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Dimensions of Regional Processes in the Asia-Pacific Region

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Part 3. Risks & Challenges

Introduction

Asia and Pacific's growing importance to the rest of the world is widely acknowledged today. The dynamics of Asian economic development have tremendously impacted global trade relationships and regional cooperation. Thus, it is with great pleasure that we deliver another volume of Research Papers on Asia-Pacific economic issues.

This year we present 19 papers by various authors who examine the Asia-Pacific region from different perspectives. We decided to group them into 3 Chapters:

- Cooperation and trade
- Economy and policy
- Risks & challenges

Papers grouped in the First Chapter describe newly emerging regional trade architecture. You will find there a few analyses of general nature and regional scope (J. Dudziński, A. H. Jankowiak, E. Majchrowska) and some studies on specific trade agreements (A. Klimek writes about Shanghai Free Trade Zone, A. McCaleb and G. Heiduk try to find out what motivates China's cities to establish partner agreements with cities in Asia, B. Michalski analysing U.S.-Republic of Korea Free Trade Agreement, while M. Maciejewski and W. Zysk look for opportunities for Polish exports in the trade agreement between EU and Vietnam).

The Second Chapter is the most diverse one. It is devoted mostly to economic policy issues (including financial sector). S. Bobowski, L. Zyblikiewicz and K. Żukrowska look at the main threads in Asian regionalism. P. Pasierbiak and K. Łopacińska analyse the movements of Chinese capital. M. Dziembała and S. Mazurek deal with the subject of innovation supporting growth and development.

Articles in the Third Chapter are focused on extraordinary events influencing economies and development of the Asia-Pacific region. J. Pera prepared an assessment of risk of APEC countries, based on the country risk classification method and selected indexes of internal stability. A. Kukułka and B. Totleben analyse the impact of natural disasters on gross capital formation in Southeastern Asia. Finally, T. Serwach and M. Grabowski and S. Wyciślak deal with synchronization of business cycles and contagion of crises.

We sincerely hope that all the articles will be of great value to those who want to understand the role of Asia-Pacific economies in the global economy. Through various interests of authors, our volume provides a valuable insight into the problems of this region.

All the papers where submitted for the 8th international scientific conference "Dimensions of Regional Processes in the Asia- Pacific Region" which took place in

November 2015 at Wroclaw University of Economics, under the patronage of Polish Ministry of Foreign Affairs, Ministry of Science and Higher Education and the Ministry of Economy.

We appreciate your time and consideration, and we look forward to the submission of your own good work. We also appreciate the time and effort of our peer reviewers. Thank you!

Bogusława Drelich-Skulska, *Anna H. Jankowiak*, *Szymon Mazurek*

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THE SYNCHRONIZATION OF BUSINESS CYCLES IN EAST ASIA AND PACIFIC REGION. A NETWORK APPROACH

SYNCHRONIZACJA CYKLI KONIUNKTURALNYCH W REGIONIE AZJI WSCHODNIEJ I PACYFIKU: PODEJŚCIE SIECIOWE

DOI: 10.15611/pn.2015.413.18
JEL Classification: E3, O5.

Summary: The synchronization of business cycles is crucial for a proper functioning of currency unions, diversification opportunities in trade and finance etc. In an open economy it is almost impossible to isolate from situation in other countries when real and financial links are established. However, it is also very hard to find a country responsible for the facilitation of the transmission of economic shocks. In the article, the author analyzes the economic network formed within the East Asia and Pacific region with the aim to point those pairs of countries which are significantly connected and labels that countries with regard to the role they play in the business cycle synchronization. It seems that the biggest facilitator of such a synchronization is Indonesia, which gives rise to the role of involvement in international production chains.

Keywords: business cycles, synchronization, networks.

Streszczenie: Synchronizacja cykli koniunkturalnych jest niezwykle istotna dla sprawnego funkcjonowania unii walutowych, kreowania możliwości dywersyfikacji w sferze handlu i finansów międzynarodowych itd. W gospodarce otwartej jest niemal niemożliwe, aby być odizolowanym od sytuacji w krajach, z którymi posiada się powiązania realne bądź finansowe. Jednocześnie jednak określenie, które kraje ułatwiają transmisję szoków gospodarczych, jest niezwykle trudne. W niniejszym artykule przedstawiono analizę sieci ekonomicznych uformowanych w regionie Azji Wschodniej i Pacyfiku, w celu wskazania powiązań między krajami oraz roli, jaką odgrywają one w owych sieciach (w odniesieniu do synchronizacji cykli koniunkturalnych). Z uzyskanych rezultatów wynika, że kluczowa w tym względzie jest Indonezja.

Słowa kluczowe: cykle koniunkturalne, synchronizacji koniunktury, sieci gospodarcze.

1. Introduction

The synchronization of economic fluctuations has been one of the most important topics in international macroeconomics. For example, at least since Mundell's [1961] seminal paper it has been known that such a synchronization is crucial for a proper functioning of currency unions. The level of business cycle synchronization leads also to co-movements in financial assets valuation or trade performance affecting diversification opportunities both for real economy and finance.

The general feature of East Asia and Pacific region is that countries experienced a decrease (or at least a slowdown) in their output during the current financial crisis. Figure 1 presents the conduct of business cycle during 2000-2013 period for the major economies in the region. It is striking that, for example, Australia experienced the period of relative stability, but business cycles of other economies were more erratic.

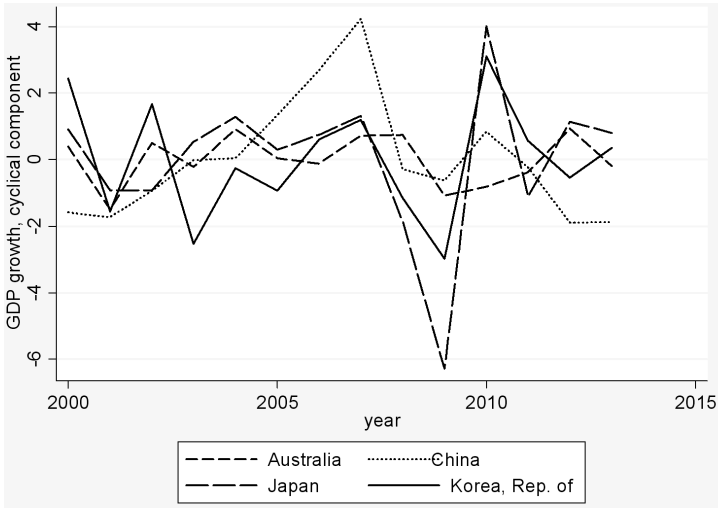


Fig. 1. Cyclical components of GDP growth in major economies in East Asia and Pacific region (Hodrick-Prescott filter)

Source: Own study.

It is worth analyzing whether countries belonging to that region are synchronized in terms of their economic fluctuations. It is also important to know which country (or countries) facilitates such a synchronization. With that aim in mind, the network approach was used to investigate the properties of the business cycle similarities between countries. This research differs from other studies on economic synchronization. While it is common to apply structural VAR methods (as in Bayoumi

and Eichengreen [1993]), here network analysis[1] is applied, because it enables to capture indirect linkages between countries[2].

The rest of the paper is divided into two sections. The first one is the brief overview of the method and the description the network seen in the data. The second part presents the analysis of the roles countries play in business cycles synchronization. The last part concludes.

2. Methodology and the description of the network

The first research step was to extract cyclical component of GDP growth from the data. To do so, Hodrick-Prescott filter (HP filter henceforth), commonly applied in empirical studies was used. The background data was annual GDP growth rate (2000-2013) at market prices based on constant local currency and in constant 2005 USD [World Bank 2015]. Focus was only on countries[3] belonging to the "East Asia and Pacific" region which report the data for the time horizon in question. Table 1 lists all countries analyzed.

Table 1. List of countries

Countries (codes)	
Australia (AUS)	Marshall Islands (MHL)
Brunei (BRN)	New Zealand (NZL)
Cambodia (KHM)	Palau (PLW)
China (CHN)	Papua New Guinea (PNG)
Federated State of Micronesia (FSM)	The Philippines (PHL)
Fiji (FJI)	Singapore (SGP)
Hong Kong (HKG)	Solomon Islands (SLB)
Indonesia (IDN)	Thailand (THA)
Japan (JPN)	Timor-Leste (TLS)
Kiribati (KIR)	Tonga (TON)
Korea, Republic of (KOR)	Tuvalu (TUV)
Laos (LAO)	Vanuatu (VUT)
Macau (MAC)	Vietnam (VNM)
Malaysia (MYS)	

Source: Own study.

In order to establish which countries experienced similar fluctuations of business cycles, I correlation analysis was conducted. The Pearson correlation coefficient for each country-pair was calculated. If the coefficient was significant at 5% level, it was

[1] Network analysis has become one of the most dynamic fields in social analysis. The overview of different methods and applications can be found in Easley and Kleinberg [2010] and Jackson [2010].

[2] The list of studies on the synchronization of business cycles in Asia include, for instance, Moneta, Rüffer [2006]; He, Liao [2012]; Dai [2014] and Duval et al. [2014].

[3] Due to simplicity any unit with an autonomy to gather and report data as to a country is referred to.

an indication that a particular pair of countries had synchronized business cycles. Then, a network of countries (nodes) with significant business cycle correlation being a link[4] was formed.

The matrix of all links in the network is called adjacency matrix and in this case it was built as follows. For countries *i* and *j* (where $i \neq j$) an entry into that matrix was equal to:

$$\begin{cases} 1 \text{ if } cor(y_{ci}, y_{cj}) \text{ was positive and statistically significant} \\ 0 - \text{otherwise} \end{cases}$$

The network which can be observed in the data may be presented graphically (see Figure 2).

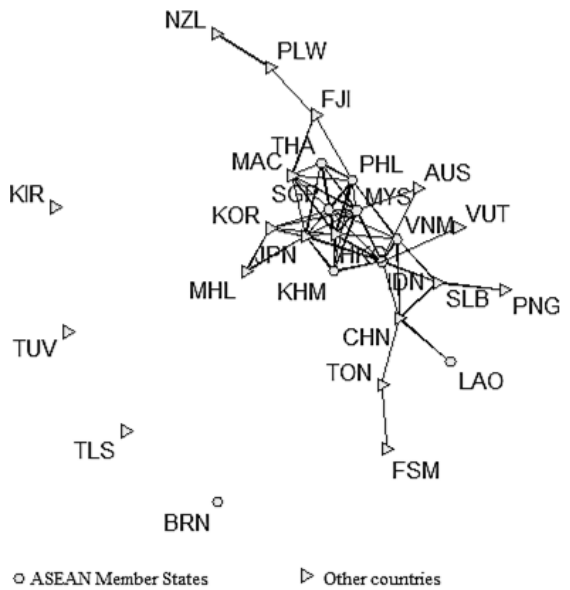


Fig. 2. Network of countries linked by their business cycles synchronization

Source: Own study.

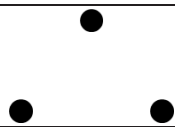
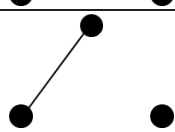
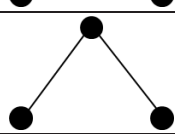
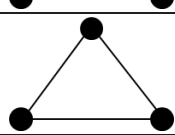
One feature of the network is that countries are almost always linked to other countries. Only four of them are isolated from other economies' impact on their own economies. Those were small units – Brunei, Kiribati, Timor-Leste and Tuvalu.

[4] There is no uniform terminology in the network analysis. Agents/actors in question are called nodes or vertices. Links between them are also called edges. It should also be specified that loops (link a node has with itself) were skipped. Finally, focus was on the positive values of correlation coefficient, because it is the idea of synchronization – countries should experience the changes in economic activity going in the same direction. In two cases negative correlations were observed – between Timor-Leste and New Zealand (–0.5775) and between Vanuatu and Palau (–0.5523).

At the same time one cannot say that the network was characterized by many interactions between the nodes. To see this, it is reasonable to analyze the density of the network – the number of actual links dived by the number of all possible links. In this case it was only 0.1595. This means that only about one sixth of the possible edges was formed. The economic interpretation is that countries may be affected by the situation in other members of the region, mostly through indirect connections. For example, Fiji and New Zealand did not have a link, but these countries were connected indirectly through Palau. It may be the case that economic shocks to New Zealand affect the economy of Fiji only through the impact on Palau.

The importance of indirect links can also be seen when one analyzes triads (systems made by three nodes). Table 2 shows, that – apart from triads without any connection – the most common one is the type with only one link. At the same time the least common is the one with full set of edges. Hence, it is obvious that economic synchronization in the region occurs through some kind of intermediation.

Table 2. Number of different types of triads

Type of triad	Number of triads
	1803
	912
	142
	68

Source: Own study.

Although indirect connections may be crucial for business cycle synchronization, it is also worth analyzing the direct linkages. In doing so, one can use a simple measure – degrees[5]. The degree distribution is presented in Figure 3.

[5] The obtained network is symmetric (the statement that economy A synchronizes with economy B is similar to that B is synchronized with A), hence it is fruitless to analyze the indegree (the number of links received by a node) and the outdegree (the number of links sent by a node), because they are equal.

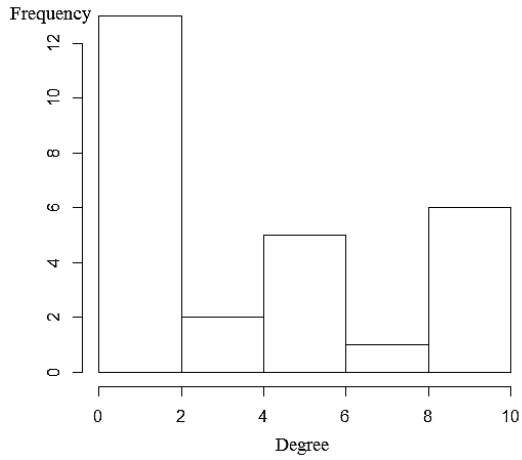


Fig. 3. Degree distribution

Source: Own study.

Most nodes were only selectively connected with other vertices. The most common number was two degrees (in case of five countries – Australia, Fiji, Marshall Islands, Palau, Tonga). It is probable that countries synchronize their business cycles only with their major trade and financial partners. At the same time, there were several economies with 10 ties to other countries – Hong Kong, Indonesia, Japan, Malaysia. Those countries are heavily involved in the international production chains.

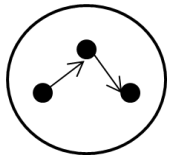
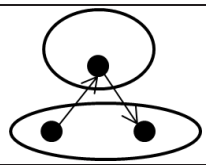
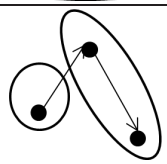
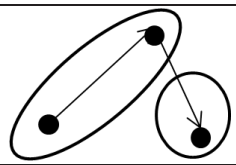
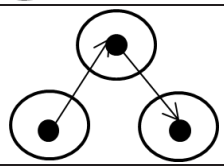
3. The role of countries in the network

Some countries may be seen as more important than others in terms of business cycle synchronization in the region. The measure one can use to investigate this characteristic of the nodes is betweenness. It is an equivalent to the answer to the question: *How many shortest paths between different nodes a particular agent lies on?* It seems that the most central node in the network is Indonesia – this country is the biggest facilitator of the synchronization.

The roles countries play in the network can by analyzed through the concept of brokerage relations (see: [Gould, Fernandez 1989]). There are five types of such relations – they are presented in Table 3.

Gould and Fernandez [1989] proposed different measures – called brokerage scores – which can enable us to label nodes according to their role in the network. In this case, countries were divided into 2 groups – ASEAN Member States and other countries – and their standardized brokerage scores were checked. The analysis with a different country grouping – members of APEC and other economies – was also conducted. The results are shown in Table 4.

Table 3. The description of brokerage relations

Type of brokerage relation	Description	Graphic representation of types of the brokerage relation
Coordinator	Brokerage relation is internal to the group – all actors belong to the same group	
Itinerant broker	One actor belongs to a different group than two other agents – that particular actor serves as an intermediary	
Gatekeeper	An actor may grant access to an outsider	
Representative	An actor may establish contact with an outsider	
Liaison	An actor links distinct groups without having allegiance to either	

Note: The description should be analyzed through the lens of the role played by the second actor in the sequence of 2 relations linking 3 agents.

Source: Own work, based on Gould, Fernandez [1989].

Table 4. East Asian and Pacific countries as brokers

Type of brokerage relation	Country (ASEAN vs. non-ASEAN)	Country (APEC vs. non-APEC)
Coordinator	The Philippines	Indonesia, Malaysia
Itinerant broker	Hong Kong	China, Indonesia, Japan
Gatekeeper	Indonesia	Indonesia
Representative	Indonesia	Indonesia
Liaison	---	---

Note: Due to dividing countries into two groups it was impossible to investigate the liaison relations.

Source: Own work.

Having looked at Table 4, one may formulate two conclusions. The first is that countries differ in the roles they play in the region. The second is that there is one country that stands out – Indonesia. This country serves especially as a gatekeeper and representative – this means that Indonesia facilitated the transmission of economic shocks between different sets of countries (members of ASEAN/APEC and non-members). Indonesia also provides important intermediation of such shocks within APEC (coordinator role, in tandem with Malaysia) and between countries not belonging to this organization (itinerant broker; with China and Japan). When one analyzes ASEAN, other countries gain significance – The Philippines (coordinator) and Hong Kong (itinerant broker).

It is not clear why Indonesia was the main facilitator of shocks in the whole region. One may assume that the country is heavily involved in the so-called international production chains. However, according to the WTO-OECD Trade in Value Added (TiVA) Database [OECD 2015], Indonesia has rather small share of foreign value added in gross exports. It may be that it is not the participation in international production chains in itself, but rather the geographical diversification of trade, which enables Indonesia to propagate shocks from and to other countries. Indonesia belongs to the countries with the most degrees in the studied sample (see Figure 3).

4. Conclusion

The network analysis enables finding that the indirect linkages between countries force the synchronization of the business cycles. The network observed in the data was not dense and the structures with full set of links (like triads) were not very common. At the same time, one country was exceptional with regard to its impact on the synchronization of the economic fluctuations in the region – Indonesia. That particular country was characterized by, not only the biggest value of betweenness measure, but also played several important roles in East Asia and Pacific (especially, Indonesia served as a gatekeeper and representative). It is assumed that geographical diversification of trade may be responsible for this result.

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