A Quantitative Evaluation of Japan's ODA on Economic Development in Indonesia and Thailand[1]*

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1. Introduction

In Tokunaga (1995), the macroeconomic impacts of Japan's Official Development Assistance (ODA) toward the economic development of Indonesia, Malaysia and Thailand were analyzed utilizing standard econometric models. The sectoral contributions of Japan's ODA in health care, water supply, electric power and road were quantitatively verified for the three host countries. Moreover, as case studies of quantitative evaluation, Japan's contributions in the "Primary Health Care Training Center Project" and the "Laem Chabang Commercial Port Project," in Thailand, were evaluated for analyzing the factors of contribution. With the results of Tokunaga (1995), this study is conducted to further analyze the macroeconomic impacts of Japan's ODA on the economic development of the East-Asian countries. The subjects of the analysis in this paper are as follows.

(1) Analysis of the macroeconomic effect of

Japan's ODA. The ODA Impact Index used in Tokunaga (1995) expressed the impact of Japan's ODA on the recipients' macroeconomic variables such as GDP and employment by the time sequence of Percentage increase. The index had the advantage of expressing ODA impact straightforwardly. However, because of a time series analysis, the comparison of indices among recipient countries became highly complex and problematic. While comparing macroeconomic effects in each year was relatively simple, it was difficult to compare the overall macroeconomic effects throughout the period, which made the use of index further inconvenient. Another drawback to utilizing this index was that the difference in the impact of ODA directly reflected the difference in the absolute amount of ODA disbursed. Consequently, the comparison of the economic effect per assistance, i. e., the efficiency of ODA, amongst recipient countries was not feasible. In addition, values of ODA were treated equally throughout the phase period not reflecting the changing currency price.

In this paper, we make the more appropriate ODA Impact Index and re-analyzed the macroeconomic impact of Japan's ODA according to Fukuchi (1989). The three countries selected for Tokunaga (1995), namely In-

donesia, Malaysia and Thailand, are continually studied.

(2) Impact of Japan's ODA on Foreign Direct Investment. Firstly, the macroeconomic impacts of Foreign Direct Investment (FDI) are measured with the same method applied for the analysis of the ODA's macroeconomic impacts. Secondly, the macroeconomic impacts of FDI are analyzed in a simulated scenario in which absolutely no ODA was given. The outcome from this analysis is then compared with the actual value of the macroeconomic impacts of FDI with fully disbursed ODA. By the comparison, the scale of the impact of Japan's ODA over the effects of FDI on macroeconomy of the recipient country is investigated.

(3) Impact of Japan's ODA and Foreign Direct Investment by Sector. Thailand is selected for the analysis of the sectoral economic effects of Japan's ODA. In order to carry out this analysis, Japan's ODA data as well as the data on Thailand's variables such as capital stock and investment has to be categorized by sectors. Moreover, in terms of FDI, a detail analysis is conducted to measure the impacts of Japan's ODA on FDI categorized by industry.

2. Macroeconomic Impacts of Japan's Official Development Assistance and Foreign Direct Investment

In this section, we analyze the macroeconomic impacts of Japan's ODA and of Foreign Direct Investment (FDI) in the private sector. Moreover, the influence of Japan's

ODA on the macroeconomic impacts of FDI is also analyzed. The analysis is conducted by using the macroeconometric model for each subject country.

2.1 Econometric Analysis of the Macroeconomic Impacts of Japan's ODA in Indonesia, Malaysia and Thailand

2.1.1 ODA Impact Index

For certain variables, the impact of ODA can be determined by calculating the difference of the values derived in the scenario with ODA and without ODA. Hence, the impact of ODA is calculated through the comparison of the estimated value of the zero-ODA case to the actual value (the final test values of the macroeconometric model).[2]

The "ODA Impact index" used in Tokunaga (1995) (the "ODA Impact Index 1" hereafter) was an index that measures the impact of Japan's ODA on each recipient's macroeconomic variables that include GDP, employment, private consumption, private investment, exports and imports, by calculating the rate of increase effect. In other words, the index calculates, as compared to the hypothetical zero-ODA case, the rate of increase in the variable values derived in the actual ODA case. This index can be expressed as the following.

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[2]The final test for the model is to confirm the level of its fitness by applying it to the actual data set. The value used in the full-ODA case is not the actual value, but the value calculated by the final test. The reason for this is to maintain the coherence of the measurement value upon comparing it to the value estimated in the simulated zero-ODA case.

ODA Impact Index 1 (%)

$$=\left(\frac{\text{Variable value with ODA disbursement}}{\text{Estimated variable value without ODA disbursement}}-1\right)$$

$* 100$

The ODA Impact Index 1 is capable of measuring the impact of ODA on each recipient's macroeconomic variables in time-series, and has an advantage to express the impact of ODA. Yet, on the other hand, there are several drawbacks to this index in comparing ODA impact amongst recipient countries. They are : ① with the impact expressed in time sequence, the comparison becomes rather complicated ; ② while it is relatively facile to compare each macroeconomic variable, it is far more difficult to compare the overall macroeconomic effects ; ③ because the difference in ODA impact directly reflects the difference in the absolute amount of ODA, it is unable to compare the economic effect per assistance, i. e., the efficiency of ODA, between recipient countries ; and ④ it fails to reflect the changing currency price, and treats an values at equal price rate regardless of the point in time. For these reasons, it is believed that the construction of an alternative index is essential.

The idea here is to construct an index that expresses time sequence as a single index and reflects the efficiency of ODA. One way of measuring ODA impact with reflecting its efficiency is by comparing the sum of ODA from a specific time span and the sum of the annual increase of an index such as GDP over the same period. This method, however, has a problem of neglecting the changes in the price values of ODA over time. Thus, assume that if an amount equivalent to the annual ODA

would be invested to other investment opportunity, it would produce a profit of $r\%$. As a result, the total sum of ODA (EA) at time T is expected to be the following.

$$EA = A_1(1+r)^{T-1} + A_2(1+r)^{T-2}$$
$$+\cdots+A_{T-1}(1+r)+A_T$$

where A_t is the amount of ODA at time t. If the total expected profit of ODA (EA) and the total sum of GDP increase (SY):

$$SY = \sum_{t=1}^{T}\varDelta GDP_t$$

are equal, the average effect of the overall ODA is considered $100r\%$. In other words, r is the average profit rate of the overall ODA project calculated from the profit rate of the investment opportunity. This is termed here as "Macroeconomic Rate of Return of ODA," or "ODA impact Index 2." The index is defined by the r-value that sets the ratio of SY/EA equal to one [see Fukuchi (1989)].

It is important to mention here of the difference between the ODA Impact index 2 and the ordinary "Internal Rate of Return (IRR)" used for project evaluations. Although both indices share similar basic concept, it is more appropriate to treat each of them distinctly. The ODA Impact Index 2 virtually indicates the impact of ODA is unique in itself that it considers the increased portion of GDP as benefit. The ordinary IRR, on the other hand, is calculated with the direct costs of individual projects and the direct profits earned from these projects. In other words, the ODA Impact Index 2 is the index for macro-level evaluation, while IRR is the one for micro-level evaluation. Therefore, both indices are measuring different

things, and the interpretation of these calcu-
lated figures is obviously going to be different.

The values of the ODA Impact Index 2 are
likely to be higher than those of IRR for project
evaluations. While only the direct profits of
the project is taken into account in the calcula-
tion of IRR, the economic effects of the project
can spread to the overall industry or the over-
all region, and to the national economy in the
end year. All of the direct and indirect benefits
of individual projects are included in the calcu-
lation of the ODA Impact Index 2. Therefore,
it will be natural that the values of the ODA
Impact Index 2 tend to be higher than those of
IRR.

2.1.2 Comparison of the Impacts of ODA in Indonesia, Malaysia and Thailand

The two types of ODA Impact Indices were
utilized to measure the macroeconomic
impacts of Japan's ODA in Indonesia, Malaysia
and Thailand. The sample period for this
study was given an additional year, extending
from 1972 to 1992. Further, there had been a
slight revision in the data and models used.
For the ODA data, only the data of the fund
cooperation (loans and grants) were included,
excluding the technical cooperation, based on a
standpoint that the former impacts capital
stock through government investment.

The measurement results of the two ODA
impact indices are as follows. In terms of the
ODA Impact Index 1, the ODA effects indicat-
ed that the effect was the largest in Thailand
for all variables (Figure 1). For instance, the
percentages of the increase effect on GDP in
1992 for each of these countries were 5.4% in
Thailand, 2.8% in Indonesia and 1.8% in
Malaysia.

The trends of macroeconomic increase
effects of Japan's ODA is as follows. The
time-series analysis of macroeconomic
increase effects revealed that the indices for
Indonesia and Malaysia had exceeded that for
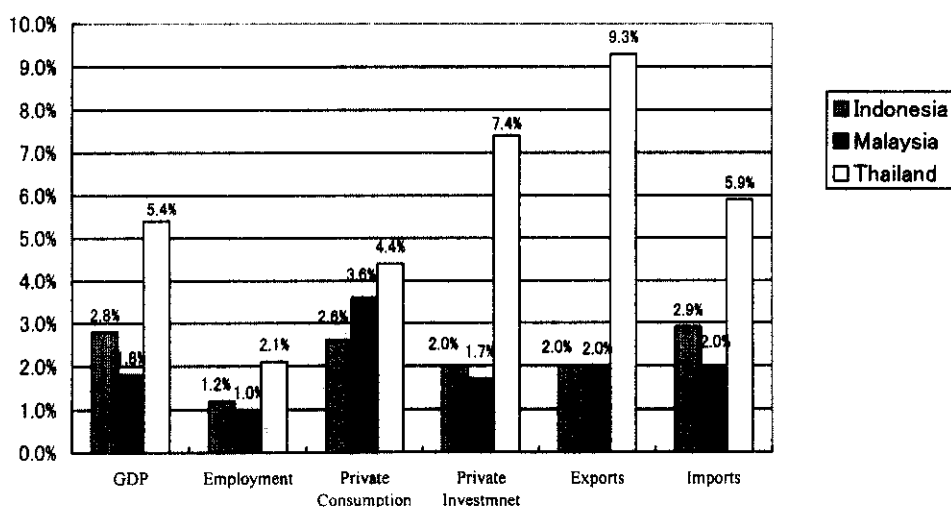Thailand during the 1970s. The index for

Figure 1. Comparison of macroeconomic effects of Japan's ODA

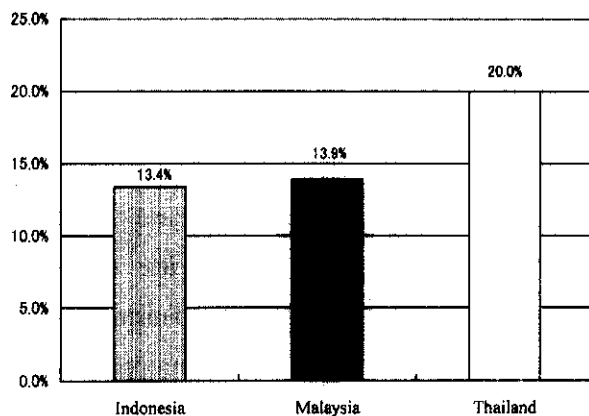Note : Figures are at the time of 1992 (the latest available figures).

Figure 2. Comparison of Macroeconomic Rate of Return of Japan's ODA

Thailand, however, began to be improved rapidly in the 1980s for almost au macroeconomic indices. This result was the same as Tokunaga (1995). In Thailand infrastructure was constructed by utilizing Japan's ODA in the 1970s, and then the private economic activity skyrocketed in the 1980s. In addition, the net disbursement of Japan's ODA to Thailand increased in the latter half of the 1980s.

With respect to the macroeconomic variables, the difference in the effect of the ODA Impact Index 1, as mentioned earlier, is heavily weighed by the difference in the absolute amount of ODA disbursed. Thus, a further attention is required in comparing the increase effect on macroeconomic variables seen in the ODA Impact Index 1 between recipient countries with different ODA amount. In terms of the macroeconomic rate of return of ODA (the ODA Impact Index 2), on the other hand, a comparison between recipient countries can be conducted from the aspect of the efficiency of ODA. With the ODA Impact Index 2, Thailand had again the largest index value with 20.0%, and Malaysia with 13.9% and Indonesia with

13.4% (Figure 2). For this reason, since Thailand has the highest macroeconomic rate of return of ODA out of all three recipients, it also indicates that Japan's ODA to Thailand has the highest effect per assistance.

This result can be explained by Thailand's highest sensibility of economic activity towards capital stock formation such as ODA. For example, this sensibility is expressed in terms of the elasticity of production with respect to capital stock, and Thailand has the largest with 0.99, followed by Malaysia with 0. 57 and Indonesia with 0.56.

2.2 Measurement of the Economic Effects of Japan's ODA on Foreign Direct Investment

In this section, the macroeconomic impacts of Foreign Direct Investment (FDI) in the private sector were measured with the same method used for the analysis of ODA. Additionally, the influence of Japan's ODA on the macroeconomic impacts of FDI was analyzed.

2.2.1 Methodology

First, FDI's economic impacts on the recipient's macro-economy were measured by the same method used in the analysis of the macroeconomic impacts of Japan's ODA. Thailand was selected as the subject of the analysis, and the macroeconomic impacts of FDI from the principal investors, namely the United States and Japan, were analyzed.

Secondly, the macroeconomic impacts of FDI to Thailand from the United States and Japan were measured under a hypothetical condition in which Japan's ODA was not dis-

bursed. By comparing the outcome of this analysis with the outcome which was calculated with ODA, the change in the macroeconomic impacts of FDI from the United States and Japan with and without Japan's ODA was analyzed.

In this analysis, the same indices as the analysis of ODA were utilized (we call "FDI Impact Index 1" and "FDI Impact Index 2"). The data of FDI to Thailand were the net flows of FDI.

2.2.2 Macroeconomic Effects of Foreign Direct Investment

As shown in Figure 3, the percentages of the increase effect on GDP, for example, in 1992 due to FDI to Thailand from Japan and US were 9.5% and 8.2%, respectively. Moreover, the macroeconomic rate of return of FDI to Thailand from Japan and US were 25.8% and 24.9%, respectively (Figure 4). The difference between them was very small.

It is important to distinguish the ma-

croeconomic rate of return of FDI measured in this paper from the ordinary rate of return of investment. That is to say, the ordinary rate of return of investment indicates the profitability from the individual investor's stand points. In contrast, the macroeconomic rate of return measures, from the recipient country's stand point, indicates the rate of economic impacts created by investments based on the increased portion of GDP. Hence, if the macroeconomic rate of return of FDI is measured high, that investment is recognized to be favorable to the recipient country. Note that for the investors, this index can not indicate whether or not each investment made is actually favorable.

2.2.3 Impacts of Japan's ODA on Macroeconomic Effects of FDI

The macroeconomic impacts of FDI to Thailand from the United States and Japan were simulated under a hypothetical condition in which no Japan's ODA was disbursed. By comparing the outcome of this analysis with
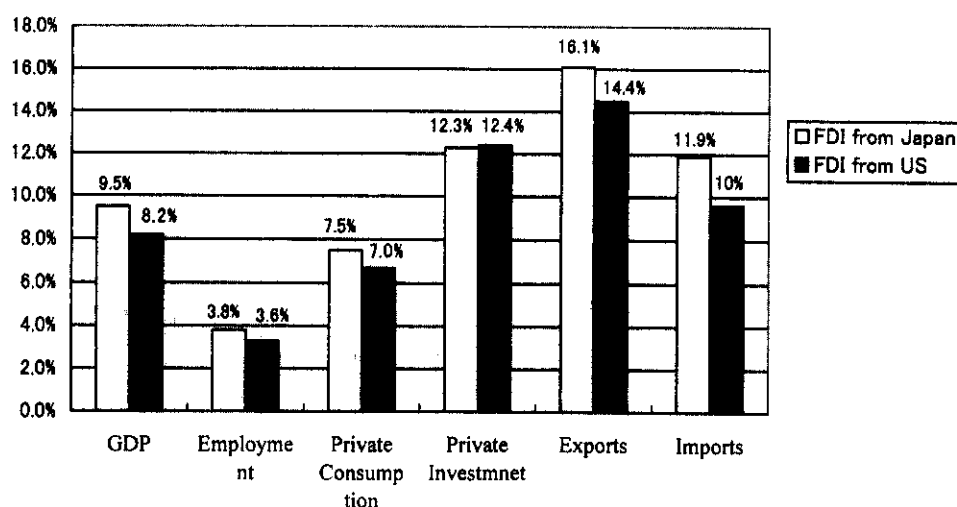

Figure 3. Macroeconomic effects of FDI to Thailand

Note : Figures are at the time of 1992 (the latest available Figures).
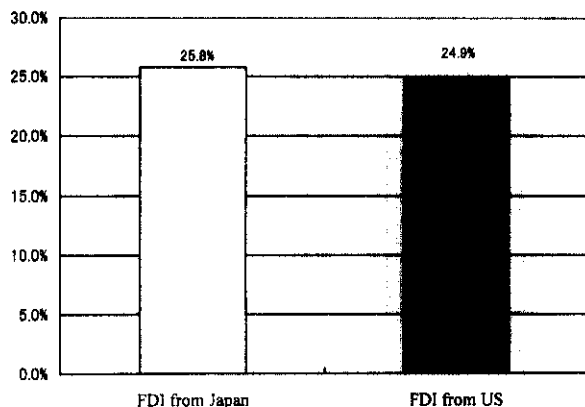
Figure 4. Macroeconomic rate of return of FDI to Thailand

the outcome above, we analyzed the change in the macroeconomic impacts of FDI with and without Japan's ODA.

The results of the analysis are shown in Figure 5 and Figure 6. The effect on each macroeconomic variable by FDI seen in the FDI Impact Index 1 derived for the case with Japan's ODA were higher than those without ODA for all variables. This indicated that, by conducting an assistance, the impacts of FDI on Thailand's macroeconomy further enlarged. The FDI Impact Index 2 also displayed a similar trend in Figure 6. In contrast to the results

of the no-ODA case, the increase in the macroeconomic impacts of FDI seen in the ODA case was not simply the result of ODA, but was a product of the synergistic effect of ODA and FDI.

3. Macroeconomic Impacts of Japan's Official Development Assistance and Foreign Direct Investment by Category : Case Study of Thailand

In this section, with its availability of data, the sectoral economic effects of Japan's ODA experienced in Thailand were examined. Additionally, the economic effects of Japan's FDI in Thailand categorized by industry, as well as, the influence of Japan's ODA on those economic effects of FDI were analyzed. Aside from the Thailand's econometric model constructed in section 2, a revised macroeconometric model that categorized Japan's ODA. Thailand's variables such as capital stock and investment were constructed for this analysis. The study period was from 1972 to
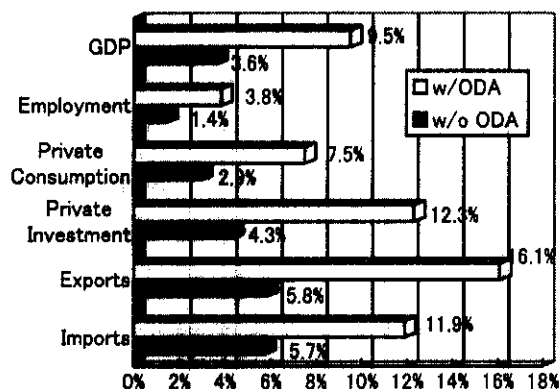
(a) FDI from Japan to Thailand
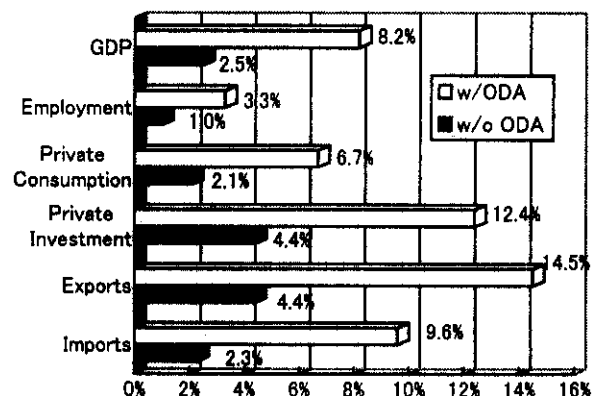
(b) FDI from US to Thailand

Figure 5. Change in macroeconomic effects of FDI to Thailand with and without Japan's ODA

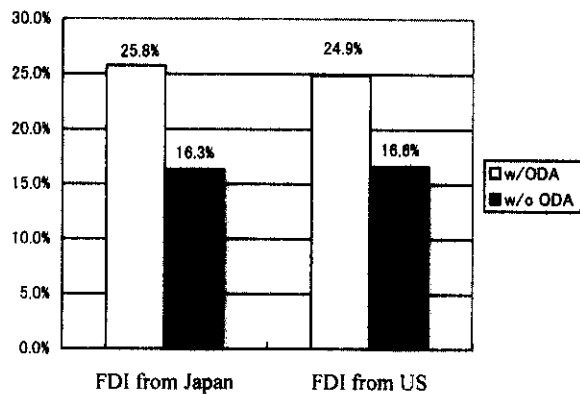Note : Figures are at the time of 1992 (the latest available figures).

Figure 6. Change in macroeconomic rate of return of FDI to Thailand with and without Japan's ODA

Figure 7. Macroeconomic rate of return of Japan's ODA to Thailand by category

1992.

3. 1 Measurement of the Impacts of ODA by Category in Thailand

First, Japan's ODA was divided into six categories : 1) agriculture, 2) industry, 3) electricity, gas and water supply, 4) transportation and communication, 5) education, 6) social service and others. For the ODA data, the gross disbursement of the fund cooperation (loans and grants) was implemented, excluding the technical cooperation.

The measurement was conducted using the "Sectoral ODA Impact Index 2," or "Macroeconomic Rate of Return of Sectoral ODA." This index was based on the idea of the "ODA Impact Index 2" in section 2.

Figure 7 shows that macroeconomic rates of return of Japan's ODA to Thailand in 1) agriculture, 2) industry, 3) electricity, gas and water supply, 4) transportation and communication, 5) education, 6) social service arid others, were 15.0%, 16.3%, 25.5%, 27.7%, 22.3%, and 10.6%, respectively.
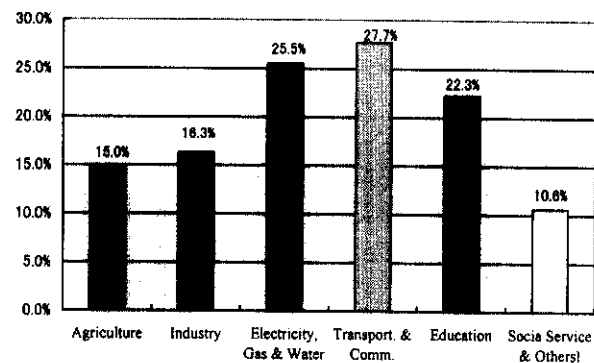
Looking at the "Sectoral ODA Impact Index

2", the ODA impacts was large in the economic infrastructure sector including transportation and communication and electricity, gas and water supply. A large effect was also seen in the education sector. Compared with the production sectors such as agriculture and industry, the infrastructure and education sectors had the larger external economic effects, which made the effects of ODA in these sectors evident.

3. 2 Measurement of the Impacts of FDI by Sector and Effects of ODA on FDI by Category

Secondly, Japan's FDI to Thailand was categorized by industry (from the primary to tertiary industry). Then, the influence of the sectoral assistance on FDI, and the macroeconomic impacts of FDI to each industry were analyzed. However, the primary industry was excluded from this analysis since the amount of direct investment in this category was very small.

In terms of constructing a model to represent the relationship between the ODA and
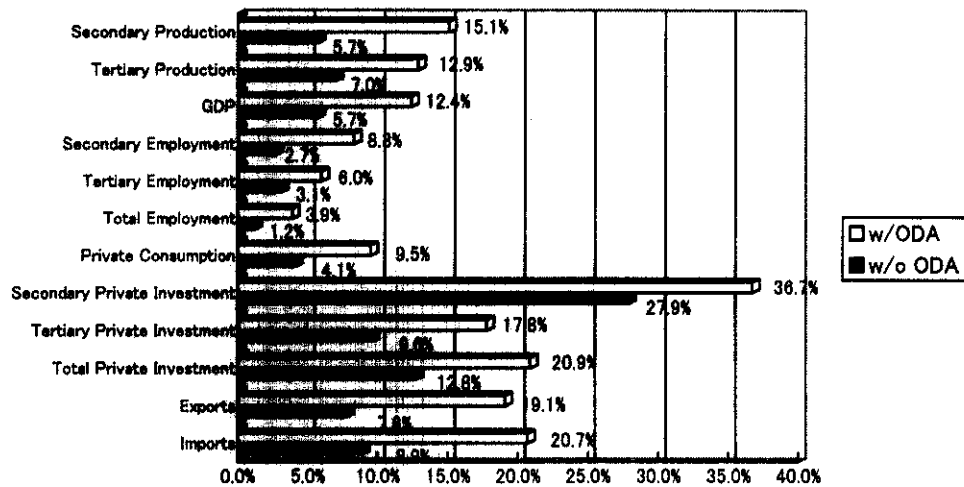
(a) FDI for the secondary industry
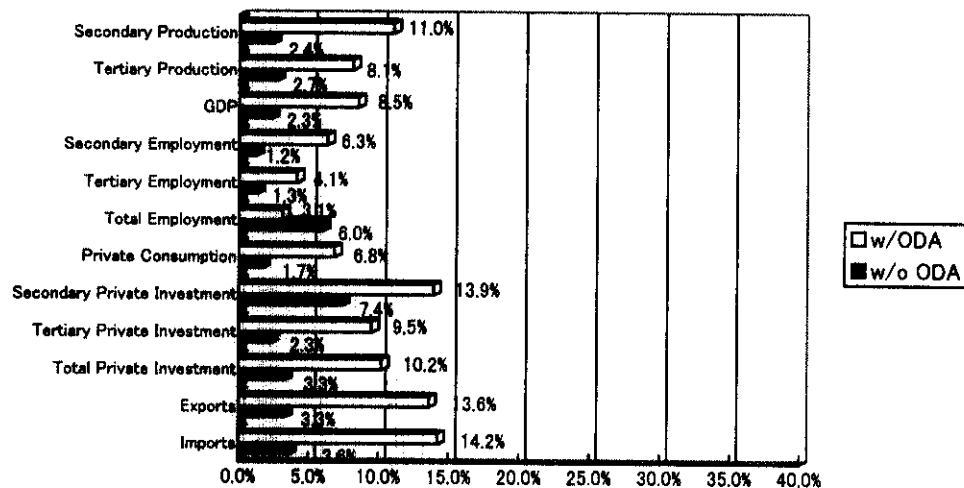
(b) FDI for the tertiary industry

Figure 8. Change in macroeconomic effects of FDI to Thailand with and without Japan's DA by category

Note : Figures are at the time of 1992 (the latest available figures).

direct investment, those sectors of assistance that impacted direct investment to the secondary industry were 1) industry, 2) electricity, gas and water supply, 3) transportation and communication, 4) education, and 5) social service and others. For the tertiary industry, those assistance with high impacts on direct investment were in sectors of 1) electricity' gas and water supply, 2) transportation and communication, 3) education, and 4) social service

and others.[3]

As for indices, the FDI Impact Index 1 and the FDI Impact Index 2 were utilized. Two scenarios in which one with sectoral assistance and the other without were simulated and the impacts of FDI in both cases were determined.

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[3]This relationship between sectoral ODA and FDI by industry represents the direct relationship in the production function, and the indirect influences are much broader

The outcomes of the analysis are shown in Figures 8. From looking at the increase effect on the macroeconomic variables (the FDI Impact Index 1), the FDI for the secondary industry indicated the larger effect for both with and without ODA cases. One explanation for this was that the absolute amount of FDI for the secondary industry was larger than that of FDI for the tertiary industry. Furthermore, the gap in the increasing effect on the macroeconomic variables between the cases with ODA and without ODA was also much larger for the FDI for the secondary industry as compared to the tertiary industry for all variables.

Moreover, with respect to the impact of FDI for the secondary industry in comparison to the zero-ODA case, when ODA was provided, the additional increase effects on production, employment and private investment were larger for the secondary industry than for the tertiary industry (the production of the secondary industry +9.4% and that of the tertiary industry +5.9%, the employment of the secondary industry +5.6% and that of the tertiary industry +2.9%, the private investment of the secondary industry +8.8% and that of the tertiary industry +8.2%). With respect to the impact of FDI for the tertiary industry, on the other hand, the additional increase effect with ODA was larger for the tertiary industry than for the secondary industry on private investment (the private investment of the secondary industry +6.5% and that of the tertiary industry +7.2%). In terms of production and employment, however, the increasing effects on these variables were larger for the secondary industry (the production of the secondary industry +8.6% and that of the tertiary industry +5.4%, the employment of the secondary industry +5.1% and that of the tertiary industry +2.8%).

As a conclusion, in both industry cases, economic effects grew larger when sectoral ODA was provided. Nevertheless, as it was explained in section 2, the increase in the economic effects of FDI was not more simple than the result of ODA, but was a product of the synergistic effect of ODA and FDI.

4. Concluding Remarks

This study quantitatively evaluated the contribution of Japan's ODA in the economic development in Indonesia and Thailand. Traditionally, the post evaluation of ODA was often done qualitatively, and a quantitative evaluation was rarely conducted. Therefore, the quantitative evaluation of Japan's ODA in this study represented a meaningful achievement.

In this study, it was evaluated that Japan's ODA has been providing positive economic impacts to such macroeconomic variables as GDP, employment, private consumption, private investment, and trade in Indonesia, Malaysia and Thailand. Amongst the three recipient countries, ODA impact in Thailand was the highest in terms of the increase effect on the macroeconomic variables such as GDP and employment, and also in terms of the macroeconomic rate of return (average rate of

return). Furthermore, when the economic impacts of ODA were analyzed by sector utilizing the macroeconomic rate of return of ODA, the economic infrastructure and education sectors resulted with the highest index rates.

Lastly, Japan's ODA was proved to increase the macroeconomic impacts of FDI in the recipient countries. The inflows of private direct investment from Japan and other countries played an important factor in the economic development of the East-Asian countries. Japan's ODA, in addition, contributed to increase the impacts of FDI on the economies of the East-Asian countries through constructing infrastructure.

Through the findings of this study, it was made apparent of the significant impacts of Japan's ODA on the macroeconomic variables in Indonesia, Malaysia and Thailand.

It should be made aware, however, that these macroeconomic impacts are not the sole purpose of conducting ODA. Large macroeconomic impacts themselves should be highly praised, but there are other effects that ODA projects that are not shown in the macroeconomic variables. Therefore, it is not appropriate to evaluate Japan's ODA solely on its size of macroeconomic impacts. For example, the contribution of Japan's ODA to each sector in the three recipient countries was numerically examined in Tokunaga (1995). In the study the amount of grant cooperation was less than that of yen loans, and its impacts to the overall country was not necessarily significant. Nevertheless, there were cases such as the projects in Thailand of Mahasarakham

Nursing College in the Northeast and Maharaj Nakhon Si Thammarat Hospital in the South, that the grant cooperation contributed quite significantly, in this case, to the regional society.

In this paper, the macroeconomic impacts of Japan's ODA was compared amongst the recipient countries and the recipient sectors from a standpoint of the macroeconomic rate of return of ODA. In the sectoral analysis, the economic infrastructure and education sectors earned the highest effect from Japan's ODA.

One must be also cautious to these findings. Firstly, the analysis of this study was an *ex post* evaluation of Japan's ODA. Thus, in studying a recipient country or a priority sector in the future, one must provide a careful consideration when implementing the results of this study. It is clearly important to increase the effectiveness of assistance. Yet, the essential objective of ODA is to assist those projects that can not be financed by the private sector due to low return or high risks, for the benefit of the pubic.

Secondly, looking at the rate of return of ODA by sector, assistance to the economic infrastructure and education sectors resulted the highest. This does not necessarily mean, however, that the private sector can take over these sectors. This is due to the fact that the index used in this analysis was the rate of return at the macro-level determined on a basis of the contribution to GDP. In other words, this rate of return measures the benefits at the national economy level, and they do not directly transform as profits of the projects.

Furthermore, Japan's ODA was proved to increase the macroeconomic impacts of FDI in the recipient countries in this Study. The inflows of private direct investment from Japan and other countries played an important factor in the economic development of the East-Asian countries. Japan's ODA contributed to increase the impacts of FDI on the economies of the East-Asian countries through constructing infrastructure.

When the results of this analysis are compared prosaically, the macroeconomic impacts of Japan's ODA might seem to be sometimes shown larger than those of FDI or vice versa. It is more suitable to think that the synergistic relationship of ODA and FDI produces large economic effects. Therefore, rather than comparing the economic effects of ODA and FDI, it is more important to avert more attention on the relationship between ODA and FDI.

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