

CGE Simulation of the ASEAN Economic Community and RCEP under Long-term Productivity Scenarios ¹

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In December 2015, 10 ASEAN Member States officially established the ASEAN Economic Community (AEC). As envisioned in the AEC Blueprint 2025, this single market and production base will make the AEC a highly integrated and cohesive economy, and bring about competitive, innovative, and dynamic ASEAN Member States through enhanced connectivity and sectoral cooperation (ASEAN Secretariat, 2015).

With AEC's aim of strengthening the economic prospect of the ASEAN Member States, one might wonder if it would function as an integrated market and production base. According to the IMF's World Economic Outlook Database April 2017, the economic growth of ASEAN is faster than the world growth: 4.6% compared to 3.1%. Its projected growth rate for 2017 is 4.7% compared to 3.5% of the world (Table 1). With its 3.2% compound annual growth between 2012 and 2017, ASEAN's share in the world economy has been continuously increasing. If this level of growth is sustained by productivity rise, ASEAN's economic size could be twice larger by 2040. Of course, this is an optimistic assumption; conversely, there could be no productivity growth at all in the region. If the latter, then ASEAN's annual GDP growth rate would decelerate over time as its population grows older.

We conduct counterfactual simulation experiments of economic growth in the ASEAN Member States through a computable general equilibrium

¹ Slightly different version is posted on the web site of Economic Research Institute for ASEAN and East Asia (ERIA) as "Whither the ASEAN Economic Community in 2025-2035" (www.eria.org/publications/key_reports/asean50-vol.5.html). Further revision and updating work are in progress as of January, 2018).

(CGE) model of global trade. Based on the CGE model involving 24 countries and 25 sectors, we construct four simulation scenarios from 2018 to 2035, and then we consider the simulation results on real GDP, productivity growth, production structure, and wage rates for ASEAN. In addition, we consider potential impact of the AEC and the Regional Comprehensive Economic Partnership (RCEP), another regional free trading area by the ASEAN Plus Six countries. In the next section, we briefly describe the database and CGE model used in this study as well as the simulation scenarios. Results are shown in Section 3, followed by a concluding summary.

Analytical Framework

In this study, we use the recursively dynamic CGE model of global trade as developed by Ianchovichina and McDougall (2001) and Ianchovichina and Walmsley (2012), and which is an extension of the comparative static GTAP² model (Hertel, 1997; McDougall, 2003). Standard assumptions in the GTAP model are constant returns to scale in production technology, perfectly competitive market, and product differentiation by country of origin. Representative regional household allocates income for private consumption expenditure, government consumption expenditure, and savings. Expenditure shares are almost constant because the Cobb-Douglas type preference is assumed for the representative household as well as the adjustment for the non-homotheticity in the constant difference elasticity function applied to the private household expenditure. The dynamic GTAP model incorporates capital accumulation, international capital mobility, and ownership in terms of domestic and foreign equity. For the time dimension in this study, the dynamic GTAP model spans the period of 2011 to 2035, and is calibrated to 2011 base year using version 9.0 of the Dynamic GTAP database (Aguiar et al, 2016).

Table 2 lists the 24 countries and regions for these simulation experiments. The ASEAN Member States are Brunei Darussalam, Cambodia,

² Global Trade Analysis Project

Indonesia, the Lao PDR, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam. Because of data limitation, Myanmar is grouped together with Timor-Leste as Rest of Southeast Asia (RoSEAsia). Table 3 lists the 25 sectors aggregated from the original 57 sectors of the GTAP Data Base (Aguiar et al., 2016).

Construction of simulation scenarios begins by generating a hypothetical state of the global economy that is consistent with key projections obtained from international organisations. Projections for total population and working-age population – defined as 15–64 years old as proxy to endowments of labour – are obtained from the United Nations’ World Population Prospects (2015) based on the medium projection variant. In this study, the UN’s projections for 1950–2100 are available for all countries (Table 2). Another set of projections, for 1980–2022, is obtained from the International Monetary Fund’s World Economic Outlook (2017) for real GDP. Assumed to be the high-case scenario (H), we extrapolate the real GDP growth rates in 2022 to the end of simulation period of 2035. Given the projections of total population, working-age population, and real GDP for 2011–2035, the model can compute the Hick’s neutral technological change, a measure of productivity we use in this study, for the high-case scenario. As for the low-case scenario (L), we assumed that the productivity growth rates are zero for the ASEAN Member States for 2018–2035. Also, we assumed that the lower-middle-case scenario (LM) restricts the productivity growth rates in the ASEAN to be one fourth of the high case for 2018–2035, whereas the middle-case scenario (M) halves the productivity growth rates.

Scenarios for 2018–2035

High-case scenario (H): the ASEAN Member States sustain the real GDP growth rates as shown in Table 4.

Middle-case scenario (M): productivity growth rates for the ASEAN Member States are 50% of the high-case scenario.

Lower-middle-case scenario (LM): productivity growth rates for the

ASEAN Member States are 25% of the high-case scenario.

Low-case scenario (L): No productivity growth rates for the ASEAN Member States.

There is no difference in simulation results when the model tracks the time path given by the historical data estimated for population, GDP, productivity, and investment from 2011 to 2017. Only after 2018 can we observe difference between the simulation scenarios.

Simulation Results

Table 4 shows the compound annual growth rates of total population, working-age population, and real GDP for the ASEAN Member States as well as the ASEAN aggregate. Population growth rates are set to be same across the four scenarios. For ASEAN as a whole, working-age population grows by 0.7%, slightly less than the total population growth of 0.8%, suggesting that population aging is in progress. Table 4 shows that the real GDP growth rates reflect the corresponding four scenarios. If the productivity growth in ASEAN is simulated at 3.9% as reported in Table 5, then the real GDP in ASEAN can grow at 5.2%. In other words, ASEAN needs to keep raising productivity by 3.9% to keep the real GDP growth rate at 5.9%. This is the high-case scenario for ASEAN and its implication for the productivity growth that agrees with the real GDP projection in Table 5. It should be noted that lack of positive productivity growth computed within the model leaves out Singapore's real GDP from varying across the scenarios.

Time path from 2011 to 2035 of ASEAN's real GDP level is depicted in Figure 1. Real GDP in ASEAN grew from US\$2.2 trillion in 2011 to US\$2.9 trillion in 2017. Depending on the scenario, time path diverges after 2018 and resulted in US\$7.3, US\$5.6, US\$5.0, and US\$4.4 trillion in 2035, respectively, from the high scenario to the low scenario.

Having simulated the four scenarios, it is possible to observe the change in sectoral outputs in ASEAN. Table 6 shows ASEAN's sectoral outputs in

the benchmark year of 2011 and the sectoral output change by 2035. The sectoral production structure in ASEAN is characterised by large share of primary, trade, and other services industries, which are about 15% (727 million over the total), 10%, and 11%, respectively. Looking at the changes in sectoral output captured by the ratio from 2011 to 2035, it is clear that all sectors expand for all scenarios. However, by comparing the sectoral production ratio with the total, it can be inferred that the share of primary industry becomes smaller in 2035; the sectoral production ratio in primary industry under the high-case scenario is 2.8, as compared to the total ratio of 3.3. Thus, the total output in 2035 becomes 3.3 times larger than in 2011 while the sectoral output of primary increases 2.8, resulted in shrinking share in the economy. Similarly, textile, apparel, and leather lose their share. On the other hand, under the high-case scenario, the sectoral outputs in manufacturing industries (minerals, metals, motor vehicles, and transport equipment) expand as well as in construction boosted by increased investment. Shift in production structure from the primary and the light manufacturing industries towards the heavy manufacturing and machinery industries can be inferred from the changes in sectoral production ratios.

Effect on wage rates for unskilled labour and skilled labour in ASEAN is shown in Table 7. Under the high-case scenario, compound annual growth rate of the unskilled labour's wage rate is 4.2% and 3.5% for the skilled labour for the 2018–2035 period. They are about same for the middle-case scenario: 1.7%. Growth rate of the unskilled labour becomes smaller than the skilled labour under the lower-middle-case scenario, and worsens to negative in the low-case scenario. These results suggest that the gap in wage rate between unskilled and skilled labour would be getting wider if the productivity growth were to stagnate at lower rate.

We experimented with the four scenarios in this study. Although there are numerous ways of constructing different future scenarios, it might be worth considering the full completion of the AEC and RCEP as one more assumption to append to the existing scenarios. While the AEC is the regional integration among the ASEAN Member States, RCEP is another large regional free-trade pact of 16 countries in which all ASEAN Member

States are participating in the negotiation process. We can consider additional effect of the AEC and RCEP by incorporating into the scenarios import tariffs removal, logistic improvement of merchandise trade, and services trade liberalisation, adopting the implementation similar to Itakura (2014). These liberalisation components are gradually phased into the scenarios over the 2018–2027 period.

Table 8 shows the resulting effect of the AEC and RCEP on top of the existing scenarios for the ASEAN Member States. As compared to Table 4, ASEAN's compound annual growth rate is increased by 0.2% points for the high-case scenario, and by 0.3% points for the other scenarios. These differences can be understood as the effect of the AEC and RCEP pushing up the growth path. Cambodia indicates the highest gain in growth rate, about 1.5% point, because the relatively high bilateral import tariffs are completely removed.

Figure 2 updates the growth path for ASEAN's real GDP. It can be clearly seen that implementing the AEC and RCEP raises the time path above the scenarios shown in Figure 1. By the end of simulation period in 2035, ASEAN's real GDP reaches US\$7.6, US\$5.9, US\$4.6 trillion, respectively, for the high, middle, and low-case scenarios with the AEC and RCEP.

Summary

In this study, we use the recursively dynamic GTAP model to conduct counterfactual simulation experiments by constructing scenarios with different productivity growth for the ASEAN Member States. Additionally, we include the AEC and RCEP components to the simulation scenarios. Simulation results show that ASEAN's real GDP would register the compound annual growth rate ranging from 2.2% to 5.2% over the 2018–2035 period, depending on the scenarios. The sectoral outputs also increased significantly, and the results reveal the structural change in production by shifting from primary and light manufacturing towards heavy manufacturing, machinery, and construction. Growth in wage rates of the unskilled labour surpasses the skilled labour under the high-case scenario. However, under the low-case and the lower-middle-case scenarios, gap in the

wage rates between the unskilled and the skilled would become wider. From the additional components of the AEC and RCEP, the simulation results clearly show that the AEC and RCEP increase the economic growth of ASEAN as a whole. Also, gains in real GDP for the ASEAN Member States are confirmed in the simulation results. Because of the relatively high import tariffs to be removed, Cambodia's gain in real GDP stands out as the largest. If the AEC and RCEP were implemented on top of the scenarios, then ASEAN's real GDP level would reach US\$7.6 trillion under the high-case scenario and US\$4.6 trillion under the low-case scenario.

Key data inputs of projections are taken from UN's World Population Prospects and IMF's World Economic Outlook. Also, the benchmark data set and the CGE model are drawn from the GTAP Database and the Dynamic GTAP model. It may be obvious that the simulation results will be affected by change in the data inputs and the model, not to mention the remaining error of the author.

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Table 1. GDP Growth Rate in ASEAN and World, and ASEAN's Share in World, 2012–2017

	ASEAN	World	Share in world
2012	5.9	3.5	3.2
2013	5.1	3.4	3.2
2014	4.6	3.5	3.3
2015	4.5	3.4	3.4
2016	4.6	3.1	3.4
2017	4.7	3.5	3.5

Note: Real GDP, annual percent change, for growth rates. Share in percent. ASEAN = Association of Southeast Asian Nations.

Source: IMF WEO 2017 and author's computation based on GTAP Data Base v9.0.

Table 2. List of Countries and Regions

Country / Region		Country / Region	
1	Brunei	13	Korea
2	Cambodia	14	India
3	Indonesia	15	Australia
4	Lao PDR	16	New Zealand
5	Malaysia	17	Hong Kong
6	Philippines	18	Taiwan
7	Singapore	19	USA
8	Thailand	20	Canada
9	Viet Nam	21	Mexico
10	RoSEAsia	22	Chile
11	Japan	23	Peru
12	China	24	ROW

Note: RoSEAsia is rest of Southeast Asia, which includes Myanmar and Timor-Leste. ROW is for rest of the world. ASEAN is defined as an aggregate from Brunei to RoSEAsia.

Lao PDR = Lao People's Democratic Republic.

Source: Author's aggregation from GTAP Data Base v9.0

Table 3. Sectoral Aggregation

No.	Name	GTAP 57 sectors
1	Primary	Paddy rice; Wheat; Cereal grains nec; Vegetables, fruit, nuts; Oil seeds; Sugar cane, sugar beet; Plant-based fibers; Crops nec; Cattle,sheep,goats,horses; Animal products nec; Raw milk; Wool, silk-worm cocoons; Forestry; Fishing; Minerals nec; Meat: cattle,sheep,goats,horse; Meat products nec; Vegetable oils and fats; Dairy products; Processed rice; Sugar; Food products nec.
2	Energy	Coal; Oil; Gas.
3	BvrgTbcc	Beverages and tobacco products.
4	Textile	Textiles.
5	Apparel	Wearing apparel.
6	Leather	Leather products.
7	Wood	Wood products.
8	Paper	Paper products, publishing.
9	PetCoProduct	Petroleum, coal products.
10	Chemical	Chemical,rubber,plastic prods.
11	Minerals	Mineral products nec.
12	FerrousMetal	Ferrous metals.
13	OtherMetal	Metals nec.
14	MetalProduct	Metal products.
15	Motorvehicle	Motor vehicles and parts.
16	TrnsprtEquip	Transport equipment nec.
17	ElecEquip	Electronic equipment.
18	Machinery	Machinery and equipment nec.
19	OthMnfct	Manufactures nec.
20	Utilities	Electricity; Gas manufacture, distribution; Water.
21	Construction	Construction.
22	Trade	Trade.
23	TransComm	Transport nec; Sea transport; Air transport; Communication.
24	FinsBusi	Financial services nec; Insurance; Business services nec.
25	OthSrv	Recreation and other services; PubAdmin/Defence/Health/Educat; Dwellings.

Source: Author's aggregation from GTAP Data Base v9.0.

Table 4. Growth Scenario for the ASEAN, 2018–2035
(compound annual growth rate, %)

	Total Population	Working-age Population	Real GDP			
			H	M	LM	L
ASEAN	0.8	0.7	5.2	3.6	2.9	2.2
Brunei	0.9	0.6	6.1	4.9	4.4	3.8
Cambodia	1.2	1.4	6.4	4.3	3.2	2.1
Indonesia	0.8	0.8	5.5	3.6	2.7	1.7
LaoPDR	1.3	1.8	6.8	4.5	3.4	2.2
Malaysia	1.0	0.9	4.8	3.4	2.7	2.0
Philippines	1.3	1.4	7.0	6.1	5.7	5.2
Singapore	0.7	−0.3	2.6	2.6	2.6	2.5
Thailand	−0.1	−0.7	3.1	2.0	1.5	1.0
VietNam	0.7	0.4	6.2	3.2	1.8	0.3
RoSEAsia	0.7	0.7	7.5	3.9	2.3	0.7

ASEAN = Association of Southeast Asian Nations; H = high-case scenario; L = low-case scenario; LaoPDR = Lao People's Democratic Republic; LM = lower-middle-case scenario; M = middle-case scenario; RoSEAsia = Rest of Southeast Asia.

Source: Author's simulation

Table 5. Productivity Growth Scenario for ASEAN, 2018–2035
(compound annual growth rate, %)

	Productivity			
	H	M	LM	L
ASEAN	3.9	1.8	0.8	0.0
Brunei	2.5	1.3	0.6	0.0
Cambodia	5.5	2.8	1.4	0.0
Indonesia	3.7	1.9	0.9	0.0
LaoPDR	4.8	2.4	1.2	0.0
Malaysia	3.5	1.7	0.9	0.0
Philippines	2.2	1.1	0.5	0.0
Singapore	..	..	..	..
Thailand	2.7	1.3	0.7	0.0
VietNam	6.5	3.3	1.6	0.0
RoSEAsia	6.0	3.0	1.5	0.0

ASEAN = Association of Southeast Asian Nations; H = high-case scenario; L = low-case scenario; Lao PDR = Lao People's Democratic Republic; LM = lower-middle-case scenario; M = middle-case scenario; RoSEAsia = Rest of Southeast Asia.

Source: Author's simulation.

Table 6. Effect on Sectoral Outputs of ASEAN, 2035

	2011	Production ratio: 2035 / 2011			
	billion USD	H	M	LM	L
Primary	727	2.8	2.1	1.9	1.6
Energy	153	3.4	2.4	2.0	1.7
BvrgTbcc	45	2.7	2.0	1.8	1.6
Textile	77	1.9	1.7	1.6	1.5
Apparel	49	2.0	1.8	1.7	1.6
Leather	34	1.5	1.4	1.3	1.2
Wood	45	3.3	2.6	2.3	2.0
Paper	54	3.1	2.6	2.4	2.2
PetCoProduct	188	2.5	2.0	1.9	1.7
Chemical	342	3.3	2.9	2.7	2.5
Minerals	60	4.1	2.8	2.3	1.9
FerrousMetal	37	4.2	3.2	2.8	2.4
OtherMetal	43	4.7	4.2	3.9	3.6
MetalProduct	96	4.0	2.7	2.2	1.8
Motorvehicle	94	3.7	3.0	2.7	2.4
TrnsprtEquip	41	3.8	3.1	2.8	2.5
ElecEquip	288	2.9	2.7	2.6	2.5
Machinery	192	3.4	3.1	2.9	2.7
OthMnfct	47	2.3	1.8	1.6	1.4
Utilities	103	3.0	2.3	2.1	1.8
Construction	391	5.0	3.2	2.6	2.1
Trade	502	3.6	2.7	2.4	2.1
TransComm	354	2.8	2.4	2.2	2.0
FinsBusi	368	2.8	2.3	2.1	2.0
OthSrv	555	3.5	2.6	2.3	2.0
Total	4884	3.3	2.6	2.3	2.0

Note: change in sectoral output volume is based on constant price in 2011.

ASEAN = Association of Southeast Asian Nations; H = high-case scenario; L = low-case scenario; LM = lower-middle-case scenario; middle-case scenario.

Source: Author's simulation results.

Table 7. Effect on Wage Rates for Unskilled and Skilled Labour in ASEAN, 2018–2035 (compound annual growth rate, %)

	H	M	LM	L
Unskilled labor	4.2	1.7	0.8	–0.1
Skilled labor	3.5	1.7	1.1	0.5

Note: change in wages rates is based on constant price in 2011.

ASEAN = Association of Southeast Asian Nations; H = high-case scenario; L = low-case scenario; LM = lower-middle-case scenario; M = middle-case scenario.

Source: Author’s simulation results.

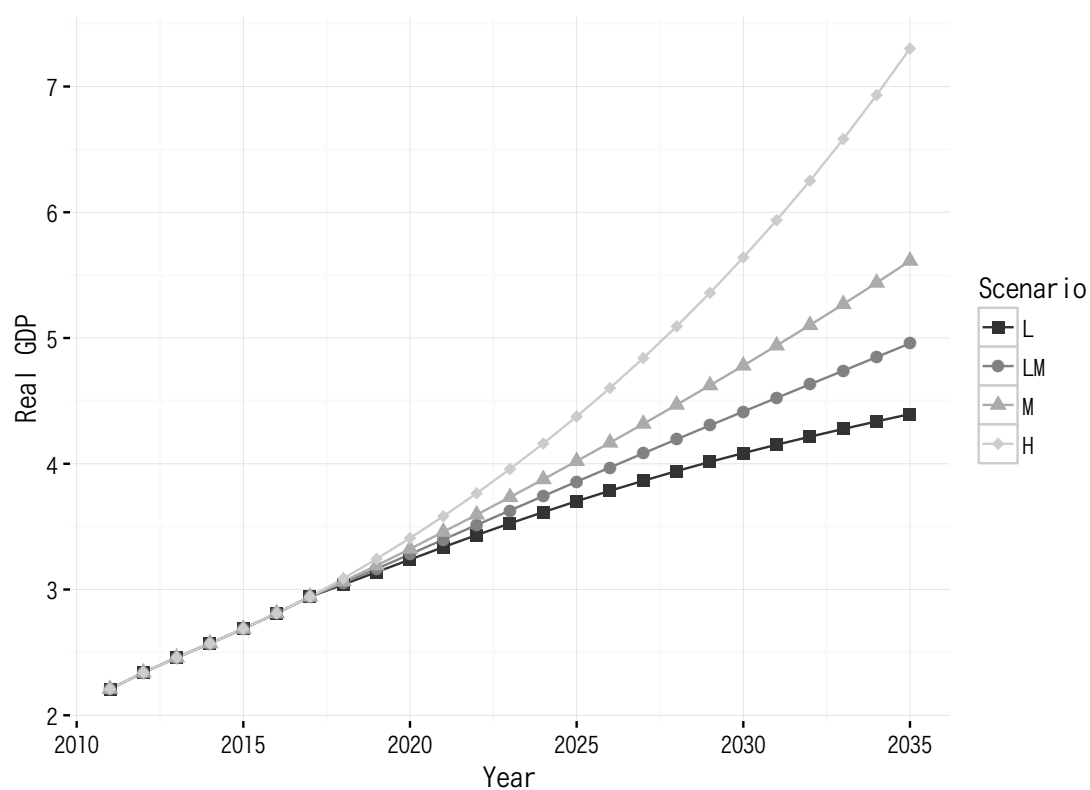
Table 8. Effect of AEC and RCEP on Real GDP Growth, 2018–2035 (compound annual growth rate, %)

	Real GDP			
	H+	M+	LM+	L+
ASEAN	5.4	3.9	3.2	2.4
Brunei	6.2	5.1	4.5	3.9
Cambodia	7.9	5.7	4.7	3.6
Indonesia	5.6	3.7	2.8	1.9
LaoPDR	7.3	5.1	3.9	2.8
Malaysia	5.1	3.7	3.0	2.3
Philippines	7.2	6.3	5.9	5.4
Singapore	2.9	2.8	2.8	2.8
Thailand	3.7	2.7	2.2	1.7
VietNam	6.6	3.7	2.2	0.7
RoSEAsia	7.5	3.9	2.3	0.8

ASEAN = Association of Southeast Asian Nations; GDP = gross domestic product; H = high-case scenario; L = low-case scenario; Lao PDR = Lao People’s Democratic Republic; LM = lower-middle-case scenario; M = middle-case scenario; RoSEAsia = Rest of Southeast Asia.

Source: Author’s simulation results.

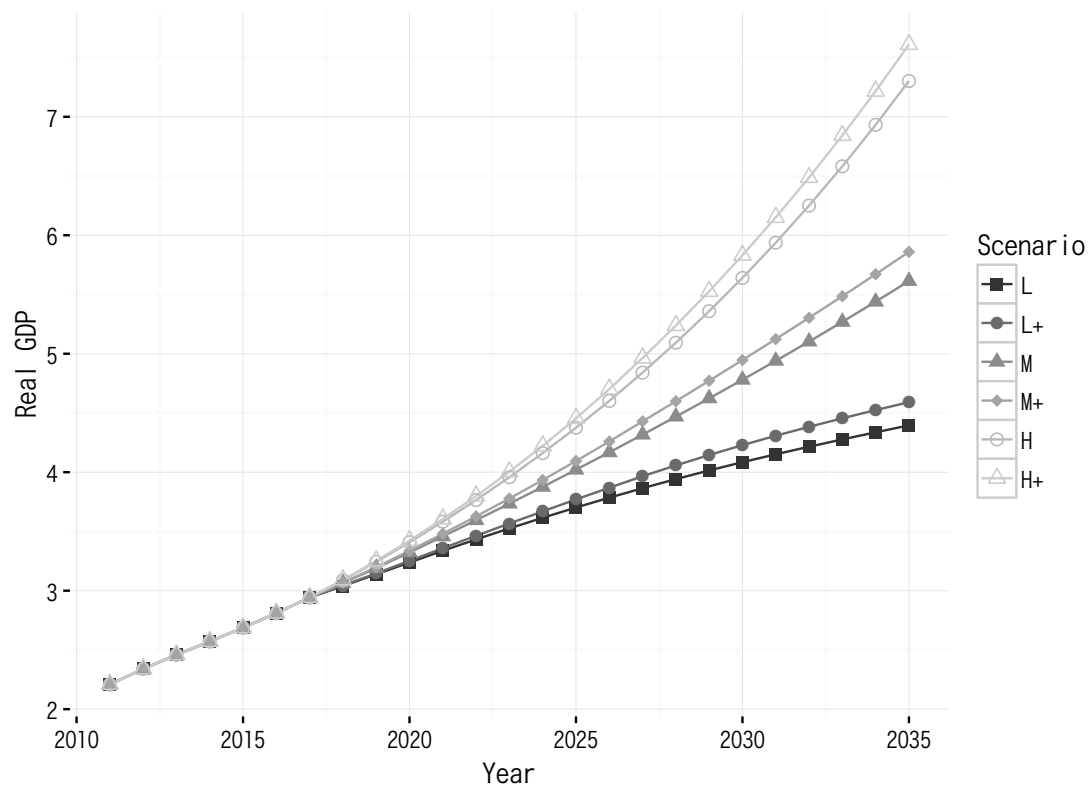
Figure 1. ASEAN's Real GDP for 2011–2035 (trillion US\$, 2011 constant price)



ASEAN = Association of Southeast Asian Nations; GDP = gross domestic product; H = high-case scenario; L = low-case scenario; LM = lower-middle-case scenario; M = middle-case scenario.

Source: Author's simulation results.

Figure 2. ASEAN's Real GDP for 2011–2035 for AEC and RCEP (trillion US\$, 2011 constant price)



Note: The sign “+” denotes the scenario with AEC and RCEP.

AEC = ASEAN Economic Community; ASEAN = Association of Southeast Asian Nations; GDP = gross domestic product; H = high-case scenario; L = low-case scenario; LM = lower-middle-case scenario; M = middle-case scenario; RCEP = Regional Comprehensive Economic Partnership.

Source: Author's simulation results.