An analysis of the role of information and communication technology sectors on Japanese national economy from 1995 through 2005: An application of multiplier analysis

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Abstract. The purpose of this study is to continue the previous studies which focused on Japanese Information and Communication Technology (ICT) sectors. More specifically, this study aims to analyze the role of ICT sectors on Japanese national economy using simple household income multiplier, one of the analysis instruments in Input-Output (IO) analysis. The analysis period of this study is from 1995-2005. The results show that the sectors did not have an important role on the national economy of Japan on the period. Besides, the results also show that, from the point of view of the multiplier, Japanese national economy tended to stable during the period.

1. Introduction

The importance of Information and Communication Technology (ICT) on the daily lives of people can be easily perceived in recent years. The evidence is almost all people utilize a mobile phone as one of the communication tools. Besides, the use of computer, both in office and home, is another evidence of the condition. ICT also has an important role on the macro aspect. For example, the international trade between two or more countries will go smoother if ICT is applied.

Many previous studies discussed the ICT topic. For example, [1] compared the calculation results generated by simple output multiplier method and Structural Decomposition Analysis (SDA) which the focus was Japanese ICT sectors. Both tools are analysis tool in Input-Output (IO) analysis. His study aimed to get the other perspective regarding the role of sectors on the national economy of Japan from 1995-2005. Using the similar methodology, [2] analyzed the ICT sectors of Indonesia.

[3] analyzed the effects of final demand modifications on the total output of Japanese ICT sectors in the future. He employed demand-pull IO quantity model, one of the analysis instruments in IO analysis, as a tool of calculation. In his study, the modifications only appeared on the sectors. Using the similar methodology, [4] focused on the Indonesian ICT sectors. In their study, however, the modifications appeared on all Indonesian industrial sectors. The study focused on the ICT sectors of Indonesia and used both modifications was conducted by [5]. On the other hand, the study focused on Japanese energy sectors and also used both modifications was done by [6].
The study analyzes the role of ICT sectors on the national economy of specific country using the other multiplier, viewed from above previous studies, however, is still thin. This analysis is important because it can give the deeper understanding regarding the role. This study is conducted in order to fulfill the gap.

The purpose of this study is to continue the previous studies which focused on Japanese ICT sectors. More specifically, this study aims to analyze the role of ICT sectors on Japanese national economy using income multiplier, one of the multipliers in IO analysis. The analysis period of this study is from 1995-2005.

2. Methodology
The methodology of this study is explained as follows. The first step is to describe the data of study. This study uses Japanese IO tables for 1995, 2000, and 2005 as data. These tables consist of 93, 104, and 108 industrial sectors, respectively. The second step is to conduct the process of aggregation for these industries. This process aims to get the compatibility among different periods. The industries are aggregated into 89 sectors through the process.

The third step is to describe the ICT sectors used in this study. These sectors come from the aggregated industries. Table 1 shows these sectors. The fourth step is to conduct the calculation using income multiplier model. [7] described that this multiplier has two types, namely simple and total household income multipliers. They explained that the former model is described as:

\[ m(h)_j = \sum_{i=1}^{n} a_{n+1, j} l_{ij} \]  

while the latter one is:

\[ \bar{m}(h)_j = \sum_{i=1}^{n+1} a_{n+1, j} \bar{l}_{ij} \]  

More specifically, \( m(h)_j \), \( \bar{m}(h)_j \), \( n \), \( l_{ij} \), and \( \bar{l}_{ij} \) are the simple household income multiplier for sector \( j \), the total household income multiplier for sector \( j \), sector numbers, a sector-to-sector multipliers matrix, and a sector-to-sector multipliers matrix with respect to households endogenous, respectively. This study uses the former one as a calculation tool. In this study, the households income part on the row of IO tables is represented by compensation of employees. This part is chosen because it consists of (1) wages and salaries, (2) contribution of employers to social insurance, and (3) other payments and allowances [8]. On the other hand, the part on the column is described by consumption expenditure of outside households.

The next step is to conduct the analysis based on the calculation results. The final step is to describe the conclusions of this study and give the suggestions for the further research. One of the objectives of these suggestions is to get the deeper understanding regarding the role of ICT sectors on Japanese national economy.

| No. | Sector number | Sector name                              |
|-----|---------------|------------------------------------------|
| 1   | 72            | Communication                            |
| 2   | 73            | Broadcasting and information services    |
| 3   | 80            | Advertising, survey, and information services |

(Source: [9])
3. Results and analysis

Tables 2, 3, and 4 show the top five Japanese industrial sectors viewed from the value of simple household income multiplier on 1995, 2000, and 2005, respectively. ICT sectors not appear in these Tables. Therefore, from this phenomenon, one can argue that these sectors did not have an important role on the national economy of Japan from 1995-2005.

On the other hand, Figures 1, 2, and 3 describe the values of simple household income multiplier of all Japanese industrial sectors on 1995, 2000, 2005, respectively. The patterns of the values on the periods are explained in Figures 4, 5, and 6. From the information in these Figures, one can argue that the similar pattern appeared from 1995-2005. In other words, during this period, from the point of view of the multiplier, Japanese national economy tended to stable.

4. Conclusions and further researches

This study, as a continuation of previous studies, analyzed the role of ICT sectors on Japanese national economy from 1995-2005. This study employed simple household income multiplier as an instrument of analysis. The results showed that the sectors did not have an important role on the national economy of Japan on the period. Besides, the results also showed that, from the point of view of the multiplier, Japanese national economy tended to stable during the period.

Table 2. Top five Japanese industrial sectors viewed from the value of simple household income multiplier, 1995.

| No. | Sector number | Sector name                        | Simple household income multiplier |
|-----|---------------|-----------------------------------|-----------------------------------|
| 1   | 75            | Education                         | 0.83                              |
| 2   | 74            | Public administration             | 0.80                              |
| 3   | 78            | Social security                   | 0.78                              |
| 4   | 79            | Other public services             | 0.72                              |
| 5   | 65            | Road transport (except transport  | 0.72                              |
|     |               | by private cars)                  |                                   |

Table 3. Top five Japanese industrial sectors viewed from the value of simple household income multiplier, 2000.

| No. | Sector number | Sector name            | Simple household income multiplier |
|-----|---------------|------------------------|-----------------------------------|
| 1   | 78            | Social security        | 0.80                              |
| 2   | 75            | Education              | 0.79                              |
| 3   | 76            | Research               | 0.72                              |
| 4   | 79            | Other public services  | 0.71                              |
| 5   | 65            | Road transport (except  | 0.71                              |
|     |               | transport by private cars)|                                   |
Table 4. Top five Japanese industrial sectors viewed from the value of simple household income multiplier, 2005.

| No. | Sector number | Sector name                                           | Simple household income multiplier |
|-----|---------------|-------------------------------------------------------|-----------------------------------|
| 1   | 78            | Social security                                       | 0.78                              |
| 2   | 75            | Education                                             | 0.78                              |
| 3   | 79            | Other public services                                 | 0.72                              |
| 4   | 65            | Road transport (except transport by private cars)     | 0.69                              |
| 5   | 76            | Research                                              | 0.66                              |

Figure 1. Values of simple household income multiplier of all Japanese industrial sectors, 1995.

Figure 2. Values of simple household income multiplier of all Japanese industrial sectors, 2000.
**Figure 3.** Values of simple household income multiplier of all Japanese industrial sectors, 2005.

**Figure 4.** The pattern of values of simple household income multiplier of all Japanese industrial sectors, 1995.

**Figure 5.** The pattern of values of simple household income multiplier of all Japanese industrial sectors, 2000.
The role of Japanese ICT sectors on the national economy and the patterns of Japanese national economy during the analysis period were discussed in this study. This study, however, did not describe the changes of simple household income multiplier value of these sectors on the period. The discussion regarding these changes is needed in elaborating the characteristics of the sectors during the period. This study suggests this discussion as a further research.

The other suggested further research is to use the value-added multiplier to analyze the role of ICT sectors on the national economy of Japan from 1995-2005. This analysis will explore in more details the contribution of these sectors on Japanese national economy during the period. Besides, this study also suggests the international comparison on the specific analysis period which the compared point is the values of income multipliers of ICT sectors. This comparison will describe in more details the structural changes of these sectors for each analyzed country.

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