

Forecasting Future Amount of Trade and Maritime Container Cargo Based on International Economic Scenario

Ryuichi SHIBASAKI
Dr. Eng., Senior Researcher
National Institute for Land and
Infrastructure
Management, MLIT, Japan
3-1-1, Nagase, Yokosuka, Kanagawa,
239-0826 Japan
Fax: +81-46-844-6029
E-mail: shibasaki-r92y2@ysk.nilim.go.jp

Tomihiko Watanabe
M. Eng., Head of Port System Division
National Institute for Land and
Infrastructure
Management, MLIT, Japan
3-1-1, Nagase, Yokosuka, Kanagawa,
239-0826 Japan
Fax: +81-46-844-6029
E-mail: watanabe-t2w3@ysk.nilim.go.jp

Hitoshi ONODERA
M. Eng., Researcher
Pacific Consultants co.,ltd.
1-7-5, Sekido, Tama, Tokyo,
206-8550, Japan
Fax: +81-42-372-6184
E-mail: Hitoshi.Onodera@ss.pacific.co.jp

Abstract: In order to examine the investment strategy of port and harbor facilities in Japan, future trade values are needed forecasted as prerequisite. Although, forecasting in the future includes massive uncertainty such as world economic recession occurred in 2008. In forecasting the future, future trends of global economy, economic policies include FTA and EPA, and international transport policies include infrastructure investment of each country must be considered as much as possible.

A research group including the authors established several scenarios as "baseline scenario" and "future scenarios" with the high probability in the future based on the trend of global economy and the questionnaire survey result by Delphi method about international economy, as described in Yoshida et al. (2009a). Based on these scenarios, the authors forecast the future amount of trade by applying the GTAP model, which is one of the most popular international SCGE model. In addition, future amounts of international maritime container cargo by transport mode are also estimated, based on the estimated results of the trade value.

Key Words: *Trade Value, Future Forecasting, GTAP model, International Economic Scenario*

1. INTRODUCTION

In order to forecast future cargo throughput by ports, future trade value needs to be forecasted as prerequisite as model input. When forecasting future trade value, it is desired to consider future trends on international economics, trade and international economic policies including FTA (Free Trade Agreement) and EPA (Economic Partnership Agreement), and international transport policies including infrastructure investment as far as possible. Meanwhile, future forecast has a large uncertainty; for example, recent world's economic downturn had been generally unpredictable before it happened.

To deal with them, this research forecasts future trade value and real GDP of each country and region, by applying the GTAP (Global Trade Analysis Project) model which is a typical international SCGE (Spatial Computable General Equilibrium) model targeting world trade and had been used by the authors before in order to measure impacts of FTA and EPA conclusion as a sensitivity analysis. They are estimated not only based on a "baseline scenario" according to the historic trends on economic indices, but also based on three

scenarios with a wide range considering variations on economic indices and related policies of each country and region which are assumed by the result of the questionnaire survey that a research group including the authors conducted in 2008.

2. RESEARCH REVIEW

The Global Trade Analysis Project (GTAP) model, developed by Hartel et al. (1997) at Perdue University in the U.S., is a typical special computable general equilibrium (SCGE) model based on microeconomic theory, in which the behaviors of all economic bodies are simultaneously considered to reach equilibriums based on the balance of supply and demand. The model was often used not only in academic field, but also in intergovernmental cooperation efforts, such as by APEC (1997) to evaluate the effects of the Manila Action Plan and by GATT (1994) to evaluate the effects of the Uruguay Round. Until now, the authors (Shibasaki et al. 2005b, Shibasaki et al. 2008) examined the impact of international economic policies such as conclusion of Free Trade Agreement (FTA) on the amount of trade and international cargo shipping, by utilizing the GTAP model. However, those simulations were static as in year 2003; i.e. they did not forecast any future. This research tries to estimate the future trade amount, by incorporating the GTAP model continuously in five-year steps. Yoshida et al. (2009a, 2009b) has also premised future shifts in various economic indicators and significant uncertainty in the global economy and transport policy in performing a questionnaire survey of close to 200 items on almost 100 experts. This led to the authors being able to understand the views of these experts on future trends up to 2025 on such indices and policies. In this study, these results are used in configuring multiple future scenarios and in making a future forecast of value of trade by the GTAP model.

There are several other researches on forecasting the future trade amount, especially by applying SCGE model. For example, the Ministry of Economy, Trade and Industry (METI) (2005) and Abe et al. (2007) performed analysis using the GTAP model respectively. The future simulation used by the METI predicted trading volume for each 10 year period up to 2030 after changing each factors of production and other measures. While this can be seen as the same as the method used in this study, basically, the predictive value is one baseline and cannot be taken as scenario analysis. The study performed by Abe et al. (2007), used a dynamic GTAP model that took account of more refined results of capital accumulation, focusing on future changes to the price of crude oil, and performed analysis on a scenario regarding future crude oil production. Kunita et al. (2005) is another example to construct an independent SCGE model that more explicitly considered international transportation, and through combining the capital flow models from two points in time, developed a method for forecasting future trade value. Kumagai et al. (2008) also estimated the future economy and international transport reflecting the future infrastructure investment in the ASEAN regions.

In this study the authors assigned a future predictive value for factors of productions, tariff rates, and the other parameters for each period (every five years in this study) using a static model that describes supply-demand balance for a single point in time GTAP basic model to estimate trade value in each period. Rather than focusing on one or multiple changes to variables, the authors are able to perform predictive estimates of international trade value based on multiple scenarios that reflect future comprehensive changes on each factors of productions based on the results of the future trend questionnaire regarding international economics conducted by the authors. Despite aiming to construct a model that describes more refined results of capital accumulation during the predictive period, due to the initial aim of the study being examining trends of predictive results for each scenario at the start of the

study, a comparatively simple static GTAP model is used in this research.

3. CONFIGURATION OF THE MODEL

In this study, the basic GTAP model (ver.6.2) and the dataset in 2001 (ver.6) are applied. With a view its future application on estimated results for International Cargo Simulation model (MICS) developed by Shibasaki et al. (2005a, 2009), the regional classification uses the 35 countries and regions listed in Table 1, and the classification of commodities (sectors) uses the 6 categories listed in Table 2.

In terms of the period of future forecasts used in this study, actual and estimated trade value in 2005 are firstly compared with, and each trade value in every five years to 2010, 2015, 2020, and 2025 are next forecasted. In this calculation, the result of every five years is continuously applied as new dataset, and the trade value in each period is forecasted.

Table 1 Regional classification

No.	ID	Country / Region	No.	ID	Country / Region
1	jpn	Japan	19	med	Mediterranean
2	kor	Korea	20	eur	Europe
3	prc	China	21	rus	Russian Federation
4	hkg	Hong Kong	22	xsu	Rest of Former Soviet Union
5	twm	Taiwan	23	afr	Africa
6	xea	Rest of East Asia	24	usa	United States
7	phl	Philippines	25	can	Canada
8	vnm	Vietnam	26	mex	Mexico
9	tha	Thailand	27	xna	Rest of North America
10	mys	Malaysia	28	xcm	Central America
11	sgp	Singapore	29	per	Peru
12	idn	Indonesia	30	chl	Chile
13	xse	Rest of Southeast Asia	31	xap	South America West Coast
14	bgd	Bangladesh	32	sae	South America East Coast
15	ind	India	33	aus	Australia
16	lka	Sri Lanka	34	nzl	New Zealand
17	xsa	Rest of South Asia	35	xoc	Rest of Oceania
18	xme	Rest of Middle East			

Table 2 Classification of Commodities (Sectors)

No.	Commodities (Sectors)	Devison
1	Agriculture	Traded goods
2	Mining	
3	Household Consumption Products	
4	Basic Industrial Materials	
5	Processing and Assembling	
6	Others (Services, Transport, etc.)	Non-traded goods

4. ESTABLISHMENT OF FUTURE SCENARIO

Future scenarios established in this study consist of two types with four scenarios. The first one is mainly based on historic trends established as "Baseline Scenario", the second three are mainly based on the result of the questionnaire survey conducted by Yoshida et al. (2009a) established as "High Case", "Middle Case", and "Low Case". Here, trade value in 2005 is calculated by only baseline scenario that reflect actual parameters as much as possible, and values after 2010 are calculated by four scenarios.

The several endogenous parameters in GTAP model are set by each country as follows, reflecting with the result of the questionnaire survey and considering to acquire the result with wide range of variations among scenarios within a range of convergent solutions. The other parameters than those shown below remain unchanged from the GTAP model's initial values.

4.1. Population

The rate of population change is represented by the parameter pop in the GTAP model. Table A1 in Appendix shows the set values for pop (%) for each scenario and period.

(1) Baseline scenario

The medium variant of population forecasted by United Nations (for Taiwan provided by Taiwan's Council for Economic Planning and Development) is applied as the population of the basic scenario. Population as actual values in 2001 are interpolated from actual and estimated values (medium variant) in 2000 and 2005.

(2) High, middle, and low cases

Similarly, population for each scenario (high, middle, and low cases) are obtained from the statistics of the United Nations and Taiwan government.

4.2. Factors of production I: Land

The rate of change for land, which is represented by the parameter $qo(Land)$, is one of the factors of production in the GTAP model. Even if the change in national land areas can regard as negligible, changes in productivity through changes in land use remain as possibility. However, in this study, to ensure simplicity, land is assumed to unchangeable in each scenario since the starting year (2001).

4.3. Factors of production II, III: Unskilled and Skilled labor force

The rate of change in unskilled and skilled labor force is represented by the parameters $qo(UnSkLab)$ and $qo(SkLab)$ in the GTAP model. The rate of change for skilled labor $qo(SkLab)$ (%) is represented by approximately the sum of growth rate of the labor population lab (%) and growth rate of the share of the skilled labor force in the total labor force (combined unskilled and skilled labor force) $dSHR_SkLab$ (%). At this time, the rate of change in the unskilled labor force based on the definition above is represented by $(lab - dSHR_SkLab)$. Table A2 in Appendix shows the set values for lab and $dSHR_SkLab$ for each scenario and period.

4.3.1 Growth rate of labor force, lab

(1) Baseline scenario

Due to being unable to directly obtain the value lab for the rate of growth for labor force, this is replaced by using the growth rate for productive age population (15 to 64) provided by the United Nations and Taiwan government.

(2) High, middle, and low cases

The rate of growth of productive age population used in the baseline is not available for high, medium, or low variant. Therefore, while the obtained rate of growth of productive age population is used for the baseline and middle case, the rate of change of productive age population for high and low cases is provided by multiply with the rate of change of the estimated total population (high and low variant) obtained in section 4.1 and the rate of change of productive age population as middle variant in the same year.

4.3.2 Rate of change in skilled labor force share, $dSHR_SkLab$

(1) Baseline scenario

The share of skilled labor force will naturally increase due to the change of the age composition of the current skilled labor force (composition ratio of soon to be retirees older age groups and younger age group just entering the labor force), even if no consideration is taken of the rate of advancing to post-secondary education increases unlike shown in (2). However, due to being unable to obtain the actual data for this age composition, the rate of change in skilled labor force in the baseline scenario $dSHR_SkLab$ is assumed to be zero.

(2) High, middle, and low cases

Changes in the ratio of skilled labor force can be envisioned due to changes in the ratio of students who go on to the next stage of education at each educational level. Based on information such as that contained in the GTAP database manual, skilled labors are defined as having graduated from a post-secondary education (equivalent to high school in Japan). In the questionnaire survey conducted by Yoshida et al. (2009a), this posed the following questions and the answers to these are provided in Figure 1. In this study, as shown in Figure 1, based on the actual growth rate in advancing to post-secondary education in recent years in each country, maximum and minimum levels for increases and decreases in this five year period are set as $\pm 10\%$.

(A58) The percentage of students in China continuing on to senior high school (post-secondary education) was about 48% in 2004. What do you foresee for trends in the future?

(A59) The percentage of students attaining post-secondary level education in other developing countries in Asia was about 40 - 60% in 2006. What do you foresee for trends in the future?

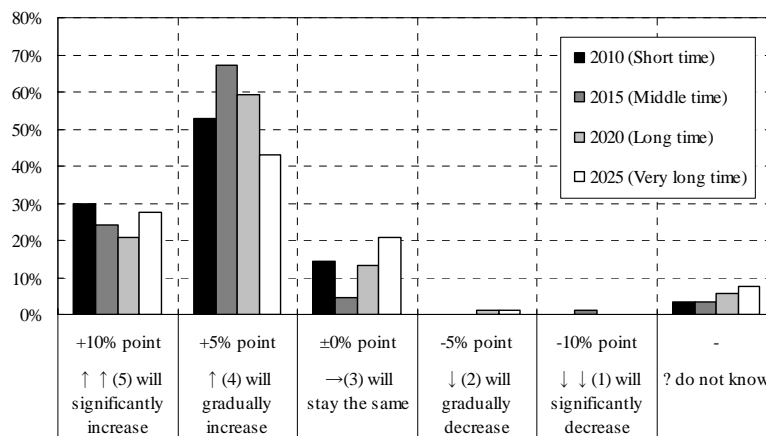


Figure 1 Range of answers (by Yoshida et al., 2009a) and values (growth rate) set for each selection in this study (example of Question A58)

In this study, the range of answers (excluding non-responses) corresponding to the top 16% (represented as median value $+1\sigma$), 50% (median value), and the bottom 16% (median value -1σ) for each time point are used as the set values for, respectively, the high, middle, and low cases. Specifically, the values provided by respondents for "Answer 5" are taken as being uniformly distributed between $+7.5\%$ points and $+12.5\%$ points in the above example. When the same distribution are assumed for all answers as shown in Figure 2, this probability distribution function allows to set values for each scenario. The methods outlined here also are used for each parameter below.

These questions were prepared only about China and other developing Asian countries in the survey. Therefore, the values for other countries are assumed as follows. 1. Developed countries, based on the current circumstance of unchanged high school advancement rates, are assumed as keeping current level (zero growth rate) in middle case, and +2.0% points and -2.0% points for each period in high and low cases. ; 2. The other developing countries outside of Asia, expediently, substituted the result of other developing Asian countries.

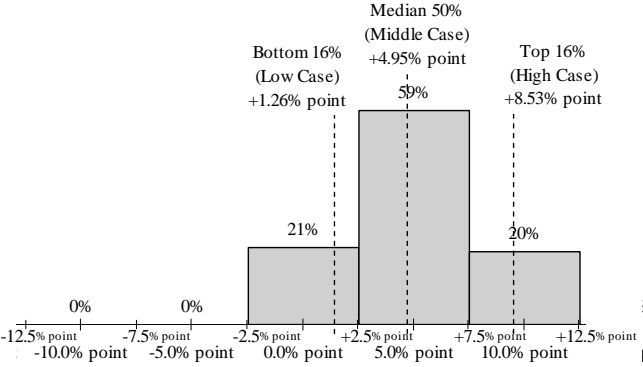


Figure 2 Example of probability distribution function assumed and scenario configuration values (Example of 2010 values for China secondary school advancement rate)

Based on the rate of change for every five year period in post-secondary education advancement for each scenario, the rate of change in share of skilled labors are calculated as follows. The rate of change for post-secondary education advancement as dHS is converted to the rate of change of the share of skilled labors $dSHR_SkLab$ by conversion coefficient α and the rate of productivity of individual skilled labors against the rate of productivity of individual unskilled labors β . That is,

$$dSHR_SkLab = dHS \cdot \alpha \cdot \beta \tag{1}$$

In this study, the conversion coefficient α assumed $\alpha = 1/48$. In regards to β , based on statistics on the number of skilled and unskilled labors provided by the International Labor Organization (ILO) and the skilled labor force and unskilled labor force values (monetary base) contained in the GTAP database, the average figure of β is approximated 3.0.

4.4. Factors of Production IV: Capital

In this study, as stated above, the authors use the standard GTAP static model so that for capital accumulation, in addition to increase in capital stock obtained from the results of the previous period model calculations, consideration of changes in capital stock over a five year period is required. In terms of the former mentioned rate of change, this corresponds to the $(KE - KB)$ used in the GTAP model (KE and KB used here refer, respectively, to capital stock before and after calculation). For the latter rate of change, this is displayed by the parameter $qo(Capital)$ as an exogenous variable. Below, the setting method for $qo(Capital)$, which is shown in Table A3 of Appendix for each scenario and period, is shown.

(1) Baseline scenario

Basically, a constant value of gross fixed capital formation (GFCF) to GDP ratio in each country is assumed. That is to say, growth rate in capital stock should be configured at the same value as the GDP growth rate (see 4.6). However, as stated above, because the capital stocks are endogenously changed in the model calculations, the exogenous capital stock

growth rate should be determined by subtracting the endogenous growth rate of capital stock from the GDP growth rate. In this research, for the sake of simplification, they are assumingly fixed to 50% of GDP growth rate across the board based on the trial calculation, while the values for 2005, in order to broadly correspond between the actual trade value and estimated value in the model, are assumed to be 100% of the GDP growth rate.

(2) High, middle, and low cases

In the questionnaire survey conducted by Yoshida et al. (2009a), the following questions were posed and the answers to each provided.

(A40) Gross fixed capital formation (public investment plus private investment) in Japan accounted for about 24% of GDP in 2006. How do you foresee this situation changing in the future?
(A41) Gross fixed capital formation in China accounted for about 43% of GDP in 2006. How do you foresee this situation changing in the future?
(A42) Gross fixed capital formation in other East Asian developing countries accounted for about 20-30% of GDP in 2006. How do you foresee this situation changing in the future?
(A43) Gross fixed capital formation worldwide accounted for about 22% of GDP in 2006 on average. How do you foresee this situation changing in the future?

Here, when initial value SHR_cap (%) of deficit of gross fixed capital formation and its growth $dSHR_cap$ (% point) acquired from the above questionnaire survey results by scenario are defined, the relationship of capital stock rate of change $qo(Capital)$ (%) with overall GDP (GDP) and its growth rate $qgdp$ (%) is displayed as the following.

$$(1 + qo(cap)) \cdot SHR_cap \cdot GDP = (1 + \gamma \cdot qgdp) \cdot GDP \cdot (SHR_cap + dSHR_cap) \quad (2)$$

Both sides of equation (2) display the change total for each capital stock. In this case, γ is the parameter considering capital accumulation within the model, and in line with the argument of the (1) baseline configuration, $\gamma = 0.5$. Based on equation (2) the authors get the following:

$$qo(cap) = (1 + \gamma \cdot qgdp) \cdot \left(1 + \frac{dSHR_cap}{SHR_cap} \right) - 1 \quad (3)$$

For countries and regions that do not fall under "Japan," "China," or "Other East Asian developing country," these are all included as part of "worldwide" in question answers.

4.5. Factors of Production V: Natural Resources

The rate of change in natural resources, one of the factors of production, is displayed in the GTAP model as parameter $qo(NatRes)$. Table A4 in Appendix shows configuration values for $qo(NatRes)$ for each scenario and period.

(1) Baseline scenario

According to the author's calculation based on U.N. data, total production of the world's three largest energy sources (oil, coal, and natural gas) was a total of 6.56 billion tons of oil equivalent in 2005. This was a rise of 1.153 over the total for 2001 (an average annual rise of 3.6%). The annual average growth rate for the 10 year period from 1997 to 2006 was at 2.1% (the same figure for the period 1996 to 2005 was 1.9%). Based on these figures, this study uses the rate of growth stipulated above (3.6% annually) for the baseline until 2005, and takes

a uniform annual growth rate of 2.0% since that period. Although actually these figures may vary from country, due to lacking data, in this study the authors assume a global uniform value.

(2) High, middle, and low cases

In the questionnaire survey conducted by Yoshida et al. (2009a) the following questions were posed and the responses.

(A76) What are your forecasts for crude oil production volume in the future? (please respond in terms of the increase / decrease in absolute amount, rather than growth rate)

As this question asks about production volume of "crude oil," this may be slightly different trend than from change in overall natural resources required for this study. However, based on responses to Questions A77 ("Do you anticipate that alternative energy will grow to eventually occupy an equal promotion of shares with conventional energies?") being overall a skeptical trend (most answers up to 2015 were negative, from 2020 most answers suggested a possibility of this, with answers indicating belief being in the minority), then using the trend of overall natural resources can be said to be valid. The questionnaire survey also only posed a question regarding changes in global terms, the authors have also configured this as the same rate of change for every country and region.

4.6. Total factor productivity (technical change of the factor of production)

The rate of change in total factor productivity for each country and region is displayed in the GTAP model as parameter *afereg*. Table A5 in Appendix shows the configuration value *afereg* (%) for each scenario and period.

(1) Baseline scenario

In this study, total factor productivity rate of change is endogenously sought by model calculations when GDP growth rate is exogenously given as model input, reflecting basic economic growth theory of macro-economics (e.g. Solow model) that total factor productivity is defined as residual factors of economic growth. Although use of the model in this way may be pointed out as a case of putting the cart before the horse, reflecting actual practical needs that the argument of the future value of GDP is often focused on rather than total factor productivity, and that in the large number of cases GDP growth rate is configured, it had been relatively well utilized.

At this point, actual and future values of the real GDP growth rate *qgdp*(%) for input is based on the configured values provided by the Ports and Harbors Bureau, Ministry of Land, Infrastructure, Transport and Tourism for Japan. For other countries and regions, actual and forecast data from the International Monetary Fund (IMF) are used. See Table A5 for further information on these values.

(2) High, middle, and low cases

The following questions were included in the questionnaire survey conducted by Yoshida et al. (2009a).

(A17) In the future, can you expect to see structural adjustments and technical innovations outweigh the persistent decrease in the labor force in Japan?

The rate of change for the baseline configuration value is established as much as possible to have variety of the calculation results from scenarios within the range of convergence for them. The questionnaire survey also only asked questions regarding Japan, and considering a rate of change for other developed countries and regions to be the same as Japan's, then the baseline configuration value for developing countries and regions is relatively large, and the authors entered half the value as that for developed countries and regions.

4.7. Tariff rate (import tax rate)

Changes in the tariff rate are divided between those which impact considerably on the overall tariff system for one particular country such as being designated by the WTO (World Trade Organization), and those which are only applied between two specific countries such as being designated under conclusions of the FTA and EPA. The GTAP model the former changes is referred to as $tm(s)$ and the latter change is displayed as $tms(r,s)$ (in this case, r indicates export country, and s refers to the import country). Below, each variable configuration value is explained.

4.7.1 Changes in average tariff rate, $tm(s)$

Changes in average tariff rate $tm(s)$ can be configured for individual commodities, but for the purpose of simplicity in this study a common value is used for all items. Table A6 in Appendix shows configuration values for $tm(s)$ (% point) for each scenario and period.

(1) Baseline scenario

Regarding the rate of change for the period from 2001 to 2005, considering the agreements provided by new accessions to the WTO in China and Taiwan, a uniform rate of -10.0% point is applied for these economies irrespective of the item (however, taking items not to fall below a tariff rate of zero, the same as below), while in other countries and regions, a uniform rate of -2.0% point is applied. For the period after 2005, since the reduction in tariff rate is thought to depend on a policy, for the baseline there is assumed no changes with taking a neutral stance.

(2) High, middle, and low cases

The following questions were included in the questionnaire survey conducted by Yoshida et al. (2009a).

(A28) Do you anticipate tariff rates across the world will decline in the future through successful WTO negotiations?

The rate of change (% point) in each selection is established as much as possible to have variety of the calculation results from scenarios within the range of convergence for them. Based on the text of the questions asked by the questionnaire, the same value is configured for all countries and regions.

4.7.2 Changes in bilateral tariff rates, $tms(r,s)$

Based on the state of progress of FTA and EPA configured by Shibasaki et al. (2008), the following configurations are used based on the adjusted combinations and states of progress as stipulated in Table A7 in Appendix. For APEC (Asia Pacific Economic Cooperation) economies, based on the Bogor Declaration of "Achieving free trade in developed countries by 2010 and in developing countries by 2020," information for each of the relevant regions added.

(1) Baseline scenario

Of the combinations shown in Table A7, the tariff rate for each pair of countries and regions in state of progress 1 and 2 are taken to be zero for all items as of 2005. From 2005 onwards, no further reductions are considered, as for the rate of change $tm(s)$.

(2) High, middle, low case configuration

For high case, as shown in Table A7, the tariff rate for each pair of countries and regions in state of progress 1 to 5 as of 2010 are taken to be zero for all items. The tariff rate for all items in each country and region in state of progress 6 will also be taken as zero in 2020. For middle case, the tariff rate for each pair of countries and regions in state of progress 1 to 3 as of 2010 are taken to be zero for all items, while that in state of progress 4 will also be taken as zero in 2020. For low case, the tariff rate for each pair of countries and regions in state of progress 1 to 3 as of 2010 are taken to be zero for all items, while from 2010 onwards no further progress are assumed.

4.8. Export subsidies (export tax rate)

The rate of change in export tax rate is expressed as variable $tx(r)$ or $txs(r,s)$ in the GTAP model.

(1) Baseline scenario

Despite becoming slightly loosened recently, the Chinese yuan remains effectively pegged against the dollar, and established at a lower exchange rate than the right level. This has been pointed out as acting as an effective export promotion measure. In this study, with the view to replicating China's export performance, China's export subsidies to its partner countries and regions are configured as +10.0% at a uniform rate across all items ($tx('prc') = 10.0$) as of 2005. This policy is also taken to continue from 2010 onwards. Here, the above assumption is an expedient because China's fixed yuan exchange rate policy is interpreted only as an export subsidy measure, not considering the effect of conversion policy in investment. For countries or regions outside of China, any additional export tariffs are not configured.

(2) High, middle, and low cases

While many responses to Question A55 of Yoshida et al. (2009a) thought that the Chinese yuan would moderately rise against the dollar in the future, pointing to the possibility of change in future Chinese exchange rate measures, in this study any additional configurations to the baseline are not assumed (i.e., the Chinese fixed conversion rate of yuan to the dollar will continue in all scenarios).

4.9. International transportation technology (international transportation margin)

In the GTAP model, the technical change of the international transportation (reduction rate of the international transportation margin) can be configured separately for each country of departure, country of arrival, transportation modes, and item. In this study the rate of change for each departure country (for use in all transportation modes and all items) $ats(r)$ and the rate of change for each arriving country (same as above) $atd(s)$ are set out below.

(1) Baseline scenario

According to estimates by Shibasaki et al. (2007), due to investment in Chinese mainland ports in the five year period from 1998 to 2003, transportation costs for transport arriving and departing China fell by 2.7%. In a similar way, in this research, various infrastructure investment and related measures in each country can be taken as a 5% point reduction in transportation costs in all countries and regions on a departing country base and arrival

country base as of 2005. From 2005 onwards any further decrease in the baseline are not considered, based on the similar way of thinking as in the tariff rate.

(2) High, middle, and low cases

The effect of declining transportation costs on the global economy is the subject of most interest to the authors. Ultimately, it will be obtained from the calculation results of the International Cargo Simulation model (MICS) developed by the authors (for example, it is shown in Shibasaki et al., 2005a, 2007, and 2009). Therefore, in this study, any additional configuration in transportation technology are not considered.

4.10. Elasticity of substitution of imported and domestic goods

Elasticity of substitution of imported and domestic goods is known as Armington parameter in the GTAP model as σ_d . The larger σ_d becomes, the higher the elasticity between imported and domestic commodities and the sensitivity for the policies to promote trade also increases.

(1) Baseline scenario

In 2005, σ_d is assumed twice as the default configuration value for all items. This is an expedient assumption for replicating the actual value of global trade in 2005, and can be said to reflect recent overall expansion of trade and globalization. In other words, the actual value of total trade in 2005 can be interpreted as reflecting the imbalance of the bubble economy conditions up to 2008. In this case, despite the possibility of a hypothetical further reduction in σ_d in the future, in this study no further reduction in σ_d from 2010 onwards and retaining 2005 value are assumed.

(2) High, middle, low case configuration

Any additional changes to the baseline configuration are not made.

5. ESTIMATED RESULTS OF FUTURE TRADE VALUES AND INTERNATIONAL MARITIME CONTAINER CARGO

Using the GTAP model shown in Chapter 3, estimated values for 2005 (baseline) and for 2010, 2015, 2020, and 2025 (baseline, high, middle, and low cases) based on the parameters configured in Chapter 4 are as follows for each country and region as well as for total global values.

5.1. Estimated results of future trade values

(1) Total value of imports and exports (Figure A1)

Estimated results of future trade values are displayed as total values of imports and exports in Figure A1 in Appendix. For each of these totals, these are displayed as indicators of 100 of the 2001 actual results (based on GTAP database). In addition, actual results from the Global Insight Database are displayed within the range of available countries and years. Estimated trade value all over the world are 280 in 2025 for the baseline scenario, and 472, 341, and 229 respectively for the high, middle, and low case scenarios. If converted using the annual rate of growth from 2001, these would come to 4.4%, 6.7%, 5.2%, and 3.5%. If taking a look at the rate of increase every five years (annualized rate), that from 2005 to 2010 comes to 3.3%, 6.2%, 4.2%, and 2.5%, while that from 2020 to 2025 is 4.6%, 7.8%, 5.7%, and 3.8%. This indicates an overall rising trend in the rate of growth with each passing year.

In the same way, looking at the estimated results for each country and region, most countries

and regions have a baseline estimated value between the middle and low case scenarios. Also, in many cases, this rate of growth gradually increased over the years. However, the rate of growth differs significantly between countries and regions, and while the rate is small in developed countries such as Japan, Europe, United States, and Canada, it is extremely large in countries such as China and India. When comparing these figures with the actual values, while some countries and regions do have corresponding estimated and actual values for 2005, many countries have results that exceed the estimated values. The reason for this is that in general for the years up to the financial crisis in 2008, can be interpreted as being a time of imbalance as part of a global bubble.

(2) Export and import trade value (Figure A2)

The export trade value in remarkable countries and regions is shown in Figure A2 in Appendix. In most countries and regions including those which are not shown in the figure, the value of exports have the same trend as for the estimated results for total imports and exports. On the one hand, the rate of growth appears to have peaked in countries such as Japan, Europe, and the United States. Of these, this trend is particularly noticeable in Japan where negative growth rate is predicted in low case. This is thought to be as a result of relative declining export competitiveness due to being caught up by developing countries such as China and India. Additionally, the reason why this trend is most noticeable in Japan, can be thought a preoccupation on future growth in order to replicate the actual values as much as possible in the estimation of 2005.

For the import values shown in Figure A2 in Appendix, there are observed the same trend as for the estimated results for total imports and exports, with little variation in the rate of growth between countries and regions.

5.2. Estimated results of future GDP (Figure A3)

The estimated results of future GDP (actual values displayed in 2001 prices) are shown in Figure A3 in Appendix. As described in Section 4.6 and displayed in Table A5, it is exogenously given in the baseline scenario. Looking at the baseline configuration value and middle case estimated values from the figure, these are almost the same or the baseline configuration value is smaller a little bit. In terms of the low case scenario for Japan, a negative rate of GDP growth is even estimated. This is thought to be due to multiple factors, including a decrease in total factors of production growth rate and decrease in capital growth rate.

5.3. Estimated results of international maritime container cargo (Figure A4)

Based on the estimated trade values above, future amounts of international maritime container cargo are also estimated. Those in remarkable countries and regions are shown in Figure A4 in Appendix. In principle, the amount of international maritime container cargo is estimated from the predicted future bilateral trade value according to the following procedure by using GI and GTA database, etc; 1. The predicted trade values in 2001 are converted into 2003 basis data according to the growth rate for each country/region pair acquired from GI database in both years, in order to correspond with other dataset's year input into the MICS; 2. The estimated trade values between regions in each year are divided into a detail country pair by GTA database and other statistics; 3. They are divided by the share of transportation mode (air, sea, and land) by GI database; 4. Then converted into tonnage basis data by unit price for each transportation mode by GI database; 5. The amount of maritime container cargo is acquired by multiplying the amount of total maritime cargo by containerization ratio provided from GI database; 6. Then they are converted into TEU basis data from tonnage basis by GI

database.

According to the figure, most countries and regions gradually increase maritime container cargo in the future. The rate of growth in developed countries such as Japan, United States are increasing moderately compared with them in emerging countries such as China, India. In particular, in Hong Kong, the estimated amounts of import maritime container cargo in the low case exceed those in the high case. The reason for this is that because of the decreasing customs barrier between various countries by the FTA and EPA including mainland China, the competition power in the international market of Hong Kong relatively deteriorates.

6. CONCLUSION

In this study the authors used the GTAP model to estimate future trade value and GDP in each country and region based on not only historical trends, but also the results of the questionnaire survey on international economics implemented in early 2008 in order to create multiple scenarios that envision each country's economic and related indices and trends. As a result, future trade values and international maritime cargo volumes up to 2025 were able to obtain predicted results maintaining within a range of calculation convergence, based on four different scenarios, baseline and high, middle, and low cases.

Here, we have to note that the questionnaire survey used in this study was implemented in February 2008. Despite being a time when concerns were rising over the world economy, this was prior to the events magnifying the decline the economy such as the collapse of Lehman Brothers. This therefore meant that if the same questionnaire survey was conducted after the time, the results may shift towards a downward direction in the predicted values, even though the distribution of answers is considered in the survey. In other words, in using the results of this study, even while making predictions with wide range, this requires being aware on social economic trends at the time of making the questionnaire survey.

In the autumn of 2008 version 7 of the GTAP database based on the 2004 was released. This new database will allow not only future predictions using the latest data, but also comparison with predicted results based on version 6 of the GTAP database released in 2001, as well as comparison both versions for configuration values for each variable.

ACKNOWLEDGEMENTS

This research was partly supported by Grant-in-Aid for Scientific Research (B) No. 20310084.

REFERENCES

a) Academic books and papers

Abe, Ishiguro, Miyamoto (2007) **Discussion Paper on Development Assistance, No.12, FACID 42p**

Hertel, T. W. (1997) **Global Trade Analysis Project: Modeling and Applications**, Cambridge University Press., Cambridge

Kumagai, S., Gokan, T., Isono, I., and Keola, S. (2008) Predicting Long-Term Effects of Infrastructure Development Projects in Continental South East Asia: IDE Geographical Simulation Model, **ERIA Discussion Paper Series, ERIA-DP-2008-02.**

Kunita, A., Mizutani, M., Tsuchiya, K., Akiyoshi, S., Koike, A., Ishikawa, Y., and Ishiguro, K.

- (2005) International Freight Transport Demand Forecasting by SCGE Model, **Proceedings of the 19th Pacific Regional Science Conference.**
- Shibasaki, R., Ieda, H., and Kadono, T. (2005a) Model Improvement of International Maritime Container Cargo Flow and Policy Evaluation for International Logistics in Eastern Asia, **1st International Conference on Transportation Logistics.**
- Shibasaki, R., Ma, L., Kadono, T., Ishikura, T., and Ieda, H. (2005b) An Estimation of International Maritime Container Volume Among Asian Countries by GTAP Model and Simulation on FTA and Transport Improvement Scenario, **8th Annual Conference on Global Economic Analysis.**
- Shibasaki, R., Kannami, Y., Onodera, H., Li, J., Miao, L. (2007) Impact Of Chinese Port Policy Using The Model For International Container Cargo Simulation, **Journal of the Eastern Asia Society for Transportation Studies**, Vol.7, pp.1083-1098.
- Shibasaki, R., Yonemoto, K., and Watanabe, T. (2008) On the effects of trade liberalization policies on regional economies based on "Transnational Interregional Input-Output Table between China and Japan", **11th Annual Conference on Global Economic Analysis.**
- Shibasaki, R., Araki, D., and Watanabe, T. (2009) How Model Accuracy is Improved by Usage of Statistics? –An Example of International Freight Simulation Model in East Asia-, **the Eastern Asia Society for Transportation Studies, Vol.7**
- Yoshida, T., Abe, K., Shibasaki, R., and Onodera, H., (2009a) Future Scenario of International Economics Based on Questionnaire Survey by the Delphi Method, **the Eastern Asia Society for Transportation Studies, Vol.7**
- Yoshida, T., Shibasaki, R., Nemoto, T., Hanaoka, S., Ono, K., and Onodera, H. (2009b) Future Scenario of International Transport Based on Questionnaire Survey by the Delphi Method, **the Eastern Asia Society for Transportation Studies, Vol.7**

b) Data and Statistics

- Global Trade Information Services, Inc. (2008) **The Global Trade Atlas**
- IHS Global Insight Inc. (2008) **Global Trade navigator**
- International Monetary Fund (IMF) (2008) **World Economic Outlook October 2008**
- Ministry of Economy, Trade and Industry (METI) (2005), **White Paper on International Economy and Trade**, pp.271-281 (*In Japanese*)
- Ministry of Economy, Trade and Industry (METI) (2008), **Negotiation of WTO Mutual Agreement** (*In Japanese*)
- The Ports and Harbours Bureau, Ministry of Land, Infrastructure, Transport and Tourism (2004), Trial calculation result of the prospect of the throughput of the harbours (*In Japanese*)
- UNESCO (2008), **Statistics (Core Themes: Education)**
- United Nations Department of Economic and Social Affairs Population Division (2006), **World Population Prospects (The 2006 Revision)**
- United Nation Statistics Division (2008), **Energy Statistics**
- World Trade Organization (WTO), United Nations Conference on Trade and Development (UNCTAD), and International Trade Centre (ITC) (2008), **World Tariff Profiles 2008**, WTO publications, Geneva, 220p

APPENDIX

Table A1 Rate of population change (pop) in each scenario and period (%)

No	ID	Country / Region	Baseline, Middle Case					High Case				Low Case			
			2001-2005	2005-2010	2010-2015	2015-2020	2020-2025	2005-2010	2010-2015	2015-2020	2020-2025	2005-2010	2010-2015	2015-2020	2020-2025
1	jpn	Japan	0.54	-0.11	-0.90	-1.67	-2.31	0.68	0.21	-0.40	-1.07	-0.91	-2.07	-3.04	-3.66
2	kor	Korea	1.85	1.68	0.91	0.21	-0.41	2.64	2.30	1.81	1.09	0.71	-0.50	-1.46	-2.03
3	prc	China	2.69	2.93	2.74	2.35	1.73	3.84	4.15	4.05	3.33	1.97	1.29	0.67	0.18
4	hkg	Hong Kong	4.69	5.13	4.38	3.82	3.30	6.13	5.79	5.39	4.70	4.13	2.94	2.18	1.79
5	twn	Taiwan	1.70	1.91	1.54	1.04	0.46	1.93	1.67	1.27	0.75	1.85	1.41	0.75	0.11
6	xea	Rest of East Asia	4.25	9.30	9.44	3.85	3.24	10.29	11.95	5.55	4.86	8.29	6.88	2.07	1.53
7	phl	Philippines	8.58	9.97	8.70	7.58	6.56	11.00	10.24	9.40	8.29	8.95	7.12	5.66	4.68
8	vnm	Vietnam	5.91	6.84	6.19	5.38	4.62	8.00	7.91	7.31	6.32	5.72	4.45	3.30	2.74
9	tha	Thailand	3.06	3.37	2.52	1.84	1.20	4.35	3.94	3.46	2.73	2.38	1.06	0.14	-0.45
10	mys	Malaysia	8.01	8.84	7.62	6.57	5.46	9.86	9.18	8.40	7.17	7.81	6.03	4.64	3.62
11	sgp	Singapore	6.08	6.12	4.71	3.24	2.80	6.91	5.92	4.79	4.28	5.31	3.50	1.66	1.21
12	idn	Indonesia	5.36	5.99	4.99	4.09	3.57	7.06	6.59	5.94	5.30	4.91	3.36	2.15	1.71
13	xse	Rest of Southeast Asia	4.25	9.30	9.44	3.85	3.24	10.29	11.95	5.55	4.86	8.29	6.88	2.07	1.53
14	bgd	Bangladesh	7.79	8.71	8.09	7.34	6.56	9.64	9.55	9.11	8.28	7.38	6.18	5.17	4.49
15	ind	India	6.63	7.56	6.75	5.89	4.95	8.56	8.27	7.69	6.68	6.57	5.20	3.99	3.10
16	lka	Sri Lanka	1.73	2.38	1.96	1.35	0.49	3.38	3.50	3.15	2.17	1.38	0.39	-0.55	-1.33
17	xsa	Rest of South Asia	4.25	9.30	9.44	3.85	3.24	10.29	11.95	5.55	4.86	8.29	6.88	2.07	1.53
18	xme	Rest of Middle East	4.25	9.30	9.44	3.85	3.24	10.29	11.95	5.55	4.86	8.29	6.88	2.07	1.53
19	med	Mediterranean	3.27	3.23	2.49	1.90	1.41	4.19	3.89	3.49	2.88	2.27	1.05	0.21	-0.19
20	eur	Europe	1.09	0.94	0.67	0.50	0.28	1.76	1.93	1.99	1.67	0.13	-0.61	-1.07	-1.25
21	rus	Russian Federation	-1.89	-2.53	-2.74	-2.98	-3.18	-1.55	-1.25	-1.38	-1.73	-3.50	-4.27	-4.73	-4.81
22	xsu	Rest of Former Soviet Union	4.25	9.30	9.44	3.85	3.24	10.29	11.95	5.55	4.86	8.29	6.88	2.07	1.53
23	afr	Africa	8.70	10.28	9.94	9.61	9.01	11.22	11.37	11.32	10.66	9.34	8.50	7.83	7.24
24	usa	United States	4.17	4.95	4.55	4.11	3.62	5.82	5.88	5.70	5.14	4.08	3.20	2.46	1.99
25	can	Canada	4.08	4.59	4.26	3.97	3.62	5.45	5.58	5.52	5.06	3.73	2.93	2.35	2.08
26	mex	Mexico	3.60	5.78	4.95	4.15	3.43	6.86	6.58	6.05	5.25	4.69	3.28	2.14	1.46
27	xna	Rest of North America	4.25	9.30	9.44	3.85	3.24	10.29	11.95	5.55	4.86	8.29	6.88	2.07	1.53
28	xcm	Central America	4.25	9.30	9.44	3.85	3.24	10.29	11.95	5.55	4.86	8.29	6.88	2.07	1.53
29	per	Peru	4.96	5.94	6.49	5.76	4.94	6.95	8.05	7.60	6.67	4.91	4.87	3.83	3.07
30	chl	Chile	4.53	5.15	4.62	3.98	3.36	6.14	6.14	5.73	5.01	4.16	3.08	2.15	1.61
31	xap	South America West Coast	4.25	9.30	9.44	3.85	3.24	10.29	11.95	5.55	4.86	8.29	6.88	2.07	1.53
32	sae	South America East Coast	5.66	6.47	5.65	4.88	4.18	7.51	7.20	6.67	5.90	5.43	4.07	3.00	2.32
33	aus	Australia	4.84	5.18	4.84	4.56	4.17	6.05	6.15	6.10	5.58	4.30	3.51	2.95	2.64
34	nzl	New Zealand	4.98	4.58	4.01	3.57	3.21	5.45	5.31	5.14	4.67	3.72	2.68	1.94	1.63
35	xoc	Rest of Oceania	4.25	9.30	9.44	3.85	3.24	10.29	11.95	5.55	4.86	8.29	6.88	2.07	1.53

Table A2 Rate of unskilled and skilled labor force change in each scenario and period

Rate of change in the labor population: *lab* (%)

No	ID	Country / Region	Baseline, Middle Case					High Case				Low Case			
			2001-2005	2005-2010	2010-2015	2015-2020	2020-2025	2005-2010	2010-2015	2015-2020	2020-2025	2005-2010	2010-2015	2015-2020	2020-2025
1	jpn	Japan	-1.75	-3.45	-5.45	-4.01	-3.22	-2.69	-4.39	-2.76	-1.99	-3.47	-5.51	-4.11	-3.34
2	kor	Korea	1.74	3.57	1.67	-1.77	-4.87	4.55	3.07	-0.20	-3.43	3.56	1.62	-1.87	-5.01
3	prc	China	6.37	5.31	2.55	-0.21	0.05	6.24	3.96	1.44	1.62	5.25	2.49	-0.22	0.09
4	hkg	Hong Kong	3.99	5.79	3.04	-1.43	-3.13	6.79	4.43	0.06	-1.82	5.78	2.99	-1.52	-3.25
5	twm	Taiwan	1.70	1.91	1.54	1.04	0.46	1.93	1.67	1.27	0.75	1.88	1.54	0.97	0.40
6	xea	Rest of East Asia	6.26	6.67	4.82	3.27	2.69	7.63	6.27	4.97	4.30	6.64	4.75	3.17	2.57
7	phl	Philippines	10.51	12.50	11.09	9.15	8.25	13.54	12.67	11.01	10.02	12.49	11.04	9.03	8.08
8	vnm	Vietnam	10.50	12.33	7.77	4.86	2.57	13.55	9.53	6.78	4.24	12.36	7.73	4.68	2.36
9	tha	Thailand	6.30	4.61	2.18	0.44	-0.65	5.61	3.60	2.04	0.86	4.60	2.13	0.33	-0.78
10	mys	Malaysia	10.16	11.91	9.12	7.51	5.75	12.96	10.70	9.37	7.46	11.90	9.06	7.39	5.58
11	sgp	Singapore	5.92	16.96	3.70	-1.78	-5.16	17.83	4.89	-0.31	-3.80	16.94	3.67	-1.83	-5.29
12	idn	Indonesia	7.01	7.93	6.96	5.81	3.95	9.02	8.58	7.69	5.68	7.92	6.90	5.67	3.78
13	xse	Rest of Southeast Asia	6.26	6.67	4.82	3.27	2.69	7.63	6.27	4.97	4.30	6.64	4.75	3.17	2.57
14	bgd	Bangladesh	10.70	11.90	10.27	8.20	6.00	12.85	11.76	9.98	7.71	11.47	9.79	7.75	5.62
15	ind	India	8.85	10.78	9.27	7.43	6.13	11.80	10.83	9.26	7.88	10.77	9.22	7.31	5.97
16	lka	Sri Lanka	5.13	3.59	0.54	1.33	1.03	4.60	2.07	3.13	2.72	3.58	0.49	1.20	0.86
17	xsa	Rest of South Asia	6.26	6.67	4.82	3.27	2.69	7.63	6.27	4.97	4.30	6.64	4.75	3.17	2.57
18	xme	Rest of Middle East	6.26	6.67	4.82	3.27	2.69	7.63	6.27	4.97	4.30	6.64	4.75	3.17	2.57
19	med	Mediterranean	4.28	4.59	2.78	1.72	0.95	5.56	4.18	3.30	2.41	4.58	2.72	1.59	0.80
20	eur	Europe	1.44	1.09	-0.97	-1.56	-1.90	1.91	0.26	-0.09	-0.53	1.08	-1.01	-1.65	-2.04
21	rus	Russian Federation	-0.01	-0.58	-4.33	-5.11	-4.90	0.41	-2.87	-3.54	-3.47	-0.59	-4.40	-5.28	-5.09
22	xsu	Rest of Former Soviet Union	6.26	6.67	4.82	3.27	2.69	7.63	6.27	4.97	4.30	6.64	4.75	3.17	2.57
23	afr	Africa	9.64	12.26	12.58	12.94	12.91	13.21	14.03	14.70	14.63	12.25	12.53	12.83	12.77
24	usa	United States	4.98	4.98	3.15	2.16	1.55	5.85	4.47	3.71	3.05	4.97	3.12	2.06	1.43
25	can	Canada	5.34	5.34	2.65	1.22	0.15	6.21	3.94	2.73	1.54	5.34	2.61	1.13	0.04
26	mex	Mexico	7.11	8.31	7.04	4.95	3.48	9.42	8.70	6.87	5.30	8.29	6.97	4.80	3.30
27	xna	Rest of North America	6.26	6.67	4.82	3.27	2.69	7.63	6.27	4.97	4.30	6.64	4.75	3.17	2.57
28	xcm	Central America	6.26	6.67	4.82	3.27	2.69	7.63	6.27	4.97	4.30	6.64	4.75	3.17	2.57
29	per	Peru	7.71	8.40	7.94	7.02	6.20	9.44	9.52	8.88	7.95	8.38	7.87	6.89	6.03
30	chl	Chile	7.13	7.46	4.72	2.67	1.08	8.48	6.24	4.40	2.69	7.45	4.68	2.56	0.95
31	xap	South America West Coast	6.26	6.67	4.82	3.27	2.69	7.63	6.27	4.97	4.30	6.64	4.75	3.17	2.57
32	sae	South America East Coast	7.33	7.77	6.56	5.11	3.21	8.82	8.13	6.90	4.91	7.75	6.51	4.98	3.04
33	aus	Australia	5.73	5.30	3.05	2.40	2.03	6.17	4.34	3.91	3.42	5.29	3.02	2.31	1.90
34	nzl	New Zealand	6.08	5.39	2.91	2.22	1.20	6.26	4.20	3.77	2.63	5.38	2.87	2.14	1.06
35	xoc	Rest of Oceania	6.26	6.67	4.82	3.27	2.69	7.63	6.27	4.97	4.30	6.64	4.75	3.17	2.57

Rate of change of the share of skilled labor force: *dSHR SkLab* (% point)

No	ID	Classification in the questionnaire survey	High Case				Middle Case				Low Case			
			2005-2010	2010-2015	2015-2020	2020-2025	2005-2010	2010-2015	2015-2020	2020-2025	2005-2010	2010-2015	2015-2020	2020-2025
1	jpn	Developed Countries	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	-0.13	-0.13	-0.13	-0.13
2	kor	Developed Countries	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	-0.13	-0.13	-0.13	-0.13
3	prc	China	0.63	0.60	0.54	0.60	0.37	0.36	0.33	0.33	0.16	0.20	0.16	0.05
4	hkg	Developed Countries	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	-0.13	-0.13	-0.13	-0.13
5	twm	Developed Countries	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	-0.13	-0.13	-0.13	-0.13
6	xea	Other developing Asian countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
7	phl	Other developing Asian countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
8	vnm	Other developing Asian countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
9	tha	Other developing Asian countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
10	mys	Other developing Asian countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
11	sgp	Developed Countries	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	-0.13	-0.13	-0.13	-0.13
12	idn	Other developing Asian countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
13	xse	Other developing Asian countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
14	bgd	Other developing Asian countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
15	ind	Other developing Asian countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
16	lka	Other developing Asian countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
17	xsa	Other developing Asian countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
18	xme	Other countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
19	med	Developed Countries	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	-0.13	-0.13	-0.13	-0.13
20	eur	Developed Countries	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	-0.13	-0.13	-0.13	-0.13
21	rus	Developed Countries	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	-0.13	-0.13	-0.13	-0.13
22	xsu	Other countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
23	afr	Other countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
24	usa	Developed Countries	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	-0.13	-0.13	-0.13	-0.13
25	can	Developed Countries	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	-0.13	-0.13	-0.13	-0.13
26	mex	Other countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
27	xna	Other countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
28	xcm	Other countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
29	per	Other countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
30	chl	Other countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
31	xap	Other countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
32	sae	Other countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16
33	aus	Developed Countries	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	-0.13	-0.13	-0.13	-0.13
34	nzl	Developed Countries	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	-0.13	-0.13	-0.13	-0.13
35	xoc	Other countries	0.53	0.50	0.49	0.51	0.31	0.33	0.32	0.32	0.08	0.18	0.16	0.16

Table A5 Rate of total factor productivity and GDP change in each scenario and period

Rate of total factor productivity change (%): *afereg*

No	ID	Classification in the questionnaire survey	Baseline					High Case				Middle Case				Low Case			
			2001- 2005	2005- 2010	2010- 2015	2015- 2020	2020- 2025	2005- 2010	2010- 2015	2015- 2020	2020- 2025	2005- 2010	2010- 2015	2015- 2020	2020- 2025	2005- 2010	2010- 2015	2015- 2020	2020- 2025
1	jpn	Japan	2.8	7.1	8.5	6.6	6.1	10.7	13.1	10.6	10.9	6.0	9.6	7.9	7.9	2.5	4.5	4.1	5.6
2	kor	Developing countries	7.0	18.5	17.4	19.3	20.9	27.8	27.1	30.9	37.6	15.5	19.8	22.9	27.1	6.5	9.3	12.1	19.2
3	prc	Other countries	20.5	39.7	42.7	44.7	44.6	49.7	54.5	58.2	62.5	36.4	45.6	49.0	51.3	26.8	32.8	36.4	42.8
4	hkg	Developing countries	7.8	12.9	17.2	19.4	20.1	19.4	26.7	31.0	36.2	10.8	19.5	23.1	26.1	4.5	9.2	12.1	18.5
5	twm	Developing countries	10.0	16.2	16.4	16.6	16.9	24.3	25.4	26.6	30.5	13.5	18.5	19.8	22.0	5.7	8.7	10.4	15.6
6	xea	Other countries	4.0	32.1	18.7	19.7	20.1	40.2	23.9	25.6	28.2	29.5	20.0	21.6	23.1	21.7	14.4	16.0	19.3
7	phl	Other countries	4.1	12.3	16.8	17.8	18.6	15.4	21.5	23.2	26.0	11.3	17.9	19.5	21.4	8.3	12.9	14.5	17.8
8	vnm	Other countries	7.4	19.1	26.1	27.5	28.5	24.0	33.4	35.7	39.9	17.6	27.9	30.1	32.8	12.9	20.1	22.3	27.4
9	tha	Other countries	5.2	16.8	20.6	21.2	21.7	21.0	26.2	27.6	30.3	15.4	21.9	23.2	24.9	11.3	15.8	17.2	20.8
10	mys	Other countries	5.4	17.5	19.1	20.0	21.0	21.9	24.3	26.0	29.4	16.1	20.3	21.9	24.1	11.8	14.6	16.2	20.1
11	sgp	Developing countries	8.1	11.5	19.2	22.1	23.8	17.2	29.8	35.4	42.9	9.6	21.7	26.3	30.9	4.0	10.3	13.8	21.9
12	idn	Other countries	5.6	20.3	22.4	23.0	23.9	25.4	28.6	29.9	33.4	18.6	23.9	25.2	27.4	13.7	17.2	18.7	22.9
13	xse	Other countries	2.3	12.0	16.6	17.3	17.7	15.0	21.1	22.5	24.7	11.0	17.6	18.9	20.3	8.1	12.7	14.1	17.0
14	bgd	Other countries	7.5	14.2	24.2	26.0	27.7	17.8	30.9	33.8	38.8	13.0	25.8	28.5	31.8	9.6	18.6	21.1	26.6
15	ind	Other countries	12.6	27.0	29.6	30.9	31.9	33.8	37.7	40.1	44.6	24.8	31.5	33.8	36.7	18.2	22.7	25.1	30.6
16	lka	Other countries	10.7	21.1	21.2	20.9	21.1	26.4	27.1	27.1	29.6	19.4	22.6	22.8	24.3	14.3	16.3	17.0	20.3
17	xsa	Other countries	3.5	26.9	23.6	24.6	25.1	33.7	30.1	32.0	35.1	24.7	25.1	26.9	28.8	18.2	18.1	20.0	24.0
18	xme	Other countries	2.0	19.0	17.9	18.6	18.9	23.8	22.9	24.2	26.5	17.4	19.1	20.4	21.7	12.8	13.7	15.2	18.1
19	med	Developing countries	0.8	10.7	18.1	18.7	19.1	16.1	28.1	29.9	34.3	8.9	20.5	22.2	24.7	3.8	9.7	11.7	17.5
20	eur	Developing countries	2.8	4.5	5.7	6.0	6.2	6.8	8.9	9.6	11.1	3.8	6.5	7.2	8.0	1.6	3.1	3.8	5.7
21	rus	Developing countries	14.5	22.7	25.1	25.6	25.4	34.1	39.0	41.1	45.7	19.0	28.5	30.5	33.0	8.0	13.4	16.0	23.3
22	xsu	Developing countries	3.7	20.9	22.1	23.7	24.9	31.4	34.3	37.9	44.8	17.5	25.0	28.2	32.4	7.3	11.8	14.8	22.9
23	afz	Other countries	4.0	17.5	15.0	15.0	15.3	22.0	19.1	19.5	21.4	16.1	16.0	16.4	17.6	11.9	11.5	12.2	14.7
24	usa	Developing countries	4.2	5.1	7.5	8.1	8.5	7.7	11.6	13.0	15.3	4.3	8.5	9.7	11.1	1.8	4.0	5.1	7.8
25	can	Developing countries	3.3	8.1	9.7	10.6	11.3	12.2	15.1	17.0	20.3	6.8	11.0	12.7	14.6	2.8	5.2	6.7	10.4
26	mex	Other countries	0.3	9.6	12.4	13.2	13.6	12.1	15.9	17.1	19.1	8.9	13.3	14.4	15.7	6.5	9.5	10.7	13.1
27	xna	Other countries	3.2	8.4	16.7	17.5	17.7	10.6	21.3	22.7	24.7	7.8	17.8	19.1	20.3	5.7	12.8	14.2	16.9
28	xcm	Other countries	2.9	9.1	14.2	15.1	15.4	11.4	18.1	19.6	21.6	8.3	15.1	16.5	17.7	6.1	10.9	12.3	14.8
29	per	Other countries	4.7	19.9	20.2	20.6	21.0	24.9	25.7	26.8	29.4	18.3	21.5	22.6	24.2	13.4	15.5	16.7	20.2
30	chl	Other countries	4.8	13.6	16.8	17.7	18.4	17.0	21.4	23.0	25.8	12.5	17.9	19.4	21.2	9.2	12.9	14.4	17.7
31	xap	Other countries	3.7	9.2	14.7	15.7	16.1	11.5	18.7	20.4	22.5	8.4	15.7	17.2	18.5	6.2	11.3	12.8	15.4
32	sae	Other countries	3.1	8.4	13.3	14.1	15.2	10.6	16.9	18.3	21.3	7.8	14.1	15.5	17.5	5.7	10.2	11.5	14.6
33	aus	Developing countries	3.9	9.5	13.1	13.5	13.7	14.3	20.3	21.6	24.7	8.0	14.8	16.1	17.8	3.3	7.0	8.5	12.6
34	nzl	Developing countries	4.0	6.0	9.7	10.0	10.6	9.0	15.0	16.0	19.0	5.0	10.9	11.9	13.7	2.1	5.2	6.3	9.7
35	xoc	Other countries	2.8	9.8	7.5	8.3	8.5	12.2	9.5	10.7	11.9	9.0	8.0	9.0	9.8	6.6	5.7	6.7	8.2

Real GDP growth rate (%): *qgdp*

No	ID	Classification in the questionnaire survey	Baseline				
			2001- 2005	2005- 2010	2010- 2015	2015- 2020	2020- 2025
1	jpn	Japan	7.0	6.1	6.1	5.1	5.1
2	kor	Developing countries	20.3	28.8	25.8	25.8	25.8
3	prc	Other countries	45.6	59.6	61.1	61.1	61.1
4	hkg	Developing countries	22.7	22.8	27.6	27.6	27.6
5	twm	Developing countries	19.7	22.8	22.8	22.8	22.8
6	xea	Other countries	12.4	47.6	27.6	27.6	27.6
7	phl	Other countries	22.2	24.6	30.7	30.7	30.7
8	vnm	Other countries	34.3	35.1	42.9	42.9	42.9
9	tha	Other countries	25.3	28.8	33.8	33.8	33.8
10	mys	Other countries	24.1	33.8	33.8	33.8	33.8
11	sgp	Developing countries	24.6	28.8	30.7	30.7	30.7
12	idn	Other countries	21.5	35.7	38.3	38.3	38.3
13	xse	Other countries	12.4	21.7	27.6	27.6	27.6
14	bgd	Other countries	23.8	26.4	38.3	38.3	38.3
15	ind	Other countries	33.0	44.9	46.9	46.9	46.9
16	lka	Other countries	23.2	30.1	27.6	27.6	27.6
17	xsa	Other countries	12.4	40.3	33.8	33.8	33.8
18	xme	Other countries	12.4	33.2	30.1	30.1	30.1
19	med	Developing countries	6.2	18.2	27.6	27.6	27.6
20	eur	Developing countries	6.7	6.7	6.7	6.7	6.7
21	rus	Developing countries	28.1	30.7	30.7	30.7	30.7
22	xsu	Developing countries	12.4	31.9	31.3	31.3	31.3
23	afz	Other countries	17.4	33.8	30.1	30.1	30.1
24	usa	Developing countries	12.3	10.4	12.0	12.0	12.0
25	can	Developing countries	11.3	14.8	14.8	14.8	14.8
26	mex	Other countries	9.4	19.9	24.0	24.0	24.0
27	xna	Other countries	12.4	15.9	25.8	25.8	25.8
28	xcm	Other countries	12.4	17.1	22.8	22.8	22.8
29	per	Other countries	22.4	37.0	37.0	37.0	37.0
30	chl	Other countries	19.0	24.6	27.6	27.6	27.6
31	xap	Other countries	12.4	17.1	22.8	22.8	22.8
32	sae	Other countries	13.4	17.1	22.8	22.8	22.8
33	aus	Developing countries	12.9	16.5	19.3	19.3	19.3
34	nzl	Developing countries	14.5	12.0	15.4	15.4	15.4
35	xoc	Other countries	12.4	18.2	13.7	13.7	13.7

Table A6 Rate of average tariff rate $tm(s)$ in each scenario and period (% point)

No	ID	Classification in the questionnaire survey	High Case				Middle Case				Low Case			
			2005- 2010	2010- 2015	2015- 2020	2020- 2025	2005- 2010	2010- 2015	2015- 2020	2020- 2025	2005- 2010	2010- 2015	2015- 2020	2020- 2025
1	jpn	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
2	kor	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
3	prc	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
4	hkg	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
5	twm	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
6	xea	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
7	phl	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
8	vnm	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
9	tha	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
10	mys	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
11	sgp	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
12	idn	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
13	xse	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
14	bgd	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
15	ind	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
16	lka	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
17	xsa	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
18	xme	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
19	med	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
20	eur	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
21	rus	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
22	xsu	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
23	afr	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
24	usa	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
25	can	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
26	mex	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
27	xna	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
28	xcm	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
29	per	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
30	chl	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
31	xap	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
32	sae	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
33	aus	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
34	nzl	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65
35	xoc	World	-3.07	-0.13	-0.19	-0.12	-1.50	-0.12	-0.50	-0.09	0.65	0.13	0.08	-0.65

Table A7 Progress circumstance of FTA and EPA in each country and region

No.	ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
		jpn	kor	prc	hkg	twi	sea	phl	vnm	tha	mys	sgp	idn	xse	bgd	ind	lka	xsa	xme	med	eur	rus	xsu	afr	usa	can	mex	xna	xcm	per	chl	xap	sae	aus	nzl	xoc	
1	jpn		3	4	5	5		2	3	1	1	1	2	1		3					4	5			5	5	1			6	1			3	4	6	
2	kor	3		4	5	5		1	1	3	1	1	1	1		3				3	3	4			2	3	3			4	1		4	4	4	6	
3	prc	4	4		1	6		1	1	1	1	1	1	1		4						6			6	6	6		4	3	1			3	3	6	
4	hkg	5	5	1				6	6	6	6	5	6	6								5			5	5	5			6	5			5	5	6	
5	twi	5	5	6				6	6	6	6	5	6	6								5			5	5	5		1	6	5			5	5	6	
6	sea																																				
7	phl	2	1	1	6	6			1	1	1	1	1	1		3				3	3	6			4	6	6			6	6			3	3	6	
8	vnm	3	1	1	6	6		1		1	1	1	1	1		3				3	3	6			4	6	6			6	6			3	3	6	
9	tha	1	3	1	6	6		1	1		1	1	1	1	3	3	3			3	3	6			3	6	6			3	6			1	1	6	
10	mys	1	1	1	6	6		1	1	1		1	1	1		3				3	3	6			3	6	6			6	4			3	3	6	
11	sgp	1	1	1	5	5		1	1	1	1	1	1	1		4				1	1	5			1	3	3			3	1			1	1	6	
12	idn	2	1	1	6	6		1	1	1	1	1	1	1		3				3	3	6			6	6	6			6	6			3	3	6	
13	xse	1	1	1	6	6		1	1	1	1	1	1	1		3				3	3	6			6	6	6			6	6			3	3	6	
14	bgd										3					1	1	1																			
15	ind	3	3	4				3	3	3	3	1	3	3	1		1	1			3	3	3							3			3	4			
16	lka										3		4			1	1		1																		
17	xsa															1	1	1		1																	
18	xme																		1							4										4	
19	med		3					3	3	3	3	1	3	3		3				1	1					1		3	4	1	4	3					
20	eur	4	3					3	3	3	3	1	3	3		3				1	1			1		1		3	4	1	4	3					
21	rus	5	4	6	5	5		6	6	6	6	5	6	6		3								1													
22	xsu																							1	1												
23	afr																					1															
24	usa	5	2	6	5	5		4	4	3	3	1	6	6					4						1	1	1		1	2	1	4	4	1	5	6	
25	can	5	3	6	5	5		6	6	6	6	3	6	6										1	1	1		3	4	1	3	3	5	5	6		
26	mex	1	3	6	5	5		6	6	6	6	3	6	6						1	1				1	1	1		1	4	1	1	1	4	5	6	
27	xna																												1								
28	xcm			4		1																				1	3	1			4	1	4	4			
29	per	6	4	3	6	6		6	6	3	6	3	6	6							4	4			2	4	4		4	2	1	1	6	6	6		
30	chl	1	1	1	5	5		6	6	6	4	1	6	6		3					1	1			1	1	1		1	2	4	1	3	1	6		
31	xap																				4	4			4	3	1		4	1	4	1	1				
32	sae		4													3					3	3			4	3	1		4	1	1	1					
33	aus	3	4	3	5	5		3	3	1	3	1	3	3		4			4						1	5	4			6	3				1	4	
34	nzl	4	4	3	5	5		3	3	1	3	1	3	3											5	5	5			6	1			1		6	
35	xoc	6	6	6	6	6		6	6	6	6	6	6	6											6	6	6			6	6			4		6	

Baseline					High Case				Middle Case				Low Case			
2001-2005	2005-2010	2010-2015	2015-2020	2020-2025	2005-2010	2010-2015	2015-2020	2020-2025	2005-2010	2010-2015	2015-2020	2020-2025	2005-2010	2010-2015	2015-2020	2020-2025
1,2	1,2	1,2	1,2	1,2	1-5	1-5	1-6	1-6	1-3	1-3	1-4	1-4	1-3	1-3	1-3	1-3

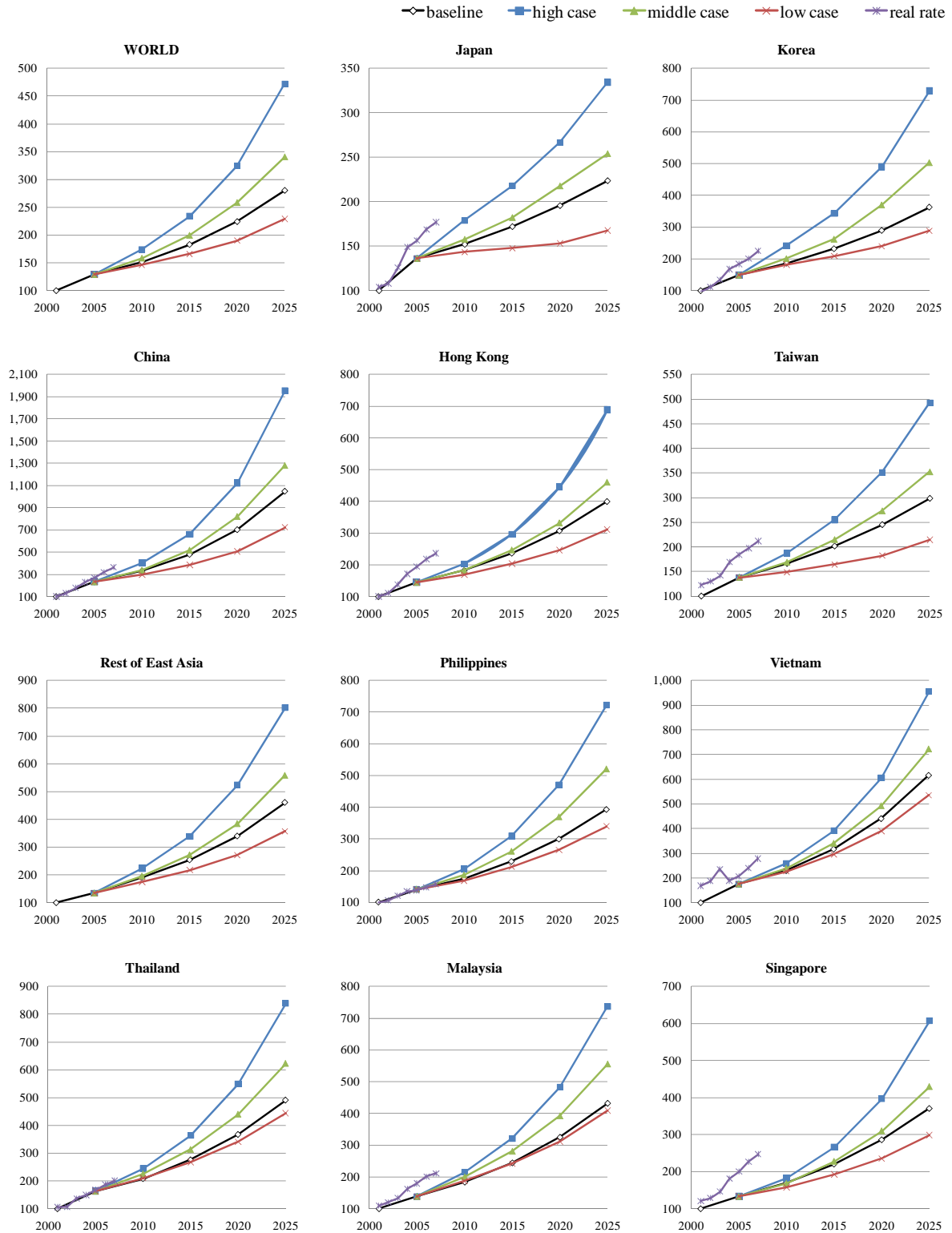


Figure A1 Result of estimated trade value (total imports and exports) in each countries and regions (in 2001 = 100) (1/3)

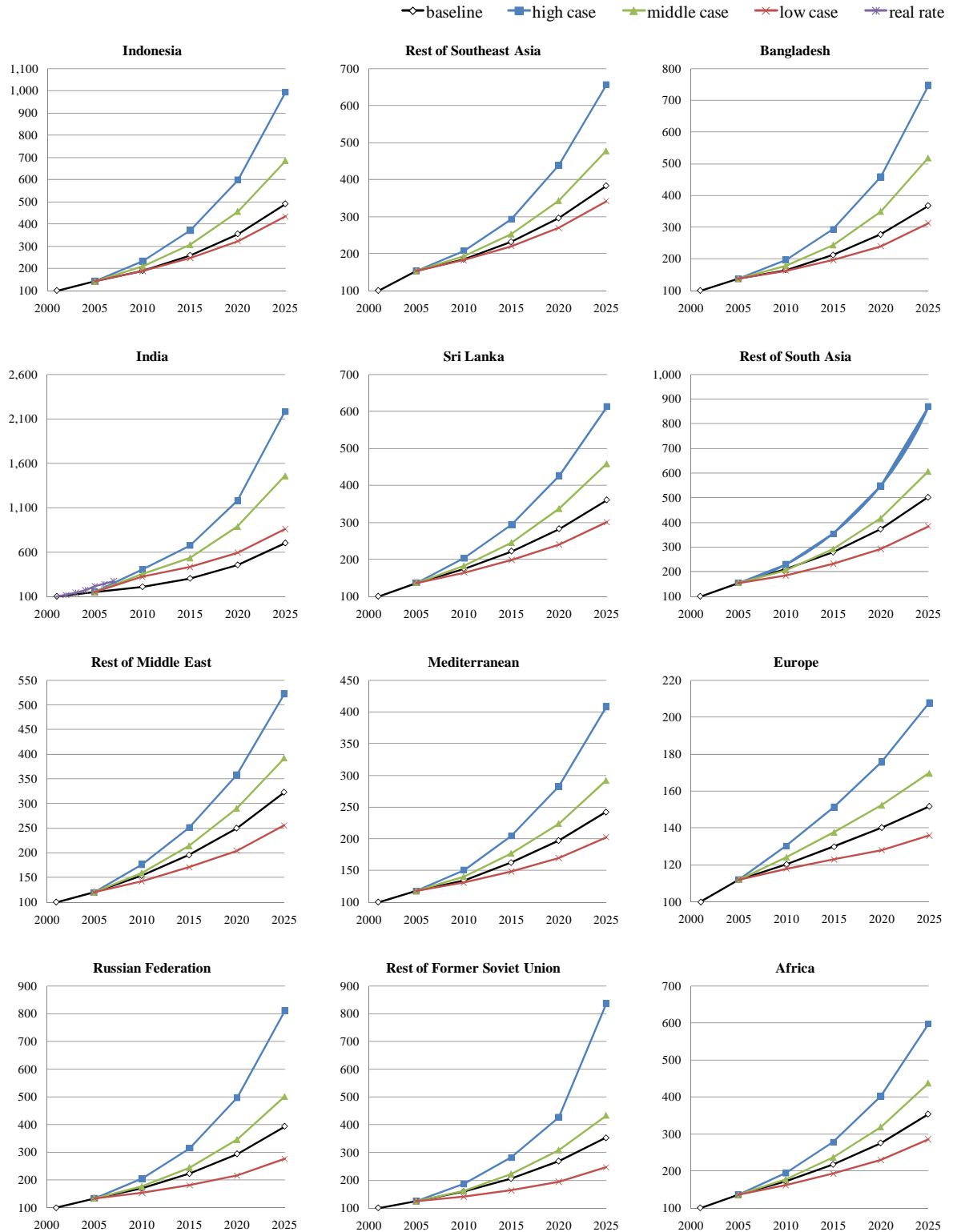


Figure A1 Result of estimated trade value (total imports and exports) in each countries and regions (in 2001 = 100) (2/3)

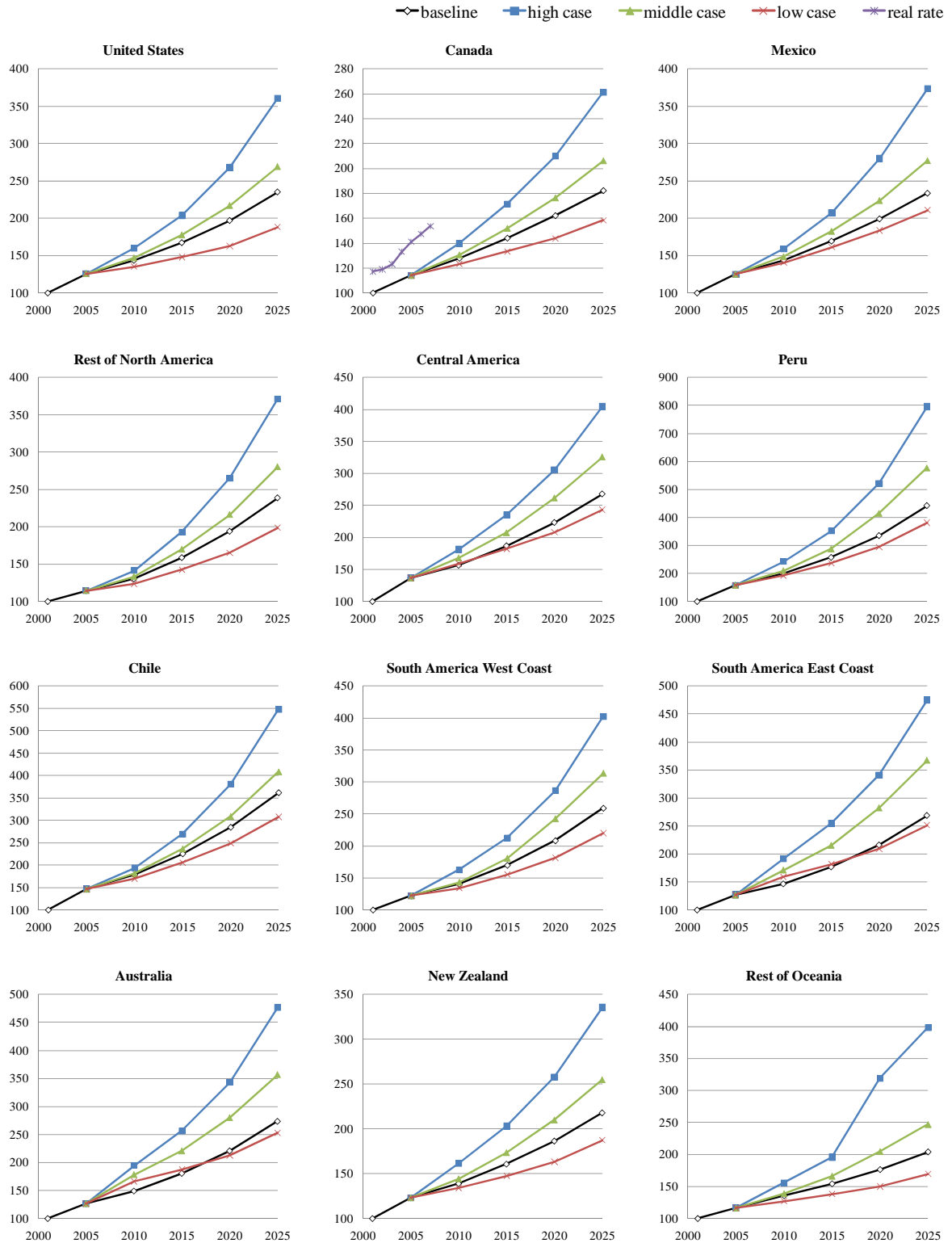
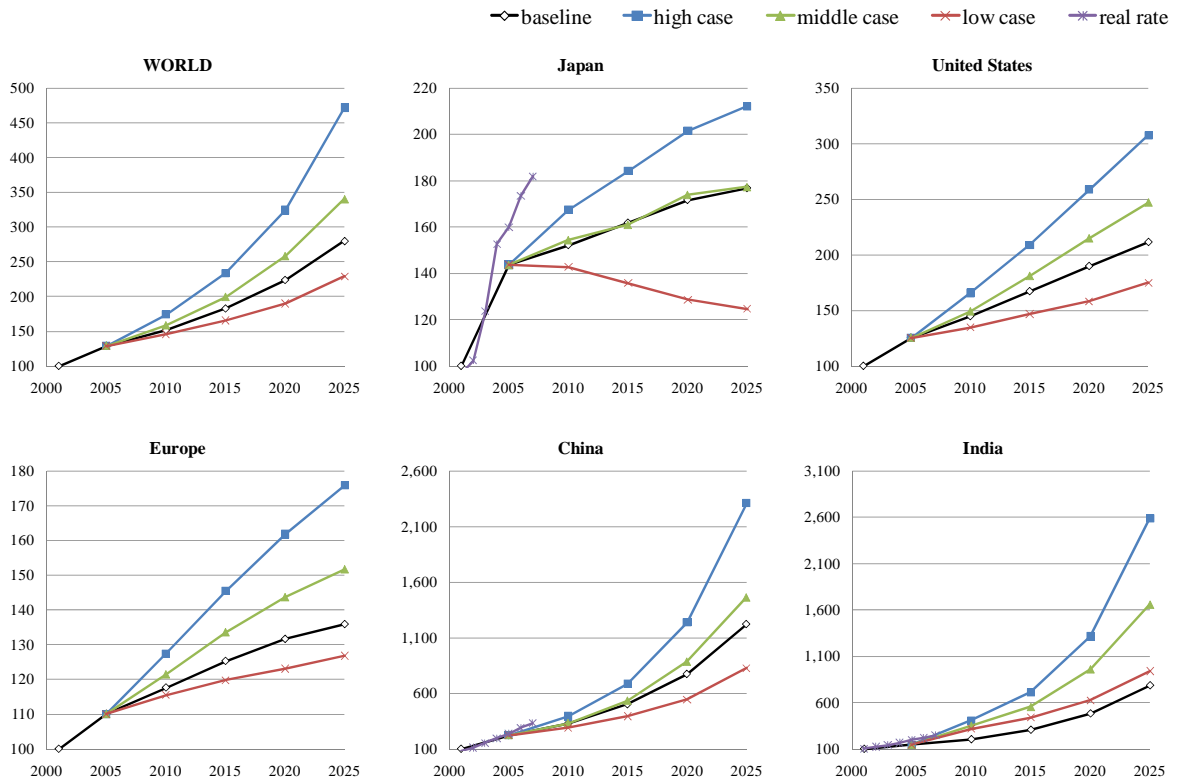


Figure A1 Result of estimated trade value (total imports and exports) in each countries and regions (in 2001 = 100) (3/3)

Export trade value



Import trade value

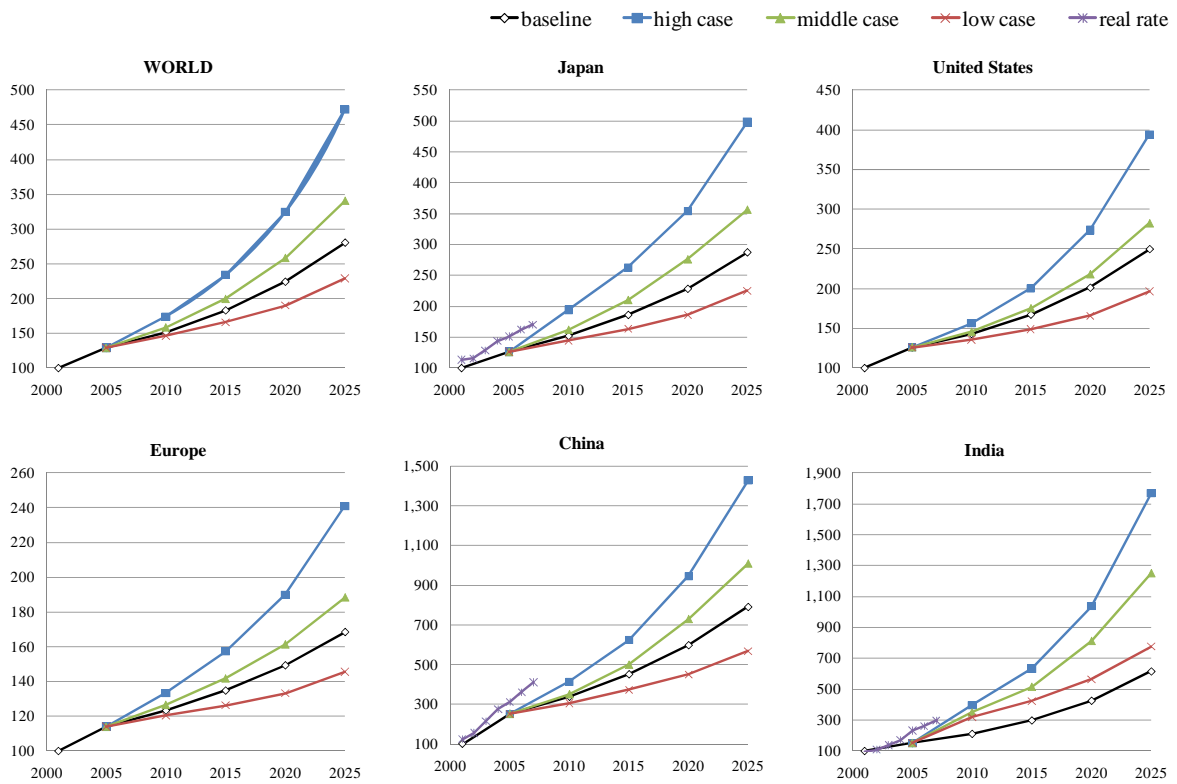


Figure A2 Result of estimated imports and exports trade value in remarkable countries and regions (in 2001 = 100)

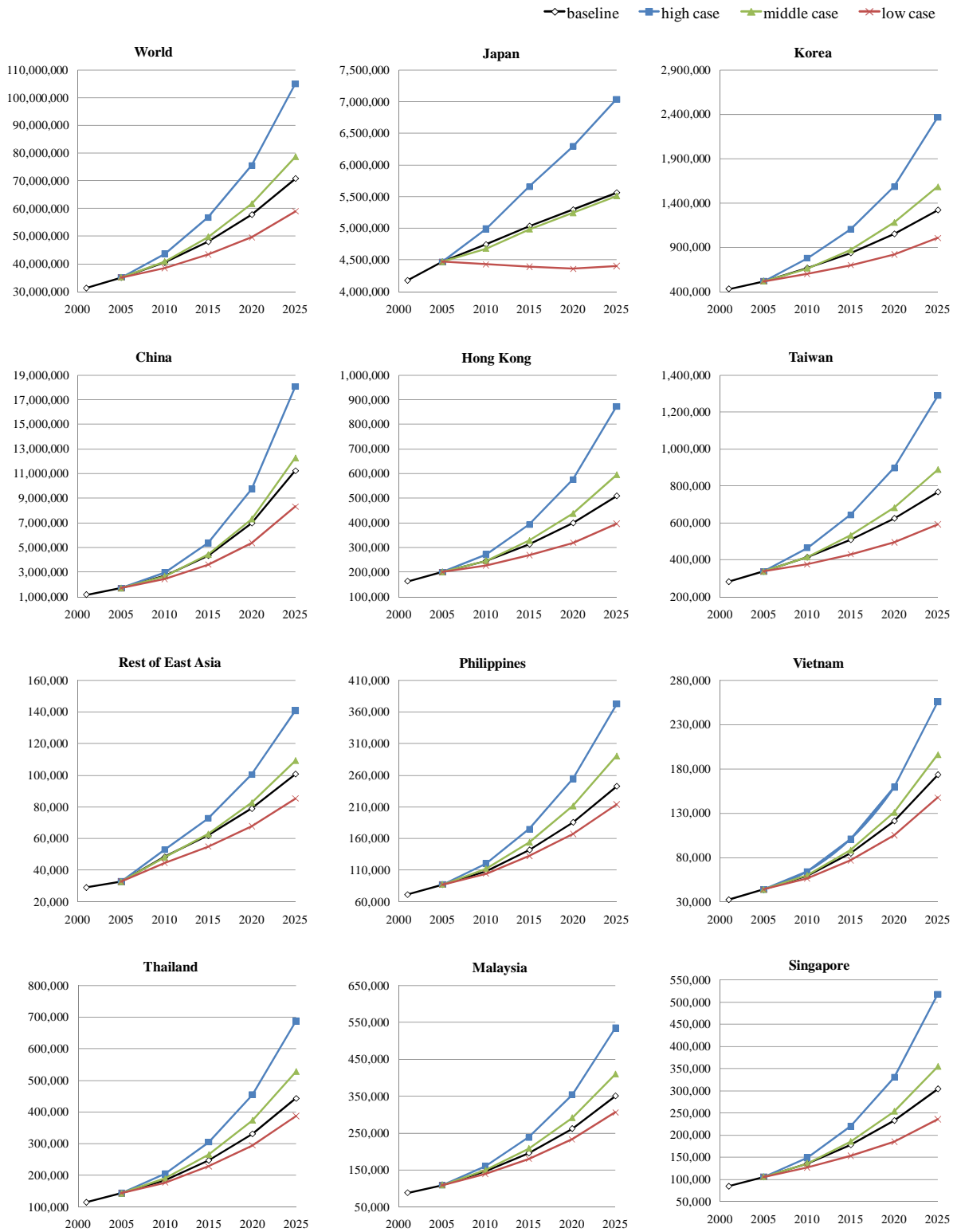


Figure A3 Result of estimated real GDP (2001 price, USD) in each countries and regions (1/3)

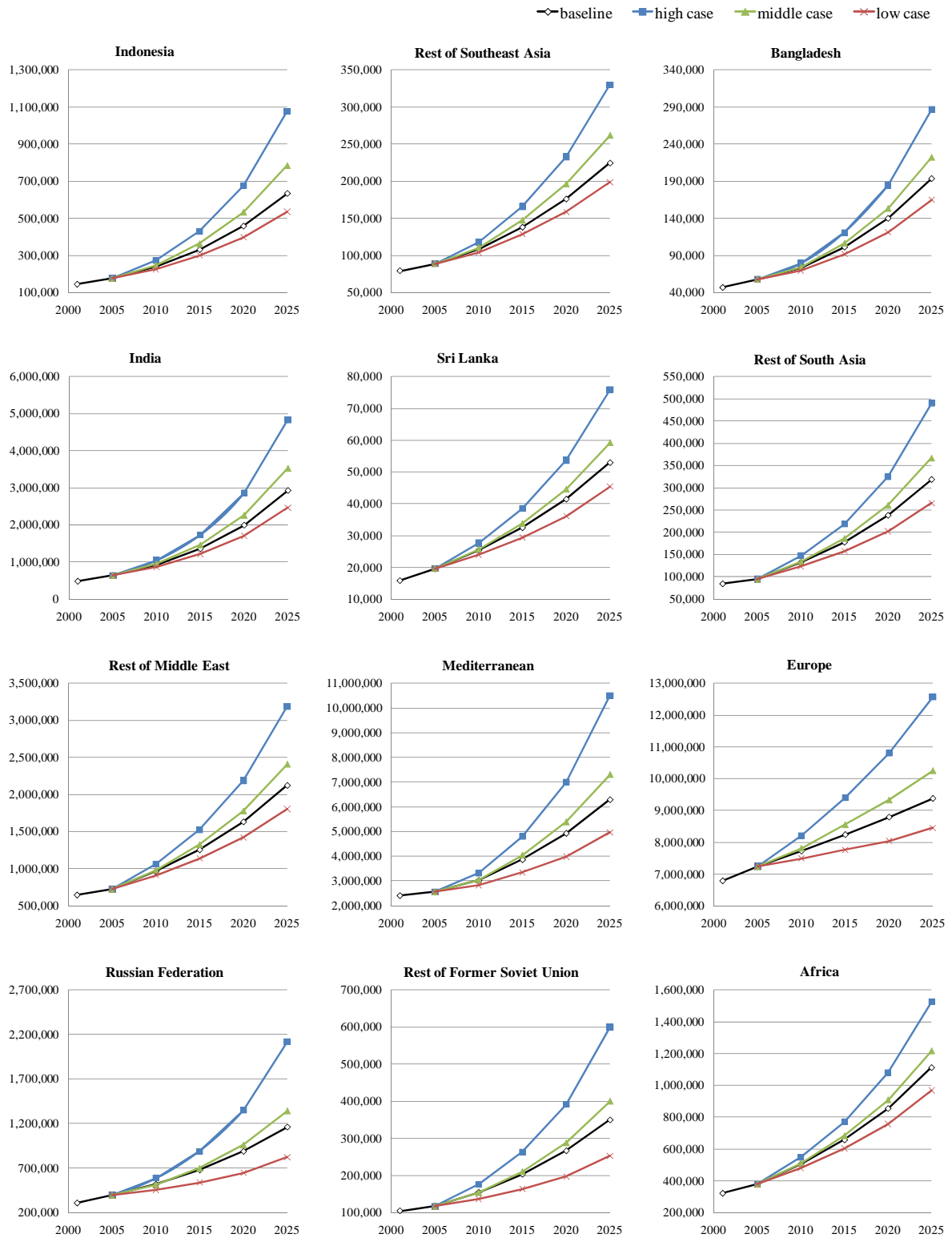


Figure A3 Result of estimated real GDP (2001 price, USD) in each countries and regions (2/3)

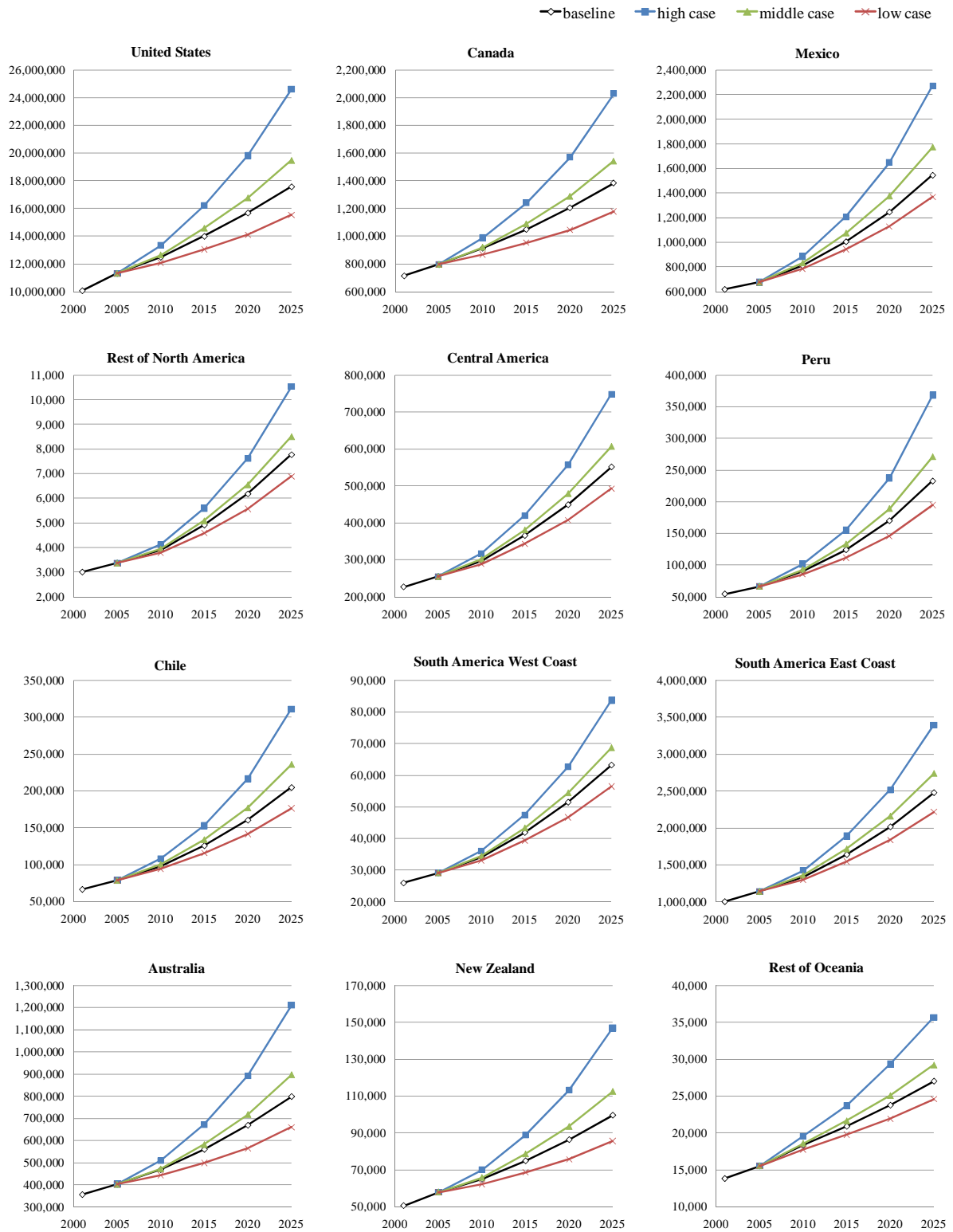


Figure A3 Result of estimated real GDP (2001 price, USD) in each countries and regions (3/3)

Total maritime container cargo

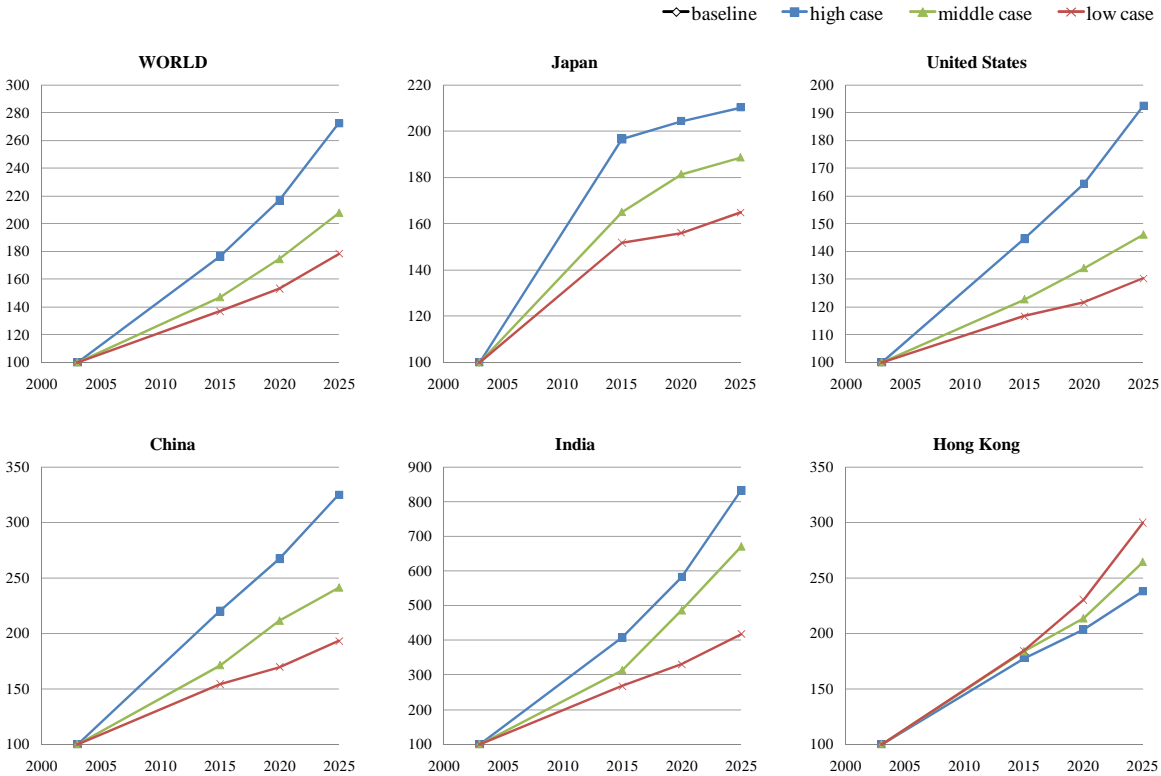
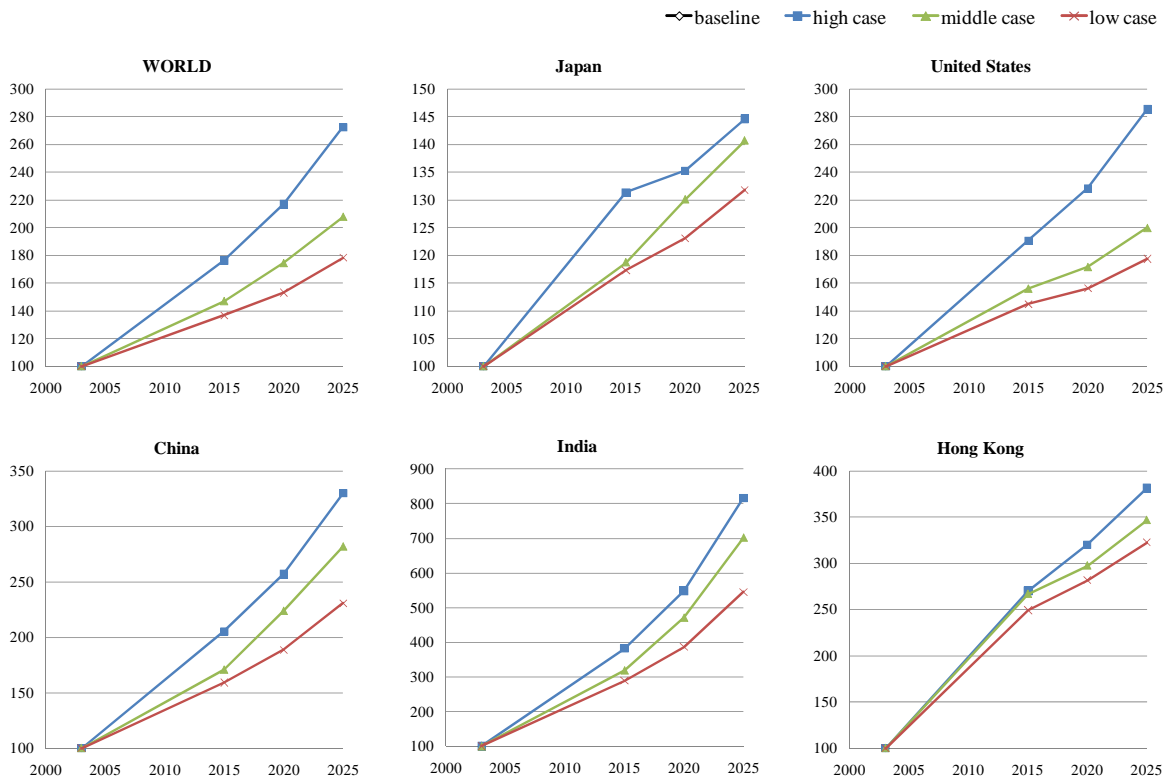


Figure A4 Result of estimated international maritime cargo (TEUs in 2003 = 100) in remarkable countries and regions (1/2)

Export maritime container cargo



Import maritime container cargo

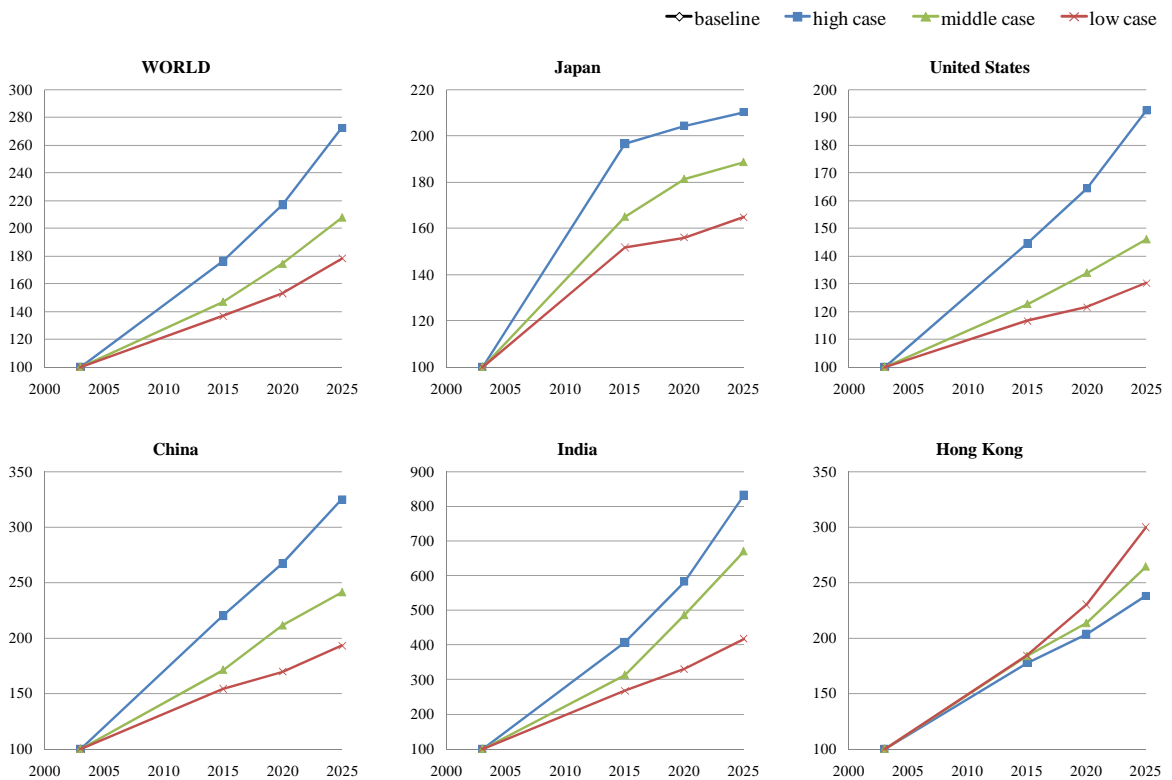


Figure A4 Result of estimated international maritime cargo (TEUs in 2003 = 100) in remarkable countries and regions (2/2)