Chapter 6

Scenarios and Results

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6. Scenarios and Results

6.1 Baseline scenario

Scenario

Some demographic parameters may be held constant and only logistic settings (by scenario) changed. The following macro parameters are then maintained across scenarios:

- The national population of each country is assumed to increase at the rate forecasted by the United Nations Population Fund (UNFPA) until year 2025;
- There is no immigration between the region covered in the simulation and the rest of the world.

The logistic settings follow the specification described in Appendix B. For instance, the average speed of land traffic is set at 38.5 km/h. However, the speed passing through a mountainous area is set at half of it—19.25 km/h.

As for sea traffic, the average speed is set at 14.7 km/h between international-class ports[5], and at half of it among other routes. For air traffic, the average speed is set at 800 km/h between the primary airports[6] of each country and at

[5] In this simulation, we designated the following ports as international-class ports: Port Singapore, Port Madras, Port Hong Kong, Port Saigon, Port Jakarta, Port Manila, Port Laem Chabang, Port Kelang.

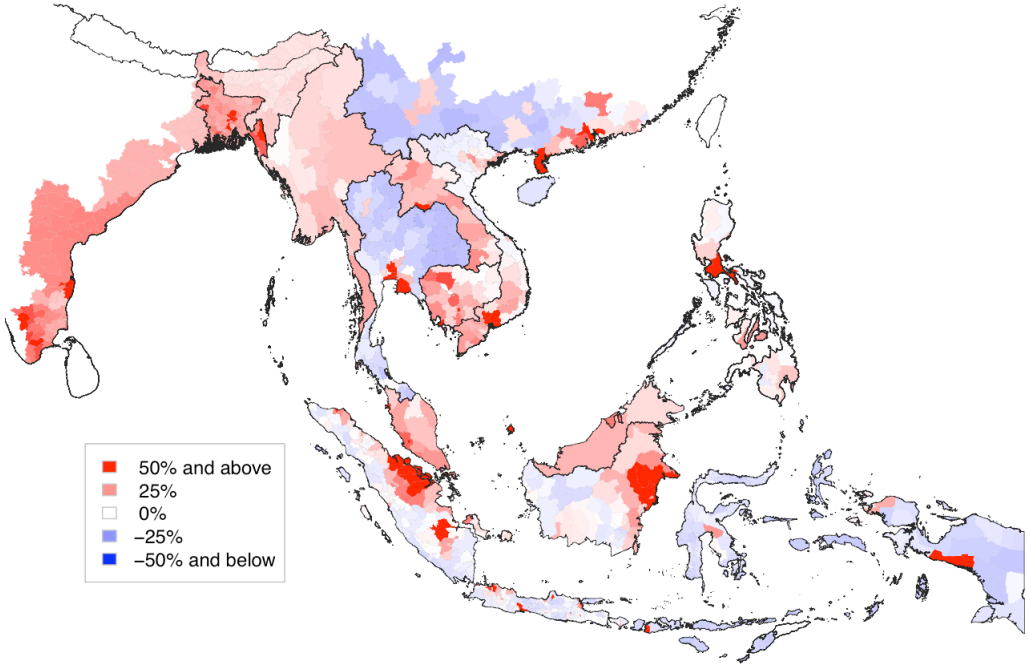
[6] In this simulation, we designated the following airports as primary airports: Brunei Intl Airport, Changi Intl Airport, Hong Kong Intl Airport, Kuala Lumpur Intl Airport, Ninoy Aquino Intl Airport, Soekarno Hatta Intl Airport, Suvarnabhumi Intl Airport, Phnom Penh Intl Airport, Yangon Intl Airport, Wattay Intl Airport, Tansonnhat Intl

400 km/h among other routes.

Population

Figure 9 shows the expected population growth from 2005 to 2020 under the baseline scenario. The countries can be classified into two categories. The first category is the country that evolved a core-periphery structure; the second category is the one that did not. The countries in the former category are China, Thailand, and Indonesia. In China, the population tends to concentrate in some provinces that are located mainly in coastal areas. In Thailand, the population is concentrated in the area near Bangkok. In Indonesia, the population tends to concentrate in some big cities, while the regions mainly have rich natural resources.

Figure 9: Expected Population Growth (2005-2020)

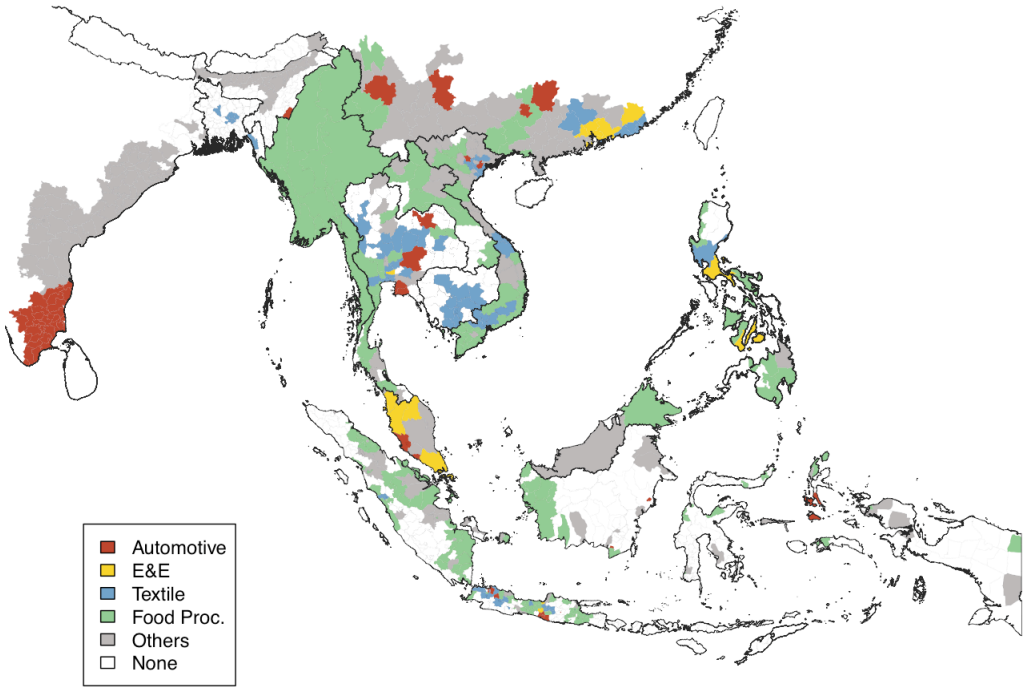


Airport, Chennai Intl Airport, Noibai Intl Airport

Industrial Agglomeration

Figure 10 shows the places of industrial agglomeration, which is represented by comparative advantage index. Basically, the distribution of industries does not change much from 2005 as depicted in Figure 8.

Figure 10: Comparative Advantage in the Manufacturing Sector (2020)

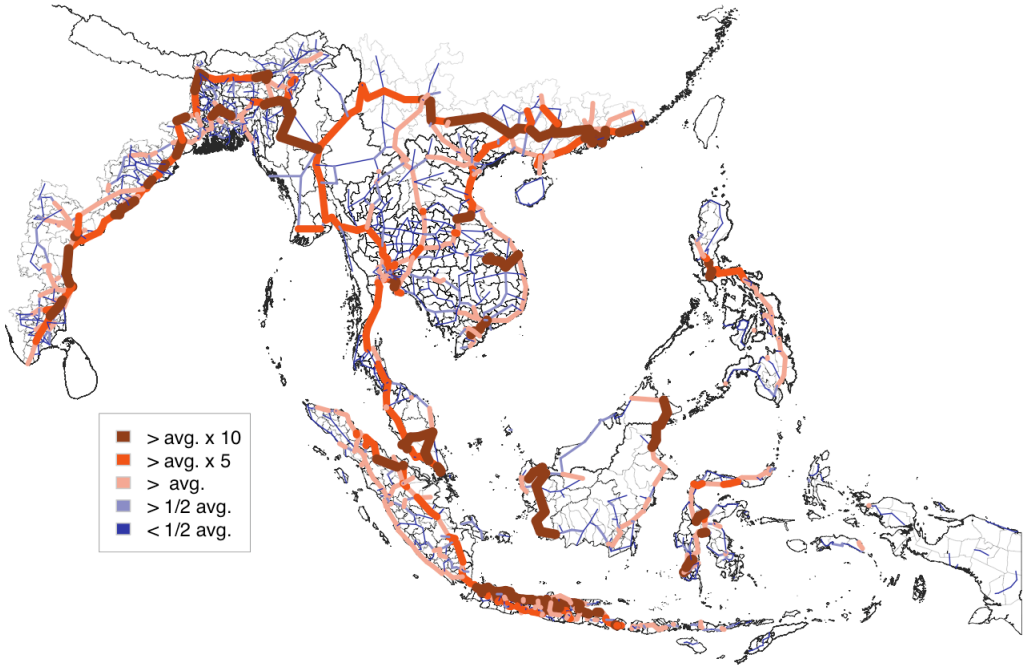


Traffic Volume

Figure 11 shows the expected land traffic volume in 2005. The traffic volume is calculated from the transaction value between any two cities in the region, and the routes used to transport the goods between those two cities. Figure 11 also shows that the traffic volume in the simulation model is relatively orderly, although some

differences from reality have been observed.

Figure 11: Expected Land Traffic (2005)



6.2 EWEC

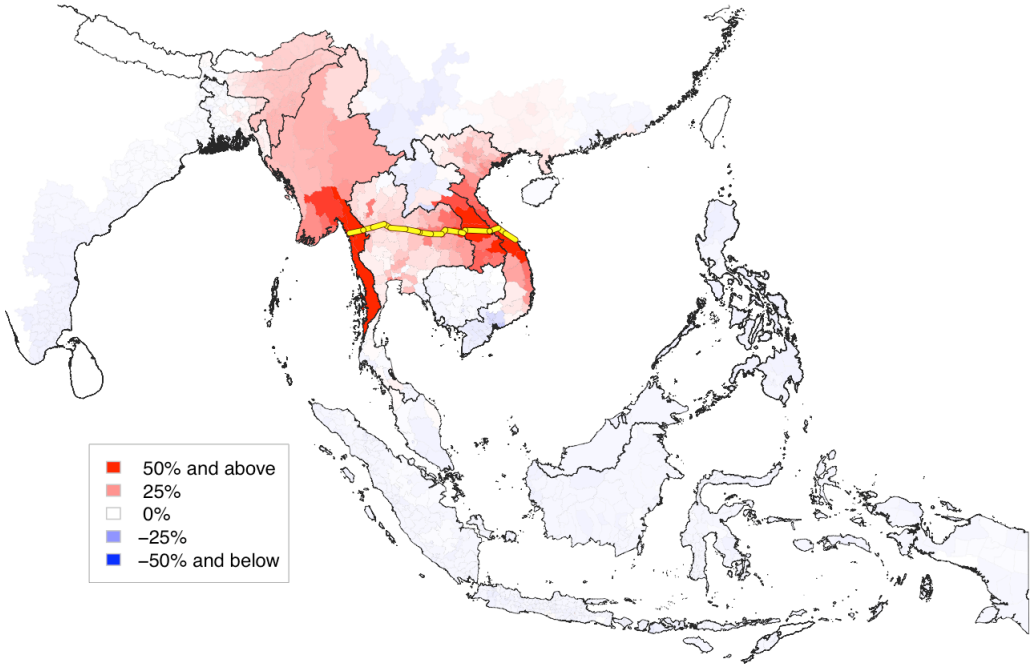
Scenario

First, we checked the effects of customs facilitation along the East-West Economic Corridor (EWEC). Specifically, the overhead time consumed at three borders, i.e., Lao Bao – Densavanh, Mukdahan – Khanthabuly, and Myawadi – Mae Sot is reduced to two hours. In addition to that, the money costs going though these borders are reduced to one-fifth of the baseline scenario.

Economic Effects

The economic effects of EWEC are depicted in Figure 12. This figure shows the cumulative difference in the regional GDP under EWEC scenario against the GDP under the baseline scenario during the 10 years after the infrastructure development, compared with the expected regional GDP at the scenario change. Generally, the regions along EWEC gain in terms of increased GDP. In particular, some regions in Lao PDR and Myanmar post the cumulative GDP gains of over 50%.

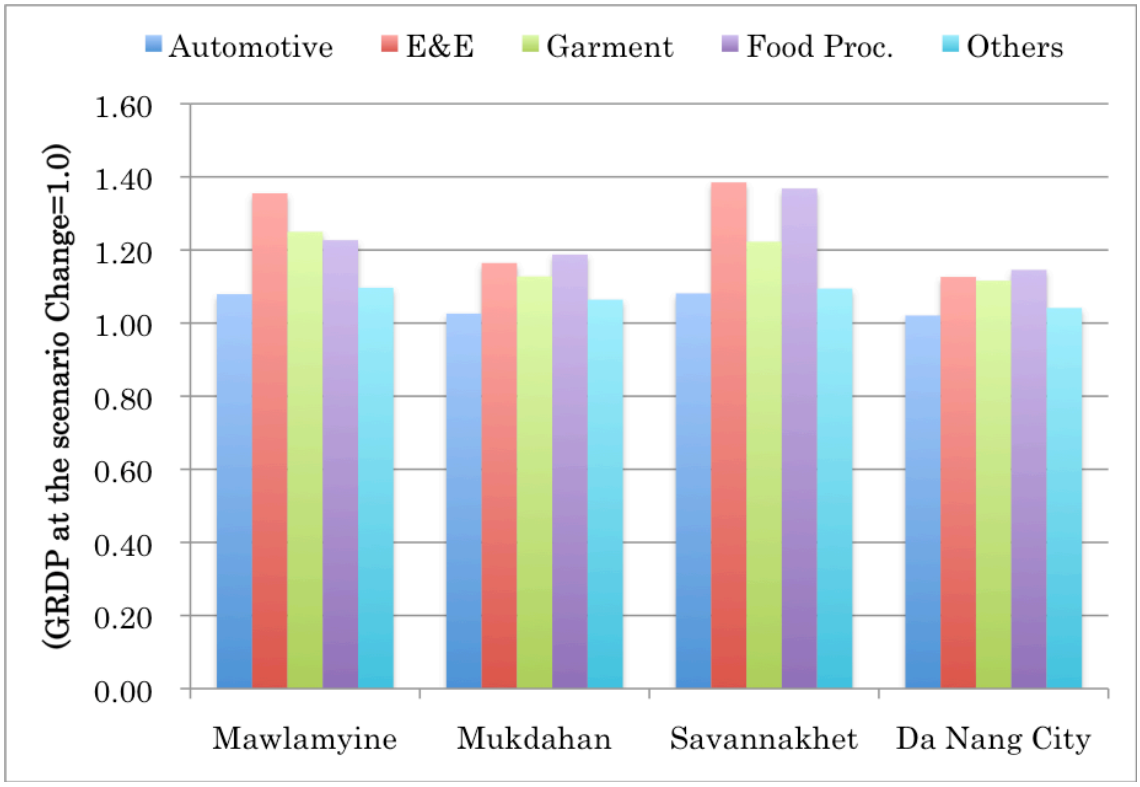
Figure 12: Gains in Regional GDP: EWEC vs. Baseline (10 years cumulative)



The economic effects of EWEC differ by place and industry. Figure 13 deconstructs the economic effects by industry for four cities along EWEC. For instance, the E&E sector in Mawlamyine and Savannakhet gains almost 30%, and the

food-processing sector in all four cities gains relatively well. The automotive sector is not changed much by the development of EWEC.

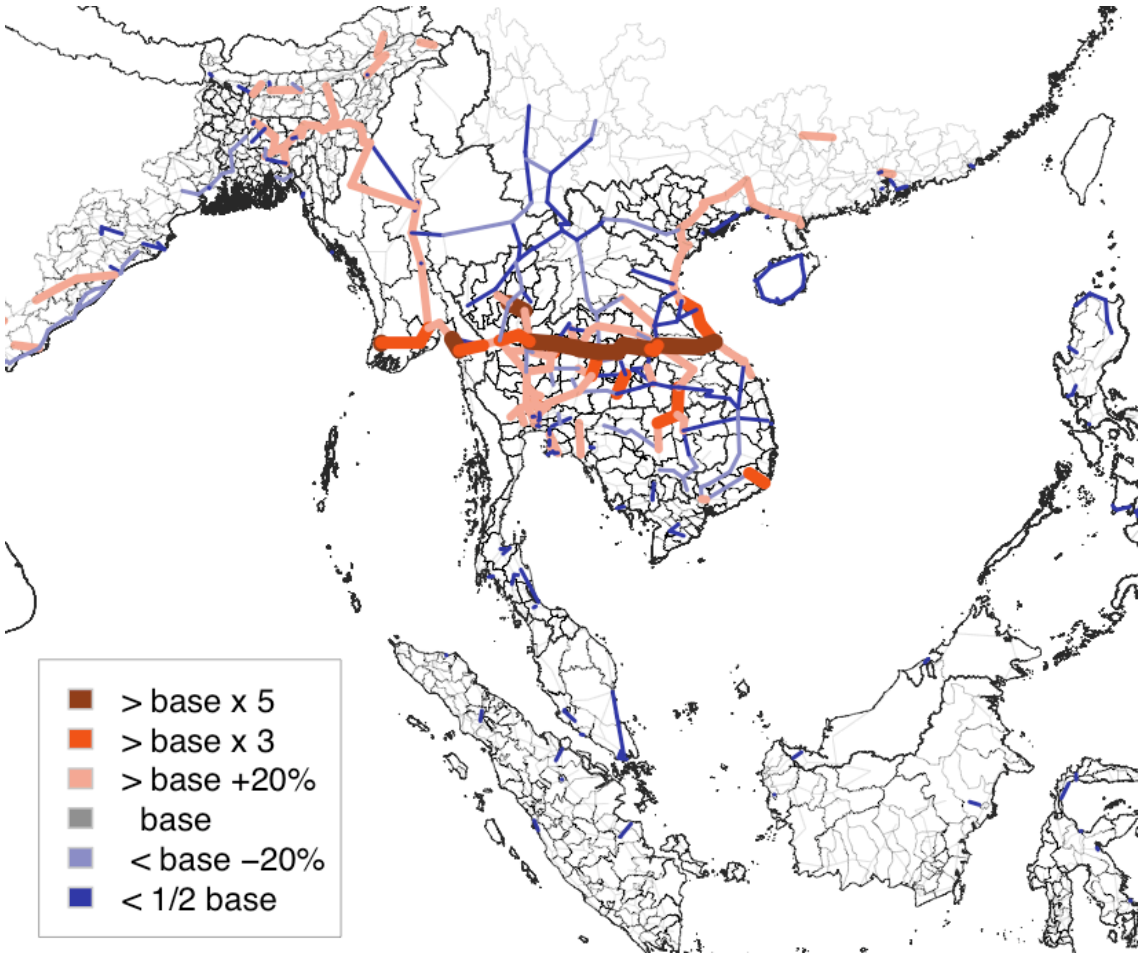
Figure 13: Ecomic Effects of EWEC by Industry (10 years after)



Traffic Volume

The traffic volume changed significantly from the development of EWEC (Figure 14). It appears that the traffic between the eastern and western parts flows into the corridor. In addition to that, the traffic going through EWEC, Bangkok area, and Myanmar is also increasing.

Figure 14: Changes in Traffic Volume EWEC vs. Baseline (10 years after)



The development of EWEC affected sea and air traffic. Tables 2 and 3 show the sea/air routes most affected by EWEC. Table 2 shows that the sea route between Port Madras and Port Laem Chabang has been substituted for by the sea route between Port Madras and Bassein of Myanmar. The port of Da Nang at the east end of EWEC is more utilized[7]. Table 3 shows that the air routes Yangon-Chiang Mai and

[7] Some air/sea routes are currently not in use but included in the simulation at this point. The increasing utilization of some routes is well understood to mean that the routes have high potential.

Yangon-Bangkok have fallen into disuse. It also seems that land routes through EWEC substituted for these two air routes.

Note that the current model of modal choice in IDE/ERIA-GSM selects only one route that minimizes time and money costs for an industry with respect to each origin-destination combination. Thus, the routes that have become relatively costly after the development of an alternative route can fall completely out of use.

Table 2: Sea Routes Most Affected by EWEC (10 years after)

Sea Route			Traffic Change
Port Madras	-	Port Bassein	9.49
Port Manila	-	Port Da Nang	2.32
Port Manila	-	Port Laem Chabang	1.17
Port Jakarta	-	Port Laem Chabang	1.11
Port Laem Chabang	-	Port Singapore	1.11
Port Jakarta	-	Port Madras	0.81
Port Kelang	-	Port Madras	0.61
Port Laem Chabang	-	Port Hong Kong	0.50
Port Chittagong	-	Port Singapore	0.23
Port Madras	-	Port Laem Chabang	0.00

Table 3: Air Routes Most Affected by EWEC (10 years after)

Air Routes			Traffic Change
Danang Intl	-	Changi Intl	1.24
Noibai Intl	-	Hong Kong Intl	1.21
Yangon Intl	-	Netaji Subhash Chandra Bose Intl	1.10
Suvarnabhumi Intl	-	Soekarno Hatta Intl	1.03
Suvarnabhumi Intl	-	Changi Intl	1.01
Yangon Intl	-	Wujiaba	0.58
Wattay Intl	-	Phnom Penh Intl	0.43
Noibai Intl	-	Suvarnabhumi Intl	0.15
Suvarnabhumi Intl	-	Yangon Intl	0.00
Chiang Mai Intl	-	Yangon Intl	0.00

Figures 15 and 16 graphically shows the sea and air routes affected by EWEC.

Figure 15: Sea Routes Most Affected by EWEC (10 years after)

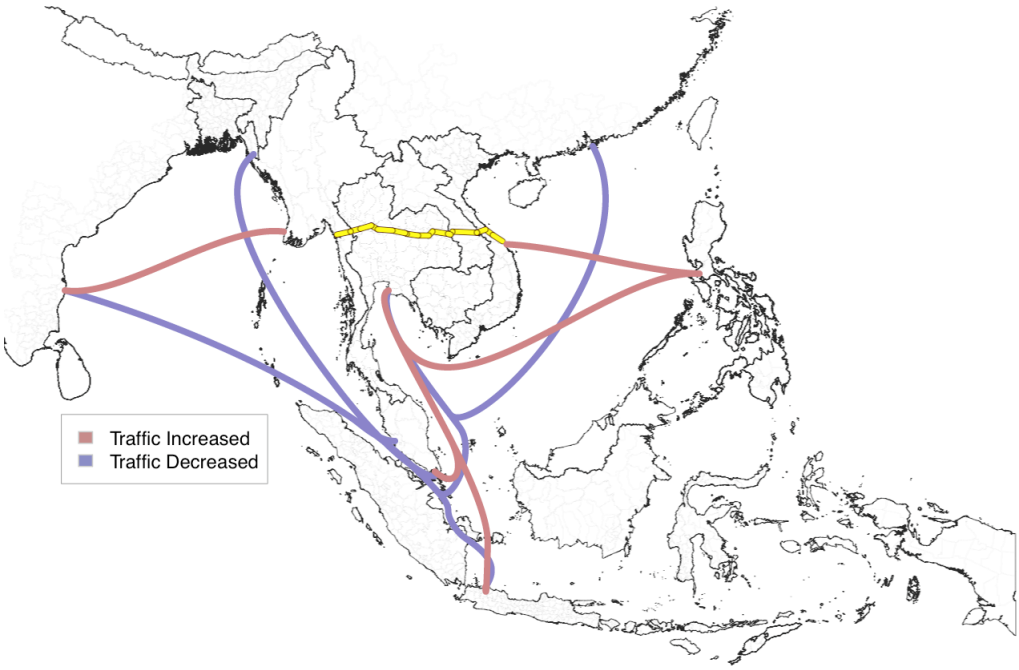
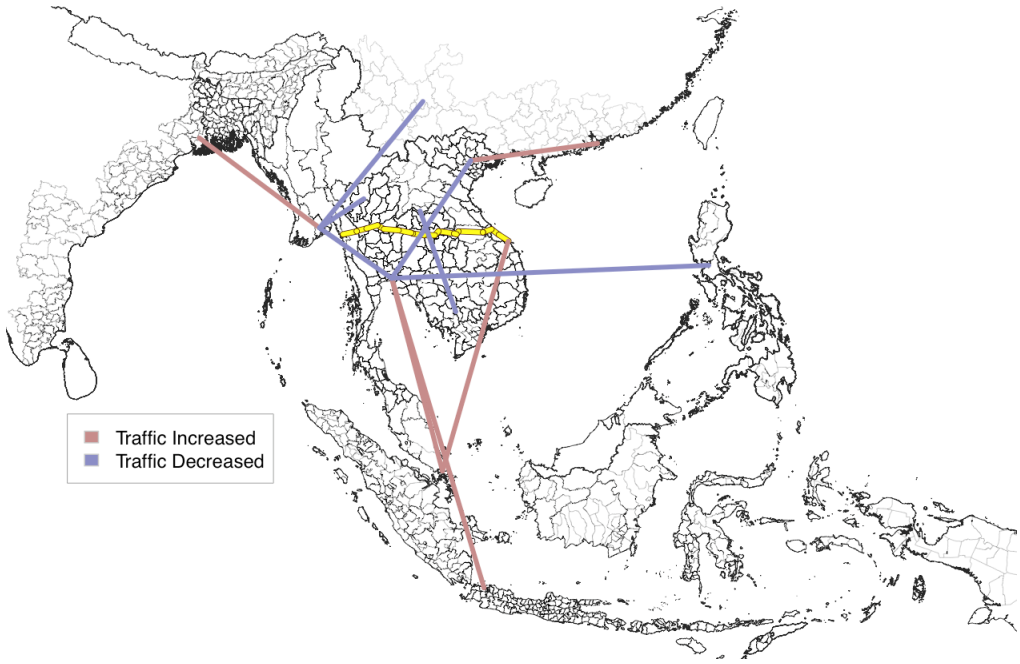


Figure 16: Air Routes Most Affected by EWEC (10 years after)



Modal Shift

Figures 17-1 and 17-2 propose an example of the modal shift. The route between Yangon and Bangkok used by the E&E sector is by air under the baseline scenario. With the development of EWEC, it changes to the land route via a part of EWEC. Before the development of EWEC, time costs consumed at the Myawadi–Mae Sot border was prohibitively high for the E&E industry, making air routes the most reasonable option. After the development of EWEC, land routes seem to be most reasonable choice because of the reduction of wasted time at the Myawadi–Mae Sot border.

Figure 17-1: Route and Mode between Yangon and Bangkok (E&E); Baseline

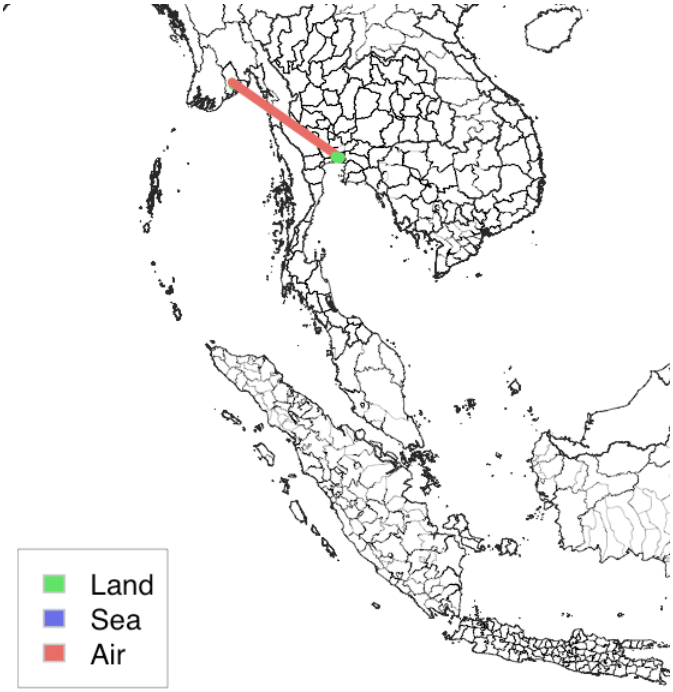
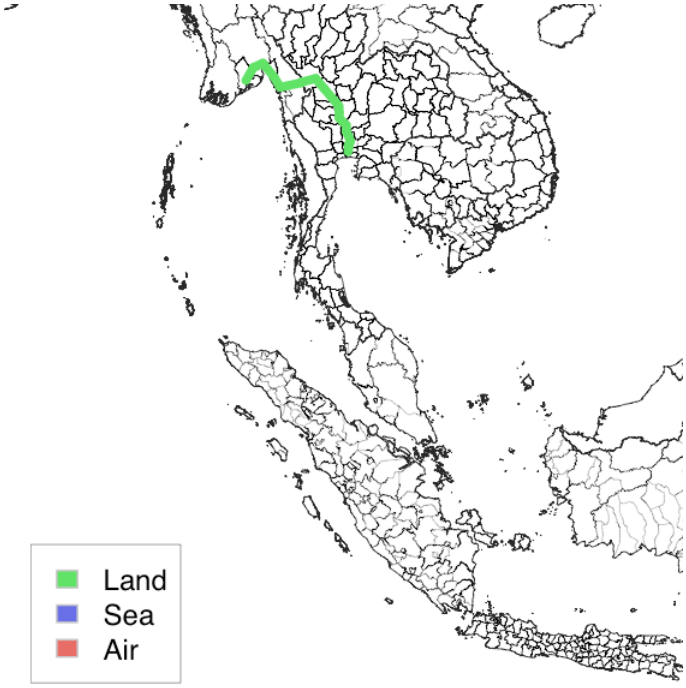


Figure 17-2: Route and Mode between Yangon and Bangkok (E&E); EWEC



6.3 MIEC

Scenario

We checked the effects of the development of the Mekong-India Economic Corridor (MIEC) using three steps. The development is the combination of the construction of the infrastructure, customs facilitation along the corridor, and the establishment of a new sea route between Dawei of Myanmar and Port Madras of India. The three steps are as follows:

- Step 1: The bridge over Mekong River at Neak Loueng is constructed.
- Step 2: Dawei and Kanchanburi of Thailand are connected by road, and

customs facilitation along MIEC is introduced. This reduces the overhead time consumed at three borders (Kanchanburi–Dawei, Ban Khlong Luek–Poipet, and Bavet–Moc Bai) to two hours while the money costs incurred in going through these borders are reduced to one-fifth of the baseline scenario.

- Step 3: We connect Dawei and Port Madras by a sea route that is equivalent to the other routes between internationally important ports[8].

Economic Effects

The economic effects of MIEC, steps 1 to 3, are depicted in Figures 18-1 to 18-3. The figure shows the cumulative difference in the regional GDP under MIEC scenario against the GDP under the baseline scenario after 10 years. At Step 1, the economic effects are limited to the southern half of Cambodia, and the cumulative gains in GDP are merely an order of 1% (Figure 18-1).

At Step 2, the regions along MIEC generally gain higher GDP (Figure 18-2). In particular, all regions in Myanmar and most regions in Cambodia and southern Viet Nam benefit well, and the cumulative gains in GDP are over 50% for some regions.

At Step 3, in addition to the regions along MIEC in the ASEAN, the Indian side also gains some benefits (Figure 18-3).

[8] At first, we connect Dawei and Port Madras by the route equivalent to other local sea routes. In this case, there are no economic effects to the Indian side. This is understood to mean that merely substituting one route for another has very limited economic effects, whereas net improvement of the connection has some economic effects.

Figure 18-1: Gains in Regional GDP: MIEC (Step 1) vs. Baseline (10 years after)

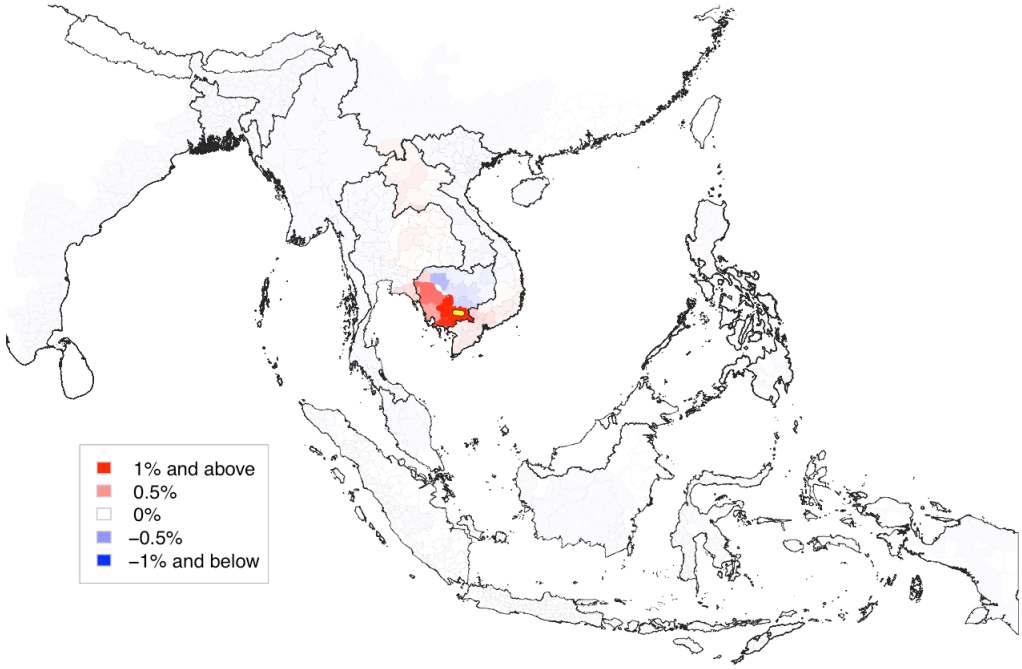


Figure 18-2: Gains in Regional GDP: MIEC (Step 2) vs. Baseline (10 years after)

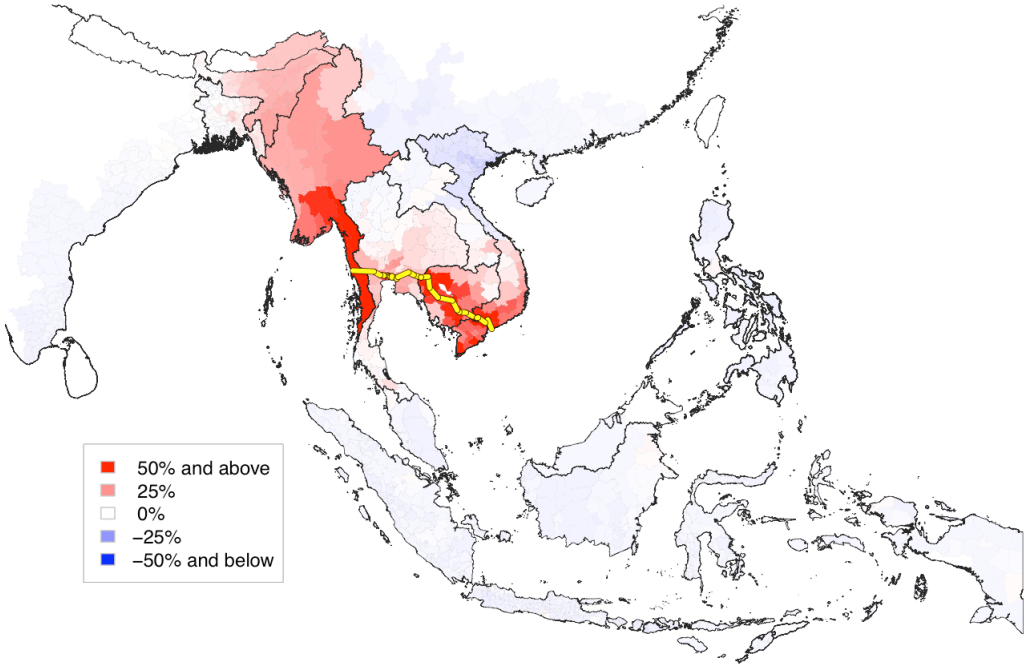
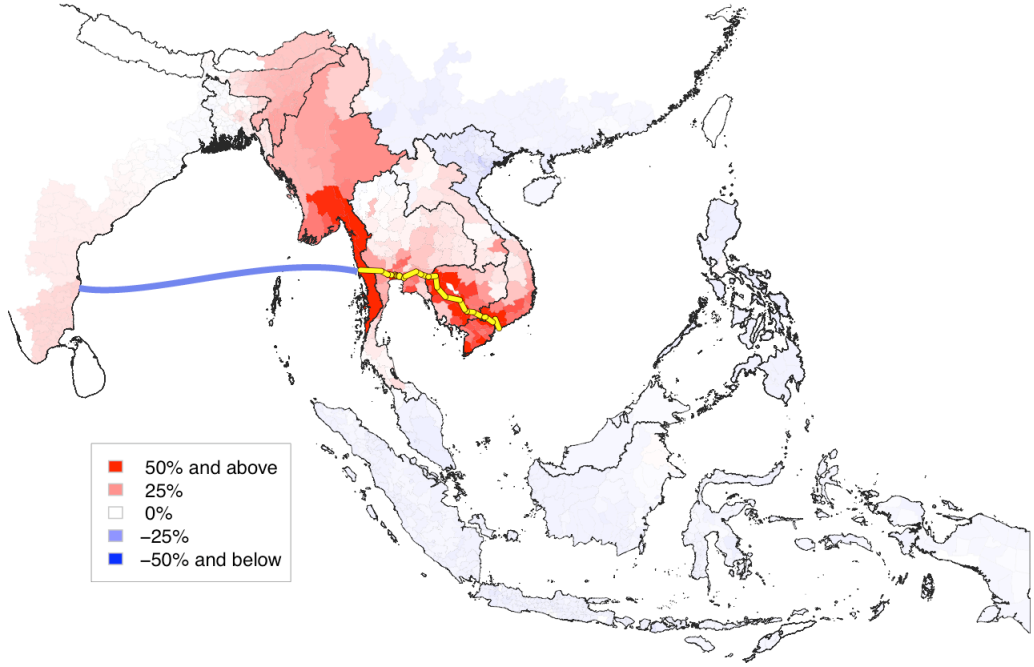
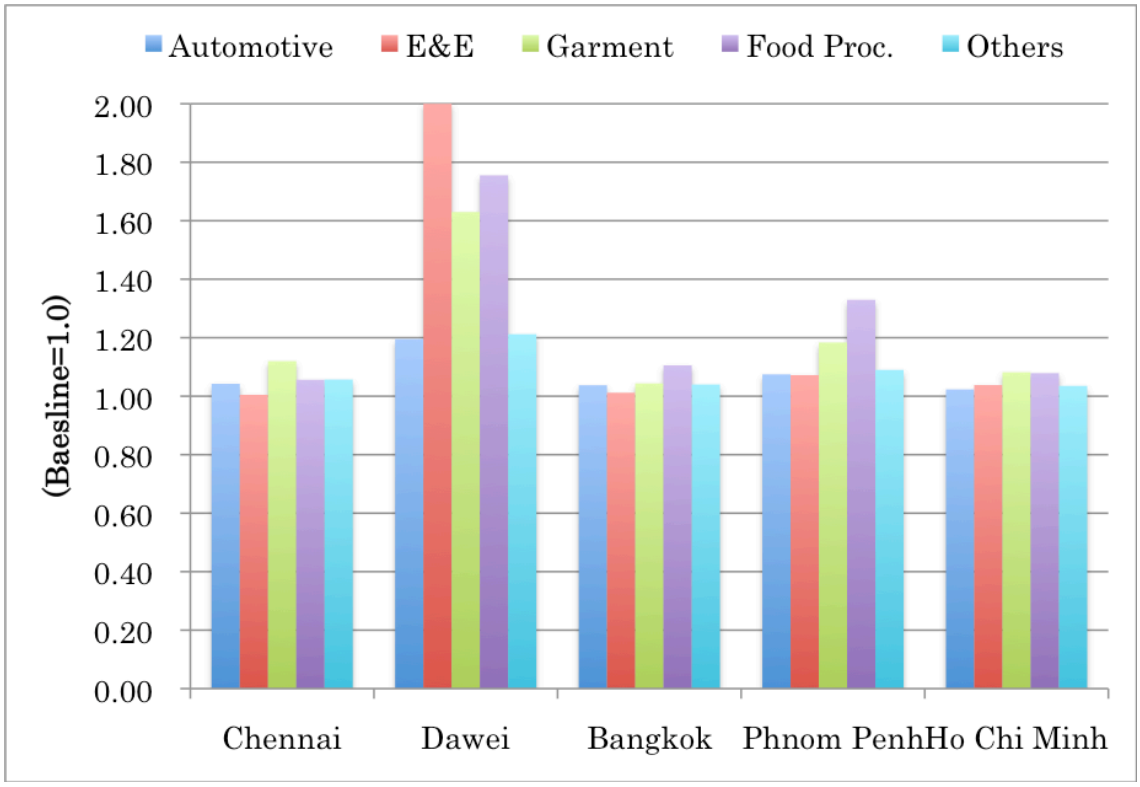


Figure 18-3: Gains in Regional GDP: MIEC (Step 3) vs. Baseline (10 years after)



The economic effects of MIEC also differ by place and industry. Figure 19 deconstructs the economic effects by industry for five cities along MIEC. It is obvious that Dawei, the city that connects the ASEAN and India, benefits the most among the five cities. In particular, the E&E, garments, and food processing industries gain much. The other four cities also benefit, with gains in the food processing industry relatively significant.

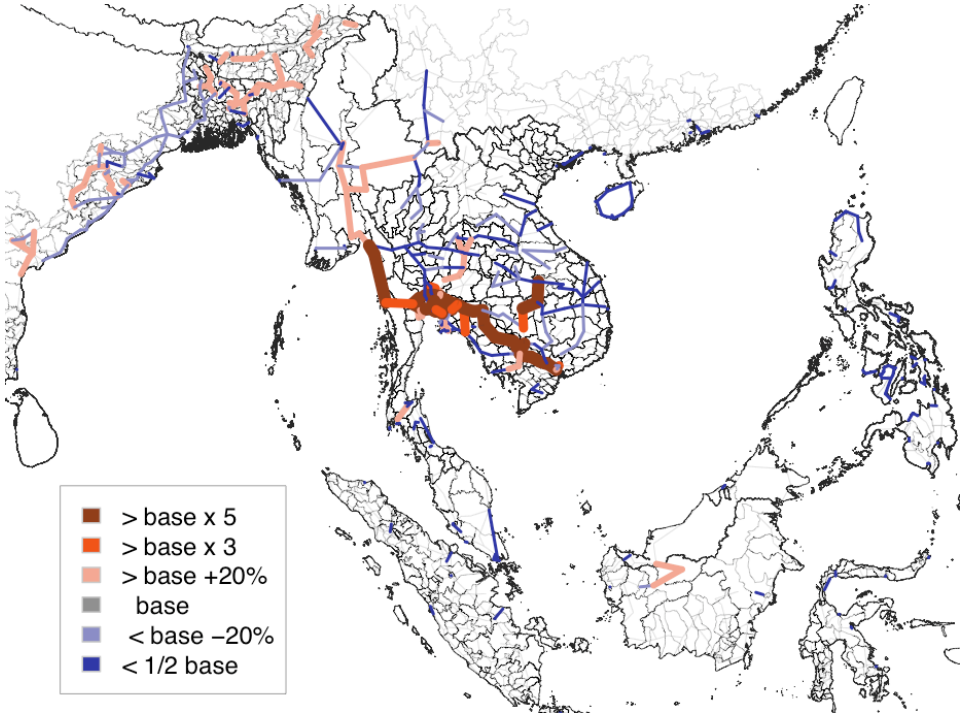
Figure 19: Ecomic Effects of MIEC by Industry (10 years after)



Traffic Volume

Traffic volume changes significantly with the development of MIEC (Figure 20); traffic along MIEC is significantly increasing. On the other hand, other routes connecting the eastern and western parts of the ASEAN generally lose traffic. Some of the routes connecting Myanmar and eastern India and the routes along the east coast of India also lose their traffic. It is easily understandable that the sea routes between Dawei and Port Madras substitute for some traffic between India and the ASEAN.

Figure 20: Changes in Traffic Volume MIEC vs. Baseline (10 years after)



The development of MIEC affects sea and air traffic. Tables 4 and 5 show the sea/air routes most affected by MIEC. Table 4 shows the following modal shifts: (1) Port Saigon, the east end of MIEC, becomes more utilized; (2) the sea routes between Port Madras and the other main ports in ASEAN are substituted for by the newly established sea route, Dawei-Port Madras; (3) Port Laem Chabang-Port Kota Kinabalu seems to be substituted for by Port Saigon-Port Kota Kinabalu and the MIEC route between Ho Chi Minh and Bangkok; (4) the sea route Port Laem Chabang-Port Saigon is substituted for by the land route of MIEC.

Table 4: Sea Routes Most Affected by MIEC (10 years after)

Sea Route			Traffic Change
Port Saigon	-	Port Sorong	5.30
Port Saigon	-	Port Kota Kinabalu	3.17
Port Saigon	-	Port Kuching	3.14
Port Saigon	-	Port Manila	2.58
Port Saigon	-	Port Hong Kong	2.51
Port Madras	-	Port Laem Chabang	0.00
Port Laem Chabang	-	Port Kota Kinabalu	0.00
Port Madras	-	Port Phuket	0.00
Port Madras	-	Port Bassein	0.00
Port Saigon	-	Port Laem Chabang	0.00
Port Saigon	-	Port Madras	0.00

Table 5 shows the following changes: (1) two airports along MIEC, Phnom Penh Airport and Tansonnhat Airport, increase their traffic for some destinations; (2) seven air routes connecting Thailand-Cambodia, Thailand-Myanmar, Thailand-Vietnam, and Vietnam-Cambodia fall into disuse. These routes seem to be substituted for by land traffic on MIEC.

Table 5: Air Routes Most Affected by MIEC (10 years after)

Air Routes			Traffic Change
Phnom Penh Intl	-	Wuxu	11.95
Wattay Intl	-	Phnom Penh Intl	4.64
Tansonnhat Intl	-	Brunei Intl	1.64
Tansonnhat Intl	-	Ninoy Aquino Intl	1.24
Suvarnabhumi Intl	-	Kuala Lumpur Intl	1.07
Suvarnabhumi Intl	-	Penang Intl	0.00
Suvarnabhumi Intl	-	Phnom Penh Intl	0.00
Suvarnabhumi Intl	-	Siem Reap	0.00
Suvarnabhumi Intl	-	Yangon Intl	0.00
Tansonnhat Intl	-	Phnom Penh Intl	0.00
Tansonnhat Intl	-	Siem Reap	0.00
Tansonnhat Intl	-	Suvarnabhumi Intl	0.00

Figures 21 and 22 graphically show the sea and air routes affected by MIEC.

Figure 21: Sea Routes Most Affected by MIEC (2020)

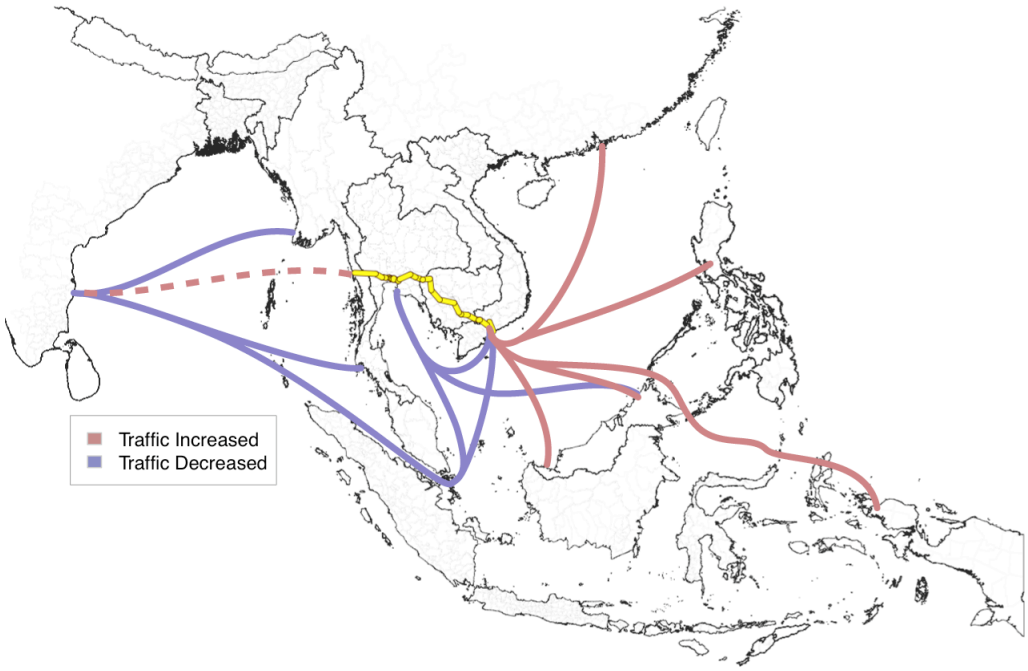
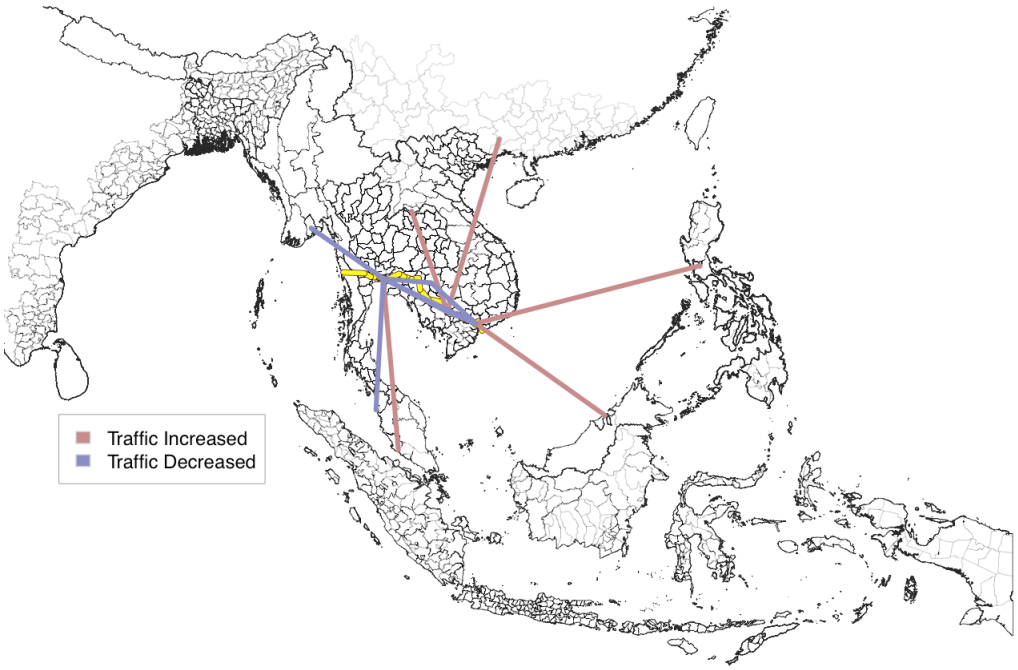


Figure 22: Air Routes Most Affected by MIEC (2020)



Modal Shift

Figures 23-1 and 23-2 propose an example of the modal shift by MIEC. The route between Chennai and Phnom Penh used by the textile and garments sector under the baseline scenario is as follows: sea route between Chennai to Ho Chi Minh, then land route between Ho Chi Minh and Phnom Penh. With the development of MIEC, it changes as follows: sea route between Chennai to Dawei, then land route between Dawei and Ho Chi Minh along MIEC.

Figure 23-1: Route and Mode between Chennai and Phnom Penh (Textile & Garments); Baseline

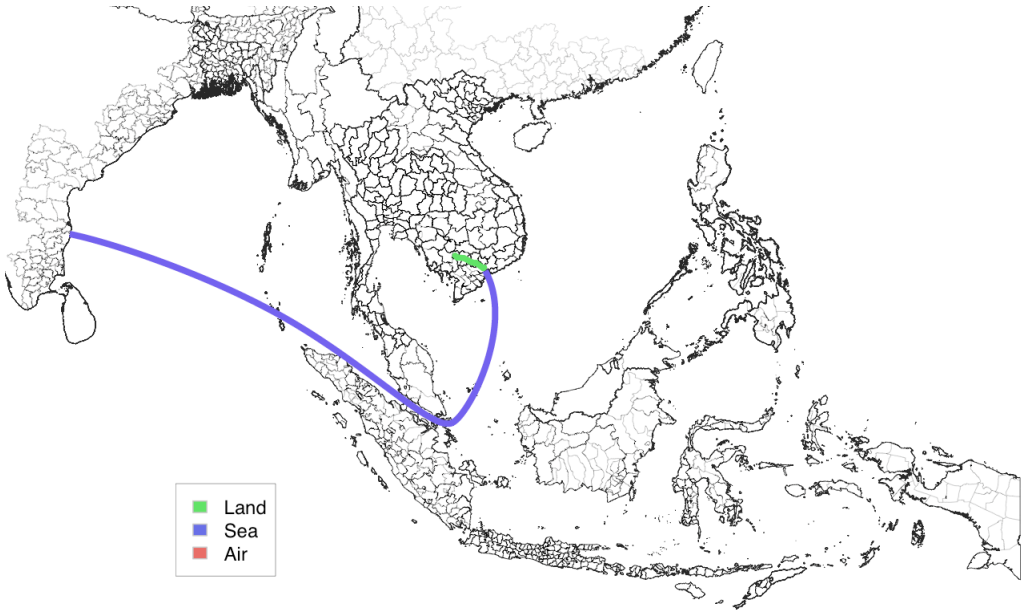
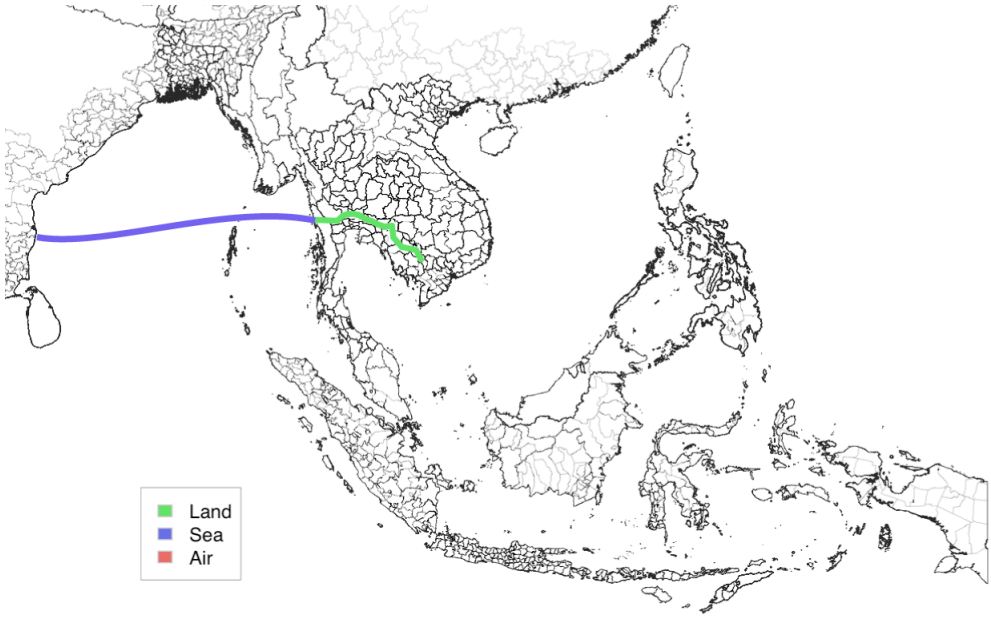


Figure 23-2: Route and Mode between Chennai and Phnom Penh (Textile & Garments); MIEC



6.4 NSEC

Scenario

We checked the effects of customs facilitation along the North-South Economic Corridor (NSEC). Specifically, the overhead time consumed at five borders, i.e., Mohan-Boten, Tachilek-Mae Sai, Chiang Khong-Houayxay, Hekou-Lao Cai, and Mongla-Daluo, is reduced to two hours. The money costs going though these borders are reduced to one-fifth of the baseline scenario. In addition to that, the quality of the road in Myanmar along NSEC is upgraded to the same level as the other NSEC routes.

Economic Effects

The economic effects of NSEC are depicted in Figure 24. The figure shows the

cumulative difference in the regional GDP under the NSEC scenario against the GDP under the baseline scenario after 10 years. Generally, the regions along NSEC gain higher GDP. However, strong economic effects like cumulative GDP gains of over 50% are concentrated in the regions near the borders of China, Myanmar, and Lao PDR. On the other hand, the economic effects for southern Thailand are limited.

Figure 24: Gains in Regional GDP: NSEC vs. Baseline (10 years cumulative)

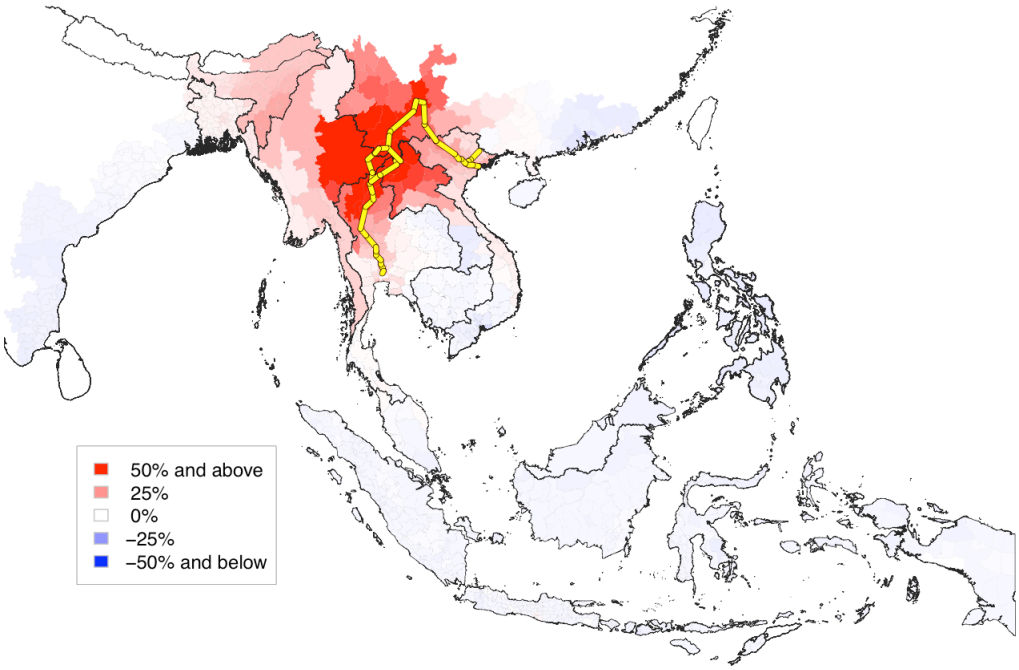
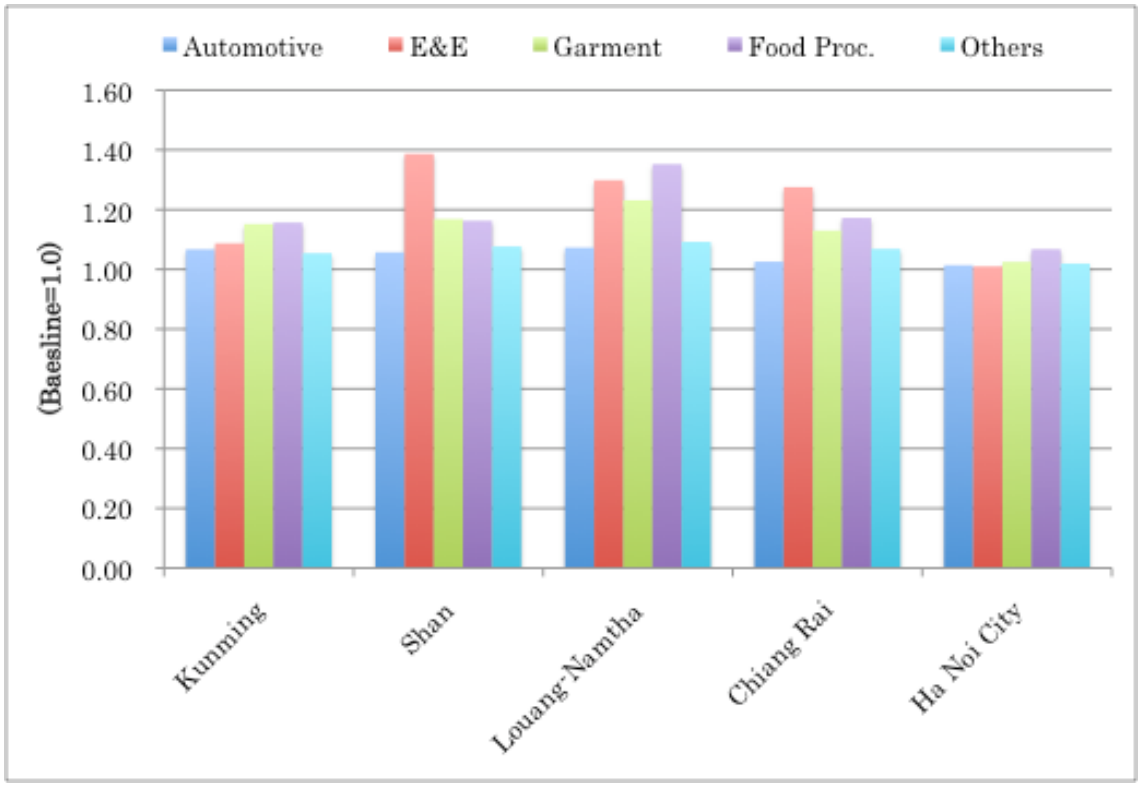


Figure 25 deconstructs the economic effects by industry for five cities along NSEC. The E&E, garment and food processing sectors seem to benefit relatively well.

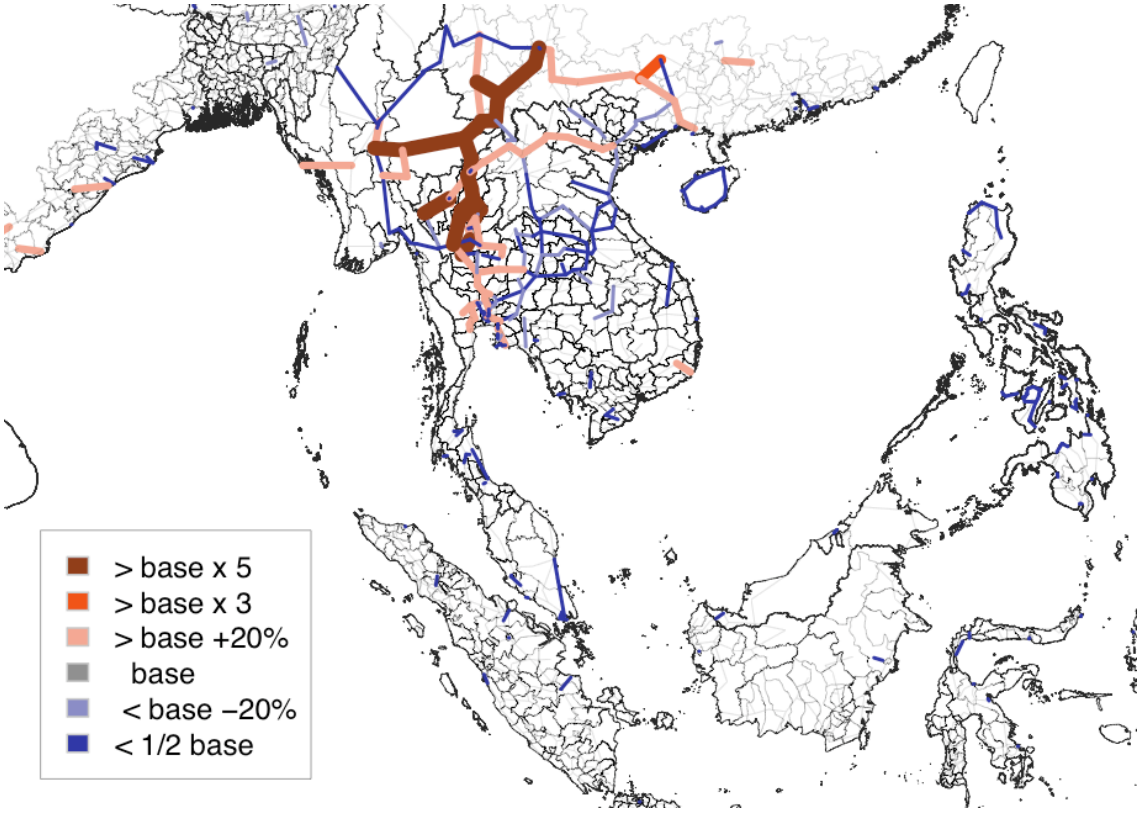
Figure 25: Ecomic Effects of NSEC by Industry (10 years after)



Traffic Volume

Figure 26 shows the changes in traffic volume brought about by the development of NSEC. It indicates that the traffic between the northern and southern regions passing through northern Lao PDR to eastern Thailand shifts to the Myanmar route of NSEC. In addition, the traffic from Yunnan Province of China to the Mandalay region of Myanmar significantly increases. Note that this scenario is based on the assumption that the Myanmar route and Lao PDR route of NSEC are equally developed.

Figure 26: Changes in Traffic Volume NSEC vs. Baseline (10 years after)



The development of NSEC affects sea and air traffic. Table 6 shows that there is no drastic modal shift from sea to land, unlike that caused by the development of EWEC. However, the traffic volume between Port Madras and Port Sittwe increases 1.6 times. This shows that some traffic between India and ASEAN shifts to Port Sittwe and flows into NSEC through Mandalay. The sea route between Leam Chabang and Hong Kong decreases more than 20%, meaning that some sea traffic between Thailand and China flows into NSEC. Table 7 shows that some air route with Wujiaba (Kunmin) and Chaing Mai fall into disuse. It is understood that this air route is substituted for by NSEC. On the other hand, the traffic volume of some air routes between Noibai (Hanoi)

and other cities increases. This can be understood to mean that some of the traffic that once passed through Kunming diverges to Noibai airport.

Table 6: Sea Routes Most Affected by NSEC (2020)

Sea Route			Traffic Change
Port Madras	-	Port Sittwe	1.63
Port Saigon	-	Port Kota Kinabalu	1.14
Port Madras	-	Port Bassein	1.12
Port Jakarta	-	Port Laem Chabang	1.08
Port Laem Chabang	-	Port Singapore	1.06
Port Madras	-	Port Laem Chabang	0.93
Port Kota Kinabalu	-	Port Hong Kong	0.92
Port Jakarta	-	Port Saigon	0.90
Port Saigon	-	Port Madras	0.88
Port Laem Chabang	-	Port Hong Kong	0.77

Table 7: Air Routes Most Affected by NSEC (2020)

Air Routes			Traffic Change
Noibai Intl	-	Changi Intl	1.72
Noibai Intl	-	Siem Reap	1.70
Noibai Intl	-	Kuala Lumpur Intl	1.12
Tansonnhat Intl	-	Noibai Intl	1.09
Suvarnabhumi Intl	-	Changi Intl	1.04
Hong Kong Intl	-	Wujiaba	0.00
Wattay Intl	-	Wujiaba	0.00
Changi Intl	-	Wujiaba	0.00
Suvarnabhumi Intl	-	Luang Phabang Intl	0.00
Suvarnabhumi Intl	-	Wujiaba	0.00
Chiang Mai Intl	-	Changi Intl	0.00
Chiang Mai Intl	-	Kuala Lumpur Intl	0.00
Noibai Intl	-	Wujiaba	0.00

Figures 27 and 28 graphically show the sea and air routes affected by NSEC.

Figure 27: Sea Routes Most Affected by NSEC (2020)

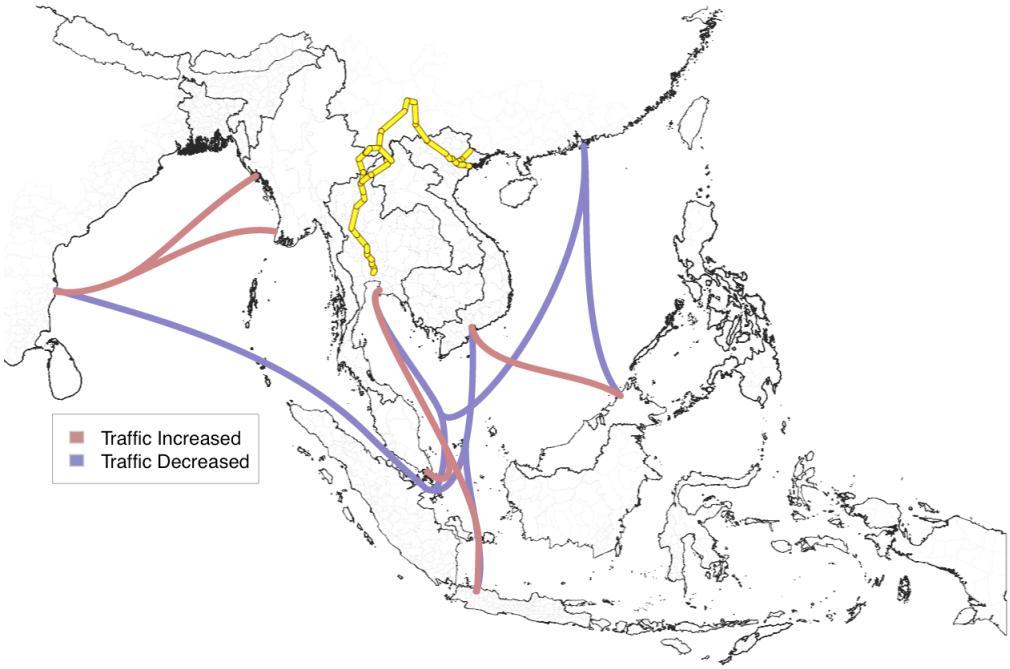
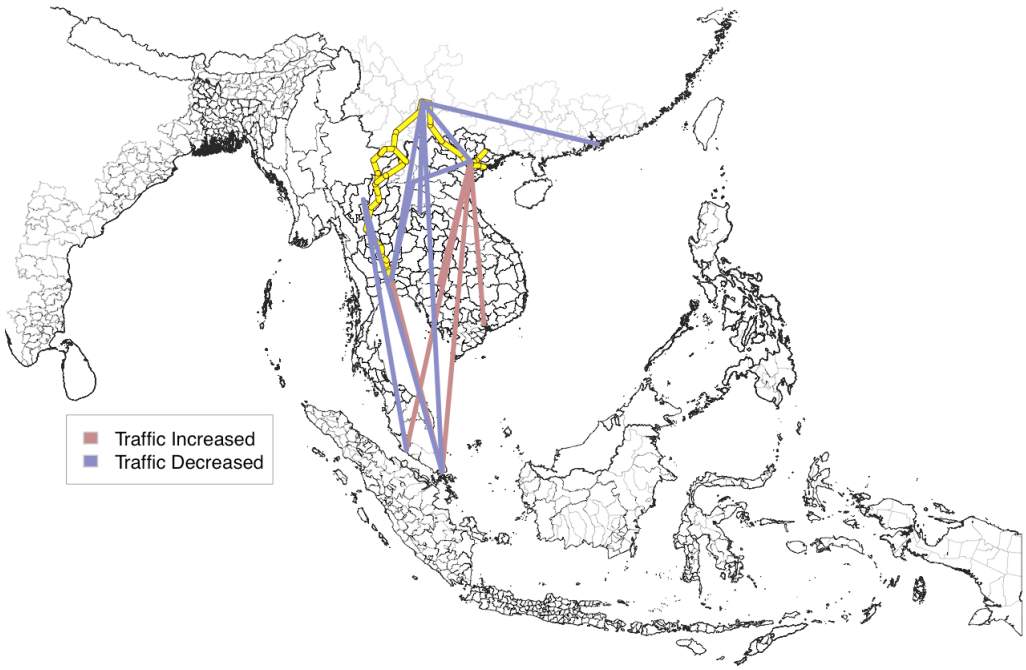


Figure 28: Air Routes Most Affected by NSEC (2020)



Modal Shift

Figures 29-1 and 29-2 propose an example of the modal shift by NSEC. The route between Kuala Lumpur and Kunming used by the food processing sector under the baseline scenario is as follows: land route between Kuala Lumpur to Singapore, sea route between Singapore and Hong Kong, and finally, land route between Hong Kong and Kunming. With the development of NSEC, this route changes to land route between Kuala Lumpur and Kunming through NSEC.

Figure 29-1: Route and Mode between Kuala Lumpur and Kunming (Food Processing); Baseline

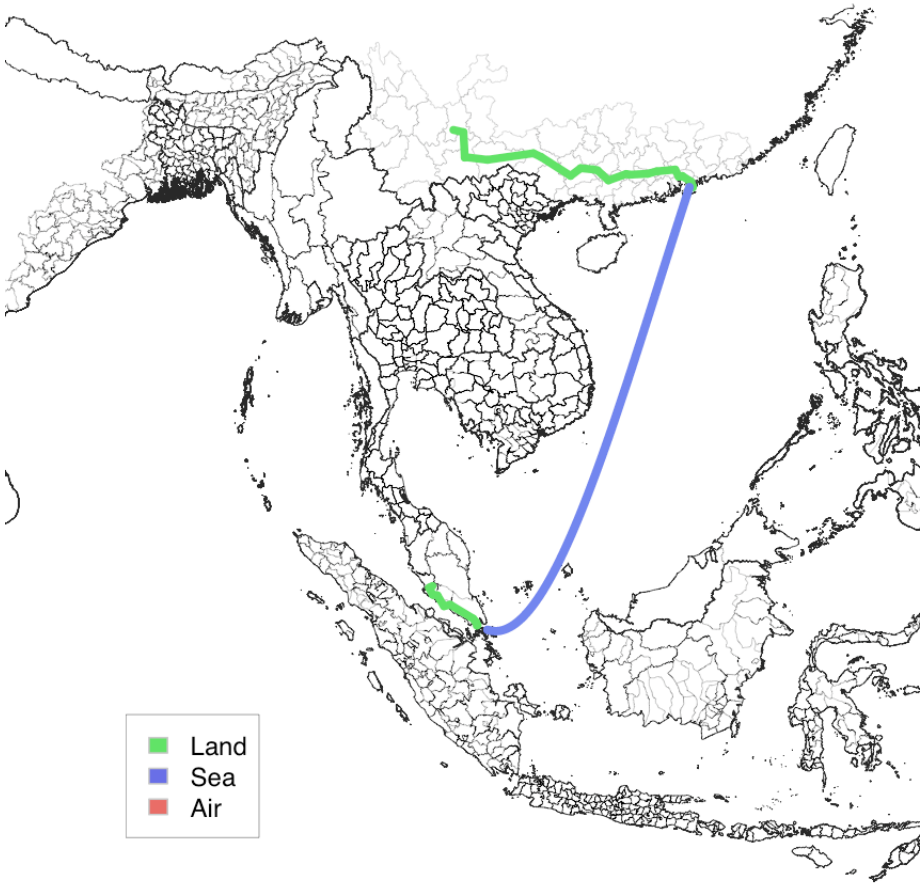
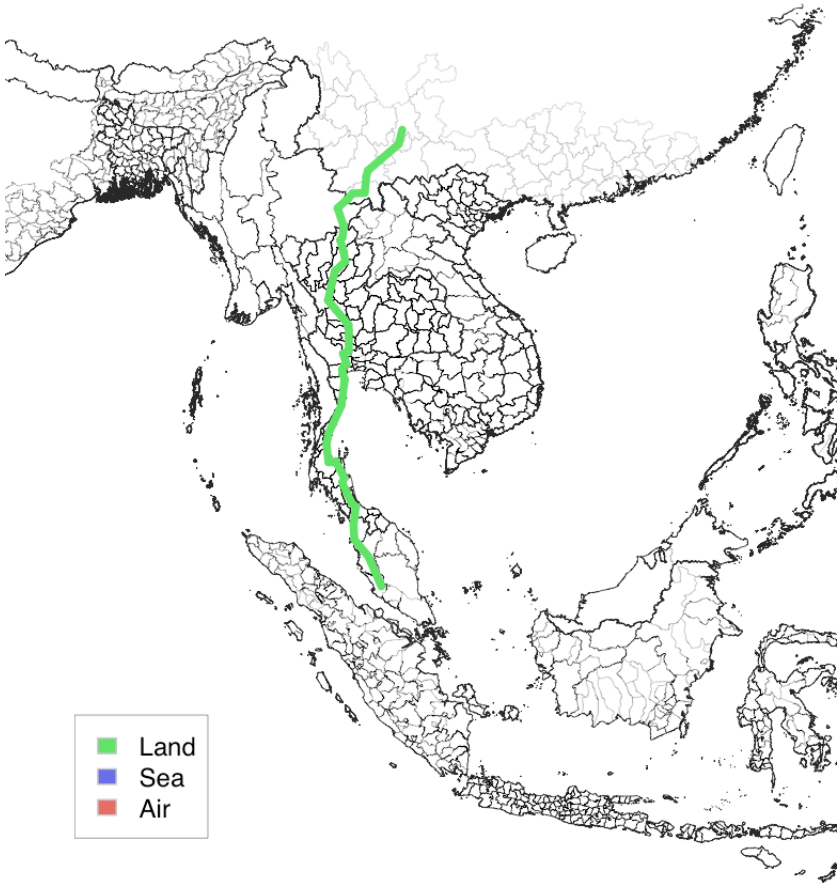


Figure 29-2: Route and Mode between Kuala Lumpur and Kunming (Food Processing); NSEC



6.5 Davao-Manado Sea Route

Scenario

Here we checked the effects of the facilitation of a sea route, Davao-Manado. The sea route between these two cities is upgraded to be on par with the routes between internationally important ports, like Singapore, Jakarta, and Manila. Specifically, the speed going through the routes increases to become twice as fast than the baseline scenario. In addition to that, overhead time spent at the port and the money costs

incurred in transshipping are reduced by half.

Economic Effects

The economic effects of the Davao-Manado sea route are depicted in Figure 30. The figure shows the cumulative difference in the regional GDP under the Davao-Manado sea route scenario against the GDP under the baseline scenario after 10 years. The result shows that the GDP in southern Philippines and Sulawesi Island of Indonesia increased.

Figure 30: Gains in Regional GDP: Davao-Manado vs. Baseline (10 years after)

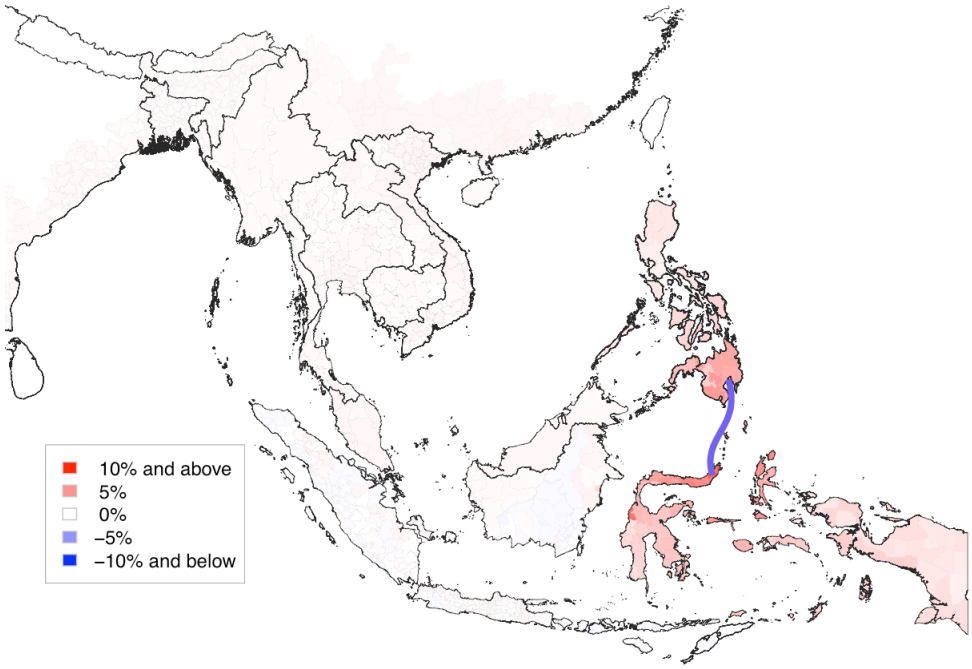
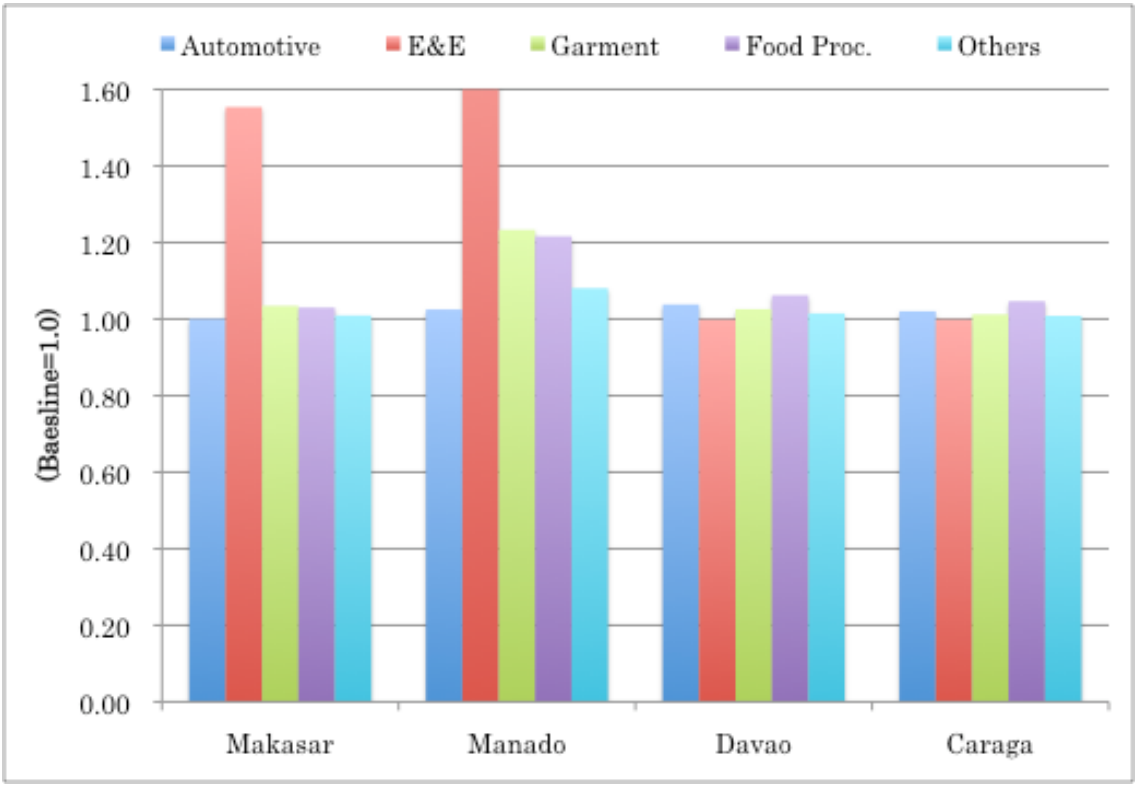


Figure 31 deconstructs the economic effects by industry for four cities near the Davao-Manado sea routes. The E&E sector in Sulawesi Island seems to benefit the most, and the Indonesian side seems to benefit more than the Philippine side.

Figure 31: Economic Effects of Davao-Manado by Industry (10 years after)



The results of additional simulations based on other scenarios are introduced in Appendix E.

7. Conclusion and Policy Recommendations

The third-generation IDE/ERIA-GSM is a cutting-edge economic model that incorporates realistic geography and modal choice. Various analyses show that the economic impacts of logistic infrastructure developments are quite complicated and differ significantly by industry. Therefore, the development should be carefully planned and, for that purpose, an analytical model like IDE/ERIA-GSM has much to