Sources of Myanmar's economic growth during 2010–2015: input–output analysis

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Abstract

This paper examines Myanmar's economic structure and its sources of economic growth during the period of economic reformation from 2010 to 2015. The study compares the economic performance of Myanmar with that of four other ASEAN countries employing the backward linkage and deviation from proportional growth (DPG) approaches. The data used for the analysis are sourced from the Eora global database and the Asian Development Bank's database. During 2010–2015, Myanmar experienced significant gross production expansion with the growth rate of 1.84 times, which stands as the highest among the selected countries. Despite its high economic growth, Myanmar lags behind the four other ASEAN countries in terms of industrialization and international trade. Myanmar's economy mainly relies on domestic market with poor international trade record. The analysis of backward linkages reveals that the transport equipment sector made the largest contribution to output growth in Myanmar. On the other hand, DPG approach indicates that Myanmar's economic growth during 2010–2015 can be mainly attributed to the expansion of the public administration sector, driven by increased consumption and public and private investment. Industrialization remained underdeveloped until 2015 with the manufacturing sectors not significantly impacting on economy and export growth. Despite some improvements in manufacturing sectors after 2016, the promotion of the manufacturing sectors and agriculture sector is still necessary to foster export and output expansion.

Keywords: Economic structure, Backward linkages, Deviations from proportional growth

1 Introduction

In 2011, Myanmar began both political and economic reform and in 2016, became a newly prodemocratic Asian nation. Until 2010, the sanctions of Western countries meant that Myanmar was isolated and consequently, the least developed country in the ASEAN region. The Asian Development Bank (ADB)'s data show that Myanmar's economy was highly reliant on agricultural production, which still dominated GDP share at around 40% in 2010. Trade development is dependent on neighboring countries.

In 2011, to access the global markets, the Myanmar government liberalized laws and regulations in the financial sector and foreign exchange market (Hofmann 2018). After the lifting of the sanctions of Western countries in 2013, the banking sector started to
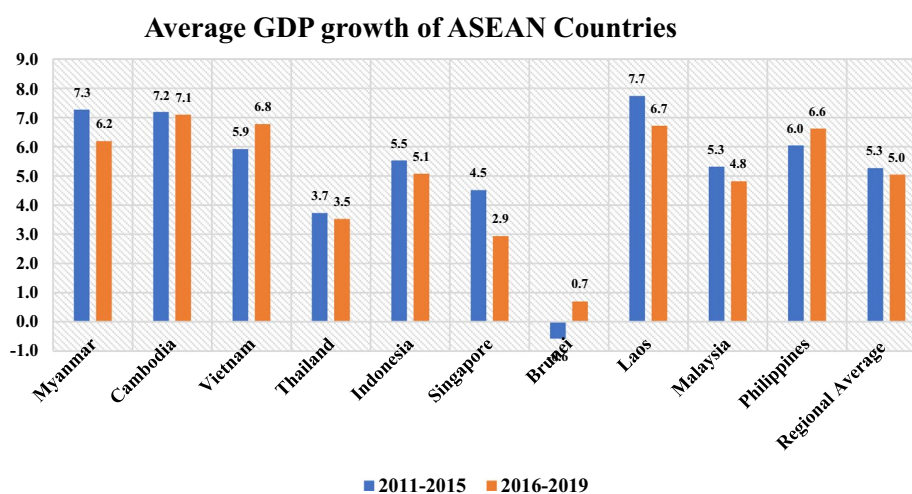
Fig. 1 Average GDP growth of ASEAN countries in the period 2011–2019. Authors' adaptation of the data from the ADB https://kidb.adb.org/

develop through their connection to international markets. To attract foreign investors, the government revised the foreign investment law in 2012 and improved the business environment. According to the World Bank, the annual average growth rate of foreign direct investment inflow was 12.4% during 2011–2015. The data of the International Monetary Fund show that private investment dramatically increased and represented over 70% share of total investment between 2010 and 2015. Additionally, the government made attempts to develop the economy and industrialization and enacted new economic policy and industrial policy in 2016.

Since 2012, the government has received financing from the ADB and Japan for the construction of the transportation infrastructures and has spent a huge budget allocation on the hosting in the Southeast Asian Games in 2013 and a series of ASEAN meetings in 2014. Furthermore, the government allowed foreign participation in the communication technology market and enhanced both the institutional and human capacity of all government ministries (Rieffel 2012). Consequently, Myanmar's economy gained international recognition and was deemed as having developing status[1] with 7% average GDP growth and a rise in GDP per capita, to 1363 USD in 2019 from 879 USD in 2011.[2]

Figure 1 demonstrates the average GDP growth of ASEAN countries during 2011–2015 and 2016–2019. The ASEAN region's average GDP growth reduced slightly to 5.0% (2016–2019) from 5.3% (2011–2015). In the transition period, 2011–2015, Myanmar had the second-highest annual average growth with 7.3%. During the 2016–2019 period, Myanmar's average GDP growth slightly reduced to 6.2%, but it remained higher than the average regional growth.

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[1] The World Development Indicators (December 2021) show that Myanmar's GDP growth rate before economic reformation (2001–2010) is the highest in the ASEAN region. This figure is consistent with the data in the Myanmar Statistical Yearbooks. However, Nomura and Shirane (2016) indicated that the GDP data in this period are unreliable because of overestimated national accounts under the military regime, fixed exchange rate and illegal trade. As to the best of our knowledge, the adjustment for GDP calculation for previous years is not explained. In this paper, we rely on the GDP data of ADB.
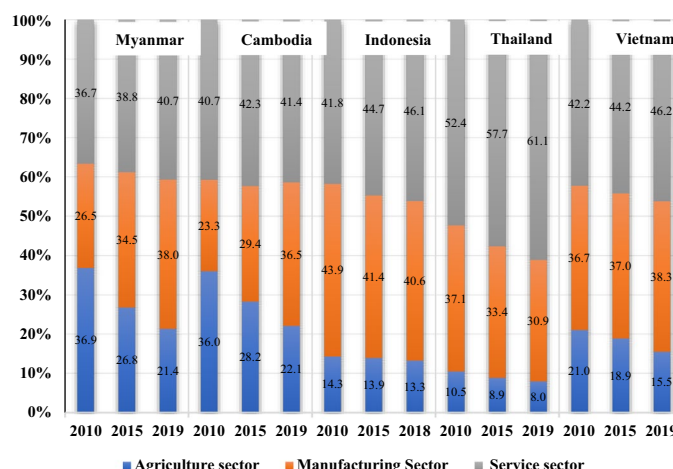
[2] https://databank.worldbank.org/source/world-development-indicators#

Fig. 2 Economic structures of 5 ASEAN countries in the period 2010–2019. Authors' adaptation of ADB's data

Figure 2 illustrates the economic structures of five ASEAN countries in the period 2010–2019. The agricultural GDP share steadily decreased in all five countries while Thailand dramatically expanded its share of the service sector within the 10-year period. In Myanmar, the GDP shares of the manufacturing and service sectors increased whereas that of the agriculture sector decreased. However, the GDP share of Myanmar's agricultural sector remained high, 1.5 times that of Vietnam, twice that of Indonesia and over 3 times that of Thailand. Despite the expansion of the service sector's GDP share in Myanmar in 2015, the degree of this share remained relatively low (38.8%), compared to 44.7% in Indonesia, 57.7% in Thailand and 44.2% in Vietnam.

In terms of GDP contribution, Myanmar's economic structure obviously changed during the transition period and was different from those of some ASEAN countries. As Myanmar's economy was highly reliant on agricultural production, it is GDP share of agriculture remained high compared to those of the other observed countries in 2015. Additionally, Myanmar is the last country in the ASEAN region in making economic reform (Riedel and Turley 1999). However, Myanmar maintained economic growth above the regional average level. Analyses of the economic structure and growth pattern enable us to identify the major changes in Myanmar's economy during the economic reformation period.

According to the United Nations (1999), an input–output table illustrates the interrelationships between industries in an economy with respect to the production and use of local products and imported products. Based on input–output models, backward linkages allow the identification of key economic industries, and deviation from proportional growth (DPG) can reveal industrial growth patterns. To the best of our knowledge, we do not find any economic analysis based on input–output structures for Myanmar after 2010. This study intends (1) to build a base for further economic analyses, (2) to check the impacts of economic reformation on Myanmar's economy, and (3) to reopen the room for input–output structure-based economic analyses of Myanmar. This study examines Myanmar's economic structure and the sources of Myanmar's economic growth during the transition period, 2010–2015, in comparison to four other ASEAN countries based on input–output techniques.

The next section reviews the previous literature regarding the patterns of industrial growth, whereas Sect. 3 explains the analytical method and the design of the data used in the analyses. Section 4 discusses Myanmar's economic structure and growth pattern in comparison to those of four other ASEAN countries, and Sect. 5 provides conclusions on findings.

2 Literature review

Previous studies using varied analyses of input–output tables have drawn attention to the key contributors to national and regional economies' growth. Analysis of backward and forward linkages identify key industries for production expansion. Gorska (2015) applies the backward and forward linkages approach and examines the structure of production differences among countries. The study highlights key industries, the strength of linkages between industries, and the effect on the economic landscape of the country.

In measuring forward linkages, Leontief's model is criticized because both direct forward linkages (the row sum of $A = [a_{ij}]$) and total forward linkages (the row sum of $L = [b_{ij}]$) are generated by a peculiar stimulus—the simultaneous increase of one unit in gross outputs of every sector in the case of $A = [a_{ij}]$, whereas an increase of one unit in the final demand of every sector in the case of $L = [b_{ij}]$. Therefore, the Ghosh model $G = [g_{ij}]$ is suggested for the measurement of forward linkages (Miller and Blair 2009). Based on the Ghosh inverse model, Masum and Inaba (2019) examine the demand–supply structure of Bangladesh's textile clothing industry compared to those of its Asian competitors and highlight the contribution of final demand to the growth of Bangladesh between 2000 and 2001.

Based on the input–output tables, the growth pattern of an economy can be analyzed by using the DPG model. The DPG model was proposed by Chenery (1960) by modifying the formal general equilibrium models, such as the Walrasian model and the Leontief input–output model. Chenery shows the patterns of industrial growth and changes in individual sectors of production at different income levels in 50 countries around the world. After that, many researchers applied the DPG model in investigating the sources and pattern of economic growth.

Chenery et al. (1962) adopt the DPG analysis to review Japan's industrial growth pattern during the period 1914–1954, when the Japanese economy changed from underdeveloped to developed. The study indicates the significant contribution of changes in supply conditions to Japan's industrial growth. Some studies apply the DPG approach in investigating the pattern of change of economic growth in a specific period. Chen and Fujikawa (1992) examine the patterns of change in Japan's output composition, including during the prewar period, in comparison with those of Korea and Taiwan. This study shows the significant contribution of the enlargement of manufacturing sectors to the growth of the Japanese, Korean and Taiwanese economies.

Kanazawa (2005) extends the DPG analysis by adding domestic inflow and outflow data to the input–output table and examines the interregional differentials of China's industrial structures. The study highlights the various combinations of differentials on the demand side of input–output tables that leads to interregional industrial structures gap in eight different regions in China. Nguyen and Chen (2016) analyze the pattern and sources of the Vietnam's economic growth compared to those of Korea, Taiwan and

Japan in their economic growth eras. The results reveal that the rapid expansion of manufacturing sectors is the main source of the Vietnam's initial growth, similar in Korea, Taiwan and Japan. Then, the rapid growth shifts to heavy industries and finally moves to service sectors.

The earlier studies apply the DPG approach in investigating the sources of growth or the change pattern in economic growing period. Our study applies the DPG model to examine the sources of economic expansion during economic reformation.

3 Methodology

3.1 Structure of analyses

The development of input–output tables has stimulated empirical analyses based on an economy's composition. The input–output table shows the allocation of output generated by each sector to meet the intermediate demand and final demand and the composition of the demand–supply pattern of an economy (Muryani and Rosario 2018). Backward and forward linkages identify key industries in the economy, as well as important backward-linked and forward-linked sectors. The comparative analysis reveals the structure of production that differs among the countries (Gorska 2015).

We identify the key sectors which lead to output growth based on backward linkages of the Leontief inverse matrix, $L = \left[I - \left(I - \widehat{M}\right)A\right]^{-1} = \left[b_{ij}\right]$, where I is identity matrix, $\widehat{M}$ is the square matrix of import coefficients and A is the matrix of input coefficients. The figure in each column of Leontief inverse matrix indicates the production required directly and indirectly at each row sector when final demand for the column sector increases by one unit. Backward linkages (*BL*) can be derived as follows:

$$BL_j = \sum_{i=1}^{n} b_{ij}, \tag{1}$$

where $\sum_{i=1}^{n} b_{ij}$ is the vertical sum of the column vectors of Leontief inverse matrix and n is the number of industries. The higher the backward linkage of an industry, the larger the demand-pull effect on the economy. The backward linkage shows the amount of increase in total output of the economy if the final demand of an industry increases by one unit. Hence, the industry with the highest backward linkage has the greatest contribution to output growth.

To identify the key sectors based on the backward linkages, the backward linkages are changed to a normalized form as shown in Eq. (2), in which the vertical sum of each column vector divided by the mean value of entire vertical sum in the inverse matrix table. In the normalized form, the sector with backward linkage greater than one strongly depends on inter-industry supply. One unit increase in output of this sector leads to an increase in the output of other sectors. The sector with backward linkage less than one is independent of other sectors and has less contribution to the output expansion of other sectors:

$$BL_j = \frac{\sum_{i=1}^{n} b_{ij}}{\frac{1}{n} \sum_{i=1}^{n} \sum_{j=1}^{n} b_{ij}}. \tag{2}$$

DPG analysis is used to examine the structural change of an economy. DPG can be derived from the following equation:

$$\delta X = X^2 - \lambda X^1, \tag{3}$$

where $X^1, X^2 =$ gross production of each industry in the period 1 and 2, and λ is the weighted average ratio of the expansion, calculated by the division of total gross production in the period 1 and 2.

δX represents the DPG of each industry. The DPGs of industries can be of three types: (i) zero DPG, (ii) positive DPG and (iii) negative DPG. The signs of DPG illustrate an increase or decrease in industries' output shares compared to the average ratio (λ), which represents the proportional growth situation. If the DPG is zero, an industry's expansion is at the average ratio. A positive DPG means an industry's growth is higher than the average growth ratio of all industries. In contrast, a negative DPG represents an industry's lower expansion compared to the industrial average. We use the method of Chen and Fujikawa (1992) based on the competitive input–output tables. The balanced equation of input–output table can be derived as follows:

$$X^t = \left(I - M^t\right)\left(A^t X^t + C^t + I^t + J^t\right) + E^t, \tag{4}$$

where I is identity matrix, A^t is the matrix of input coefficients, C^t is consumption, I^t represents investment, J^t is inventory change, E^t is the export of domestic products and M^t is the diagonal matrix of import coefficients of the domestic demand, which is the sum of intermediate demand, consumption, investment and inventory change.

The solution of Eq. (4) is,

$$X^t = \left[I - \left(I - M^t\right)A^t\right]^{-1}[(I - M^t)(C^t + I^t + J^t) + E^t]. \tag{5}$$

Then, DPGs in periods 1 and 2 are calculated as follows:

$$\delta X^{12} = B^2(I - M^2)\delta C + B^2(I - M^2)\delta I + B^2(I - M^2)\delta J + B^2 \delta E$$

$$-B^2(M^2 - M^1)\lambda(A^1 X^1 + C^1 + I^1 + J^1)$$

$$+B^2(I - M^2)(A^2 - A^1)\lambda X^1, \tag{6}$$

where $B^2 = \left[I - \left(I - M^2\right)A^2\right]^{-1}$.

The deviation of each component can be calculated based on the following formulas:

$$\delta C = C^2 - \lambda C^1 \tag{7-a}$$

$$\delta I = I^2 - \lambda I^1 \tag{7-b}$$

$$\delta J = J^2 - \lambda J^1 \tag{7-c}$$

$$\delta E = E^2 - \lambda E^1. \tag{7-d}$$

The decomposition of δX consists of six factors, the effect of the deviations of final demand ($\delta C, \delta I, \delta J$ andδE), the effects of the change of import coefficients ($M^2 - M^1$), and input coefficients ($A^2 - A^1$).

The basic structure of input–output tables lets us know the supply–demand structures of Myanmar's economy. The results of backward linkages [calculated by Eq. (1) and (2)] identify the leading industries in the production expansion of Myanmar during the observed period. Additionally, we use the DPG analysis to identify the factors which contribute to the expansion of production. Generally, DPG analysis is used to analyze the change of the growth pattern of an economy between two periods. However, because of data limitation, Myanmar's decomposition analyses are available for only one period (2010–2015).

To identify the structure of production differences between Myanmar and other countries, we intended to compare Myanmar's growth pattern and economic structure to that of other ASEAN countries since all ASEAN countries except Brunei experienced high economic growth in the period 2010–2015. For this purpose, only the data of Indonesia, Thailand, Vietnam and Cambodia are available to make a comparison with Myanmar.

3.2 Data design

Although input–output techniques have been widely utilized to analyze economic structures worldwide in recent years, it is noteworthy that, to the best of our knowledge, the Myanmar government does not publicly release its own input–output tables. However, a recent input–output table of Myanmar (2000–2001) is constructed by Thwin et al. (2010) using a non-surveyed method.

Despite the existence of worldwide databases like the ADB database, the Eora Global Database, and the World Input–Output Database, it is challenging to find input–output data for all sample countries from a single data source. This study collects data from the ADB database as it provides regional and multiregional input–output tables specifically designed for input–output studies. While the ADB database includes input–output tables for Cambodia, Indonesia, Thailand, and Vietnam, it does not compile the input–output tables for Myanmar. This limitation makes this study to use Myanmar's input–output tables from the Eora Global Database, which is the only available data source for Myanmar. However, it is important to note that the Eora database does not provide data for all the other sample countries, except for Myanmar and Cambodia. Therefore, due to the lack of comprehensive data from a single source, this study utilizes data from two different sources in our analyses.

In the initial stage, the study adjusts the original input–output tables obtained from Eora to align them with the specific focus of the research on the economic structure. This process involves removing the matrix of environmental factors and primary agricultural inputs from Eora's original input–output tables. The objective is to create input–output tables that primarily focused on the economic aspects of the analysis. Furthermore, the structure of the tables is modified to match the design of the input–output framework and ensure that the demand data and supply data are balanced appropriately. The input–output tables provided by Eora are constructed using a 26×26 matrix and have different industrial classifications compared to the input–output table (2000–2001) developed by Thwin et al. (2010).

Since the data of Cambodia are available in both Eora and ADB datasets, the study checks the comparability of two data sources. The study compares the backward linkages of Cambodia using the input–output table (2015) from Eora dataset with that of ADB dataset. The backward linkages calculated from both datasets are similar, indicating compatibility between the input–output tables of Eora and ADB for Cambodia. Based on this finding, we assume that we can use both the input–output tables of Eora and ADB. However, there are some differences in the structure and purpose of the input–output tables from these sources. The input–output tables provided by Eora require readjustment to align them with the objectives of our study. On the other hand, the ADB's input–output tables are designed specifically to meet the requirements of input–output studies.

To ensure consistency and comparability across countries, the study uses the ADB's input–output tables for Cambodia, Indonesia, Thailand, and Vietnam, while still relying on the Eora dataset for Myanmar. The ADB organizes industries into 35 noncompetitive-type transaction tables, while Eora's input–output tables consist of 26 industries in competitive types. To address this discrepancy, in the second stage, we integrate each selected country's industries into 22 sectors in competitive types to create a harmonized framework for comparison.

In the final stage, adjustments are made to account for price changes and exchange rate differences between 2010 and 2015. This is achieved by utilizing a formula: [2015 Nominal Value × 2010 Consumer Price Index (CPI)]/2015 CPI. Specifically, the nominal value of each industry in the 2015 input–output table is multiplied by the 2010 CPI and then divided by the 2015 CPI of each commodity.[3] To gather the necessary CPI data for this process, the study sources information from various reliable outlets: the Central Statistical Organization[4] for Myanmar, the Statistics Indonesia (2012) and (2018) for Indonesia, and the International Monetary Fund, Macroeconomics and Financial data for Cambodia, Vietnam, and Thailand. Since Myanmar published commodity data after 2012, commodity-specific CPI data for Myanmar in 2010 are unavailable. Thus, the study applies the 2012 CPI data to address inflation adjustments in Myanmar.

Since input–output tables are compiled by dollar values, there are exchange rates different between 2010 and 2015. To adjust for exchange rate differences, the study converts the data from both years from dollar values to the local currency. This conversion is carried out using the formula [USD Value x (Local currency/USD)], where the data are multiplied by the exchange rate (Local currency/USD) applicable in each respective year. These exchange rates are sourced from the World Bank's database and the Fxexchange Rate database.[5]

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[3] CPI data are unavailable for some commodities, such as agriculture and fishing products, wood and paper products, and construction services. In that case, the study employs the average commodity CPI to deflate the data of the industries which specific commodity CPI data are unavailable. Except these industries, other data are deflated by using the specific commodity CPI values. Additionally, to ensure the integrity of the input–output table, the study balances both row sums and column sums. The adjustment data are recorded, and any discrepancy, which is consistently less than 0.01%, is attributed as an error term.

[4] https://www.csostat.gov.mm/MonthlyPublication/PriceAnalysis

[5] There is a challenge emerges when dealing with Myanmar's exchange rate (MMK/USD) data for the year 2010. During that period, Myanmar adhered to a fixed exchange rate policy of 1 USD = 6.5 MMK until 2011. Remarkably, the market exchange rate during this time was approximately 130 times higher than the fixed rate, with 1 USD being equivalent to more than 850 MMK. The paradigm shifted in 2012 when Myanmar implemented market exchange rates as part of its economic reform policies. To effectively address this disparity, the study employs the 2012 exchange rate to convert the 2010 data.
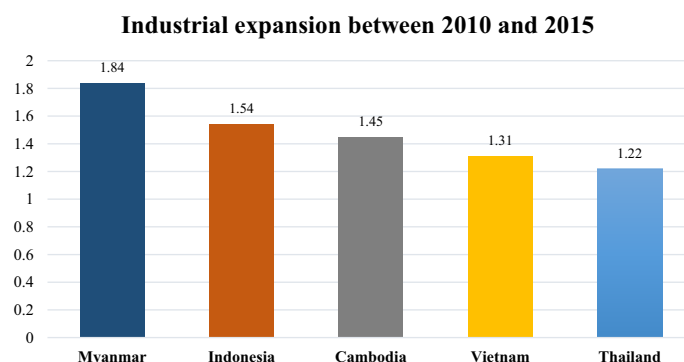
Fig. 3 Production expansion of ASEAN countries between 2010 and 2015. Authors' calculations from EORA and ADB data

4 Findings

Figure 3 expresses the production expansion of five ASEAN countries between 2010 and 2015. The five countries expanded their production at an average growth of 1.5 times in the 5-year period. Among the five countries, Myanmar had the highest production expansion at 1.84 times.

4.1 Supply and demand patterns

Table 1 provides insights into the production patterns of the selected countries from the supply side. The findings suggest that there are no significant shifts in the supply-side structures of these countries during the period spanning from 2010 to 2015. However, supply growth is indeed substantial, surpassing the 50% mark in both Myanmar and Indonesia. Myanmar exhibited the most remarkable supply growth at an impressive 86.0%, closely trailed by Indonesia at 54.0%, and Cambodia at 46.2%.

Across all five countries in focus, the proportions of domestic supply relative to the total market supply in 2010 and 2015 experienced only minimal changes. Domestic supply continued to wield significant influence over the market, consistently accounting for over 80% of the total supply. These fluctuations, however, remained relatively modest. Particularly in the case of Myanmar, domestic production played a pivotal role in the economy and constituted a substantial portion of the market supply. In 2015, despite a slight increase in the share of imports, Myanmar's import share remained remarkably low, hovering around a mere 1%. This is obviously small in contrast to other ASEAN countries, such as Cambodia (14.9%), Vietnam (19.5%), Thailand (12.4%), and Indonesia (7.6%). This highlights the importance of domestic production in fulfilling the country's market demands and emphasizes Myanmar's reliance on its internal supply capabilities.

Table 2 presents an overview of the demand-side patterns observed in the selected ASEAN countries. Each country shows modest changes in their demand structures between 2010 and 2015. Specifically, the share of intermediate demand experienced negative shifts, declining by 3% in Myanmar, 4.3% in Thailand, and 2.2% in Vietnam. In contrast, Cambodia has a 1.6% positive change in this regard. When it comes to domestic consumption, it records an increase of 1.3% in Myanmar and 2.7% in Thailand, with

Table 1 Supply-side structures

Country	Year	Domestic supply (%)	Imports (%)	Total supply (Billion)		Supply growth (%)
Myanmar	2010	99.7	0.3	MMK	79.27	86.0
	2015	98.7	1.3	MMK	147.64	
Cambodia	2010	85.9	14.1	KHR	0.12	46.2
	2015	85.1	14.9	KHR	0.08	
Vietnam	2010	82.4	17.6	VND	6.14	34.4
	2015	80.5	19.5	VND	8.26	
Thailand	2010	86.2	13.8	THB	0.02	19.6
	2015	87.6	12.4	THB	0.03	
Indonesia	2010	92.2	7.8	IDR	13.00	54.0
	2015	92.4	7.6	IDR	20.01	

Authors' calculations based on EORA's and ADB's input–output tables

Table 2 Demand-side structures

Country	Year	Intermediate demand (%)	Domestic final demand (%)				Exports (%)
			Domestic consumption	Changes in stocks	Investment	Total	
Myanmar	2010	59.7	29.9	0.2	6.3	36.4	3.9
	2015	56.7	31.2	0.2	7.8	39.2	4.1
Cambodia	2010	31.8	41.2	0.7	5.9	47.8	20.4
	2015	33.4	35.1	0.4	8.2	43.7	22.9
Vietnam	2010	47.6	21.1	0.7	9.9	32.4	20.0
	2015	45.4	21.4	-0.2	7.4	28.6	26.0
Thailand	2010	50.8	24.5	7.5	0.4	32.4	16.8
	2015	46.5	27.2	7.4	− 2.9	31.6	21.8
Indonesia	2010	40.7	30.7	0.9	15.0	46.6	12.7
	2015	41.2	32.4	− 0.2	15.6	47.8	11.0

Authors' calculations based on Eora's and ADB's input–output tables

Indonesia also showing a 1.7% increase. However, Cambodia has a notable decrease of 3.9% in the share of domestic consumption during the same period.

A noteworthy trend was observed in both Myanmar and Cambodia, as they both experienced an increased investment between 2010 and 2015. In the case of Myanmar, domestic demand continued to hold sway, constituting approximately 96% of the total market demand, and this proportion remained consistent throughout the 2010–2015 period. Furthermore, Myanmar's share of exports in total demand consistently remained low, hovering around 4%, which starkly contrasts with Cambodia's (23%), Vietnam's (26%), Thailand's (22%), and Indonesia's (11%). This underscores Myanmar's market's heavy reliance on internal consumption and investments rather than exports.

Both Tables 1 and 2 provide the Myanmar's economic dependence on the domestic market and its weak foreign trade performance before 2015. Unlike the other selected countries, Myanmar faced challenging economic circumstances as it was under an isolated military regime. This situation led to underdeveloped industrialization and an inadequate international payment system, which significantly hindered the development

of international trade during that period. Additionally, based on data from the ADB, Myanmar's main exports were primarily limited to agricultural and mineral products, which were mainly sent to their major trade partners, China and Thailand. This narrow export base further constrained Myanmar's ability to diversify its trade and reduce its reliance on a few key trading partners. Overall, these factors collectively contributed to Myanmar's poor foreign trade record and underscored the need for economic reforms and diversification of its trade partners and export commodities.

4.2 Demand effects (backward linkages)

Table 6 in the Appendix shows the backward linkages of Myanmar compared to that of the other four ASEAN countries. The industrial contribution to output expansion varies across countries. The largest backward-linked sector in each country remains unchanged between 2010 and 2015. However, the contribution size of each industry experiences slight changes during this period for all selected countries.

In Myanmar, the agriculture, hunting, forestry, and fishing sectors, as well as all manufacturing sectors (except the mining and quarrying sector and electricity, gas, and water sector), exhibit significant backward linkages. Notably, the transport equipment sector emerges as the largest contributor to output growth in Myanmar. These findings highlight the importance of specific sectors in driving production and economic growth in Myanmar and indicate the potential for further development and investment in industries with strong backward linkages.

In contrast to the other four countries, Myanmar's backward linkages reveal a less significant contribution of service sectors to production growth. While the Myanmar government has made efforts to develop the financial sector, the backward linkages of the financial intermediation sector do not indicate remarkable changes between 2010 and 2015. Despite a slight increase in backward linkages in 2015, the financial intermediation sector remains the smallest contributor to output growth in Myanmar. Furthermore, its linkages are relatively small compared to those of other countries in the ASEAN region. Despite the government's efforts to develop the financial sector, there may be certain challenges or constraints limiting its impact on overall production growth and backward linkages.

The analysis shows that the manufacturing sector, in terms of backward linkages, makes a larger contribution compared to the service sector. The results indicate that as a consequence of economic reforms, significant public and private investments were directed towards specific manufacturing sectors in 2015, including metal products, electrical and machinery, transport equipment, and other manufacturing and recycling sectors (as seen Table 8 in the Appendix). Despite the increased investments, the magnitude of backward linkages in the electrical and machinery, and transport equipment sectors experienced a slight decrease in 2015. This suggests that although investments were made, the impact on inter-industry linkages and production growth in these specific manufacturing sectors may not have been as substantial as expected.

The backward linkages of all sectors do not express the significant technological effect on output growth during 2010–2015. There might be the reason that Myanmar has been an agriculture-based economy with underdeveloped technology for many decades. According to Kudo (2001), with the political change in 1988, Myanmar initiated the

market-based economic system and opened private participation in economic activities. However, the Myanmar Industrial Development Committee (MIDC) which was established to foster industrialization was influenced by military groups. Market activities were monopolized by cronies and military partners. Industrial policies are favorable for only these groups. Perkins (2012) states that foreign investors are not willing to compete with these groups and concentrate on natural resource sectors, such as oil and gas production. As a result, both market economy and industrialization are less developed under unfair competitions.

In 2012, the new democratic government encouraged industrialization with various strategies. Despite building special economic zones in some regions, we do not see any specific supporting organizations for small businesses prior to 2014. The development of small and medium enterprises is implemented after the enactment of new economic policy in 2016. As a result, during the period 2010–2015, the backward linkages did not exhibit a significant effect on the industrialization process in Myanmar due to the prevailing economic conditions and lack of comprehensive support for SMEs and fair market competition. These historical challenges highlight the need for targeted policies and efforts to foster technological development, promote fair competition, and support the growth of SMEs, which can contribute to the overall industrialization and economic progress of Myanmar in the future.

4.3 Comparison of DPGs

The results of the DPG analysis are originally measured in monetary units, respective countries' currency. To facilitate comparisons among countries, the DPG results are normalized to percentages. This normalization process involves dividing the DPG results in the monetary units by the total amount of positive DPGs and then multiplying by 100. By doing so, the data are converted into percentages, allowing for easy identification of each economy's leading sector and enabling a country's degree of change in production sectors to be compared with those of other countries. Table 3 presents the normalized DPGs of the five ASEAN countries across 22 industries for the period 2010–2015. The detailed information on the composition of each country's normalized DPGs is presented in Table 7, Table 9, Table 10, Table 11 and Table 12 in the Appendix.

The sectoral output expansions during 2010–2015 show variations among the ASEAN countries in terms of DPGs. In Myanmar's case, its output growth can be primarily attributed to two sectors: the public administration and transport sectors, which contributed significantly with a positive deviation of 32.1%, and 17.2% from the average growth rate, respectively. Following these sectors, the post and telecommunication sector and construction sector also made notable contributions, with positive deviations of 16.3% each from the average growth rate. According to the Central Statistical Organization (Myanmar) (2015), the country's government increased capital investment and expenditure in the public administration, post and telecommunication and construction sectors after 2011. These strategic investments and spending initiatives likely played a crucial role in driving the positive output growth and development observed in these sectors during the specified period.

The changes in final demand data (Table 8) also show that the increased consumption in the financial intermediation sector, public administration sector and

Table 3 Comparison of deviations from proportional growth by industry

Industries	Normalized DPGs				
	Myanmar	Cambodia	Vietnam	Thailand	Indonesia
Agriculture, hunting, forestry and fishing	− 5.59	− 82.68	− 42.88	− 7.69	− 10.74
Mining and quarrying	1.09	6.48	− 8.13	− 2.41	− 44.04
Food beverage and tobacco	− 17.25	0.67	22.94	− 16.70	− 0.30
Textile and wearing apparel	− 0.34	7.32	− 1.35	− 2.16	− 4.46
Wood and paper	2.31	− 0.03	0.82	− 2.13	− 10.83
Petroleum, chemical and non-metallic mineral products	− 25.27	− 0.55	− 0.10	− 32.13	− 21.05
Metal products	− 12.25	1.39	− 2.38	− 15.65	− 1.30
Electrical and machinery	− 21.12	− 0.03	− 3.90	− 3.25	1.18
Transport equipment	− 9.73	0.42	13.10	− 6.04	− 0.12
Other manufacturing and recycling	− 1.76	0.23	2.07	− 1.98	− 1.91
Electricity, gas and water	− 1.46	3.08	11.60	1.81	2.78
Construction	16.25	41.53	− 29.38	− 9.84	27.42
Maintenance and repair	0.20	0.00	3.21	0.09	1.95
Wholesale trade	6.48	0.68	29.15	4.71	− 2.39
Retail trade	0.51	0.00	0.00	4.19	− 1.29
Hotels and restaurants	3.02	− 7.04	1.10	20.46	3.00
Transport	17.15	13.75	8.96	9.80	26.98
Post and telecommunications	16.34	5.59	4.43	11.07	− 1.56
Financial intermediation and business activities	− 5.10	18.87	− 11.84	21.02	12.84
Public administration	32.09	− 2.35	2.33	6.24	2.58
Education, health and other services	4.56	− 7.33	0.05	20.61	21.27
Private households and others	− 0.13	0.00	0.28	0.00	0.00
Total	0.00	0.00	0.00	0.00	0.00

Authors' calculations based on EORA and ADB data

education, health, and other service sectors in 2015. The government consumption is over 47 times that of private consumption in the public administration sector, under which, defense cost represents the highest portion of the government consumption. This huge government consumption on defense will not contribute to both technology advancement and future economic growth in Myanmar. Thus, the expansion of the public administration sector does not have an impact on the other sectors' production.

The economies of Cambodia and Indonesia were mainly supported by the construction sector. Vietnamese output expansion is attributed to the wholesale trade, food, beverage, and tobacco sectors with 29.2% positive deviation and Thailand's economy is dominated by the financial intermediation and business sector which held the biggest share of positive DPGs at 21.0%. The agriculture, forestry and fishing sectors of all selected countries have negative deviations. However, the export contribution of these sectors is obviously very large in all countries. In Myanmar, the agriculture forestry and fishing have the largest contribution to export growth (Table 7) and still maintains its contribution to economic expansion.

The output expansions of all Myanmar's manufacturing sectors, except wood and paper sectors, are below the average production growth. Despite the huge positive

investment impacts on some manufacturing sectors: petroleum, chemical and non-metallic mineral product sector, metal product sector, electrical and machinery sector, and transport equipment sector (see Table 7), these are offset by the negative effects of input coefficient changes. Moreover, the deviations of exports are insignificant in all manufacturing sectors of Myanmar. These results reflect the underdeveloped industrialization and comparatively less exportation of manufacturing products in Myanmar. According to Perkins (2012), under military regime, food sectors dominate 60% of household consumption, and spending on manufacturing goods used in investment such as cement, steel and machineries are tiny. During economic reform, investment is still very small in some manufacturing sectors: food beverage and tobacco sectors and textile and wearing apparel sectors. Since these sectors have large backward linkages and export contributions, further investment should focus on these sectors.

In contrast with Myanmar, the DPGs of Cambodia (Table 9 in the Appendix) and Vietnam (Table 10 in the Appendix) show the significant positive effects of exports, which contribute to the expansion of some manufacturing sectors, especially the textile and wearing sector in Cambodia and the food and beverage sector in Vietnam. The World Integrated Trade Solution data show that since 2008, the exports of both Cambodia and Vietnam have dramatically developed. Cambodia's export is dominated by textile and clothing while Vietnamese export is influenced by food and beverages, textile and clothing, and agricultural products.

While Thailand's economy is dominated by the financial sector, Myanmar has less benefit of its financial sector with a negative DPG −5.1%. Despite the government's effort to develop the financial sector and the increasing consumption and investment in this sector, the development has been slow. This is because Myanmar's financial sector only started development after the lifting the sanctions of Western countries in 2013. According to World Bank Group (2018), Myanmar's financial sector was ranked 177th out of 190 countries and the most underdeveloped financial sector in ASEAN region in 2018. DPGs analyses show that the effect of input coefficient change is negative in the financial sector. The effect of the financial sector might impact on other sectors' expansion.

The DPG results in Table 7 in the Appendix illustrate that the effects of coefficient changes are negative in almost all manufacturing sectors in Myanmar. These effects are particularly impactful in petroleum, chemical and non-metallic mineral product sector, metal product sector, electrical and machinery sector and transport equipment sector. The input coefficients of own industry and input coefficients of these industries used by some other sectors are slightly reduced in 2015. On the other hand, the effect of investment is positive and exceptionally large in all these sectors. However, the production expansion of these sectors is below average growth.

The increased government consumption and investment during the reformation period contributes significantly to the enlargement of the public administration sector, transport sector, post and telecommunication sectors, and construction sector of Myanmar during 2010–2015. The DPGs of these sectors are positive and relatively high compared to manufacturing sectors. Consistent with this, the quality of the trade and transport-related infrastructure of Myanmar has increased from 1.92 (2010) to 2.33 (2016) according to the World Bank's logistics performance index. Furthermore, the

Table 4 Effect of change in final demand on output growth

Description	Myanmar	Cambodia	Vietnam	Thailand	Indonesia
Consumption	41.87	− 89.84	33.77	40.19	48.64
Investment	95.95	37.94	− 84.74	− 7.50	25.98
Inventory change	5.63	− 3.17	− 58.63	− 73.64	− 28.15
Exports	8.30	43.12	345.52	133.40	− 54.75
(−) Import (change in coef.)	49.23	22.08	200.64	11.90	− 4.76
Input (change in coef.)	− 102.51	34.03	− 35.28	− 80.55	3.52
Total DPG	0	0	0	0	0

Authors' calculation based on Eora and ADB data

quality of the overall infrastructure is ranked 146th out of 148 countries in 2013 and 135th out of 151 countries in 2015 according to the World Economic Forum Global Competitiveness. This infrastructure development is favorable to economic growth. Nevertheless, both manufacturing and export do not show any significant changes caused by economic reform. Despite reforming economy since 2011, new industrial policy has not officially published until 2015. Additional investment during 2010–2015 focuses on construction, electrical and machinery, transport equipment and some service sectors and almost neglects the sectors contributing to export growth such as agriculture and fishing, food, beverage and tobacco, textile and wearing, and wood and paper sectors (see Table 8 in the Appendix). Industrial policies are necessary to encourage the promotion of these sectors for further export expansion.

4.4 Effect of change in final demand on output growth

This section assesses the sources of economic expansion in the five ASEAN countries during 2010–2015, focusing on the effects of changes in final demand on output growth, as presented in Table 4. Interestingly, the effect of coefficient change has a negative impact on the production expansion of Myanmar, Vietnam, and Thailand, which differs from the growth pattern observed in Japan between 1914 and 1954.

During the period 1914–1954, Japan experienced significant and positive changes in input coefficients, which greatly influenced its growth pattern (Chen and Fujikawa 1992). However, the growth patterns in Myanmar, Vietnam, and Thailand during 2010–2015 seem to be driven by different factors, as evidenced by the negative contribution of coefficient change to their output growth. This distinction suggests that the factors influencing economic expansion in these ASEAN countries might not align with Japan's historical experience. It highlights the importance of studying each country's unique economic context and the diverse drivers of growth to better understand their development patterns and to design appropriate policies that address specific challenges and opportunities in each country.

Despite the positive effect of export change to Myanmar's economy, its impact on the production expansion is minimal. The DPG results in Table 7 in the Appendix show that the export effects in both the manufacturing and service sectors in Myanmar were insignificant. On the other hand, the economies of Cambodia, Vietnam and Thailand are expanded by the significant effects of exports. All these countries have large export figures during 2010–2015. The results relating of Cambodia, Vietnam and Thailand are

similar to the previous finding of Fujita and James (1990): that the expansion of export contributed to the employment and production of Taiwan and Korea between 1973/74 and 1983/84. Similarly, Feldman et al. (1987) indicate that final demand change is more important than the coefficient change based on the decomposition of output change in the United States during 1963–1978. The contribution of final demand change is obvious in all five of the ASEAN countries during 2010–2015.

During the period of 2010–2015, Myanmar's economy experienced a growth pattern primarily driven by the effects of final demand, particularly due to increased consumption and investment resulting from economic reforms. This evidence indicates that domestic consumption and investment played pivotal roles in propelling the country's economic expansion during those years. Furthermore, the contribution of both exports and imports to Myanmar's economic growth further underscores the significance of international trade development. The engagement in international trade, including exports and imports, has positively impacted Myanmar's economy during this period. Given the notable contributions of international trade and the potential for future economic growth, it becomes essential for Myanmar to focus on further developing its international trade relations. By promoting exports and establishing favorable trade policies, the country can foster economic diversification, attract foreign investment, and create opportunities for sustainable economic growth in the future. Continued efforts in strengthening international trade relationships and improving the trade environment will likely be crucial for Myanmar to capitalize on its economic potential and drive long-term prosperity and development.

5 Conclusion

This study examines the pattern and sources of Myanmar's economic growth between 2010 and 2015, comparing it to four other ASEAN countries using input–output analyses. Section 4 of the study discusses the compositions of supply and demand and patterns of industrial growth in the five ASEAN countries during the specified period. During this transition period, Myanmar experienced the largest output expansion among the observed countries, with a magnitude of 1.84 times. However, both the demand and supply structures did not exhibit significant changes during this period. Over 95% of Myanmar's market demand was driven by domestic demand, indicating a heavy reliance on the internal economy. Additionally, Myanmar's exports were primarily centered around the agriculture and mining sectors, with relatively lower dependence on the manufacturing and service sectors.

Despite Myanmar's government opening to international trade in 2011, the share of both imports and exports in production remained relatively low compared to other countries prior to 2015. Factors such as an underdeveloped international payment system and Western countries' sanctions likely contributed to Myanmar's poor international trade record during this period. However, the international trade data show signs of improvement from 2013 onward, as illustrated in Table 5, suggesting progress in Myanmar's trade relations and potential for future growth in international trade.

In terms of backward linkages, the construction sector and all service sectors make a low contribution to output growth in the observed years. However, increased investment resulted in high output growth in the construction sector and public administration sector

Table 5 Exports and imports of Myanmar during economic reformation (million USD)

Items	2011	2012	2013	2014	2015	2016	2017	2018	2019
Exports	6723.6	7157.4	8081.7	9592.1	11037.2	17051.2	19350.8	21663.3	24119.4
Imports	6073.5	6299.3	9723.7	11888.6	14460.9	22962.3	25267.4	24703.8	22795.2

ADB

during 2010–2015. Thus, concerning DPGs, the growth pattern highlights the service sectors. Despite governmental encouragement of industrialization and the large backward linkages of some manufacturing sectors, the growth rates of all manufacturing industries were below the average growth of all sectors. To promote the Myanmar's export, it is critical to the development of the existing export-producing sectors: agriculture and fishing, food, beverage and tobacco, textile and wearing, and wood and paper sectors.

The Myanmar industrial policy in 2016 identified certain sectors, including manufacturing, as prioritized industries for industrial development. As per the Central Statistical Organization (Myanmar) (2020), both foreign and domestic investments in the manufacturing sectors increased in 2019. This investment boost led to gradual increases in production and export activities within the manufacturing sectors during the period 2016–2019. However, the agriculture sector did not demonstrate any significant improvement during this period. To promote agricultural production and expand agricultural exports, authorities need to focus on emphasizing and implementing effective agricultural development policies.

In summary, Myanmar's economic growth during 2010–2015 was mainly driven by the expansion of the public administration sector and the construction sector, facilitated by increased government consumption and both public and private investment. Cambodia and Indonesia's economies, on the other hand, were dominated by the enlargement of the construction sector resulting from investment expansion. In Vietnam and Thailand, export expansion played a significant role in driving economic growth. The analysis indicates that the effect of final demand change had a more pronounced impact on economic expansion in the observed countries during 2010–2015 compared to the effect of coefficient change. These findings will help policymakers to make informed decisions and develop appropriate strategies to foster sustained economic development.

The economic reformation in Myanmar, within the observed 5-year period, may not have shown significant impacts on the country's economic structure, international trade, or industrialization. Despite experiencing high economic growth during this period, Myanmar's economy, industrialization, and international trade are still lagging behind the other observed countries. However, it's essential to consider that the consequences of economic reformation may take time to materialize fully. The observed 5-year period might not be sufficient to witness the complete transformation of the economy. Data limitations may also restrict the ability to extend the observation period further, preventing a comprehensive understanding of the long-term impacts. The data until 2019 indicate promising trends in foreign investment inflow and trade, which suggest the potential for future industrialization and production growth in Myanmar. Additionally, the government's implementation of new economic policies established in 2016 and the Myanmar Sustainable Development Plan (2018–2030) provide a roadmap for further economic development.

Furthermore, international organizations such as the World Bank, the Japan International Cooperation Agency, and the ADB are providing technical and financial assistance to support Myanmar's development initiatives. Considering these factors, and assuming normal conditions, it is expected that Myanmar's economy will continue to develop and make progress in the future. The government's ongoing efforts and external support create opportunities for sustained economic growth and improvement in various aspects of the country's economic landscape. However, the pace and magnitude of progress will depend on effective implementation, policy consistency, and broader regional and global economic dynamics.

This study explains Myanmar's economic composition and sources of economic growth in the period 2010–2015. To understand more about the pattern of growth and the effect of economic reformation on industrialization, further analyses based on input–output models are required for an extended observation period.

Appendix

See Tables 6, 7, 8, 9, 10, 11 and 12.

Table 6 Backward linkages of 5 ASEAN countries between 2010 and 2015

Sectors	Myanmar		Cambodia		Vietnam		Indonesia		Thailand	
	2010	2015	2010	2015	2010	2015	2010	2015	2010	2015
Agriculture, hunting, forestry, and fishing	1.15	1.09	0.86	0.86	1.13	1.13	0.76	0.74	0.80	0.81
Mining and quarrying	0.54	0.54	0.89	0.87	0.89	0.88	0.80	0.80	1.16	1.19
Food beverage and tobacco	1.37	1.52	1.31	1.33	1.43	1.41	1.18	1.17	1.21	1.33
Textile and wearing apparel	1.33	1.40	1.00	0.96	1.08	1.01	1.01	0.98	1.08	1.10
Wood and paper	1.41	1.44	1.12	1.12	1.38	1.40	1.16	1.16	0.93	0.92
Petroleum, chemical, and non-metallic mineral products	1.66	1.74	1.09	1.11	1.10	1.11	1.08	1.10	1.24	1.15
Metal products	1.84	1.92	0.95	0.97	1.03	1.03	1.11	1.13	1.10	1.15
Electrical and machinery	1.65	1.62	1.12	1.06	1.03	0.99	1.07	1.12	1.06	1.11
Transport equipment	2.05	1.97	0.88	0.88	1.18	1.13	1.00	1.02	1.06	1.03
Other manufacturing and recycling	1.24	1.26	0.89	0.87	1.28	1.28	1.12	1.11	1.11	1.11
Electricity, gas, and water	0.83	0.83	1.32	1.29	0.75	0.78	1.50	1.49	0.98	0.96
Construction	0.89	0.83	0.96	0.98	1.05	1.06	1.14	1.14	1.15	1.09
Maintenance and repair	0.57	0.55	0.71	0.70	0.90	0.90	0.86	0.88	1.16	1.18
Wholesale trade	0.60	0.59	0.97	1.01	0.85	0.88	0.88	0.88	0.87	0.87
Retail trade	0.52	0.50	0.98	1.02	0.61	0.65	0.88	0.88	0.87	0.87
Hotels and restaurants	0.77	0.77	1.19	1.26	1.11	1.12	1.11	1.11	1.06	1.05
Transport	0.67	0.59	0.97	0.95	0.99	0.94	1.06	1.02	1.05	0.97
Post and telecommunications	0.52	0.48	1.05	1.01	1.07	0.95	0.89	0.90	0.97	0.96
Financial intermediation and business activities	0.44	0.45	1.05	1.04	0.89	0.91	0.84	0.84	0.91	0.89
Public administration	0.69	0.66	1.08	1.08	0.77	0.80	0.93	0.94	0.80	0.81
Education, health, and other services	0.49	0.50	0.92	0.91	0.83	0.95	0.99	0.96	0.88	0.87
Private households and others	0.78	0.78	0.71	0.70	0.66	0.69	0.61	0.61	0.53	0.58

Authors' calculations based on EORA and ADB data

Table 7 Myanmar's DPG decomposition (2010–2015)

Sectors	DPGs	Deviations of				Change in coef:	
		Consumption (C)	Investment (I)	Inventory change (J)	Export (E)	(−) Import (M)	Input
Agriculture, hunting, forestry, and fishing	− 5.59	− 4.00	0.35	0.26	3.49	0.62	− 5.08
Mining and quarrying	1.09	0.00	− 0.01	− 0.03	1.92	0.81	0.01
Food beverage and tobacco	− 17.25	− 11.38	0.21	0.30	− 0.04	1.72	− 4.62
Textile and wearing apparel	− 0.34	− 0.02	0.63	0.10	− 0.55	0.45	− 0.05
Wood and paper	2.31	1.65	3.23	0.28	0.95	2.66	− 1.14
Petroleum, chemical, and non-metallic mineral products	− 25.27	− 2.45	9.30	0.56	0.69	6.79	− 26.58
Metal products	− 12.25	0.32	9.07	0.73	0.11	3.34	− 19.14
Electrical and machinery	− 21.12	0.77	22.23	1.11	0.05	5.43	− 39.85
Transport equipment	− 9.73	− 1.53	7.25	1.12	0.01	2.34	− 14.23
Other manufacturing and recycling	− 1.76	− 0.71	1.09	0.19	− 0.10	0.47	− 1.76
Electricity, gas, and water	− 1.46	− 1.18	0.17	0.01	0.03	0.40	− 0.09
Construction	16.25	4.55	16.81	0.03	0.09	1.32	− 3.91
Maintenance and repair	0.20	0.02	0.15	0.01	0.01	0.06	0.08
Wholesale trade	6.48	− 0.34	6.85	0.37	0.19	2.70	2.10
Retail trade	0.51	− 0.39	1.45	0.01	0.03	0.97	0.38
Hotels and restaurants	3.02	2.96	0.27	0.01	0.07	1.01	0.71
Transport	17.15	4.78	2.77	0.15	0.89	1.92	10.49
Post and telecommunications	16.34	6.02	4.64	0.07	0.19	2.07	7.48
Financial intermediation and business activities	− 5.10	0.84	6.51	0.33	0.32	6.70	− 6.40
Public administration	32.09	33.68	1.99	0.00	− 0.02	3.34	− 0.23
Education, health, and other services	4.56	8.26	0.88	0.01	− 0.04	3.96	− 0.60
Private households and others	− 0.13	0.01	0.08	0.00	0.00	0.14	− 0.09
Total	0.00	41.87	95.95	5.63	8.30	49.23	− 102.51

Authors' calculations based on EORA and ADB data

Table 8 Changes in components of final demand of Myanmar (2010–2015) (MMK billion)

Sectors	Consumption		Investment		Inventory		Import		Export	
	2010	2015	2010	2015	2010	2015	2010	2015	2010	2015
Agriculture, hunting, forestry, and fishing	209.2	344.2	2.1	4.9	7.3	18.3	17.7	3.0	967.4	1883.6
Mining and quarrying	8.0	14.8	0.2	0.6	3.2	8.8	9.2	7.1	1369.5	2645.0
Food beverage and tobacco	1421.7	2279.8	0.001	0.002	13.0	31.8	6.9	4.3	73.5	127.4
Textile and wearing apparel	194.1	351.0	9.0	23.7	2.0	5.7	2.4	1.1	245.1	436.9
Wood and paper	112.2	207.7	2.2	5.7	2.6	7.2	5.8	3.5	175.6	340.9
Petroleum, chemical, and non-metallic mineral products	599.4	985.1	6.0	14.2	3.6	8.9	10.5	6.4	13.2	22.7
Metal products	21.6	36.5	25.4	59.6	8.0	2.8	6.5	19.6	13.1	23.5
Electrical and machinery	520.3	901.4	760.2	1681.1	21.6	51.2	17.2	7.7	17.5	28.9
Transport equipment	534.3	905.7	277.5	617.0	37.4	88.5	8.1	4.2	4.8	7.7
Other manufacturing and recycling	271.2	451.9	54.9	128.6	13.2	33.2	5.3	2.2	29.4	48.0
Electricity, gas, and water	378.6	611.7	0.001	0.001	0.005	0.013	5.2	2.5	1.3	2.0
Construction	2279.1	507.3	720.9	5116.9	0.0	0.001	14.3	11.7	7.5	13.4
Maintenance and repair	90.7	167.9	6.0	16.3	0.2	0.5	1.6	0.5	3.4	6.4
Wholesale trade	1197.2	2161.0	241.8	618.3	10.4	28.2	15.0	9.5	13.1	23.0
Retail trade	2542.5	4647.5	65.0	171.9	0.0	0.001	2.8	5.8	6.1	11.4
Hotels and restaurants	1841.4	3537.4	0.001	0.002	0.0	0.001	3.7	5.5	29.3	57.2
Transport	752.2	1643.6	33.8	105.5	1.4	4.8	8.4	8.4	310.8	229.2
Post and telecommunications	821.0	1712.8	141.9	421.3	0.1	0.4	4.0	7.9	21.5	44.5
Financial intermediation and business activities	5082.3	9200.4	302.2	776.7	14.9	40.5	38.4	38.5	1.2	2.1
Public administration	2279.1	6406.4	720.9	1458.5	0.0	0.0	14.3	33.3	3.4	5.3
Education, health, and other services	4477.2	8757.8	99.2	229.3	0.01	0.4	12.7	28.0	24.8	42.6
Private households and others	164.5	302.0	0.001	0.004	0.001	0.001	3.2	1.2	4.6	8.3
Total	23688.0	46133.8	4982.8	11450.0	139.0	347.7	229.4	194.9	3129.1	6010.3

Authors' calculations based on EORA and ADB data

Table 9 Cambodia's DPG decomposition (2010–2015)

Sectors	DPGs	Deviations of				Change in coef:	
		Consumption (δC)	Investment (δ I)	Inventory change (δJ)	Export (δE)	(−) Import (δM)	Input
Agriculture, hunting, forestry, and fishing	− 82.68	− 76.01	− 0.99	− 2.01	21.13	5.74	− 19.06
Mining and quarrying	6.48	4.02	0.28	− 0.02	0.42	− 0.24	1.53
Food beverage and tobacco	0.67	− 4.89	0.18	− 0.18	4.67	3.83	4.73
Textile and wearing apparel	7.32	− 0.87	0.01	− 0.44	27.16	15.03	− 3.51
Wood and paper	− 0.03	− 0.04	0.04	− 0.02	0.36	0.12	− 0.24
Petroleum, chemical, and non-metallic mineral products	− 0.55	− 1.09	0.26	− 0.12	1.58	0.80	− 0.38
Metal products	1.39	0.26	1.11	− 0.08	0.49	− 0.54	− 0.94
Electrical and machinery	− 0.03	0.01	0.01	0.00	0.05	0.11	0.00
Transport equipment	0.42	− 0.07	− 0.03	0.00	0.84	0.30	− 0.02
Other manufacturing and recycling	0.23	0.00	0.05	0.00	0.05	− 0.08	0.05
Electricity, gas, and water	3.08	4.86	0.16	− 0.01	0.22	− 0.19	− 2.34
Construction	41.53	0.65	32.58	− 0.01	− 2.29	− 6.39	4.21
Maintenance and repair	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wholesale trade	0.68	− 8.24	0.64	− 0.10	7.03	0.08	1.42
Retail trade	0.00	− 0.13	0.01	0.00	0.14	0.04	0.03
Hotels and restaurants	− 7.04	3.75	0.56	− 0.03	− 23.00	− 1.64	10.05
Transport	13.75	− 1.72	1.66	− 0.06	2.04	0.15	11.97
Post and telecommunications	5.59	1.12	0.35	− 0.03	3.82	0.95	1.28
Financial intermediation and business activities	18.87	− 5.08	0.81	− 0.05	− 0.84	0.32	24.35
Public administration	− 2.35	0.12	0.01	0.00	− 1.68	0.41	− 0.40
Education, health, and other services	− 7.33	− 6.48	0.24	− 0.02	0.93	3.29	1.29
Private households and others	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	− 89.84	37.94	− 3.17	43.12	22.08	34.03

Authors' calculations based on EORA and ADB data

Table 10 Vietnam's DPG decomposition (2010–2015)

Sectors	DPGs	Deviations of			Change in coef:		
		Consumption (δC)	Investment (δ I)	Inventory change (δJ)	Export (δE)	(−) Import (δM)	Input
Agriculture, hunting, forestry, and fishing	− 42.88	− 11.51	− 5.15	− 22.29	45.13	28.65	− 20.41
Mining and quarrying	− 8.13	− 0.29	− 1.29	− 2.58	13.35	12.51	− 4.81
Food beverage and tobacco	22.94	8.36	− 0.93	− 15.03	59.34	18.02	− 10.78
Textile and wearing apparel	− 1.35	− 3,28	− 0.14	− 4.59	44.53	30.71	− 7.16
Wood and paper	0.82	0.54	− 1.84	− 2.42	10.56	5.84	− 0.17
Petroleum, chemical, and non-metallic mineral products	− 0.10	1.62	− 7.99	4.83	29.96	21.67	− 6.85
Metal products	− 2.38	1.75	− 3.78	3.08	12.24	13.05	− 2.63
Electrical and machinery	− 3.90	0.68	− 4.46	− 5.44	31.26	27.28	1.34
Transport equipment	13.10	13.79	− 4.45	− 4.84	8.57	3.74	3.78
Other manufacturing and recycling	2.07	1.22	− 3.25	− 2.20	9.90	4.61	1.02
Electricity, gas, and water	11.60	4.32	− 0.99	− 0.61	5.68	2.89	6.10
Construction	− 29.38	8.00	− 39.37	− 1.66	1.19	5.88	8.34
Maintenance and repair	3.21	3.04	− 0.15	− 0.04	0.50	0.27	0.13
Wholesale trade	29.15	2.61	− 5.26	− 2.45	37.55	9.33	6.02
Retail trade	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hotels and restaurants	1.10	0.03	− 0.25	− 0.11	4.17	1.47	− 1.25
Transport	8.96	2.35	− 1.59	− 0.78	14.85	7.23	1.37
Post and telecommunications	4.43	3.39	− 0.32	− 0.16	3.17	2.13	0.48
Financial intermediation and business activities	− 11.84	− 4.59	− 3.41	− 1.29	13.26	7.73	− 8.08
Public administration	2.33	2.30	− 0.01	0.00	0.05	0.02	0.00
Education, health, and other services	0.05	− 0.83	− 0.10	− 0.04	0.25	− 2.41	− 1.74
Private households and others	0.28	0.26	− 0.01	0.00	0.02	0.01	0.02
Total	0.00	33.77	− 84.74	− 58.63	345.52	200.64	− 35.28

Authors' calculations based on EORA and ADB data

Table 11 Thailand's DPG decomposition (2010–2014)

Sectors	DPGs	Deviations of				Change in coef:	
		Consumption (δC)	Investment (δ I)	Inventory change (δJ)	Export (δE)	(−) Import (M)	Input
Agriculture, hunting, forestry, and fishing	− 7.69	− 14.27	− 0.07	− 2.24	9.94	− 1.87	− 2.92
Mining and quarrying	− 2.41	2.58	− 0.38	− 8.44	4.00	4.28	4.10
Food beverage and tobacco	− 16.70	− 19.23	− 0.02	− 3.31	7.43	− 7.31	− 8.89
Textile and wearing apparel	− 2.16	− 1.42	− 0.09	− 1.16	1.94	0.54	− 0.90
Wood and paper	− 2.13	0.58	− 0.11	0.35	1.13	− 0.63	− 4.71
Petroleum, chemical, and non-metallic mineral products	− 32.13	19.51	− 1.65	− 33.86	26.19	34.73	− 7.60
Metal products	− 15.65	0.92	6.74	− 3.49	− 4.75	− 8.22	− 23.30
Electrical and machinery	− 3.25	0.83	− 0.29	− 0.75	1.90	0.56	− 4.38
Transport equipment	− 6.04	− 1.94	− 1.91	0.23	− 2.56	− 4.89	− 4.74
Other manufacturing and recycling	− 1.98	0.28	− 0.07	− 0.99	0.83	0.10	− 1.92
Electricity, gas, and water	1.81	4.66	− 0.11	− 2.74	4.32	2.49	− 1.83
Construction	− 9.84	0.10	− 9.62	− 0.03	0.19	− 0.05	− 0.54
Maintenance and repair	0.09	0.02	0.00	− 0.02	0.17	− 0.01	− 0.09
Wholesale trade	4.71	− 1.26	− 0.24	− 3.38	20.59	0.32	− 10.68
Retail trade	4.19	2.59	0.64	− 3.46	6.69	− 1.69	− 3.96
Hotels and restaurants	20.46	9.36	0.00	− 0.23	10.42	− 1.02	− 0.12
Transport	9.80	− 0.96	0.14	− 2.26	15.81	− 0.17	− 3.09
Post and telecommunications	11.07	3.34	− 0.04	− 0.65	6.47	− 0.40	1.55
Financial intermediation and business activities	21.02	14.21	− 0.41	− 6.92	17.62	− 1.93	− 5.40
Public administration	6.24	5.51	0.01	− 0.07	0.15	− 0.81	− 0.16
Education, health, and other services	20.61	14.78	− 0.02	− 0.23	4.92	− 2.13	− 0.98
Private households and others	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	40.19	− 7.50	− 73.64	133.40	11.91	− 80.55

Authors' calculations based on EORA and ADB data

Table 12 Indonesia's DPG decomposition (2010–2015)

Sectors	DPGs	Deviations of				Change in coef:	
		Consumption (δC)	Investment (δ I)	Inventory change (δJ)	Export (δE)	(−) Import (δM)	Input
Agriculture, hunting, forestry, and fishing	− 10.74	0.69	− 3.30	− 4.34	0.41	1.90	− 2.30
Mining and quarrying	− 44.04	− 0.19	1.72	− 1.72	− 30.96	− 1.41	− 14.30
Food beverage and tobacco	− 0.30	− 2.53	0.02	− 0.04	6.62	2.29	− 2.08
Textile and wearing apparel	− 4.46	3.59	0.09	− 6.43	1.53	2.96	− 0.27
Wood and paper	− 10.83	0.75	0.87	− 0.58	− 1.78	0.54	− 9.55
Petroleum, chemical, and non-metallic mineral products	− 21.05	− 1.40	2.87	− 3.19	− 8.17	2.10	− 9.06
Metal products	− 1.30	0.06	1.77	− 0.46	− 3.76	− 0.90	0.20
Electrical and machinery	1.18	1.08	− 0.88	− 0.51	− 4.22	− 3.67	2.05
Transport equipment	− 0.12	0.02	− 1.05	− 0.02	1.36	− 0.11	− 0.54
Other manufacturing and recycling	− 1.91	− 0.96	− 0.79	− 0.28	1.92	0.94	− 0.86
Electricity, gas, and water	2.78	1.12	0.23	− 0.10	− 0.66	0.20	2.38
Construction	27.42	0.74	22.38	− 3.25	− 1.88	− 1.05	8.38
Maintenance and repair	1.95	1.37	0.16	− 0.56	− 0.44	− 0.29	1.13
Wholesale trade	− 2.39	0.14	− 0.17	− 2.38	− 1.22	− 0.82	0.41
Retail trade	− 1.29	0.09	− 0.07	− 1.40	− 0.54	− 0.30	0.32
Hotels and restaurants	3.00	2.96	0.33	− 0.17	− 2.78	0.17	2.83
Transport	26.98	15.95	0.72	− 1.08	− 3.16	− 2.39	12.17
Post and telecommunications	− 1.56	− 0.73	0.21	− 0.23	− 1.34	− 0.80	− 0.27
Financial intermediation and business activities	12.84	4.74	0.85	− 1.09	− 4.25	− 1.47	11.12
Public administration	2.58	1.46	0.12	− 0.06	− 0.59	− 1.87	− 0.21
Education, health, and other services	21.27	19.69	− 0.10	− 0.26	− 0.81	− 0.78	1.97
Private households and others	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	48.64	25.98	− 28.15	− 54.75	− 4.77	3.52

Authors' calculations based on EORA and ADB data

Declarations

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