Appendix A: Details of the Model

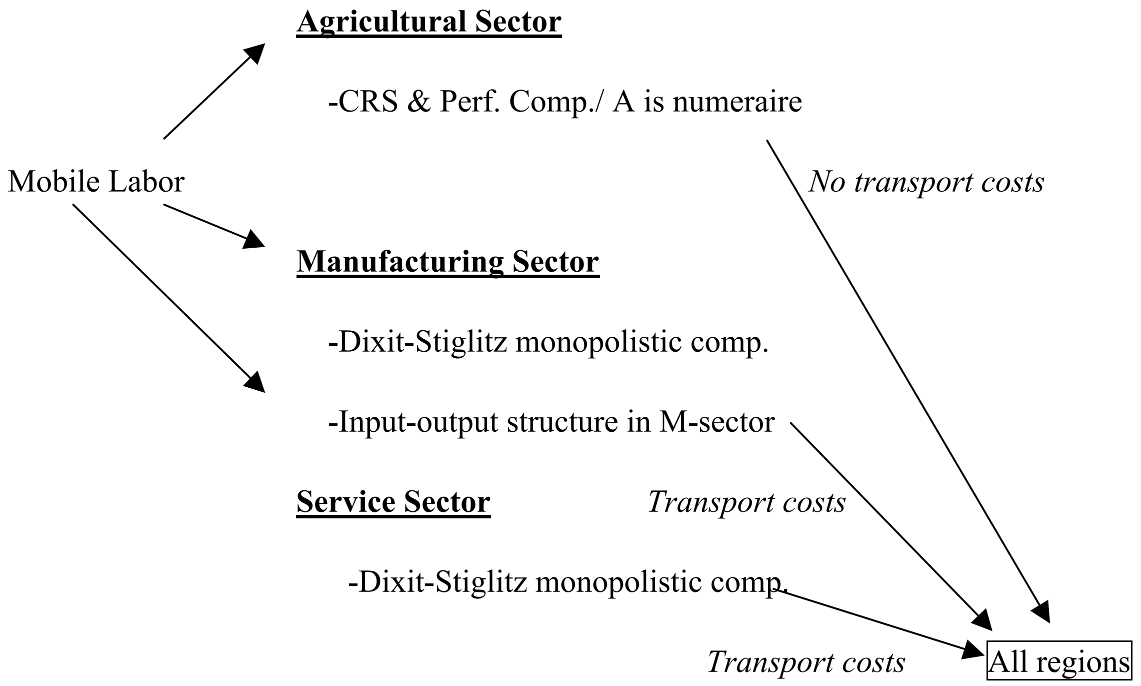
This appendix intends to provide a specific structure for the general equilibrium core-periphery model used in our simulations. The model for our simulations was built by combining the new economic geography models in Fujita, Krugman, and Venables (1999).

A1. The basic structure of our simulation model

In economies, there are 956 locations, indexed by $\boldsymbol{r}$. The basic structure of the model is shown in Fig. A1. There are two endowments: labor and arable land. Labor is mobile within a country, but immobile among countries as Fig. A1 shows. Arable lands are unequally spread in all regions and owned by all labors of a region.

Everyone in a country is assumed to share the same tastes. Preferences are described by a Cobb-Douglas function of consumption of an agricultural good, a manufactures aggregate, and a services aggregate. Consumption shares of three types of products in the budget of a household differ among countries. The manufactures aggregate is expressed by a constant elasticity of substitution (CES) function of consumption of individual manufactured goods. Likewise, the services aggregate is expressed by the other CES function of consumption of individual services. This pertains to one mass of varieties of manufactured goods and another mass of varieties of services. The expenditure share on an agricultural good is supposed to be so large that an agricultural good is produced in all locations.

Figure A1: Basic Structure of a Model in Simulation



There are three sectors: agriculture, manufacturing, and services. As Figure A1 shows, the agricultural sector produces a single and homogeneous good using a constant-returns technology under conditions of perfect competition in economies. However, manufacturing firms produce differentiated products among a mass of varieties of manufactured goods using an increasing-returns technology under conditions of monopolistic competition. Similarly, differentiated services among the other mass of varieties of services are produced using an increasing-returns technology under conditions of monopolistic competition. The economies of scale arise at the level of variety; there are no economies of scope or of multiplant operations. Since each firm produces or serves one variety, the spread of varieties affects the available size of inputs in each region. Inputs for agricultural products are labor and arable land, inputs for manufactured goods are labor and manufactures aggregate, and input for services consist only of labor. That is, manufacturing firms use input-output structures, but services do not have such structures. Manufactured intermediaries are procured from all manufacturing firms. As for labor, the sectors do not have sector-specific labor; thus, labor moves to the sectors that offer higher nominal wage rates in a region.

All products in three sectors are tradable. Transport costs for an agricultural good are supposed to be costless. Note that the price of an agricultural good is chosen as the numeraire, so the price of the good is one in the economies. Transport costs on manufactured goods and services are supposed to be of the iceberg type. That is, if one unit of product is sent from a location to another location, only some portion of the unit arrives. Depending on the lost portion, the supplier sets a higher price. The increase in price in comparison with the mill price is regarded as transport cost. Transport costs within a region are supposed to be negligible.

A2. The specification of our simulation model

Our simulation model is used to decide twelve values of the following regional variables: nominal wage rates in three sectors; land rent; regional income; regional expenditure on manufactured goods; price index of manufactured goods and of services; average real wage rates in three sectors; population share of a location in a country; and population shares of a sector in three industries within one location. The dynamics of labors are decided by three differential equations. We start from the specification of equation which decides each variable under a given distribution of labors and then move to the dynamics of labor selection working within a sector in a place.

Nominal wage rates in the agricultural sector is derived from cost minimization in the agricultural sector subject to the production function for the agricultural sector

$$f_A(r) = A_A(r)L_A(r)^{\alpha} F(r)^{1-\alpha}, \tag{A.1}$$

where $A_A(r)$ is the efficiency of production at location *r*; $L_A(r)$ represents the labor inputs of the agricultural sector at location *r*; and $F(r)$ is the area of arable land at location *r*. Since the price of an agricultural good is one in all locations, nominal wage rates in the agricultural sector in location *r*, which is expressed as $w_A(r)$, are the value of the marginal product for labor input as follows:

$$w_A(r) = A_A(r)\alpha\left(\frac{F(r)}{L_A(r)}\right)^{1-\alpha} \tag{A.2}$$

When used with the production amount, land rent is not used explicitly.

Regional incomes in the NEG model correspond to regional GDPs in our simulations. Supposing that revenues from land at location *r* belong to household at location *r*, GDP at location *r* is expressed as follows:

$$Y(r) = w_M(r)L_M(r) + f_A(r) + w_S(r)L_S(r) \tag{A.3}$$

where $w_M(r)$ and $w_S(r)$ are, respectively, nominal wage rates in the manufacturing sector and the services sector at location *r*, and $L_M(r)$ and $L_S(r)$ are labor input of the manufacturing sector and the services sector at location *r*, respectively.

Regional expenditure on manufactured goods at location r, which is expressed as $E(r)$, consists of the purchases of a household as final consumption and that of manufacturing firms as intermediary:

$$E(r) = \mu_M Y(r) + \frac{1-\beta}{\beta} w_M(r) L_M(r) \tag{A.4}$$

where μ_M is the consumption share of expenditures on manufactured goods and β is the input share of labor in output. Thus, the first term in (A.4) shows expenditure on manufactured goods, and the last term in (A.4) expresses the expenditure on manufactured goods as intermediary since $1-\beta$ shows the share of intermediary in the output of manufacturing firms.

The price index of manufactured goods at location r is expressed as follows:

$$G_M(r) = \left[\sum_{s=1}^{R} L_M(s) A_M(r)^{\sigma_M - 1} w_M(s)^{(1-\sigma_M)\beta} G_M(s)^{-\sigma_M(1-\beta)} T_{rs}^{M\,-(\sigma_M - 1)} \right]^{\frac{1}{-(\sigma_M - 1)}}, \tag{A.5}$$

where T_{rs}^M is the iceberg transport costs from location r to another location s for manufactured goods and σ_M is the elasticity of substitution between any two differentiated manufactured goods. To derive (A.5), we substitute the price of manufactured goods and the number of varieties into the minimum cost of purchasing a unit of manufactures aggregate. Manufacturing firms at location r produce using the composite of labor and manufactures aggregate. The technology on the composite requirements is the same for all varieties and in all locations and is expressed as a linear function of production quantity with a fixed input requirement. The price of manufactured goods is set as $p_M(r) = w_M(r)^{\beta} G_M(r)^{1-\beta} / A_M(r)$ where $w_M(r)$ is the nominal wage of the manufacturing sector at location *r*, and $G_M(r)$ is the price index of manufactured goods at location *r*. Here, the marginal input requirement is supposed to equal the price-cost markup. The supply of a variety is decided by the zero-profit condition. The quantity of supply depends on the size of the fixed input requirement. Using the supply of manufactured goods and choosing the size of the fixed input requirement adequately, the number of manufacturing firms at a location is decided using the relation between the share β of labor input and the demand for manufactured goods. As a first step, the price index of manufactured goods is derived from the expenditure minimization of a constant-elasticity-of-substitution function.

The price index of services at location *r* is expressed as follows:

$$G_S(r) = \left[\sum_{s=1}^{R} L_S(s) A_S(r)^{\sigma_S - 1} w_S(s)^{-(\sigma_S - 1)} T_{rs}^{S-(\sigma_S - 1)} \right]^{\frac{1}{-(\sigma_S - 1)}} \tag{A.6}$$

where T_{rs}^S is the iceberg transport costs from location *r* to another location *s* for services, σ_S is the elasticity of substitution between any two differentiated services. We choose the production units by a firm that equals to the inverse of the consumption share of services. The derivation processes are slightly different. Using only labor, the technology is the same for all varieties and in all locations and is expressed as a linear function of production quantity with a fixed input requirement. The price of services is set as $p_S(r) = w_S(r) / A_S(r)$ where $w_S(r)$ is the nominal wage of the service sector at location *r* and $A_S(r)$ is the production efficiency of the service sector at location *r*. The number of varieties of services is decided from the equality of wage payment and the expenditure share of labor at location *r*.

Nominal wages in the manufacturing sector at location r at which firms in each location break even is expressed as follows:

$$w_M(r) = \left[\frac{A_M(r)\beta^{\frac{1}{\sigma_M}} \left[\sum_{s=1}^{R} E(s) T_{rs}^{M\,1-\sigma_M} G_M(s)^{-(1-\sigma_M)} \right]^{\frac{1}{\sigma_M}}}{G_M(r)^{1-\beta}} \right]^{\frac{1}{\beta}}, \tag{A.7}$$

using the equality of demand and supply on a variety of manufactured goods. Similarly, nominal wages in the service sector at location r are expressed as follows:

$$w_S(r) = A_S(r) \left[\sum_{s=1}^{R} Y(r) T_{rs}^{S\,1-\sigma_S} G_S(s)^{-(1-\sigma_S)} \right]^{\frac{1}{\sigma_S}}. \tag{A.8}$$

From (A.1) to (A.8), the variables are decided using a given configuration of labor. Derived regional GDP, nominal wage rates, and price indexes are used to determine labor's decision on a working sector and place. The dynamics for labor to decide on a specific sector within a location is expressed as follows:

$$\dot{\lambda}_I(r) = \gamma_I \left(\frac{\omega_I(r)}{\overline{\omega}(r)} - 1 \right) \lambda_I(r), \quad I \in \{A, M, S\}, \tag{A.9}$$

where $\dot{\lambda}_I(r)$ is the change in labor (population) share for a sector within a location γ_I is the parameter used to determine the speed of job change within a location, $\omega_I(r)$ is the real wage rate of any sector at location *r*, and $\overline{\omega}(r)$ is the average real wage rate at location ***r***. The population share for a sector within a country is expressed as follows:

$\lambda_I(r) = \dfrac{L_I(r)}{L_A(r) + L_M(r) + L_S(r)}$. The dynamics of labor migration in a country is expressed as follows:

$$\dot{\lambda}_L(r) = \gamma_L\left(\frac{\omega(r)}{\overline{\omega}_C} - 1\right)\lambda_L(r) \qquad \text{(A.10)}$$

where $\dot{\lambda}_L(r)$ is the change in the labor (population) share of a location in a country, γ_L is the parameter for determining the speed of migration between locations, and $\lambda_L(r)$ is the population share of a location in a country. In (A.10), $\omega(r)$ shows the real wage rate of a location and is specified as follows:

$$\omega(r) = \frac{Y(r)/(L_A(r) + L_M(r) + L_S(r))}{G_M(r)^{\mu} G_S(r)^{\nu}} \quad ,$$

where ν shows the consumption share of services. Furthermore, $\overline{\omega_C}$ in (A.10) shows the average real wage rate at location *r*.

Notice that labor migration is affected by per capita regional GDP and price index.

Using two dynamics, (A.9) and (A.10), we decided the spread of labors among locations and the selection of sector in a location.

APPENDIX B: Transport Costs

This appendix explains how transport costs between regions are calculated. We first specify firms' behavior in shipping their products and estimate the multinomial logit model on it by using firm-level data. Next, we estimate some parameters such as holding time across borders. By employing those estimates in addition to the multinomial logit results, transport costs T are calculated.

B1. Firm-level Transportation Modal Choice

In this section, we calculate the geographical distance between trading partners in which transportation modes such as air and sea become indifferent to each other in terms of their chosen probability. The next subsection summarizes the mechanics of firms' modal choice by developing a simple theoretical model. Based on the model, Section B1.2 specifies the empirical equation to investigate firms' modal choice, of which estimation results are reported in Section B1.3.

B1.1. Theoretical Framework

We develop a model in which firms choose a transportation mode from among the three modes: air, sea, and truck. Our model specifies the probability that a mode yields the highest profits for a particular firm. We choose functional forms to obtain a final specification that is linear in parameters.

The firm manufactures a unique variety with log demand curve ln x_{ji} = ln $A_i - \eta$ ln p_{ji}, where $p_j = p_{ji}\, t_{ji}$. The variable p_j is the price of the variety produced in country j, and A_i is the income of consumers of the varieties in country i. The variable x_{ji} denotes the demand of country i for the variety produced in country j while η is the elasticity of substitution between varieties and is assumed to be greater than unity. The variable t_{ji} represents transportation time between countries i and j (expressed in tariff equivalent) rather than the standard trade costs and captures the depreciation of goods, which occurs because the characteristics of goods that consumers desire change randomly over time.

The market structure is assumed to be Chamberlinian monopolistic competition. The producer of each country inputs labor and pays shipping costs. The shipping costs are assumed to be a function of transportation time. Notice that, strictly speaking, the shipping costs here are specified to be simpler compared with the ones above (e.g., τ_{ij}). Furthermore, the transportation time is also specified to be different from $Time_{ij}$. In short, the transport cost structure of the model in this section is simplified so as to be able to easily estimate the model.

Specifically, the cost function is assumed to be:

$$C\left(x_{ji}\right) = w_j^{\theta_w} t_{ji}^{\theta_M} x_{ji} + f_j,\ \theta_w > 0,\ \theta_M > 0,$$

where w_j and f_j denote wages and fixed costs, respectively. The parameter θ_M is a parameter for transportation time and plays a role in transforming the time to the total transportation charge. Its magnitude depends on the mode M: $\theta_{Air} > \theta_{Truck} > \theta_{Sea}$.

We assume that in the short run, firms can change only the quantity of production, not transportation mode. Each firm maximizes its profit with respect to quantity to derive producer prices:

$$p_j = \left(\frac{\eta}{\eta - 1}\right) w_j^{\theta_w} t_{ji}^{\theta_M}.$$

As a result, we can derive a profit function from supplying products from country *j* to country *i*:

$$\pi_{ji} = kA_i w_j^{-\theta_w(\eta-1)} t_{ji}^{-[(\theta_M+1)(\eta-1)+1]} - f_j, \quad k \equiv \eta^{-\eta}(\eta-1)^{1-\eta}. \tag{B.1}$$

We assume that transportation time can simply be specified as:

$$\ln\ t_{ji} = \lambda_M\ \ln\ d_{ji}, \tag{B.2}$$

where λ_M is a parameter that transforms distance (d_{ji}) into transportation time and is mode specific: $\lambda_{Sea} > \lambda_{Truck} > \lambda_{Air}$. Substituting equation (B.2) into the log version of equation (B.1), we obtain:

$$\ln\left(\pi_{ji}^M + f_j\right) = \ln k + \ln A_i - (\eta-1)\theta_w \ln w_j - \left[(\eta-1)(\theta_M+1)+1\right]\lambda_M \ln d_{ji},$$

Only mode-specific variables affect the profit ordering of modes. We define U_M as:

$$U_M \equiv \ln\left(\pi_{ji}^M + f_j\right) - \ln k - \ln A_i + (\eta-1)\theta_w \ln w_j = -\left[(\eta-1)(\theta_M+1)+1\right]\lambda_M \ln d_{ji}. \tag{B.3}$$

The firm chooses a mode with the highest U_M among air, sea, and truck. In other words, given the elasticity, a mode with the lower λ_M and/or the lower θ_M is chosen in shipping varieties.

B1.2. Empirical Issues

We empirically investigate the determinants of firms' transport mode. To do that, we estimate equation (B.3) after some modification. First, our parameters, particularly η and θ_M, obviously differ among industries. For example, machinery parts are small and light, so that firms producing them have a relatively low θ_{Air} and thus a small difference between θ_{Air} and θ_{Sea}. Therefore, if λ_M is not so different among industries, air transportation is more likely to be chosen in shipping machinery parts because θ_M becomes a crucial element for firms' choice of a mode. These differences among industries are controlled by introducing the intercepts of industry dummy variables (u_s) with distance variable. Second, the level of port infrastructure is obviously different among countries. Its difference yields different λ_M and θ_M among modes in each country. To control such differences among countries in which reporting firms locate, we introduce country dummy variables (v_k). Last, qualitative differences between intra- and international transactions are controlled by introducing a binary variable (*Abroad*), taking unity if transactions are international ones and zero otherwise.

Based on this modification, we redefine our profit function as:

$$V_M \equiv U_M + \varepsilon_M = \alpha \cdot Abroad_{ji} + \sum_s \beta_s^M u_s \ln d_{ji} + \sum_k \gamma_k^M v_k + \varepsilon_M , \qquad \text{(B.4)}$$

where ε_M denotes unobservable mode characteristics, while $Abroad_{ji}$ takes unity if regions i and j belong to different countries and zero otherwise. When ε_M is independent and follows identical type I extreme value distribution across modes, the probability that the firm chooses mode M is given by:

$$\Pr\left(Y_i = M \mid Abroad_{ji}, \ln d_{ji}\right) = \frac{e^{U_M}}{1 + e^{U_{Air}} + e^{U_{Truck}} + e^{U_{Sea}}} \text{ for M = Air, Sea, Truck.} \qquad \text{(B.5)}$$

The coefficients are estimated by maximum likelihood procedures. In other words, a multinomial logit (MNL) model is used to estimate the probability that a firm chooses one of the three transportation modes: air, sea, and truck.

Our main data source is the Establishment Survey on Innovation and Production Network for selected manufacturing firms in four countries in East Asia for 2008 and 2009. The four countries covered in the survey were Indonesia, the Philippines, Thailand, and Vietnam. The sample population is restricted to selected manufacturing hubs in each country (JABODETABEK area, i.e., Jakarta, Bogor, Depok, Tangerang, and Bekasi, for Indonesia; CALABARZON area, i.e., Cavite, Laguna, Batangas, Rizal, and Quezon, for the Philippines; Greater Bangkok area for Thailand; and Hanoi area and Ho Chi Minh City for Vietnam). This dataset includes information on transport mode that each firm chose in supplying its main product and sourcing its main intermediate inputs. From there, the products' origin and destination can be also identified. In our analysis, however, the combination between origin and destination is restricted to one accessible by land transportation in order to assure consistency with our theoretical framework.

B1.3. Empirical Results

We take a brief look at firms' choice of transportation mode. Table 1 reports the combination of trading partners in our dataset. There are three noteworthy points here. First, as mentioned above, firms in the Philippines and Indonesia are restricted to the ones with intranational transactions, although most of the firms in the other countries in our dataset are also engaged in the intranational transactions. Second, there is a relatively large number of Vietnamese firms trading with China. Third, Table B2 shows the transportation mode by location of firms, indicating that most of our sample firms tend to choose truck. Intuitively, this may be consistent with the first fact that most of the firms trade domestically.

Table B1. The Combination of Trading Partners in the Dataset

	Indonesia	Philippines	Thailand	Vietnam
Cambodia				1
China			6	52
Hong Kong				5
Indonesia	449			
Malaysia				2
Myanmar			1	
Philippines		254		
Singapore				2
Thailand			151	7
Vietnam				382

Source: The Establishment Survey on Innovation and Production Network

Table B2. The Chosen Transportation Mode by Location of Firms

	Indonesia	Philippines	Thailand	Vietnam
Air	19	7	2	11
Sea	17	11	6	51
Truck	413	236	150	389

Source: The Establishment Survey on Innovation and Production Network

The MNL result is provided in Table B3. Three points are noteworthy. First, in trading with partners abroad, firms are likely to choose air or sea. Second, the coefficients for distance are estimated to be significantly positive, indicating that the larger the distance between trading partners, the more likely the firms are to choose air or sea. Specifically, this result implies that the product of λ_M and θ_M is lower in air and sea than in truck. Third, the intercept term of distance in machinery industries has a significantly positive coefficient in air. As mentioned before, not only the elasticity but also θ_M are different among industries. As is consistent with our expectation, our result may indicate the lower value of θ_{Air} in machinery industries.

Table B3. Result of Multinomial Logit Analysis

Truck as a basis	Air			Sea		
	Coef.		S.D.	Coef.		S.D.
Abroad	3.573	***	0.736	2.915	***	0.428
ln Distance (Food as a basis)	0.444	***	0.170	1.268	***	0.167
*Textiles	0.104		0.126	-0.151		0.094
*Machineries	0.300	**	0.135	0.112		0.086
*Automobile	0.201		0.174	-0.104		0.154
*Others	0.148		0.106	-0.068		0.066
Constant	-5.711	***	0.760	-9.621	***	0.993
Country dummy: Indonesia as a basis						
Philippines	-0.336		0.470	0.364		0.446
Thailand	-2.239	**	0.904	-0.794		0.624
Vietnam	-2.483	***	0.683	-0.437		0.419
Statistics						
Observations			1,312			
Pseudo R-squared			0.3407			
Log likelihood			-321.5			

Note: ::, :, and : show 1%, 5%, and 10% significance, respectively.

Last, we conduct some simulations to get a more intuitive picture on the transportation modal choice. Specifically, employing our estimators, we calculate the distance between trading partners in which the two transportation modes become indifferent in terms of their probability. For example, suppose that a firm in the food industry in Bangkok trades with a partner located in a city. Our calculation reveals how far the city is from Bangkok if the probability of choosing air/sea is equal to that of choosing truck. In the calculation, we set *Abroad* to the value of one, i.e., international transactions. The results are reported in Table B4. In Bangkok, for example, firms in machinery industries choose air or sea if their trading partners are located more than 400 km away. On the other hand, firms in the food industry basically use only truck.

Table B4. Probability Equivalent Distance with Truck (Kilometer): Domestic and International Transportation from Bangkok

	Domestic		International	
	Air	Sea	Air	Sea
Food	60,300,000	3,699	19,254	371
Textiles	2,022,900	11,218	2,968	825
Machineries	44,009	1,899	361	229
Automobile	225,394	7,693	886	628
Others	684,540	5,909	1,634	520

Source: Authors' calculation based on the MNL result in Table 3

B2. The Calculation of Transport Costs

In this section, we calculate the transport costs by using the estimates and the logit results in the previous section. To this end, several parameters are necessary, some of which are estimated in Section B2.1.

B2.1. The Estimation of Speed and Holding Time

Our strategy for estimating transportation speed and holding time is very straightforward and simple. Specifically, we regress the following equation:

$$Time_{ij}^{M} = \rho_0 + \rho_1 Abroad_{ij}^{M} + \rho_2 Distance_{ij}^{M} + \varepsilon_{ij}^{M}.$$

The coefficients ρ_0^M and ρ_1^M represent mode M's holding time in domestic transportation and its additional time in international transportation, respectively. The inverse of ρ_2^M indicates the average transportation speed in mode M. We use the same data as in the previous section. However, the estimation in this section does not require us to restrict our sample to firms with transactions between regions accessible by truck. In other words, for example, the estimation here includes transactions between Indonesia and Thailand.

The OLS regression results are reported in Table B5. Although some of the holding time coefficients, i.e., ρ_0^M and ρ_1^M, are insignificantly estimated, their magnitude is reasonable enough. As for the distance coefficient, its magnitude in sea and truck is reasonable, but that in air is disappointing and too far from the intuitive speed, say, around 800 km/h. One possible reason is that "time" in our dataset always includes the land transportation time to airport. This will underestimate the air transportation speed.

Table B5. Results of OLS Regression: Holding Time and Transportation Speed

	Air	Sea	Truck
Estimation Resutls			
Abroad	9.010	11.671	10.979***
	[8.350]	[13.320]	[2.440]
Distance	0.018*	0.068***	0.026***
	[0.010]	[0.018]	[0.002]
Constant	6.123	3.301	2.245***
	[7.940]	[13.099]	[0.739]
Holding Time (Hours)			
Domestic	9.010	11.671	10.979
International	15.133	14.972	13.224
Speed (Kilometers/Hour)	55.556	14.706	38.462
Observations	51	34	754
R-squared	0.1225	0.3698	0.1772

Notes: ::, :, and : show 1%, 5%, and 10% significance, respectively. A dependent variable is transportation time.

B2.2. Specifying Transport Cost Function

We specify a simple linear transport cost function, which consists of physical transport costs and time costs. We assume the behavior of the representative firm for each industry as follows:

- A representative firm in machineries industry will make a choice between truck and air transport and choose the mode with the higher probability in (B.5).
- A representative firm in the other industries will make a choice between truck and sea transport and choose the mode with the higher probability in (B.5).

Specifically, the transport cost in industry *s* by mode *M* between regions *i* and *j* is assumed to be expressed as:

$$C_{ij}^{s,M} = \underbrace{\left[\left(\frac{dist_{ij}}{Speed_M}\right) + \left(1 - Abroad_{ij}\right) \times ttrans_M^{Dom} + Abroad_{ij} \times ttrans_M^{Intl}\right]}_{Total\ \ Transport\ \ Time} \times ctime_s$$
$$+ \underbrace{dist_{ij} \times cdist_M}_{Physical\ \ Transport\ \ Cost} + \underbrace{\left(1 - Abroad_{ij}\right) \times ctrans_M^{Dom} + Abroad_{ij} \times ctrans_M^{Intl}}_{Physical\ \ Transshipment\ \ Cost} \quad , \text{(B.6)}$$

where $dist_{ij}$ is travel distance between regions i and j, $speed_M$ is travel speed per one hour by mode M, $cdist_M$ is physical travel cost per one kilometer by mode M, and $ctime_s$ is time cost per one hour perceived by firms in industry s. The parameters $ttrans_M^{Dom}$ and $ctrans_M^{Dom}$ are the holding time and cost, respectively, for domestic transshipment at ports or airports. Similarly, $ttrans_M^{Intl}$ and $ctrans_M^{Intl}$ are the holding time and cost, respectively, for international transshipment at borders, ports, or airports.

The parameters in the transport function are determined as follows. First, by using the parameters obtained from the results of Section B2.1 and borrowing some parameters from the ASEAN Logistics Network Map 2008 by JETRO, we set some of the parameters in the transport function as in Table B6. Notice that our estimates of $Speed_{\mathrm{Air}}$ and $ttrans_{\mathrm{Air}}^{Intl}$ in Table B5 went beyond our expectations. Thus, we set $Speed_{\mathrm{Air}}$ at the usual level (800 km/h) and we made $ttrans_{\mathrm{Air}}^{Intl}$ consistent with the ASEAN Logistics Network Map 2008.

Table B6. Parameters from Estimation and ASEAN Logistics Network Map 2008

	Truck	Sea	Air	Unit	Source
$cdist_M$	1	0.24	45.2	US$/km	Map
$Speed_M$	38.5	14.7	800	km/hour	Table 5
$ttrans_M^{Dom}$	0	11.671	9.01	hours	Table 5
$ttrans_M^{Intl}$	13.224	14.972	12.813	hours	Table 5 & Map
$ctrans_M^{Dom}$	0	190	690	US$	Map
$ctrans_M^{Intl}$	500	N.A.	N.A.	US$	Map

Notes: Costs are for a 20-foot container. The parameter $ctrans_M^{Dom}$ is assumed to be half of the sum of border costs and transshipment costs in the international transport from Bangkok to Hanoi. The parameters $ttrans_M^{Dom}$ and $ctrans_M^{Dom}$ for sea and air include one-time loading at the origin and one-time unloading at the destination.

Second, after substituting those parameters for the equation (B.6) under domestic transportation, $C_{ij}^{s,M}$ becomes a function of $dist_{ij}$ and $ctime_s$. To meet the above-mentioned assumptions on firms' behavior, we add the following conditions:

- The transport cost using trucks becomes the lowest among the three modes when $dist_{ij}$ is zero for each industry.
- If the transport cost is depicted as a function of $dist_{ij}$, the line drawn by the function in truck intersects with it in air at only one point for the machineries industry and with it in sea, at only one point for the other industries for all non-negative $dist_{ij}$.

Under the probability equivalent (domestic) distances in Table B4, the transport cost $C^{s,Air}$ should be equal to $C^{s,Truck}$ in machineries, and $C^{s,Sea}$ should be equal to $C^{s,Truck}$ in the other industries. By using this equality, we calculate $ctime_s$ for each industry as in Table B7. The functions meet the above conditions.

Table B7. Time Costs per One Hour by Industry Perceived by Firms (*$ctime_s$*): US$/hour

	Food	Textile	Machineries	Automobile	Others
$ctime_s$	15.7	17.2	1803.3	16.9	16.5

Source: Authors' calculation

Third, substituting again these parameters including $ctime_s$ and $ctrans_{\mathrm{Truck}}^{Intl}$ under international transportation, $C_{ij}^{s,Truck}$ becomes a function of only $dist_{ij}$, and $C_{ij}^{s,M}$ for air and sea becomes a function of $dist_{ij}$ and $ctrans_{\mathrm{M}}^{Intl}$. Then using the probability equivalent (international) distances in Table B4 again, we can calculate $ctrans_{\mathrm{Air}}^{Intl}$ and $ctrans_{\mathrm{Sea}}^{Intl}$ for each industry. Last, $ctrans_{\mathrm{Sea}}^{Intl}$ is uniquely set as the average among the other industries. These parameter values are reported in Table B8. The functions obtained also fulfill the above conditions.

Table B8. Costs for Transshipment in International Transport ($ctrans_M^{Intl}$): US$

	Truck	Sea	Air
$ctrans_M^{Intl}$	500	504.2	1380.1

Source: Authors' calculation

APPENDIX C: Elasticity of Substitution in Services

This appendix explains how we estimate the elasticity of substitution in the services sector. Our theoretical background lies in Anderson and van Wincoop (2003). Under the usual assumptions (e.g., CES utility function), we derive the following gravity equation for the *goods* sector (equation 9 on page 175):

$$x_{ij} = \frac{y_i y_j}{y^W}\left(\frac{\tau_{ij}}{\Pi_i P_j}\right)^{1-\sigma}, \qquad \text{(C.1)}$$

where

$$\Pi_i \equiv \left(\sum_j \left(\tau_{ij}/P_j\right)^{1-\sigma}\theta_j\right)^{1/(1-\sigma)}, \quad P_j \equiv \left(\sum_i \left(\tau_{ij}/\Pi_i\right)^{1-\sigma}\theta_i\right)^{1/(1-\sigma)}, \text{ and } \theta_j \equiv y_j \big/ y^W .$$

The variables x_{ij}, y_i, τ_{ij}, and y^W are the nominal value exports from countries *i* to *j*, total income of country *i*, iceberg trade costs from countries *i* to *j*, and world nominal income, respectively. The coefficient σ denotes the elasticity of substitution among varieties. Taking logs in equation (C.1), we obtain:

$$\ln x_{ij} = \ln y^W + \ln y_i + \ln y_j + (1-\sigma)\tau_{ij} + (\sigma-1)\ln\Pi_i + (\sigma-1)\ln P_j . \qquad \text{(C.2)}$$

We simply apply this gravity formulation in the goods sector into the services sector. Furthermore, due to data limitations, we drop the last two terms, the so-called "multilateral resistance terms," although we really recognize such a treatment is quite serious.

In this paper, we specify the trade cost function as:

$$\tau_{ij} = \left(1 + tax_j\right)\cdot Dist_{ij}^{\alpha_1}\cdot e^{\alpha_2 RTA_{ij}} e^{\alpha_3 Continent_{ij}} e^{\alpha_4 Language_{ij}} e^{\alpha_5 Colony_{ij}} . \qquad \text{(C.3)}$$

The variable *dist* is geographical distance between trading partners. The variable *RTA* is a binary variable taking unity if trading partners conclude regional trade agreements (RTAs) and zero otherwise. The variable *tax* is the corporate tax rate (100:*tax*%). The variable *language* is a linguistic dummy variable that takes one if the same language is spoken by at least 9% of the population in both countries. The variable *colony* is a binary variable that takes one if an importer (an exporter) was ever a colonizer of an exporter (importer) and zero otherwise. Introducing this trade cost function into equation (C.2) and taking logs, we obtain:

$$\begin{aligned}\ln x_{ij} = \ln y^W + \ln y_i + \ln y_j + (1-\sigma)\ln(1+tax_j) \\ + (1-\sigma)\alpha_1 \ln Dist_{ij} + (1-\sigma)\alpha_2 RTA_{ij} + (1-\sigma)\alpha_3 Continent_{ij}\end{aligned}.$$

Thus, the coefficient for tax variable gives us direct information on the elasticity of substitution.

Our data set is an unbalanced panel between 2000 and 2005. Data on international trade values in services have been obtained from "Organisation for Economic Co-operation and Development (OECD) Statistics on International Trade in Services." We restrict the sample sector only to other services: communications services; construction services; insurance services; financial services; computer and information services; royalties and license fees; other business services; and personal, cultural, and recreational services. An RTA dummy is constructed using the lists of RTAs provided on the website of the World Trade Organization (WTO). The source of geographical distance and other dummy variables is the website of Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

Our estimation of gravity provides us an elasticity of “2.93893.” There are two noteworthy points. The first one is a shortcoming due to the use of services trade data. The services trade statistics in the OECD database are the balance-of-payments basis, which primarily covers modes 1 and 2. This implies that our estimate is based on a quite-limited part of services. Second, in the OECD database, trade data between non-OECD countries are not available. Thus, it does not include almost all trade among our GSM sample countries. In other words, our estimation is valid only when we assume that the elasticity of substitution in services is almost same between developed countries (OECD countries) and developing countries (GSM countries).

Appendix D: Data Description

Bangladesh:

The data are based on three-sector (primary, manufacturing, and service) GDP data by state from various sources. Then the manufacturing sector was divided into five subsectors using value-added data from the industrial censuses conducted in 2002 and 2003.

Cambodia:

Cambodia's GDP data are available on the national level. The Japan International Cooperation Agency (JICA) estimated provincial income and employed labor in three industries, namely, primary, secondary, and tertiary industries based on Cambodia's socioeconomic survey iCSES03-05j conducted between 2003 and 2005. Provincial gross value added by industries was calculated by applying the ratio of income to national GDP. Nationwide M1 to M5 was calculated based on annual statistics published by the appropriate authority and used as a coefficient to divide provincial GDP of secondary industries into five sectors.

China, Hong Kong, and Macau:

For China, the shares of the number of employees in each industry at the provincial level were used to divide provincial GDP, and then the derived values were considered as industrial GDP at the provincial level. Data on the GDP of the subdivisions of provinces were collected from the 2004 provincial statistical yearbook. Employment data were collected from the 2004 provincial economic census yearbook.

Data on Hong Kong's GDP and employment were obtained from the 2003 annual survey of industrial production and the 2003 social and economic trends in Hong Kong. Data used for the simulation were derived using the same procedure done for the China data.

The 2005 statistics yearbook was used to obtain relevant data for Macau. Note, however, that only employment data in the textile industries were available. The data used for simulations were derived in the same way as the China data.

India:

Population data were derived from the website http://www.censusindia.gov.in/. Three-sector (primary, manufacturing, and service) GDP data were obtained from the statistics office of each state. Manufacturing GDP in five sectors was compiled from the value added by industry in the Indian annual survey of industry (ASI). District-level GDP was not available for some states, and uniform GDP per capita was used for districts in the same state.

Lao PDR:

Provincial-level industrial statistics for Laos were obtained from several sources. Population and value-added figures for each province were based on mostly unpublished annual provincial reports on the implementation of the socioeconomic plan.

These provincial value added are divided among three industries, namely, agriculture, industry, and service, in source. The value added for industry of each province was then used to create the value added for five sectors by splitting them according to the provincial share of labor in M1 to M5. The labor share in M1 to M5 for each province was calculated from the nationwide business establishment survey in 2005.

Malaysia:

Malaysia's data are based on three-sector (primary, manufacturing, and service) GDP data by state culled from various sources. The manufacturing sector is divided into five subsectors using value-added data from the establishment survey provided by the Department of Statistics.

Myanmar:

Data consisted of national-level, three-sector GDP data and income per capita by state based on the Report of 1997: Household Income and Expenditure Survey, published by the Central Statistical Organization. The manufacturing sector was divided into five subsectors using data from Table 6.11 in Myat Thein's (2004) Economic Development of Myanmar.

Singapore:

We used sectoral GDP data from the economic survey of Singapore. The transport sector was divided into automotive and others using the data provided by Singstat.

Thailand:

The data for Thailand were produced in the same way as the data for China. The data were collected from the manufacturing industrial survey for Bangkok and the statistical report of Changwat. Data from the following provinces were also obtained: Chonburi (1999); Ayutthaya, Chaiyaphum, Chanthaburi, Chiangrai, Chumphon, Krabi, Lopburi, Mae Hong Son, Mukudahan, Nan, Songkhla, Yala, and Yasothon (2000); Nakhon Panom (2002); Nakhon Ratchasima (2005); other provinces (2001). Some provincial data did not separate automotive industries from transport equipment, but the data on transport equipment were used for automobiles. A small number of establishments in specific industries might be included in the group "others."

Vietnam:

This is based on three-sector (primary, manufacturing, and service) GDP data by state from various sources. The manufacturing sector was divided into five subsectors using value-added data from an establishment survey.

Appendix E: Results of Additional Simulations

E1. The "Missing Link" in EWEC

Scenario

In this scenario, the baseline is changed. The baseline is the state that EWEC has already developed, except for the "missing link" between Mawlamyin-Myawadi routes in Myanmar. The other part of EWEC is "upgraded," meaning cars can run on it at 60 km/h. In addition, border costs (time and money) are already reduced to two hours and one-fifth of the original baseline scenario.

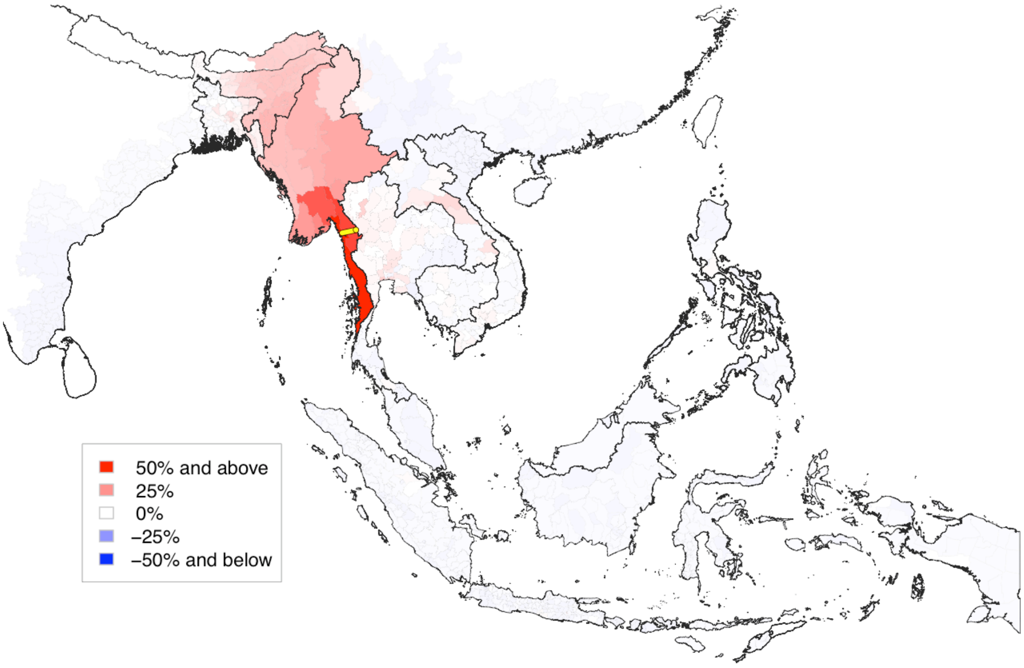
Compared with this new baseline, the development of the "missing link" scenario is as follows:

- The route between Mawlamyin-Myawadi is constructed and cars can run on it at 60 km/h.
- At the border between Myawadi-Moe Sot, the time and money costs of custom clearance are reduced to be on par with the new baseline scenario.

Economic Effects

The economic effects of the development of the "missing link" in EWEC are depicted in Figure E1. The figure shows that strong economic effects are observed in Tanintharyi division and in Mon state of Myanmar. Other parts of Myanmar and eastern India also benefit from the development of the "missing link."

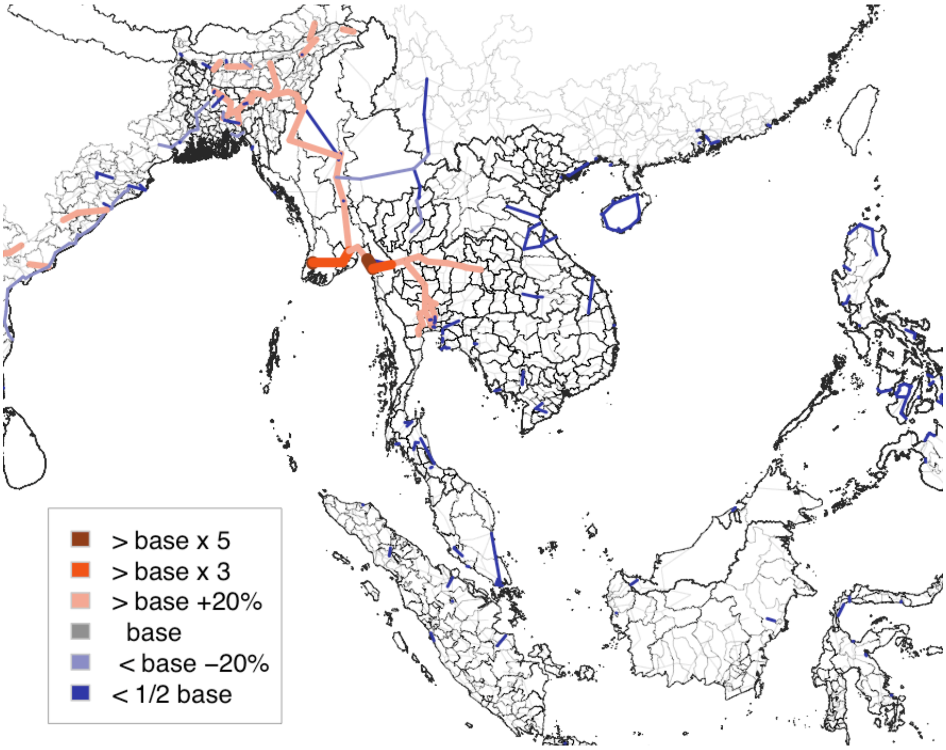
Figure E1: Gains in Regional GDP: Development of the "Missing Link" in EWEC (10 years cumulative)



Traffic Volume

Figure E2 shows the changes in traffic volume as a result of the development of the "missing link" in EWEC. In addition to the newly constructed "missing link" and the routes along EWEC, the routes to Bangkok, Mandalay, and Port Bassein have shown increased traffic. On the other hand, the routes from Mandalay to Yunnan Province of China and to India have decreased traffic.

Figure E2: Changes in Traffic Volume Caused by the Development of the "Missing Link" in EWEC (10 years after)



Tables E1 and E2 show the sea and air routes affected by the development of the "missing link" in EWEC. Table E1 shows that the traffic between Port Madras and Port Bassein has significantly increased, while the route of Port Madras-Port Laem Chabang has fallen into disuse. This is understood to mean that the latter sea route has substituted for the former sea route and the land routes through EWEC from Port Bassein.

Table E1: Sea Routes Most Affected by the Development of the "Missing Link" in EWEC (10 years after)

Sea Route			Traffic Change
Port Madras	-	Port Bassein	9.08
Port Manila	-	Port Laem Chabang	1.19
Port Jakarta	-	Port Laem Chabang	1.10
Port Laem Chabang	-	Port Singapore	1.10
Port Laem Chabang	-	Port Kuching	1.09
Port Saigon	-	Port Madras	0.83
Port Jakarta	-	Port Madras	0.81
Port Kelang	-	Port Madras	0.61
Port Chittagong	-	Port Singapore	0.23
Port Madras	-	Port Laem Chabang	0.00

Table E2 shows that the traffic between Yangon International Airport and other parts of Southeast Asia have decreased. This seems to be substituted for by the land routes going through EWEC. On the other hand, the air route between Yangon and Kolkata has increased traffic.

Table E2: Air Routes Most Affected by the Development of the "Missing Link" in EWEC (10 years after)

Air Routes			Traffic Change
Yangon Intl	-	Netaji Subhash Chandra Bose Intl	1.10
Suvarnabhumi Intl	-	Soekarno Hatta Intl	1.03
Suvarnabhumi Intl	-	Hong Kong Intl	1.01
Suvarnabhumi Intl	-	Macau Intl	1.01
Suvarnabhumi Intl	-	Changi Intl	1.01
Noibai Intl	-	Suvarnabhumi Intl	0.74
Changi Intl	-	Yangon Intl	0.72
Yangon Intl	-	Wujiaba	0.58
Suvarnabhumi Intl	-	Yangon Intl	0.00
Chiang Mai Intl	-	Yangon Intl	0.00

Figures E3 and E4 graphically show the sea and air routes affected by the development of the "missing link" in EWEC.

Figure E3: Sea Routes Most Affected by the Development of the "Missing Link" in EWEC (10 years after)

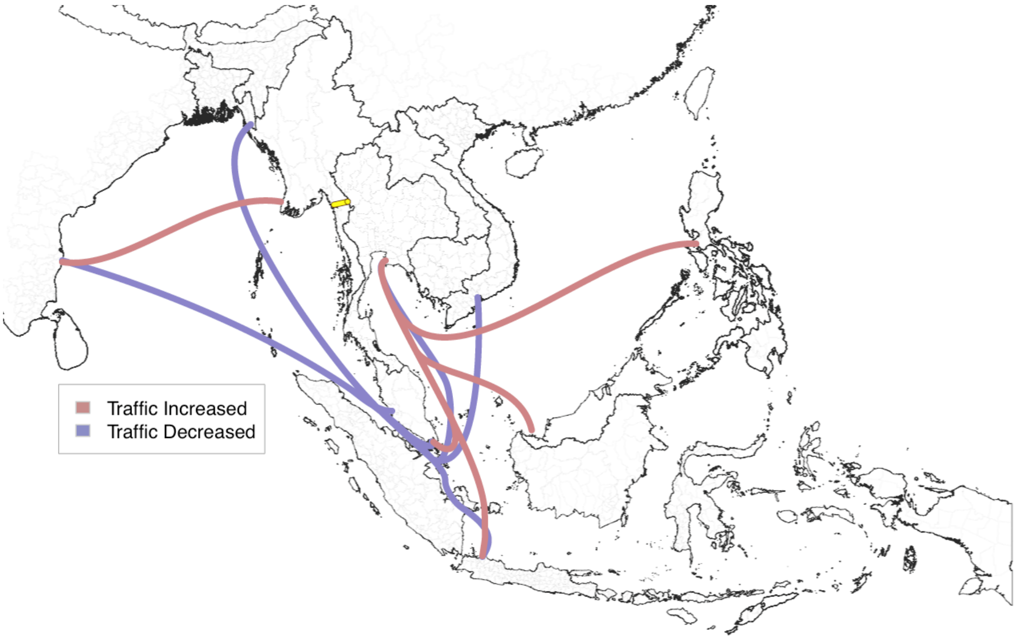
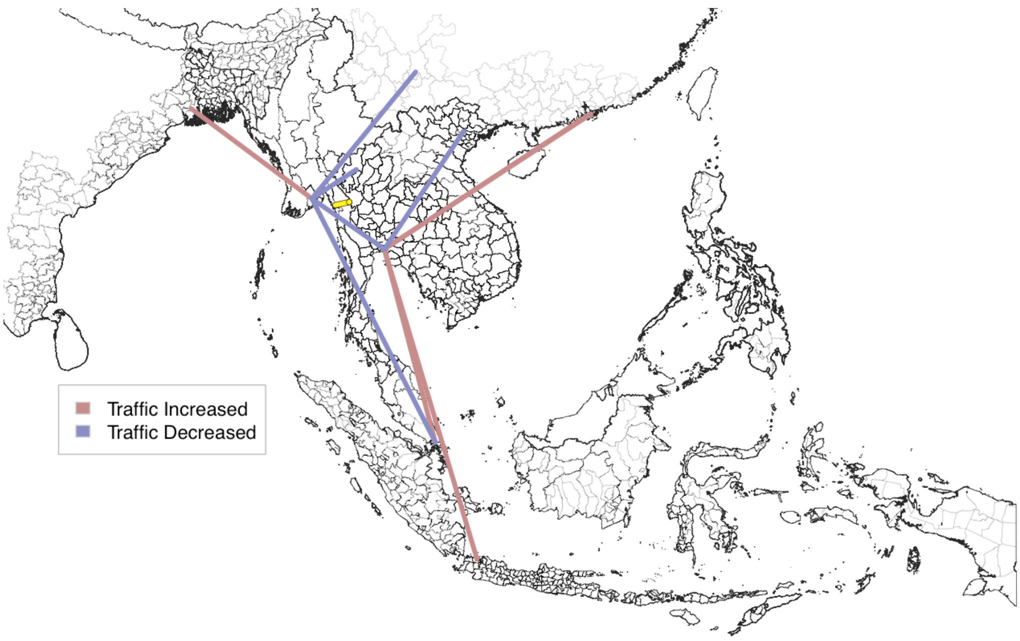


Figure E4: Air Routes Most Affected by the Development of the "Missing Link" in EWEC (10 years after)



E2. Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT)

Scenario (Highway between Bandar Ache and Jakarta, and ro-ro vessels between Penang-Medan and Dumai-Malacca)

In this scenario, one highway and two sea routes are developed. The highway, on which vehicles can run at 60 km/h, starts at Bandar Ache and goes through the eastern part of Sumatra Island and ends at Jakarta. At the Sunda Strait, Bakaheuni and Merak are assumed to be connected by a bridge. Two sea routes, Port Belawan-Port Penang and Port Dumai-Port Malacca, are connected at the speed of 14.7 km/h, on par with the other internationally important routes, and the time cost is reduced to two hours, and money costs are reduced to one-fifth of the baseline scenario.

Economic Effects

The economic effect of the IMT-GT is depicted in Figures E5. In the scenario, Sumatra Island benefits well and other part of the continental regions also benefit, while a few other regions in Kalimantan Island seem to suffer a slight dip in their GDP.

Figure E5: Gains in Regional GDP: IMT-GT (10 years cumulative)

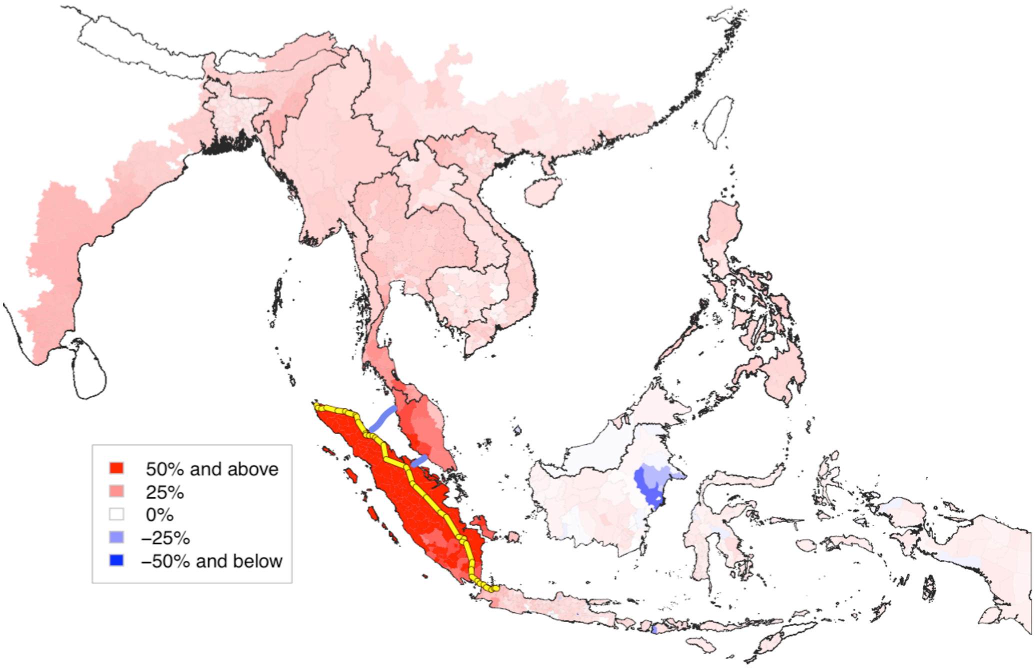
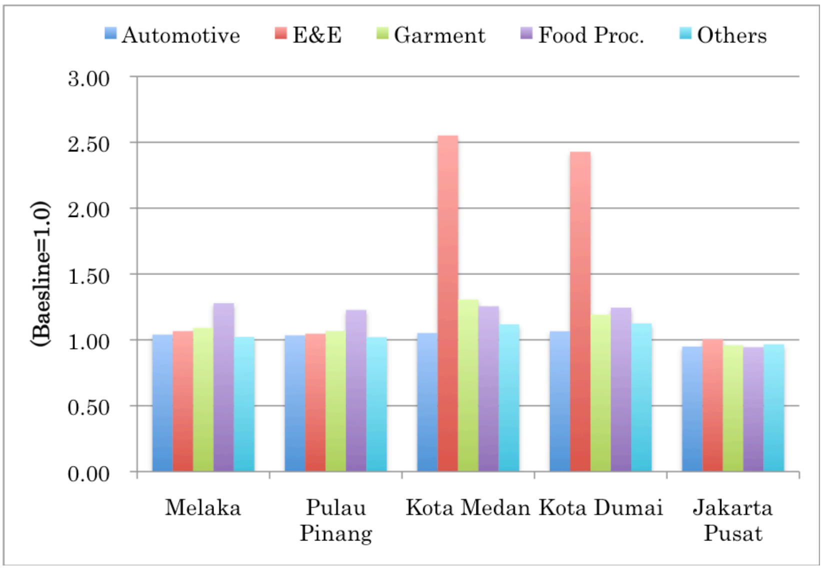


Figure E6 deconstructs the economic effects by industry for five cities near IMT-GT. The economic effects on the E&E industry in Medan and Dumai are outstanding while Melaka and Penang benefit moderately in the food processing industry. On the other hand and surprisingly, Jakarta receives virtually no economic benefits.

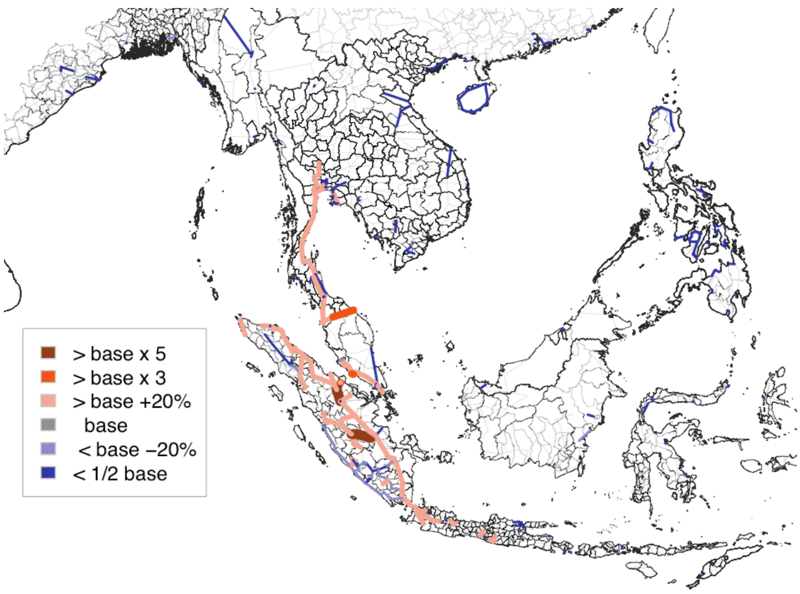
Figure E6 :Ecomic Effects of IMT-GT by Industry (10 years after)



Traffic Volume

Figure E7 shows the changes in the land traffic volume by IMT-GT. It is understood that the traffic volume along the highway though Sumatra Island has increased along with the traffic though the western end of Java Island and from Bangkok area to Malay Peninsula. On the other hand, the alternative route of Sumatra Island has lost its traffic.

Figure E7 : Changes in Traffic Volume by IMT-GT (10 years after)



The development of IMT-GT affects sea and air traffic significantly. Table E3 shows the sea routes most affected by IMT-GT. The sea routes connecting Sumatra and other parts of Indonesia gain traffic. The four international routes between Singapore/Kelang of Malaysia and Indonesia fall into disuse. These routes seem to be substituted for by the sea routes between Penang-Medan and Dumai-Malacca.

Table E3: Sea Routes Most Affected by IMT-GT (10 years after)

Sea Route			Traffic Change
Toboali	-	Tanjung Pandan	8.70
Muntok	-	Port Palembang	2.30
Port Dumai	-	Tanjung Balai Karimun	2.17
Bakaheuni	-	Merak	1.39
Port Kelang	-	Port Madras	1.36
Port Ambon	-	Port Singapore	0.44
Port Singapore	-	Port Palembang	0.00
Port Dumai	-	Port Singapore	0.00
Port Kelang	-	Port Jakarta	0.00
Port Kelang	-	Port Belawan	0.00

Tables E4 shows the air routes most affected by IMT-GT. Most of the air routes that gain traffic significantly involve Kuala Lumpur International Airport. On the other hand, the nearby airports of Thailand, Indonesia, Malaysia, and Singapore seem to lose traffic. While IMT-GT in this simulation does not involve airlines, it shows a significant effect on the traffic of existing air routes.

Table E4: Air Routes Most Affected by IMT-GT (10 years after)

Air Routes			Traffic Change
Phuket Intl	-	Kuala Lumpur Intl	8.08
Kuala Lumpur Intl	-	Wujiaba	2.34
Noibai Intl	-	Kuala Lumpur Intl	2.20
Tansonnhat Intl	-	Kuala Lumpur Intl	2.00
Kuala Lumpur Intl	-	Phnom Penh Intl	1.79
Tansonnhat Intl	-	Changi Intl	0.71
Changi Intl	-	Soekarno Hatta Intl	0.69
Kuala Lumpur Intl	-	Kota Kinabalu Intl	0.57
Kuala Lumpur Intl	-	Bali Ngurah Rai	0.00
Kuala Lumpur Intl	-	Soekarno Hatta Intl	0.00

Figures E8 and E9 graphically depict the air/sea routes affected by IMT-GT. Figure E8 shows that the trans-Sumatra highway and the Medan-Penang and Dumai-Malacca sea routes substitute for the competing sea routes. Figure E9 shows, somewhat surprisingly, that the utilization of Kuala Lumpur International Airport increases in the IMT-GT.

Figure E8: Sea Routes Most Affected by IMT-GT (10 years after)

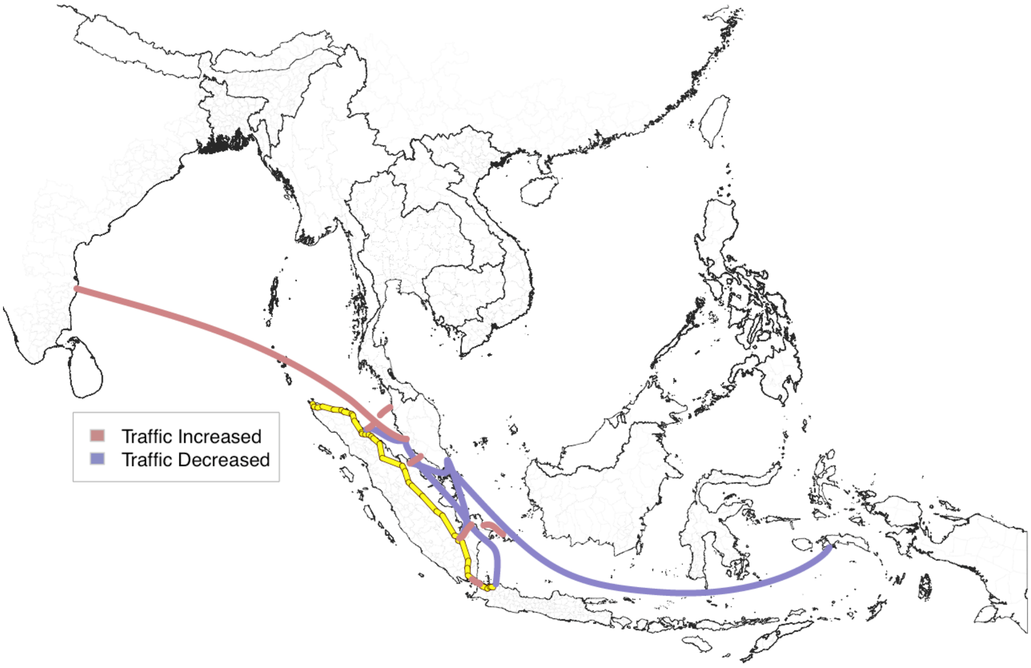
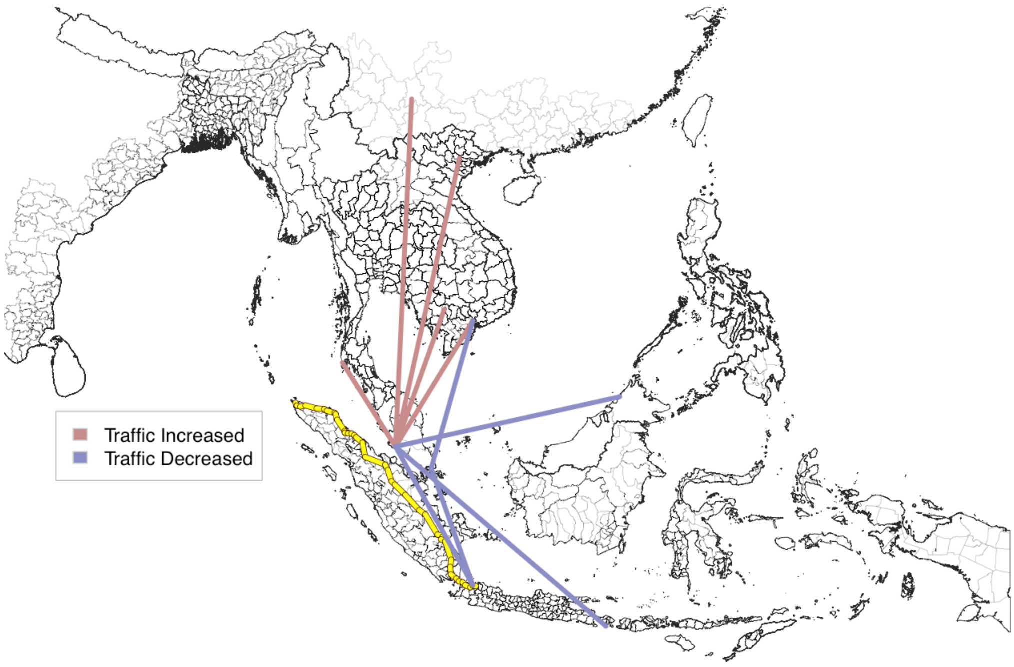


Figure E9: Air Routes Most Affected by IMT-GT (10 years after)



E3. ASEAN Highways

We checked the effects of the development of ASEAN Highway Networks from No.1 to No.16 (Table E5).

Table E5: ASEAN Highway Networks

No.	Origin - Destination	Criteria
1	Tamu (Myanmar / India Border) - Mandalay - Payagyl (Including Payagyl - Yangon) - Myawadi / Mae Sot (Myanmar / Thailand Border) - Tak - Bangkok - Aranyaprahet / Pol Pet (Thailand / Cambodia Border) - Sisophon - Phnom Penh - Bavet / Moc bal (Cambodia / Vietnam Border) - Ho Chi Minh City (Including Dong Nal - Vung Tau) - Danang - Hanoi - Haiphong	Capital - Capital
2	Muse (Myanmar / China Border) - Thibaw - Mandalay Melktila - Loilem (Including Loilem - Thibaw) - Keng Tung (Including Keng Tung - Monglar) - Thackilelk / Mae Sal (Myanmar / Thailand Border) - Tak - Bangkok - Chumphon Hat Yal - Sadao / Bukit Kayu Hitam (Thailand / Malaysia Border) - Ipoh - Kuala Lumpur - Seremban - Tanj'ung Kupang/ Tuas (Malaysia / Singapore Border 2nd link) (Including Johor Bahru - Malaysia / Singapore Border 1st link) - Singapore (Ferry Service) - Jakarta (Indonesia) - Semarang - Surakarta Surabaya - Denpasar	Capital - Capital
3	Boten (Lao PDR / China Border) - Luang Namtha - Huai Sal / Chiang Khong (Lao PDR / Thailand Border) - Chiang Rai	Linkage to China
4	Natrey (Lao PDR) - Oudomsay - Luang Phrabang - Vientiane - Thanalaeng / Nong Khal (Lao PDRiThalland Border) - Khon Kaen - Saraburl - Bangkok	Capital - Capital
5	Hanoi (Vietnam) - Tay Trang / Deo Tay Chang (Vietnam / Lao PDR Border) - Oudomsay - Pak Beng - Muang Ngeon / Hualkon (Lao PDR / Thailand Border) - Nan - Phitsanulok - Nakhon Sawan	Seaport - Capital
6	Vientiane (Lao PDR) - Savannakhet - Muang KhongNeun Kham (Lao PDR / Cambodia Border) - Streng Treng - Phnom Penh - Sihanoukville Port	Capital - Capital
7	Vinh (Vietnam) - Keo Nua/Nape (Vietnam/Lao PDR Border) - Laksao - Ban Lao - Thakhek / Nakhon Phanom (Lao PDR / Thailand Border) - Udon Thani	Seaport - Major City
7A	Vung Ang Port (Vietnam) - Mu Ghla (Vietnam / Lao PDR Border) - Thakhek	Seaport - Major City
7B	Quang Ngal Port - Kontum - Ban Het (Vietnam / Lao PDR Border) -Attapeu - Pakse	Seaport - Major City
7C	Hanoi (Vietnam) - Lao Cal (Vietnam/China Border)	Capital - China
8	Tak (Thailand) - Khon Kaen - Mukdahan / Savannakhet (Thailand / Lao PDR Border) - Lao Bao (Lao PDR / Vietnam Border) - Dong Ha	Major City - Seaport
9	Savannakhet / Mukdahan (Lao PDR / Thailand Border) - Yasothon - Burlram - Sakaeo - Phanom Sarakham - Sattahip	Seaport - seaport
9A	Phnom Sarakham - Kabinburl - Pakthongchal - Nakhon Ratchasima	Seaport - Lao PDR
10	Thaton (Myanmar)-Mawlamylne - Tavoy - Mugul - Lenya - Kawthong (including Lenya-Khlong Loy (Myanmar/Thalland Border) - Bang Saphan)	Country's back bone-port
11	Tavoy (Myanmar) - Sinptyutang/Bong Ti (Myanmar/Thailand Border) - Kanchanaburl - Bangkok - Laem Chabung - Maptaput - Hat Lek/Koh Kong (Thailand/ Cambodia Border) - Sre Ambel - Ho Chi Minh City - Kontum - Danang	Seaport - Seaport

Table E5: ASEAN Highway Networks (contd.)

No.	Origin - Destination	Criteria
12	Hat Yai (Thailand) - Pattani - Narathlwat - Sungal Kolok / Rantau (Thailand/Malaysia Border) - Kota Bharu - Kuala Terengganu - Kuantan - Mersing - Johore Bahru (Malaysia/Singapore Border) - Singapore	International linkages Major City - Major City
13	Kota Bharu (Malaysia) - Sungal Patani (Malaysia)	Country's back bone-port
13A	Port Klang (Malaysia) - Kuala Lumpur - Kuantan (Malaysia)	Seaport - Seaport
13B	Kuantan (Malaysia) - Segamat - Yong Peng (Malaysia)	Major City - Major City
13C	Kuching (Malaysia, Sarawak) - Serian - Bintulu - Miri - Sg. Tujoh (Malaysia/Brunei Darussalam Check Point) - Brunei Darussalam - Kuala Lurah (Brunei Darussalam/Malaysla Check Point) - Limbang / Puni (Malaysia / Brunei Darussalam Check Point) - Brunei - Labu (Brunei / Malaysia Check Point) - Lawas - Sindumin - Kota Kinabalu - Sandakan - Lahad Datu - Tawau - Serudong/Nunukan (Malaysia, Sabah / Indonesia Border) - Samarinda - Banj'armasin - Palangka Raya - Pontianak - Entikong/Tebedu (Indonesia/Malaysia,Sarawak Border) - Serian	Major City - Capital City in Pan Borneo Island
14	Banda Aceh (Indonesia) - Medan - Dumal - Palembang - Bakahuni	Country's back bone-port
15	Tebingtinggi (Indonesia) - Padang - Bakahuni - (Ferry Service) - Merak - Jakarta - Bandung - Jogyakarta - Surakarta (Indonesia)	Major Cities - Major Cities
16	Laoag City (Philippines) - Manila - Matnog - (Ferry Service) - San Isidro - Taeloban City - Liloan - (Ferry Service) - Lipata - Surigao City - Davao City - General Santos City - Zamboanga City (Philippines)	Country's back bone-port

Source: ASEAN official website (http://www.aseansec.org/ahnp_a.htm)

The development is the combination of the construction and upgrading of the infrastructure, customs facilitation along the corridor, and the establishment of a new sea routes. Specifically, the overhead time consumed at the border 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. The "upgrading" of land routes means cars can run on it at 60 km/h, and speed going through the sea routes increases to become twice as fast than the baseline scenario. The economic effects and the changes in traffic volume as a result of the development of Each ASEAN highway are depicted in Figures E10 to E55.

Figure E10: Gains in Regional GDP: ASEAN Highway No. 1 (10 years after)

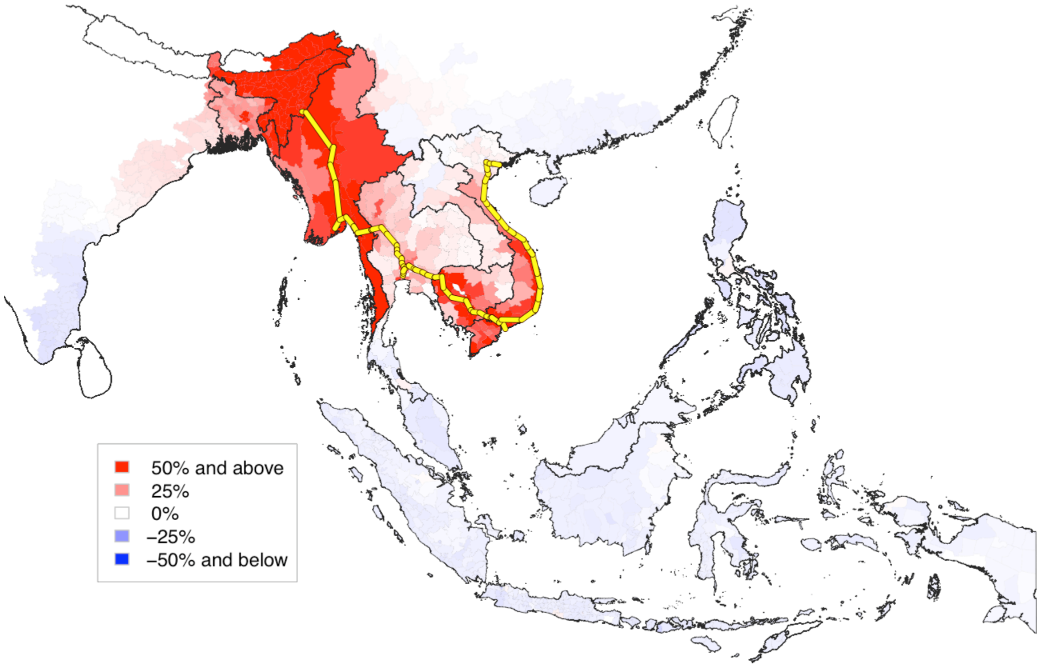


Figure E11: Changes in Traffic Volume by ASEAN Highway No.1 (10 years after)

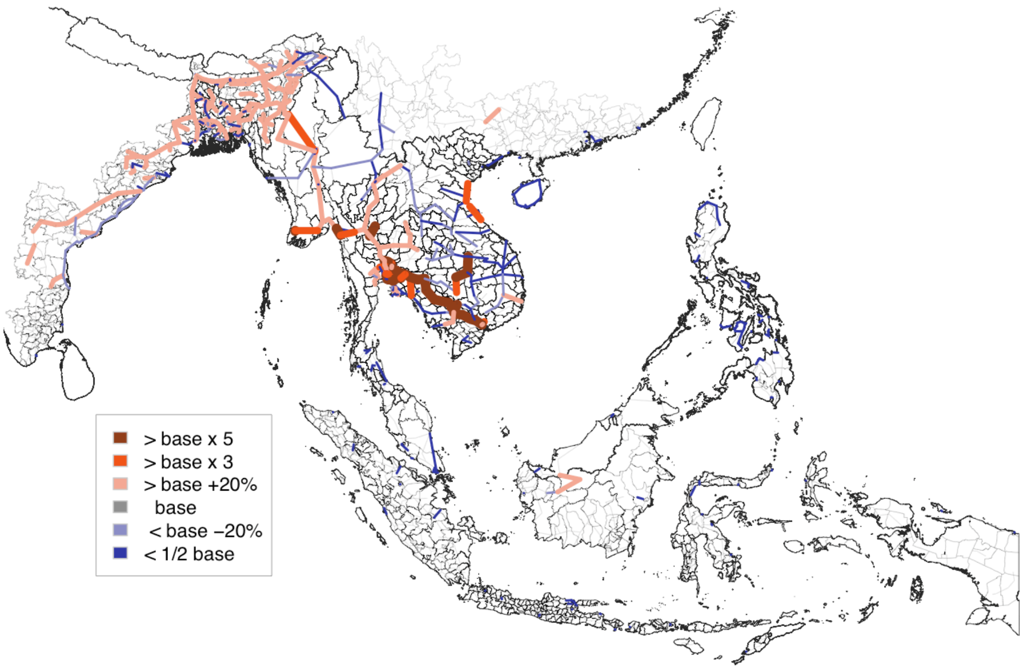


Figure E12: Gains in Regional GDP: ASEAN Highway No. 2 (10 years cumulative)

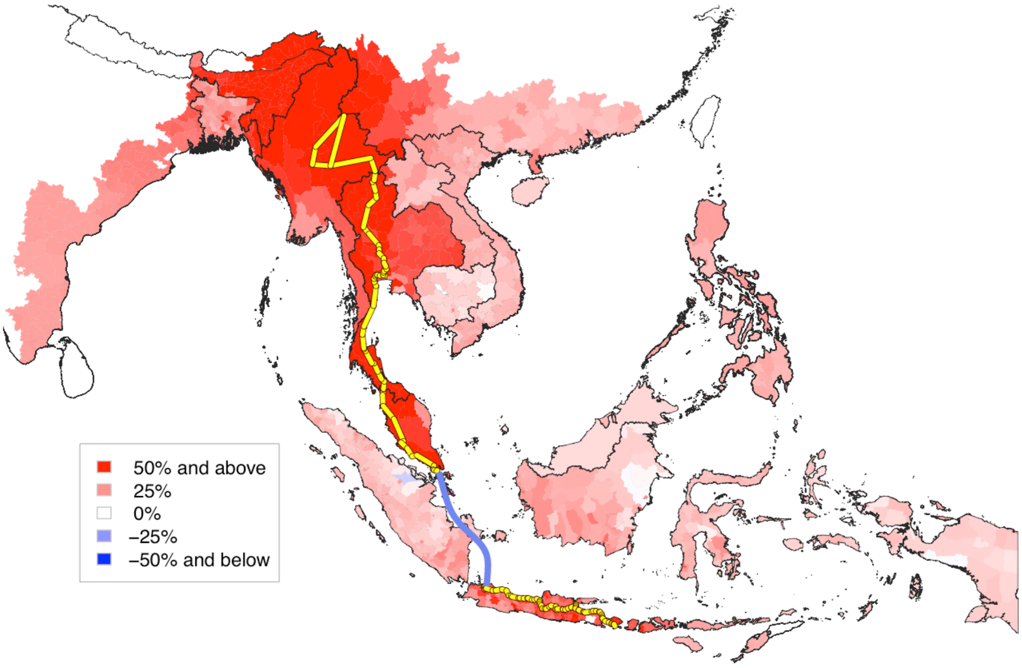


Figure E13: Changes in Traffic Volume by ASEAN Highway No.2 (10 years after)

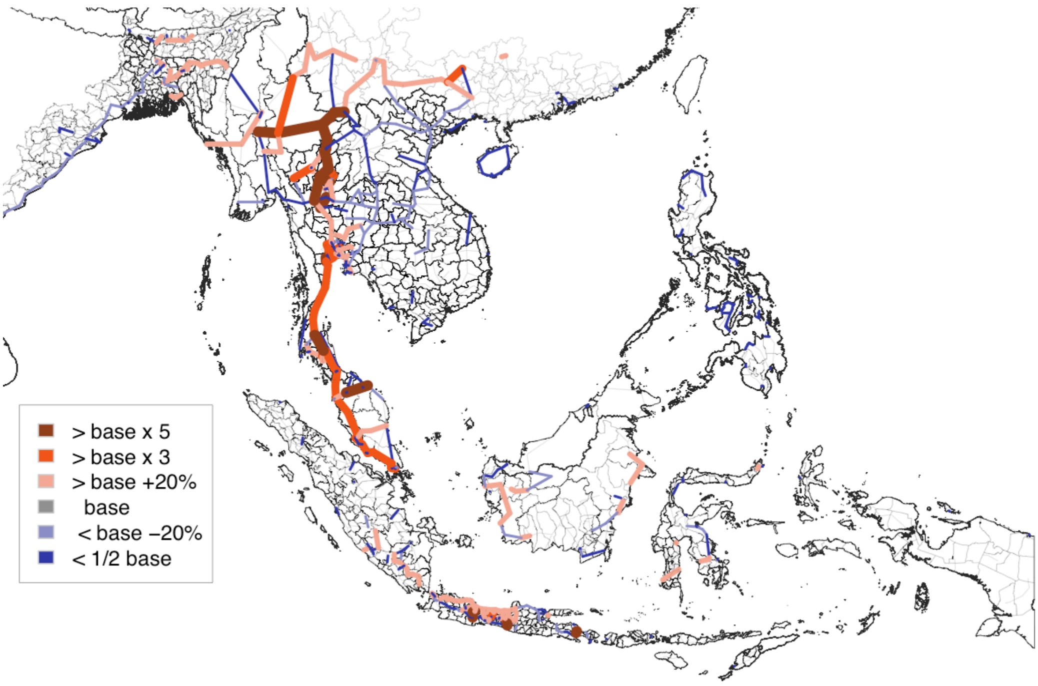


Figure E14: Gains in Regional GDP: ASEAN Highway No. 3 (10 years cumulative)

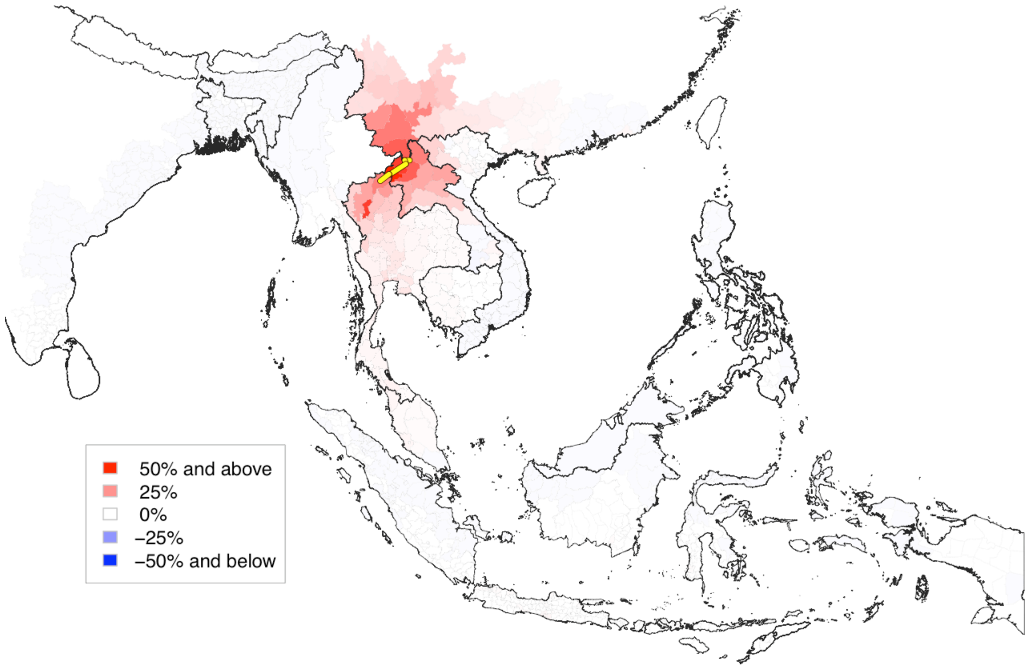


Figure E15: Changes in Traffic Volume by ASEAN Highway No.3 (10 years after)

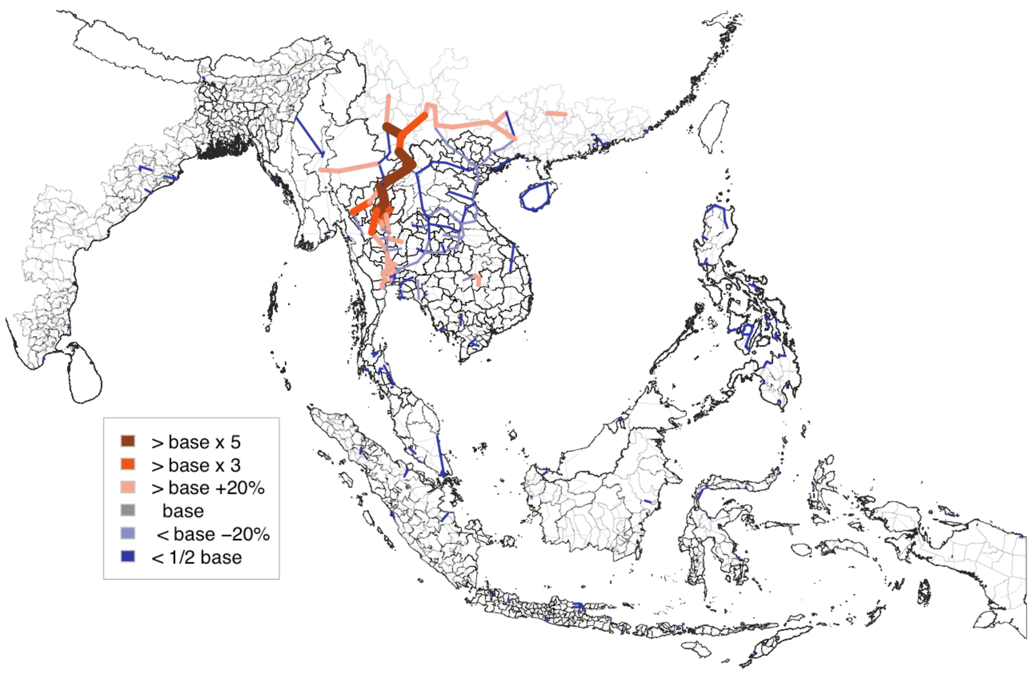


Figure E16: Gains in Regional GDP: ASEAN Highway No. 4 (10 years cumulative)

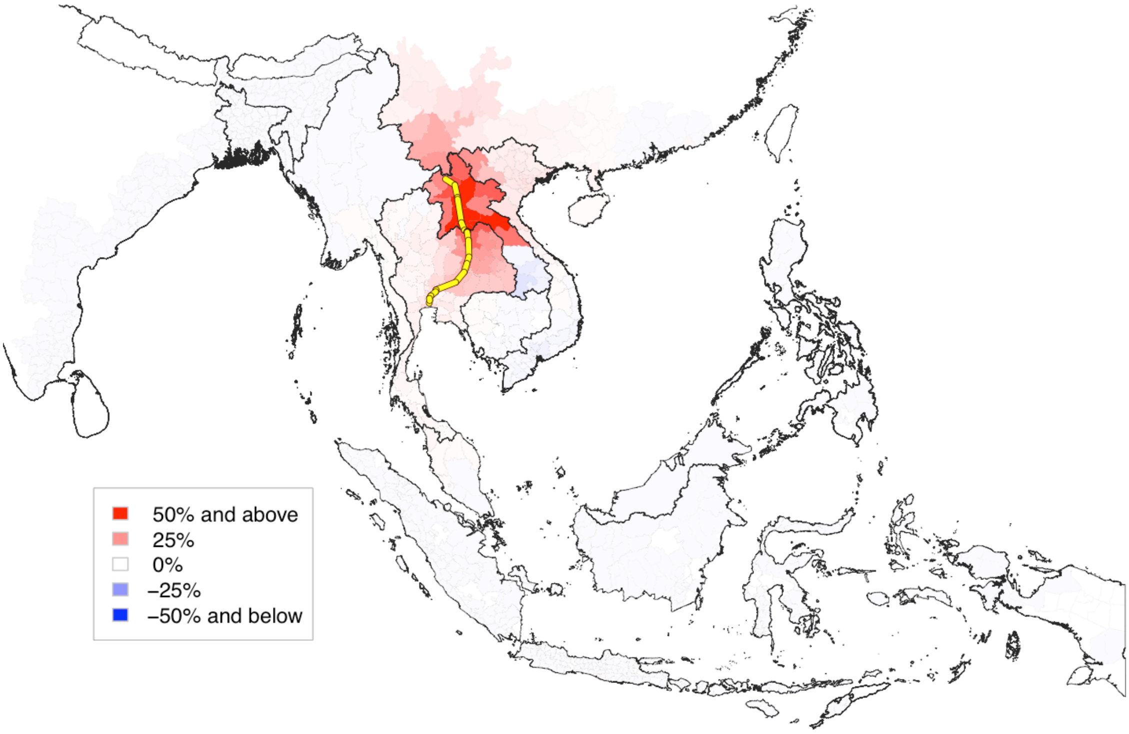


Figure E17: Changes in Traffic Volume by ASEAN Highway No.4 (10 years after)

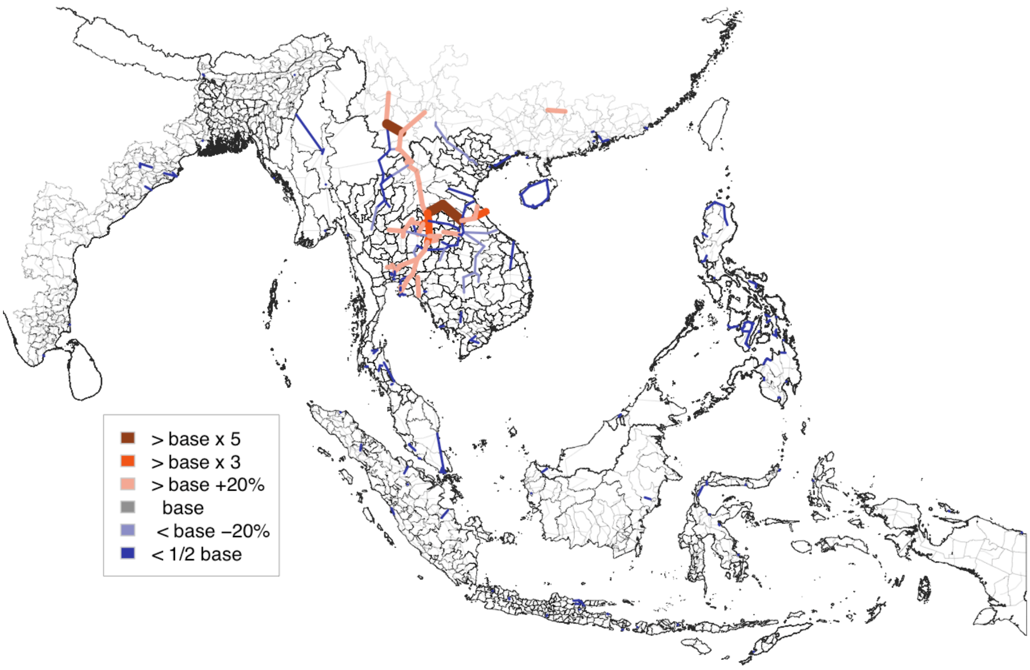


Figure E18: Gains in Regional GDP: ASEAN Highway No. 5 (10 years cumulative)

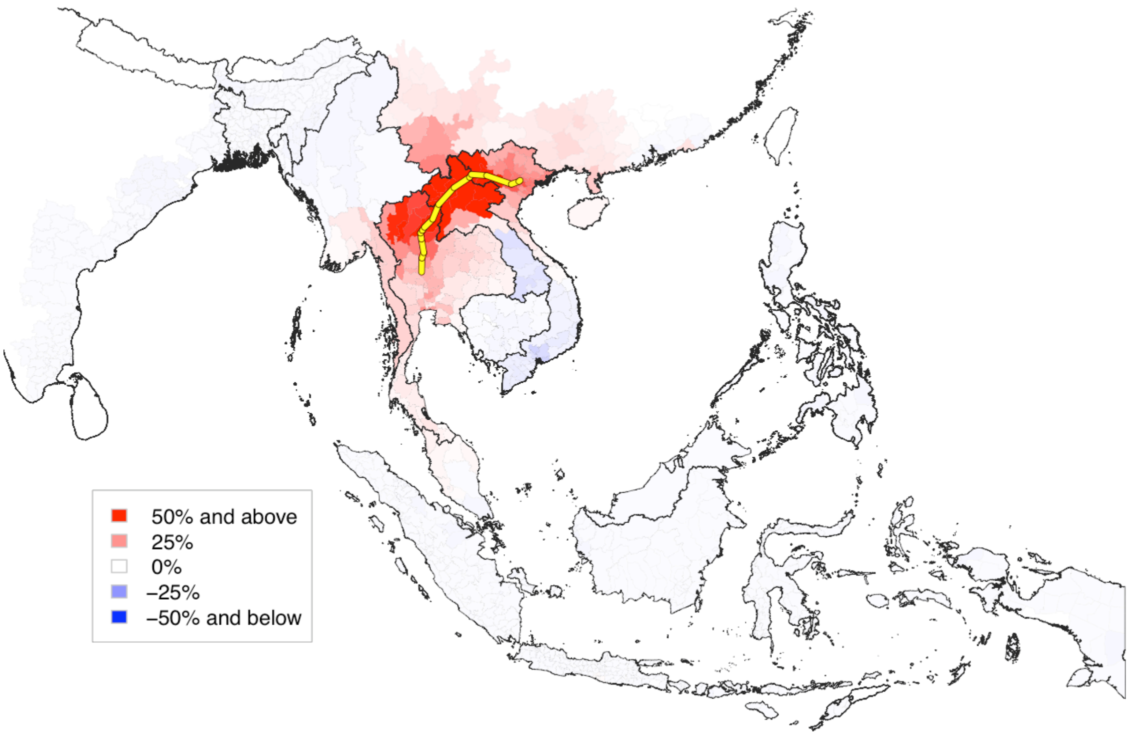


Figure E19: Changes in Traffic Volume by ASEAN Highway No.5 (10 years after)

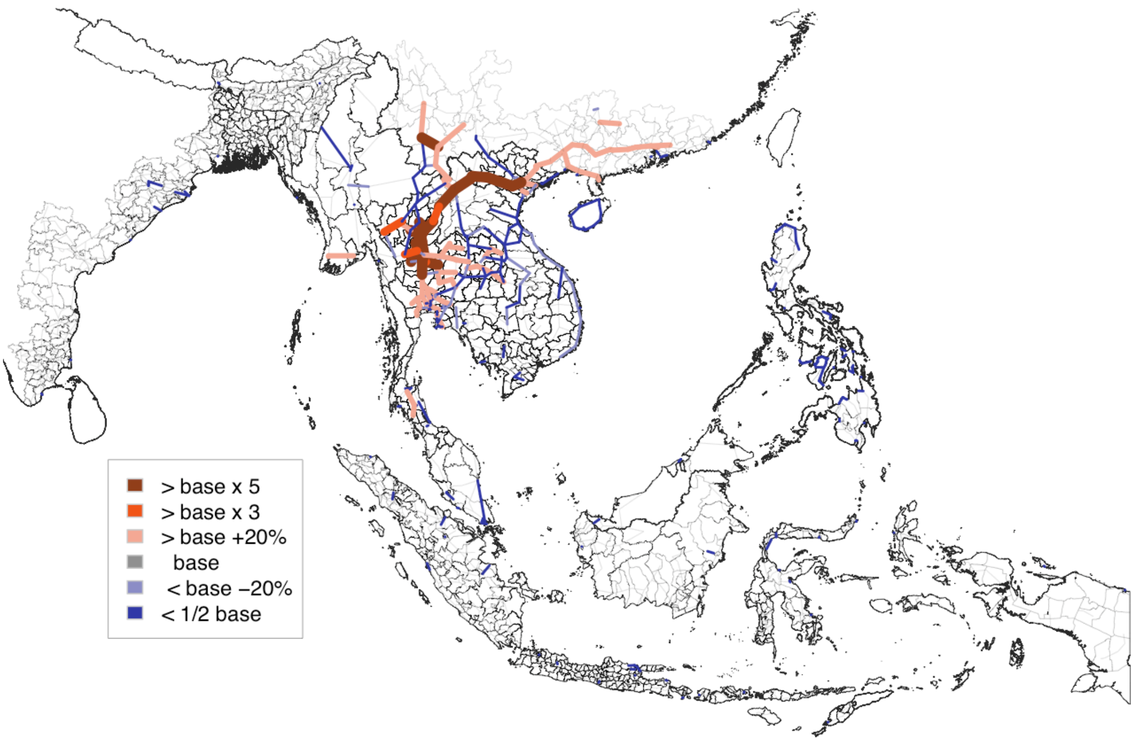


Figure E20: Gains in Regional GDP: ASEAN Highway No. 6 (10 years cumulative)

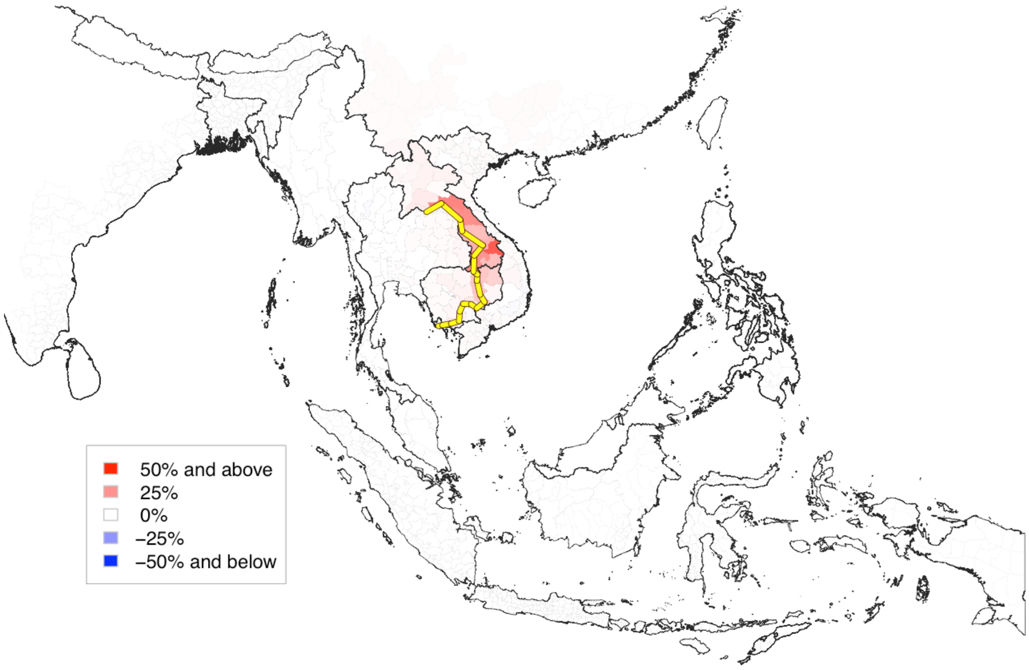


Figure E21: Changes in Traffic Volume by ASEAN Highway No.6 (10 years after)

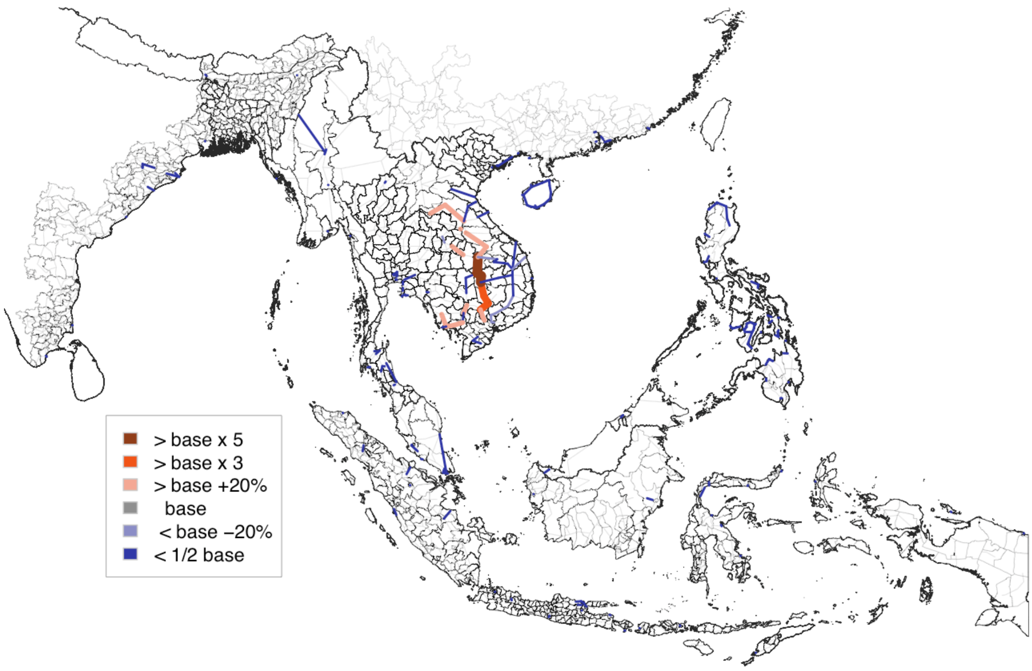


Figure E22: Gains in Regional GDP: ASEAN Highway No. 7 (10 years cumulative)

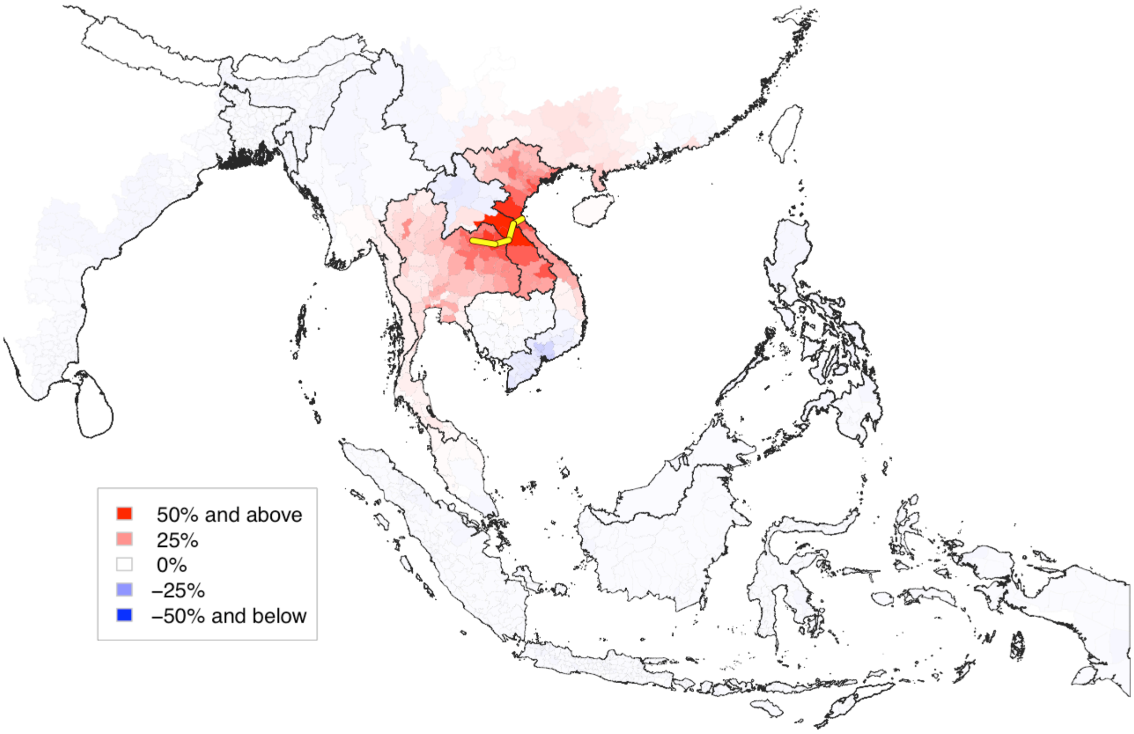


Figure E23: Changes in Traffic Volume by ASEAN Highway No.7 (10 years after)

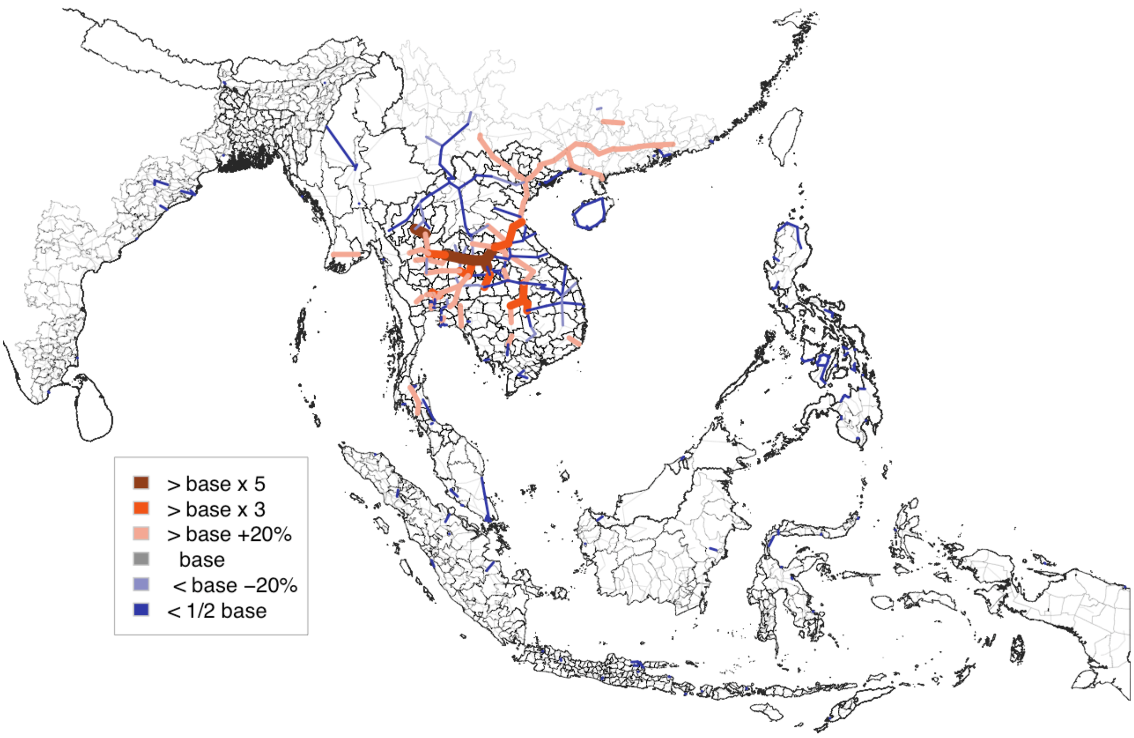


Figure E24: Gains in Regional GDP: ASEAN Highway No. 7A (10 years cumulative)

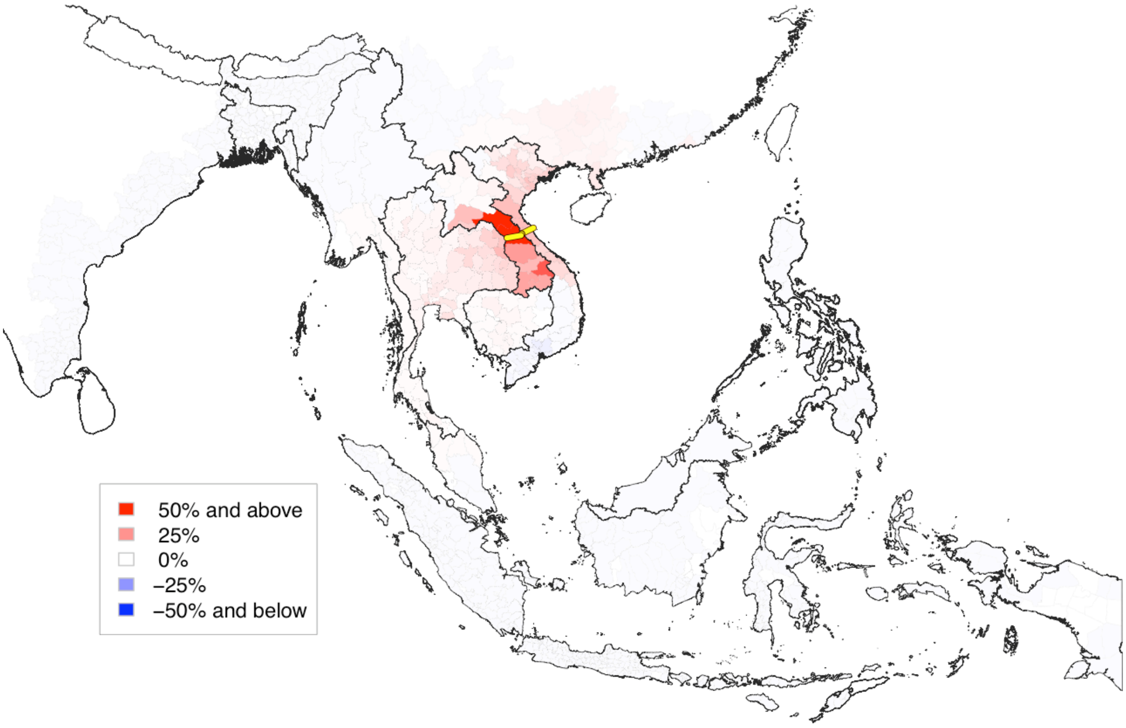


Figure E25: Changes in Traffic Volume by ASEAN Highway No.7A (10 years after)

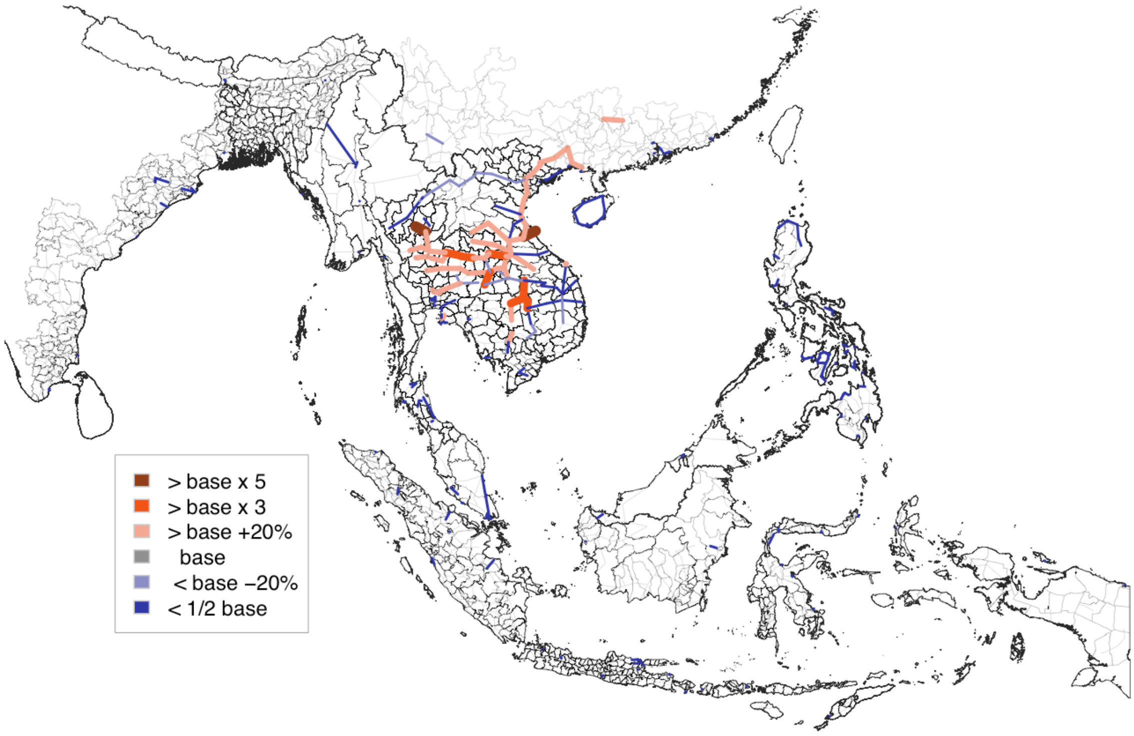


Figure E26: Gains in Regional GDP: ASEAN Highway No.7B (10 years cumulative)

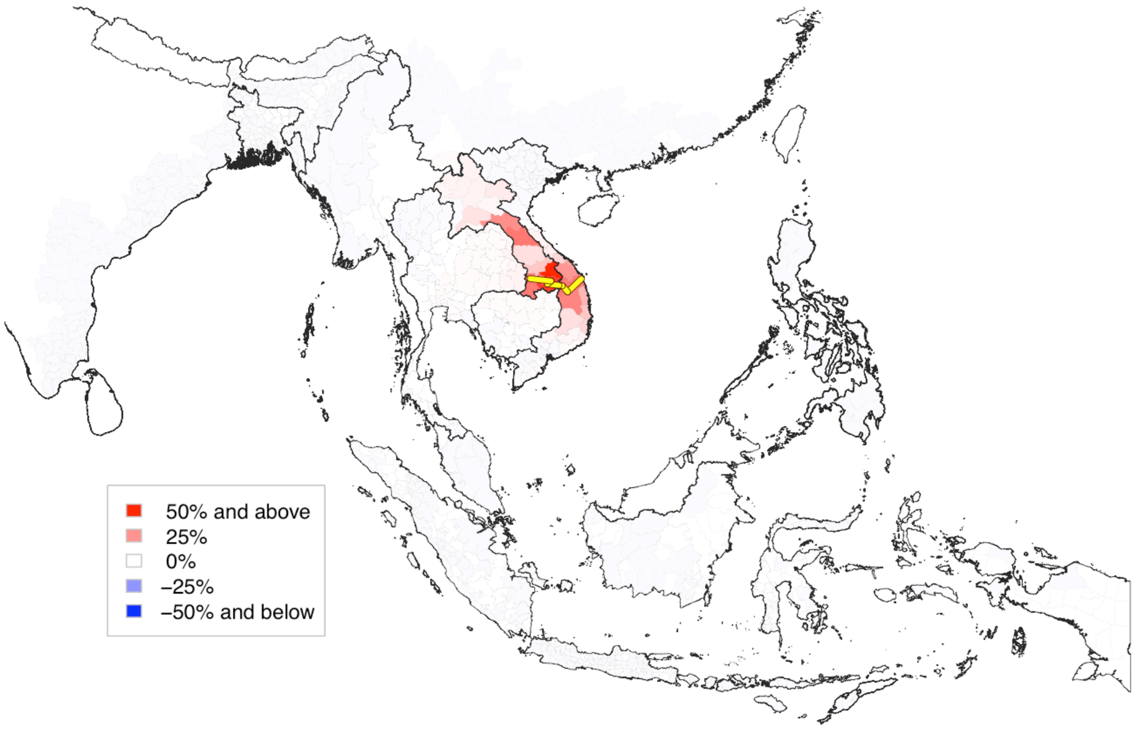


Figure E27: Changes in Traffic Volume by ASEAN Highway No.7B (10 years after)

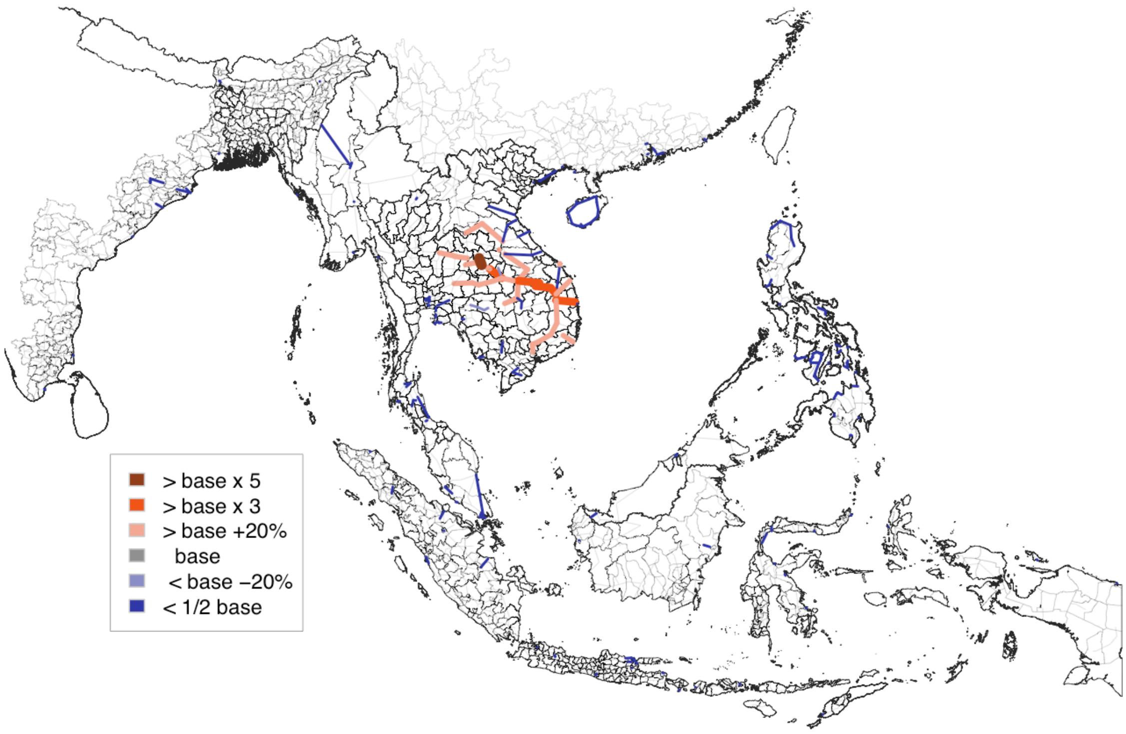


Figure E28: Gains in Regional GDP: ASEAN Highway No. 7C (10 years cumulative)

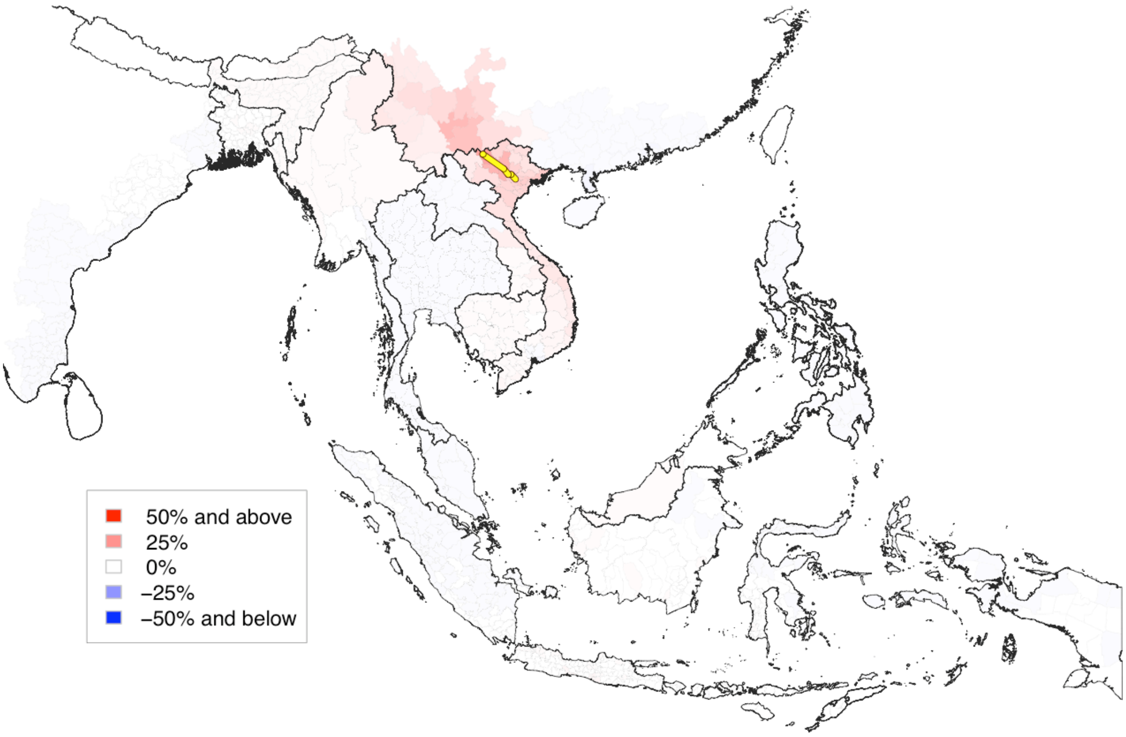


Figure E29: Changes in Traffic Volume by ASEAN Highway No.7C (10 years after)

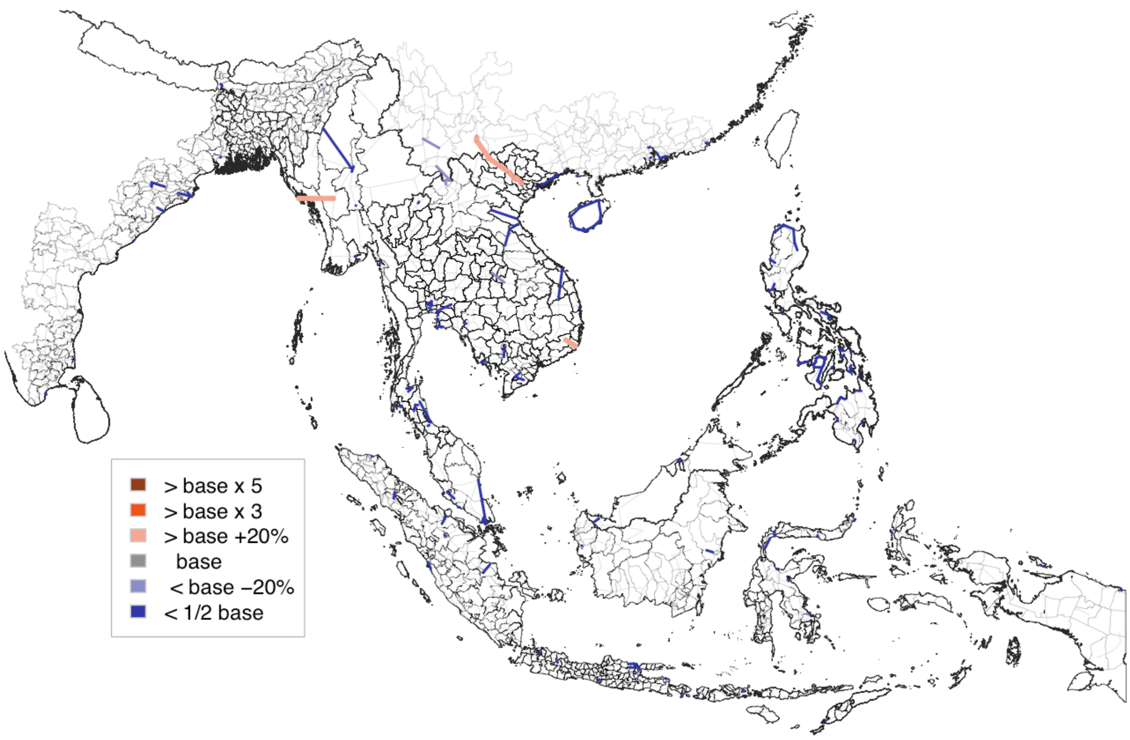


Figure E30: Gains in Regional GDP: ASEAN Highway No. 8 (10 years cumulative)

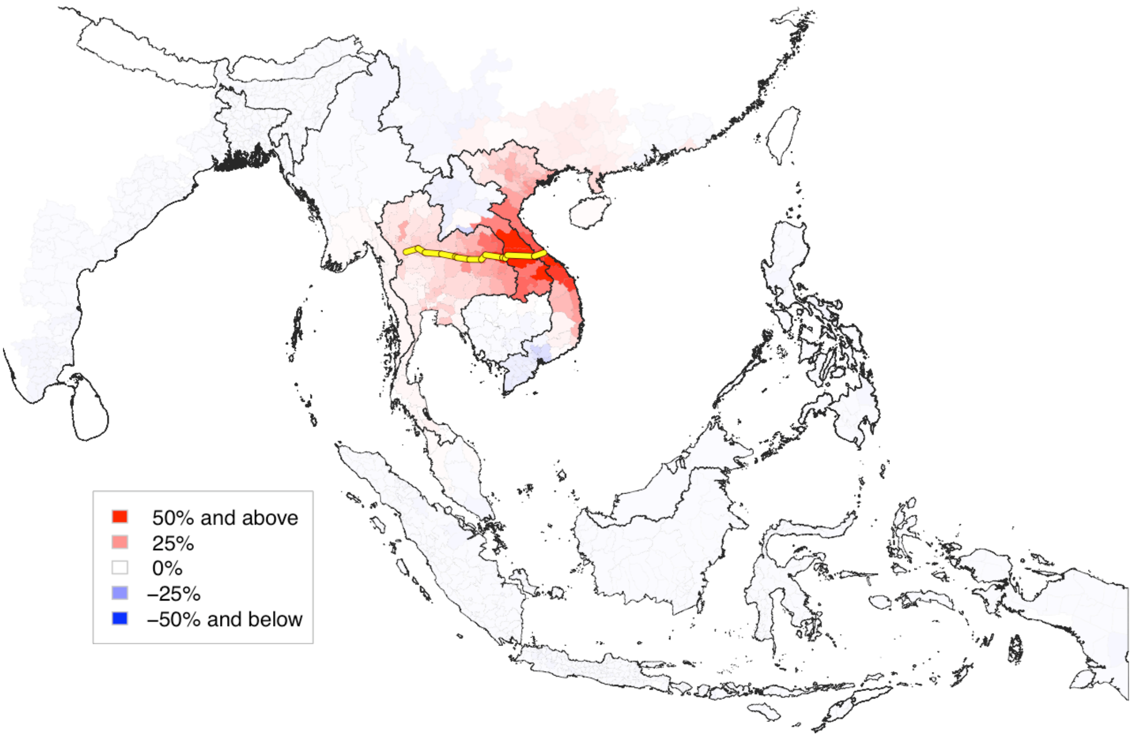


Figure E31: Changes in Traffic Volume by ASEAN Highway No.8 (10 years after)

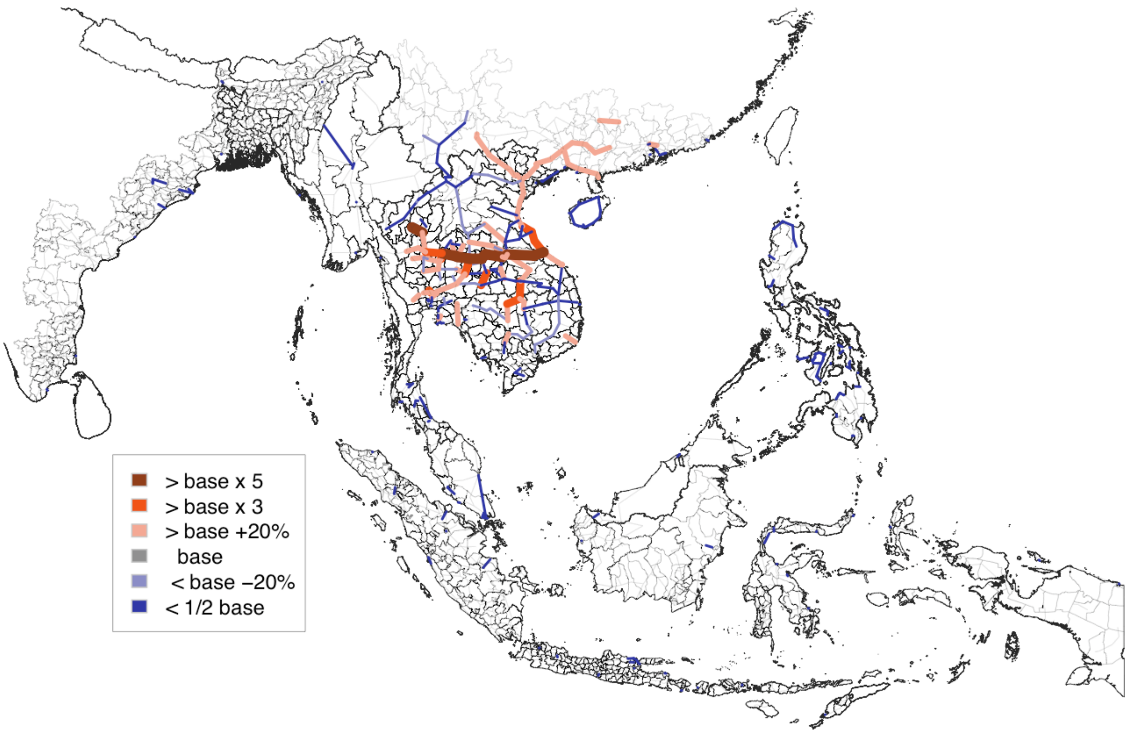


Figure E32: Gains in Regional GDP: ASEAN Highway No.9 (10 years cumulative)

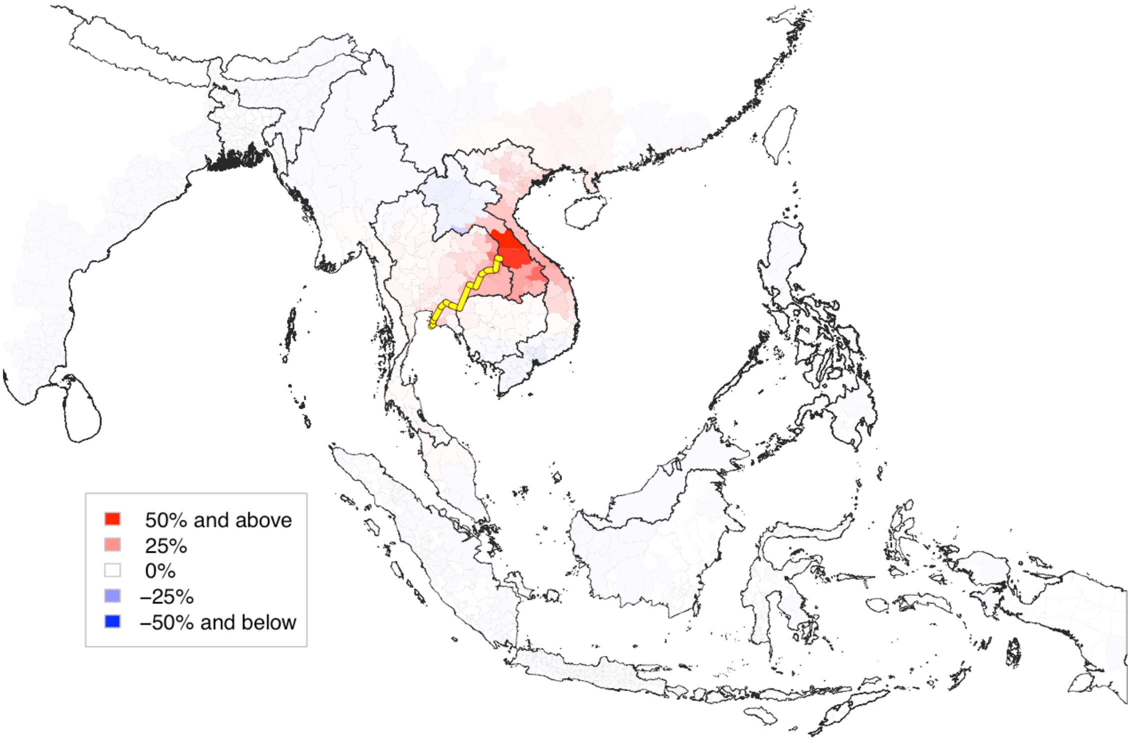


Figure E33: Changes in Traffic Volume by ASEAN Highway No.9 (10 years after)

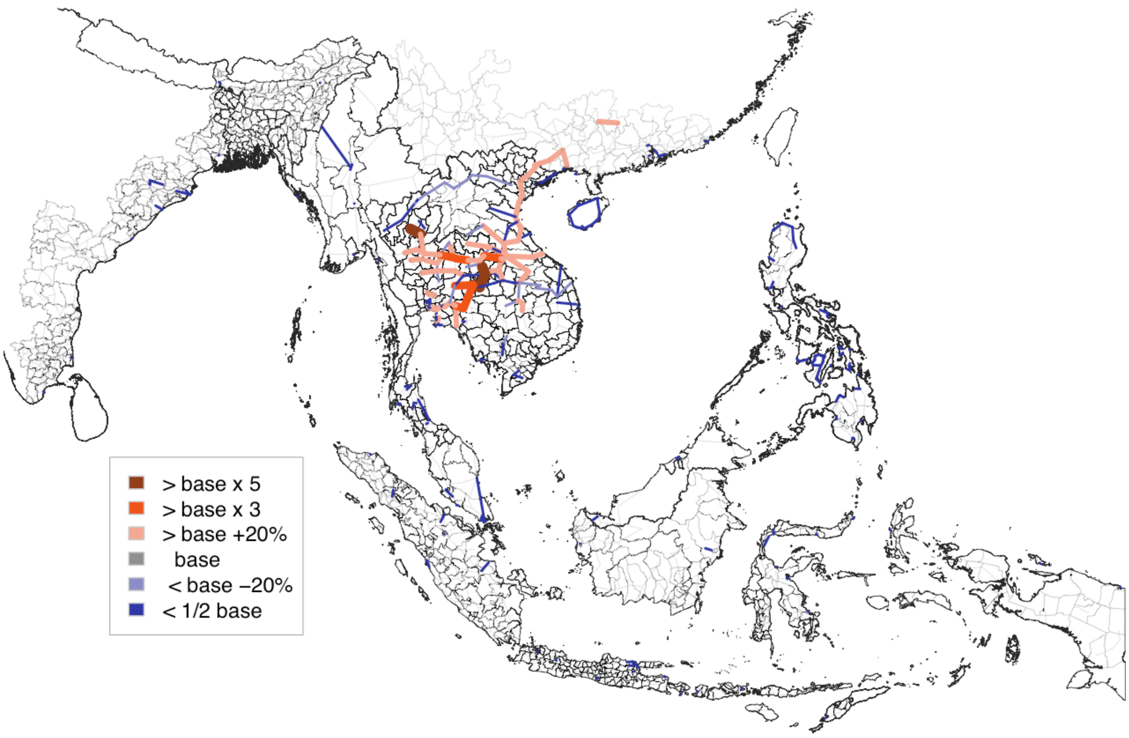


Figure E34: Gains in Regional GDP: ASEAN Highway No.9A (10 years cumulative)

Figure E35: Changes in Traffic Volume by ASEAN Highway No.9A (10 years after)

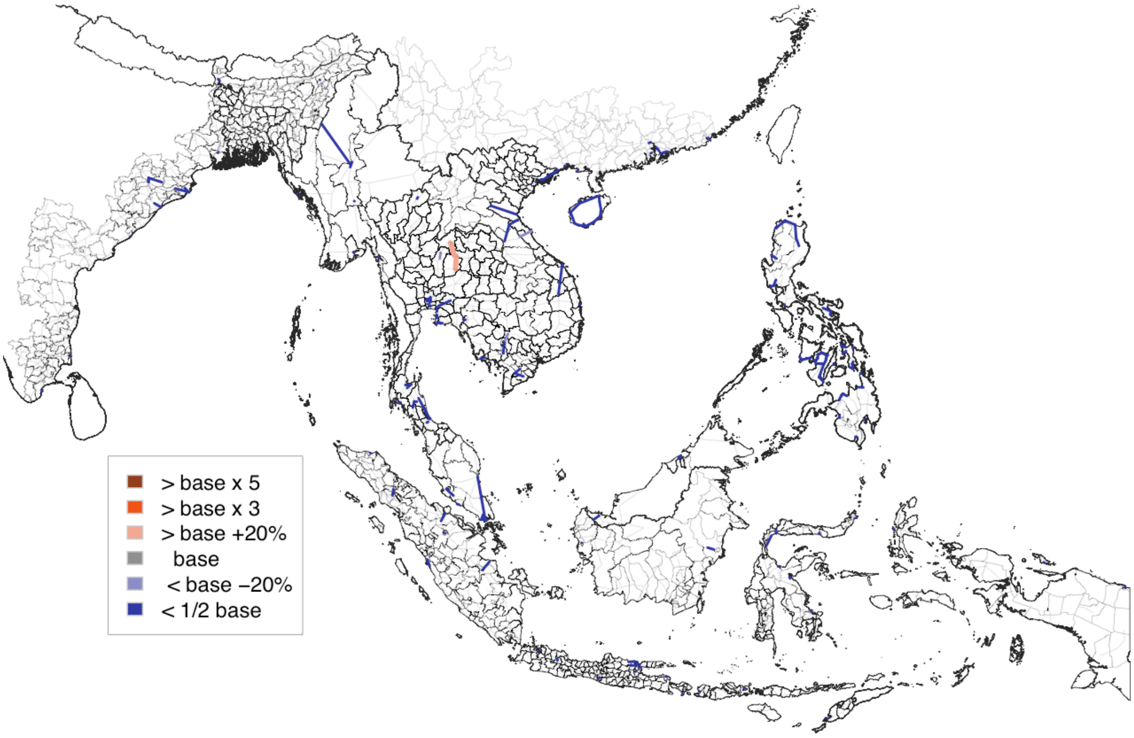


Figure E36: Gains in Regional GDP: ASEAN Highway No.10 (10 years cumulative)

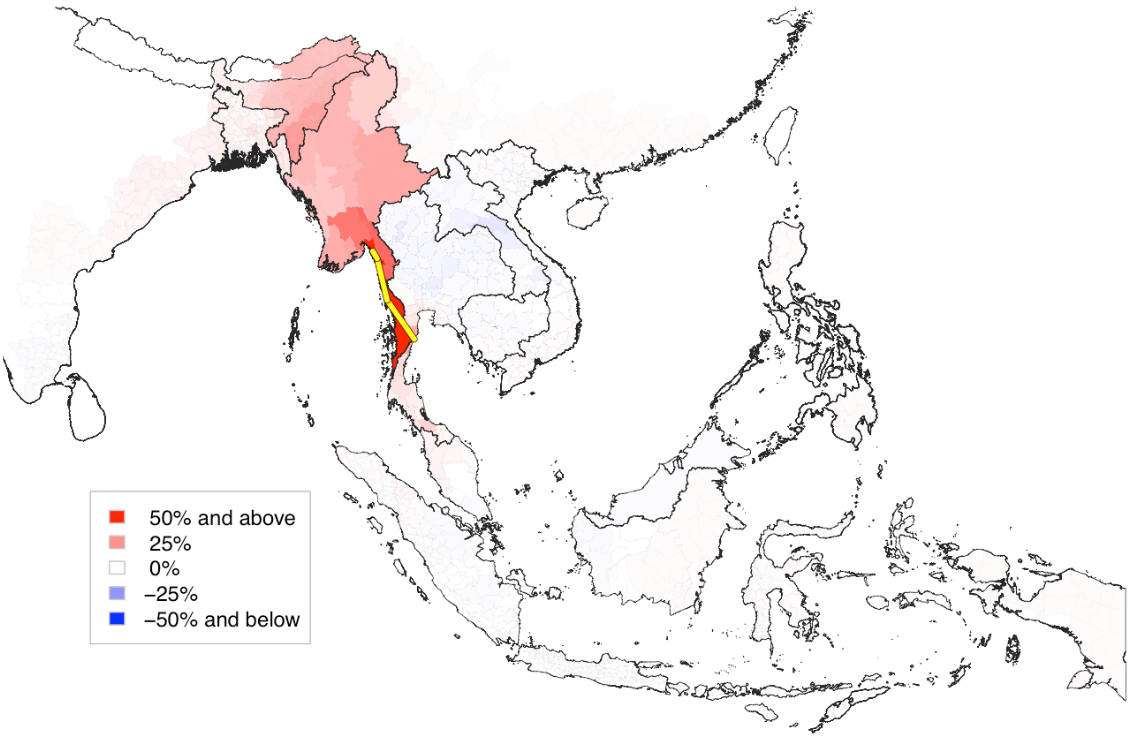


Figure E37: Changes in Traffic Volume by ASEAN Highway No.10 (10 years after)

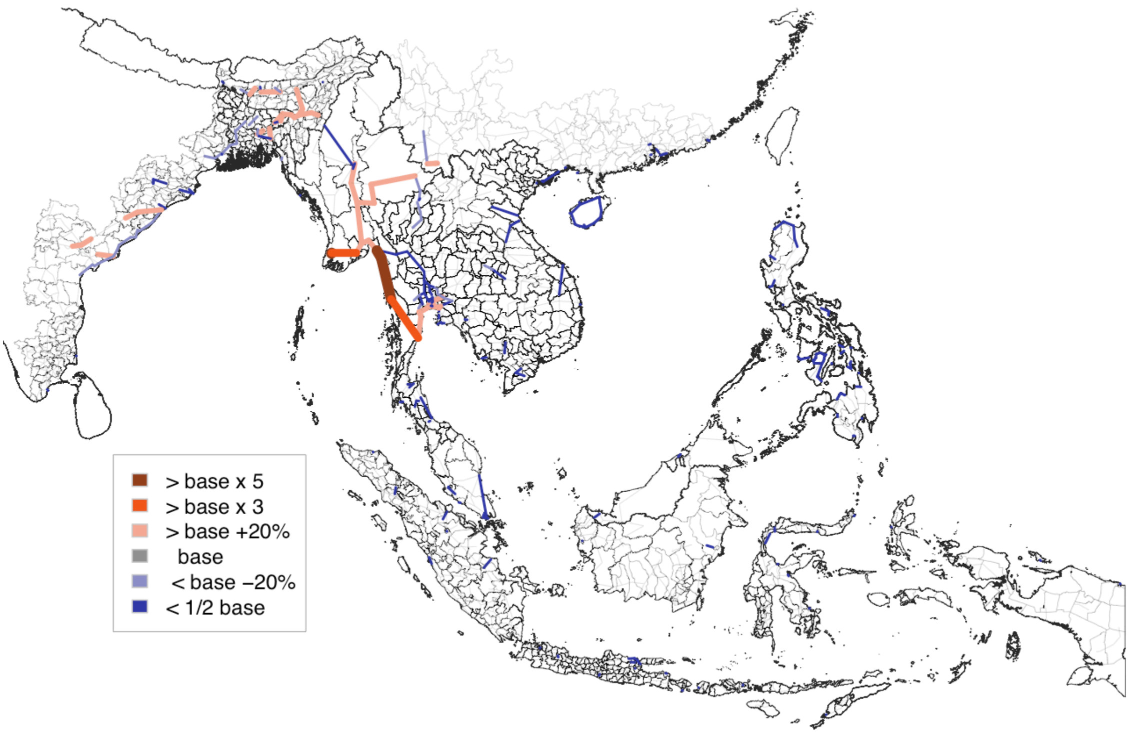


Figure E38: Gains in Regional GDP: ASEAN Highway No.11 (10 years cumulative)

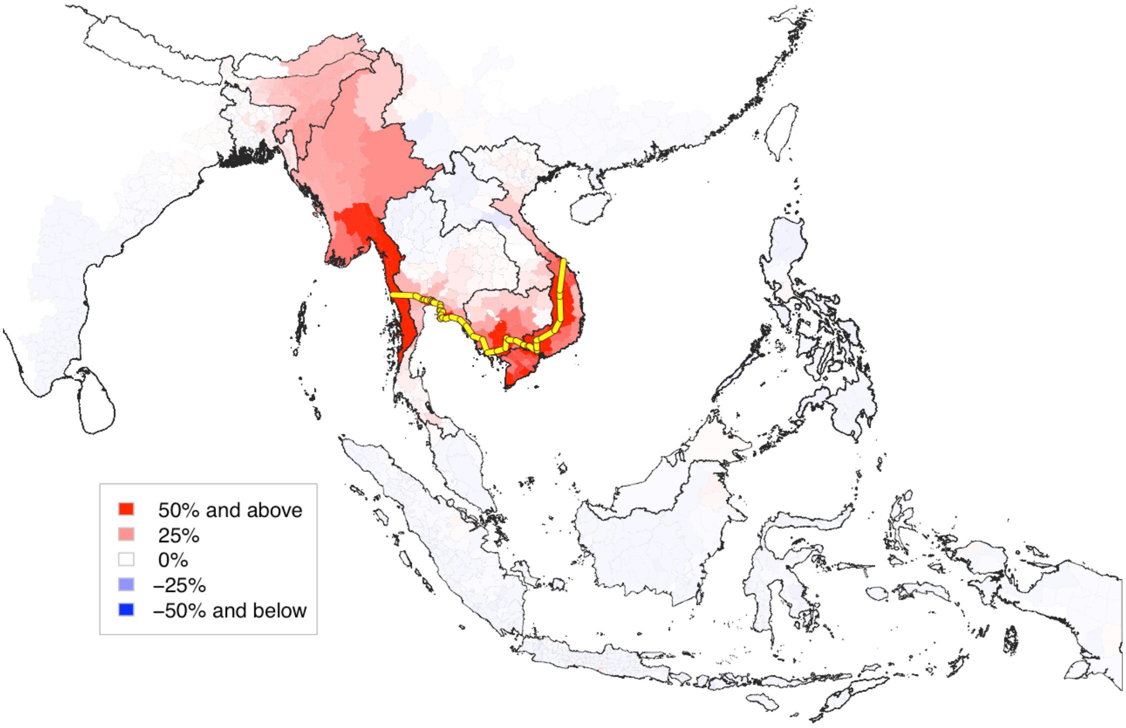


Figure E39: Changes in Traffic Volume by ASEAN Highway No.11 (10 years after)

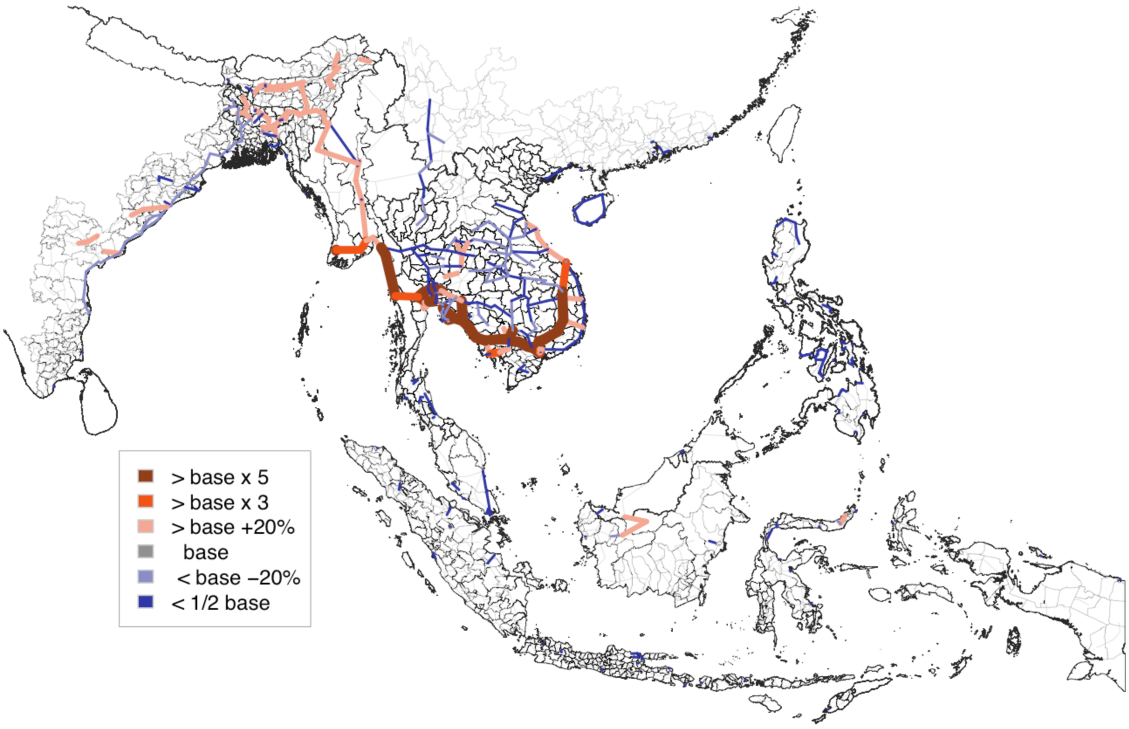


Figure E40: Gains in Regional GDP: ASEAN Highway No.12 (10 years cumulative)

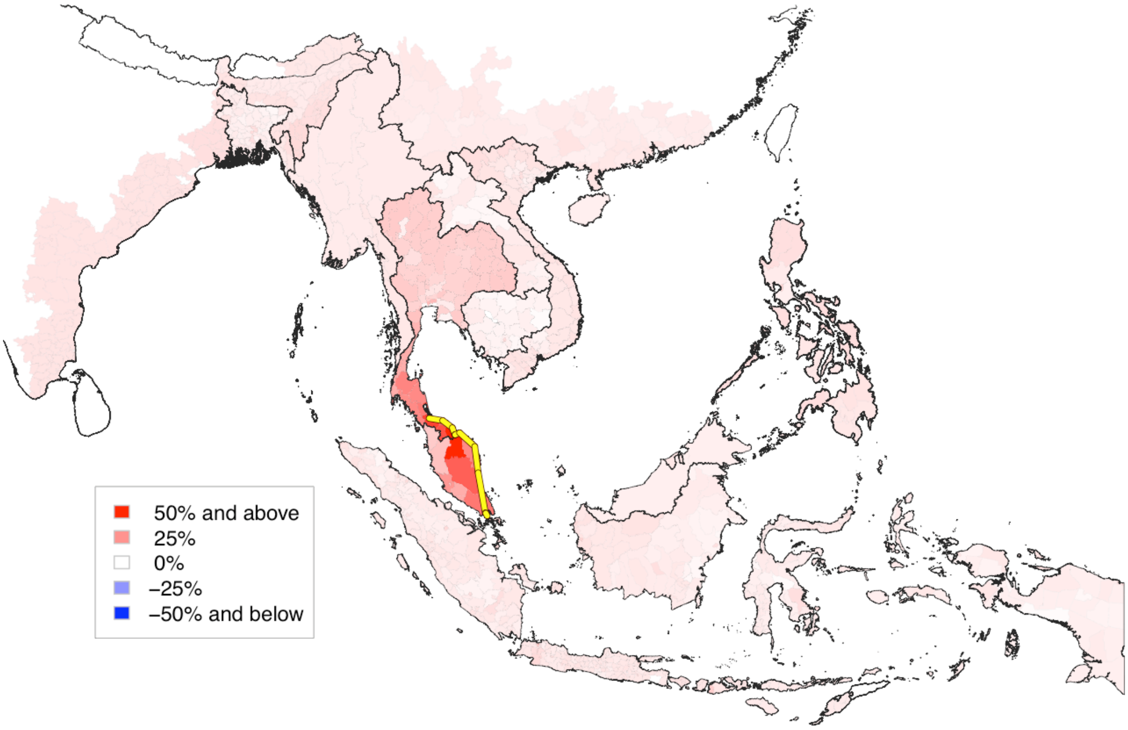


Figure E41: Changes in Traffic Volume by ASEAN Highway No.12 (10 years after)

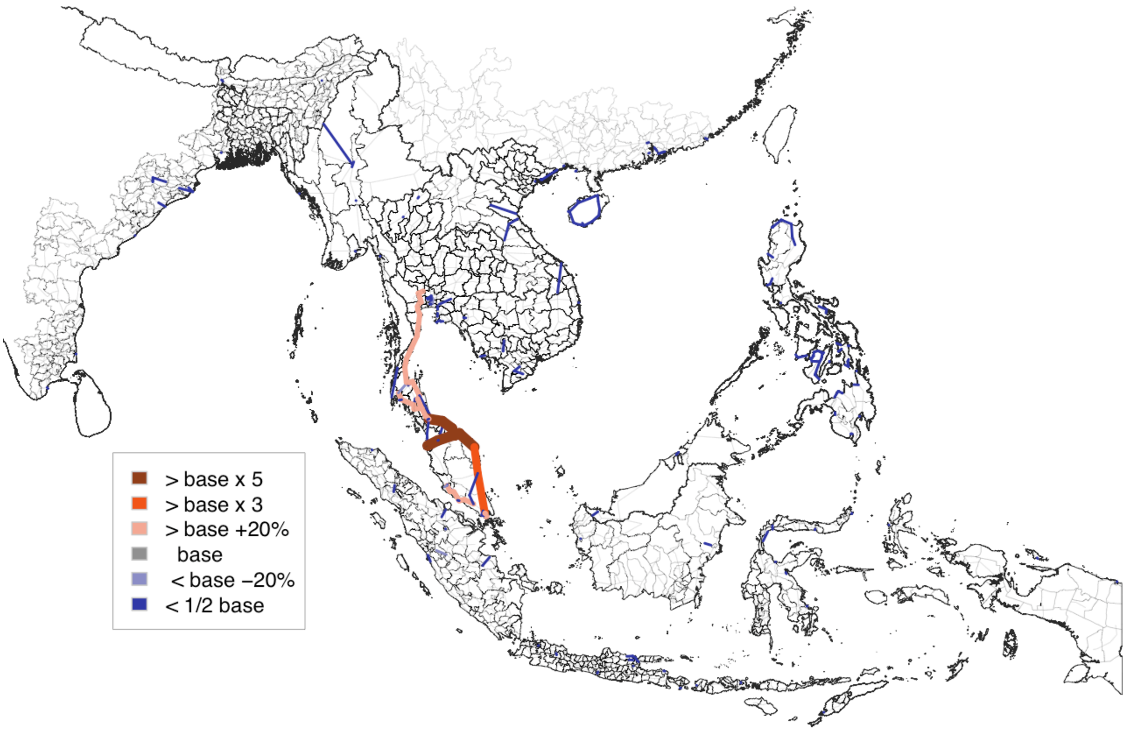


Figure E42: Gains in Regional GDP: ASEAN Highway No.13 (10 years cumulative)

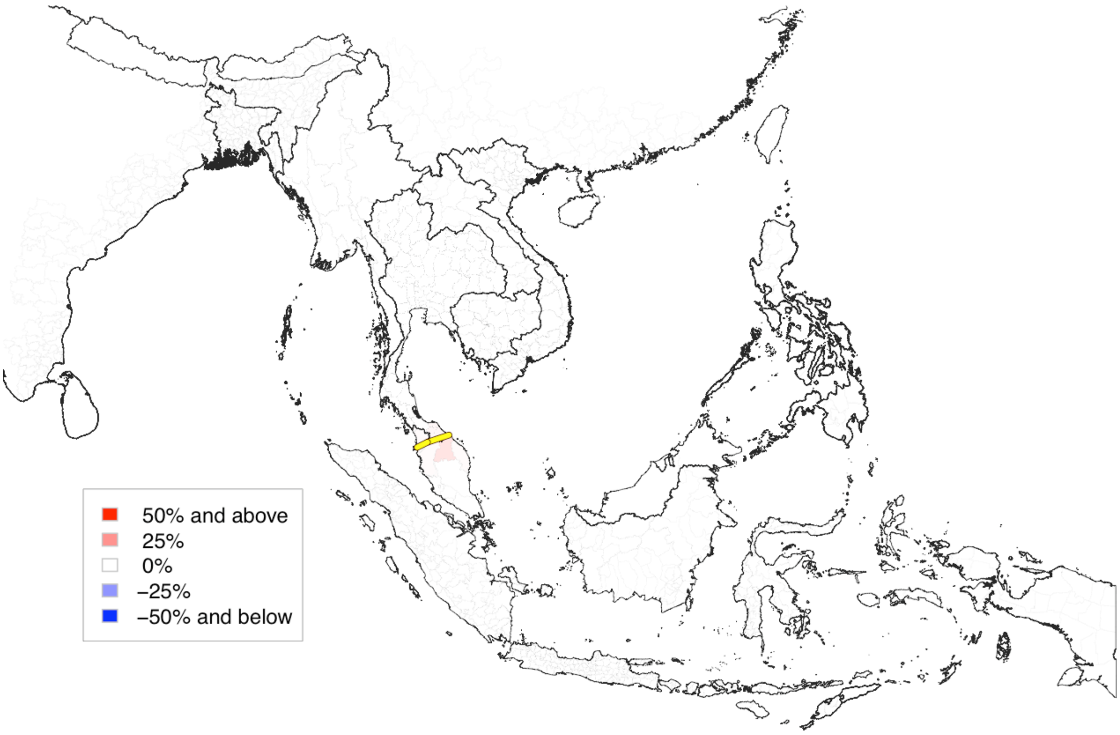


Figure E43: Changes in Traffic Volume by ASEAN Highway No.13 (10 years after)

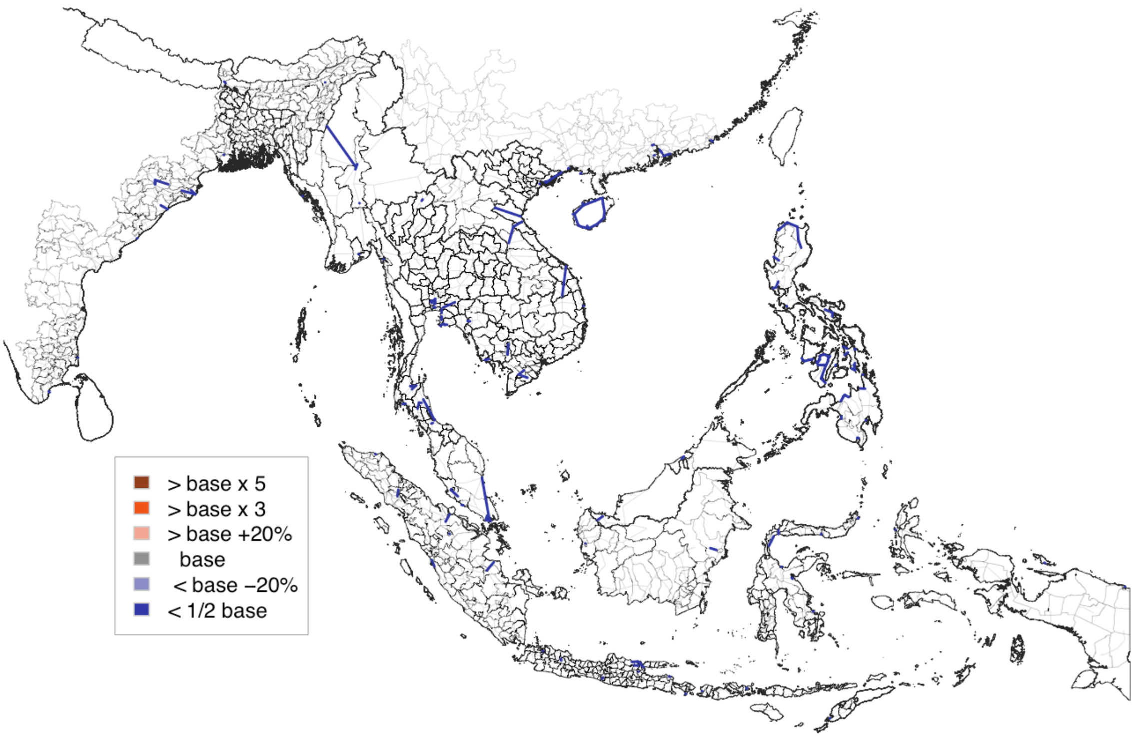


Figure E44: Gains in Regional GDP: ASEAN Highway No. 13A (10 years cumulative)

Figure E45: Changes in Traffic Volume by ASEAN Highway No.13A (10 years after)

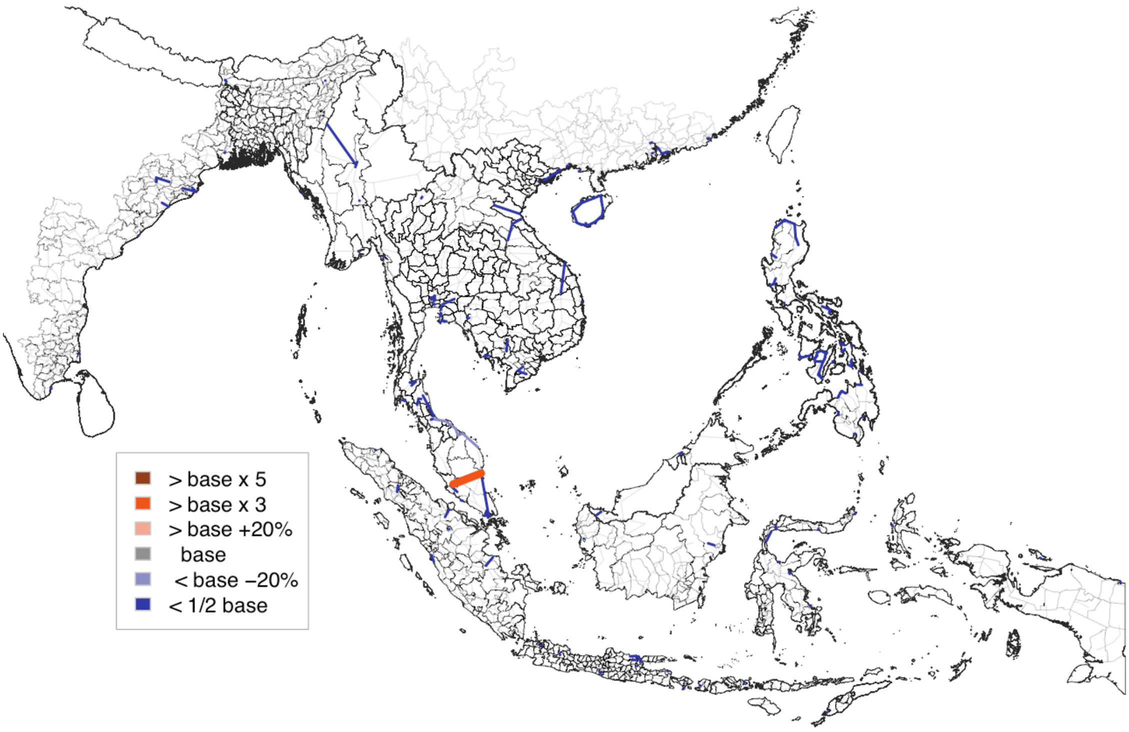


Figure E46: Gains in Regional GDP: ASEAN Highway No.13B (10 years cumulative)

Figure E47: Changes in Traffic Volume by ASEAN Highway No.13B (10 years after)

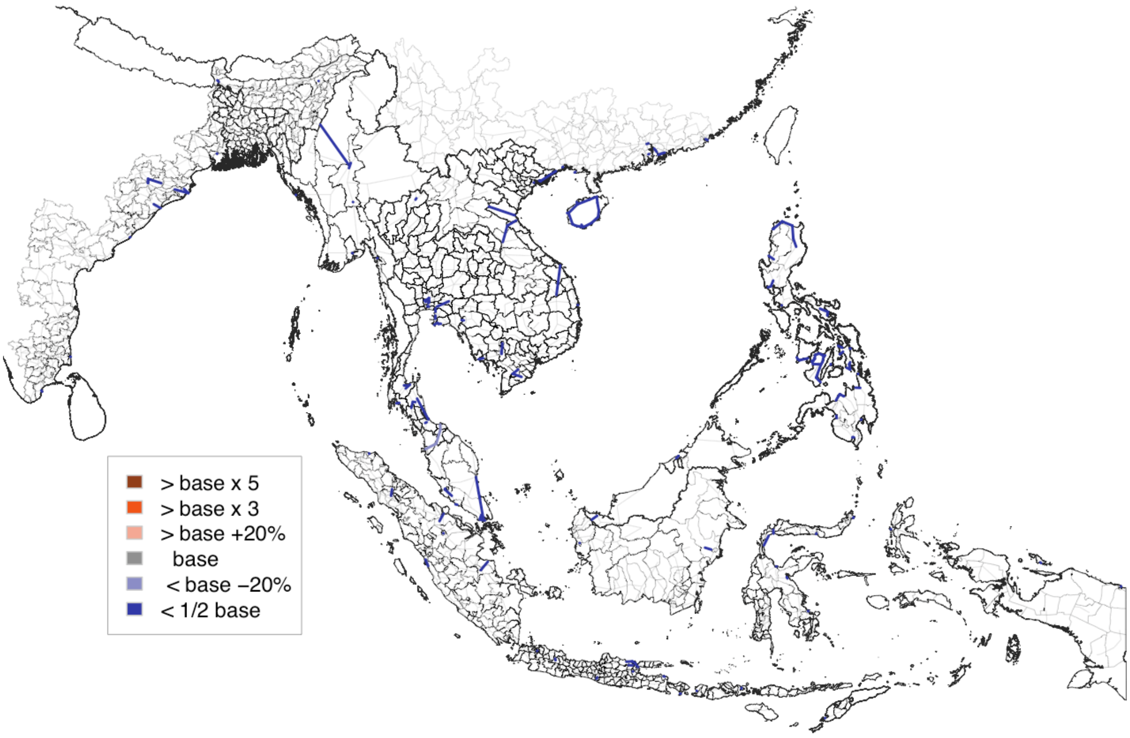


Figure E48: Gains in Regional GDP: ASEAN Highway No.13C (10 years cumulative)

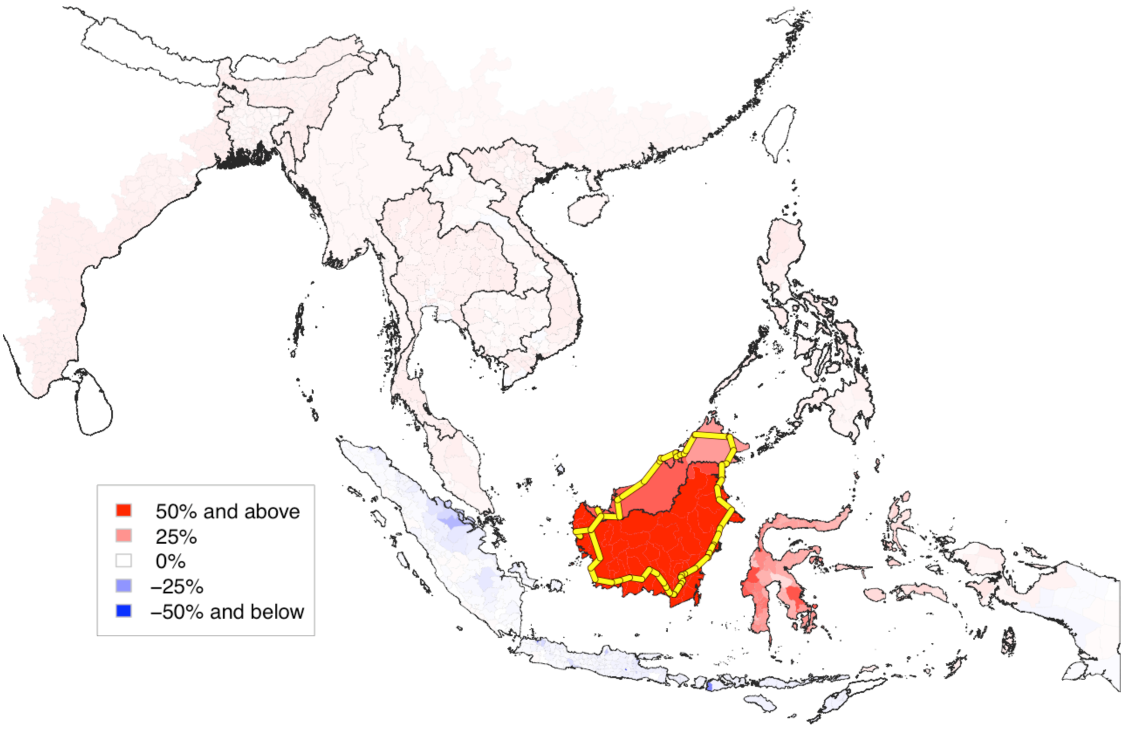


Figure E49: Changes in Traffic Volume by ASEAN Highway No.13C (10 years after)

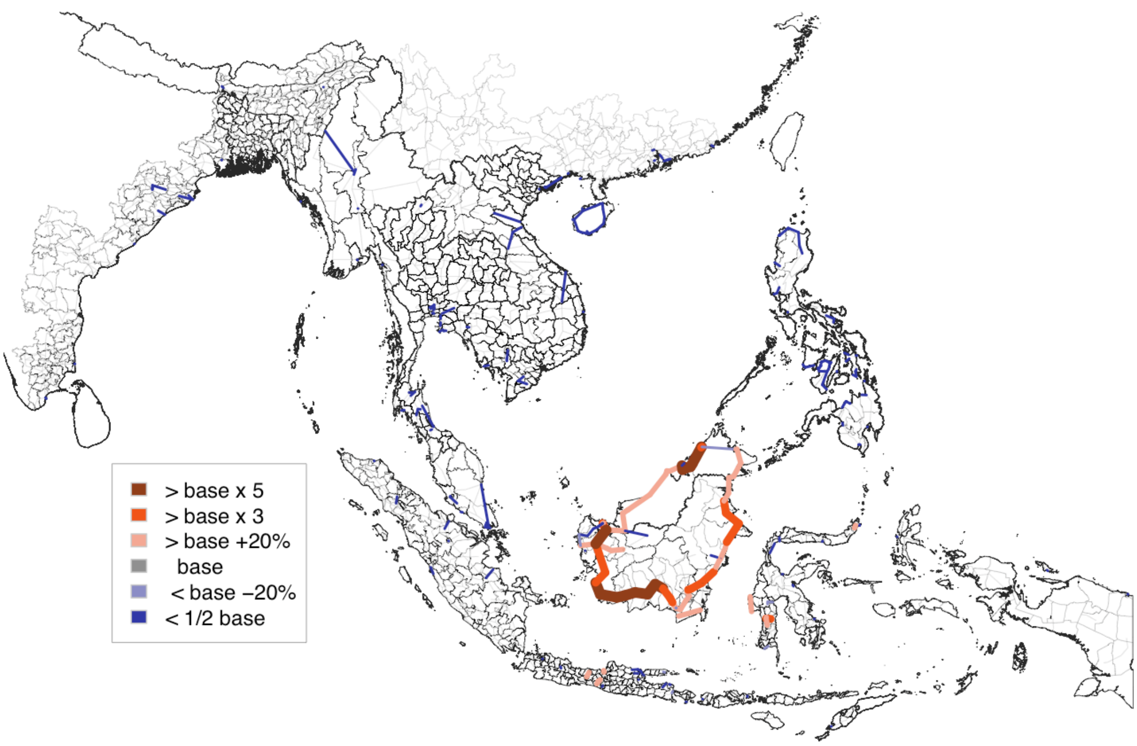


Figure E50: Gains in Regional GDP: ASEAN Highway No.14 (10 years cumulative)

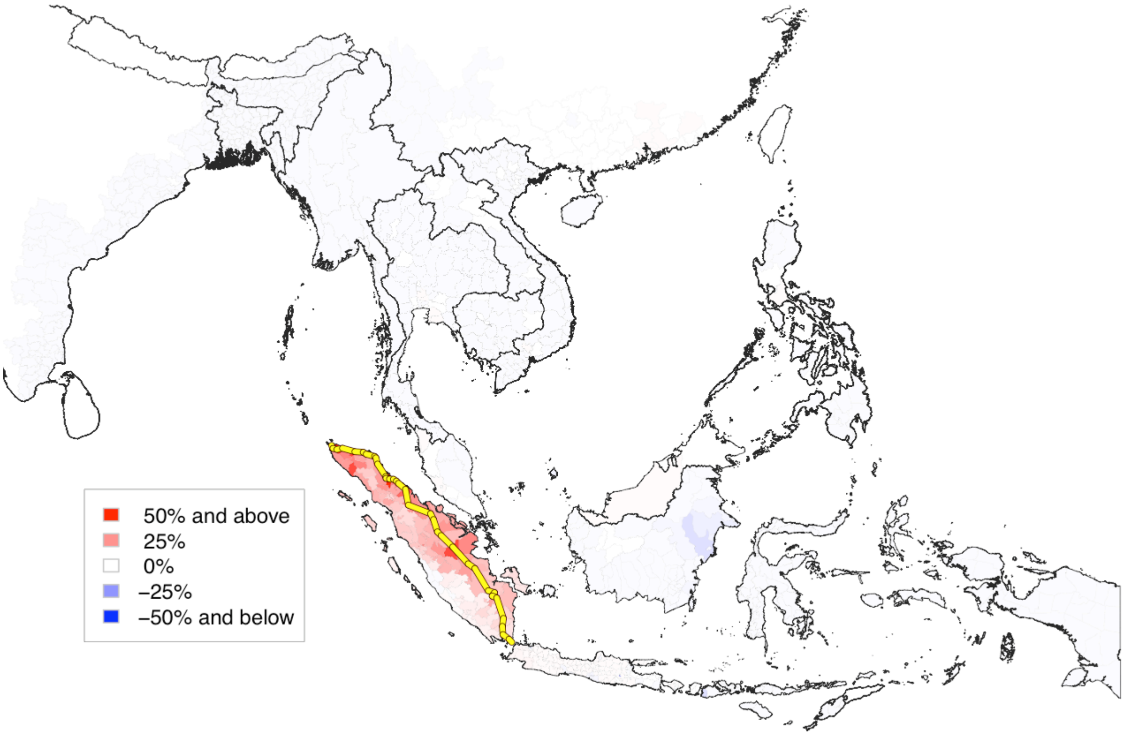


Figure E51: Changes in Traffic Volume by ASEAN Highway No.14 (10 years after)

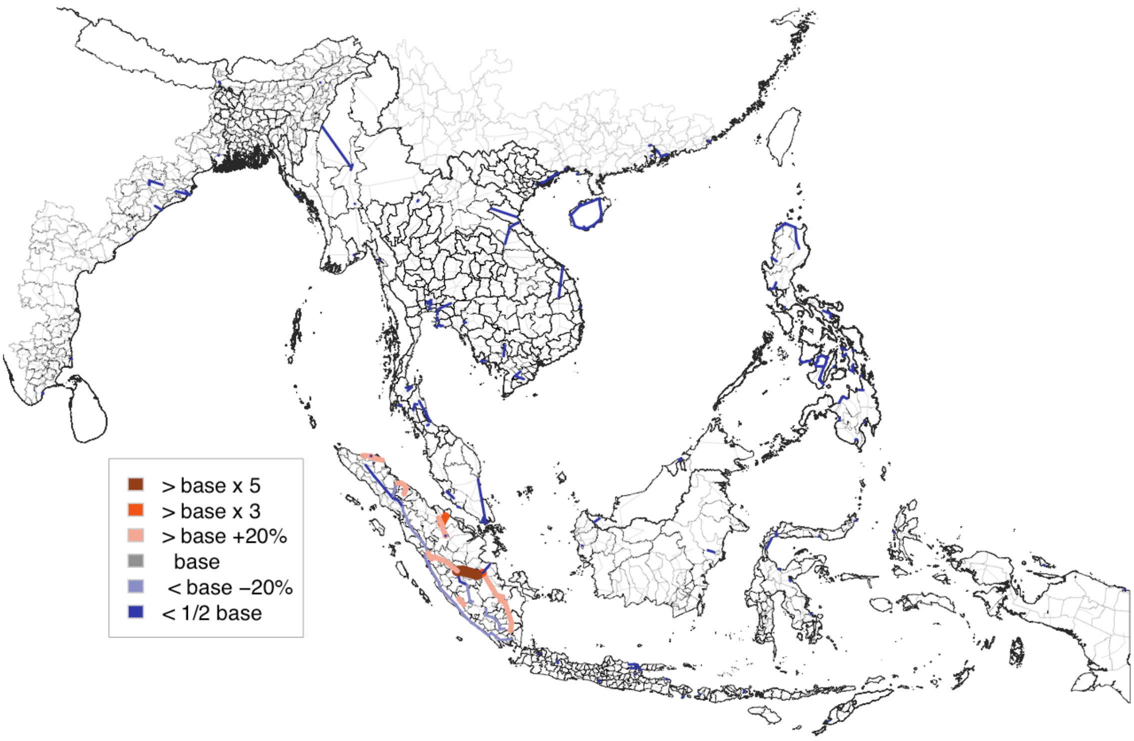


Figure E52: Gains in Regional GDP: ASEAN Highway No.15 (10 years cumulative)

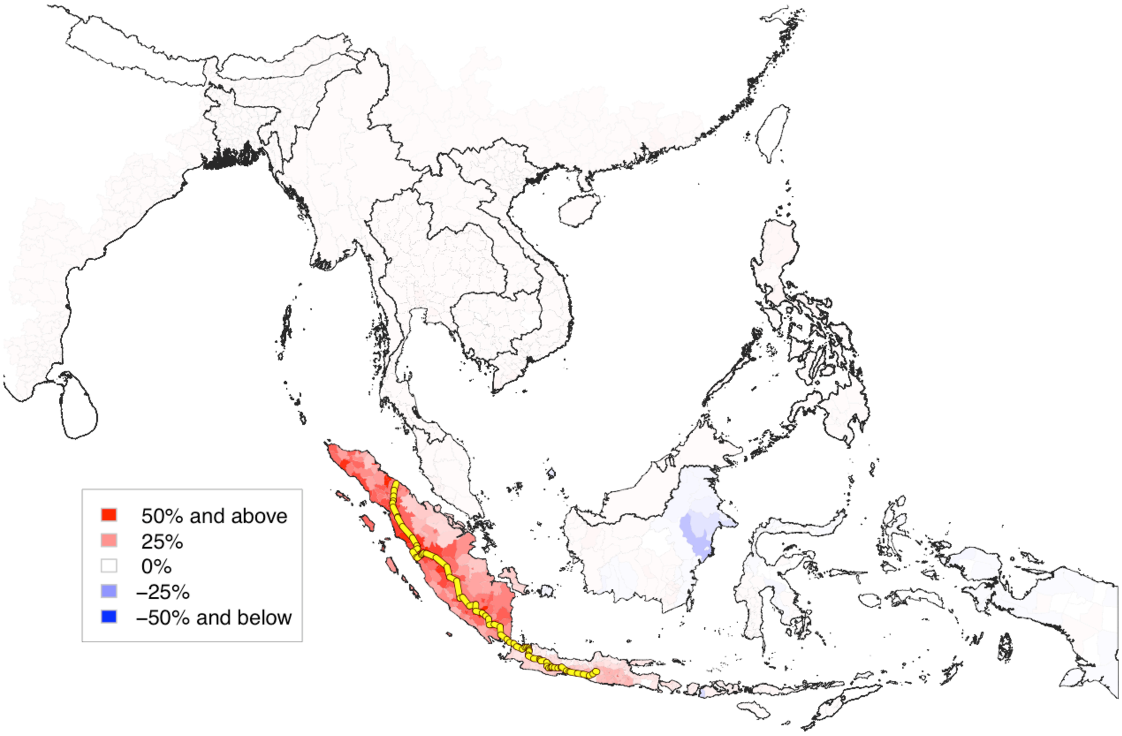


Figure E53: Changes in Traffic Volume by ASEAN Highway No.15 (10 years after)

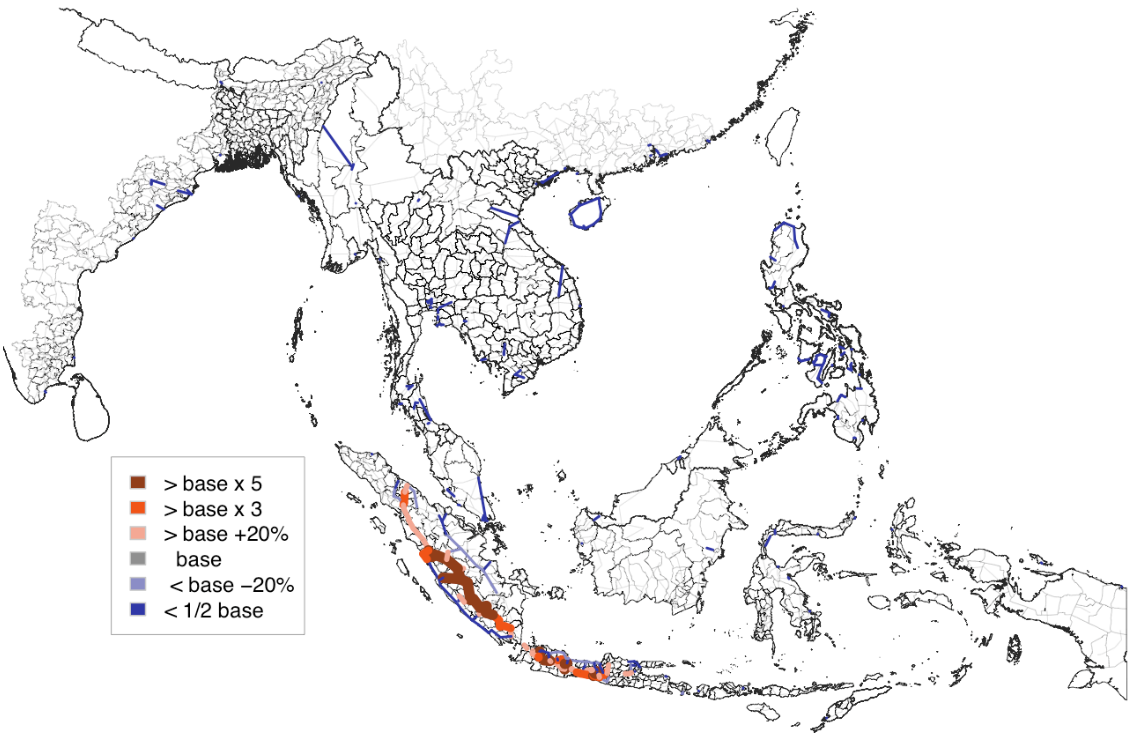


Figure E54: Gains in Regional GDP: ASEAN Highway No.16 (10 years cumulative)

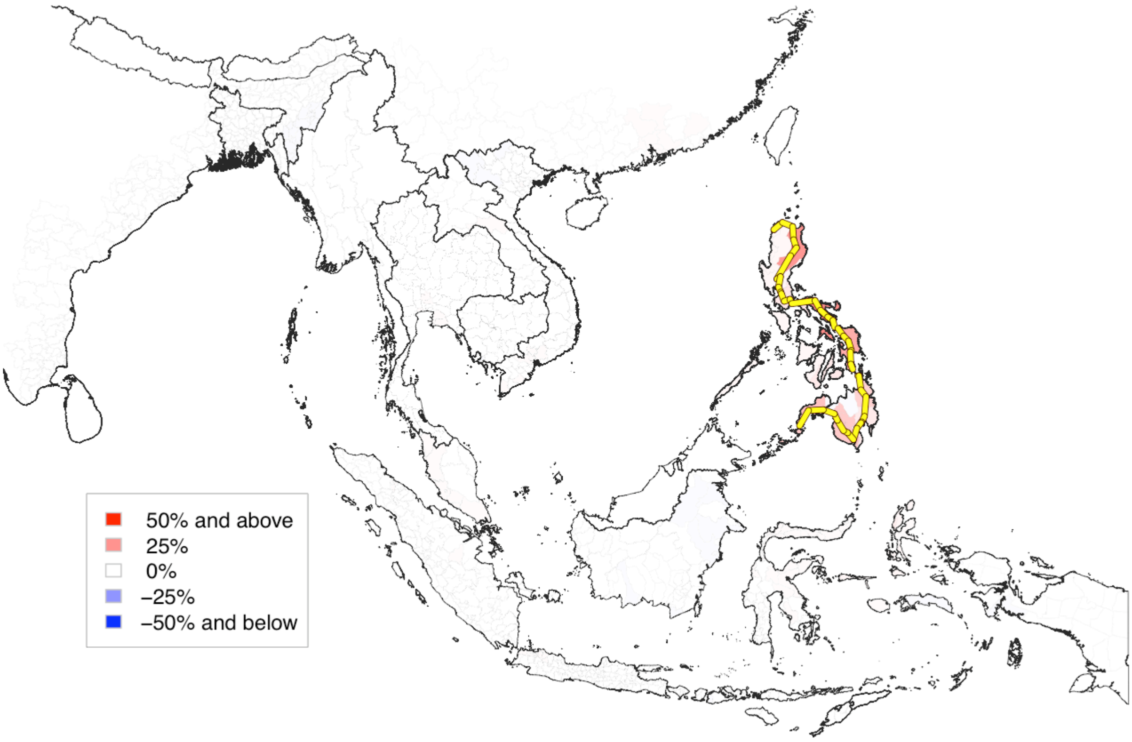
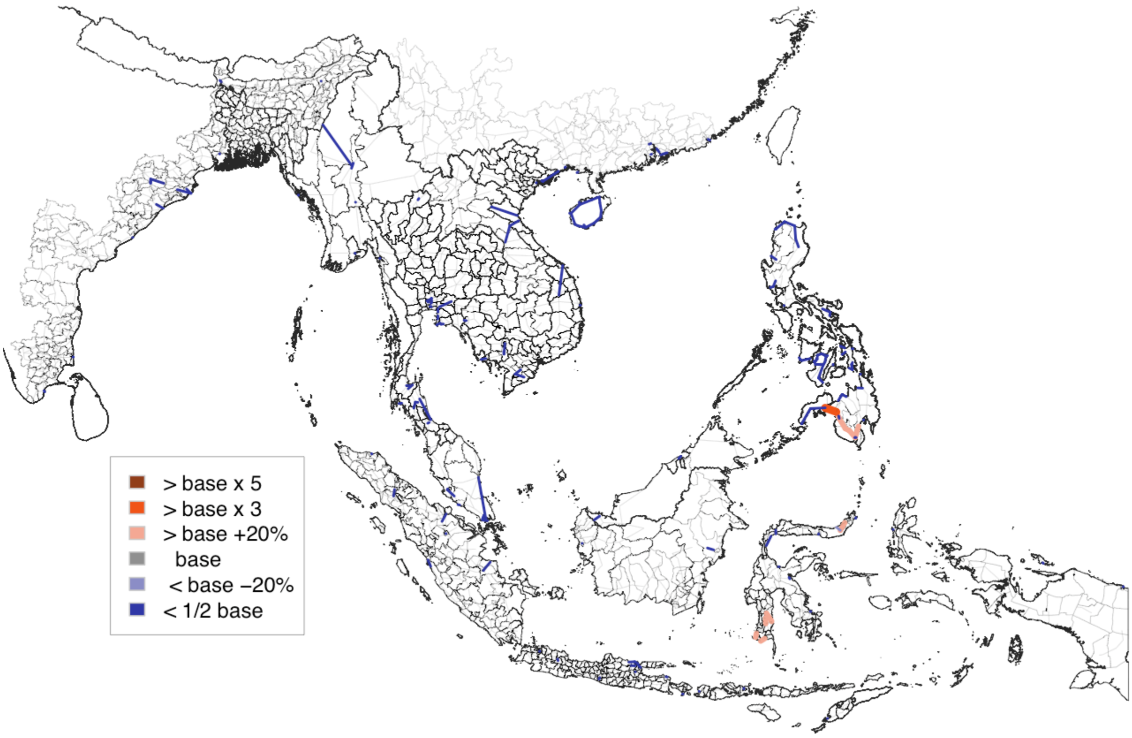


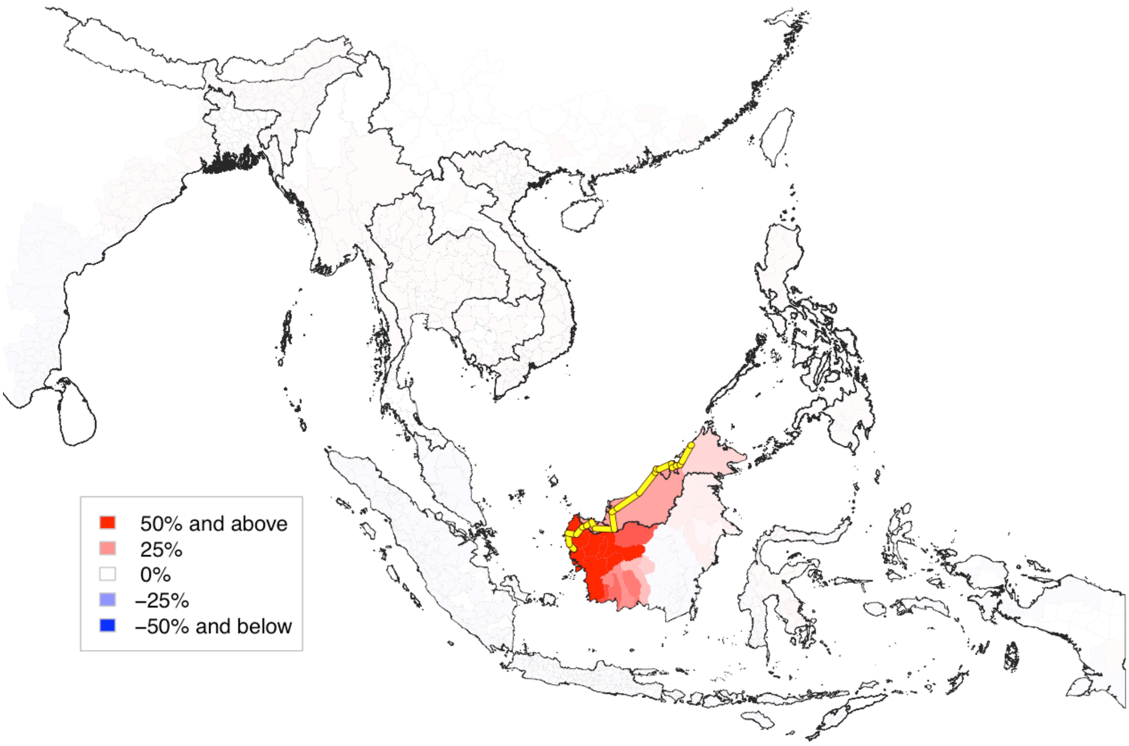
Figure E55: Changes in Traffic Volume by ASEAN Highway No.16 (10 years after)



E4. Pontianak - Kota Kinabalu Route

In this scenario, the route between Pontianak and Kota Kinabalu through Bander Seri Begawan is upgraded, ” meaning cars can run on it at 60 km/h. In addition, border costs (time and money) are are reduced to two hours and one-fifth of the original baseline scenario.The economic effects of the development of Pontianak-Kota Kinabalu route are depicted in Figure E61.

Figure E56: Gains in Regional GDP: Pontianak - Kota Kinabalu (10 years cumulative)



E5. “Ring Route” around Borneo/Kalimantan

In this scenario, the land routes of Jakarta-Surabaya, and Manila-Davao are upgraded, ” meaning cars can run on it at 60 km/h. In addition, the sea routes of Manila-Singapore-Jakarta and Davao-Manado-Balikpapan-Surabaya are also upgraded, meaning the speed is doubled and border costs (time and money) are reduced to the half of the original baseline scenario. The economic effects of the development of the “Ring” route are depicted in Figure E62.

Figure E57: Gains in Regional GDP: “Ring Route” around Borneo/Kalimantan (10 years cumulative)