Investigating ASEAN’s Participation in Global Value Chains: Production Fragmentation and Regional Integration

SHENG ZHONG AND BIN SU

This paper focuses on the Association of Southeast Asian Nations (ASEAN)—a major final assembler in production—where studies and evidence on the role of the region in global value chains are limited. We seek to provide new evidence regarding the extent and patterns of international fragmentation in ASEAN. To do so, we derive the foreign value-added shares of final products for all global value chains of ASEAN. Using the Asian Development Bank’s multiregional input–output tables for 2000–2017, we document a series of stylized facts. The results show declining foreign value-added shares in ASEAN. Regional economic integration within ASEAN has increased, while value-added contributions vary widely across its members. We find evidence of increasing value-added contributions from emerging economies to ASEAN, whereas the contributions from advanced economies have declined.

Keywords: ASEAN, global value chains, production fragmentation, regional integration

JEL codes: C67, F23, L16, M11
I. Introduction

Factor movements across national borders have been strongly underway for some decades, involving labor (e.g., migration); capital (e.g., investment and trade); knowledge (e.g., innovation collaboration, technological transfer, and spillover); raw materials; and goods. This has led to a globalizing world economy in which upstream and downstream sectors across economies are closely linked together. Following the intuitive notion of comparative advantage, one may view production as a fragmented process with many stages in which each stage is outsourced to a place where it is cost-effective to do so (Grossman and Rossi-Hansberg 2008; Johnson 2018). To produce a certain product, each economy participates and adds value at each stage, while the extent of involvement, specialization, and gains varies between economies. In recent years, researchers have studied backshoring—relocating production activities back to home economies—and the factors that influence this decision (Stentoft et al. 2016; Di Mauro et al. 2018). Understanding the way in which production activities take place is critical to the design of appropriate trade policies, public finance, industrial policies, and foreign policies.

In this paper, we seek to provide up-to-date macroeconomic evidence regarding the extent of international fragmentation, with a special focus on the economies of the Association of Southeast Asian Nations (ASEAN). The ASEAN region is very diverse and one of the most dynamic regions in the world. It includes economies at different stages of development, from Singapore, a successful catching-up economy, to Indonesia and Malaysia, which are major emerging economies. During the period 2000–2017, ASEAN’s gross domestic product (GDP) increased by 134.6%, with an average annual growth of 5.1% (World Bank, World Development Indicators).1 However, knowledge about ASEAN in the global economy is less well-understood, probably due to a lack of data. Therefore, this raises some research questions that are potentially important. How pervasive is international fragmentation of production in ASEAN? Do various production stages take place mainly among those in the same geopolitical bloc such as ASEAN, or do they involve a wider range of economies outside the region? And how do patterns differ between advanced and emerging ASEAN economies?

These questions can only be investigated using an input–output framework that is able to describe complex trade networks between sectors and across economies. Traditional aggregate trade statistics, on the other hand, would contain substantial

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1See https://databank.worldbank.org/source/world-development-indicators (accessed May 15, 2020).
double counting by overstating domestic contribution, as products may cross sectoral and national borders several times (Koopman, Wang, and Wei 2014). Recent advances in multiregional input–output datasets with longitudinal and global coverage have led to some influential academic research and practical applications (see Johnson [2014] for a survey of these datasets and their applications). Still, ASEAN trade between sectors and across economies is less well-known in the literature, as most ASEAN economies are included in the aggregate of the rest of the world. To deal with this issue, we utilize the most recent global multiregional input–output (MRIO) tables developed by the Asian Development Bank (ADB) that include nine ASEAN member economies.

Following the approach by Timmer et al. (2014), we analyze the questions posed earlier from the perspective of global value chains of final products, as identified by the sector–economy of completion. We trace the value added by each economy that is needed for the production of final goods in each value chain of ASEAN, and we do the same for ASEAN as a whole. We explicitly distinguish between the domestic and foreign parts in these value chains, and we use the latter to develop measures of international fragmentation and economic integration based on Los, Timmer, and de Vries (2015). We discuss four major trends, characterizing ASEAN as a region with heterogeneous members in which production localization, enhanced regional integration, and increasing linkages with other emerging economies outside the region are taking place.

Throughout this paper, our focus is on documenting some salient patterns that can guide further research on ASEAN and inform policy makers in this region. We believe that accounting for value added by source at the final stage of production is a necessary step toward a comprehensive understanding of ASEAN’s development in the global economy. This paper is structured as follows. Section II provides a brief literature review. Sections III and IV discuss the data and methodology, respectively. Section V presents the four major stylized facts. Section VI concludes.

II. Literature Review

In recent years, influential literature on international fragmentation of production has been increasing. This includes some studies on theoretical models or methodological frameworks addressing various critical aspects in this field, such as (i) explaining the emergence of global supply chains and outsourcing (Costinot and Rodríguez-Clare 2014; Costinot, Vogel, and Wang 2013; Grossman and Rossi-Hansberg 2008); (ii) characterizing the structures of fragmentation, for example, “snakes” and
“spiders” (Baldwin and Venables 2013); and (iii) measuring double counting in gross exports (Koopman, Wang, and Wei 2014). There have been more empirical studies on this topic, for example, on patterns of global supply chains and production fragmentation (Baldwin and Lopez-Gonzalez 2015, Timmer et al. 2014); patterns of global production sharing (Johnson and Noguera 2012, 2017); the People’s Republic of China’s (PRC) domestic value added in exports (Koopman, Wang, and Wei 2012); and fragmentation and Europe’s competitiveness (Timmer et al. 2013). Further, advances in research have led to several applications in policy arenas across leading international organizations, such as ADB (2018), the Organisation for Economic Co-operation and Development’s Trade in Value Added (TiVA) indicators (OECD 2017), and UNCTAD (2013).

The analysis in this paper draws on the strand of literature focusing on the value chains of final products, as documented extensively by Los, Timmer, and de Vries (2015); Timmer et al. (2015); and Timmer et al. (2014). This literature refers to the value-added distribution at the last stage of production before delivery to final consumers. Such a measure is a backward method of tracing value, that is, starting from the final product and tracing the value added back to all production stages. In particular, Timmer et al. (2014) used this method to derive the foreign value-added content in 560 manufacturing value chains and decompose the value added into contributions of capital and labor. Their results confirm the pervasiveness of international production fragmentation and find a specialization pattern between high-income economies (driven by high-skilled labor) and emerging economies (driven by capital). Further, Los, Timmer, and de Vries (2015) find that value chains in regions such as the European Union (EU), East Asia, and the North American Free Trade Agreement (NAFTA) become more globalized as international fragmentation deepens. However, in these prior studies, most ASEAN economies are included in the rest of the world, and thus, their value chains cannot be investigated.

Another strand of literature measures value added in exports differently. Koopman, Wang, and Wei (2012) develop a measure of value added in exports for direct use, showing that the PRC’s domestic content of value added in manufacturing exports has risen by about 10% due to World Trade Organization membership. Another value-added

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2A snakes structure refers to a series of production stages in which intermediate goods are sent from one place to another until the final stage of production before delivery to final consumers, namely, assembly. There is no feedback loop in snakes. A spiders structure involves multiple suppliers of intermediate goods that send their intermediate goods to a single location (final assembler) for the production of final products. Production processes in reality are mostly a combination of these two types of structures and may contain feedback loops.
measure proposed by Johnson and Noguera (2012) traces the portion consumed abroad. Using this measure, they find that the trade imbalance between the PRC and the United States (US) is probably overestimated. Despite various measures available, Los and Timmer (2018) show that all three measures of value added in exports—direct use, consumption, and final stage of production—are related and can be derived using the hypothetical extraction method proposed in Los, Timmer, and de Vries (2016). However, the direct-use perspective may have the issue of double counting under a situation in which production networks contain sizable back-and-forth trade (Los and Timmer 2018), whereas the consumption perspective is relevant to consumer preferences. The final-product perspective, on the other hand, can reflect the extent to which an economy has participated in global production, which is associated with industrial capacity and technological competence. This is highly relevant to development. Hence, analyzing value chains of final products seems more suitable to our research agenda.

Participating in global value chains has important implications for development. It can improve overall welfare because it unlocks the opportunities for economies to specialize according to their comparative advantages (Timmer et al. 2014). The emergence of global value chains has facilitated massive technological change and structural transformation, which is extensively documented in Alcorta et al. (2021). In this process, manufacturing serves as the engine of growth, especially for developing economies (Haraguchi, Cheng, and Smeets 2017; Felipe 2018a). Haraguchi, Cheng, and Smeets (2017) document development trends in several ASEAN economies with high manufacturing growth, including Cambodia, the Lao People’s Democratic Republic (Lao PDR), Myanmar, and Viet Nam over the period 1990–2015. For developing ASEAN economies, global value chains allow them to produce for more advanced markets and, more importantly, engage in technological upgrading (e.g., from low-tech to high-tech industries) and structural transformation (Felipe 2018b). This consists of acquiring foreign knowledge, adapting the knowledge to local circumstances, and accumulation of capacities. Felipe (2018a) investigates the product complexity of six major ASEAN members over the period 2001–2007 in total exports. However, few studies have applied the framework of global value chains to ASEAN. An exception is the study by ADB (2018), which provides value chain-based statistics from a direct-use perspective (Koopman, Wang, and Wei 2012; 2014). Using the same data source as ADB (2018), our paper seeks to provide quantitative information regarding ASEAN’s participation in global value chains from a final-product perspective. Our analysis covers nine ASEAN members (excluding Myanmar) over the period 2000–2017.
III. Data

The data source at our disposal is the MRIO tables for 62 economies developed by ADB (ADB MRIO database, 2019 release). Each economy in the database contains 35 standardized sectors across primary industry, manufacturing, and services, which are identical with the World Input–Output Database (WIOD, 2013 release). The current ADB MRIO database is available for 2000 and the period 2007–2017. In particular, nine out of 10 ASEAN members have been included in the current input–output database, namely Brunei Darussalam, Cambodia, Indonesia, the Lao PDR, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam. The ADB MRIO tables have been used in ADB’s flagship publication Key Indicators for Asia and the Pacific since 2015 (ADB 2018).

There are three other widely used input–output tables, namely the WIOD (Dietzenbacher et al. 2013), Eora (Lenzen et al. 2013), and Global Trade Analysis Project (GTAP) (Andrew and Peters 2013). These tables are produced using different methods and cover different geographical areas and time periods. Global Trade Analysis Project and WIOD are more consistent with one another than they are with Eora (Owen et al. 2014). The ADB MRIO database, to some extent, can be viewed as an extension of the WIOD database with a broader geographical coverage for ASEAN. This is suitable for the purpose and scope of our analysis.

IV. Methodology

A. Measuring Global Value Chains of Final Products

We derive the value added of each economy contributing to a certain value chain in an input–output framework with 63 economies (62 individual economies and the rest of the world), each of which has 35 standardized sectors. The method of measuring value chains used in this paper specifically focuses on the final product, either physical goods or services, which draws on the study by Timmer et al. (2014). By doing so, the value chain is identified by the sector–economy of completion. We follow the basic input–output equations and matrix notations by Miller and Blair (1985). The matrix $E$ is the distribution of value added contributing to each of the 2,205 value chains in the world ($63 \times 2,205$ matrix) and can be

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3See https://mrio.adbx.online/.
4See Appendix 1 for detailed lists of sectors and economies in the ADB MRIO database.
expressed as

$$E = C\hat{e}L\hat{f},$$

(1)

where $C$ is an economy aggregation matrix of $63 \times 2,205$ dimension. The row $n$ and column $m$ headers of $C$ indicate the economy and sectors of each economy, respectively. The value in row $n$ column $m$ ($n = 1, 2, \ldots, 63; m = 1, 2, \ldots, 205$) is

$$C_{n,m} = \begin{cases} 
1 & \text{if the economy of origin and destination economy are identical;} \\
0 & \text{otherwise.}
\end{cases}$$

e' = [e_1, \ldots, e_{2,205}],$$

which represents a vector of sectoral value added per unit of gross output, defined as $e_i = \frac{V_i}{X_i}$, ($i = 1, 2, \ldots, 2,205$), in which $V$ and $X$ are the vector of sectoral value added ($2,205 \times 1$ vector) and the vector of sectoral output ($2,205 \times 1$ vector), respectively. The matrix $\hat{e}$ is the diagonal matrix of $e$. $L$ is the Leontief inverse matrix of $2,205 \times 2,205$ dimension, defined as $L = (I - A)^{-1}$. $I$ is a $2,205 \times 2,205$ identity matrix, and $A$ is the technical coefficient matrix which is calculated as $A = Z \times (X)^{-1}$. Matrix $Z$ denotes the matrix of intermediate inputs. $\hat{f}' = [f_1, \ldots, f_{2,205}]$, which is the vector of sectoral final demand. $\hat{f}$ is the diagonal matrix of $f$.

The matrix $E$ describes how much an economy contributes to a specific value chain. Figure 1 shows a stylized input–output framework with all of the basic variables. We extract all value chains that belong to ASEAN economies from $E$, denoted by the matrix $E^{\text{ASEAN}}$:

$$E^{\text{ASEAN}} = EC^{\text{ASEAN}} = C\hat{e}L\hat{f}C^{\text{ASEAN}},$$

(2)

Figure 1. A Stylized Input–Output Framework of the ADB MRIO Database

| **Intermediate Inputs** | **Final Demand** | **Gross Output** |
|-------------------------|------------------|-----------------|
| Economy 1 Sector        | $Z$ ($2205 \times 2205$) | $f$ ($2205 \times 1$) | $X$ ($2205 \times 1$) |
| ...                     |                  |                 |                 |
| Economy i Sector        |                  |                 |                 |
| ...                     |                  |                 |                 |
| Economy 63 Sector       |                  |                 |                 |
| Value added             | $V'$ ($1 \times 2205$) |                 |                 |
| Gross output            | $X'$ ($1 \times 2205$) |                 |                 |

ADB MRIO database = Asian Development Bank Multiregional Input–Output database.
Source: Authors.
where $C_{\text{ASEAN}}$ is a selection matrix of $2,205 \times 315$ dimension that selects all value chains of ASEAN economies.$^5$ The row header indicates the sectors of each economy and the column header is the sector of each ASEAN economy. $\forall i, j, (i = 1, 2, \ldots, 2,205; j = 1, 2, \ldots, 315)$,

$$
C_{i,j}^{\text{ASEAN}} = \begin{cases} 
1 & \text{if the sector–economy in the row is identical to that in the column;} \\
0 & \text{otherwise.}
\end{cases}
$$

B. Decomposing Global Value Chains of the Association of Southeast Asian Nations

To understand the production fragmentation and economic integration in this region, we decompose each of ASEAN’s global value chains into two components, namely the value-added contribution from the economy of completion (domestic value added) and the value-added contribution from all other foreign economies. The measure used here is based on Timmer et al. (2015) and Timmer et al. (2014).

We apply the decomposition to each of ASEAN’s global value chains, that is, each column of the matrix $E^{\text{ASEAN}}$. Let $VA_{ij}^q$ denote the value added of the $i$th economy ($i = 1, 2, \ldots, 63$) that contributes to the $q$th sector of the $j$th economy in ASEAN ($q = 1, 2, \ldots, 35; j = 1, 2, \ldots, 9$). Then the total value created in the global value chain identified by the $q$th sector of the $j$th economy can be decomposed into

$$
\sum_{i} VA_{ij}^q = DVA_{j}^q + FVA_{j}^q,
$$

where $DVA_{j}^q$ and $FVA_{j}^q$ are the domestic and foreign value added of the $j$th ASEAN economy’s $q$th sector, respectively.

Further, following the approach by Los, Timmer, and de Vries (2015), we decompose the foreign value added of ASEAN’s global value chain, $FVA_{j}^q$, into two parts, namely the regional value added and the global value added:

$$
FVA_{j}^q = FVA_{\text{Regional}}_{j}^q + FVA_{\text{Global}}_{j}^q
$$

where $FVA_{\text{Regional}}_{j}^q$ is the regional value added that comes from the other ASEAN economies except the $j$th economy; and $FVA_{\text{Global}}_{j}^q$ is the value added contributed by the economies outside ASEAN.

$^5$There are nine ASEAN economies in the ADB MRIO, each of which contains 35 sectors (products). Hence, there are $9 \times 35 = 315$ value chains that belong to ASEAN.
Using equations (3) and (4), each of ASEAN’s global value chains can be decomposed into three parts. Figure 2 presents the distribution of value added and the related decomposition.

Formally, for the $q$th global value chain in ASEAN’s $j$th economy, the three decomposition components can be expressed as follows:

$$DVA_j^q = S_{\text{dom}} \times C_{\text{ASEAN}} \times P,$$

$$FVA_{\text{Regional}}_j^q = S_{\text{reg}} \times C_{\text{ASEAN}} \times P,$$

$$FVA_{\text{Global}}_j^q = S_{\text{glo}} \times C_{\text{ASEAN}} \times P.$$

We construct four selection vectors:

$P$ is a $315 \times 1$ vector that selects the global value chain from the matrix $C_{\text{ASEAN}}$. The cell’s value is 1 if the cell indicates the $q$th sector of the $j$th ASEAN economy, and the other cells are 0.

$S_{\text{dom}}$, $S_{\text{reg}}$, and $S_{\text{glo}}$ are $1 \times 63$ vectors that sum up the domestic, regional, and global value added, respectively, where the column header indicates the economy in the input–output tables. For the $i$th cell ($i = 1, 2, \ldots, 63$),

$$S_{i}^{\text{dom}} = \begin{cases} 1 & \text{if origin economy and destination economy are identical;} \\ 0 & \text{otherwise.} \end{cases}$$
\( S_{ij}^{\text{reg}} = \begin{cases} 1 & \text{if origin is from ASEAN economies except the } j\text{th ASEAN economy;} \\ 0 & \text{otherwise.} \end{cases} \)

\( S_{ij}^{\text{glo}} = \begin{cases} 1 & \text{if the } i\text{th economy is from outside the ASEAN;} \\ 0 & \text{otherwise.} \end{cases} \)

Following Los, Timmer, and de Vries (2015), Timmer et al. (2015), and Timmer et al. (2014), we obtain the following indicators measuring the international fragmentation of production and regional economic integration of ASEAN’s global value chains:

\[
\text{Fragmentation} = \frac{FVA_j^q}{\sum_{i} VA_{ij}^q} \tag{5}
\]

and

\[
\text{Integration} = \frac{FVA_{\text{Regional}}^q}{FVA_{\text{Global}}^q}. \tag{6}
\]

We use the share of foreign value added to measure the extent of international fragmentation of production. As shown in Los, Timmer, and de Vries (2015), under a final product framework, it does not matter how the production chain is organized, for example, snakes or spiders, and the accounting captures foreign value added from all stages. Thus, the share in equation (5) reflects the importance of foreign value added. The economic integration of ASEAN’s global value chain is measured by the ratio of regional value added to global value added. A higher (smaller) ratio, as expressed in equation (6), indicates relatively more (less) regional sourcing, and thus a higher (lower) level of economic integration.

V. Results

Using equations (5) and (6) derived in the methodology, we calculate the foreign value-added share for each value chain of each ASEAN member and further decompose the foreign value added into regional and global. In addition, viewing ASEAN as a single economy, we calculate the value-added contributions within ASEAN and from outside ASEAN. Several crucial stylized facts stand out in our analyses.

A. Stylized Fact No. 1: Declining International Fragmentation of Production in the Association of Southeast Asian Nations

The focus of this section is to analyze the trends of production fragmentation in ASEAN, which, we believe, is complementary to the prior literature by Timmer et al. (2014)
on manufacturing global value chains across 40 major economies. We derive the foreign value-added share using equation (5) for each value chain in each ASEAN member.

Figure 3 depicts the distributions of foreign value-added shares by aggregate industry, namely primary industry, manufacturing, and services (panels A, B, and C, respectively). A global value chain is identified by the sector and economy of completion. Thus, in each year, we have 18 global value chains for two sectors in primary industry, 126 global value chains for 14 manufacturing sectors, and 171 global value chains for 19 sectors in services (see Appendix 1 for a full list of industry and economy classifications). In each panel of Figure 3, we plot the distributions for 2000, 2007, and 2017.

Panel A of Figure 3 for ASEAN’s global value chains in primary industry shows that the density curve for 2007 shifted to the right of the curve for 2000, indicating enhanced international fragmentation of production over the period 2000–2007. However, the 2017 distribution curve shifted back to the left of the other two curves, suggesting a declining fragmentation process. In particular, over the entire period

ASEAN = Association of Southeast Asian Nations.
Notes: Industry classification is based on Table A1.1 in Appendix 1. Density is based on the kernel estimation (Epanechnikov kernel). The plots in each panel cover all nine ASEAN economies.
Source: Authors’ calculations.
2000–2017, 10 out of 18 global value chains experienced a decline in foreign value-added shares.

For manufacturing value chains (panel B of Figure 3), more value chains had lower foreign value-added shares in 2007, as the curve is distributed to the left of the 2000 curve. For 2017, the curve has a lower peak but a longer tail toward the left side than the 2007 curve. The unweighted average of foreign value-added shares over all manufacturing value chains was 34.64% in 2000, and it dropped to 34.24% in 2007. It further declined to 34.16% in 2017. This means that, overall, ASEAN’s manufacturing value chains have sourced more local contents, suggesting development patterns similar to those in the PRC as documented in Koopman, Wang, and Wei (2012).

Services value chains in ASEAN show similar trends compared to those in primary industry (panel C of Figure 3). The 2007 curve has a peak distributed to the right of the 2000 and 2017 curves. The unweighted average of shares declined to 20.63% in 2007 from 21.09% in 2000. The curve for 2017 then shifted to the left of both curves, with an unweighted average of 20.02%. This provides evidence of declining foreign value-added shares.

Over the entire period 2000–2017, our analysis shows that the decline in foreign value-added shares is a common pattern in ASEAN. Such a decline has been stronger in recent years. We also examine the foreign value shares in each ASEAN member, summing up all value chains by economy (see Figure A2.1 in Appendix 2). At the economy level, we find declining foreign value-added shares in Indonesia, the Lao PDR, Malaysia, Singapore, and Thailand.

This indicates that, overall, ASEAN has experienced decreasing international fragmentation of production, and production localization has been enhanced. Prior studies by Timmer et al. (2015) and Timmer et al. (2014) show enhanced production fragmentation, but in their studies, most ASEAN economies (except Indonesia) are included in the rest of the world. Our finding provides some complementary evidence to these prior studies: production (either physical goods or services) has been shifted from other economies to ASEAN, as the latter has become an important supplier of products (at the last stage of production) for the world economy.

B. Stylized Fact No. 2: Enhanced Economic Integration in the Association of Southeast Asian Nations

This section focuses on economic integration in ASEAN. For each value chain in each ASEAN member, we decompose the foreign value added into (i) regional value
added, that is, the value added from ASEAN economies except the economy of completion; and (2) global value added, that is, the value added from outside ASEAN. Then we calculate the ratio of regional value added to global value added. To understand the trends in economic integration, we plot the distributions for 2000, 2007, and 2017. Figure 4 presents the results.

Panel A of Figure 4 shows the density distribution of regional value-added shares. The curve for 2007 has a higher peak but a smaller standard deviation than the curve for 2000, whereas the 2017 curve has moved to the right. On the other hand, the distribution curve of global value-added shares, as presented in panel B of Figure 4, shifted to the left in 2017, indicating decreasing contributions of value added from outside ASEAN.

Panel C of Figure 4 depicts the distribution of economic integration based on equation (6). This indicator captures the combined effect of the dynamics of regional

\[ \text{FVA} = \text{foreign value added.} \]

Notes: Industry classification is based on Table A1.1 in Appendix 1. Density is based on the kernel estimation (Epanechnikov kernel). The plots in each panel cover all nine economies of the Association of Southeast Asian Nations.
Source: Authors’ calculations.
value added and global value added. The trend is evident. The distribution curve shows a trend of shifting to the right. The unweighted average ratio remained almost unchanged between 2000 and 2007 (about 0.17), and then grew to 0.19 in 2017. This suggests that economic integration in ASEAN has been enhanced over the entire period 2000–2017.

Further, we investigate the average level of economic integration by aggregate industry by year. To do so, we calculate the unweighted average of the integration ratio of regional to global value added across all value chains in ASEAN. The results are presented in panel D of Figure 4. The three aggregate industries exhibit similar trends. In most years, manufacturing has the highest level of economic integration, while services has the lowest. Overall, the average ratio of regional to global value added experienced a decline until 2012, but the ratio started to increase afterward. Between 2000 and 2017, this ratio increased from 0.18 to 0.2 for primary industry (an increase of about 12%), from 0.188 to 0.191 for manufacturing (about 1.6%), and from 0.15 to 0.18 for services (about 19.1%). This means that the recent economic integration in ASEAN has mainly been driven by the integration in services and primary industry. Our finding in this section goes beyond the prior study by Los, Timmer, and de Vries (2015), which claims a tendency of decreasing ratio of regional to global value added for 34 economies-of-completion in the EU, East Asia, and NAFTA over the period 1995–2011.

C. Stylized Fact No. 3: Uneven Value-Added Contributions within the Association of Southeast Asian Nations

In this section, the analysis looks into the evidence when viewing ASEAN as a single economy. We then derive the value-added contributions of each individual economy to the entire ASEAN economy and to ASEAN’s aggregate manufacturing industry. Table 1 presents the distribution of value-added contributions in 2000, 2007, and 2017 (see Table A2.2 in Appendix 2 for the full list).

The results for the entire ASEAN economy (“all sectors”) and those for manufacturing show similar trends, which are consistent with the results at the value-chain level in stylized fact no. 1. Indeed, the international fragmentation of production has been decreasing in ASEAN, indicating more localized production. For the entire ASEAN, the domestic share, that is, value-added contribution from within ASEAN, accounted for 77.44% in 2000, increased to 79.64% in 2007, and further increased to 82.04% in 2017. For ASEAN manufacturing chains, the domestic share rose from 68.37% in 2000 to 73.1% in 2017. The domestic shares for all sectors are higher than
those for manufacturing, as manufacturing products are more internationally tradable. ASEAN members’ shares of value-added contributions from a global value chain perspective (Table 1) are correlated with their shares of total GDP (Table A2.1), and the magnitudes of these shares vary across members.

Possible explanations for the rise in value-added contributions from within ASEAN include the shift of production from advanced economies to ASEAN, enhanced local industrial capabilities, and local availability of required intermediates and services. However, the value-added contributions across ASEAN members are distributed unevenly. The largest contributor is Indonesia, followed by Thailand and the Philippines. The contributions from the other members are mostly less than 10%. In addition, ASEAN economies show different patterns across years. Production localization is driven by Indonesia, whose domestic value-added contribution to ASEAN rose by 11.83 percentage points for all sectors in 2000–2017 and 5.36 percentage points for manufacturing. This is because Indonesia experienced the

Table 1. Distribution of Value-Added Contributions to ASEAN (%)

|                     | All Sectors |          | Manufacturing |          |
|---------------------|-------------|----------|---------------|----------|
|                     | 2000 | 2007 | 2017 | 2000 | 2007 | 2017 |
| Ratio of DVA to FVA |      |      |      |      |      |      |
| Domestic value added (DVA), of which | 3.43 | 3.91 | 4.57 | 2.16 | 2.36 | 2.72 |
| Brunei Darussalam  | 0.62 | 0.56 | 0.29 | 0.36 | 0.22 | 0.10 |
| Indonesia           | 24.16 | 30.51 | 35.99 | 23.62 | 24.45 | 28.98 |
| Cambodia            | 0.54 | 0.57 | 0.67 | 0.35 | 0.42 | 0.56 |
| Lao People’s Democratic Republic | 0.23 | 0.28 | 0.44 | 0.11 | 0.13 | 0.20 |
| Malaysia            | 8.97 | 9.83 | 8.70 | 8.57 | 10.70 | 8.75 |
| Philippines         | 13.56 | 9.72 | 10.34 | 12.17 | 9.00 | 9.41 |
| Singapore           | 9.66 | 7.83 | 6.75 | 6.66 | 5.50 | 5.14 |
| Thailand            | 15.69 | 15.81 | 12.97 | 13.66 | 15.19 | 12.09 |
| Viet Nam            | 4.01 | 4.53 | 5.89 | 2.87 | 4.67 | 7.89 |
| Foreign value added (FVA), of which | 22.56 | 20.36 | 17.96 | 31.63 | 29.72 | 26.90 |
| European Union      | 3.61 | 3.21 | 2.34 | 4.93 | 4.57 | 3.38 |
| East Asia           | 7.54 | 6.16 | 6.35 | 11.46 | 9.75 | 10.59 |
| NAFTA               | 4.32 | 2.83 | 1.95 | 6.35 | 4.09 | 3.06 |
| Others              | 7.08 | 8.16 | 7.32 | 8.90 | 11.30 | 9.87 |

ASEAN = Association of Southeast Asian Nations, NAFTA = North American Free Trade Agreement.
Notes: In “All sectors,” ASEAN is viewed as a single economy by summing up all ASEAN value chains, while “Manufacturing” calculations are based on value-added contributions to ASEAN’s manufacturing sectors only. As ASEAN is regarded as a single economy, each ASEAN member is considered a domestic region. Thus, “Domestic value added” in this table refers to the value-added contributions from ASEAN members. “Foreign value added” represents those from outside ASEAN. A detailed table of value-added contributions to ASEAN-9 is available in Table A2.2 of Appendix 2.
deepest recession among all ASEAN economies during the 1997 Asian financial crisis, and it experienced fast growth in services after 2000 (World Bank, World Development Indicators). The shares from Viet Nam and less developed members such as Cambodia and the Lao PDR also increased between 2000 and 2017, probably due to high growth in manufacturing (Haraguchi, Cheng, and Smeets 2017). The other ASEAN members generally experienced a decline in value-added shares. This is probably due to the heterogeneity in economic structures, policies, and industrial and absorptive capacities.

Correspondingly, foreign contribution continued to decrease from 22.56% in 2000 to 17.96% in 2017 for all sectors, and from 31.63% in 2000 to 26.9% for manufacturing. We find declining value-added shares in all major economy aggregates, namely the EU, East Asia, and NAFTA.

**D. Stylized Fact No. 4: Enhanced Value-Added Contributions from Emerging Economies and Declining Value-Added Contributions from Advanced Economies**

As shown in Table 1, the overall value-added contributions from outside ASEAN have decreased over time, particularly from the EU, East Asia, and NAFTA. The analysis in this section looks at each individual economy outside ASEAN and explores whether there is a distributional difference across these economies. The finding confirms the heterogeneity between advanced economies and emerging economies in terms of their value-added contributions to ASEAN.

Figure 5 compares ASEAN’s foreign value-added shares in 2000 and 2017 by plotting the value-added contributions from each individual economy outside ASEAN (in log points) together with a 45-degree line. It is evident that the economies that are distributed above the 45-degree line are mostly emerging economies, and most advanced economies are below the 45-degree line. This indicates an increase (a decline) in value-added contributions to ASEAN from emerging (advanced) economies between 2000 and 2017. There are some exceptions. For example, emerging economies such as Mexico, Fiji, and Nepal contributed less to ASEAN, while contributions from advanced economies such as the Czech Republic and Slovakia increased slightly during this period. In particular, in 2000, the foreign economy with the highest value-added contribution to ASEAN was Japan (4.46%), followed by the US (3.92%) and the PRC (1.1%). In 2017, the PRC overtook Japan and the US and became the most important foreign contributing economy in terms of value added (PRC: 3.06%, Japan: 1.69%, and the US: 1.73%).
Further, we are interested in whether such a distributional difference across economies is mainly driven by some specific industries or a pervasive pattern across industries. To do so, we derive the value-added contributions to ASEAN by economy and by aggregate industry. Figure 6 presents these results. All five aggregate industries show a very similar pattern, namely an increase (decrease) in value-added contributions from emerging (advanced) economies. This finding is consistent with the results in Figure 5, suggesting that such an empirical pattern is pervasive and robust. This is probably due to the economic development and enhanced industrial capabilities of those emerging economies (e.g., the PRC), leading to more economic linkages through trade (Felipe 2018b). In addition, as the value-added contributions from advanced economies declined faster than the growth of contributions from emerging economies, the total foreign contribution to ASEAN declined during this period. This may provide some evidence on backshoring of advanced economies in ASEAN. Overall, the results suggest that there has been a shift toward other emerging economies in supply chains that belong to ASEAN.
This paper has examined the global value chains of ASEAN. The recent development of the ADB MRIO database has enabled us to have a more comprehensive understanding of ASEAN in the global economy, which is less well-known in the literature. The analysis has focused on each value chain of a final product that belongs to ASEAN economies (as identified by the sector-economy of completion), as well as the entire ASEAN economy. We employed the share of foreign value added in the value chain to measure the extent of international fragmentation of production, following Timmer et al. (2014). Further, we decomposed the foreign value added in each value chain into a regional part (from within ASEAN)
and a global part (from outside ASEAN) based on Los, Timmer, and de Vries (2015). The ratio of these two parts was used to measure the extent of economic integration.

Four stylized facts stand out. First, we find that ASEAN members’ foreign value-added shares have declined, indicating increased localization of production. Second, the portion of foreign value added from within the ASEAN region has increased, suggesting enhanced integration in ASEAN. Third, even as economies within ASEAN have become more integrated in terms of regional sourcing, members’ value-added contributions to ASEAN have varied widely across its members. Fourth, we find evidence of increasing value-added contributions from emerging economies to ASEAN, whereas the contributions from advanced economies have declined. Our findings fit a broader story of the development of ASEAN in a globalizing world, characterizing ASEAN as a key participant in global value chains. As local technological capacities and competencies have been gradually built and improved, production in ASEAN economies has become more localized by sourcing locally within its own economies and within ASEAN. The supply chains of ASEAN economies have gradually shifted toward other emerging economies outside ASEAN region. This is probably due to backshoring in advanced economies and improved capacities in other emerging economies.

We have documented a series of stylized facts in this paper that can serve as a starting point for further research. Our research questions are answered affirmatively based on empirical evidence. We are able to trace the source of value added in a way that is meaningful and relevant to development and globalization. In particular, we have shown that the perspective of final products seems useful, which is what Los and Timmer (2018) and Timmer et al. (2014) have argued. Nonetheless, more research on theoretical frameworks and more case studies are needed. In addition, the method used in this paper can be applied (probably with some revision) to a wider range of environmental, social, and economic indicators—not just value added—such as energy use, emissions, labor (e.g., total, high-skilled, and low-skilled labor), and capital stock. These new applications could be very useful and influential, leading to more comprehensive interpretations in related policy areas.

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### Table A1.1. Sector Classifications in the ADB Multiregional Input–Output (MRIO) Database

| Sector                    | Industry | Description                                         |
|---------------------------|----------|-----------------------------------------------------|
| Primary industry          |          | Agriculture, hunting, forestry, and fishing         |
| Mining and quarrying      |          | Mining and quarrying                                |
| Manufacturing             | Low tech | Food, beverages, and tobacco                        |
| Low tech                  |          | Textiles and textile products                       |
| Low tech                  |          | Leather, leather products, and footwear            |
| Low tech                  |          | Wood and products of wood and cork                  |
| Low tech                  |          | Pulp, paper, paper products, printing, and publishing |
| Low and medium tech       |          | Coke, refined petroleum, and nuclear fuel           |
| Medium and high tech      |          | Chemicals and chemical products                     |
| Low and medium tech       |          | Rubber and plastics                                 |
| Low and medium tech       |          | Other nonmetallic mineral                           |
| Low and medium tech       |          | Basic metals and fabricated metal                  |
| Medium and high tech      |          | Machinery, nec                                      |
| Medium and high tech      |          | Electrical and optical equipment                    |
| Medium and high tech      |          | Transport equipment                                 |
| Low tech                  | Manufacturing, nec; recycling                     |
| Services                  |          | Electricity, gas, and water supply                  |
| Construction              |          | Construction                                        |
| Sale, maintenance, and repair of motor vehicles and motorcycles; retail sale of fuel | Wholesale trade and commission trade, except of motor vehicles and motorcycles |
| Retail trade, except of motor vehicles and motorcycles; repair of household goods | | |
| Hotels and restaurants    |          | Hotels and restaurants                              |
| Inland transport          |          | Inland transport                                    |
| Water transport           |          | Water transport                                     |
| Air transport             |          | Air transport                                       |
| Other supporting and auxiliary transport activities; activities of travel agencies | | |
| Post and telecommunications|          | Post and telecommunications                          |
| Financial intermediation  |          | Financial intermediation                            |
| Real estate activities    |          | Real estate activities                              |
| Renting of machinery and equipment; other business activities | | |
| Public administration and defense; compulsory social security | | |
| Education                 |          | Education                                           |
| Health and social work    |          | Health and social work                              |
| Other community, social, and personal services | | |
| Private households with employed persons | | |

ADB = Asian Development Bank, nec = not elsewhere classified.
Source: ADB MRIO database (2019 release).
Table A1.2. **Economies in the ADB Multiregional Input–Output (MRIO) Database**

| ADB MRIO Code | Economy            | ADB MRIO Code | Economy            |
|---------------|--------------------|---------------|--------------------|
| AUS           | Australia          | BAN           | Bangladesh         |
| AUT           | Austria            | BGR           | Bulgaria           |
| BEL           | Belgium            | BUH           | Bhutan             |
| CAN           | Canada             | BRA           | Brazil             |
| CYP           | Cyprus             | BRU           | Brunei Darussalam  |
| CZE           | Czech Republic     | CAM           | Cambodia           |
| DEN           | Denmark            | FIJ           | Fiji               |
| EST           | Estonia            | HRV           | Croatia            |
| FIN           | Finland            | HUN           | Hungary            |
| FRA           | France             | IND           | India              |
| GER           | Germany            | INO           | Indonesia          |
| GRC           | Greece             | KAZ           | Kazakhstan          |
| HKG           | Hong Kong, China   | KGZ           | Kyrgyz Republic    |
| IRE           | Ireland            | LAO           | Lao People’s Democratic Republic |
| ITA           | Italy              | MAL           | Malaysia           |
| JPN           | Japan              | MEX           | Mexico             |
| KOR           | Republic of Korea  | MLD           | Maldives           |
| LUX           | Lithuania          | MON           | Mongolia           |
| LVA           | Latvia             | NEP           | Nepal              |
| MLT           | Malta              | PHI           | Philippines         |
| NET           | Netherlands        | POL           | Poland             |
| NOR           | Norway             | PRC           | People’s Republic of China |
| POR           | Portugal           | ROM           | Romania            |
| SIN           | Singapore          | RUS           | Russian Federation |
| SPA           | Spain              | SRI           | Sri Lanka          |
| SVK           | Slovak Republic    | THA           | Thailand           |
| SVN           | Slovenia           | TUR           | Turkey             |
| SWE           | Sweden             | VIE           | Viet Nam           |
| SWI           | Switzerland        | ROW           | Rest of the world  |
| TAP           | Taipei, China      |               |                    |
| UKG           | United Kingdom     |               |                    |
| USA           | United States      |               |                    |

**ADB = Asian Development Bank.**

Note: Classifications of advanced and emerging and developing economies are in accordance with the IMF World Economic Outlook (October 2020 release).

Source: ADB MRIO database (2019 release).
Appendix 2. Empirical Results

Figure A2.1. Foreign Value-Added Shares in each Association of Southeast Asian Nations Economy

Note: See Table A1.2 for definitions of country codes.
Source: Authors’ calculations.

Table A2.1. Shares of Gross Domestic Product in the Association of Southeast Asian Nations (%)

|      | 2000  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| BRU  | 1.10  | 0.94  | 0.95  | 0.72  | 0.76  | 0.87  | 0.84  | 0.78  | 0.73  | 0.55  | 0.46  | 0.45  |
| CAM  | 0.58  | 0.61  | 0.64  | 0.65  | 0.56  | 0.56  | 0.57  | 0.60  | 0.65  | 0.70  | 0.73  | 0.74  |
| INO  | 29.72 | 34.99 | 35.72 | 37.83 | 39.80 | 40.63 | 39.19 | 37.77 | 36.51 | 39.05 | 40.01 | 40.52 |
| LAO  | 0.26  | 0.30  | 0.33  | 0.37  | 0.34  | 0.38  | 0.41  | 0.48  | 0.51  | 0.53  | 0.55  | 0.55  |
| MAL  | 14.24 | 15.01 | 15.44 | 13.67 | 13.67 | 13.69 | 13.57 | 13.49 | 14.05 | 12.14 | 11.54 | 11.19 |
| PHI  | 15.37 | 11.48 | 11.10 | 11.28 | 10.80 | 10.40 | 10.91 | 11.47 | 11.96 | 12.15 | 12.03 | 11.54 |
| SIN  | 14.94 | 12.86 | 12.08 | 12.25 | 12.08 | 12.07 | 11.94 | 12.09 | 12.37 | 11.89 | 11.47 | 11.16 |
| THA  | 18.79 | 18.54 | 17.83 | 16.89 | 16.44 | 15.78 | 16.41 | 16.77 | 16.17 | 15.73 | 15.88 | 16.37 |
| VIE  | 5.01  | 5.28  | 5.91  | 6.33  | 5.55  | 5.61  | 6.17  | 6.54  | 7.04  | 7.27  | 7.34  | 7.47  |
| Total| 100   | 100   | 100   | 100   | 100   | 100   | 100   | 100   | 100   | 100   | 100   | 100   |

Notes: Calculations in this table are based on the Asian Development Bank Multiregional Input–Output database (ADB MRIO). Myanmar is not included in the calculation. See Table A1.2 for definitions of economy codes.
Source: Authors’ calculations.
Table A2.2. Full Results of Value-Added Contributions to the Association of the Southeast Asian Nations (%)  

(a) All sectors

|               | 2000  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  |
|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Domestic value added (from ASEAN-9), of which |       |       |       |       |       |       |       |       |       |       |       |       |
| BRU           | 0.62  | 0.56  | 0.52  | 0.37  | 0.37  | 0.42  | 0.43  | 0.43  | 0.38  | 0.34  | 0.31  | 0.29  |
| CAM           | 0.54  | 0.57  | 0.59  | 0.60  | 0.52  | 0.53  | 0.52  | 0.54  | 0.58  | 0.62  | 0.66  | 0.67  |
| INO           | 24.16 | 30.51 | 30.40 | 33.40 | 34.50 | 34.83 | 33.72 | 32.67 | 31.73 | 34.49 | 36.19 | 35.99 |
| LAO           | 0.23  | 0.28  | 0.29  | 0.34  | 0.30  | 0.33  | 0.36  | 0.42  | 0.43  | 0.43  | 0.45  | 0.44  |
| MAL           | 9.97  | 9.83  | 10.19 | 9.94  | 9.89  | 10.26 | 10.33 | 10.44 | 10.94 | 9.55  | 9.35  | 8.70  |
| PHI           | 13.56 | 9.72  | 9.56  | 10.17 | 9.61  | 9.50  | 9.75  | 10.30 | 10.77 | 10.95 | 11.00 | 10.34 |
| SIN           | 15.69 | 15.81 | 14.98 | 14.27 | 13.74 | 13.05 | 13.26 | 13.45 | 12.95 | 12.53 | 12.95 | 12.97 |
| THA           | 3.61  | 3.21  | 3.26  | 2.71  | 2.70  | 2.58  | 2.49  | 2.58  | 2.55  | 2.31  | 2.13  | 2.34  |
| VIE           | 0.07  | 0.07  | 0.07  | 0.06  | 0.06  | 0.06  | 0.06  | 0.06  | 0.06  | 0.05  | 0.05  | 0.05  |
| Foreign value added (from outside ASEAN-9), of which | | | | | | | | | | | | |
| European Union | 0.14  | 0.12  | 0.12  | 0.10  | 0.10  | 0.10  | 0.10  | 0.10  | 0.09  | 0.09  | 0.09  | 0.09  |
| AUT           | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  |
| BEL           | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| BGR           | 0.02  | 0.03  | 0.03  | 0.02  | 0.03  | 0.03  | 0.03  | 0.03  | 0.03  | 0.03  | 0.02  | 0.03  |
| CZE           | 0.08  | 0.07  | 0.07  | 0.05  | 0.07  | 0.06  | 0.05  | 0.06  | 0.06  | 0.05  | 0.04  | 0.05  |
| DEN           | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  |
| FRA           | 0.08  | 0.07  | 0.09  | 0.07  | 0.07  | 0.05  | 0.05  | 0.05  | 0.05  | 0.05  | 0.04  | 0.04  |
| GER           | 0.42  | 0.33  | 0.34  | 0.30  | 0.29  | 0.30  | 0.28  | 0.28  | 0.28  | 0.25  | 0.22  | 0.24  |
| GRC           | 0.84  | 0.77  | 0.77  | 0.65  | 0.65  | 0.61  | 0.60  | 0.62  | 0.62  | 0.55  | 0.52  | 0.57  |
| HRV           | 0.04  | 0.05  | 0.05  | 0.05  | 0.04  | 0.03  | 0.03  | 0.04  | 0.03  | 0.03  | 0.03  | 0.03  |
| HUN           | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  |
| IRE           | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  |
| ITA           | 0.28  | 0.25  | 0.25  | 0.21  | 0.19  | 0.20  | 0.20  | 0.20  | 0.20  | 0.18  | 0.17  | 0.18  |

Continued.
Table A2.2. Continued.

(a) All sectors

|        | 2000  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  |
|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| LTU    | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  |
| LUX    | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  |
| LVA    | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  |
| MLT    | 0.01  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| NET    | 0.29  | 0.25  | 0.28  | 0.22  | 0.23  | 0.21  | 0.23  | 0.23  | 0.20  | 0.19  | 0.21  |       |
| POL    | 0.04  | 0.04  | 0.05  | 0.04  | 0.04  | 0.05  | 0.05  | 0.05  | 0.04  | 0.04  | 0.05  |       |
| POR    | 0.02  | 0.03  | 0.03  | 0.02  | 0.02  | 0.02  | 0.03  | 0.03  | 0.02  | 0.02  | 0.02  |       |
| ROM    | 0.01  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  | 0.02  |       |
| SPA    | 0.14  | 0.13  | 0.13  | 0.11  | 0.11  | 0.11  | 0.11  | 0.11  | 0.11  | 0.11  | 0.11  |       |
| SVK    | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  |       |
| SVN    | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  |       |
| SWE    | 0.16  | 0.14  | 0.14  | 0.11  | 0.11  | 0.11  | 0.10  | 0.10  | 0.10  | 0.09  | 0.08  | 0.09  |
| UKG    | 0.79  | 0.64  | 0.59  | 0.48  | 0.46  | 0.44  | 0.43  | 0.46  | 0.44  | 0.35  | 0.38  |       |
| East Asia | 7.54  | 6.16  | 6.34  | 5.86  | 6.36  | 6.07  | 6.24  | 6.25  | 6.47  | 6.52  | 5.86  | 6.35  |
| HKG    | 0.26  | 0.17  | 0.23  | 0.14  | 0.16  | 0.13  | 0.11  | 0.11  | 0.11  | 0.11  | 0.09  | 0.12  |
| JPN    | 4.46  | 2.46  | 2.50  | 2.18  | 2.38  | 2.04  | 2.01  | 1.79  | 1.65  | 1.63  | 1.56  | 1.69  |
| KOR    | 0.95  | 0.86  | 0.79  | 0.77  | 0.87  | 0.83  | 0.87  | 0.92  | 0.98  | 0.91  | 0.96  |       |
| PRC    | 1.10  | 2.13  | 2.34  | 2.29  | 2.46  | 2.59  | 2.78  | 2.97  | 3.23  | 3.27  | 2.82  | 3.06  |
| TAP    | 0.77  | 0.53  | 0.48  | 0.48  | 0.50  | 0.47  | 0.47  | 0.46  | 0.50  | 0.53  | 0.49  | 0.53  |
| NAFTA | 4.32  | 2.83  | 2.80  | 2.33  | 2.41  | 2.31  | 2.22  | 2.19  | 2.18  | 2.10  | 1.87  | 1.95  |
| CAN    | 0.27  | 0.24  | 0.25  | 0.19  | 0.22  | 0.22  | 0.21  | 0.21  | 0.20  | 0.18  | 0.16  | 0.17  |
| MEX    | 0.13  | 0.09  | 0.08  | 0.06  | 0.07  | 0.08  | 0.07  | 0.08  | 0.07  | 0.07  | 0.05  | 0.06  |
| USA    | 3.92  | 2.50  | 2.47  | 2.07  | 2.12  | 2.02  | 1.94  | 1.90  | 1.90  | 1.86  | 1.66  | 1.73  |
| Others | 7.08  | 8.16  | 8.51  | 7.20  | 7.58  | 8.34  | 8.50  | 8.24  | 7.88  | 7.21  | 6.37  | 7.32  |
| AUS    | 0.85  | 0.76  | 0.78  | 0.68  | 0.78  | 0.85  | 0.78  | 0.74  | 0.68  | 0.59  | 0.58  | 0.65  |
| BAN    | 0.01  | 0.01  | 0.01  | 0.02  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  | 0.01  |
| BHU    | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |
| BRA    | 0.15  | 0.27  | 0.30  | 0.27  | 0.32  | 0.34  | 0.33  | 0.33  | 0.26  | 0.21  | 0.24  |       |
| FIJ    | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  | 0.00  |

Continued.
Table A2.2. Continued.

(a) All sectors

| Country | 2000 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|
| IND     | 0.25 | 0.47 | 0.50 | 0.37 | 0.46 | 0.47 | 0.45 | 0.46 | 0.44 | 0.42 | 0.41 | 0.43 |
| KAZ     | 0.03 | 0.05 | 0.03 | 0.07 | 0.04 | 0.06 | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 |
| KGZ     | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MLD     | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MON     | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NEP     | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NOR     | 0.12 | 0.10 | 0.11 | 0.08 | 0.10 | 0.10 | 0.10 | 0.10 | 0.12 | 0.11 | 0.10 | 0.09 |
| PAK     | 0.04 | 0.03 | 0.02 | 0.04 | 0.03 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| RUS     | 0.32 | 0.39 | 0.48 | 0.35 | 0.45 | 0.51 | 0.57 | 0.52 | 0.35 | 0.27 | 0.35 | 0.35 |
| SRI     | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| SWI     | 0.23 | 0.20 | 0.26 | 0.19 | 0.22 | 0.28 | 0.22 | 0.20 | 0.19 | 0.18 | 0.16 | 0.17 |
| TUR     | 0.08 | 0.09 | 0.12 | 0.10 | 0.09 | 0.09 | 0.09 | 0.10 | 0.10 | 0.09 | 0.08 | 0.09 |
| ROW     | 4.99 | 5.80 | 5.85 | 5.04 | 5.09 | 5.64 | 5.93 | 5.62 | 5.40 | 5.14 | 4.49 | 5.23 |

(b) Manufacturing

| Country | 2000 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|
| BRU     | 0.36 | 0.22 | 0.28 | 0.09 | 0.13 | 0.18 | 0.18 | 0.17 | 0.16 | 0.10 | 0.07 | 0.10 |
| CAM     | 0.35 | 0.42 | 0.38 | 0.37 | 0.33 | 0.37 | 0.36 | 0.41 | 0.45 | 0.50 | 0.54 | 0.56 |
| INO     | 23.62| 24.45| 24.49| 27.48| 27.47| 28.24| 27.14| 26.20| 24.84| 27.66| 29.16| 28.98|
| LAO     | 0.11 | 0.13 | 0.14 | 0.26 | 0.16 | 0.17 | 0.19 | 0.18 | 0.19 | 0.20 | 0.21 | 0.20 |
| MAL     | 8.57 | 10.70| 10.69| 10.19| 10.47| 10.97| 10.70| 10.75| 11.12| 9.72 | 9.85 | 8.75 |
| PHI     | 12.17| 9.00 | 8.76 | 9.62 | 9.29 | 8.88 | 9.73 | 10.25| 10.23| 10.37| 9.41 | 9.41 |
| SIN     | 6.66 | 5.50 | 4.36 | 3.97 | 4.64 | 4.41 | 4.80 | 4.30 | 4.92 | 5.01 | 4.98 | 5.14 |

Continued.
Table A2.2.  
(b) Manufacturing

| Country | 2000 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---------|------|------|------|------|------|------|------|------|------|------|------|------|
| THA     | 13.66| 15.19| 14.45| 15.10| 14.31| 12.13| 13.12| 13.79| 13.37| 12.90| 12.32| 12.09|
| VIE     | 2.87 | 4.67 | 6.25 | 6.76 | 5.46 | 5.79 | 6.05 | 6.44 | 6.87 | 7.34 | 7.82 | 7.89 |
| Foreign value added (from outside ASEAN-9), of which European Union | | | | | | | | | | | | |
| AUT     | 0.10 | 0.10 | 0.11 | 0.09 | 0.09 | 0.10 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.08 |
| BEL     | 0.18 | 0.17 | 0.17 | 0.14 | 0.14 | 0.13 | 0.13 | 0.13 | 0.13 | 0.12 | 0.12 | 0.12 |
| BGR     | 0.01 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| CYP     | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| CZE     | 0.03 | 0.04 | 0.04 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| DEN     | 0.09 | 0.09 | 0.10 | 0.07 | 0.08 | 0.07 | 0.07 | 0.07 | 0.07 | 0.06 | 0.05 | 0.06 |
| EST     | 0.01 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| FIN     | 0.11 | 0.10 | 0.11 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.06 | 0.06 |
| FRA     | 0.60 | 0.48 | 0.50 | 0.44 | 0.42 | 0.43 | 0.42 | 0.41 | 0.41 | 0.36 | 0.34 | 0.37 |
| GER     | 1.18 | 1.17 | 1.15 | 0.95 | 0.96 | 0.90 | 0.90 | 0.90 | 0.93 | 0.84 | 0.83 | 0.88 |
| GRC     | 0.05 | 0.08 | 0.07 | 0.06 | 0.06 | 0.05 | 0.05 | 0.05 | 0.05 | 0.04 | 0.03 | 0.04 |
| HRV     | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| HUN     | 0.02 | 0.03 | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| IRE     | 0.13 | 0.12 | 0.12 | 0.09 | 0.09 | 0.09 | 0.09 | 0.09 | 0.08 | 0.07 | 0.09 | 0.10 |
| ITA     | 0.40 | 0.38 | 0.37 | 0.30 | 0.28 | 0.29 | 0.29 | 0.29 | 0.30 | 0.27 | 0.26 | 0.27 |
| LTV     | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 |
| LUX     | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| LVA     | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| MLT     | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| NET     | 0.36 | 0.34 | 0.35 | 0.28 | 0.28 | 0.27 | 0.26 | 0.29 | 0.29 | 0.26 | 0.26 | 0.28 |
| POL     | 0.06 | 0.06 | 0.07 | 0.05 | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.06 | 0.06 | 0.07 |
| POR     | 0.03 | 0.05 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |

Continued.
Table A2.2. Continued.

|            | 2000 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|------------|------|------|------|------|------|------|------|------|------|------|------|------|
| ROM        | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 | 0.03 | 0.03 | 0.04 |
| SPA        | 0.18 | 0.18 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.16 | 0.14 | 0.14 | 0.14 | 0.17 |
| SVK        | 0.01 | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| SVN        | 0.01 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| SWE        | 0.23 | 0.19 | 0.18 | 0.14 | 0.14 | 0.14 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.12 |
| UKG        | 1.06 | 0.82 | 0.73 | 0.59 | 0.59 | 0.57 | 0.57 | 0.60 | 0.58 | 0.52 | 0.47 | 0.52 |
| East Asia  | 11.46| 9.75 | 9.91 | 9.09 | 9.80 | 9.79 | 9.92 | 9.95 | 10.37| 10.50| 9.97 | 10.59|
| HKG        | 0.29 | 0.20 | 0.27 | 0.15 | 0.18 | 0.15 | 0.12 | 0.12 | 0.11 | 0.11 | 0.10 | 0.13 |
| JPN        | 6.77 | 3.89 | 3.90 | 3.37 | 3.64 | 3.27 | 3.17 | 2.80 | 2.57 | 2.54 | 2.59 | 2.73 |
| KOR        | 1.55 | 1.42 | 1.32 | 1.24 | 1.41 | 1.42 | 1.48 | 1.58 | 1.68 | 1.69 | 1.65 | 1.74 |
| PRC        | 1.62 | 3.34 | 3.64 | 3.54 | 3.73 | 4.12 | 4.35 | 4.65 | 5.10 | 5.20 | 4.71 | 5.01 |
| TAP        | 1.24 | 0.90 | 0.79 | 0.78 | 0.83 | 0.84 | 0.80 | 0.80 | 0.89 | 0.95 | 0.92 | 0.98 |
| NAFTA      | 6.35 | 4.09 | 4.09 | 3.39 | 3.54 | 3.51 | 3.38 | 3.29 | 3.33 | 3.21 | 2.95 | 3.06 |
| CAN        | 0.37 | 0.36 | 0.38 | 0.28 | 0.32 | 0.32 | 0.31 | 0.31 | 0.30 | 0.26 | 0.23 | 0.25 |
| MEX        | 0.16 | 0.12 | 0.12 | 0.09 | 0.10 | 0.12 | 0.12 | 0.12 | 0.11 | 0.10 | 0.08 | 0.09 |
| USA        | 5.81 | 3.61 | 3.59 | 3.01 | 3.12 | 3.07 | 2.86 | 2.92 | 2.85 | 2.64 | 2.72 |      |
| Others     | 8.90 | 11.30| 11.65| 9.97 | 10.39| 11.57| 11.74| 11.23| 10.54| 9.41 | 8.64 | 9.87 |
| AUS        | 1.17 | 1.08 | 1.13 | 0.99 | 1.15 | 1.28 | 1.16 | 1.15 | 1.07 | 0.93 | 0.96 | 1.05 |
| BAN        | 0.02 | 0.01 | 0.02 | 0.03 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| BHU        | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| BRA        | 0.19 | 0.39 | 0.43 | 0.39 | 0.46 | 0.50 | 0.50 | 0.53 | 0.53 | 0.42 | 0.38 | 0.41 |
| FIJ        | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| IND        | 0.35 | 0.68 | 0.71 | 0.53 | 0.66 | 0.72 | 0.68 | 0.69 | 0.66 | 0.64 | 0.64 | 0.66 |
| KAZ        | 0.03 | 0.05 | 0.07 | 0.04 | 0.05 | 0.06 | 0.06 | 0.05 | 0.05 | 0.03 | 0.02 | 0.03 |
| KGZ        | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Continued.
Table A2.2.  Continued.

|        | 2000 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|--------|------|------|------|------|------|------|------|------|------|------|------|------|
| MLD    | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MON    | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NEP    | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NOR    | 0.16 | 0.14 | 0.16 | 0.11 | 0.14 | 0.13 | 0.16 | 0.16 | 0.14 | 0.12 | 0.11 |     |
| PAK    | 0.06 | 0.04 | 0.07 | 0.04 | 0.04 | 0.07 | 0.06 | 0.05 | 0.06 | 0.05 | 0.05 |     |
| RUS    | 0.40 | 0.58 | 0.71 | 0.52 | 0.63 | 0.67 | 0.71 | 0.76 | 0.70 | 0.47 | 0.39 | 0.47 |
| SRI    | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |     |
| SWI    | 0.34 | 0.27 | 0.37 | 0.26 | 0.29 | 0.40 | 0.31 | 0.29 | 0.28 | 0.26 | 0.24 | 0.24 |
| TUR    | 0.10 | 0.13 | 0.17 | 0.14 | 0.12 | 0.13 | 0.13 | 0.13 | 0.13 | 0.12 | 0.12 | 0.12 |
| ROW    | 6.06 | 7.90 | 7.83 | 6.86 | 6.80 | 7.57 | 7.94 | 7.38 | 6.87 | 6.29 | 5.66 | 6.68 |

ASEAN = Association of Southeast Asian Nations, NAFTA = North American Free Trade Agreement.

Note: See Table A1.2 for definitions of economy codes.

Source: Authors’ calculations.