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**The Uneven Distribution  
of the Benefits of Growth  
Impeding the Expansion  
of Asia's  
Middle-Income Stratum**

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## Abstract

- As high growth continues in the Asian countries, the middle-income stratum in each country is expanding, and this can be expected to add to the ranks of purchasers and consumers. At the same time, since income redistribution mechanisms are poorly developed, an uneven distribution of the benefits of growth is seen, in which high income earners can enjoy higher income growth.
- This paper offers a quantitative analysis of the effect of continuance of the uneven distribution of the benefits of growth on the pace of expansion of the middle-income stratum and the consequent degree of loss in the level of human development. This analysis was conducted as part of the NIRA's research project "Japan's New Role in Supporting Economic and Social Development in Asia." The analysis produced the following results:
  - 1) If income inequality neither worsens nor improves against its 2011 status, the expansion in the future scale of the population of the middle-income stratum will be greater than has previously been estimated.
  - 2) If the uneven distribution of the benefits of growth continues (if income inequality continuously worsens), the pace of expansion of the middle-income stratum will slow significantly, checking the growth of consumption.
  - 3) At the same time, since the effects of income redistribution policies will appear only gradually, long-term efforts will be necessary.
  - 4) If there is no improvement in income inequality against its present status, the level of human development will not be improved so much as the middle-income stratum expands.
- The expansion of the middle-income stratum in Asian countries presents opportunities not only for the countries concerned, but also for Japan as their partner country. However, if a worsening of income inequality leads to a weakening in consumption, the destabilisation of societies, and a loss of opportunities for capacity-building among the low-income stratum, the partner countries like Japan may lose the opportunities. In other words, partner countries are required to collaborate with Asian countries in order for them to realise the expansion of their middle-income strata compatible with the achievement of stable economic and social development by means of income redistribution policies.

# The Uneven Distribution of the Benefits of Growth Impeding the Expansion of Asia's Middle-Income Stratum

Akio Egawa

## 1. Introduction

Until the middle of the 2000s, consideration of the importance of Asia in the world economy focused mainly on production activities, with Asia representing one segment of the global supply chain as a supplier of low-wage labour. The main investor in Asia and the main provider of support for development was Japan, which actively conducted investment and provided ODA to aid the development of core industries which support numerous parts supply industries and the construction of the infrastructure essential to this.

On the other hand, continuing economic growth in Asian countries has expanded the ranks of domestic consumers and purchasers rapidly, and provided related business opportunities both domestically and internationally. In response to these opportunities, Europe and the U.S. joined Japan as major suppliers of investment, as did China and Asian NIEs, making use of their rapid growth in economic power.

The expansion of new ranks of purchasers and consumers is identified as an expansion of the “middle-income stratum”, and in Japan both the National Institute for Research Advancement (NIRA) and the Ministry of Economy, Trade and Industry have conducted estimates of its future scale. Since the growth of Asia's middle-income stratum will continue even if the present level of high economic growth declines somewhat, it has been indicated that the positioning of Asia as a “domestic market” will be important to Japan's future growth.

However, since high growth in Asian countries is being driven by industrialisation in the cities, and it is chiefly workers in the cities who are entering the middle-income stratum, against the background of inadequate income redistribution mechanisms, we have a situation in which high income earners can enjoy higher income growth, i.e. there is an uneven distribution of the benefits of growth<sup>1</sup>. At the same time, since the needs of the agricultural population and the low-income stratum, which are not sufficiently sharing in the benefits of growth, come powerfully into conflict with those of the urban population and the middle- and high-income strata, a worsening of income inequality between households and regions produces the potential for destabilisation of society. The uneven distribution of the benefits of growth also robs the low-income stratum of opportunities for capacity-building, and by this means may act as a factor impeding the improvement of the level of human development in the country in question.

It will be essential for Asian countries to overcome these problems if they are to realise sustainable economic development stemming from the expansion of their middle-income strata. In doing so, we may consider that Japan's accumulated experience will provide hints towards the resolution of problems, and also that Japan will be able to smoothly offer co-operation in fields in which win-win relationships have been fostered. Based on this understanding of the issues, NIRA

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<sup>1</sup> A great deal of literature focuses on the mechanisms of development of urban/rural income disparities in the course of Asian development and the rapid growth of the manufacturing industry with industrialisation (for example, Cabinet Office [2010]), and discussion of these mechanisms will therefore be omitted in this paper.

launched its fiscal 2012 research project “Japan’s New Role in Supporting Economic and Social Development in Asia.” Offering quantitative analyses of the magnitude of the potential effect of an uneven distribution of the benefits of growth (a worsening of income inequality) on the pace of expansion of the middle-income stratum and the degree of loss this would entail in economic and social opportunities, this paper is allied to this basic understanding of the issues.

In conducting these analyses, it is necessary to advance a stage further on methods previously used by NIRA, and to estimate the status of income distribution and changes in that status separately for each country. First, Section 2 estimates the income distribution in each of the countries concerned, and calculates the future population of the middle-income stratum in the event that income inequality neither improves nor worsens, based on the results of these estimates. Using the results of these calculations as the baseline scenario, Section 3 measures the degree of slowing in the pace of expansion of the middle-income stratum which would occur if the pattern of worsening of income inequality observed in the 2000s was to continue until 2020. Based on concerns that when income inequality is high, the level of human development which a country actually achieves will be low in comparison to its latent potential for human development, Section 4 measures the effect on the level of human development if income inequality does not improve against its present status. Bringing these analyses together, Section 5 emphasises the fact that the achievement of a balance between the expansion of the middle-income stratum and stable economic and social development is essential not merely for the countries concerned, but also for Japan as their partner country, following which it offers a conclusion.

## **2. Estimation of Income Distribution by Country and Calculation of Middle-Income Population**

### **(Previous research)**

Using the income distribution for each of the countries under consideration, this section will estimate the future middle-income population assuming that income inequality neither improves nor worsens in future. Prior to doing so, it will offer a brief overview of how income inequality and income distribution coefficients have been treated in previous research.

Estimates of the future scale of Asia’s middle-income population have been conducted in Japan by NIRA [2009], Yanagawa and Mori [2010], and the Ministry of Economy, trade and Industry [2010]. Each of these studies employed cross-country data, and, using GDP per capita, calculated the ratio of middle-income (and high-income) households to all households based on the results of regression analyses. In this method, the regression equation is calculated based on the assumption that the form of the income distribution in all of the countries forming the subject of the analysis is identical; in addition to this, when the future population of each income stratum in each country is determined, the error in estimation for each country as calculated in the regression analysis is simply added as is to the composition ratio of each stratum calculated on the basis of the regression equation. Since, under these conditions, information concerning the differences in the income distributions of each country is incorporated in the error term (the difference between actual values and estimated values), it is not possible to determine the forms of the income distributions or their changes over a time series, or to analyse the effect of the uneven distribution of the benefits of growth on the future scale of the middle-income population.

Overseas, Kharas [2010] derived Lorenz curves from income decile data for the countries

under study using Povcal, the poverty and income disparity analysis software provided by the World Bank, and determined their future middle-income populations from the information on the curves. This method is equivalent to estimating the income distribution for each country under study and conducting future estimates with consideration of the differences between the countries in the status of their income gaps. However, Kharas calculated future estimates only on the basis of the assumption that “the Lorenz curve remains constant over time, i.e. that growth is distributionally neutral” (Kharas [2010: 49]); no estimates were conducted on the assumption of change in the income distribution.

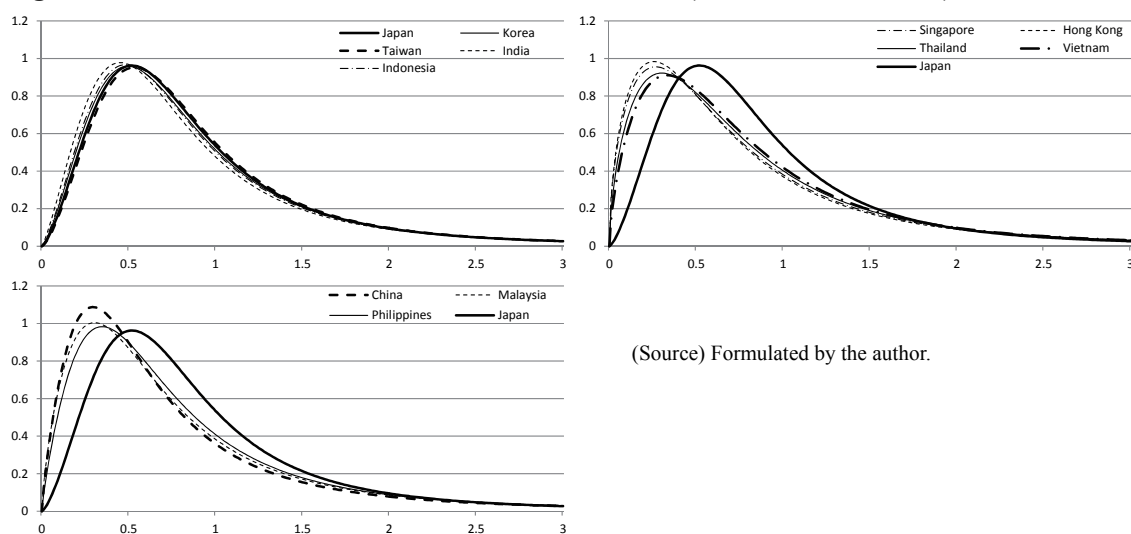
**(Method of calculation of income distribution function for each country under study and calculation results)**

In order to examine the significance of the expansion of the middle-income stratum under conditions of a continuing worsening of income inequality in the future, it is necessary to allow income distribution functions to take on different forms for different countries, and to calculate the future population of their middle-income strata using these income distribution functions; in addition, it is also necessary to investigate the effect on society and the economy of the worsening or improvement of income inequality.

Accordingly, the present income distribution function for each of the countries under study is estimated below, and the results of these estimates are used to calculate the future populations of the middle- and high-income strata for a scenario in which there is distributionally-neutral growth. First, in estimating the present income distribution functions (cumulative density functions) for each country, based on 2011 data for each country published in Euromonitor International’s World Consumer Lifestyles Survey, distribution functions which allow breadth in the tails of the distribution curves were assumed. (For further details, see Technical Note 1 at the end of the paper). Figure 1 shows the results of these estimations in graph form. Note however, that for each country a scale adjustment has been applied to make the average income unity on the horizontal axis.

For the income distribution functions shown in Figure 1 (in the forms of probability distribution function), the closer the peak of the curve (the mode) is to the average income, and the lower the peak, the lower the degree of income inequality. At the same time, the wider the tails of the curve are on the right-hand side, the greater the income inequality. Of the 12 countries shown in Figure 1, Japan’s income inequality is the lowest. Taking Japan as the standard, it can be seen that there is almost no difference between the forms of the distributions for Korea, Taiwan, India and Indonesia (This represents the low income inequality group). In the results for Singapore, Hong Kong, Thailand and Vietnam, the mode is positioned further to the left than for Japan. The peaks are higher for Singapore and Hong Kong than for Thailand and Vietnam, and the modes are also positioned further leftward. In other words, income inequality is higher in Thailand and Vietnam than in Japan, but can be considered still higher in Singapore and Hong Kong. The peaks of the curves for Malaysia and the Philippines are the same height as for Japan, but their modes are positioned further to the left, and income inequality in these countries can therefore be considered to be greater; in the case of the Philippines, relatively higher frequency around the average income can be considered to indicate that income inequality has eased to this extent. In the case of China, the mode is the same as for Malaysia, while the peak of the curve is higher, and income inequality can be considered to be greater to this extent.

**Figure 1: Income distribution functions for Asian countries (Results of estimations)**



(Source) Formulated by the author.

**(Estimates of future populations of middle- and high-income strata)**

Using the income distributions estimated for each of the countries under study, as discussed above, this section calculates the future populations of the middle- and high-income strata in each country assuming distributionally-neutral growth. Future incomes for each household were calculated with prices fixed at 2011 levels; the dollar exchange rate was also fixed at 2011 levels. This makes it a simple matter to study the results based on present criteria for the judgment of value. For the growth rate, real growth rates measured by the local currency unit of each country were used; in addition, taking the income convergence hypothesis into consideration<sup>2</sup>, the calculations were performed so as to have the growth rate for each year decline progressively with the level of development until 2030. To enable comparison with the results of the previous NIRA and Ministry of Economy, Trade and Industry estimations, middle-income households were defined as having annual incomes of between \$5,000 and \$35,000, and high-income households were defined as having annual incomes higher than this (See Technical Note 2 at the end of the paper for details of the estimation method, including the above).

Figure 2 shows the results of estimates conducted by means of this procedure. Looking at Figure 2, we see that the middle-income population of Asia as of 2011 was 1.67 billion (53% of the population), and the region’s high-income population was 110 million (3%). In 2020, the middle-income population will have increased significantly to 2.42 billion (72%), while the

<sup>2</sup> The income convergence hypothesis states that while poor nations are able to learn from the political and economic systems, methods of business management, and technologies of rich nations and thus achieve rapid development, there are no systems for the rich nations to learn from, and they are therefore unable to achieve this rapid development. For this reason, the income levels of all nations will tend to converge (Barro and Sala-i-Martin [1995]). When this happens, the relationship between the income level and the growth rate becomes a downward-sloping one. In fact, if we consider the 10-year period from 1999, when recovery from the currency crisis began, to 2008, when the Lehman shock occurred, and look at the relationship between income per capita (GNI) at purchasing power parity and the growth rate, despite the fact that the coefficient of determination is low, the relationship can be considered to describe a downward-sloping asymptotic line to a certain extent, in particular for lower-middle-income and higher countries (see Figure A3 in Technical Note 2 at the end of the paper). For this reason, the income convergence hypothesis has been assumed in this paper in relation to the growth rates used in conducting estimates for the future middle-income stratum. It may be noted that the countries whose growth rates deviate from the asymptotic line have been assumed to display growth rates which approach a gently asymptotic line. For details, refer to Technical Note 2 at the end of this paper.

**Figure 2: As of 2020 there has been a rapid expansion in the middle-income stratum; as of 2030 there has been a rapid expansion in the middle-income stratum (Estimation results)**

	2011	2020	(Against 2011)	2030	(Against 2020)	(Against 2011)
Low- income stratum Rate of change	<b>1.35 bn (43%)</b>	<b>0.61bn (18%)</b>	-0.73bn -55%	<b>0.24bn ( 7%)</b>	-0.37bn -61%	-1.10bn -82%
Middle-income stratum Rate of change	<b>1.67bn (53%)</b>	<b>2.42bn (72%)</b>	+0.75bn +45%	<b>2.49bn (71%)</b>	+0.08bn +3%	+0.83bn +50%
High-income stratum Rate of change	<b>0.11bn ( 3%)</b>	<b>0.32bn (10%)</b>	+0.21bn +199%	<b>0.79bn (22%)</b>	+0.47bn +147%	+0.69bn +638%
(Reference) Population Rate of Change	<b>3.12 bn</b>	<b>3.35bn</b>	+0.23bn +7%	<b>3.53bn</b>	+0.18bn +5%	+0.41bn +13%

(Notes) 1. Here, Asia is defined as 10 countries: China, Korea, Hong Kong, India, Singapore, Malaysia, the Philippines, Indonesia, Thailand and Vietnam.

2. The figures in parentheses show the percentage of the total population represented by each income stratum.

(Source) Formulated by author.

high-income population increases to 320 million (10%); in 2030, the volume of the high-income population increases, with the middle-income population reaching 2.49 billion (71%), against a high-income population of 790 million (22%). These results calculate the middle-income population significantly higher than the previous NIRA studies, at the same time as calculating the high-income population in 2030 slightly lower (see Figure A5 in Technical Note 2)<sup>3</sup>. However, these results and the results of the previous studies concur in predicting a future expansion of the middle-income stratum against the background of continuing dynamic growth in Asia.

### **3. Uneven Distribution of the Benefits of Growth and the Slowing of the Pace of Growth of the Middle-Income Stratum**

The calculations discussed above are based on the assumption that in the future the benefits of growth will be shared equally by each citizen of the countries concerned. However, even as the world is giving increasing attention to the growth of the middle-income stratum, income inequality is worsening in most Asian countries. The worsening of income inequality functions to rob the low-incomes of opportunities to enter the middle-income stratum. This has the result of dampening the burgeoning of consumption due to the new members of the middle-income stratum, in addition to reducing the desire to invest in the relevant consumer goods markets.

Given this, below, this study investigates the degree to which income inequality worsened in the 2000s, and seeks to understand quantitatively the effect of a continuance of this trend into the future on the pace of growth of the middle-income stratum.

#### **(Uneven distribution of the benefits of growth)**

The worsening of income inequality and the uneven distribution of the benefits of growth

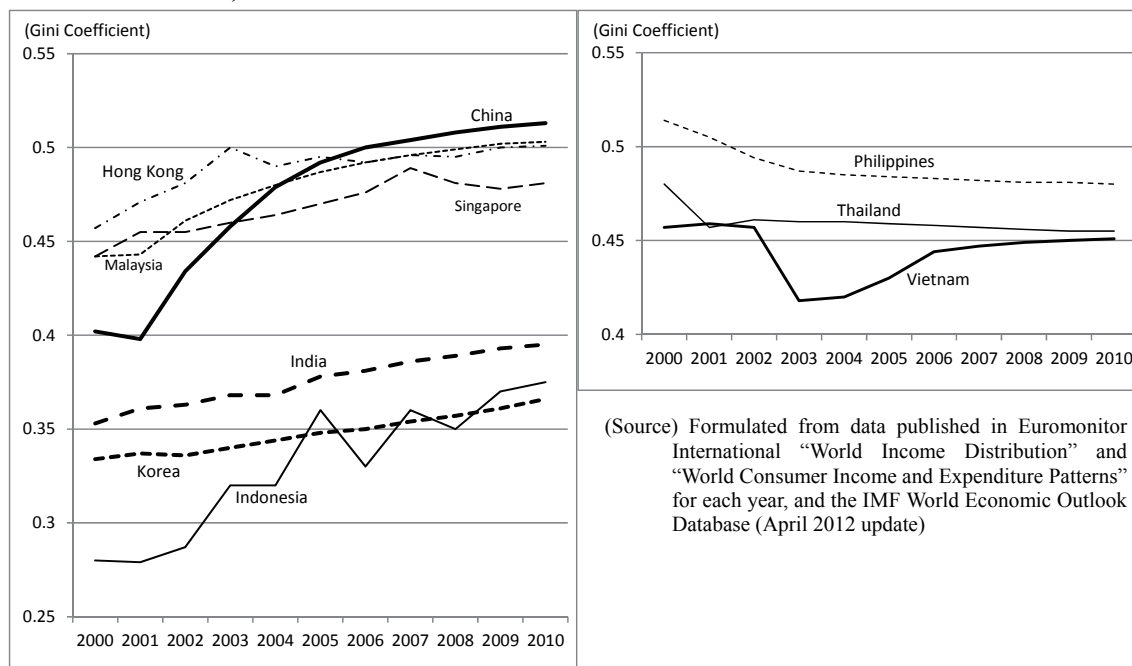
<sup>3</sup> A number of factors may be considered as to why the estimates for 2020 in particular significantly exceed the estimates in National Institute for Research Advancement [2009] and Yanagawa and Mori [2010]. The main factors may be summed up as follows:

- (1) The actual figure for the ratio of middle-income households in 2011 significantly exceeded projections estimated in 2009 (i.e. the rate of income growth in this three-year period greatly exceeded predictions; however, general appreciation due to the exchange rate between 2008 and 2011 was probably also a factor), resulting in significant differences for the middle-income populations of countries with large populations, such as China and India.
- (2) The growth rates used in this paper are based on the annual average real growth rates in the period between the Asian currency crisis and the Lehman shock, and because of this, growth rates, in particular growth rates to 2020, would have been predicted high for most countries.

can be indicated as being the same phenomenon under different names. First, considering trends in income inequality in all of the countries under consideration using the Gini coefficient (Figure 3), we find that the Gini coefficient has risen for all countries other than the Philippines, Thailand, and Vietnam for each year during the 10-year period from 2000. In other words, most Asian countries displayed growth in combination with a worsening of their income inequality. The pace of worsening of income inequality was particularly high in China and Indonesia, each characterised by high populations and high growth rates<sup>4</sup>.

Figure 4 shows differences in the rate of growth of real disposable income per capita between the income strata for each country. Consistent with the trends shown in Figure 3, we see that the benefits of growth were unevenly distributed in the 10-year period from 2000 in the countries which displayed increases in their Gini coefficients. Despite the fact that India and Korea displayed high growth, during this 10-year period the first income decile received only approximately half of the benefits of growth, and in China, the first income decile received less than half of the benefits of growth. In Singapore, the rate of income growth in the second to ninth income deciles was negative, while the rate of growth was positive in the top decile, indicating a monopolisation of the benefits of growth. In the cases of Vietnam, Thailand, and the Philippines,

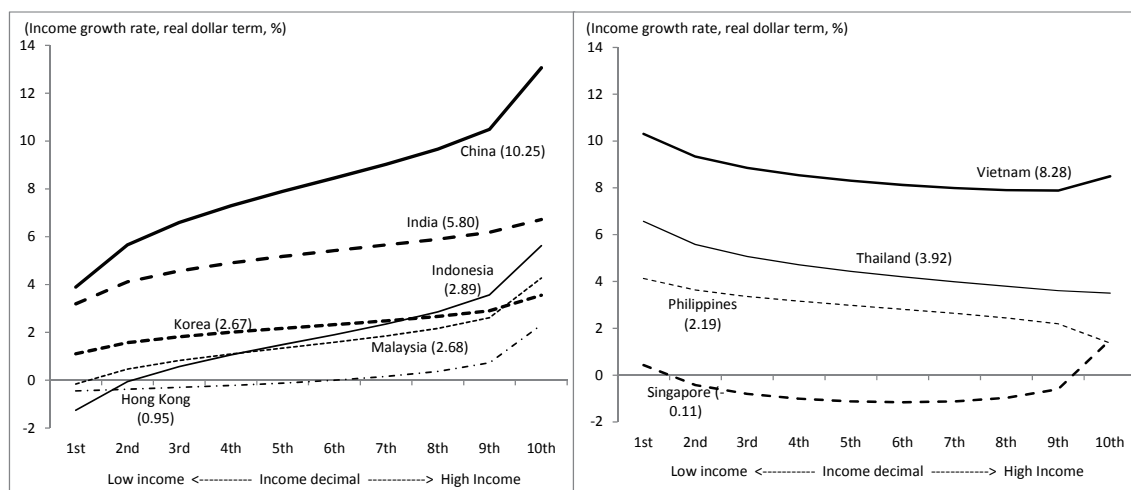
**Figure 3: Income inequality has worsened in most Asian countries (Changes in the Gini coefficient, 2000-2010)**



<sup>4</sup> With regard to growth in Asian economies, it is possible to indicate that the relationships shown in Figure 3 appear as a result of the worsening of income inequality and the uneven allocation of limited resources during the low-income country stage (the Kuznets hypothesis). In order to generate a Kuznets curve, a regression of the S5/S1 ratio (Average income of the 20% of the population earning the highest incomes divided by average income of the 20% of the population earning the lowest income: Multiplication rate) on per-capita GDP (in purchasing power parity term (logarithmic expression)) is performed. The value at the maximum of the curve was US\$ 3,836 (nominal PPP). In other words, the Kuznets hypothesis is supported for countries with income levels below US\$ 3,836. However, the only countries matching this condition in the left-hand graph of Figure 3 are China (only until 2004), India and Indonesia. Of these, Indonesia's per-capita GDP exceeded this level in 2010, India's is expected to exceed it in 2012. Given this, Asian countries will, at least, not be able to legitimise the pursuit of growth through the uneven allocation of resources in future using the Kuznets hypothesis.



**Figure 4: The benefits of growth are unevenly distributed in countries in which income inequality has worsened (Growth rate of disposable income by income stratum)**



(Notes) 1. The growth rate for average real disposable income (1995 prices) for the 10-year period from 2000 to 2010 was calculated for each of the income deciles.

2. The figures in parentheses following the country names are the average growth rates for disposable income on the macro level.

(Source) Same as for Figure 3.

income growth for the lowest income decile was equivalent to or greater than the average figure on the macro level, and uneven distribution of the benefits of growth can therefore not be observed. However, rather than this representing the success of income redistribution measures, the fact that agriculture, an industry with a high proportion of low-income workers, is an export industry for these countries, and that the rate of growth of agricultural incomes increased at a faster pace than was the case for other industries with the surge of price of primary products in the second half of the 2000s, can be considered to have contributed to this result.

**(If the uneven distribution of the benefits of growth continues, the middle-income population of Asia as a whole will decline by 170 million)**

This section quantitatively considers the effect in limiting the future growth of the middle-income stratum of a continuance until 2020 of the situation of uneven distribution of the benefits of growth existing in the 2000s in each of the countries under study. In doing so, it was necessary to conduct estimations using a new income distribution obtained by multiplying the income distribution function estimated in Section 2 by a formula modelling the status of the uneven distribution of the benefits of growth which was actually experienced in the 2000s.

If the ratio of income earners earning less than the average income is calculated using the income distribution functions shown in Figure 1, the figure is in the range of 67-73% for each country (i.e., the seventh and eighth income deciles represent the average wage). Turning to Figure 4, we find that the rate of growth of real disposable income in the seventh and eighth income deciles is almost exactly the same as that of real disposable income on the macro level. A “multiplier” function producing the effects of (1) having the income growth rate increase as income increases, and (2) having earners of the average wage experience income growth of the same level of growth as displayed at the macro level is therefore calculated, and the change in effect produced by multiplying this function by the original income distribution functions are observed. To do so, it is also necessary to assume an income growth rate for the lowest income decile. The assumption in this

**Figure 5: If the uneven distribution of the benefits of growth continues into the future, Gini coefficients worsen significantly in 2020**

	<b>China</b>	HK	<b>India</b>	Indonesia	<b>Malaysia</b>	Philippines
2011 → 2020 (Magnitude of worsening)	<b>51.5 → 57.4</b> <b>(+5.9)</b>	50.9 → 54.2 (+3.3)	<b>43.1 → 47.8</b> <b>(+4.7)</b>	41.6 → 45.4 (+3.8)	<b>50.8 → 55.1</b> <b>(+4.3)</b>	47.6 → 51.5 (+4.0)
	Singapore	Korea	Thailand	<b>Vietnam</b>	Japan (ref.)	Taiwan (ref.)
2011 → 2020 (Magnitude of worsening)	48.2 → 51.2 (+3.0)	41.1 → 44.2 (+3.1)	48.5 → 52.0 (+3.4)	<b>47.2 → 51.6</b> <b>(+4.4)</b>	39.1 → 40.7 (+1.6)	39.3 → 42.2 (+2.9)

(Note) 1. For ease of legibility, the Gini coefficients are shown as fractions of 100 (100 is the highest value).

2. Countries for which the increase in the Gini coefficient was greater than four points are shown in bold.

3. The figures employed for 2011 and 2020 were calculated based on the income distribution coefficients estimated in Section 2; readers should bear in mind that the method of calculation differs to that for the figures up to 2010 published by Euromonitor International (also referenced in Figure 3).

(Source) Calculated by the author.

paper is that (3) the rate of growth in the lowest income decile is half the rate of income growth on the macro level. Looking at Figure 4, India and Korea correspond to this scenario. China displays a higher level of unevenness of distribution of the benefits of growth than this; for Malaysia, Hong Kong and Indonesia, while income growth is positive, income growth in the lowest income decile is negative<sup>5</sup>.

The income growth rate function formulated in this way is multiplied by the income distribution functions for each country for 2011, formulated in Section 2, in order to calculate new income distributions (for details of this multiplier function and the method of multiplication employed, see Technical Note 3 at the end of this paper). Using the new income distributions, Gini coefficients for 2020 are then calculated (Figure 5; the Gini coefficients take values between 0 and 100 from considerations of legibility). Reviewing these results, we find that income inequality worsens by three points or more compared to the case in which there is distributionally-neutral growth. Naturally, countries for which a high growth rate is projected in future and countries for which the peak of the income distribution curve (Figure 1) is high or for which the mode is skewed to the left displayed a high level of increase in the Gini coefficient. China (+5.9 points), India (+4.7 points), and Vietnam (+4.4 points) correspond to these scenarios. The increases in the coefficients for Malaysia, the Philippines, and Indonesia were also high at around +4 points.

If the income distribution changes, the scale of the middle- and high-income strata changes even if the real economic growth rate on the macro level is the same. Looking at the magnitude of the change in 2020, we find that as a result of the worsening of income inequality due to the uneven distribution of the benefits of growth, there will be 170 million members of the low-income stratum unable to enter the middle-income stratum; this figure corresponds to 5% of the future population of the countries in study (Figure 6). With the worsening of income inequality, in addition to an expected decline in purchasing power with the contraction in the number of people entering the middle-income stratum, it is also possible that a keener sense of the risk of future downward trends in incomes will cause people to forgo consumption and direct more of their income towards savings. From this perspective also, it is possible to see the importance of introducing income redistribution policies which will have the effect of controlling fluctuations in present incomes, and policies to mitigate the risks generated by income fluctuations by means, for example, of enhancing the social security system, as measures to ensure future income stability.

<sup>5</sup> This is to say that if a model of the uneven distribution of the benefits of growth had been formulated on the basis of conditions in China, Malaysia, Hong Kong, or Indonesia, it is possible that an even more severe worsening of income inequality would have been predicted.

**Figure 6: As a result of the effects of the uneven distribution of the benefits of growth, in 2020 there will be 170 million people throughout Asia unable to enter the middle-income stratum**

	2011	2020 (Uniform growth)		2020 (Uneven distribution)		Difference in comparison to uniform growth
		Scale	(Compared to 2011)	Scale	(Compared to 2011)	
Low-income stratum	1.35bn (43%)	0.61bn (18%)	-0.73bn	0.78bn (23%)	-0.57bn	<b>+0.17bn</b>
Middle-income stratum	1.67bn (53%)	2.42bn (72%)	+0.75bn	2.24bn (67%)	+0.57bn	<b>+0.18bn</b>
High-income stratum	0.11bn (3%)	0.32bn (10%)	+0.21bn	0.34bn (10%)	+0.23bn	+0.02bn

(Note) Figures in parentheses show the proportion of the population represented by each income stratum.

(Source) Calculated by the author.

**(Further expansion of the middle-income stratum brought about by economic circumstances favouring the redistribution of income)**

As indicated above, the expansion of the middle-income stratum in a country is recognised by other countries as representing a rapid growth in the number of consumers in that country, and this provides opportunities for new investment and profit for the Asian region. Considered from another perspective, the worsening of income inequality will exclude a potential purchasing stratum larger than the population of Japan from these opportunities in less than 10 years' time, making it clear that cooperating more actively in correcting income inequality in Asian countries is an issue of considerable significance both for the countries themselves and for investing countries.

Let us attempt to quantify that significance. Assuming the introduction of income redistributive policies, and using the income growth rate function calculated above, this section estimates the change in the scale of the middle- and high-income strata if all the countries under consideration realised the same income growth rates by income strata as experienced by Vietnam (the lower the income, the greater the proportion of the benefits of growth received) until 2020<sup>6</sup>. The results, shown in Figure 7, indicate that further 70 million low-income people would enter the middle-income stratum<sup>7</sup>.

While these results adequately predict that Gini coefficients will worsen by three to five points by 2020 if the uneven distribution of the benefits of growth continues, ongoing long-term efforts would be required to correct income inequality, and in particular in the initial stages, results would begin to appear only gradually<sup>8</sup>. Taking this into consideration, it will be important to

**Figure 7: If the same improvement in income inequality as experienced in Vietnam was realised in all the countries under consideration, the middle-income stratum would increase by 70 million people throughout Asia**

	2011	2020 (Uniform growth)		2020 (Improvement in income inequality)		Difference in comparison to uniform growth
		Scale	(Compared to 2011)	Scale	(Compared to 2011)	
Low-income stratum	1.35bn (43%)	0.61bn (18%)	-0.73bn	0.54bn (16%)	-0.81bn	<b>-0.07bn</b>
Middle-income stratum	1.67bn (53%)	2.42bn (72%)	+0.75bn	2.50bn (74%)	+0.83bn	<b>+0.08bn</b>
High-income stratum	0.11bn (3%)	0.32bn (10%)	+0.21bn	0.32bn (9%)	+0.21bn	-0.01bn

(Note) 1. The method of calculation of the population of each income stratum for "2020 (Improvement in income inequality)" was the same as the method used in Figure 6.

2. This magnitude was calculated as  $d=-0.25$  in "Income Growth Rate Coefficients" in Technical Note 3.

(Source) Calculated by the author.

<sup>6</sup> For the  $g^i(x)$  function in Technical Note 3,  $d=-0.25$ .

<sup>7</sup> In this case, the magnitude of the improvement in the Gini coefficient is extremely low; the greatest improvement, displayed by India, was only 0.8 points.

<sup>8</sup> Calculating the rate of improvement in China's Gini coefficient using a hypothetical figure of  $d=-0.5$  produced an improvement of around 2.5 points. This figure is low compared to the degree of worsening at  $d=0.5$  (+5.9 points), tending to indicate that the pace of improvement in income inequality is slow, and that considerable effort will be required in order to correct the income inequality.

introduce systems which stimulate income transfer to and increased earnings for low-income earners in order to eradicate the roots of this future increase in income inequality now, to improve income inequality and at least prevent the situation from worsening in relation to its present status. In addition, income inequality is not related only to the height and position of the peak of the income distribution curve, but is also related strongly to the breadth of the tails of the curve. In Figure 4, while Singapore displays a distribution structure indicating improvement in income inequality up to the ninth income decile, because the structure at the tenth decile indicates a monopoly of the benefits of growth, income inequality has increased. As this shows, if the gently sloping areas of the income distribution curve are broad, the Gini coefficient will be high. From this perspective, it will be important from this point onwards to reduce the breadth of the tails of the income distribution, in addition to moving its peak further to the right, by means of rich-to-poor-transfer-type income redistribution policies.

**Column: What an increase in the size of Asia's middle-income stratum means**

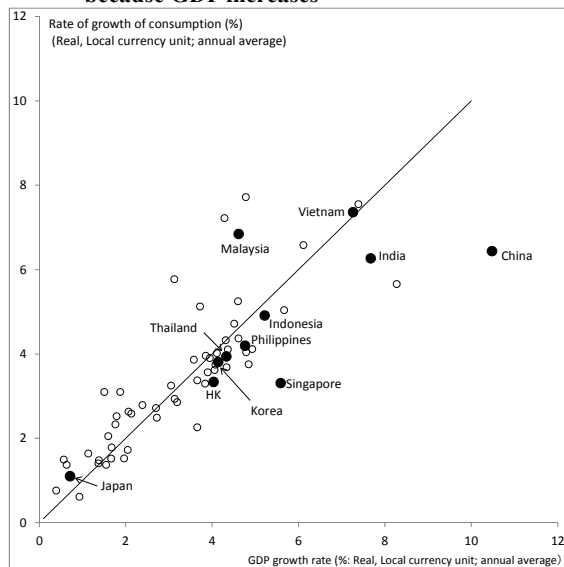
The section above has considered the effect of worsening or improvement of income inequality on the size of the middle-income stratum, the stratum which is expected to represent a new consuming class in Asia. What, though, is the actual relationship between the size of the middle-income stratum and consumption?

An expansion in the size of the middle-income stratum can be referred with general expectation of an increase in the number of people moving from the low-income stratum to the middle-income stratum. In this context, an expansion in the size of the middle-income stratum would represent an increase in the number of people able to purchase a small amount of goods over and above those absolutely necessary to life, and it may be assumed that the associated increase in consumption will result in the production of (low-priced) luxury goods which are able to be purchased with these small amounts of excess funds. This could be considered to be the first step on the path to a more culturally rich lifestyle for the new members of the middle-income stratum. For the government, the reduction in the size of the low-income population would make it possible to reduce the amount of budget previously allocated to measures targeting low-income earners and anti-poverty initiatives, and to allocate a greater amount of budget to investment in infrastructure, the creation of a social safety net, and other measures to provide the foundation for future growth. In other words, it may be more appropriate to regard the phenomenon of an increase in the size of the middle-income stratum as a phenomenon characterized by a period in which the groundwork can be laid for more healthy and humane growth in the future for the country as a whole.

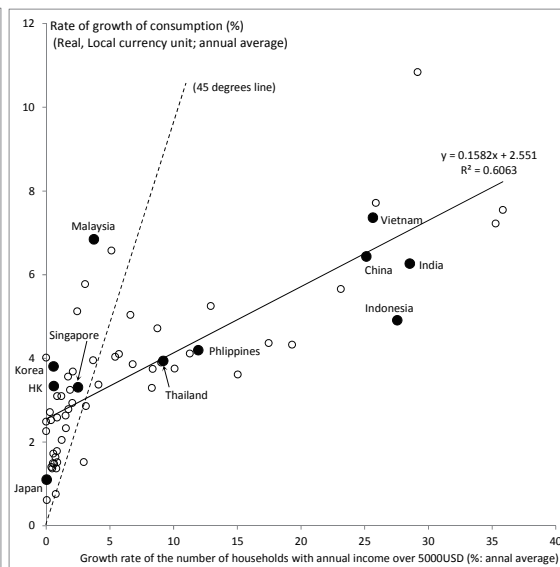
Among the diverse arguments surrounding this issue, there is a perspective which discusses an increase in the size of the middle-income stratum and the possibility of a rapid increase in the consumption of high-priced consumer durable goods in the same category. However, while it is certain that high-priced consumer goods will sell in greater numbers in Asia, the phenomenon will result from an increase in the amount of consumers in any given country able to purchase such goods due to the fact that the incomes of the entire population will increase in almost exact parallel with increases in the GDP, irrespective of whether the number of people in the middle-income stratum increases (Figure A). In fact, if we look at the correlation between the rate of growth of the population earning US\$5,000 or more per year and the rate of growth of consumption (Figure B), we find an upward-sloping relationship: When the rate of growth in the population earning at least US\$5,000 is high, the rate of growth of consumption is high. However, the gradient of the incline is gentle; we do not observe an explosive increase in consumption in countries in which there is a significant increase in the middle-income population.

Ultimately, in terms of the general argument that an increase in the size of the middle-income population will result in an increase in consumption, the argument that consumption will increase in countries with large populations because high growth is expected to continue into the future might be said to be enjoying a free ride on the more rational interpretation that there is a possibility that the low-priced luxury goods market will expand rapidly in parallel with the expansion of the middle-income stratum (for example, a rapid growth in the number of convenience stores in Asian countries, etc.).

**Figure A: Consumption does not increase because the middle-income population increases, but because GDP increases**



**Figure B: An increase in the middle-income population results in only a slight increase in consumption**



(Source for Figures A and B): Formulated from data published in World Consumer Lifestyles Databook 2012, Euromonitor International, and World Economic Outlook Database, IMF, April 2012 update

This substitution of the concept of population (the expansion of the middle-income population) in discussions of a phenomenon which should be considered in terms of the details of consumption (the increase in the purchasing power of each consumer in newly emerging nations, etc.) cannot be considered unproblematic. However, this substitution can also be taken as an expression of the fact that, while the effect of the growth of the middle-income stratum on the growth of consumption in a country might be small, the middle-income stratum in countries with large populations is increasing rapidly enough to give the entire world the sense of a significant increase in consumption, and Asia is a region which contains a number of such countries.

#### 4. The Expansion of the Middle-income Stratum and Human Development in the Event of a Worsening of Income Inequality

Despite the fact that a worsening of income inequality would cause 170 million people to lose the opportunity to enter the middle-income stratum, if we restrict our attention to Figure B in the Column above, it appears that the momentum of consumption would not be greatly reduced, and from this perspective investing countries, including Japan, would presumably recognize no great merit in contributing to correcting income inequality.

However, it is possible that a worsening of income inequality would not merely weaken the momentum of consumption, but would further dampen consumption as a result of an increase in saving on the part of the population as a hedge against possible future downward income fluctuations. This would also retard the preparations for more healthy and humane growth, and might also slow the growth and development of a country's economy and society as a whole by delaying the human development of people in the low-income stratum. We may therefore consider that there is a good reason for Japan and other partner countries to actively co-operate in improving income inequality in Asian countries.

Based on this view of the issues, this section attempts to consider what the effect on the level of human development will be in a scenario in which the middle-income stratum expands with

no correction of income inequality, using automatic calculations.

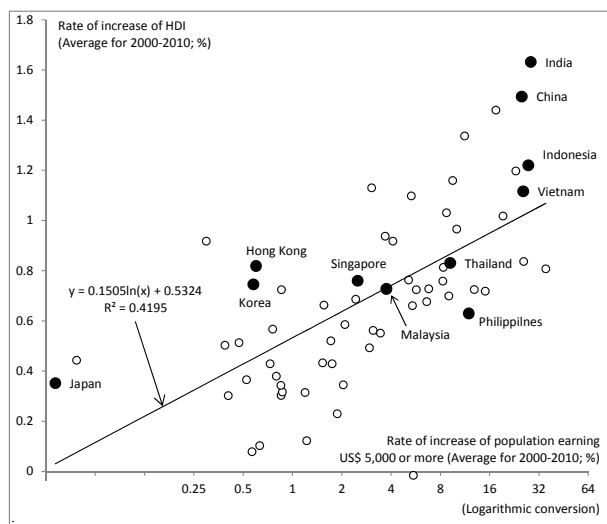
**(The relationship between increase in the level of human development and the expansion of the middle-income stratum)**

“Human development” is a term employed by the UN<sup>9</sup>, and is a concept under which humans themselves are regarded as the wealth of a country, and the creation of an environment in which each person is able to realise their full potential and lead a productive and creative life, and the expansion of the range of choice available to each person, is regarded as development. Based on the concept that the foundation for this expansion of the range of choice is the fostering of human capabilities, and the minimum essential level of these capabilities is ensured through access to the necessary resources to realise health and longevity, the acquisition of knowledge and the maintenance of an adequate standard of living, and by participation in society and community, the United Nations Development Program (UNDP) formulates the Human Development Index (HDI), which synthesises several indicators into a single scale.

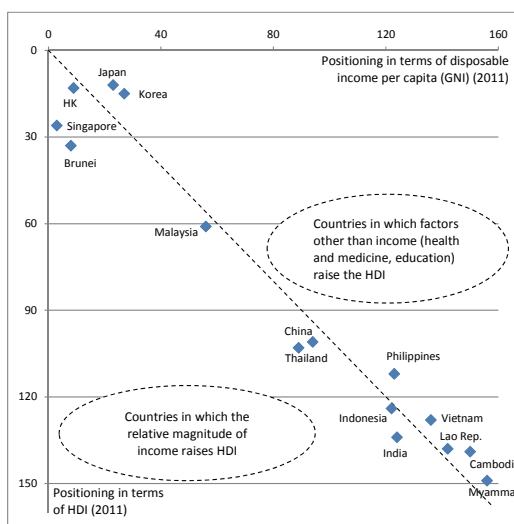
The HDI takes values of between 0 and 1, and makes it possible to grasp changes over time. Considering the relationship between the rate of increase in the HDI and the rate of growth of the population earning US\$5,000 per year or more (Figure 8), we observe an upward-sloping relationship, and we see that the rate of growth of the HDI for Asian countries is high even if we take into account the high rate of growth of the population earning at least US\$ 5,000 per year. Together with the increase in the middle-income population, human development in the region has increased at a rapid pace in the past ten years.

Of the elements making up the HDI (life expectancy, years of schooling, gross national income per capita), the expansion of the middle-income stratum can be considered to have the greatest effect on the HDI via life expectancy and years of schooling, factors which have upper

**Figure 8: The level of human development has increased in Asian countries, but...**



**Figure 9: Increased income contributes strongly to HDI increases**



(Note) Positioning in terms of disposable income per capita is based on comparisons at PPP.

(Source for Figures 8 and 9) Formulated from data published by Euromonitor International and published in UNDP [2011]

<sup>9</sup> This description of human development is a summary by the author of information found on the website of the Japan office of the United Nations Development Program (UNDP) (<http://www.undp.or.jp/hdr/>).

limits, but in which there is strong potential for standard-raising improvement. However, if we consider the relationship between the positioning of countries in terms of world HDI rankings and disposable income per capita (Figure 9), we see that the increase in HDI in India, Thailand, Malaysia, Singapore and Hong Kong is strongly related to increases in income. This is to say that, in these countries, despite the fact that there has been a rapid increase in the standard of living with economic growth, it is possible that the development of human capabilities with increased health and access to medical care and education, which might be considered to increase significantly among new members of the middle-income stratum, has not kept pace with increases in income (while average income has increased and the middle-income stratum has expanded, there has been insufficient consideration of increasing possibilities for the new members of the middle-income stratum).

**(The effect on the level of human development if income inequality remains uncorrected)**

Eliminating the roots of income inequality is important not merely from the perspective of its effect on the scale of the middle-income and high-income strata, but also of removing a factor impeding human development.

The Human Development Report published by the UNDP in 2011 proposes the inequality-adjusted HDI as a new index which considers the rate of loss in the HDI resulting from income inequality as an attempt to quantify the effect of a worsening of income inequality on human development. According to the UNDP, “while the HDI can be viewed as an index of the potential human development that could be achieved if there is no inequality,” the IHDI can be interpreted as an index of the actual level of human development, with consideration of inequality and other factors<sup>10</sup>.

The UNDP has formulated the HDI for the majority of countries, and when we restrict our attention to this index, even the significant income disparities of Asian countries become “average” when included in comparisons with data for countries outside the region, and there is no major change in the positioning of Asian countries between the HDI and the IHDI. In fact, the positioning of comparatively low-income Asian countries, including India, Indonesia, the Philippines, and the CLV countries (Cambodia, Laos, and Vietnam), in the IHDI ranking reflects the fact that income inequality in these countries are less severe than those of countries with similar income levels, and they take a higher ranking than they do in the HDI. In addition, in Asian countries there is little unevenness to be observed in access to health- and education-related services, which are related to the development of human capabilities and the realisation of an expanded range of choice. Figures for these elements are therefore high (the rate of loss is low), and many countries therefore take a higher position in the IHDI than in the HDI<sup>11</sup>.

However, there is a possibility that income inequality may function to reduce the position of Asian countries on the IHDI if they experience high growth without correcting the present income inequality. Given this, the author attempted to calculate the position of each of the Asian countries under study on the IHDI if the HDI followed past trends and increased until 2020 without improvement in the rate of loss due to income inequality (Figure 10; For details of the calculation method employed, see Technical Note 4).

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<sup>10</sup> UNDP [2011: 169]

<sup>11</sup> Ibid.

**Figure 10: If there is no improvement in income inequality, the IHDI becomes lower (According to mechanical calculations)**

	China		India		Indonesia		Philippines	
	2011	2020	2011	2020	2011	2020	2011	2020
Position on HDI	101→	91 (+10)	134→	134 (0)	124→	119 (+5)	112→	114 (-4)
Position on IHDI	102→	91 (+11)	133→	130 (+3)	116→	109 (+7)	108→	111 (-3)
Position on IHDI with no change in rate of loss		↓ 92		↓ 130-131		↓ 111		↓ 113
	Korea		Thailand		Vietnam			
	2011	2020	2011	2020	2011	2020		
Position on HDI	15→	5 (+10)	103→	100 (+3)	128→	127 (+1)		
Position on IHDI	32→	32 (0)	101→	100 (+1)	114→	107 (+7)		
Position on IHDI with no change in rate of loss		↓ 33~36		↓ 101-102		↓ 107		

(Notes and source): Figures for 2011 are taken from the Human Development Report 2011, published by the UNDP. However, the UNDP data does not show relative positioning for the IHDI in 2011, but only the degree of change from the HDI. The author calculated relative positioning on the IHDI based on this data. Figures for 2020 are estimates by the author.

The results show that while Korea reaches fifth position in terms of HDI in 2020, in the case of IHDI, even if the trend holds and there is an increase, the country will be in 32<sup>nd</sup> position (the same position as 2011), and if there is no improvement in income inequality, it will drop to a position between 33<sup>rd</sup> and 36<sup>th</sup>. Similarly for China (91<sup>st</sup> position for both HDI and IHDI in 2020, dropping to 92<sup>nd</sup> position for IHDI if income inequality is uncorrected), Thailand (100<sup>th</sup> position for both HDI and IHDI, dropping to 101<sup>st</sup> or 102<sup>nd</sup> for IHDI), the Philippines (114<sup>th</sup> and 111<sup>th</sup> positions for HDI and IHDI respectively, dropping to 113<sup>th</sup> position for IHDI), and Indonesia (119<sup>th</sup> and 109<sup>th</sup> positions for HDI and IHDI respectively, dropping to 111<sup>th</sup> position for IHDI). Under the conditions used in these calculations, we see that the development of human capabilities and the expansion of the range of choice do not reach the level indicated by figures on the HDI for any of these countries. In the cases of Korea and the Philippines, if the rate of loss remains unchanged, the countries' positions on the IHDI in 2020 will drop below their respective positions in 2011. For these countries, assuming that income inequality is not improved, the merits of the improvement in the state of society and the economy generated by the future expansion of the middle-income stratum may be offset by greater demerits (from the perspective of comparison between countries)<sup>12</sup>.

According to the UNDP's Human Development Report 2011, from the perspective of human development, the worsening of income inequality will, in particular in the poorer strata, not only restrict the development of human capabilities due to the lack of opportunity for increased health and access to education, but will also place restrictions on the fostering of the ability of the individual to expand his or her range of choice while still considering the environment for future generations. In this way, the failure to correct income inequalities robs people, in particular people in the low-income stratum, of the opportunity to engage in positive human activities.

Taking the above into consideration, the improvement of income inequality (rather than mere prevention of its worsening) is essential from the perspective of realising the level of human

<sup>12</sup> It is also necessary to analyse the IHDI under conditions in which the distribution of the benefits of growth becomes even more unequal, but it was not possible to obtain the geometric and arithmetic means of income samples employed by the UNDP in calculating the rate of loss in the IHDI, and it was therefore not possible to conduct calculations which would be comparable with the other calculations shown in Figure 10. Assuming hypothetically that a worsening in the rate of loss of the same proportion as the degree of worsening in the Gini coefficients shown in Figure 5 applied to incomes, calculation of the IHDI for 2020 shows China dropping by seven ranks and Korea by between one and four ranks. Other countries, with the exception of India, drop by two ranks (India's positioning does not change).



development befitting increased income and building a foundation for future growth, but is also a necessary present task for the realisation of sustainable human development for future generations. This is to say that it will be important for Asian countries to discover a more positive significance in realising the steady improvement of income inequality by means of policy measures, and to adopt a more active stance in co-operating with other countries in these types of initiatives.

## **5. Conclusion**

To sum up, it is predicted that Asia's middle-income stratum will expand rapidly in future, and that the increase in purchasing power will also continue to be high, presenting the world with new opportunities. However, the pace of this expansion of the middle-income stratum is also related to whether or not efforts have been made to correct income inequality in the countries concerned, and the continuance of the uneven distribution of the benefits of growth which can be observed for the past ten-year period will represent a considerable impediment to the expansion of this income stratum. It is to be feared that this effect will be particularly conspicuous in countries with large populations which are experiencing rapid economic growth while GDP per capita remains low, such as China, India and Vietnam, and countries in which there are already major distortions in the income distribution, making efforts to improve income inequality essential in parallel with the realisation of continuing high growth. If these efforts are not made, and income inequality is simply left as is, more than the lost opportunity for the expansion of the middle-income stratum, the result could impede attempts to increase the level of human development in Asian countries. Potentially acting as a factor generating a sense that the lifestyles which should have been realised by growth have not materialised and reducing the benefits of efforts, for example, to consider the environment, it is to be feared that this would promote social instability, impeding the realisation of sustainable growth and development.

At present, the advantages presented by economic development presumably outweigh the disadvantages caused by income inequality, but based on the theory of income convergence, the growth rate will gradually decline in future as incomes rapidly increase. In times of high growth, there is little awareness of the necessity for income redistribution policies, and in times of low growth, the enhancement of income redistribution policies only increases difficulties. Given that such a situation could lead to social instability and political conflicts among stratification of society, it is essential to implement appropriate policies before it is too late.

This paper has been formulated as a contribution to the NIRA research project "Japan's New Role in supporting Economic and Social Development in Asia," and has attempted to provide a quantitative basis for the necessity of formulating income redistribution policies even as high growth continues. It is my hope that this research project will serve to stimulate further thought in these areas, opening onto the possibility of thinking together with other Asian countries about what lessons might be learned from advanced nations which have introduced income redistribution policies and achieved further economic and social development, giving consideration to the factors which will impede the introduction of income redistribution policies in the future in Asia, and the development of human capabilities through the realisation of increased health and the provision of access to medical care and education in order to increase the level of human development and by this means to resolve economic, social and environmental issues related to development.

## Technical Note 1: Methodology for Calculation of Income Distribution Functions<sup>13</sup>

### (Assumptions concerning the shape of income distribution functions)

First, in order to conduct an analysis involving cross-country comparison, it is necessary to “reproduce” the income distribution function of each country concerned. Cross-country comparable data published by Euromonitor International (EI) is available to enable this. The data provide the cumulative density of households earning no less than every income level identified.

According to EI, the data was generated based on the assumption that the income distribution function for each country is the Singh-Maddala Cumulative Density Function. This function,  $F(x)$ , is expressed as

$$F(x) = 1 - \left(1 + \left(\frac{x - \gamma}{\beta}\right)^\alpha\right)^{-k}$$

where  $x$  is the income level of each household,  $\alpha$  and  $k$  are shape parameters,  $\beta$  is a scale parameter and  $\gamma$  is a location parameter (note that EI assumes that  $\gamma=0$  in their estimates). Note also that, when  $k=1$ , this function is transformed into the log-logistic cumulative distribution function expressed as follows:

$$F(x) = \frac{1}{1 + \left(\frac{x - \gamma}{\beta}\right)^{-\alpha}}$$

Given these preconditions, it is natural that the income distribution function for each country is estimated with the assumption that it is either the Singh-Maddala function or a log-logistic function.

### (Interpolation of Data)

EI’s Databook provides sets of data for only 21 income levels and the corresponding cumulative density of households which earn no less than each income level. Interpolation of data is therefore necessary to obtain the parameters of the distribution function. The methodology for interpolation is as follows.

- (1) Because the cumulative density data in EI’s Databook are provided in units of 0.1%, 1000 sets of data (income, cumulative density) must be obtained for each country. In order to do so, the income levels at the  $p$ th 0.1% point ( $p = 0, 1, \dots, 999$ ) are calculated as the weighted average of two points from the Databook just below and above that point. If  $x$  is the income level for the  $p$ th 0.1% point,  $x_i$  is the income level just below  $x$  (published in the Databook), and  $x_{i+1}$  (also in the Databook) is the level of income one step higher than  $x_i$  and, of course, just above  $x$ , then

$$\hat{x} = x_i + (p - p_i) \cdot \frac{x_{i+1} - x_i}{p_{i+1} - p_i}$$

- (2) Using these 1000 data, a test of the goodness of fit is conducted. The Kolmogorov-Smirnov (KS) test statistics for the Singh-Maddala and log-logistic cumulative density functions are calculated and, by comparing two values, the more appropriate distribution is identified for each country’s distribution. The parameters of the distribution are also identified.
- (3) It is often the case that there is a significant discrepancy between the income distribution for country  $j$  identified above (i.e.  $F_j(x^j)$ ) and the data published in the EI Databook. An additional procedure is therefore employed, and the income level corresponding to the  $p$ th 0.1% point is recalculated on the basis of the following equation.

$$\hat{x} = x_i + (F^{-1}(p) - F^{-1}(p_i)) \cdot \frac{x_{i+1} - x_i}{F^{-1}(p_{i+1}) - F^{-1}(p_i)}$$

where  $x_0 = 0, x_1 = 500, x_2 = 750, \dots, x_{21} = 300,000$  and  $p$  satisfies  $p_i < p < p_{i+1}$ .

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<sup>13</sup> The explanation of statistics and income distribution in Technical Note 1 is based on the “Help” command of the statistical processing software “EasyFit” produced by MatWave. All estimates are conducted with EasyFit, unless otherwise noted.

(4) However, the cumulative density function recalculated via process (3) is skewed at each of the  $(x_i, p_i)$  points. To make the distribution function smooth, the cumulative density function is identified again, using the 1000 data generated by process (3). The process itself is the same as process (2). The cumulative density function identified after this process is used in the analysis. Note that, even after this treatment, the gaps between identified cumulative density levels and those published in the Databook are not completely eliminated.

**(Identification of the distribution function)**

Tests including the Kolmogorov-Smirnov test (KS test) and the Anderson-Darling test (AD test) are available for testing the goodness of fit. The choice of the most appropriate test statistic is important. It is important for this paper to possess greater testing power for goodness of fit at income levels between 5,000 and 35,000 dollars. The KS statistic is therefore applied, because the KS test is indicated as having greater power in testing the goodness of fit of the middle section (the tail) of the distribution<sup>14</sup>.

The candidate cumulative density functions (CDF) are 3-value ( $\gamma = 0$ ) and 4-value ( $\gamma \neq 0$ ) Singh-Maddala distribution functions, and 2-value ( $\gamma = 0$ ) and 3-value ( $\gamma \neq 0$ ) log-logistic distribution functions. The function which gives the lowest KS statistic is identified (the results are shown in Figure A1) and its parameters are estimated (Figure A2). Note that, for each country, KS statistics for 4-value Singh-Maddala CDF and 2-value log-logistic CDF are not referred to in the figures, because the KS statistics of 4-value Singh-Maddala CDF are larger than those of 3-value Singh-Maddala CDF, and the KS statistics of 2-value log-logistic CDF are larger than those of 3-value log-logistic CDF.

**Figure A1: KS Statistics (Generated by Process (4) Above)**

	China	Hong Kong	India	Indonesia	Japan	Malaysia
Singh-Maddala	<b>0.00307</b>	<b>0.00185</b>	0.01121	0.01408	0.74498 (rejected)	<b>0.00313</b>
Log-logistic	0.00458	0.01142	<b>0.01058</b>	<b>0.01321</b>	<b>0.01186</b>	0.00661
	Philippines	Singapore	Korea	Taiwan	Thailand	Vietnam
Singh-Maddala	<b>0.00673</b>	<b>0.00393</b>	<b>0.01300</b>	<b>0.01620</b>	<b>0.01175</b>	<b>0.01108</b>
Log-logistic	0.00979	0.01779	0.01407	0.01642	0.01549	0.01593

(Note) Both the Singh-Maddala CDF and Log-logistic CDF are 3-variable.

**Figure A2: Parameters of the Income Distribution Functions for Each Country**

	China	Hong Kong	India	Indonesia	Japan	Malaysia
	S-M	S-M	L-L	L-L	L-L	S-M
$k$	1.0540	1.5433	-----	-----	-----	1.1135
$\alpha$	1.8143	1.5216	2.2604	2.3576	2.5876	1.7862
$\beta$	6,272	74,481	5,330	5,592	65,863	13,639
$\gamma$	-----	-----	10.489	-29.081	-2,694.7	-----
	Philippines	Singapore	Korea	Taiwan	Thailand	Vietnam
	S-M	S-M	S-M	S-M	S-M	S-M
$k$	1.1508	1.9881	1.1908	1.1978	1.4998	1.3385
$\alpha$	1.8881	1.4755	2.1734	2.2763	1.6294	1.7690
$\beta$	6,236	119,710	35,283	39,969	11,271	3,873
$\gamma$	-----	-----	-----	-----	-----	-----

(Note) "S-M" indicates Singh-Maddala CDF, and "L-L" indicates log-logistic CDF.

<sup>14</sup> The KS test has the null hypothesis that the pre-specified distribution is the true distribution for the dataset in question. Therefore, the null hypothesis cannot be statistically rejected unless the KS statistic has significance greater than 5%. Moreover, more than one candidate distribution remains unrejected. In this case, KS statistics for all the candidate distributions are calculated in order to judge the goodness of fit, and to determine the function that gives the lowest KS statistic.

## Technical Note 2: Estimation of the Populations of the Middle- and High-Income Strata

In estimating the populations of the middle- and high-income strata for this study, the exchange rates have been fixed at the 2011 level and the future growth rates calculated in real terms on a local currency basis. These conditions enable us to gain a sense of future prospects with a present-day perspective. In order to conduct these calculations, in addition to the estimated income distribution, projections of the real GDP growth rate per capita and the population growth rate projection are required.

### **(Assumptions concerning the Future Growth Rate of Real GDP Per Capita)**

As mentioned above, the validity of the income convergence hypothesis is assumed in this paper in the calculation of the future speed of economic growth for each country. While questions may remain as to the condition(s) under which the hypothesis is valid, it is at least difficult to assume, for example, that China and India will display the same rate of growth for the next 20 years (China and India may possess systems which facilitate long-term economic growth in addition to huge inputs of labour and capital (as Barro and Sala-i-Martin [1995] argue), but the dominance of these systems would not last long, because low-growth countries would become eager to imitate them). From this point of view, it is natural to assume that the growth rate will gradually decline as incomes grow, and the income convergence hypothesis is used as the basis for calculating the pace of such slowdown.

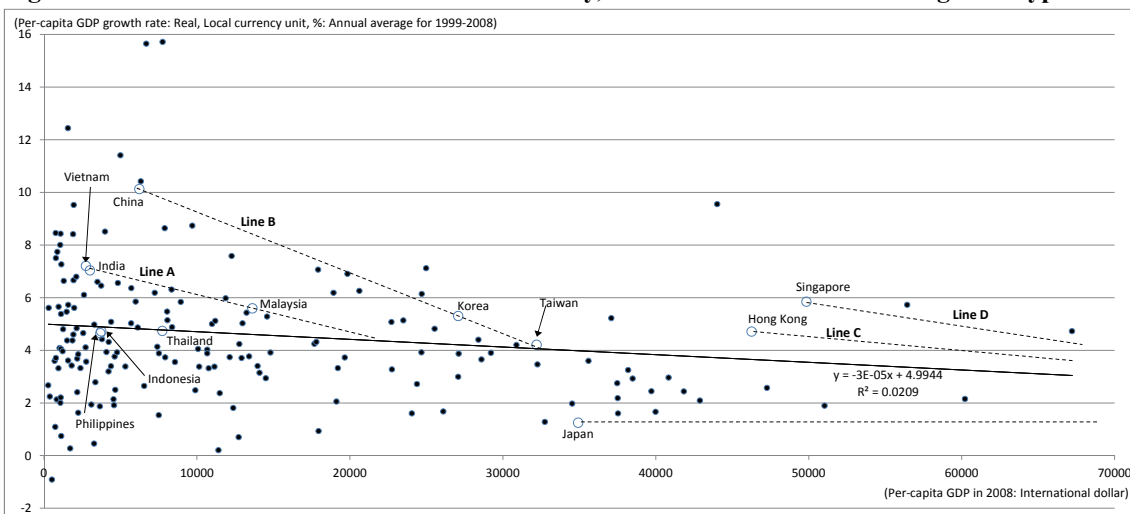
Figure A3 shows the relationship between the per-capita real GDP growth rate (average for 1999-2008, local currency unit basis) and the per-capita GDP level in 2008 measured in purchasing power parity for that year, using data for 177 countries.

The following assumptions are made regarding real growth rates after 2011 for the countries being considered, based on Figure A3.

(1) Of the countries above the asymptotic line in Figure A3,

- Vietnam, India and Malaysia are assumed to be on a largely linear growth path (Line A), and will follow the growth path shown by Line A until the income level at which Line A crosses the asymptotic line. Following this, the three countries will grow at the rate shown by the asymptotic line.
- China and Korea are assumed to be on the same growth path (Line B), and will follow the growth path shown by Line B until the income level at which Line B crosses the asymptotic line. Following this, the two countries will grow at the rate shown by the asymptotic line.

**Figure A3: Assumed Growth Path for Each Country, Based on the Income Convergence Hypothesis**



(Source) Estimated by the author, using data from World Bank, "World Economic Data 2011" and Euromonitor International, "Consumer Lifestyles Databook"

**Figure A4: Ratio of Increase of Per Capita GDP for Each Country (in 2020 and 2030, against 2011)**

	China	Hong Kong	India	Indonesia	Japan	Malaysia
2020	2.34	1.52	1.91	1.60	1.13	1.63
2030	4.18	2.09	3.48	2.55	1.28	2.46
	Philippines	Singapore	Korea	Taiwan	Thailand	Vietnam
2020	1.61	1.60	1.49	1.45	1.58	1.93
2030	2.56	2.20	2.11	1.99	2.46	3.55

- The growth rates of Hong Kong (1.29 times higher than the growth rate indicated by the asymptotic line) and Singapore (1.65 times higher) will decline, while maintaining their respective multiplication factors (Hong Kong will follow Line C, and Singapore Line D).
- (2) The growth paths of countries on the asymptotic line (the Philippines, Indonesia, Thailand and Taiwan) will continue to follow this line.
- (3) The growth rate of the country below the asymptotic line (Japan) will be flat (the same rate of growth will be maintained) until the asymptotic line is reached.

Figure A4 below shows the ratio of increase of per-capita real GDP in 2020 and in 2030 against 2011 based on these assumptions.

**(Methodology for Calculation of the Population of the Middle- and High-Income Strata in 2020 and 2030)**

The current and future population of the middle-income stratum can be calculated based on the income distribution function identified in Technical Note 1. When growth is assumed to be distribution-neutral, households with annual incomes between  $5000 \cdot M_{2011}^i / M_{20XX}^i$  and  $35000 \cdot M_{2011}^i / M_{20XX}^i$  ( $M_{20XX}^i$  denotes the average household income for country  $i$  in the year 20XX) would be categorised as middle-income households in the year 20XX. Similarly, households with annual incomes over  $35000 \cdot M_{2011}^i / M_{20XX}^i$  would be categorised as high-income households. When the cumulative density function of country  $i$  is denoted by  $F^i(x)$ , the population shares of the middle- and high-income strata are therefore

Population share of the middle-income stratum:

$$F^i(x \geq 5000 \cdot M_{2011}^i / M_{20XX}^i) - F^i(x \geq 35000 \cdot M_{2011}^i / M_{20XX}^i)$$

Population share of the high-income stratum:

$$F^i(x \geq 35000 \cdot M_{2011}^i / M_{20XX}^i)$$

The population of each stratum is easily calculated, by multiplying its population share by the multiplication factor for the total population in 20XX against 2011. Population projections for each country until 2100 are available from the website of the United Nations Department of Economic and Social Affairs<sup>15</sup>. In the calculation of total “population”, the relatively strong assumption that the average household in each stratum (low, middle and high) have the same number of members has been applied.

Figure A5 shows the results of calculations for each country, and provides Yanagawa and Mori’s [2010] estimates for reference.

<sup>15</sup> [http://esa.un.org/wpp/unpp/panel\\_indicators.htm](http://esa.un.org/wpp/unpp/panel_indicators.htm)

**Figure A5: Results of Estimations of the Future Population of Each Income Stratum**

Unit: Thousands		China			Hong Kong			India		
		2011	2020	2030	2011	2020	2030	2011	2020	2030
This study	Low-income	556,373	215,722	88,229	177	112	76	555,663	252,962	84,203
	Middle-income	736,700	987,256	891,180	2,289	1,665	1,220	628,278	1,022,093	1,143,986
	High-income	47,836	178,571	407,400	4,659	6,023	7,184	16,832	67,008	246,031
	Total (=Population)	1,340,910	1,381,549	1,386,810	7,125	7,800	8,480	1,200,772	1,342,063	1,474,220
Yanagawa and Mori	Middle-income	-----	1,007,470	435,810	-----	2,046	2,103	-----	455,453	794,128
	High-income	-----	134,530	915,097	-----	5,505	5,923	-----	10,359	20,570
		Indonesia			Malaysia			Philippines		
		2011	2020	2030	2011	2020	2030	2011	2020	2030
This study	Low-income	102,871	56,991	24,204	4,514	2,616	1,491	42,257	28,513	15,917
	Middle-income	129,058	188,902	220,910	20,486	22,036	20,254	51,293	76,257	94,844
	High-income	3,067	8,839	26,198	3,635	8,087	15,243	2,159	5,980	16,719
	Total (=Population)	234,996	254,732	271,312	28,634	32,740	36,988	95,710	110,750	127,481
Yanagawa and Mori	Middle-income	-----	104,906	126,436	-----	22,935	21,236	-----	53,849	70,560
	High-income	-----	2,868	3,241	-----	6,884	13,076	-----	1,765	2,117
		Singapore			Korea			Thailand		
		2011	2020	2030	2011	2020	2030	2011	2020	2030
This study	Low-income	93	56	39	822	402	195	20,711	12,562	6,738
	Middle-income	1,239	822	592	26,483	17,981	10,610	45,308	51,318	48,929
	High-income	3,806	4,715	5,343	21,684	32,064	40,174	3,500	8,262	17,707
	Total (=Population)	5,138	5,592	5,973	48,989	50,447	50,979	69,519	72,142	73,373
Yanagawa and Mori	Middle-income	-----	1,231	1,274	-----	10,587	8,290	-----	48,222	55,609
	High-income	-----	3,927	4,122	-----	38,259	40,260	-----	2,334	3,542
		Vietnam			Japan (ref.)			Taiwan (ref.)		
		2011	2020	2030	2011	2020	2030	2011	2020	2030
This study	Low-income	62,969	42,635	20,941	489	402	319	242	116	56
	Middle-income	24,324	50,718	71,952	23,779	18,790	14,012	10,983	6,940	3,896
	High-income	465	1,928	7,458	102,845	106,274	106,525	11,937	16,219	18,844
	Total (=Population)	87,759	95,281	100,351	127,114	125,466	120,855	23,162	23,275	22,796
Yanagawa and Mori	Middle-income	-----	32,228	62,062	-----	-----	-----	-----	-----	-----
	High-income	-----	765	2,171	-----	-----	-----	-----	-----	-----

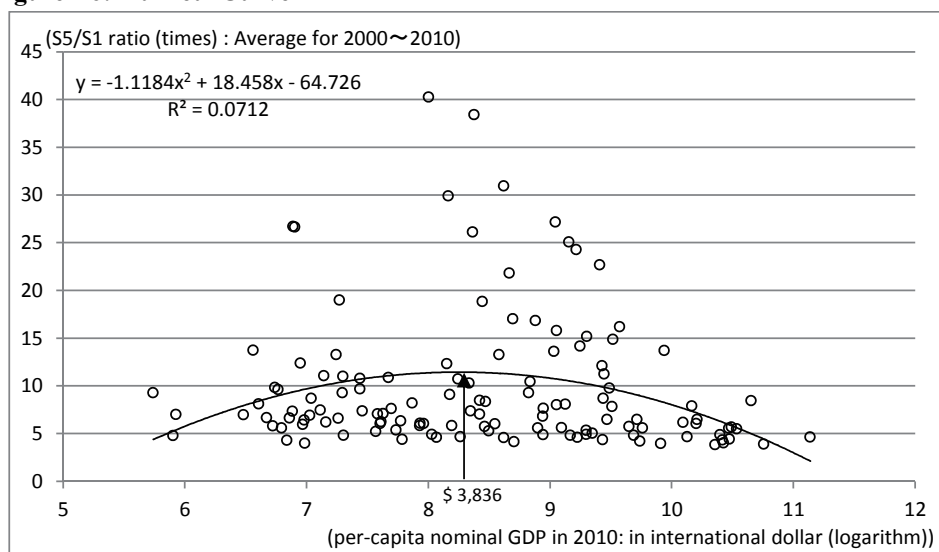
### Technical Note 3: Methodology for Calculation of the Population of the Middle-Income Stratum under Conditions of Uneven Distribution of the Benefits of Growth

#### (Kuznetz Hypothesis)

The Kuznetz hypothesis states that relative inequality worsens in the early stage of development and then improves in the course of development (Meier [1995:20-21]). Kuznetz [1955] shows, using cross country data, the relationship between the income levels of countries and their degree of income inequality displays an inverted U-shape, and the hypothesis is also frequently termed the Kuznetz inverted-U curve hypothesis. This relationship can be interpreted as follows: The need to concentrate limited domestic resources in prioritised sectors worsens inequality but accelerates economic development in the early stage of development (at the left of the peak of the Kuznetz curve). In the course of development (at the right of the curve), the country begins to consider an equitable distribution of the benefits of growth among the population, and policy measures result in an improvement in income inequality.

Figure A6 shows the results of regression of the Kuznetz curve, using data for per-capita GDP at nominal purchasing power parity (PPP) in 2010 on the horizontal axis and for the average S5/S1 ratio on the vertical axis<sup>16</sup>. The peak of the curve is at \$3,838 (in PPP). In Asia (the scope of Asia considered here is indicated in Note 1 for Figure 2 in the text) the only countries which had not reached that level in 2011 were India (\$3,694) and Vietnam (\$3,359). That is, for most countries in Asia, the use of the worsening of inequality as an engine to accelerate economic growth is not supported by the Kuznetz hypothesis<sup>17</sup>.

**Figure A6: Kuznetz Curve**



(Note) The estimate of the coefficient is statistically significant at the 5% level, and estimated parameters for both income and the square of income are significant at the 1% level.

(Data source) IMF "World Economic Outlook Database April 2012"

<sup>16</sup> The S5/S1 ratio is the ratio of the average income of the highest-earning 20% (S5) against the average income of the lowest-earning 20% (S1). The IMF Database offers S5 and S1 data for every year from 2000 to 2010 for few countries. Here, the average of the available data for 2000-2010 is employed. This means that if data is only available for one year, the data is adopted as is, without averaging.

<sup>17</sup> However, it can be argued that the result of a data analysis is strongly dependent on the method of calculating income disparity and the choice of the base year. For example, Anand and Kanbur [1993] show that differences in the method of calculation of income inequality and the choice of dataset can produce a U relationship, an inverse-U relationship, or no relationship at all. This paper uses the S5/S1 ratio as an indicator of income inequality simply because it is the indicator for which data is available for the largest number of countries.

**(Estimation of Income Distribution under Conditions of Worsening Income Disparity: Details of the “Income Growth Rate Function”)**

To establish a model which expresses a scenario in which the economy grows while income disparity worsens in the future, the original income distribution function is multiplied by the following “income growth rate function” (denoted as  $g^i(x)$ ).

$$g^i(x^i) = \begin{cases} (1 + \pi^i) - \pi^i \cdot d \frac{(\mu^i - x^i)}{\mu^i} & \text{if } x^i < \mu^i \\ (1 + \pi^i) + \rho^i \cdot \log \frac{x^i}{\mu^i} & \text{if } x^i \geq \mu^i \end{cases}$$

Where  $x^i$ ,  $\mu^i$ ,  $\pi^i$  are household incomes in country  $i$  in 2011 ( $x^i$  varies for each household), the average income of country  $i$  in 2011, and the future growth rate from 2011 to the target year, respectively.  $d$  expresses the degree of unevenness of distribution of the benefits of growth (the degree to which the rate of growth of household income for the households with the lowest income is reduced in comparison to the average rate of growth of household income).

$$\rho^i \text{ satisfies } \int_0^\mu \left( \pi^i \cdot d \frac{(\mu^i - x^i)}{\mu^i} \right) f^i(x) dx = \int_\mu^\infty \left( \rho^i \cdot \log \frac{x^i}{\mu^i} \right) f^i(x) dx .$$

$g^i(x)$  expresses a situation in which the households with the lowest income enjoy only  $100(1-d)\%$  of the benefits of growth. The analysis in this paper assumes that  $d=0.5$ , and attempts to determine the impact on the future population of the middle-income stratum if income inequality continues until 2020 for all the Asian countries being considered. Figure 6 in the text shows the results obtained.

**(Methodology for Calculation of the Future Population of the Middle-Income Stratum when the Uneven Distribution of the Benefits of Growth continues in the Future)**

Based on the assumptions above, the population of the middle- and high-income strata under the conditions of uneven distribution of the benefits of growth can be calculated as follows.

- (1) Calculation of the income levels in 2011 which will become \$5,000 and \$35,000 in 2020 (denoted as  $x_{5000}^i$  and  $x_{35000}^i$ , respectively).

$$x_{5000}^i \times g^i(x_{5000}^i) = 5000 \quad x_{35000}^i \times g^i(x_{35000}^i) = 35000$$

- (2) As long as  $d > -1$ , multiplying  $f^i(x)$  by  $g^i(x)$  does not change the order of households within country  $i$  in terms of income level. In the situation above, because  $d > 0$ , the calculation process is the same as described in Technical Note 2. That is,

$$\text{Population of the middle income stratum in 2020: } \{F^i(x \geq x_{5000}^i) - F^i(x \geq x_{35000}^i)\} \times q_{2020}$$

$$\text{Population of the high-income stratum: } F^i(x \geq x_{35000}^i) \times q_{2020}$$

- (3) However, the solutions of the equations in (2) above cannot be directly derived, as the equations are nonlinear for values above the mean income. Therefore, the second-best method is to generate 1,000 sets of  $p = 0, 1, 2, \dots, 999$ ,  $\left( F^{i-1} \left( \frac{p}{1000} \right) \cdot g^i \left( F^{i-1} \left( \frac{p}{1000} \right) \right), \frac{p}{1000} \right)$  data for each country ( $p = 0, 1, 2, \dots, 999$ ), and observe which values of  $p$  result in  $F^{i-1} \left( \frac{p}{1000} \right) \cdot g^i \left( F^{i-1} \left( \frac{p}{1000} \right) \right)$  exceeding 5,000 and 35,000. Using such values of  $p$  in the calculation described in (2) above will give the future population of each stratum.

- (4) Note that this second-best method may generate an error (a discrepancy no larger than 0.1% of the total population) in the populations of each stratum compared with the results of the first-best method. However, executing the same calculation for 10 countries offsets the error to some extent, and there is very little likelihood that the discrepancy between the populations given by the different methods would exceed 10 million people. This level of error will not fatally affect the analysis conducted in this paper. Figure A7 shows the results obtained for each country using the method described in (3).



**(Methodology for Calculation of the Future Population of the Middle-Income Stratum when Income Disparity Improves)**

The same calculation methodology can be applied to the estimation of the populations of income strata in a scenario in which income inequality improves, as long as  $d > -1$  (i.e. as long as the households with the lowest incomes enjoy a rate of growth of income less than double the rate of growth of mean income for the population as a whole). This paper assumes that  $d = -0.25$  based on the experience of Vietnam. The results of calculations of the populations of the respective income strata under these conditions are shown in Figure A8.

**Figure A7: Future Population of Each Stratum when Uneven Distribution of the Benefits of Growth Continues**

Stratum	China		Hong Kong		India		Indonesia		Malaysia	
	Population	Loss	Population	Loss	Population	Loss	Population	Loss	Population	Loss
Low-income	291,507	75,785	140	28	320,753	67,791	67,504	10,513	3,339	723
Middle-income	904,915	-82,342	1,872	207	946,155	-75,938	177,293	-11,608	21,248	-788
High-income	185,128	6,557	5,788	-236	75,156	8,147	9,935	1,096	8,152	65
	Philippines		Singapore		Korea		Thailand		Vietnam	
	Population	Loss	Population	Loss	Population	Loss	Population	Loss	Population	Loss
Low-income	33,003	4,491	67	11	504	102	14,861	2,300	46,211	3,576
Middle-income	71,323	-4,934	962	140	19,321	1,340	48,696	-2,622	46,783	-3,936
High-income	6,423	444	4,563	-151	30,622	-1,442	8,585	323	2,287	359
	Japan (ref.)		Taiwan (ref.)							
	Population	Loss	Population	Loss						
Low-income	376	-26	140	23						
Middle-income	19,949	1,159	7,611	671						
High-income	105,140	-1,134	15,525	-694						

**Figure A8: Future Population of Each Income Stratum when Income Disparity Improves**

Stratum	China		Hong Kong		India		Indonesia		Malaysia	
	Population	Loss	Population	Loss	Population	Loss	Population	Loss	Population	Loss
Low-income	185,128	-30,595	94	-19	221,440	-31,522	51,965	-5,026	2,292	-325
Middle-income	1,020,965	33,708	1,560	-105	1,056,204	34,111	194,361	5,459	22,361	325
High-income	175,457	-3,114	6,147	123	64,419	-2,589	8,406	-433	8,087	0
	Philippines		Singapore		Korea		Thailand		Vietnam	
	Population	Loss	Population	Loss	Population	Loss	Population	Loss	Population	Loss
Low-income	26,358	-2,154	45	-11	303	-100	11,471	-1,091	40,590	-2,045
Middle-income	78,521	2,264	755	-67	17,203	-779	52,519	1,201	52,881	2,162
High-income	5,870	-110	4,792	78	32,942	878	8,152	-110	1,810	-117
	Japan (ref.)		Taiwan (ref.)							
	Population	Loss	Population	Loss						
Low-income	376	-26	93	-23						
Middle-income	17,942	-848	6,564	-376						
High-income	107,148	874	16,618	400						

## **Technical Note 4: Methodology for Automatic Calculation of Future HDI Values**

### **(Automatic Calculation of Future HDI Values)**

Time series data for the HDI are available from the UNDP website (database). While varying from country to country, the database provides HDI data for five-year intervals from 1980 to 2005 and annual data after 2006. Although changes in the HDI can be tracked over a time series, it can only take values between 0 and 1, and simple calculation of the rate of increase of the HDI will tend to give a lower rate of increase the higher the HDI (and vice versa).

I will therefore introduce the notion of “rate of approach”, by means of which we calculate the extent to which the gap between a country’s HDI level and 1, the maximum possible level, has been narrowed. Looking at the rates of approach for each country from 1980 (five-year intervals), it can be casually confirmed that the rates are moderately stable for almost all the countries. The following recurrence formula can therefore be derived for a country  $i$ ’s HDI in 2020, with its HDI in 2011 as the base. Given that the rate of approach for country  $i$  (denoted as  $s^i$ ) is the five-year rate, when calculating the change from 2011 to 2015, the rate must be multiplied by 4/5.

$$HDI_{2020}^i = HDI_{2015}^i + (1 - HDI_{2015}^i)s^i = (1 - 1.8s^i + 0.8s^{i^2})HDI_{2011}^i + 1.8s^i - 0.8s^{i^2}$$

where  $HDI_{20XX}^i$  is the HDI level for country  $i$  in the year 20XX.

### **(Automatic Calculation of Future IHDI values)**

The HDI is an index which comprises indicators for three areas: health (life expectancy), education and income. In the inequality-adjusted HDI (IHDI), the UNDP introduces inequality measures (expressed as “ $A$ ” in UNDP [2011]) for each of the three indices and calculates the “inequality-adjusted” life-expectancy index, education index and income index. The IHDI is the geometric mean of these three inequality-adjusted indices.

This paper deals with income inequality. Because the status of education and health is only weakly correlated with income inequality, in calculating the “inequality-uncorrected” IHDI it is assumed that while the loss rates for the education and life expectancy indices will decrease in accordance with the trend, the loss rate for the income index will be unchanged. The procedure for calculation is as follows.

- (1) First, the IHDI in 2011 is regressed on the HDI in 2011 for each area  $k$  ( $k$  = health, education, income), and the coefficient for HDI ( $\beta_{k,HDI}$ ) is obtained.  $\beta_{k,HDI}$  is multiplied by the difference between HDI in 2020 and in 2011 (denoted as  $\Delta HDI$ ),  $\beta_{k,HDI}$  and this figure is added to the 2011 IHDI of the specific area under consideration.
- (2) The IHDI of country  $i$  in 2020 is calculated as the geometric average of the IHDI for the three areas. This treatment is applied to each country’s IHDI as long as that country’s IHDI is calculated by the UNDP.
- (3) The methodology for calculation of the inequality-uncorrected IHDI is as follows: First, inequality-uncorrected IHDI for income in 2020 (denoted as  $IHDI_{i,2020}^i$ ) is calculated using the following equation:

$$IHDI_{i,2020}^i = IHDI_{i,2011}^i + \Delta HDI \cdot \beta_{HDI} \cdot (1 - A)$$

The geometric mean of  $IHDI_{i,2020}^i$  and the IHDI for health and education is the inequality-uncorrected IHDI.

- (4) Note that IHDI are not calculated for all countries. Furthermore, figures for the IHDI are significantly lower than figures for HDI. This paper therefore expresses the influence of lack of action regarding income inequality on the HDI not as changes in the figures themselves but as changes in the country’s ranking. The ranking method follows the UNDP [2011].

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