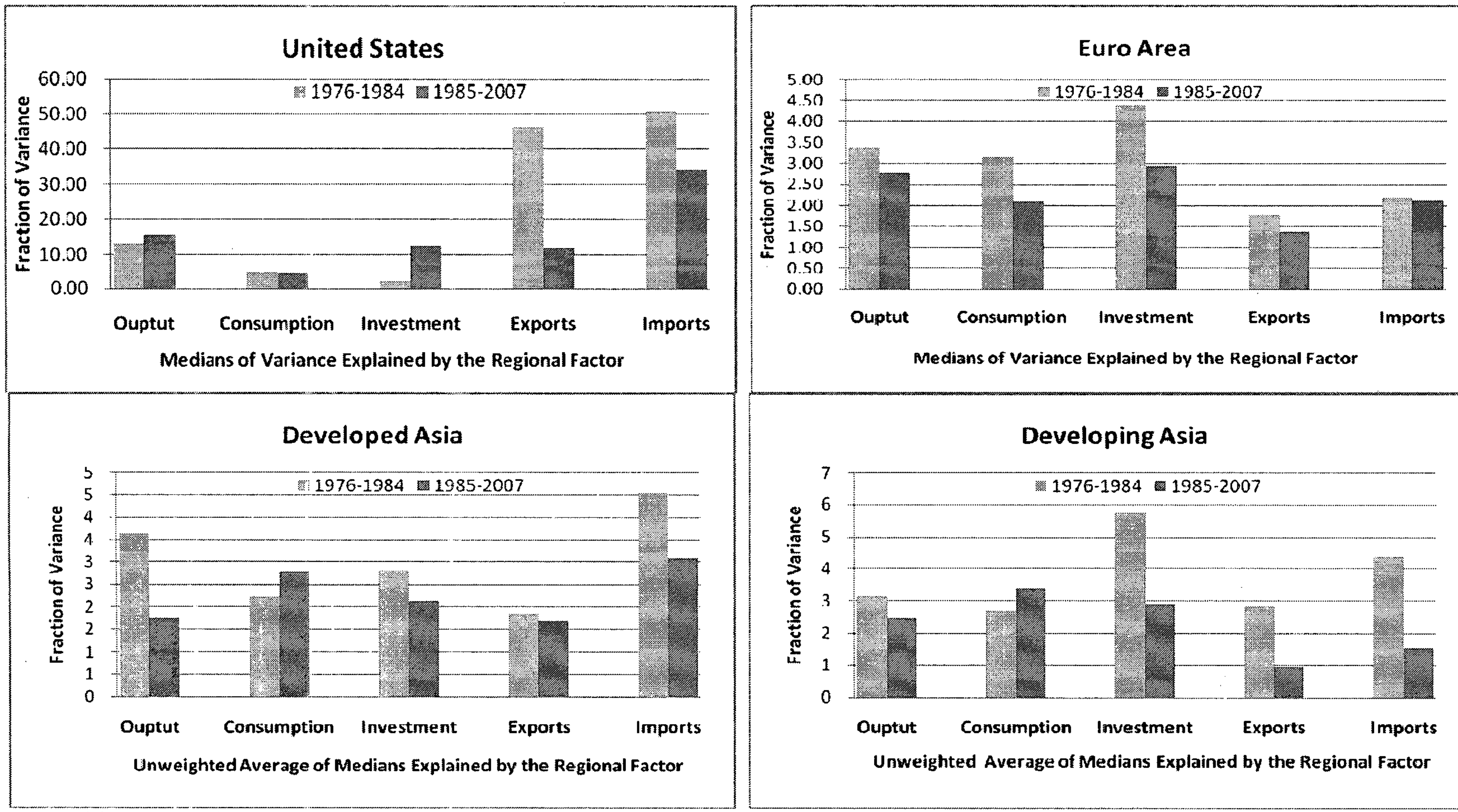
Notes: Industrial countries include Japan, EU and US. Emerging economies include the other 10 Asian countries.

Figure 15 Unweighted Average Variance Explained by the World Factor for Different Regions



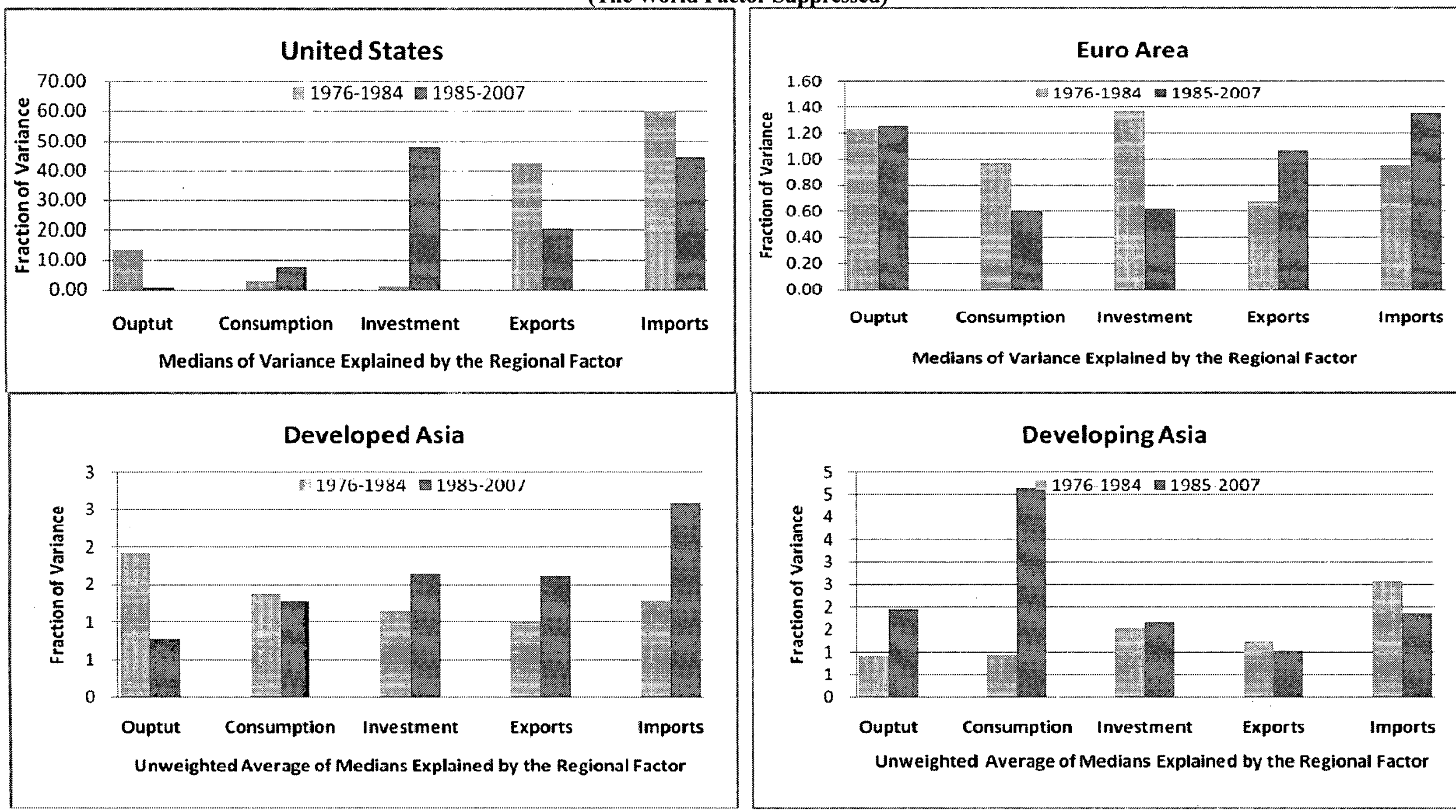
Notes: Developed Asia includes Hong Kong, Japan, Korea, Malaysia, Singapore, Thailand and Taiwan. Developing Asia includes China, India, Indonesia, and the Philippines.

Figure 16a Unweighted Average Variance Explained by Regional Factors for Different Regions



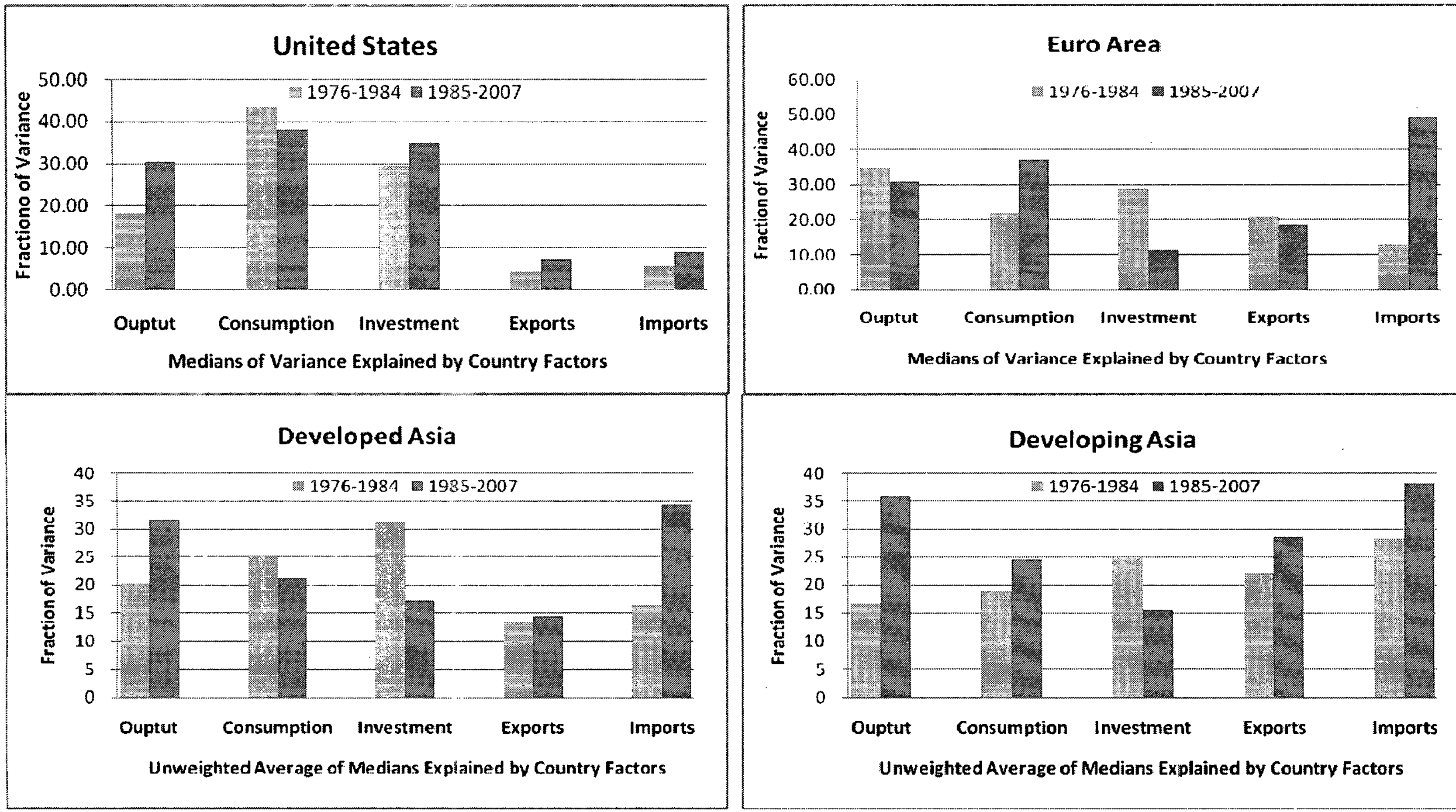
Notes: Each bar represents the cross-sectional average of the variance share distributable to the region factors for each particular variable in the given period.

Figure 16b Unweighted Average Variance Explained by Regional Factors for Different Regions
(The World Factor Suppressed)



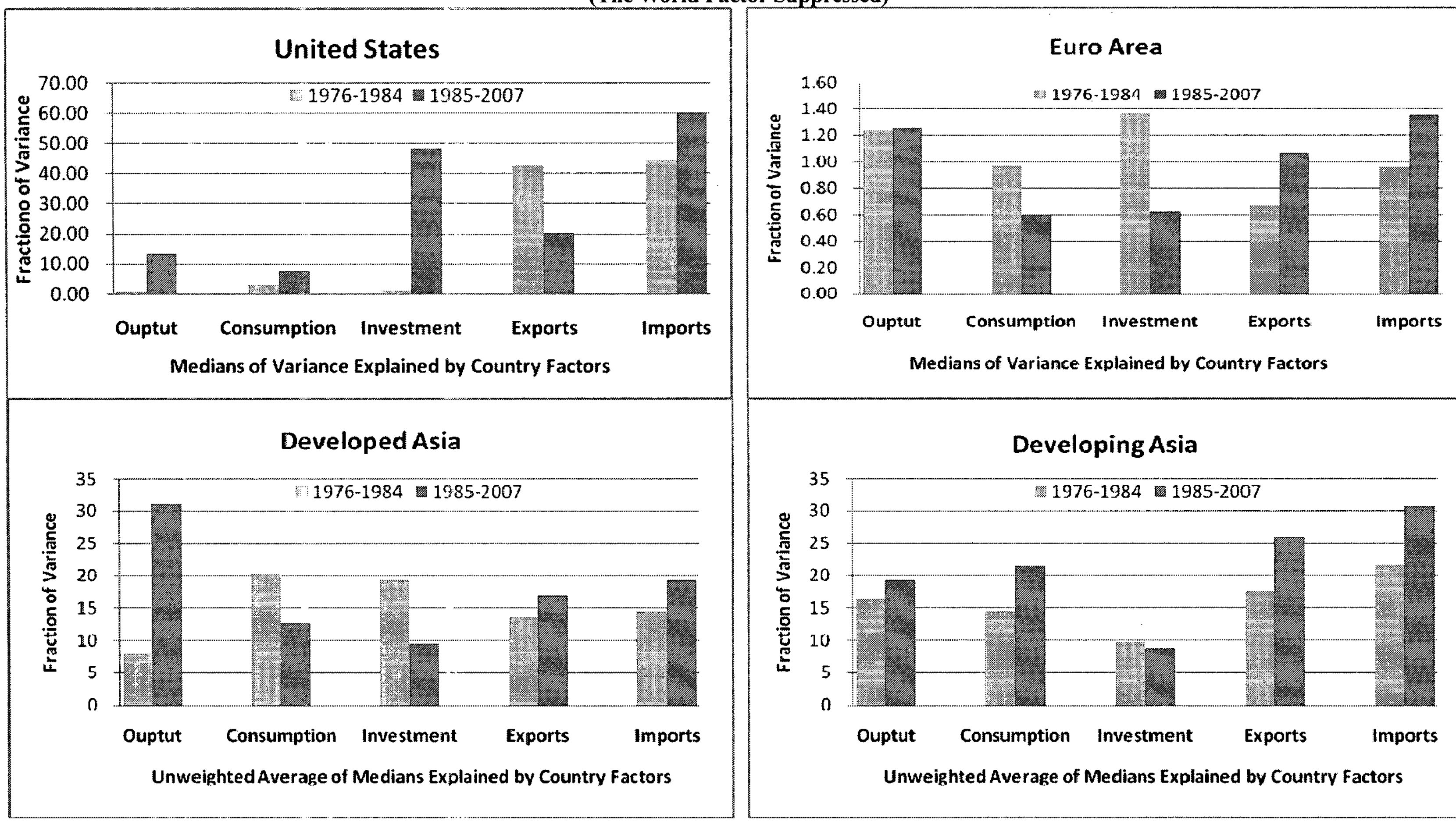
Notes: Each bar represents the cross-sectional average of the variance share distributable to the region factors for each particular variable in the given period.

Figure 17a Unweighted Average Variance Explained by Country Factors for Different Regions



Notes: Each bar represents the cross-sectional average of the variance share distributable to the region factors for each particular variable in the given period.

Figure 17b Unweighted Average Variance Explained by Country Factors for Different Regions
(The World Factor Suppressed)



Notes: Each bar represents the cross-sectional average of the variance share distributable to the region factors for each particular variable in the given period.