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Chapter 2

Geographical Simulation Analysis for the East-West Economic Corridor Railway

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Abstract: The economic impact of railroad development along the East-West Economic Corridor in Thailand and the neighboring countries of the Mekong region is calculated using the Geographical Simulation Model. Since the East-West Economic Corridor railway does not pass through big cities, the economic impacts are relatively small. In addition to the East-West Economic Corridor railway's Thailand section, this paper also analyses the case where the railroad is extended to Laos, Vietnam, and Myanmar, the case where the high-speed railroad is additionally constructed along the corridor, and the case where development near the railway stations is implemented at the same time.

Keywords: Simulation, East-West Economic Corridor, Railway
JEL Classification: O53; R13; R40

Introduction

This paper utilises the Institute of Developing Economies-Geographical Simulation Model (IDE-GSM) to estimate the economic impact when the railroad starts operating along the East-West Economic Corridor (EWEC). This paper is based on the preliminary simulation result from November 2018. The East-West Economic Corridor is one of the three major economic corridors in the Greater Mekong Sub-region, connecting Da Nang, Vietnam, through Laos and Thailand, to Mawlamyine, Myanmar.

The IDE-GSM can estimate the economic impact at the province level when the infrastructure connecting the regions is improved. As of November 2018, the IDE-GSM covers 22 countries and economies (hereafter countries) in East Asia; Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Hong Kong, India, Indonesia, Japan, Korea, Laos, Macao, Malaysia, Mongolia, Myanmar, Nepal, the Philippines, Singapore, Sri Lanka, Taiwan, Thailand, and Vietnam.

These 22 countries are divided into 1,846 regions. In addition, the province level data of 1,112 regions in total is also used for 88 countries outside East Asia. For another 59 countries, we utilize the country level data. As a result, the model covers 3,017 regions in 169 countries. In this paper, we focus on Thailand and its neighboring countries at the provincial level. For this paper, we consider the transport mode (cargo or passenger), frequency, opening year, section, location of the stations, new/improved (double track)

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facilities, etc. Other domestic railway projects in Thailand are also incorporated into the scenario, and we compare (1) A case where no project is implemented (baseline scenario A), (2) A case with only a Thai domestic railway project (baseline scenario B), and (3) A case with the EWEC railroad section and other Thai domestic rail projects. We compare these three scenarios by 2030, and calculate the economic impact.

With regard to EWEC, some analyses by the IDE-GSM have already been conducted (e.g., ERIA 2010, 2015). In these analyses, improvement of roads and reduction of time and cost at the borders are assumed within the model, and we see how the economic activity changes. The conclusions obtained are as follows. First, the economic impact will be relatively small compared to the North-South Economic Corridor, or the Mekong-India Economic Corridor. This is because the North-South Economic Corridor connects the large economic clusters of Bangkok, Kunming and Hanoi, and the Mekong-India Economic Corridor connects the big cities of Ho Chi Minh City, Phnom Penh, Bangkok, and Chennai; whereas along the EWEC there are no large economic clusters comparable to these two other corridors. Second, although the economic impact is small, improvement of the EWEC will increase land transport between Bangkok and Yangon, and between Bangkok and Hanoi. For this reason, when the condition of the East-West Economic Corridor is improved, many trucks in the model will run along the East-West Economic Corridor between Mukdahan and Dong Ha, and between Tak and Hpa An.

The features of this paper are as follows. First, we analyse the EWEC railway for the first time with the IDE-GSM. Secondly, we assume other railway projects are ongoing and being planned in Thailand as the scenario. Third, we set up three additional scenarios, i.e., the case when extending the EWEC railway to Laos, Vietnam, and Myanmar, the case of adding a high-speed railway (HSR) service to the EWEC railway, and the case when promoting transit oriented development (TOD) in the provinces along the EWEC railway route. By conducting these additional scenarios ahead of the detailed feasibility studies, the policy makers and experts can obtain clues to know what kind of economic impact can be expected and what kind of problems could arise.

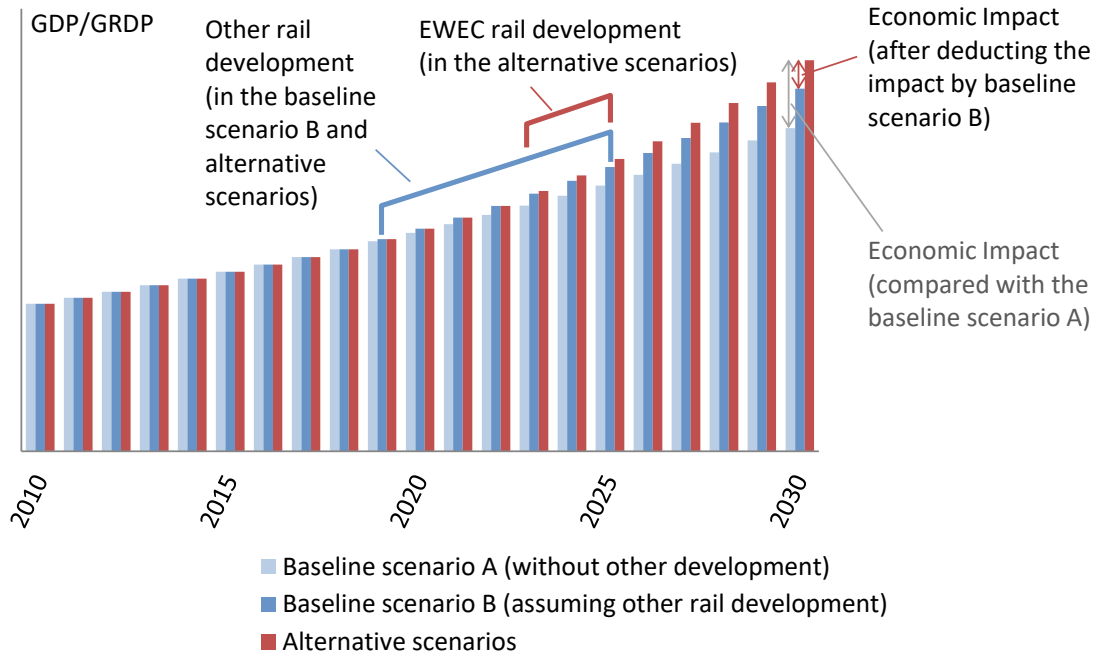
The structure of this paper is as follows. Section 2 summarizes the important assumptions arising from the settings of the IDE-GSM; Section 3 sets the scenarios; Section 4 argues the scenarios with railway projects in Thailand other than the EWEC railway; Section 5 discusses the results and interpretation of the EWEC railway; Section 6 introduces scenarios with additional development on top of the EWEC railway; Section 7 discusses the impact on Cambodia, Laos, Myanmar, and Vietnam; and the final section is the conclusion.

2. Assumptions in the scenario

The image of the economic impact is shown in Figure 2-1. In this paper, we set two baseline scenarios; baseline scenario A is that no additional railway projects will be conducted, and baseline scenario B is that additional railway projects will be conducted from 2019 to 2022, except for the EWEC railway projects. On top of that, we add an additional project for the railway along the EWEC as an alternative scenario, and compare the GDP or regional GDP (gross regional domestic product: GRDP) with the baseline A and B scenarios. The economic impact is indicated by the difference between the alternative scenario of 2030 and each baseline scenario. Depending on the scenario, a negative economic impact may emerge in some regions, which means that it can be a

lower GRDP than the 2030 GRDP in the baseline scenario, and it does not necessarily mean that it will make the GRDP to be lower than the current GRDP.

Figure 2-1: Image of the economic impact



Source: Author.

How does improvement of the transportation infrastructure in the model lead to changes in GDP and GRDP? The model covers firms and households. Improvement of infrastructure reduces the cost for firms by reducing transport costs in a broad sense. Firms in that region will increase sales and profits. This leads to an increase in the wages of the workers, and since workers are also consumers, their consumption will increased through the increased wages. Some firms and households will move to regions which offer higher revenues and wages. In addition, reducing transport costs means that consumers will purchase more products and services from other regions, reduce consumption of domestic products, and increase real wages through more balanced consumption among varieties. Relocation of firms and households to more advantageous regions means that more sales and profits are expected for firms located there, and there will be a ripple effect. Through these behavioral changes, GDP and GRDP will change in the relevant country and region.

The framework of the simulation in the analysis in this paper is given by Kumagai et al (2013), but the important settings influencing the interpretation of the results are summarised as follows.

First, in the model, the provision and improvement of the infrastructure is assumed that the time of a certain section is exogenously reduced. Therefore, this model does not take into account the cost of construction. The economic impact should be evaluated in combination with another analysis/survey estimating the construction costs. Also, with this assumption, even if the infrastructure is built with domestic capital, or even if another country constructs the infrastructure, the assumptions and the results do not change.

Second, since the economic impact is indicated by an increase in GDP by the change

through the economic activities mentioned above, careful consideration should be given regarding whether a direct comparison with the construction costs is appropriate. It is recommended to apply another model to estimate a railway company's revenue and the government's tax revenue.

Third, unless stated explicitly, additional productivity improvement due to the railway is not assumed. Since the manufacturing industry utilises intermediate goods in the model, the reduction of transport costs leads to cheaper intermediate goods from other regions, and as a result productivity will increase through this mechanism. On the other hand, other additional productivity gains are not assumed, except for Scenario 6.

3. Scenarios and the overall impact on Thailand

We have set eight scenarios as follows.

Scenario 1 (Baseline scenario B)

- Thanon Chira-Khon Kaen railway section is improved to double-track in 2019.
- Lopburi-Nakhon Sawan railway section is improved to double-track in 2021.
- Nakhon Pathom-Chumphon railway section is improved to double-track in 2021.
- Thanon Chira-Ubon Ratchathani railway section is improved to double-track in 2021.
- Hat Yai-Padang Besar railway section is improved to double-track in 2021.
- Kaeng Khoi-Thanon Chira railway section is improved to double-track in 2022.
- Nakhon Sawan-Den Chai railway section is improved to double-track in 2022.
- Khon Kaen-Nong Khai railway section is improved to double-track in 2022.
- Chumphon-Hat Yai railway section is improved to double-track in 2022.
- Den Chai-Chaing Mai railway section is improved to double-track in 2022.
- HSR Bang Sue-Nakhon Ratchasima starts operating in 2022.
- HSR Bang Sue-Hua Hin starts operating in 2022.
- HSR Don Mueang-U Tapao Airport starts operating in 2024.
- HSR Bang Sue-Phitsanulok starts operating in 2025.

Scenario 2 (Western section of EWEC railway)

- Developments stated in the baseline scenario B are implemented.
- New line between Nakhon Sawan and Mae Sot starts operating in 2025.

Scenario 3 (Central section of EWEC railway)

- Developments stated in the baseline scenario B are implemented.
- New line between Hua Wai and Lam Narai starts operating in 2025.
- Lam Narai-Bua Yai railway section is improved to double-track in 2025.

Scenario 4 (Eastern section of EWEC railway)

- Developments stated in the baseline scenario B are implemented.
- New line between Ban Phai and Nakhon Phanom starts operating in 2023.

Scenario 5 (EWEC railway, Scenario 2+3+4)

- Developments stated in Scenarios 2, 3, and 4, as well as the baseline scenario B, are implemented.

Scenario 6 (Extending the EWEC railway to Dong Ha and Mawlamyine)

- Developments stated in Scenario 5, as well as the baseline scenario B, are implemented.
- New line between Mukdahan and Dong Ha, Vietnam starts operating in 2025.
- New line between Mae Sot and Mawlamyine, Myanmar starts operating in 2025.

Scenario 7 (Adding the EWEC HSR)

- Developments stated in Scenario 5, as well as the baseline scenario B, are implemented.
- HSR Mae Sot-Nakhon Phanom starts operating in 2025.

Scenario 8 (Adding transit oriented development along the EWEC)

- Developments stated in Scenario 5, as well as the baseline scenario B, are implemented.
- We increase the productivity parameters of the service sector by 3% in 2025 in Tak, Kampaeng Phet, Nakhon Sawan, Lopburi, Chaiyaphum, Maha Sarakham, Roi Et, Mukdahan, and Nakhon Phanom provinces by considering service oriented TOD. Increase the productivity parameters of the manufacturing sector by 3% in 2025 in Tak, Phitsanulok, Khon Kaen, Mukdahan, and Nakhon Phanom provinces by considering manufacturing related special economic zones/industrial parks.

The overall economic impact on Thailand by each scenario is listed as Table 2-1. Since scenarios 2 to 8 include the improvements in scenario 1 (baseline scenario B), they generate a greater economic impact than in scenario 1. Subtracting the economic impact by scenario 1, scenario 7, which has added the HSR to the EWEC railway, achieves the greatest impact (0.055%). Subsequently, the economic impact of scenario 8 assumes the transit oriented development in the provinces along the EWEC railway in addition to the EWEC railway is higher (0.046%).

Table 2-1: Overall economic impact on Thailand by scenario (2030)

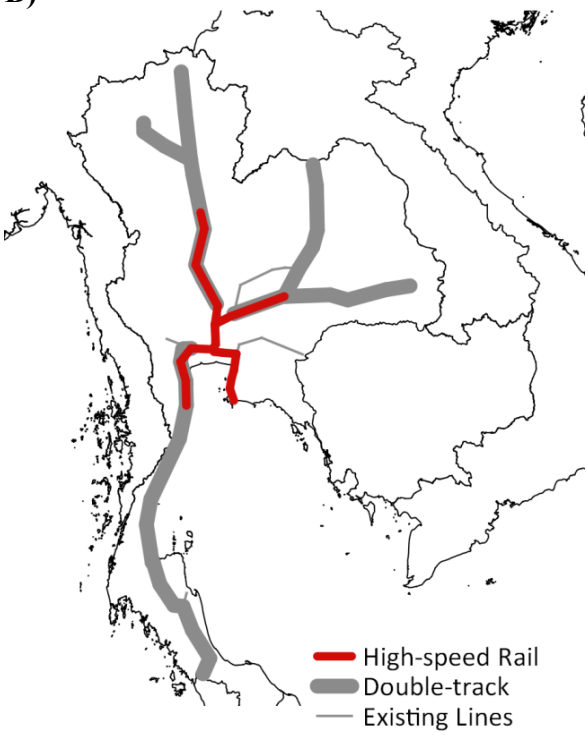
	Economic impact (compared with baseline scenario A)		Economic impact (after deducting economic impact by baseline scenario B)	
Scenarios	%	Value (million USD)	%	Value (million USD)
1 Baseline B	0.613	3,679		
2	0.615	3,689	0.002	9.6
3	0.613	3,679	0.000	0.2
4	0.614	3,685	0.001	6.2
5	0.616	3,695	0.003	16.0
6	0.619	3,715	0.006	35.9
7	0.669	4,010	0.055	330.6
8	0.659	3,955	0.046	275.7

Source: IDE-GSM simulation result.

4. Other railway projects in Thailand (Scenario 1-Baseline scenario B)

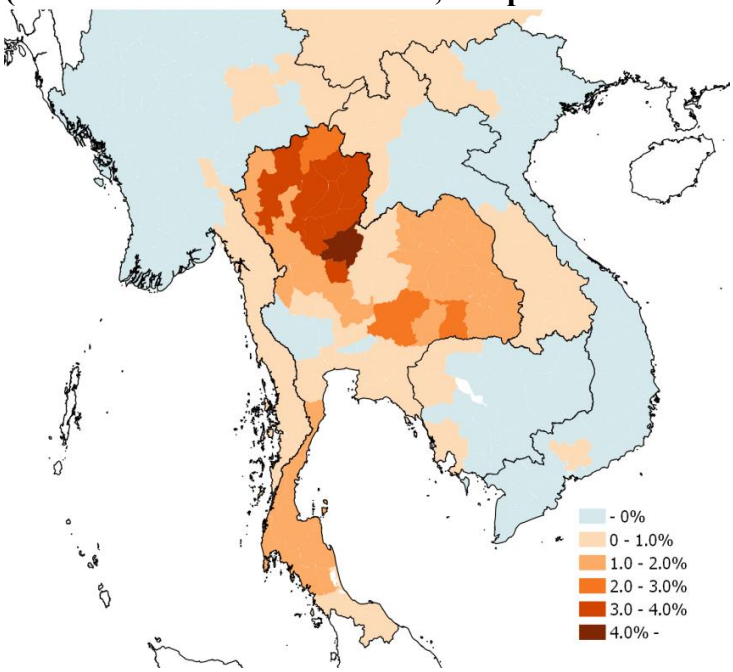
In this section we see how the economic impact of each scenario emerges in each province. Scenario 1 assumes extensive double tracking and opening of the HSR service (Figure 2-2). Top gaining provinces are Phitsanulok (4.04%), Phichit (3.91%) and Phrae (3.90%), and many northern provinces of Thailand will benefit from the scenario thanks to the HSR service to Phitsanulok (Figure 3).

Figure 2-2: Scenario map for other railway projects (Scenario 1-Baseline scenario B)



Source: Author.

Figure 2-3: Economic impact of other railway projects
(Scenario 1-Baseline scenario B, compared with baseline scenario A, 2030)

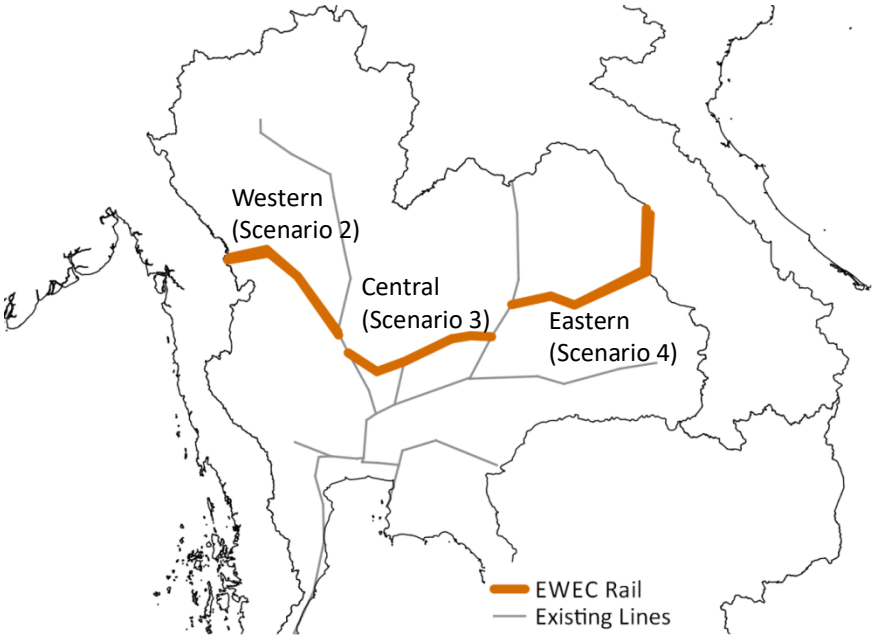


Source: IDE-GSM simulation result.

5. EWEC railway

Compared to other scenarios, the economic impact of scenario 1-baseline scenario B is very large; therefore, these analyses show the result if the economic impact of scenario 1 is deducted. Firstly, the scenarios have been set separately for different sections of the EWEC railway (Scenarios 2 to 4). The western section runs between Mae Sot and Nakhon Sawan in scenario 2, the central section runs from Hua Wai to Bua Yai in scenario 3, and the eastern section runs between Ban Phai and Nakhon Phanom in scenario 4. Scenario 5 combines the EWEC railway in scenarios 2 to 4.

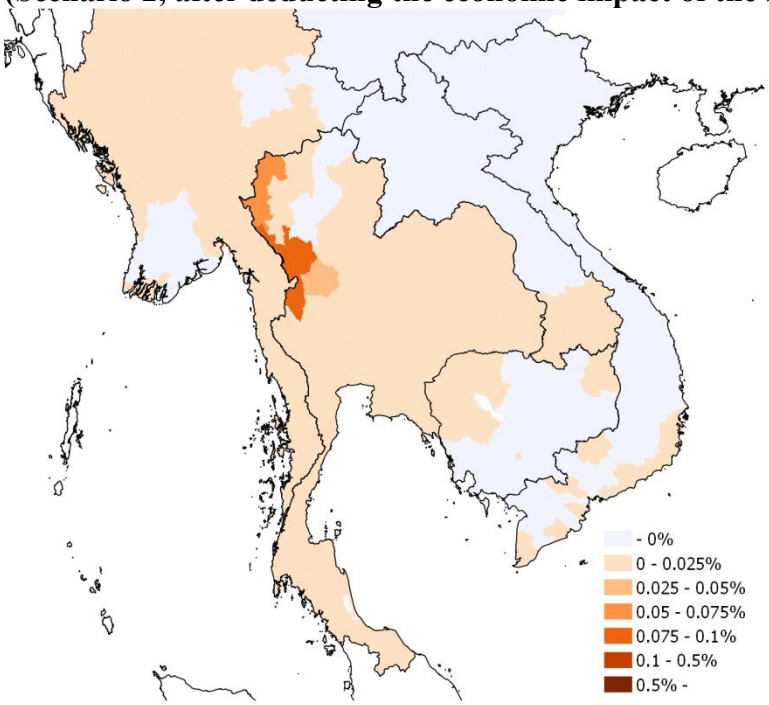
Figure 2-4: Scenario map for the EWEC railway



Source: Author.

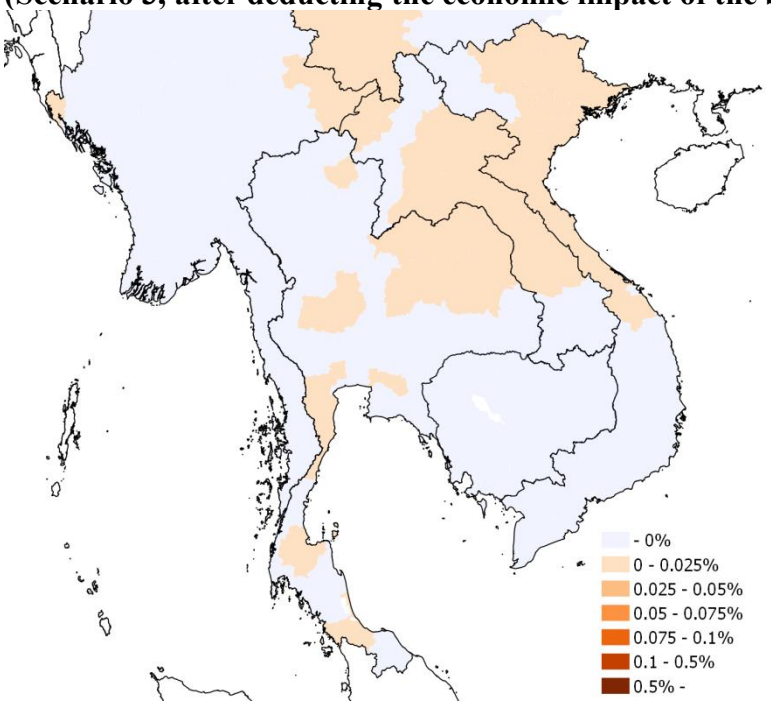
Although the economic impact of only the western section is small, it has a comparatively large economic impact for the provinces along this section and the northern provinces of the line (Figure 2-5). Top gainers in scenario 2 are Tak (0.09%), Mae Hong Son (0.06%) and Kampaeng Phet (0.05%), after deducting the economic impact of the baseline scenario B. This is because the railway in this section can be utilised for trade with Bangkok. On the other hand, the impact of the central section is smaller (Figure 2-6). In this figure many regions have a negative economic impact, but in fact this is almost negligible. The eastern section may still increase trade with Bangkok, and thus the economic impact is larger than that by the central section (Figure 2-7). Mukdahan (0.11%), and Khammouan (0.10%), and Savannakhet (0.09%) in Laos will achieve a larger positive impact from the western section.

Figure 2-5: Economic impact of the western section of the EWEC railway (Scenario 2, after deducting the economic impact of the baseline scenario B, 2030)



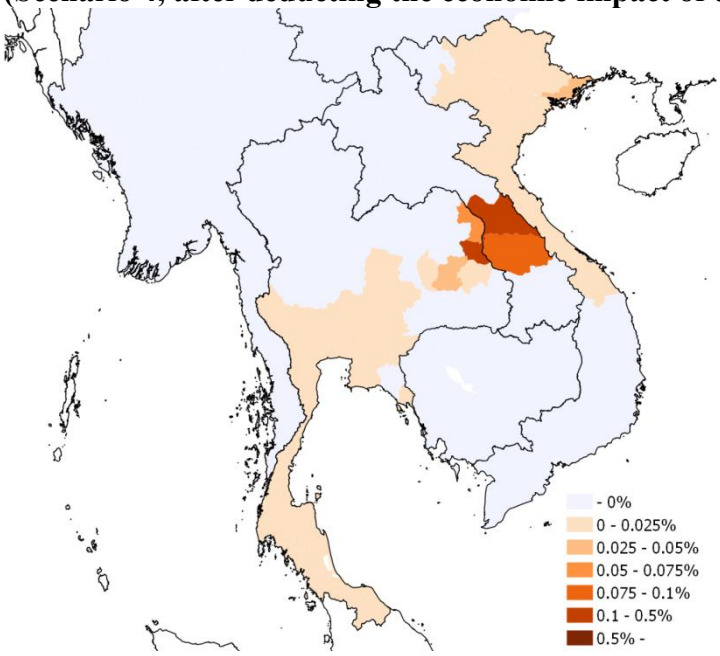
Source: IDE-GSM simulation result.

Figure 2-6: Economic impact of the central section of the EWEC railway (Scenario 3, after deducting the economic impact of the baseline scenario B, 2030)



Source: IDE-GSM simulation result.

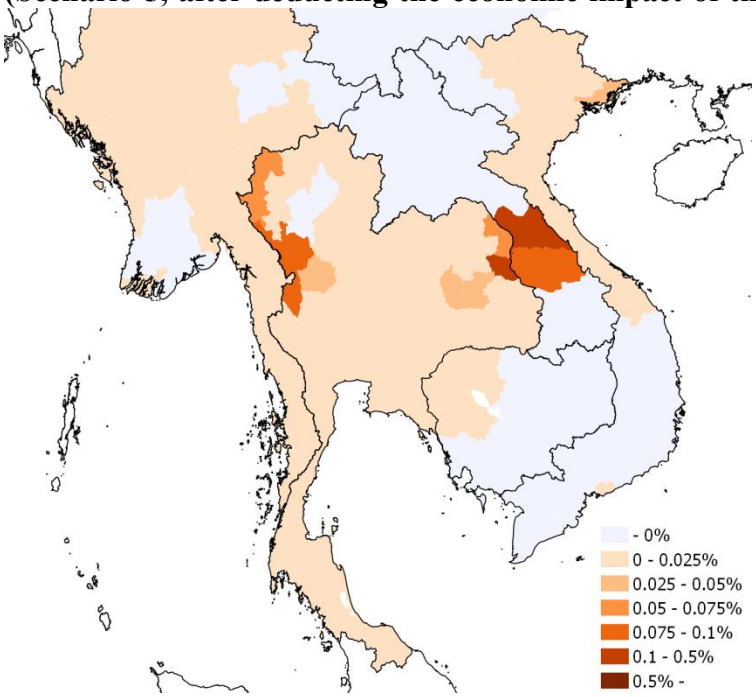
Figure 2-7: Economic impact of the eastern section of EWEC railway (Scenario 4, after deducting the economic impact of the baseline scenario B, 2030)



Source: IDE-GSM simulation result.

In scenario 5, which integrates scenarios 2 to 4, there is a relatively larger economic impact in the provinces where the trade with Bangkok is increased by the western section and the eastern section of the railway (Figure 2-8). Top gainers in scenario 5 are Mukdahan (0.11%), Khammouan (0.10%), and Savannakhet (0.10%), and they gain a larger impact than that in scenario 4 alone. The economic impact varies widely from industry to industry. In Mukdahan, the mining industry is the highest gainer at a 1.42%, and a higher economic impact is expected for food processing (0.80%), garments and textiles (0.70%), and other manufacturing industries (0.68%). Meanwhile, the service industry is unaffected, resulting in a negative economic impact of -0.01%. This is because the roads are well maintained in Thailand, so in the model road transport is mainly used for transactions by the service industry.

Figure 2-8: Economic impact of the EWEC railway
(Scenario 5, after deducting the economic impact of the baseline scenario B, 2030)



Source: IDE-GSM simulation result.

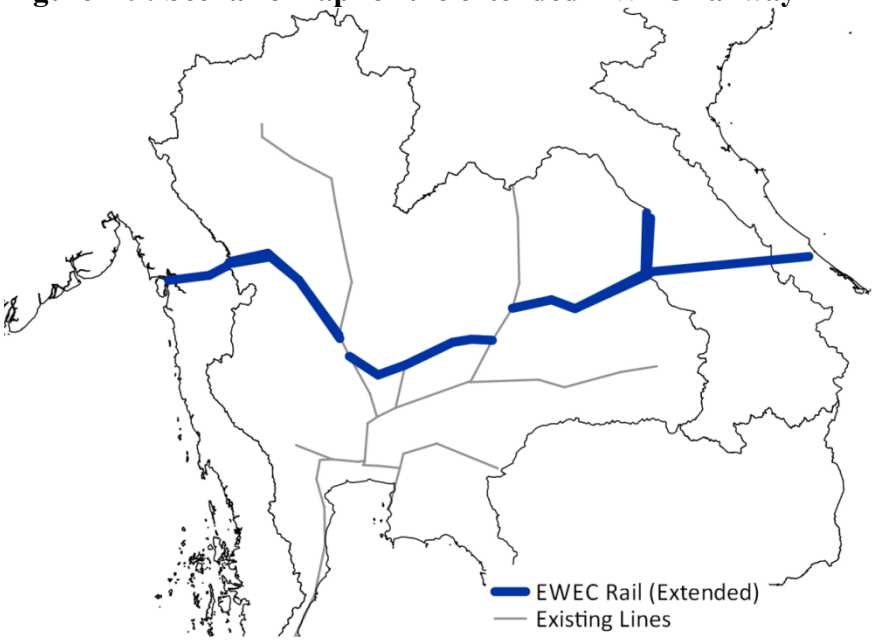
6. Development additional to the EWEC railway

While the EWEC railway will have a positive economic impact in many provinces in Thailand, the impact itself is likely to be relatively small. Although it contributes to the manufacturing industry, the economic impact on the service industry is limited; rather it helps shift workers from the service industry to the manufacturing industry. Thus, we see the economic impact of developing additional infrastructure in the development in scenario 5.

6.1. Extending the EWEC railway to Dong Ha and Mawlamyine

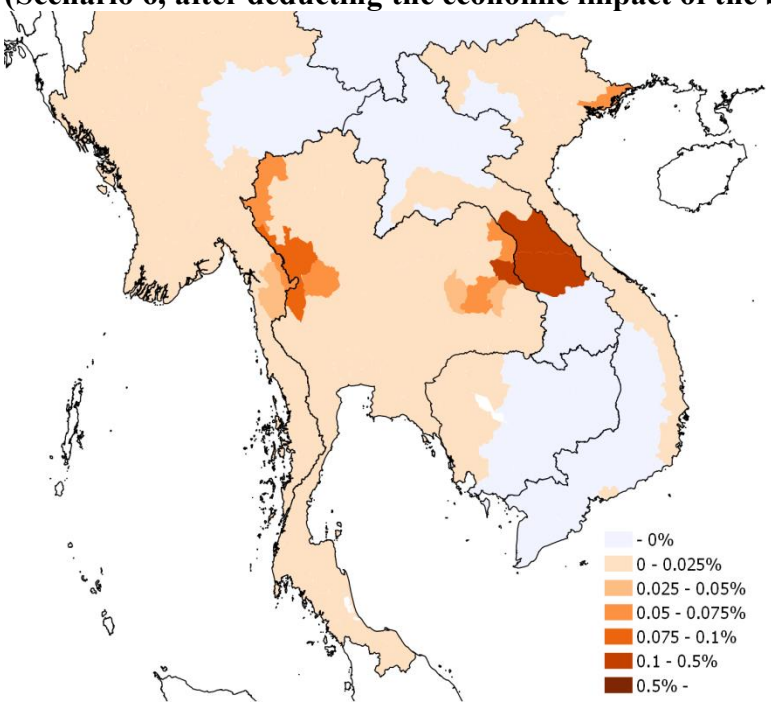
Scenario 6 extends the EWEC railway to Dong Ha in Vietnam and Mawlamyine in Myanmar (Figure 2-9). The EWEC railway branches to Nakhon Phanom and Savannakhet at Mukdahan station. At the border between Thailand and Laos, Laos and Vietnam, and Thailand and Myanmar it is assumed that the same waiting time and cost as forroad transport will apply. Frequency of the service in Laos, Vietnam, and Myanmar is assumed to be low and similar to a single line. From Dong Ha the railway connects to Hanoi and Ho Chi Minh City, and from Mawlamyine the railway connects to Yangon. The economic impact on Thailand will more than double the scenario 5 (Figure 2-10). Laos' Savannakhet (0.19%) and Khammouan (0.12%) will see a higher impact than Mukdahan (0.12%) in this scenario.

Figure 2-9: Scenario map for the extended EWEC railway



Source: Author.

Figure 2-10: Economic impact of the extended EWEC railway (Scenario 6, after deducting the economic impact of the baseline scenario B, 2030)

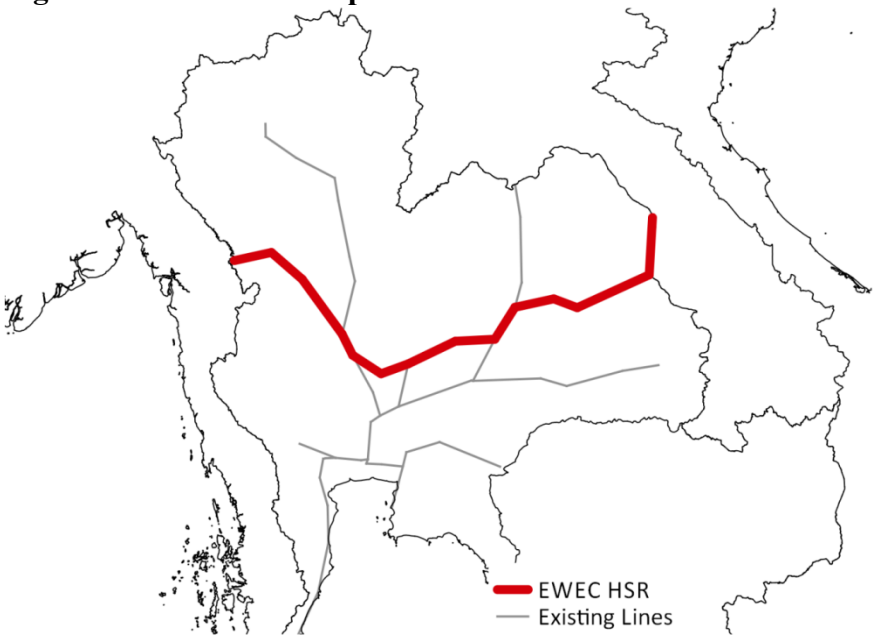


Source: IDE-GSM simulation result.

6.2. Adding the EWEC HSR

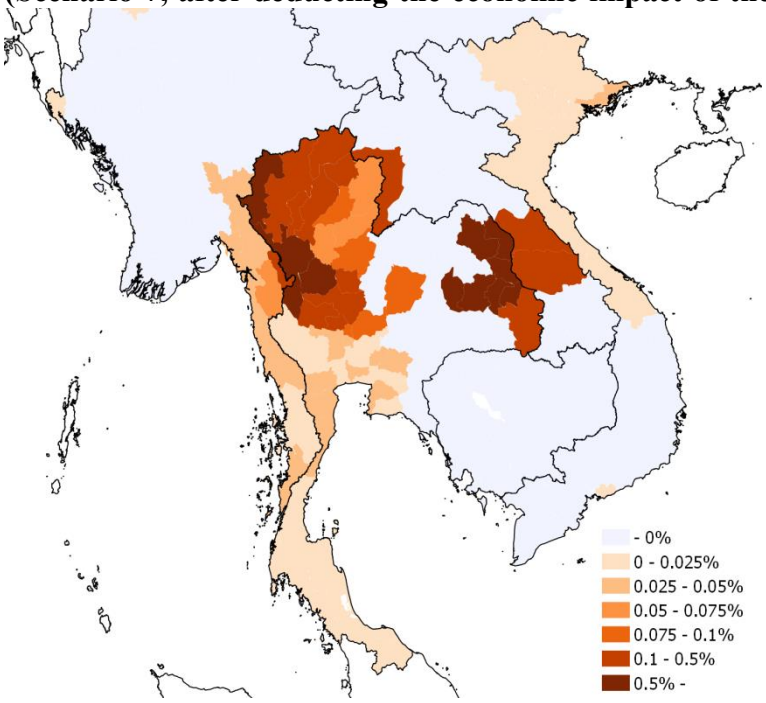
Scenario 7 views the HSR service in addition to the EWEC railway on the same route (Figure 2-11). Since the HSR service is assumed to be utilised only by passengers, it is expected that a larger economic impact will emerge in the service industry. Many northeastern provinces in Thailand will see a positive economic impact from this scenario (Figure 2-12). On the other hand, negative impact can be seen in provinces located in the center-northern region. Nakhon Phanom (6.02%), Mae Hong Son (4.74%), and Mukdahan (4.62%) will receive the largest benefit. Unlike in the previous scenarios, the service industry is the main beneficiary of the positive impact. In Nakhon Phanom, the economic impact for the service industry is 8.35%, which exceeds mining (1.35%), and other industries. Udon Thani (-0.12%), Loei (-0.10%), and Nong Khai (-0.10%) will suffer the largest negative impact.

Figure 2-11: Scenario map for the EWEC HSR service



Source: Author.

Figure 2-12: Economic impact of the EWEC HSR service and the EWEC railway (Scenario 7, after deducting the economic impact of the baseline scenario B, 2030)

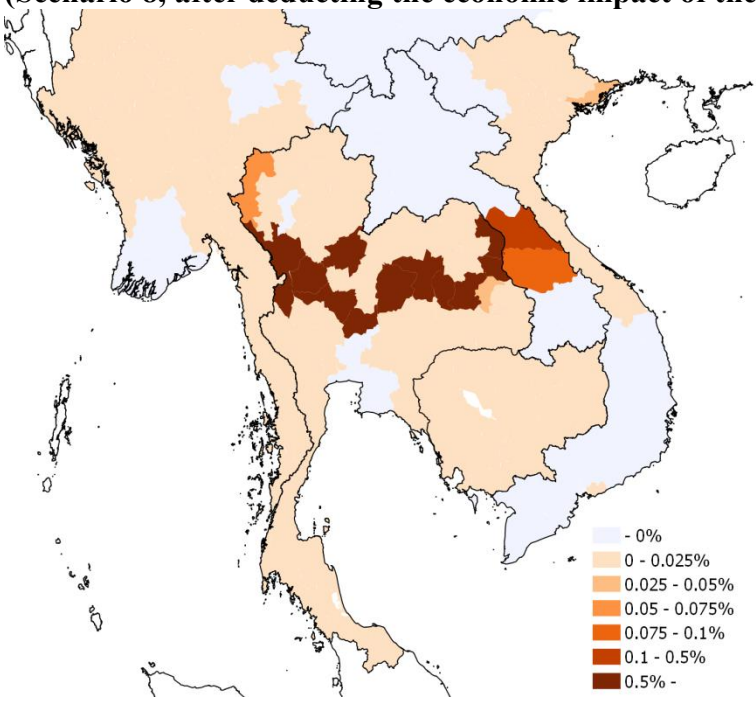


Source: IDE-GSM simulation result.

6.3. Transit oriented development along the EWEC

Scenario 8 assumes transit oriented development in the provinces along the EWEC railway route, in addition to the EWEC railway, and this will raise the productivity of the service industry. In these provinces, large positive economic impacts can be observed (Figure 2-13). Tak (3.02%), Mukdahan (2.95%), and Nakhon Phanom (2.46%) receive a large impact. In Tak, the economic impact of the service industry is 3.15%. Laos' Khammouan and Savannakhet will see 0.10% and 0.10%, respectively, which are almost the same as in scenario 5.

Figure 2-13: Economic impact of transit oriented development along the EWEC and the EWEC railway route
(Scenario 8, after deducting the economic impact of the baseline scenario B, 2030)



Source: IDE-GSM simulation result.

7. The impact on the CLMV countries

The economic impact on Cambodia, Laos, Myanmar, and Vietnam (CLMV) is summarised on Table 2-2. Different from the impact on Thailand, the CLMV countries will achieve the largest economic impact in scenario 6, as Myanmar, Laos, and Vietnam will also have an extension of the EWEC railway. Scenario 8, where Thailand has TOD development, follows. It is interesting that the HSR service scenario delivers a smaller economic impact on the CLMV countries than in scenario 8, while it is having a relatively larger negative impact on Myanmar in scenario 7, which cancels out the positive impact on Cambodia, Laos, and Vietnam.

Table 2-2: Economic Impact on the CLMV countries by scenario (2030, million USD)

	Scenarios			
	5	6	7	8
Cambodia	0.23	0.22	0.19	0.29
Laos	3.38	6.28	7.11	3.57
Myanmar	0.16	5.74	-2.90	-0.01
Vietnam	3.39	10.73	3.10	4.39
Sum of CLMV	7.17	22.97	7.49	8.24

Source: IDE-GSM simulation result.

Summary

This paper has analysed the expected impact of the EWEC railway. The conclusion is as follows. First, the economic impact of the EWEC railway alone is relatively small. This is because, like the past analyses focusing on road transport along the EWEC, the corridor does not have large cities. Meanwhile, the EWEC railway can be utilised by manufacturing trading between Bangkok and the northwest and the northeast provinces. It also benefits Khammouan and Savannakhet in Laos.

In the light of the relatively small impact of the EWEC, we have conducted three scenarios assuming additional infrastructure improvements to the EWEC railway alone. Stretching the EWEC railway not only in Thailand but also to Laos, Vietnam, and Myanmar will increase the economic impact for Thailand as well. The HSR service can be expected to deliver a large economic impact, but in reality, it is necessary to consider separately the financial burden of the construction costs and profitability of the operating body of the service. If the profit is unsatisfactory, the government must provide sufficient financial support. This should be supplemented by an analysis other than the IDE-GSM simulation. Transit oriented development mainly targeting the service industry offers a larger economic impact, but not as high as that seen in the HSR service scenario. It is important to encourage development that will contribute to the service industry, rather than just build railways, in order to increase the economic impact.

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