INTERMEDIATE TRADE IN GLOBAL VALUE CHAINS AND ITS ROLE IN FINAL DEMAND, PRICE AND BUSINESS CYCLE CO-MOVEMENT

By

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This study assessed ASEAN-4 participation in regional value chain as downstream suppliers and their external trade relations with the upstream suppliers China and Japan. The first objective examines the relationship between final demand and intermediate imports at aggregated and disaggregated levels. Second objective assess the impact of a computed import price on intermediate imports, exchange rate pass through (ERPT) and elasticity of substitution (EOS). While the third objective compare the effect of intermediates trade on the business cycle co-movement between China–ASEAN-4 and Japan–ASEAN-4.

Autoregressive Regressive Distributed Lag (ARDL) Bounds test was used for the first and third objective while the second objective used Panel ARDL technique for dataset from 1970 to 2015. Three main findings were extracted from the analysis. Firstly, the findings based on the first objective showed a positive impacts of final demand fluctuation on import of intermediates. Second objective analysis reveals that compared to the domestic price, import price was less significant in determining demand of intermediates import. Moreover, ERPT suggests that firms in ASEAN-4 tend to absorb the fluctuation in import prices and maintain domestic price stability. The findings from third objective indicates trade in intermediates is significant in influencing business cycle co-movement between downstream suppliers and upstream suppliers.

The empirical results imply that a growing ASEAN-4 is likely to create more demand for intermediates within the region and thus policy that drive trade integration in the region is expected to benefit all. Moreover, import price is less significant in determining imports, thus implying competition on non-price factor in between domestic intermediates and imported intermediates. The result also reveals that more trade in intermediates will cause business cycle co-movement.

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Therefore, countries should formulate appropriate international trade policy by carefully evaluating the cost and benefits of value chain participation at the regional level.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

PERDAGANGAN BARANG PERTENGAHAN DALAM GLOBAL VALUE CHAINS DAN PERANANNYA DALAM PERMINTAAN AKHIR, HARGA DAN PERGERAKAN-KITAR-PERNIAGAAN-BERSAMA

Oleh

SIOW HUI SIAN

Julai 2021

Pengerusi : Shivee Ranjanee Kaliappan, PhD
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Tesis ini mengaji hubungan perdagangan antara pembekal hiliran (ASEAN-4) dan antara ASEAN-4 dan pembekal hulu – China dan Japan dalam rantaian nilai Asia. Objektif pertama menguji hubungan permintaan akhir dan permintaan barang pertengahan dalam tahap agregat dan disagregat. Objektif kedua menguji kesan harga import atas permintaan import barang pertengahan, kadar pertukaran kelaluan (ERPT) dan keanjalan penggantian (EOS). Sementara itu, objektif ketiga membanding kesan-kesan perdagangan barang pertengahan atas kitaran perniagaan bersama antara China-ASEAN-4 dan Japan-ASEAN-4.

Autoregressive Regressive Distributed Lag (ARDL) Bounds test telah digunakan dalam objektif pertama dan ketiga. Sementara itu, objektif kedua menggunakan Panel ARDL teknik untuk mengaji data dari 1970 ke 2015. Tiga carian telah diekstrak dari analisis. Pertamanya, perubahan permintaan akhir ada kesan positif atas import barang pertengahan. Keduanya, harga import tiada pengaruh yang ketara atas import barang pertengahan berbanding dengan harga tempatan. ERPT menunjukkan firma-firma dalam ASEAN-4 berkecenderungan menyerap turun naik dalam harga import dan menjaga kestabilan harga tempatan. Ketiganya, perdagangan dalam barang pertengahan akan menyebabkan pergerakan kitaran perniagaan bersama antara pembekal hiliran dan pmebekal hulu.

Hasil empirikal kajian ini menunjukkan perkembangan ASEAN-4 akan menambah permintaan barang pertengahan dari ASEAN-4. Jadi, polisi-polisi yang mendorong integrasi perdagangan dijangka akan memanfaatkan semua. Selain itu, harga import tiada kesan yang ketara dalam penentuan import. Oleh itu, penentu-penentu bukan harga dijangka akan mempengaruhi permintaan

barang pertengahan. Selain itu, penambahan perdangangan dalam barang pertengahan juga akan menyebabkan pergerakan kitaran perniagaan bersama. Jadi, polisi perdagangan antarabangsa patutnya menimbang kebaikan and keburukan penyertaan rantaian nilai serantau sebelum pelaksanaan.

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CHAPTER 1

INTRODUCTION

1.1 An Overview

In recent decades, globalisation has changed the world significantly (Baldwin, 2011). The first wave of globalisation, known as the first industrial revolution, occurred between 1870 and 1914. During this period, industrialisation focused on developing domestic supply chains and meeting the worldwide demand for final goods. The second wave of globalisation started with the end of World War II. From the 1980s, the third wave of globalisation marked a new beginning for the global economy. This period saw rapid worldwide economic integration through trade, migration and the flow of capital.[1] Production processes were fragmented into vertical stages and split between multiple countries (Athukorala & Menon, 2015). Further, according to Breda, Cappariello and Zizza (2009), cost reductions through lower trade barriers, organisational innovations and advancing information and communication technologies facilitated increased outsourcing and offshoring activities. This geographical fragmentation of production led to global value chains (GVCs), also known as international supply chains or production networks.[2]

1.2 Background of the Study

1.2.1 Definition of Global Value Chains (GVCs) and Related Concepts

There are various definitions of GVCs. Baldwin defined GVCs as 'sliced and diced' production fragments spread worldwide (IDE-JETRO, WTO, 2011, p.10). Grossman and Rossi-Hansberg described GVCs as 'trade in tasks' (IDE-JETRO, WTO, 2011, p.10), where countries tend to trade in stages of production activities, from design to manufacturing and commercialisation. In other words, countries trade in intermediate goods, specialising in tasks or adding value during each production stage. This leads to GVCs creating more integrated and specialised trade relationships between countries.

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[1] http://documents.worldbank.org/curated/en/954071468778196576/310436360_20050007015044/additional/multi0page.pdf.

[2] The concept of GVC has received more attention because of the Organization for Economic Co-operation and Development (OECD) publications of 2007, such as 'Staying Competitive in the Global Economy: Moving up the Value Chain' and 'Staying Competitive in the Global Economy: Compendium of Studies on Global Value Chains' as well as the new database in international trade – Trade in Value-added (TiVA), initiated by the OECD and the World Trade Organization (WTO) in 2013.

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This study uses the definition of GVCs provided by the OECD which describes GVCs as the interconnectedness of production processes wherein their various stages happen across locations in different countries.[3] This definition is different to that of vertical specialisation[4] and intra-industry trade.[5] However, all three concepts are commonly used in studies on trade in intermediates. GVCs differ from vertical specialisation and intra-industry trade because GVCs do not emphasise the sequential link in production stages but assume that intermediates are from different industries, whether domestic or abroad, and thus not necessarily vertically specialised or from within the same industry.

Trade in GVCs involves domestic or imported intermediates from all industries during the production. This can be visualised through an input–output table.[6] Multiple industries' outputs are inputs in other industries for production to meet final demand or to create additional intermediates. At the end of the process, the value of intermediates used in production to meet final demand can be computed using the Leontief inverse formula, which will be discussed further in the following chapters.

Upstream Suppliers and Downstream Suppliers in GVCs

Countries engaging in GVC activities can be divided into two categories: (1) those involved in upstream activities producing key components or intermediate goods (requiring advanced techniques or skills) and (2) those involved in downstream activities reproducing the intermediates imported from upstream suppliers, assembling the processed products or specialising in customer services (De Backer & Miroudot, 2014).

Figure 1.1 highlights GVC trade linkages between countries A, B and C. Country A participates in upstream GVCs by exporting domestic inputs to its trading partners in the downstream production stages. The intermediates exported from country A to B are termed 'domestic value added sent to third economies'[7] and considered forward GVC participation. The indicator captures the domestic value added in inputs exported through the value chain for further processing. The

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[3]Definition taken from OECD at https://www.oecd.org/sti/ind/global-value-chains.htm

[4]'Vertical specialization' refers to links between firms, or within a firm, up-and-down the production chain for a particular product. (OECD, June 2004, Glossary, OECD Economic Outlook, Paris, France. https://stats.oecd.org/glossary/detail.asp?ID=6169).

[5]There are two types of intra-industry trade: (1) horizontal trade in which trade in similar products with differentiated varieties (e.g., cars of a similar class and price range) and (2) vertical trade in which trade in 'vertically differentiated' products is distinguished by quality and price (e.g., exports of high-quality clothing and imports of lower-quality clothing [modified from OECD Glossary, https://stats.oecd.org/glossary/search.asp]).

[6] The sample of the input–output table can be provided as soft copy if required because of the huge amount of data. For example, the input–output table of Malaysia comprises the value of inputs used and outputs produced in 101 domestic industries in Malaysia, import for intermediates by all 101 industries from 189 countries, final demand for all industries and export to 189 countries. The total number of pages of one input–output table of Malaysia is around 96.

[7]An indicator in the OECD-WTO TiVA database

inter-dependencies among industries in forward linkages indicate that increased output in country B would increase the supply in country A.
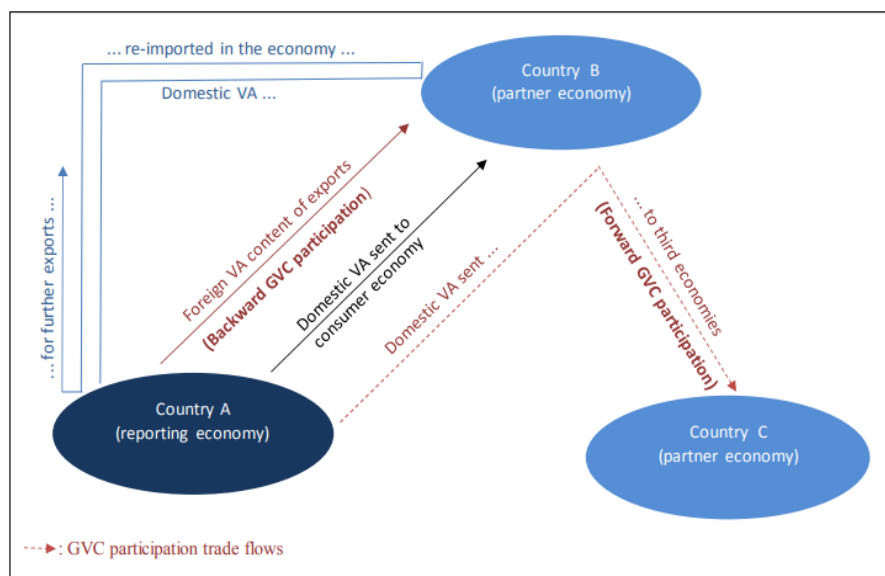
Figure 1.1 : Visualisation of the Value-Added Components of Gross Exports and GVC Trade Flows
(Source: World Trade Organization, Trade in Value-Added and Global Value Chains Profile: Explanatory Notes[8])

In the same figure, country B partakes in downstream GVCs by importing inputs for production and then exporting those inputs. Country B imports intermediate goods from country A and exports reproduced intermediate or final goods to country C. Therefore, an increase in the price level or an exchange rate appreciation in country A would increase the production cost in country B and, as a result, reduce its competitiveness in the international market and vice versa. This downstream linkage is known as backward GVC participation, measured by 'foreign value-added content of exports'[9]. This indicator corresponds to the value-added content of imported inputs to produce intermediates or final goods to be exported. The inter-dependencies among industries in backward linkages indicate that an increase in final demand would derive intermediates demand. Lastly, a more integrated trade relationship is expected to cause a closer business cycle movement among countries A, B and C.

Final Demand and Import of Intermediates

In GVCs, the process of producing goods from raw materials to finished products is completed wherever the necessary skills and resources are available at the

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[8]Obtain from website https://www.wto.org/english/res_e/statis_e/miwi_e/Explanatory_Notes_e.pdf.
[9]An indicator in the OECD-WTO TiVA database

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lowest cost. These activities have increased the trade in intermediates[10] across countries. Consequently, the imports of intermediates have increased significantly in certain countries. Theoretically, the demand of intermediates is derived from the final product demand. Therefore, a change in the final demand will proportionally change the demand for imported intermediates. However, this proportion may vary according to the individual final demand components. A single aggregated variable such as the gross domestic product (GDP) might not illustrate how the import of intermediates responds to a change in individual final demand components. This is because the influence of a particular component may be neutralised by other components when aggregated. To avoid this aggregation bias, this thesis investigates the relation between final demand and import of intermediates at aggregated and disaggregated levels.

The study of final demand and imports at disaggregated level can be found in existing works such as those by Giovannetti (1989) and Narayan and Narayan (2005). However, unlike previous research studying the impact of final demand components on aggregate imports, this thesis focuses on the import of intermediates. As demand for intermediates is derived from final demand, change in the components of final demand has a direct impact on the import of intermediates. However, these impacts are expected to vary. For example, Table A1.0 in the appendix shows a higher volume of imported intermediates in export, investment and household consumption in Malaysia in 1970 and a lower volume in government spending from foreign countries. However, government spending is included in this thesis because it is contained in the final demand values, and it maintains an important role in international trade with ASEAN-4.

The empirical findings at disaggregated level provide a thorough explanation of how the individual final demand component affects the import of intermediates and the extent of that influence.

Import Price in GVCs

Import price is generally assumed to be determined by firms' marginal cost, mark-up and exchange rate (Goldberg & Knetter, 1997). However, the import price of intermediates in GVCs is slightly different. In a simple GVC, intermediates cross borders once they are imported to produce the final goods. However, in a dynamic GVC, intermediates cross borders multiple times, when they are imported and exported to produce more intermediates until they transform into a final good. Each time an intermediate cross a border, the marginal cost changes because of the value added at each production stage and exchange rate fluctuation. Therefore, intermediates' prices are affected by these two factors (Powers & Riker, 2013). For ease of discussing price determination in GVCs, the terms 'value added' and 'intermediates' are used interchangeably in the following paragraphs.

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[10] The parts and materials imported to make products for both domestic and foreign consumption.

During the production process, if an intermediate flows through multiple import–export processes along a value chain, the influence of each imported value added on the price is assumed to differ according to its weight in the production process. It is assumed that the higher the weightage of a value added, the greater the influence it has on marginal cost and thus price. Therefore, this thesis will use a weighted average import price of intermediates computed based on the share of the value added to capture this impact on price.

Furthermore, the import price of intermediates is also determined based on exchange rate fluctuation. The impact of exchange rate fluctuation on the import price of intermediates is inverse to that on the price of final goods in the international market. For example, currency depreciation would reduce the international price of a final good, thereby increasing the product's competitiveness, but the same currency depreciation would increase the cost of purchasing intermediates for import and thus reduce a country's competitiveness in GVCs.

The computed price of the intermediate imports is assumed to be more accurate in GVCs setting and provides a more exact estimation. The domestic and foreign value added in each industry is taken from an individual country's input–output table, and the weight of value added is computed using the Leontief input–output analysis. The weighted average price of intermediate imports is a variable in the empirical model to understand how price affects the use of domestic and imported intermediates in GVC settings. Exchange rate pass-through (ERPT) and elasticity of substitution (EOS) are parameters in the model.

In GVCs, import firms might choose to entirely or partially pass through exchange rate fluctuation into local-currency import prices, referred to as ERPT. ERPT displays how the changes or fluctuations in the import prices are passed through into the domestic price. ERPT is also commonly related to a firm's market power in controlling price. Firms with less market power tend to absorb the exchange rate fluctuation, while firms with greater market power tend to pass the exchange rate fluctuation into the domestic price. Meanwhile, the EOS parameter explains the relationship between domestic and imported intermediates in GVCs. Complementary domestic and imported intermediates will result in a positive EOS, while a negative EOS is expected if they are substitutes. Moreover, the value of the EOS also suggests the degree of complementarity or substitution.

The empirical result based on the weighted average prices of intermediate imports, ERPT and EOS tells a more complete story of how prices affect the demand of imported and domestic intermediates in GVCs. This is important for the implementation of international policy, such as exchange rate policy. Depreciation in currency is usually assumed to benefit domestic firms in international markets; however, depreciation might increase the cost of production and thus reduce domestic firms' competitiveness in GVCs.

Business Cycle Co-movement and Trade in Value Chain

This business cycle movement of downstream players, such as small and open countries in ASEAN-4, can be easily influenced by the movement of regional upstream suppliers, such as China and Japan, because of higher trade interdependency in GVCs. The increasing reliance on foreign demand and supply, as in GVCs, makes downstream suppliers more vulnerable to fluctuations of external final demand, which might eventually affect the country's business cycle movement. More discussion on the trade relationship between ASEAN-4, China and Japan can be found in Section 1.2.5. In order to test the validity of the above assumption, the present thesis examines whether trade in intermediates acts as a transmission channel to transfer business cycle movements from one country to another in the region.

Trade in intermediates is represented by two common trade variables: trade intensity and trade linkage. Trade intensity is measured by the sum of two countries' bilateral intermediate import volume over their total output. Trade intensity illustrates the size of bilateral trade in intermediates between the countries. Based on extant research by Frankel and Rose (1998), Shin and Wang (2003) and Fidrmuc (2004), the present thesis assumes a positive impact of trade intensity on business cycle co-movement.

Meanwhile, trade linkages represent bilateral international trade involving reciprocal export of intermediate inputs. A positive impact of trade linkage on business cycle co-movement is assumed if the import of intermediates is sufficiently essential in the production process. More discussion on these two variables and the method of computation can be found in Section 3.3.3.

Undertaking studies on business cycle co-movement in GVCs is important for policy implementation for downstream suppliers. If a downstream supplier's business cycle movement is easily affected by the upstream supplier in GVCs, regional growth is expected during a regional boom; however, negative external shocks during a regional recession would be catastrophic.

1.2.2   Stylized Facts: Justification of the Selected Sample Countries

Despite the use of the word 'global' in GVCs, these value chains have a regional component. Figure 1.2 shows the three common regional value chain clusters (i.e., European, American and Asian) in 2000 and 2017. The size of the country in the regional value chain is represented by the size of the circle in the figure. Germany, USA, China and Japan are major suppliers in regional value chains because of their size and the volume of their bilateral trade with other countries.

This thesis focuses on the Asian value chain for two reasons. First, the downstream suppliers in the Asian value chain, such as Indonesia (IDN), Malaysia (MAL), Thailand (THA) and Singapore (SIN),[11] were actively involved during 2000 and 2017, as shown in Figure 1.2. However, the role of these four ASEAN countries in the Asian value chain is discussed minimally in existing literature and therefore provides ample opportunity for study. Because of the unavailability of complete datasets, other countries in active in the Asian value chain, such as the Philippines and Vietnam, are not included in this paper.

Second, two changes in the direct trade relationship between China, Japan, USA and Southeast Asian countries were observed in the Asian value chain, as seen in Figure 1.2. First, the role of Japan in the Asian value chain has been taken over by China. Second, trade between USA and ASEAN-4, excluding Singapore, reduced in 2017. This emphasises the emergence of China in the Asian value chain and a change in the trade relations between ASEAN-4 and the global domain players – China, Japan and the USA.

Therefore, using input–output analysis, the author studied empirically the bilateral trade relationship within the ASEAN-4 countries and between ASEAN-4 and China and Japan. USA was not included in the sample countries because less direct value chain trade was observed between USA and ASEAN-4 as compared to trade with China and Japan (Figure1.2). Moreover, USA is an upstream supplier that is not the focus of the present thesis that emphasize on downstream suppliers in the Asian value chain. Second, the divergence in industries makes it difficult to match the input–output tables between the USA and ASEAN-4, thus increasing the difficulty of assessing the bilateral trade relationship between them using input–output analysis.

In summary, 14 bilateral country pairs were studied. They are Malaysia–Singapore, Malaysia–Thailand, Malaysia–Indonesia, Malaysia–China, Malaysia–Japan, Singapore–Thailand, Singapore–Indonesia, Singapore–China, Singapore–Japan, Thailand–Indonesia, Thailand–China, Thailand–Japan, Indonesia–China and Indonesia–Japan. The studying period is from 1970 to 2015. ARDL Bound test was used for time series analysis in objective 1 and 3 while panel ARDL cointegration technique used in objective 2.

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[11] These four countries are referred to as the ASEAN-4 throughout the thesis.
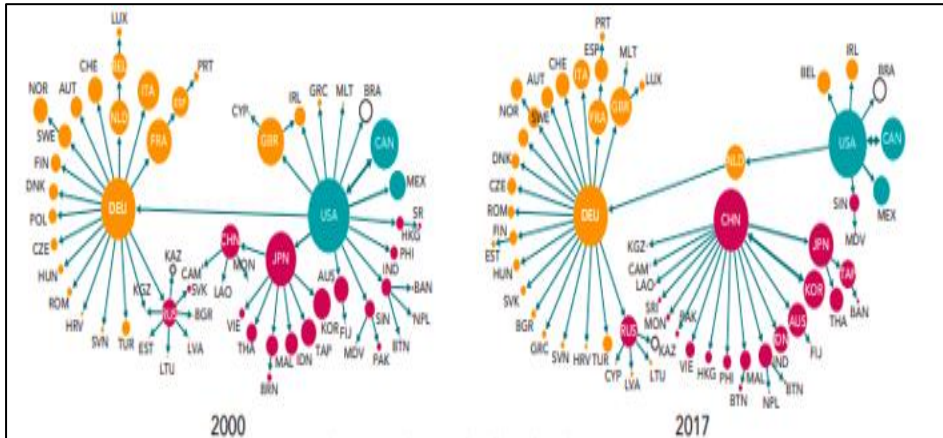
Figure 1.2 : Simple Global Value Chain Trade Networks (All Goods and Services)
(Source: Global Value Chain Development Report 2019)

GVC Participation Index

The GVC participation index[12] shows the extent of GVC trade participation among countries in the East and Southeast Asian regions (Figure 1.3). The GVC participation index comprises a sum of upstream and downstream linkages. A high GVC participation index indicates that a high volume of the country's input was exported and used for a third country's export (upstream linkage) and high foreign value added embodied in a country's gross export (downstream linkage). Malaysia and Singapore have experienced a higher GVC participation index. This observation is consistent with the findings of Escaith, Lindenberg and Miroudot, (2010b), which suggest that developing countries' exports are associated, if not embodied, with a higher import of intermediates.

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[12]The GVC participation index simply added the share of foreign industries' contribution in export (without the contribution of domestic industries) to the world and the share of domestically produced intermediates' contribution to export to a third country (without the contribution of domestic industries) (De Backer & Miroudot, 2014).

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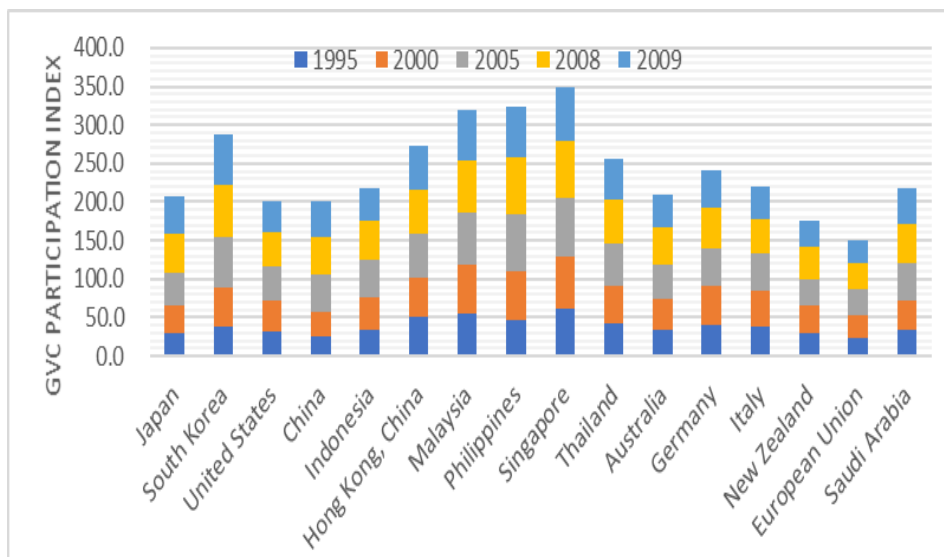
Figure 1.3 : Global Value Chain Participation Index, 1995–2009
(Source: OECD Global Value Chains Indicators Dataset, 2013)

The upstream and downstream linkages in GVCs are displayed in figures 1.4 and 1.5. An upstream supplier has a high domestic value added embodied in other countries' export. This is captured by forward participation in GVCs (Figure 1.4). However, a downstream supplier who has a high volume of foreign value added embodied in their exports would suggest a high reliance on imported intermediates. This is captured by backward participation in GVCs (Figure 1.5).

From figures 1.4 and 1.5, Japan is an upstream supplier in the value chain because of its high domestic value added in foreign export and low foreign value added in export during the period of 1995–2011. Meanwhile, it is difficult to define China's role in the value chain because it has a high domestic value added in the foreign export and a high value of foreign value added in its export.

Malaysia, Singapore, Indonesia and Thailand (ASEAN-4) are downstream suppliers from 1995 to 2011 because of the high foreign value added embodied in their export compared to the export of domestic value added. The downstream suppliers have no or very little control over the design or quality of the intermediates they export. They are part of the value chain that imports high-technological intermediate goods for re-exportation or functions as an assembly centre.

In contrast to existing literature that emphasises upstream suppliers, this thesis focuses on downstream suppliers (ASEAN-4) and their relationship with upstream suppliers (China and Japan). However, the direct trade relationship between China and Japan will not be empirically tested and discussed because

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the trade relationship between these upstream suppliers is not in the scope of the present thesis.
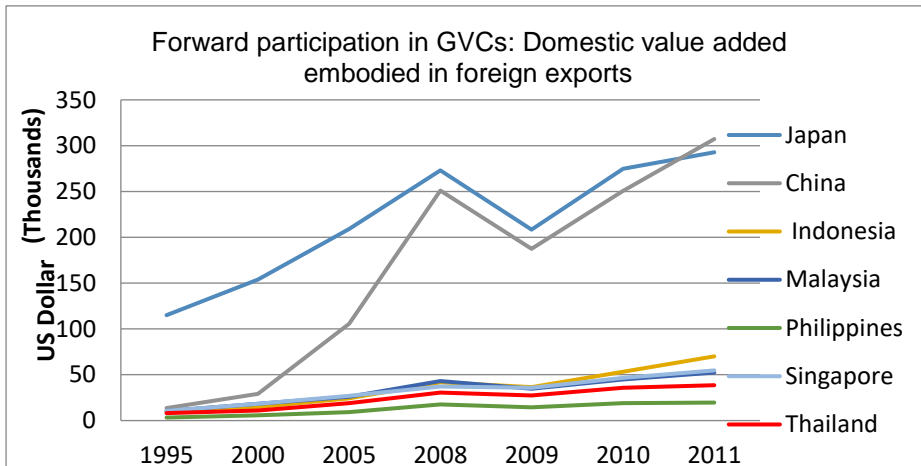
Figure 1.4 : Forward Participation in GVCs, 1995–2011
(Source: OECD Global Value Chains Indicators Dataset, 2013)
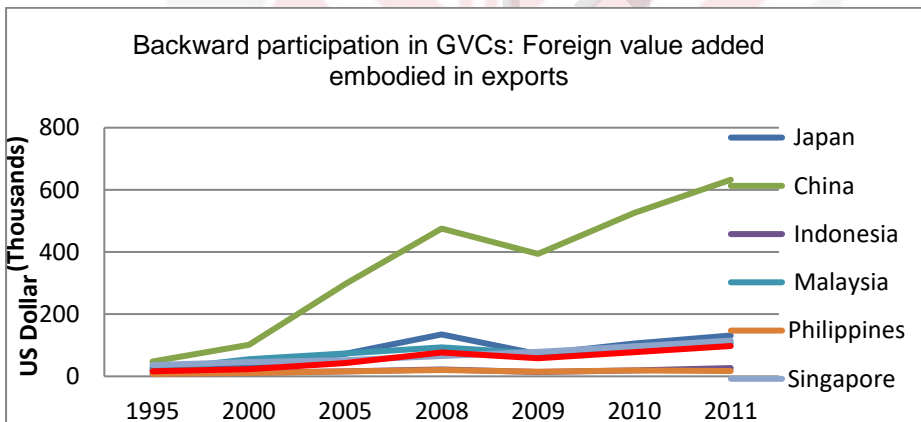
Figure 1.5 : Backward Participation in GVCs, 1995–2011
(Source: OECD Global Value Chains Indicators Dataset, 2013)

Trade Relationship Within ASEAN-4 and Between ASEAN-4, China and Japan

The trade relations regarding intermediates among ASEAN-4 and their external partners have changed over time. There is a shift from Japan and the USA to China and intra-ASEAN-4 trade, as shown in Table 1.1. Table 1.1 illustrates the sum of the intermediate goods imported by ASEAN-4 from their top five trade partners in all industries. These top trade partners make up a significant portion of individual ASEAN-4 countries' total intermediate imports. Table 1.1 reports

that nearly 50% of the total imports of intermediates stemmed from these five countries.

Japan was the largest intermediates provider to ASEAN-4 in 1995 (Table 1.1). The proportion of intermediates imported by ASEAN-4 from Japan was approximately 15%–20% of their total annual import of intermediates. However, since 2010, China has maintained a greater influence on ASEAN-4, possibly because of the implementation of the ASEAN–China Free Trade Area (ACFTA) in that year. In 2010, China surpassed Japan and became the largest intermediates provider to Thailand and the second largest to Indonesia and Singapore. Although intermediate imports from China have continued to increase, Japan remains an important player in the Southeast Asia region and maintains a high bilateral trade volume with ASEAN-4. In 2015, 8.6%–12% of individual ASEAN-4 country imports of intermediates stemmed from Japan.

Simultaneously, trade in intermediates within ASEAN-4 was also increasing, particularly among Singapore–Malaysia and Singapore–Indonesia. Singapore has become the largest intermediates provider to and importer from Malaysia. The bilateral intermediates trade volume between these two countries comprised 14% of their total trade in intermediates. Meanwhile, bilateral intermediates trade between Singapore and Indonesia was also observed, where Singapore was the largest intermediates provider to Indonesia, and Indonesia was the fifth largest provider to Singapore during 2010, 2013 and 2015. Thailand maintained a high portion of intermediates trade with external ASEAN partners, such as China and Japan, in 1995, 2000, 2005 and 2010. However, closer intermediates trade relations were observed in 2015 between Thailand and Singapore, when Singapore became Thailand's fifth largest intermediates trade partner.

Table 1.1 : ASEAN-4's Top Five Trade Partners Based on Intermediate Imports (in %)

Indonesia											
Country	Year	Country	Year	Country	Year	Country	Year	Country	Year	Country	Year
	1995		2000		2005		2010		2013		2015
Japan	19.2	Japan	15.1	Japan	14.0	Singapore	14.1	Singapore	14.3	Singapore	14.9
USA	11.5	USA	11.6	Singapore	12.4	China	12.5	China	13.6	China	13.6
Singapore	9.1	Singapore	9.8	China	8.7	Japan	12.2	Japan	10.9	Japan	10.7
South Korea	6.8	South Korea	8.0	USA	8.6	USA	7.6	USA	7.5	USA	7.3
Germany	6.8	Germany	6.0	Germany	6.5	South Korea	6.6	Australia	6.6	South Korea	6.8
Total	53.3	Total		Total	50.3	Total	53.1	Total	53.0	Total	53.4
Malaysia											
Country	Year	Country	Year	Country	Year	Country	Year	Country	Year	Country	Year
	1995		2000		2005		2010		2013		2015
Japan	18.8	Japan	15.3	Japan	13.2	Singapore	14.4	Singapore	14.6	Singapore	14.9

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Table 1.1 : Continued

Country	Year	Country	Year	Country	Year	Country	Year	Country	Year	Country	Year
USA	15.1	USA	13.4	Singapore	13.0	USA	11.7	USA	11.1	USA	10.9
Singapore	11.2	Singapore	10.7	USA	12.8	Japan	10.7	Japan	9.6	China	10.2
Germany	5.2	Germany	5.1	China	6.3	China	8.4	China	9.2	Japan	9.7
Australia	4.2	China	5.1	Germany	5.2	Australia	5.2	Thailand	5.3	Australia	5.2
Total	54.5	Total	49.6	Total	50.6	Total	50.4	Total	49.8	Total	50.9

Singapore

Country	Year	Country	Year	Country	Year	Country	Year	Country	Year	Country	Year
	1995		2000		2005		2010		2013		2015
Japan	16.5	Japan	15.0	Malaysia	13.8	Malaysia	14.8	Malaysia	14.4	Malaysia	14.8
USA	13.5	USA	14.6	Japan	12.3	China	10.5	China	11.2	China	11.6
Malaysia	13.0	Malaysia	13.3	USA	10.6	USA	9.7	USA	9.4	USA	9.2
Germany	6.5	Indonesia	6.6	China	8.1	Japan	9.6	Japan	8.4	Japan	8.6
Indonesia	5.7	Germany	5.7	Indonesia	6.0	Indonesia	7.3	Indonesia	7.7	Indonesia	7.7
Total	55.2	Total	55.2	Total	50.6	Total	51.8	Total	51.2	Total	51.8

Thailand

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Table 1.1 : Continued

Country	Year	Country	Year	Country	Year	Country	Year	Country	Year	Country	Year
	1995		2000		2005		2010		2013		2015
Japan	20.1	Japan	18.3	Japan	15.9	China	13.2	China	14.4	China	15.4
USA	12.3	USA	11.3	China	9.8	Japan	13.0	Japan	11.6	Japan	12.0
Germany	7.2	China	6.7	USA	7.8	USA	7.6	USA	7.4	USA	7.1
China	4.3	Germany	6.1	Germany	6.7	Germany	6.3	Germany	6.4	South Korea	5.2
Taiwan	4.0	Taiwan	5.8	Malaysia	5.0	South Korea	5.1	South Korea	5.1	Singapore	5.2
Total	47.8	Total	48.1	Total	45.1	Total	45.2	Total	44.9	Total	44.8

(Source: Author's own calculation based on Eora input–output tables)

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1.2.3 Final Demand and Import of Intermediates

Figure 1.6 illustrates the relationship between final demand and the import of intermediates. Generally, final demand is a sum of domestic final demand (i.e., household consumption, investment and government spending) and foreign final demand (i.e., export). Meanwhile, imports can be divided into import of final goods and intermediates. Import of final goods refers to direct demand of foreign final goods, while import of intermediates involves an induced demand of foreign intermediates for production to meet final demand. Therefore, import of intermediates is also expected to change with variations in final demand.
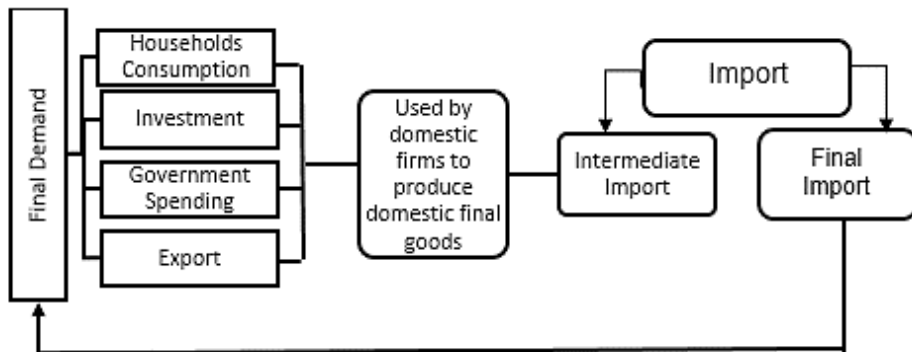
Figure 1.6 : Import Content of Final Demand Components

Figure 1.7 depicts the import of intermediates and final demand in ASEAN-4. Comparing 2015 to 1970, the volume of import of intermediates has increased sharply, by around six times. A sharp increase was also observed in the final demand during the same period. These two variables have followed a similar trend over time. Therefore, a positive relationship is assumed.

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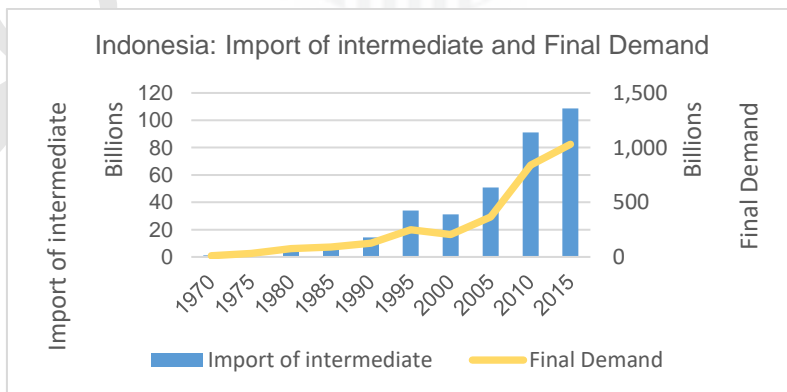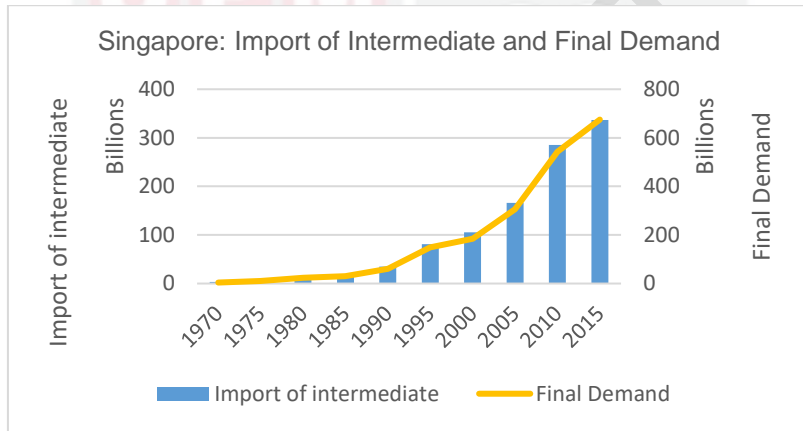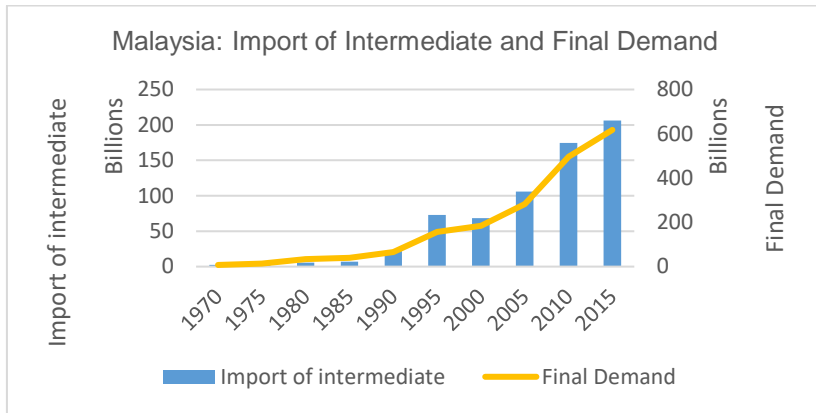
Figure 1.7 : Import of Intermediates and Final Demand
(Source: Author's drawing based on Eora input–output tables)

Figure 1.8 shows the percentage change in the final demand components and import of intermediates in total. Based on the figure, total export is the greatest component

in ASEAN-4 final demand which implies foreign demand on domestically produced goods. Meanwhile, household consumption is the largest domestic final demand component in ASEAN-4. As The final demand on domestic output is not completely produced domestically and may include import of intermediates. Studying the impacts of final demand fluctuation on import of intermediates at disaggregate level will confirm the degree of influence by each final demand components on import of intermediates

Investment is also an important final demand component in GVC analysis. Import of intermediates is historically linked to investment activities, such as investment from multinational companies, outsourcing and offshoring activities. As import of intermediates represents foreign value added in the domestic production which also illustrate a value chain activities and thus studying the impacts of final demand fluctuation on import of intermediates at disaggregate level report the impact of individual final demand components fluctuation on the regional value chain activities. Meanwhile, the amount of government spending is relatively insignificant in the total final demand, but it plays an important role in total final demand and international trade matters; therefore, government spending is also included in the study.

An import intensity adjusted measure of aggregate demand (IAD) was computed to represent final demand. IAD is a measure of aggregate demand (AD) through input–output analysis, introduced by Bussière et al. (2013), whereby the AD components are adjusted for import content. The details of the variables and computation can be found in Section 3.1.2.
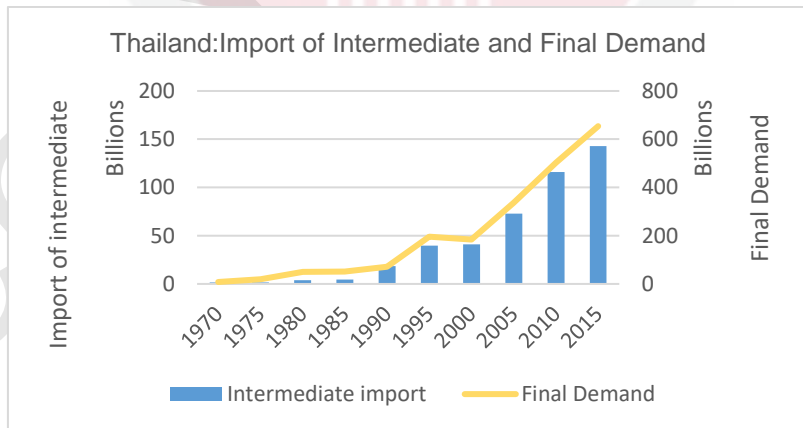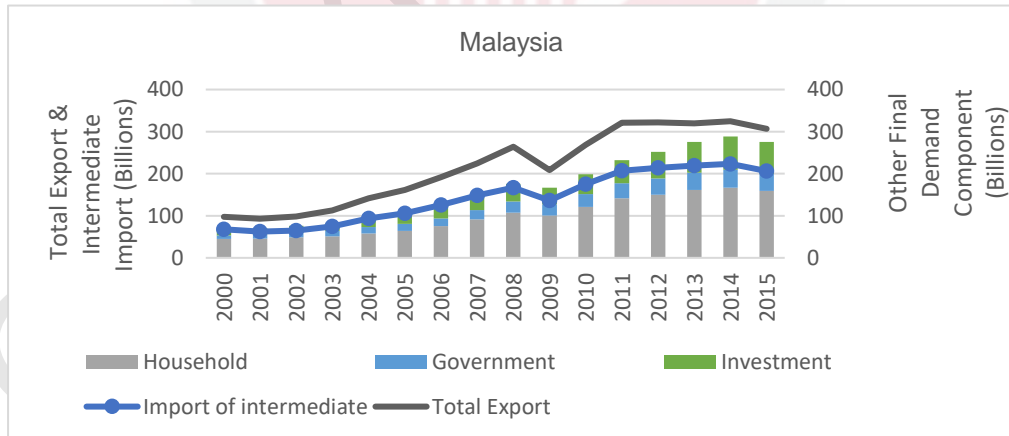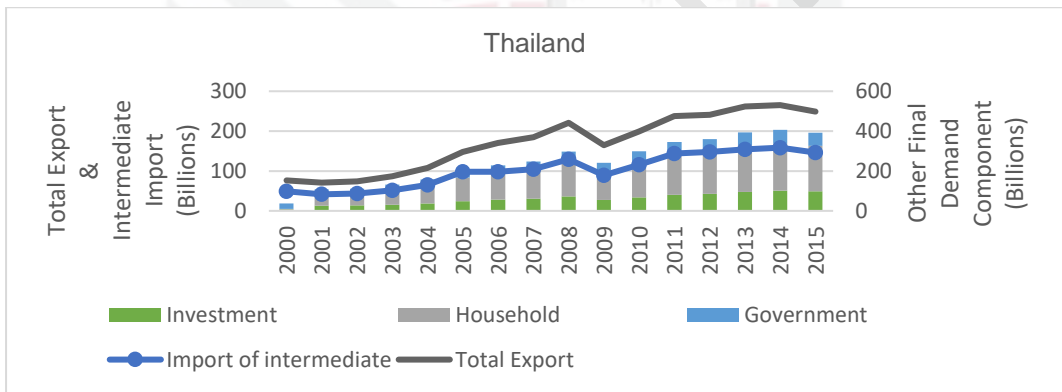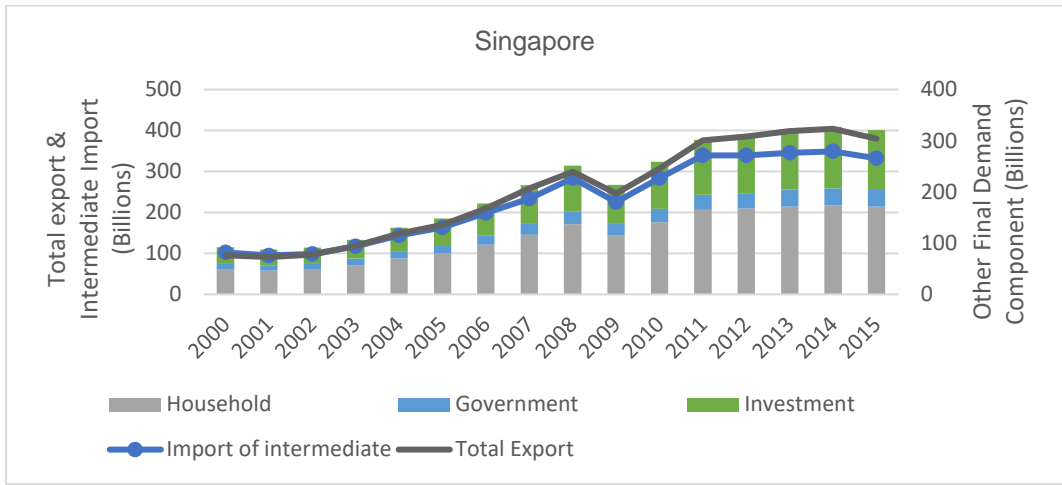
Figure 1.8 : Import of Intermediate and Final Demand Components
(Source: Author's drawing based on Eora input–output tables)

1.2.4 Import Prices, Exchange Rates and Import of Intermediates

Price determination is complicated in GVCs. Figure 1.9 shows a simple GVC model with three countries. Country C's output is assumed to be directly reliable on intermediates from country B and indirectly on intermediates from country A. The direct and indirect effects can be captured by the Leontief inverse $(I-A)^{-1}$. Although the Leontief demand model is based on quantity changes, the results can be formulated in monetary terms by including the price. The Leontief's price model is given by

$$P' = P'A + w'\hat{x}^{-1}$$

where P' denotes the price of one unit of output, w' denotes the marginal costs and $\hat{x}$ denotes the diagonal matrix with the elements of the vector x on its main diagonal. Here, we compute the weighted average import price based on value-added share, using the input–output (IO) model and Leontief inverse to understand the role of prices in the regional intermediates trade flow.

Country B's import price = Country A's marginal cost + markup + exchange rate

Country C's import price = Country B's export price = Country B's marginal cost + markup + exchange

Country A
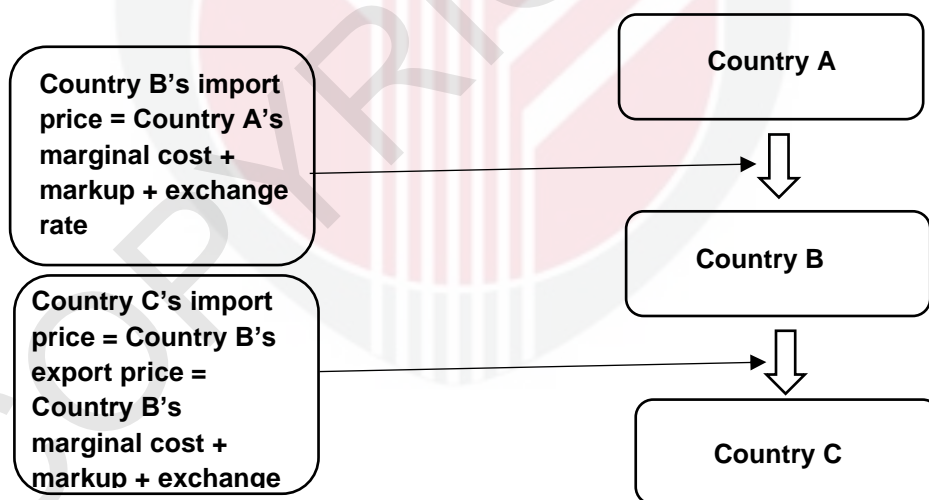
Country B

Country C

Figure 1.9 : Price Determination in Global Value Chains

Further, Figure 1.10 shows the import price, domestic price and exchange rate change of ASEAN-4 countries. A relatively stable domestic price (CPI) was observed as compared to the import price (represented by import value index) and exchange rate fluctuations in Indonesia, Malaysia, Singapore and Thailand (ASEAN-4). It implies an

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inconsistency in international prices contradicting the law of one price, which assumes the price of all outputs are the same after adjusting for exchange rate changes (Goldberg and Knetter, 1997).

Furthermore, it is commonly assumed that in a more integrated trade environment, inflation can be transmitted from exchange rate movements to domestic prices (Aron et al., 2014). Thus, a closer movement between import price, domestic price and exchange rate is commonly expected in a more integrated trade environment, such as GVCs. However, no such trend is found in Figure 1.9, where import price is represented by a common import value index. This is possible because (1) the import value index is computed without the value-added share in marginal cost and (2) the domestic sellers choose not to pass through the exchange rate fluctuation into the domestic price. This is also known as incomplete ERPT.

Following these observations, this thesis computed a weighted average import price based on value-added shares to replace the common import value index to suit the GVCs setting and used the computed price to examine how prices affect the use of domestic and imported intermediates. ERPT and EOS are the parameters of the model.

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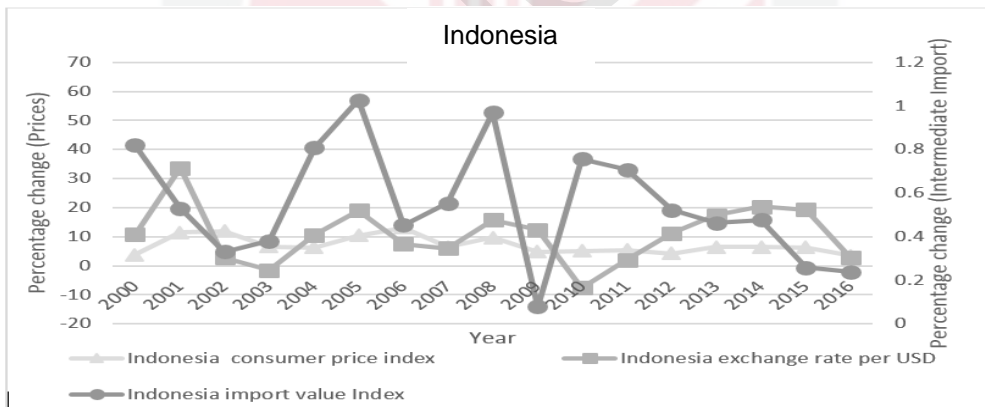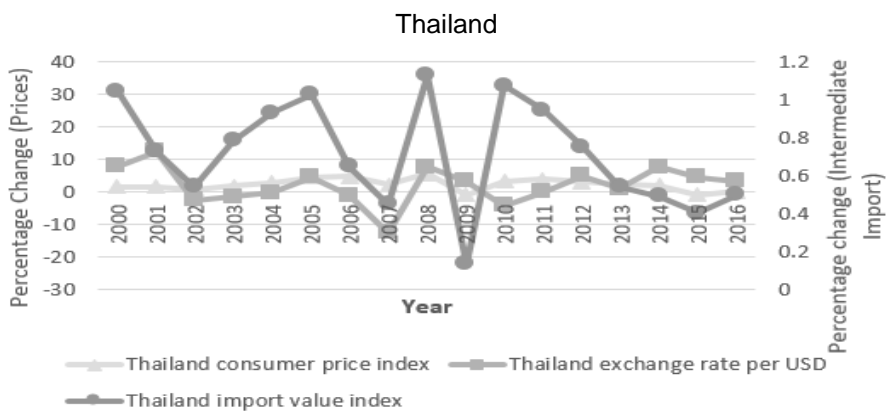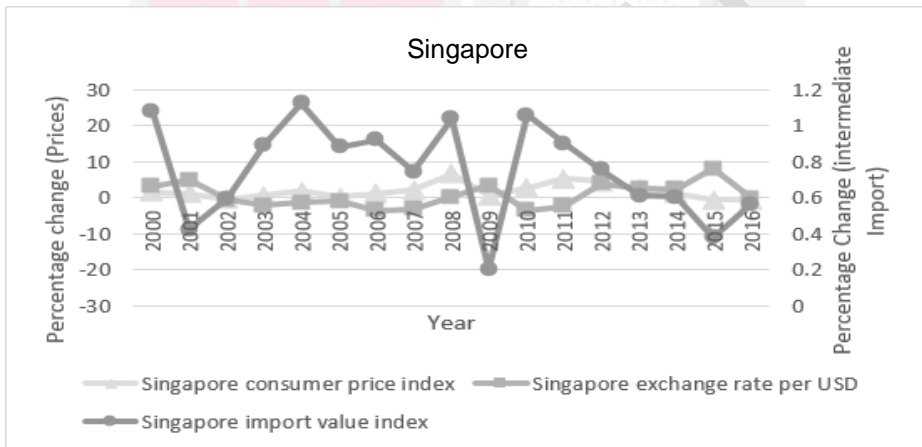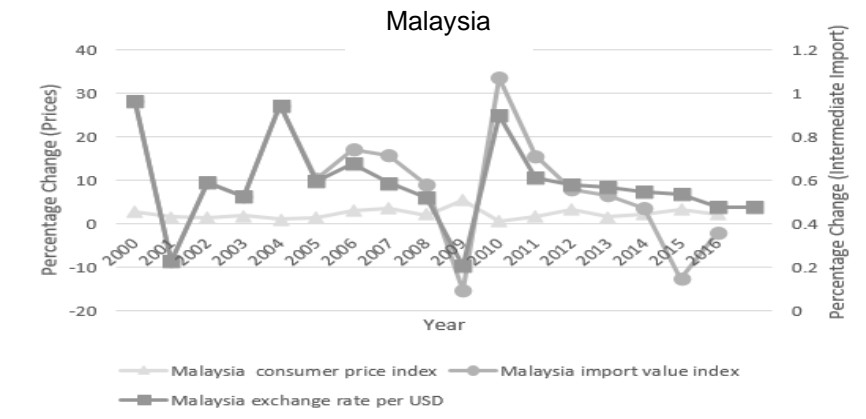
Figure 1.10 : Intermediates, Prices and Exchange Rates in ASEAN-4 2000–2016 (in %)
(Source: Eora input–output tables, World Development Indicators, World Bank)

1.2.5   Trade in Intermediates and Business Cycle Co-movement

Trade in value chains occurs in the form of trade in intermediates, where intermediates are value added imported to produce other products before ultimately transforming into a final good. Meanwhile, business cycle co-movement occurs when GDP correlated. Figure 1.11 and Figure 1.12 below show GDP correlation and bilateral import of domestic value added.

From figure 1.11, the GDP correlation between China–ASEAN-4 and Japan-ASEAN-4 were significantly positive in the 1990s and 2000s, excluding the global recession period, implies business cycle co-movement. Notably, the GDP correlation coefficient between Japan–ASEAN-4 is remarkably high during periods of financial shock in the region, such as the Asia financial crisis (in 1998 and 1999) and the global financial crisis (in 2009 and 2010).

Based on the existing literature, such as Frankel and Rose (1998); Shin and Wang (2003) and Fidrmuc (2004), business cycle co-movement was because of countries specialising in the production of intermediates that complement each other along the value chain. Following this, a more integrated trade relationship such as between downstream (ASEAN-4) and upstream (China and Japan) suppliers in the regional value chain is assumed to cause business cycle co-movement. From Figure 1.12, an increasing bilateral import of domestic value added between China-ASEAN-4 and Japan-ASEAN-4 was observed. Decreases in the bilateral domestic value added during financial shocks was observed too. The observation implies that GDP correlation can because of an increase in bilateral import of domestic value added or simply because of common financial shocks. Therefore, an empirical model that test the relationship between trade in intermediates and business cycle co-movement was built with the control of shocks common to both countries.

However, the observation in this section didn't provide further insight on intermediates trade and business cycle co-movement, it serves as an introduction to the third objective that studying on the relation between GVC trade and business cycle co-movement. Detailed explanations and formulas for the variables that represents trade in intermediates can be found in Section 3.2.3. The discussion in this section is solely on the data present in figures 1.11 and figure 1.12.
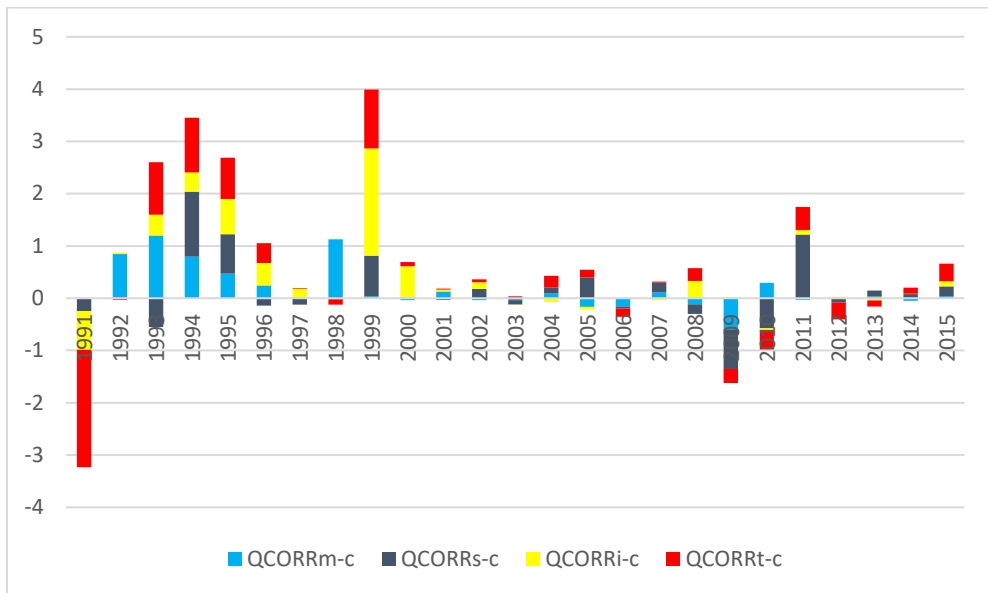
Notes: bilateral business cycle co-movement between China and Malaysia (QCORRm-c), Singapore (QCORRs-c), Indonesia (QCORRi-c) and Thailand (QCORRt-c)
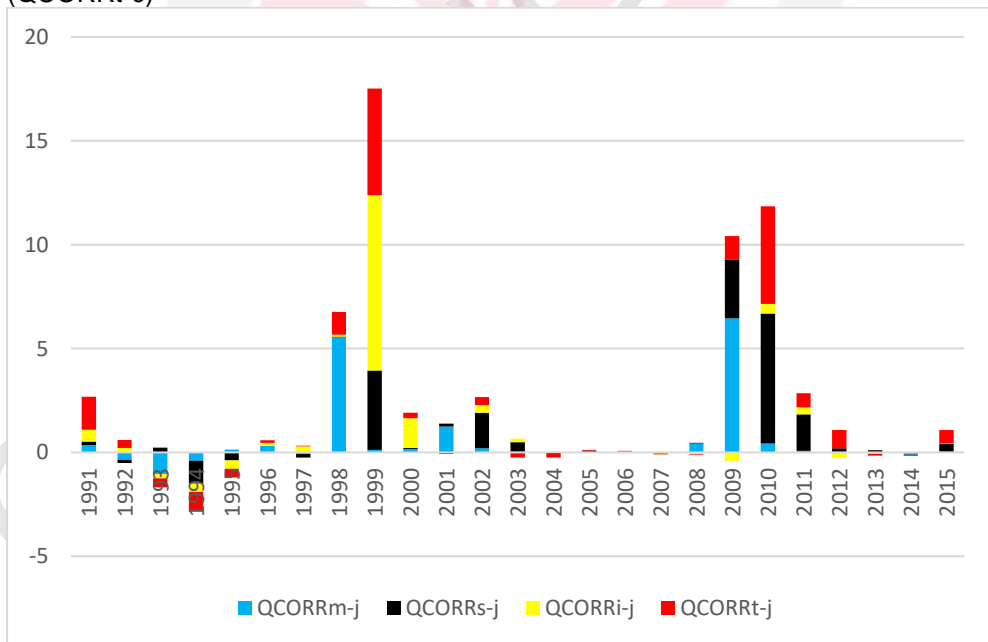
Notes: bilateral business cycle co-movement between Japan and Malaysia (QCORRm-j), Singapore (QCORRs-j), Indonesia (QCORRi-j) and Thailand (QCORRt-j)

Figure 1.11 : GDP Correlation
(Source: Author's calculation based on Eora input–output tables)

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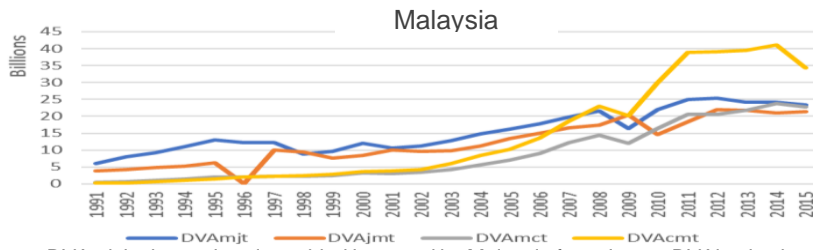
Malaysia

Notes: DVAmjt is domestic value added imported by Malaysia from Japan; DVAjmt is domestic value added imported by Japan from Malaysia; DVAmct is domestic value added imported by Malaysia from China; DVAcmt is domestic value added imported by China from Malaysia

Thailand

Notes: DVAtjt is domestic value added imported by Thailand from Japan; DVAjtt is domestic value added imported by Japan from Thailand; DVAtct is domestic value added imported by Thailand from China; DVActt is domestic value added imported by China from Thailand.
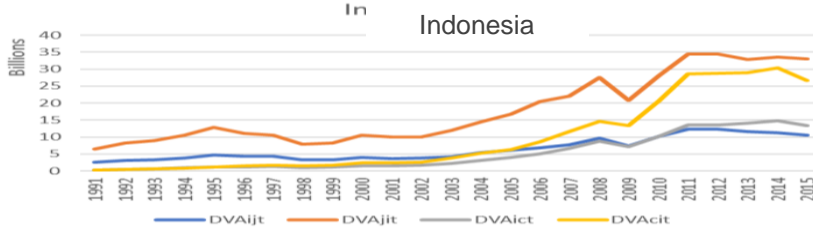
Indonesia

Notes: DVAijt is domestic value added imported by Indonesia from Japan; DVAjit is domestic value added imported by Japan from Indonesia; DVAict is domestic value added imported by Indonesia from China; DVAict is domestic value added imported by China from Indonesia.
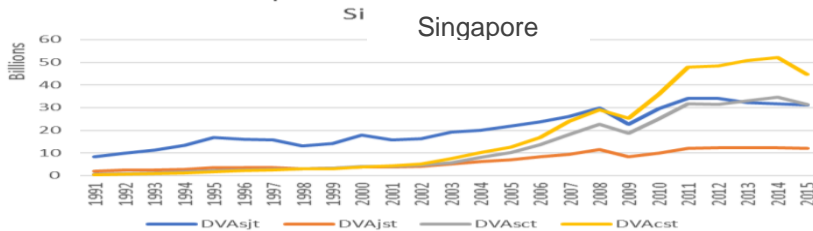
Singapore

Notes: DVAsjt is domestic value added imported by Singapore from Japan; DVAjst is domestic value added imported by Japan from Singapore; DVAsct is domestic value added imported by Singapore from China; DVAcst is domestic value added imported by China from Singapore.

Figure1.12 : Bilateral Import of Domestic Value Added
(Source: Author's calculation based on Eora input–output table)

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Based on this observation, this thesis empirically investigates the impacts of trade in the value chain on business cycle co-movement between downstream (ASEAN-4) and upstream (China and Japan) suppliers. The results will indicate how participation in value chains affects downstream suppliers' business cycle movement and enables a comparison of the roles of China and Japan in the region.

1.3   Problem Statement

The dynamics of the global economy and international trade are increasingly characterized by global value chains (GVCs), within which intermediate goods and services are traded in fragmented and internationally dispersed production processes. Successful integration of firms and countries in GVCs is increasingly important for their development and integration in the international economy. ASEAN-4 have participated in the international value chain activities actively since 1980s. However, with the strong emergence of China, changes are expected in the bilateral trade relationship between ASEAN-4, China and Japan within the regional value chain. Therefore, the bilateral trade relations in the Asian value chain are an interesting topic of study. This study focuses on three aspects.

Firstly, it has been widely documented that final demand is fulfilled by domestic output and imports. However, the final demand on domestic output is not completely produced domestically and may include import of intermediates.[13] Despite the similar trend in growing of trade in the import of intermediates and final demand, as found in Section 1.2.3, limited studies focus on how final demand affects the import of intermediates among downstream suppliers in Southeast Asia. Therefore, this thesis attempts to fill this gap in the literature. The present thesis does not use a common proxy of final demand, such as GDP. Instead, IAD will be computed for ASEAN-4 to represent the final demand of ASEAN-4 through input–output analysis. IAD is computed using Leontief inverse matrix and Rasmussen's indices[14] to trace the change in output from the entire system of industries because of a unit increase in the final demand for a particular industry.

Second important issue related to GVCs study is the role of import price on the exchange rate pass through (ERPT), elasticity of substitution, and intermediates trade. Preliminary observation in the previous section has revealed a relatively stable domestic price as compared to the import price and exchange rate fluctuation seen in ASEAN-4. This violates the law of one price that assumes that the prices of all outputs are the same after adjusting for exchange rate changes. Specifically, price of imported intermediates is part of the production cost in

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[13] In the same context, gross imports may comprise domestic intermediates too. However, gross imports are not the focus of the present thesis and, thus, will not be discussed here.
[14] More information can be found in Section 2.2.

GVCs which will be affected by the exchange rate fluctuation and the price change in origin country. Thus, there is a need to compute an alternative proxy for import price in GVCs because the standard import price proxy such as the import value index, is overly simplistic in GVCs. Therefore, the present thesis computes a weighted value-added share price of intermediates for ASEAN-4 to capture the dynamic impacts of multiple countries' production stages in GVCs on price. The computed import price will more accurately capture the price in GVCs by including the weightage of value added and impacts of exchange rate fluctuation in marginal cost. Further, the computed price will also improve the estimation of the ERPT and EOS, thus solving the lack of a complete dataset in ASEAN-4 GVC analysis.

Lastly, trade was commonly accepted as one of the channels that transfer shock from one country to another (Frankel & Rose, 1998; Shin Wang, 2003; Fidrmuc, 2004) and causes business cycle co-movement. Following the mentioned existing studies, business cycle co-movement is expected in a more integrated trade environment, such as in GVCs. A closer trade relationship in GVCs may integrate the downstream suppliers' business cycle movement to the upstream supplier's business cycle movement and thus lead to a business cycle co-movement between the two parties. However, limited studies were found on the business cycle co-movement between upstream and downstream suppliers in GVCs despite the increasing volume of intermediates trade. Thus, the present thesis fills this gap in the literature by addressing this problem.

In summary, this study seeks to address the following research questions:

1. How does final demand affect intermediate imports at aggregated and disaggregated levels?
2. How does a weighted average import price based on value-added share affect ERPT, EOS and intermediates trade?
3. Does trade in intermediates cause business cycle co-movement among China–ASEAN-4 and Japan–ASEAN-4?

1.4   Research Objectives

In international trade literature, empirical research on the GVCs in ASEAN-4 is limited and inconclusive, particularly on topics such as how final demand fluctuations affect intermediate trade; price, ERPT and EOS in GVCs and the extent to which GVCs affect business cycle co-movement. Therefore, the specific objectives of this thesis are to:

1. Examine the relationship between final demand and intermediate imports at aggregated and disaggregated levels.
2. Assess the impact of a computed import price on intermediate imports, exchange rate pass through (ERPT) and elasticity of substitution (EOS).

3.   Compare the effect of intermediates trade on the business cycle co-movement between China–ASEAN-4 and Japan–ASEAN-4.

1.5   Significance of the Study

Looking at the development of the Asian value chain over the past decades, there is a need to systematically assess the participation of ASEAN-4 as downstream suppliers in the Asian value chain. The findings of the present thesis will extend the existing literature on GVCs by discussing common international trade topics such as final demand, price and business cycle co-movement among the downstream suppliers in GVCs through input–output analysis. The significance of the present study is discussed based on the three research objectives outlined in Section 1.4.

The present thesis assesses the impacts of final demand fluctuation on import of intermediates among the downstream suppliers (ASEAN-4). Despite the importance of this topic, limited existing research focuses on it. The empirical findings related to the first objective are expected to assist governments and firms of downstream suppliers to identify reliance on import of intermediates for each final demand component. If demand for import of intermediates is primarily for export, close value chain relationships are likely and trade policy that promotes regional cooperation is expected to encourage further growth. Meanwhile, if demand for import of intermediates is for household and business sector consumption, it implies intermediates are imported for production to meet domestic final demand. Trade policy should then consider the cost and benefits of cheaper intermediates and provide useful measures to the domestic industry. This knowledge enables governments to thoroughly plan international matters such as protectionism or regional cooperation and firms to be more efficient in value-chain management.

Second, the present thesis contributes to the existing literature by computing an annual average value-added weighted import price based on input–output analysis in ASEAN-4. This computed import price captures the impact of exchange rate fluctuations on the marginal cost according to the weight of the value added. To the best of the author's knowledge, limited research has been conducted on ASEAN-4. A realistic import price will provide a more accurate estimation of the role of price in the value chain and a more realistic ERPT and EOS. Understanding the impacts of price and ERPT on the demand for intermediates is important for downstream suppliers' government and firm to predict the demand in value chains during price or exchange rate fluctuations. Further, the EOS explains the relation between domestic and imported intermediates, allowing more efficient government policy on import substitution and resource allocation to promote economic growth.

Finally, as presented in Figure 1.2 in previous section, China has taken over the role of Japan as the center in Asia value chain. However, limited empirical

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examination and comparison on China–ASEAN-4 and Japan–ASEAN-4 business cycle co-movements in GVC settings. It has resulted in a gap in the literature, which this thesis attempts to fill. The empirical findings are expected to provide an explanation on the impacts of the trade in intermediates on business cycle co-movement between the upstream and downstream suppliers in the Asian value chain. The estimated results provide some insights to the downstream suppliers in the implementation of trade policies, particularly in bilateral cooperation and domestic industry protection. This information is also important to prevent developing countries' fragility as a result of trade openness to value-chain activities.

In summary, as GVCs are considered a great opportunity for developing countries to be industrialised, this thesis attempts to provide additional insights on the impacts of participation in regional value chains, particularly among downstream suppliers.[15]

1.6   Scope and Relevance

The present thesis aims to assess the participation of ASEAN-4 as downstream suppliers in the Asian value chain during 1971–2015. The duration was selected based on the availability of input–output data. This thesis is focused on the downstream suppliers in the Asian value chain, specifically ASEAN-4, because of unavailability of a complete dataset for additional Asian countries. Moreover, the heterogeneous nature of the chosen country pairs, in terms of natural resources, degree of development and industry focus, is sufficiently high for the purpose of this research. Additionally, the bilateral trade relationship between the upstream suppliers, China and Japan, is considered out of scope for this thesis.

1.7   Organisation of Chapters

This thesis is organised into five chapters. Chapter 1 provides the background of the study focusing on GVCs as well as a trend analysis on selected sample countries, the problem statement, research objectives and the significance of the study. Chapter 2 provides theoretical and empirical literature reviews emphasising determinants of GVCs, impacts of exchange rate fluctuation on prices and trade and the role of trade (GVCs) in business cycle co-movements. Chapter 3 discusses the theoretical framework, model specification, variables description, empirical methodology and data sources of the present study. Chapter 4 discusses the empirical findings based on the estimation, and the final chapter concludes the study presenting policy implications and suggestions for future research.

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[15] However, because of the time limitation, the sample countries are limited to those that are part of ASEAN-4, considering that the computation and matching of data in individual countries' input–output tables is time consuming.

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