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## Business Cycle Synchronization in Asia: The Role of Financial and Trade Linkages

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# BUSINESS CYCLE SYNCHRONIZATION IN ASIA: THE ROLE OF FINANCIAL AND TRADE LINKAGES

*Yuwen Dai*

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## Business Cycle Synchronization in Asia: The Role of Financial and Trade Linkages

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## **Abstract**

In this research project, we attempt to examine the behavior of business cycles in Asia in order to deepen our understanding of and expand research on this topic. Given the importance of the People's Republic of China, Japan, and the United States in the region economy, we use these three economies as our "reference countries" to study the synchronization of their business cycles with other Asian economies of interest. In particular, we investigate the potential determinants underlying the synchronization of their business cycles, including trade linkages, financial linkages, and policy similarities. From our panel data analysis, we find empirical evidence of the impacts of trade channels, financial channels, and policy channels in determining the degree of their business cycle synchronization.

*Keywords:* business cycle synchronization, macro interdependence, trade integration, financial integration, interest rate, fiscal balance, and policy coordination; Asia, NIE-4, ASEAN-4, PRC, Japan, and the US; panel data analysis

*JEL Classification:* E30, E32, F00, F15, F36, F42, F44





## 1. Introduction

It is common to hear that the world has become smaller, as the economic and political spheres have become increasingly globalized. This has far-reaching implications for economics and finance, because the borders between national, regional, and global issues are becoming less clearly defined. The Global Financial Crisis (GFC) in 2008–2009 highlighted again that we live in a globalized world, which is comprised of a network of intricately interconnected entities. Globalization makes it impossible for modern societies to collapse in isolation.

Amid the current global economic turmoil, we have witnessed a tepid economic recovery in the United States (US), and diminished prospects for a quick recovery in the eurozone. Conventional wisdom suggests that “when the US sneezes, the rest of the world catches a cold.” Commonly used sayings sometimes represent distilled wisdom, while at other times they represent mistaken inferences. During recent years, some discussion has arisen about a “decoupling” of economic activity in emerging markets from the US and other developed economies. For instance, Akin and Kose (2008) find that the impact of economic activities in advanced economies on emerging economies has declined. Some people have started to turn their new hopes to emerging economies in Asia as a means of sustaining global economic growth.

In the case of Asia, there has been the notion of an emerging Asian regionalism. Economic growth is expected to be promoted through closer economic links within the Asian region, especially with respect to the poorer economies. With the strengthening of economic ties (e.g., trade linkages, financial linkages, and policy similarities) across the Asian region, there are also spillover effects from one economy to another. Macro interdependence determines the degree to which the region could be integrated. The synchronization of business cycles determines whether the economies within the region have the scope for macro cooperation. Business cycle synchronization is our main interest in this research project.

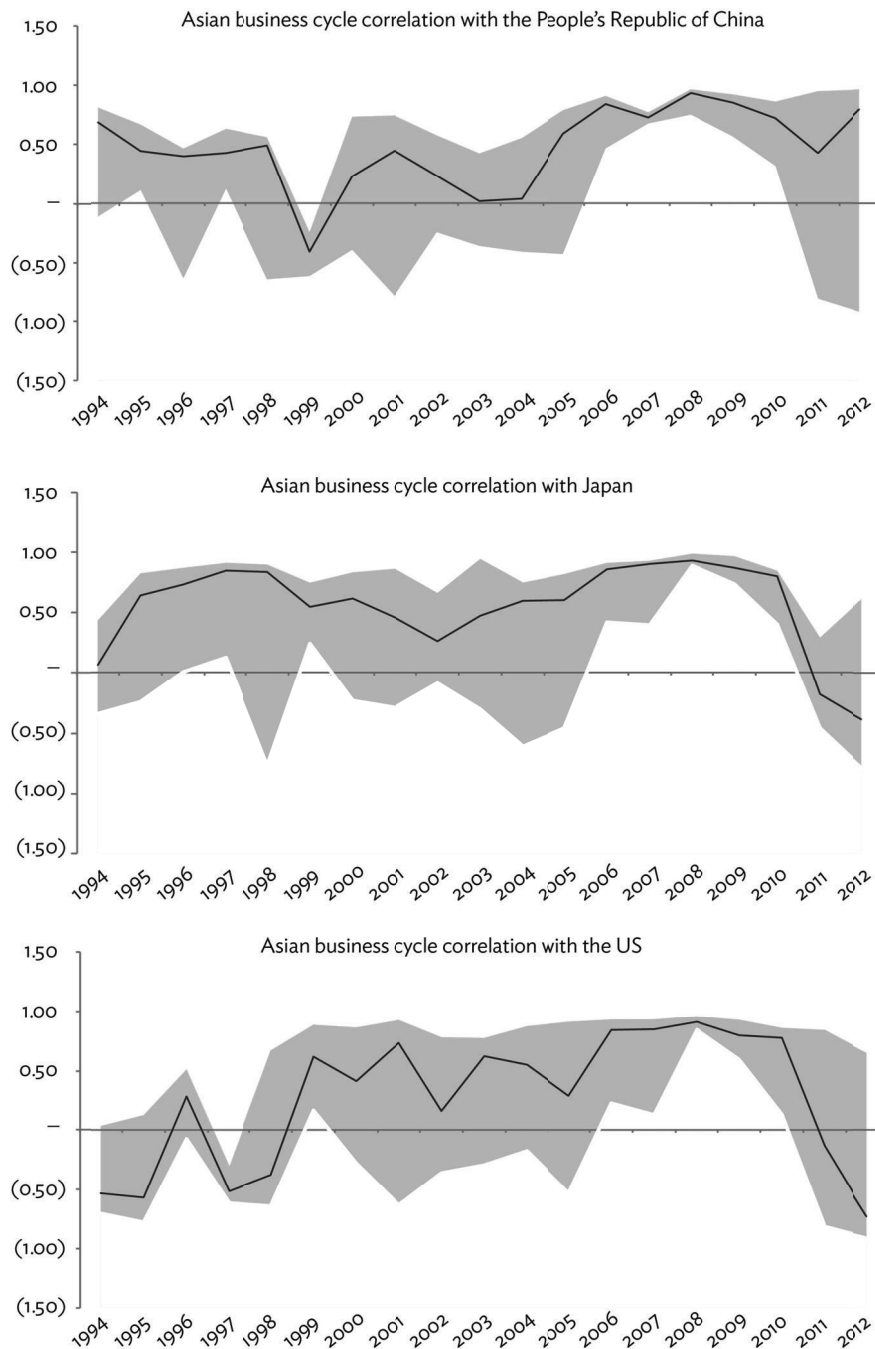
So for Asian economies, how correlated are their business cycles with the two big economies in the region: the People’s Republic of China and Japan? What is the influence of the US on Asian cycles? In Figure 1, we present some stylized facts on the macro interdependence between Asian business cycles and those of the PRC, Japan, and the US. As we can see, the correlation of business cycles between Asia<sup>1</sup> and the PRC has increased during recent years, but there is a declining trend in cycle correlation between Asia and Japan, and between Asia and the US.

To pursue our interest further, we have a few research questions: What are the determinants underlying the synchronization of business cycles between Asia and the PRC, between Asia and Japan, and between Asia and the US? What are the linkages between trade flows and the synchronization of their business cycles?

---

<sup>1</sup> Asia refers to the New Industrial Economies (NIE-4), four of the ten members of the Association of Southeast Asian Nations (ASEAN), and India. NIE-4 includes Hong Kong, China; the Republic of Korea; Singapore; and Taipei, China. ASEAN-4 includes Indonesia, Malaysia, the Philippines, and Thailand.

**Figure 1: Asian Business Cycle Synchronization with the People's Republic of China, Japan, and the United States (US) (cyclical HP filtered GDP)**



Source: Haver Analytics, author's calculation.

Also, what are the linkages between financial flows and the correlation of their business cycles? On top of that, how relevant are monetary policy and fiscal policy to the degree of synchronization in business cycles?

Why are these questions interesting? From the perspective of a policymaker at the country level, it is important to have a good understanding of the relationship between the domestic economy and the rest of the region. From the standpoint of a macroeconomist at the regional level, say in a regional development bank, it is also critical to understand the dynamics among different economies within the region, in order to be in a better position to provide policy recommendations on macro policy coordination.

### **Roadmap**

Looking ahead, the rest of this paper is structured as follows. In Section 2, we review literature on the possible determinants of business cycle synchronization.

In Section 3, we discuss the construction of variables for our study of business cycle synchronization in Asia. In Section 4, we conduct our panel data analysis to study the synchronization of business cycles between Asia and the PRC, between Asia and Japan, and between Asia and the US. Section 5 concludes and discusses the policy implications.

## **2. Literature Review**

### **2.1 Trade Channel**

At the economic theory level, it is not clear whether intensified bilateral trade results in more or less synchronization in business cycles. On the one hand, economic models of international trade (with monetary or technology innovation) focus on the cross-country spillover effects from shocks, and therefore predict that more synchronized business cycles are associated with higher trade volumes. See Imbs (2004) for an overview on this topic. On the other hand, increased trade relations may also lead to an increase in the degree of trade specialization, which can be explained by our first principle of comparative advantage. Depending on whether the bilateral trade flows occur at the level of intra-industry trade or inter-industry trade, the corresponding effects on the correlation of business cycles could go either way. See, for example, Krugman (1992) with his “Krugman Hypothesis.” Hence, it is more of an empirical issue to study the relation between trade integration and business cycle synchronization, which should be evaluated on a case-by-case basis.

At the empirical level, Frankel and Rose (1998) estimate a single-equation model with instrumental variable (IV) regressions based on a large sample of developed and developing countries, from which they find a strong, robust, and positive relationship between bilateral trade and business cycle synchronization. This result is confirmed in a later empirical paper by Baxter and Kouparitsas (2004), who apply extreme bound analysis and find that with an increase in trade intensity, there will be an increase in the correlation of business cycles. Building on that, Imbs (2004) adopts a simultaneous equation approach with three-stage least squares, and he also finds an overall positive impact of trade on business cycle synchronization.

From the lens of structural models, Moneta and Ruffer (2006, 2009) adopt a dynamic factor model, and find that business cycle synchronization in East Asia mainly reflects strong export synchronization. Following a similar line of research, He and Liao (2012) suggest that structural forces such as increased vertical trade linkages within the Asian region have contributed more to regional business cycle synchronization.

Some work has been done to fill the gap between empirics and theory. For example, Kose and Yi (2005) apply a three-country DSGE model to evaluate their empirical study on the relation between trade and cycle comovement. Unfortunately (but not surprisingly), the predication of their model falls short of the empirical findings on the strong linkage between trade channel and business cycle synchronization.

## **2.2 Financial channel**

Other than the trade–export linkages in Asia, another potential candidate that is expected to influence cycle correlation is financial linkage, although there is also mixed empirical evidence regarding its impact on the degree to which business cycles are correlated. Kalemli-Ozcan, Sorensen, and Yosha (2003) apply ordinary least squares (OLS) and IV regressions, and find that economies with a high degree of financial integration have more specialized industrial patterns and less correlated business cycles. However, Imbs (2004) uses three-stage least squares, from which he finds that a rise in the degree of financial integration leads to an increase in the extent of business cycle correlation between two economies. In some sense, it also depends on the way financial integration is measured or proxied. The empirical literature on financial crises and financial contagion shows that there is a direct and positive effect of capital flows on the synchronization of business cycles. See Calvo and Reinhart (1996) and Kose et al. (2003) for some examples. More recently, Kim and Kim (2013) explain business cycle synchronization in Asia via the channel of international capital flows, and their empirical evidence indicates that capital market liberalization has contributed to cycle synchronization in Asia.

## **2.3 Trade and financial channels**

Combining trade and financial channels, Imbs (2010) proposes a decomposition of the dynamics in business cycle synchronization into goods trade and financial linkages, and his results present us with the findings that changes in regional cycle synchronization in East Asia are associated with a decrease in bilateral trade within the region, and with a fall in financial trade with the rest of the world.

## **2.4 Policy channel**

In addition to the trade and financial channels, there has been some discussion on the policy channel in the literature as well. For instance, Clark and van Wincoop (2001) use the variable constructed as the bilateral correlation of HP-filtered real gross domestic product (GDP) data, apply IV regressions, and find that similarity in policies has no effect on the degree of business cycle synchronization.

### 3. Determinants of Synchronization in Business Cycles

In this section we discuss the potential determinants underlying the synchronization of business cycles between Asia and the PRC, Japan, and the US. In particular, we are interested in the impact of trade linkages, financial linkages, and policy linkages on the correlation of business cycles.

#### 3.1 Trade variables

In this part, we construct several trade variables to capture the potential of the trade channel on the correlation of business cycles in Asia.

##### Export share

In order to construct the *export share* variable, we take the ratio of economy *i*'s exports to economy *j*, and economy *i*'s total exports to the rest of the world. This measures economy *j*'s share of economy *i*'s exports. In other words, this variable measures the relative importance of economy *j*'s market for economy *i*'s exports.

A higher share indicates a higher degree of economy *i*'s export dependence on economy *j*.

$$ES_{ij,t} = \frac{x_{ij,t}}{x_{it}}$$

where:

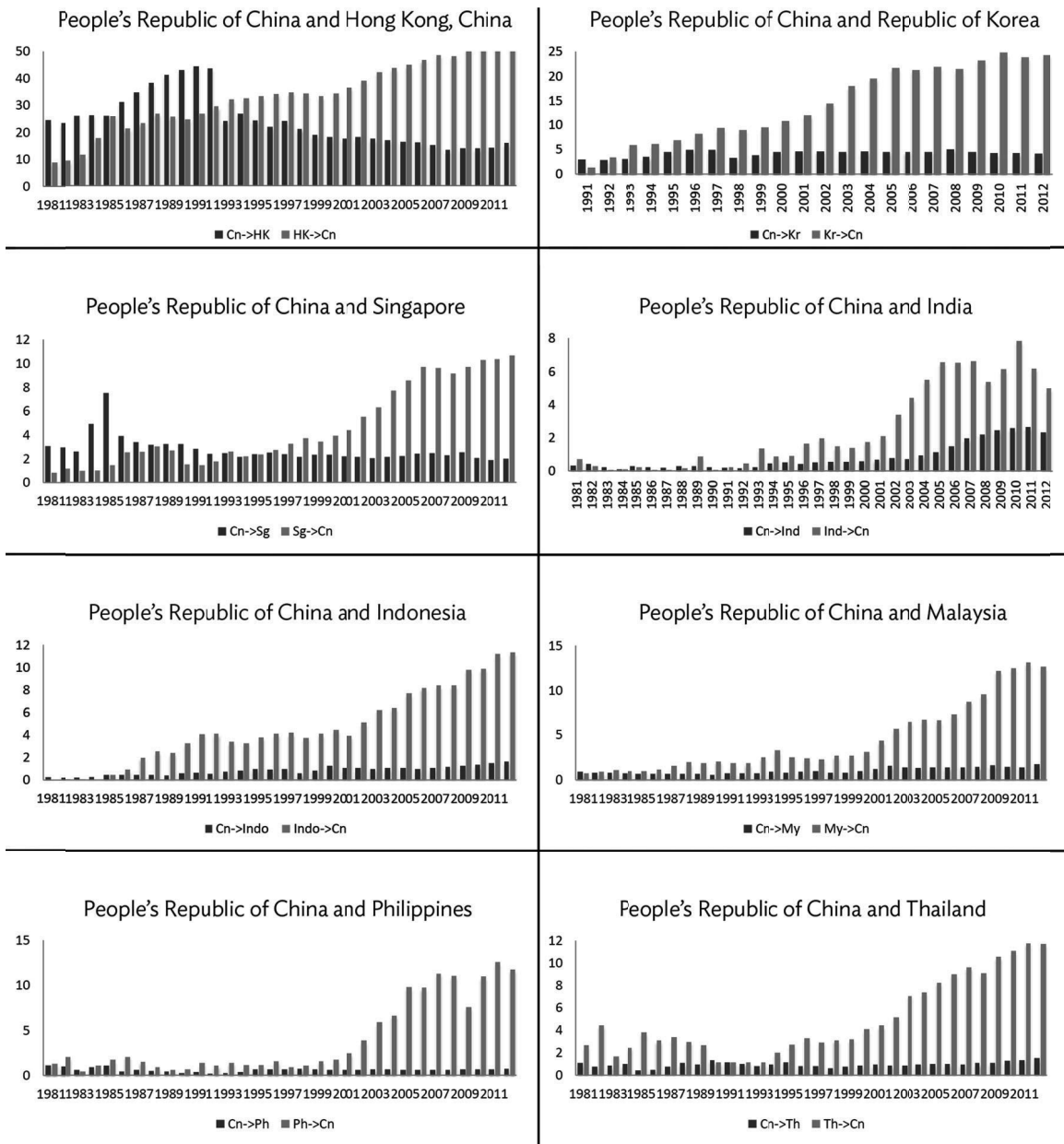
- $x_{ij,t}$  = the exports of economy *i* to economy *j* at time *t*.
- $x_{it}$  = the total exports of economy *i* at time *t*.

The bilateral trade flow data and total export–import trade data are collected from the *Direction of Trade Statistics* (DOTS) published by the International Monetary Fund (IMF). These data are for the PRC, Japan, and the US; and Hong Kong, China; Indonesia; the Republic of Korea; Malaysia; the Philippines; and Thailand. The data for Taipei, China are from the Bureau of Foreign Trade in the Ministry of Economic Affairs.

Figure 2 shows the export share in the case of the PRC. The blue bars represent the PRC's export share to an Asian economy, and the red bars represent an Asian economy's export share to the PRC. From these charts, we can see that all the Asian economies under review here have significantly increased their export share to the PRC. This indicates that Asian economies have become more and more export dependent on the PRC.

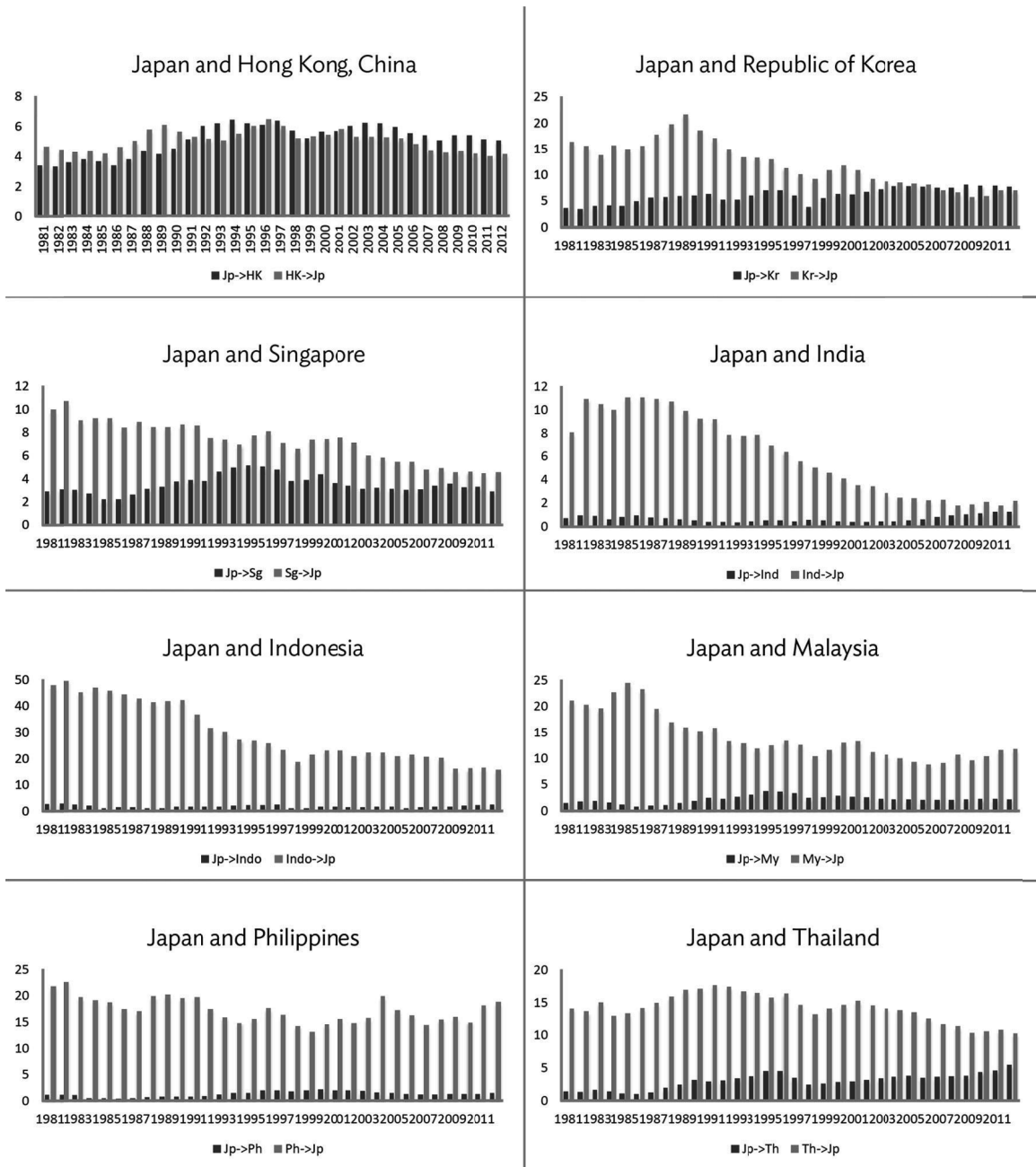
Figure 3 and Figure 4 show the export share in the case of Japan and the US, respectively. From these figures, it can be seen that Asian export dependence on Japan and the US has been declining over the past decade or so. This is in contrast to the climbing trending of export dependence on the PRC.

**Figure 2: Bilateral Trade Flow Share with the People’s Republic of China**



Sources: Haver Analytics, IMF, author’s calculation.

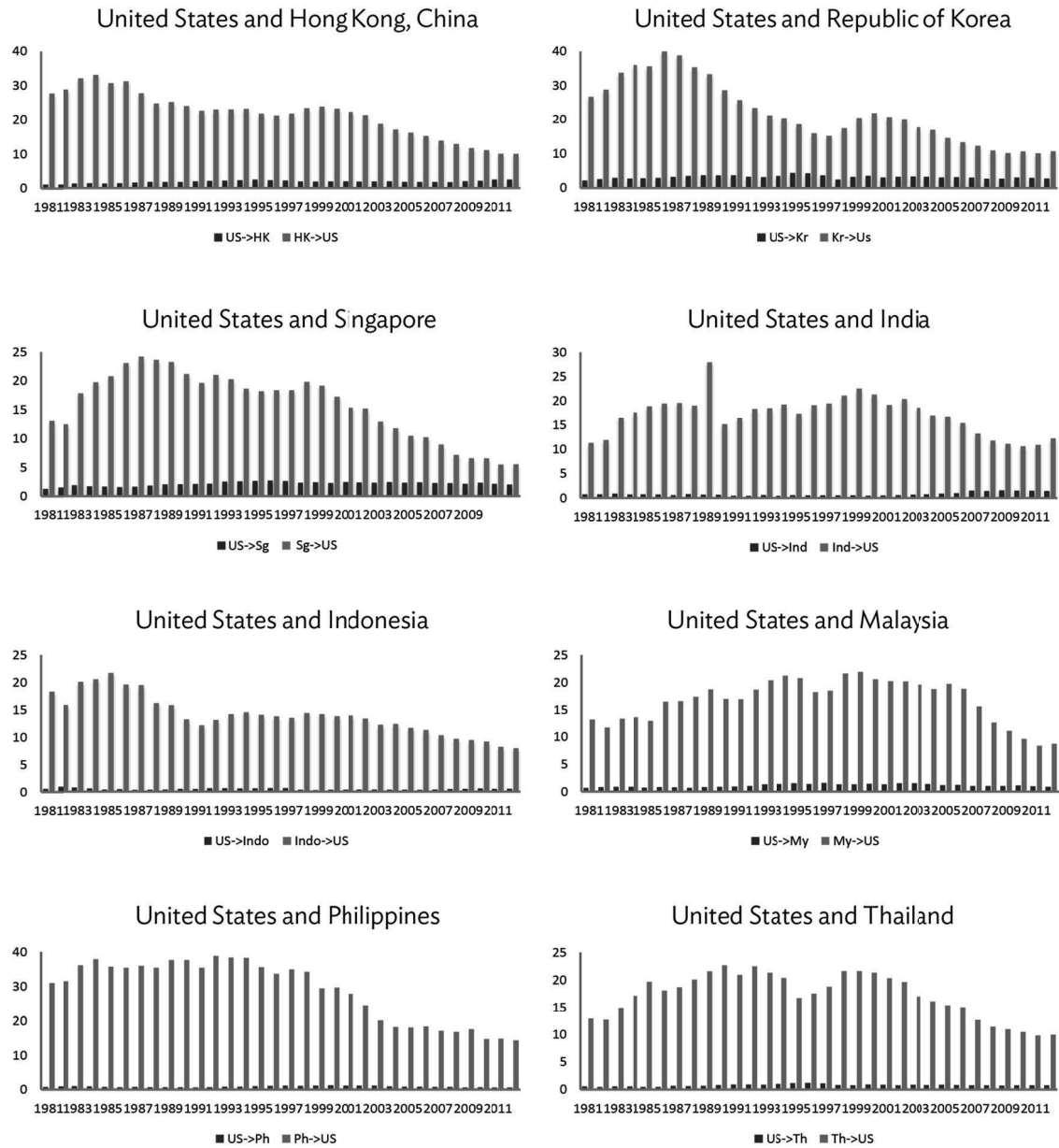
**Figure 3: Bilateral Trade Flow Share with Japan**



Sources: Haver Analytics, IMF, author's calculation.



**Figure 4: Bilateral Trade Flow Share with the United States**



Sources: Haver Analytics, IMF, author's calculation.

Bilateral trade share

There are (at least) two ways to construct the bilateral trade share variable. One approach is to construct as the average of the sum of bilateral exports and imports (reported by both economies) divided by the sum of total exports and imports of the two economies. Intuitively, a higher bilateral trade share is an indication that there is a higher degree of trade integration between the two economies.

$$BTS_{ij,t} = \frac{(x_{ij,t} + m_{ij,t} + x_{ji,t} + m_{ji,t})/2}{x_{it} + m_{it} + x_{jt} + m_{jt}}$$

where:

- $x_{ij,t}$  = the exports of economy  $i$  to economy  $j$  at time  $t$ .
- $m_{ij,t}$  = the imports of economy  $i$  to economy  $j$  at time  $t$ .
- $x_{it}$  = the total exports of economy  $i$  at time  $t$ .
- $m_{it}$  = the total imports of economy  $i$  at time  $t$ .

See Figure 2, Figure 3, and Figure 4 again for bilateral trade flow shares. When adding up the export share in both directions for the two economies, we get the bilateral trade flow share between them, which measures their degree of trade integration.

Alternatively, the bilateral trade share variable can also be constructed and scaled by the sum of total national GDPs of the two economies.

$$BTY_{ij,t} = \frac{(x_{ij,t} + m_{ij,t} + x_{ji,t} + m_{ji,t})/2}{y_{it} + y_{jt}}$$

Our hypothesis is that business cycle correlation increases with the intensification of bilateral trade, both relative to total trade and to GDP.

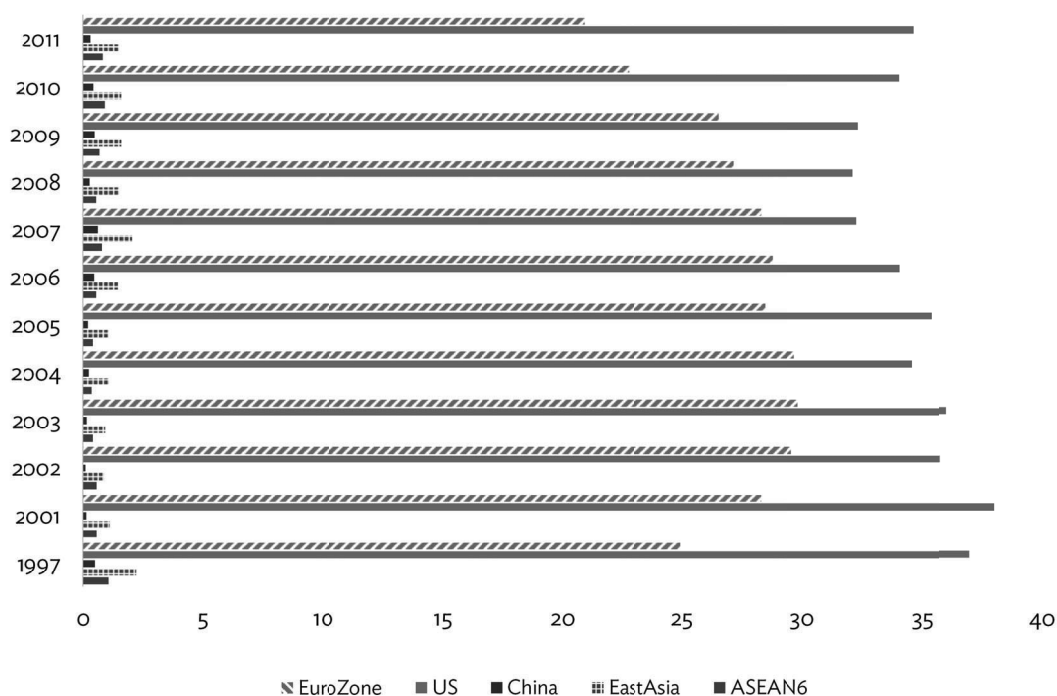
### 3.2 Financial variable

Bilateral investment share

The bilateral investment share variable is constructed as the bilateral investment flows between economy  $i$  and economy  $j$  divided by their total investment flows with the rest of the world.

$$BIS_{ij,t} = \frac{inv_{ij,t} + inv_{ji,t}}{inv_{it} + inv_{jt}}$$

Figure 5 presents Japan's portfolio investment in its major destinations around the globe. This includes the US; the eurozone (Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovak Republic, Slovenia, and Spain); the PRC; East Asia (the PRC; Hong Kong, China; the Republic of Korea; and Taipei, China); ASEAN-6 (Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam). As can be shown in Figure 5, Japan invests much more in the US and the eurozone than it invests in Asia.

**Figure 5: Japan's Investment Share (%)**

Sources: IMF, author's calculation.

We get our bilateral portfolio investment flow data from the Coordinated Portfolio Investment Survey (CPIS) database provided by the IMF. Unfortunately, but not surprisingly, there is no investment outflow data for the PRC. But a lot of the PRC's portfolio investment outflows are channeled via its sovereign wealth funds.

### 3.3 Monetary Policy Variable

We consider the short-term interest rate differential as one of our monetary policy variables, to determine whether difference in monetary policy stance could be related to the synchronization of business cycles between the two economies in one way or another.

The real short-term interest rate differential variable is constructed by taking the difference of the 3-month money market rates between the two economies, after taking into account the change in their respective inflation rates.

In economic theory, it is not clear how a change in the short-term interest rate differential will affect the correlation of business cycles between two economies. On the one hand, if the two economies have a similar monetary policy stance, we would expect that they would be affected and react in a similar way to shocks due to monetary policy, as monetary policy shocks are one source of business cycles. In this case, it would be expected that small difference in their

interest rate spread (due to a monetary policy shock) would cause large correlations in the comovement of their business cycles. On the other hand, if the two economies have different monetary policy regimes and are hit by shocks, they may not be able to respond by their individual monetary policy in the presence of policy coordination, and as a consequence of that their business cycles would be less correlated. That is, a small difference in the interest rate spread would be associated with a small correlation in business cycles. Hence, the direction of impact is more of an empirical issue.

The 3-month money market nominal interest rates and the inflation data are taken from the IMF's *International Financial Statistics* (IFS).

### 3.4 Fiscal Policy Variable

#### *Fiscal balance differential (as % of GDP)*

The fiscal balance differential variable is calculated by taking the difference in the general budget balance (as a percentage of GDP) between the two economies.

Similar to the case of monetary policy, it is unclear from a theoretical standpoint what the direction of fiscal effects would be on the correlation of business cycles, which should be quantified on an empirical basis.

The data on fiscal balance differential are from ADB's *Key Indicators* for the PRC; Hong Kong, China; Indonesia; the Republic of Korea; Malaysia; the Philippines; Taipei, China; and Thailand. The data for Singapore are from the World Bank's *World Development Indicators*. The data for the US are from the FRED database of the US Federal Reserve Bank of St. Louis.

## 4. Panel Data Analysis

In this section, we conduct our panel data analysis to study the potential determinants of the synchronization of business cycles in Asia. Given the influence of the PRC, Japan, and the US, we use these three economies as our reference countries to see how the other Asian economies' business cycles comove with the Chinese, Japanese, and US business cycles. We also consider the subgroups of Asia, including the NIE-4 economies and ASEAN-4 economies.

### 4.1 Business Cycle Synchronization between Asia and the People's Republic of China

#### 4.1.1 Export Dependence and Business Cycle Synchronization

Most Asian economies are more export-oriented. For the PRC, the export market in Asian economies is less important, given their relative size. But for other Asian economies, the export destination in the PRC is very important, given the size of the PRC economy and the Chinese population. So we focus on the export dependence on the PRC by other Asian economies.

In this part, we use the PRC as our benchmark to study the pairwise correlation of business cycles between the PRC and other Asian economies of interest. This is due to our hypothesis that rapid economic growth in the PRC has led to more business cycle synchronization between Asia and the PRC.

We stack our data by country, and specify our equation of interest for the panel data analysis as follows:

$$CORR_{China,i} = \alpha + \beta_1(ES_{China,i}) + \beta_2(IRS_{China,i}) + \beta_3(FBD_{China,i}) + \beta_4(CORR_{US,i}) + \varepsilon$$

where:

- $ES$  = export share
- $IRS$  = interest rate spread
- $FBD$  = fiscal balance differential (as % of GDP)

The left-hand side variable  $CORR_{China,i}$  is constructed as the pairwise correlation of the cyclical component of the HP-filtered real GDP data between the PRC and another Asian economy  $i$ . To construct this variable, we use the quarterly real GDP data, take the logarithm, apply the HP filter with a dampening factor  $\lambda = 1600^2$ , extract the cyclical component as the deviation from the HP-filtered data, calculate the cross-correlation with a 3-year rolling window, and convert the quarterly correlation to annual correlation.

The right-hand side explanatory variable  $CORR_{US,i}$  is our control variable. It is constructed as the pairwise correlation of the cyclical component of the HP-filtered real GDP data between the US and another Asian economy  $i$ . The rationale behind using this control variable is to check the common dependence on the US, by the PRC and other Asian economies.

We first check that there is no multi-collinearity problem in this regression,<sup>3</sup> and then run a Hausman test to decide whether to use random-effect or fixed-effect panel regressions.<sup>4</sup>

#### 4.1.2 Trade Integration and Business Cycle Synchronization

In the same vein, we test the relation between trade integration and business cycle synchronization by replacing the export share (ES) variable with the bilateral trade share (BTS) variable.

$$CORR_{China,i} = \alpha + \beta_1(BTS_{China,i}) + \beta_2(IRS_{China,i}) + \beta_3(FBD_{China,i}) + \beta_4(CORR_{US,i}) + \varepsilon$$

where:

- $BTS$  = bilateral trade share

<sup>2</sup> See Maravall and Rio (2001) for an example on the rationale behind the popular  $\lambda$  value of 1600 used for data at a quarterly frequency.

<sup>3</sup> In Stata, first regress *corr es irs fbd*, and then check *vif*. (If the variable inflation factor (*vif*) < 10, then there is no issue of multi-collinearity problem.)

<sup>4</sup> In Stata, regress *corr e sirs fdb, fe*; estimates store *fixed*; regress *corr e sirs fdb, re*; estimates store *random*; hausman *fixed random*. (If the p-value > 0.05, use RE GLS.)

**Main findings:**

**“trade beta”** - The three measures of trade variables are considered successively. For these variables, we expect a positive coefficient: the more intensive trade between two countries, the higher the trade variable, and the more synchronous the business cycles. For the trade channel, we do find significant evidence of the linkage between trade integration and business cycle synchronization for nine Asian economies as a group with the PRC, for NIE-4 economies as a subgroup with the PRC, and for ASEAN-4 economies as a subgroup with the PRC. This is probably due to the existence of a “Factory Asia”, in the sense that the PRC has its production network across Asia, especially in East Asia and Southeast Asia.

**“monetary beta”** - For the monetary policy variable, we also find some evidence for ASEAN-4 economies of the significance of the real interest rate spread variable,<sup>5</sup> with a negative coefficient. The intuition behind that if their monetary policy is similar, then there will be a decrease in their interest rate spread, which would lead to an increase in their business cycle correlation. Hence, similar monetary policy would give us closer cycle correlation.

**“fiscal beta”** - The effects of similar fiscal policies are estimated by the bilateral differentials in fiscal budget deficits as shares of GDP. For the fiscal channel, we only find weak evidence for NIE-4 economies, on the relevance of the fiscal balance differential explanatory variable. In particular, the more different their fiscal stance is, the greater their fiscal balance differential would be and the more correlated their business cycles would be.

**“US beta”** - For the PRC and ASEAN-4 economies, there is strong evidence regarding their common dependence on the US. From our panel regression results, it is estimated that a 1% increase in the correlation of the US and ASEAN-4 business cycles would cause a more than 20% increase in the correlation of the PRC and ASEAN-4 business cycles. This is evidence against the hypothesis of Asian “de-coupling” from the US economy.

**Table 1: Summary of main findings, for the case of the People’s Republic of China**

	PRC + NIE-4	PRC + ASEAN-4
Trade beta	(+)	(+)
Monetary beta		(-)
Fiscal beta	(+)	
US beta		(+)

Note: (+) and (-) indicate the sign of each coefficient.

<sup>5</sup> The real interest rate is an important measure of the competitiveness of an economy, which also relates to the movement of its business cycle. First, the real interest rate measures the opportunity cost of consumption. For each dollar in your pocket, you can either deposit it in your savings account with your bank, earning nominal interest rate while taking into account inflation, or you can use it for consumption. Second, the real interest rate measures the borrowing cost. The higher the real interest rate, the more expensive it is to finance new investment projects. Third, the real interest rate also measures the interest cost for debt. A higher real interest rate means that it costs more to pay the interest on your debt. So we could say that the real interest rate is a price in the real economy, which impacts the business cycle of the economy.

## 4.2 Business Cycle Synchronization between Asia and Japan

In the case of Japan, we add in our financial variable: bilateral investment share (BIS). The rest of the variables of interest are the same as those in the case of the PRC. We specify our panel equations of interest in the following way so as to study the business cycle synchronization between Asia and Japan, between the NIE-3 and Japan,<sup>6</sup> and between ASEAN-4 and Japan.

Econometrics is all about specification. In the first specification, we test the relation between business cycle synchronization and export dependence, financial integration, monetary policy similarity, fiscal policy similarity, and common dependence on the US economy.

$$\begin{aligned} &CORR_{Japan,i} \\ &= \alpha + \beta_1(ES_{Japan,i}) + \beta_2(BIS_{Japan,i}) + \beta_3(IRS_{Japan,i}) + \beta_4(FBD_{Japan,i}) + \beta_5(CORR_{US,i}) \\ &+ \varepsilon \end{aligned}$$

Our second specification tests the relation between cycle synchronization and trade integration, financial integration, similarity in monetary policy, similarity in fiscal policy, and common dependence on the US.

$$\begin{aligned} &CORR_{Japan,i} \\ &= \alpha + \beta_1(BTS_{Japan,i}) + \beta_2(BIS_{Japan,i}) + \beta_3(IRS_{Japan,i}) + \beta_4(FBD_{Japan,i}) + \beta_5(CORR_{US,i}) \\ &+ \varepsilon \end{aligned}$$

where:

- *BIS* = bilateral portfolio investment share.

### Main findings:

“trade beta” - Significant evidence is only found for NIE-3 economies as a group, on the linkage of trade integration and business cycle synchronization between NIE-3 and Japan.

“financial beta” - With the add-in of the financial variable on bilateral investment share, we find that a deepening of financial integration would cause an increase in the business cycle correlation with NIE-3 and Japan, and between ASEAN-4 and Japan.

“monetary beta” - As found in the case of the PRC, we also find a negative coefficient on the interest rate spread variable for ASEAN-4 economies as a group. Similar reasoning applies here. The more similar the monetary policy stance is between Japan and ASEAN-4 economies, the more correlated are their business cycles.

“fiscal beta” - On the fiscal front, a negative coefficient is found for NIE-3 economies as a group. So if there is a decrease in their fiscal balance differential with Japan, implying their fiscal stance (and economic structure) becomes more similar, then there would be an increase

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<sup>6</sup> NIE-3 = Hong Kong, China; the Republic of Korea; and Singapore.

in the degree of their business cycle synchronization. That is, the more similar the fiscal stance is between Japan and NIE-3, the more correlated their business cycles become.

“US beta” - Solid evidence exists that there is common dependence on the US among Japan and other Asian economies. For NIE-3 economies as a group, a 1% increase in the correlation between the US and NIE-3 leads to a more than 30% jump in the cycle correlation between Japan and NIE-3. For ASEAN-4 economies as a group, a 1% increase in the correlation between the US and NIE-3 is associated with an almost 60% increase in the cycle correlation between Japan and ASEAN-4.

**Table 2: Summary of main findings, for the case of Japan**

	Japan + NIE-3	Japan + ASEAN-4
Trade beta	(+)	
Financial beta	(+)	(+)
Monetary beta		(-)
Fiscal beta	(-)	
US beta	(+)	(+)

Note: (+) and (-) indicate the sign of each coefficient.

### 4.3 Business Cycle Synchronization between Asia and US

In the case of the US, we do not need the control variable  $CORR_{US,i}$  for the US impact, but the rest of variables stay the same, as in the case for Japan. We specify our panel equations of interest as follows for the study of business cycle synchronization between Asia and the US, between NIE-3 and the US, and between ASEAN-4 and the US.

$$CORR_{US,i} = \alpha + \beta_1(ES_{US,i}) + \beta_2(BIS_{US,i}) + \beta_3(IRS_{US,i}) + \beta_4(FBD_{US,i}) + \varepsilon$$

$$CORR_{US,i} = \alpha + \beta_1(BTS_{US,i}) + \beta_2(BIS_{US,i}) + \beta_3(IRS_{US,i}) + \beta_4(FBD_{US,i}) + \varepsilon$$

#### Main findings:

“trade beta” - From our panel regressions, it is found that increased trade linkages between the US and NIE-3 result in a decrease in their business cycle correlation. This is probably due to the exploitation of comparative advantage, which would cause intensified trade relations between the US and NIE-3 and lead to a higher degree of specialization in their export sector.

“financial beta” - Evidence exists of the positive relation between financial integration and business cycle synchronization for NIE-3 economies, but not for ASEAN-4 economies.



“monetary beta” - Contrary to what we find in the case of the PRC and Japan, we find a positive coefficient for the relation between interest rate spreads and business cycle correlation. That is, the more their monetary policies differ, the higher their business cycles correlation.

“fiscal beta” - As is the case with the PRC, a positive coefficient is found between fiscal balance differential and cycle correlation for NIE-3 economies. That is, the more different the fiscal policies of the US and NIE-3, the higher their business cycle correlation.

**Table 3: Summary of main findings, for the case of US**

	US + NIE-3	US + ASEAN-4
Trade beta	(-)	
Financial beta	(+)	
Monetary beta	(+)	(+)
Fiscal beta	(+)	

Note: (+) and (-) indicate the sign of each coefficient.

## 5. Conclusion

### 5.1 Recap

Our project expands the dimension of research conducted on business cycles in the Asian region. This is achieved by investigating and quantifying the potential determinants underlying the synchronization of business cycles between Asia and the PRC, Japan, and the US. We conduct our panel data analysis on nine Asian economies, with the PRC, Japan, and the US as reference countries. We summarize our main findings as follows.

**Table 4: Summary of main findings, for the case of People’s Republic of China, Japan, and US**

	PRC+ NIE-4	PRC+ ASEAN-4	Japan+ NIE-3	Japan+ ASEAN-4	US+ NIE-3	US+ ASEAN-4
Trade beta	(+)	(+)	(+)		(-)	
Financial beta			(+)	(+)	(+)	
Monetary beta		(-)		(-)	(+)	(+)
Fiscal beta	(+)		(-)		(+)	
US beta		(+)	(+)	(+)		

Note: (+) and (-) indicate the sign of each coefficient.

## 5.2 Policy Implications

The GFC has given us cause to rethink the extent to which the world is interconnected. Bankruptcies in the US in 2008 brought the global economy to its knees. And then the troubles in the eurozone shocked the world economy again. Today, another worry is the risk of a potential slowdown in emerging markets. It reminds us that policy actions in one corner of the world can reach all corners. This is also true in the case of Asia. It is the job of a regional bank like the ADB to shine a light on developments in all corners of Asia: how we are linked with one another in the region, and how we are linked with the rest of the world. As John F. Kennedy once put it: “We are not here to curse the darkness, but to light the candle that can guide us through that darkness to a safe and sane future.” It is our collective job to light a candle in that dark room, which sometimes involves navigating a new world with respect to policy coordination.

No country is an island. We need to work better together to understand more fully the impact of our policies—at both the regional level and the global level—and to see how that affects our path forward as a region. Policymakers at all levels in Asia—within countries and across countries—have a responsibility to take the full range of actions that are needed to restore confidence, stability, and economic growth in the Asian region. In today's interconnected world, the spillovers from domestic policies spread across the region, and might even feed back to where they began. Not everyone agrees about the size, or even the direction, of spillovers. An important step toward deciding the future course of policy co-operation would be to bridge or at least narrow the gap between the difference in our understanding. As a regional development bank and a forum for regional policy co-operation, the ADB can definitely help to effectively support the policy decisions that its member economies face, and to delve more deeply into the policy inter-connections and spillovers within Asian region. With action, we can place Asian economies on a path of strong, sustainable, and balanced growth.

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## Appendix

### A.1 Data Resources

#### GDP variables

- GDP data (quarterly)  
*Source: Haver Analytics.*

#### Trade linkage variables

- bilateral trade flow data (quarterly, annual)  
*Sources: Haver Analytics, IMF Direction of Trade Statistics (DOTS)*
- total export-import trade data.  
*Sources: Haver Analytics, IMF Direction of Trade Statistics (DOTS)*
- Taipei,China's trade data.  
*Source: Ministry of Economic Affairs, Bureau of Foreign Trade.*

#### Financial linkage variable

- bilateral portfolio investment flow data  
*Source: IMF Coordinated Portfolio Investment Survey (CPIS).*

#### Monetary policy variables

- short-term money market interest rates  
*Sources: Haver Analytics, IMF International Financial Statistics (IFS)*
- CPI (inflation) data.  
*Sources: Haver Analytics, IMF International Financial Statistics (IFS).*

#### Fiscal policy variables

- fiscal balance differential  
*Sources: ADB Key Indicators, Haver Analytics, World Bank World Development Indicators, US Federal Reserve Bank of St. Louis FRED database.*

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## **Business Cycle Synchronization in Asia**

### The Role of Financial and Trade Linkages

In this research project, we attempt to study the behavior of business cycles in Asia. Given the importance of the People's Republic of China, Japan, and the United States in the region, we use these three economies as our "reference countries" to examine the synchronization of their business cycles with those of selected Asian economies. Specifically, we investigate the determinants underlying the synchronization of their business cycles, including trade and financial linkages, and policy similarities.

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ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to approximately two-thirds of the world's poor: 1.6 billion people who live on less than \$2 a day, with 733 million struggling on less than \$1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

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