An application of multiplier analysis in analyzing the role of information and communication technology sectors on Indonesian national economy: 1990-2005

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Abstract. The purpose of this study is to continue the previous studies which focused on Indonesian Information and Communication Technology (ICT) sectors. More specifically, this study aims to analyze the role of ICT sectors on Indonesian national economy using simple household income multiplier, one of the analysis tools in Input-Output (IO) analysis. The analysis period of this study is from 1990-2005. The results show that the sectors did not have an important role on the national economy of Indonesia on the period. Besides, the results also show that, from the point of view of the multiplier, Indonesian national economy tended to stable during the period.

1. Introduction
In recent years, the need for the Information and Communication Technology (ICT) on the daily lives of people can be easily observed. The evidence is almost all people have and utilize a computer in their lives. They use the technology not only for finishing their tasks but also for entertainment purposes. Besides, the use of mobile phone as one of the communication tools is another evidence of the condition. ICT also has an important role on the macro aspect. For example, the activities of political survey will be easier if this technology is applied.

Many previous studies discussed the ICT topic. For example, [1] did the comparison between the calculation results generated by simple output multiplier method and Structural Decomposition Analysis (SDA) which the focus was ICT sectors of Japan. Both tools are analysis instrument in Input-Output (IO) analysis. From the study, he tried to get the other perspective regarding the role of sectors on the national economy of Japan from 1995-2005. Applying the similar methodology, [2] analyzed Indonesian ICT sectors.

[3] analyzed the impacts of final demand changes on the total output of Japanese ICT sectors in the future. He employed demand-pull IO quantity model, one of the analysis tools in IO analysis, as an instrument of calculation. In his study, the modifications only appeared on the sectors. Using the similar methodology, [4] focused on the ICT sectors of Indonesia. In their study, the changes appeared on all Indonesian industrial sectors. The study focused on Indonesian ICT sectors and applied both
modifications was conducted by [5]. On the other hand, the study focused on Japanese energy sectors and also used both changes was done by [6].

The study investigates the role of ICT sectors on the national economy of a particular country using the other multiplier, viewed from above previous studies, however, is still thin. This investigation is important because it can generate 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 the ICT sectors of Indonesia. More specifically, this study aims to analyze the role of ICT sectors on Indonesian national economy using income multiplier, one of the multipliers in IO analysis. The period of analysis of this study is from 1990-2005.

2. Methodology
The methodology of this study is described as follows. The first step is to explain the data of study. This study uses Indonesian IO tables for 1990, 1995, and 2005 as data. These tables consist of 161, 172, and 175 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 159 sectors through the process. The process of adjustment to get the proper data is addressed to the 2005 IO table of Indonesia before conducting the aggregation procedure.

The third step is to describe the sectors of ICT 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 the model of income multiplier. [7] described that this multiplier has two types, namely simple and total household income multipliers. They explained that the former model is described as:

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

while the latter one is:

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

More specifically, \( m(h)_j \), \( \overline{m}(h)_j \), \( n \), \( l_{ij} \), and \( \overline{l}_{ij} \) 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 household endogenous, respectively. This study uses the former one as a calculation tool. In this study, the household income part on the row of IO tables is represented by wage and salary. On the other hand, this part on the column is described by consumption expenditure of household and non-profit institutions.

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

| No. | Sector number | Sector name |
|-----|---------------|-------------|
| 1   | 135           | Construction and installation on electricity, gas, water supply, and communication |
| 2   | 146           | Communication services |

(Source: [8])
3. Results and analysis

Tables 2, 3, and 4 show the top five Indonesian industrial sectors viewed from the value of simple household income multiplier on 1990, 1995, 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 Indonesia from 1990-2005.

On the other hand, Figures 1, 2, and 3 describe the values of simple household income multiplier of all Indonesian industrial sectors on 1990, 1995, 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 1990-2005. In other words, during this period, from the point of view of the multiplier, Indonesian 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 Indonesian national economy from 1990-2005. 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 Indonesia on the period. Besides, the results also showed that, from the point of view of the multiplier, Indonesian national economy tended to stable during the period.

**Table 2.** Top five Indonesian industrial sectors viewed from the value of simple household income multiplier, 1990.

| No. | Sector number | Sector name             | Simple household income multiplier |
|-----|---------------|-------------------------|-----------------------------------|
| 1   | 151           | General government      | 0.95                              |
| 2   | 154           | Other community services| 0.63                              |
| 3   | 152           | Education services      | 0.58                              |
| 4   | 11            | Rubber                  | 0.52                              |
| 5   | 140           | Railway transport       | 0.52                              |

**Table 3.** Top five Indonesian industrial sectors viewed from the value of simple household income multiplier, 1995.

| No. | Sector number | Sector name             | Simple household income multiplier |
|-----|---------------|-------------------------|-----------------------------------|
| 1   | 151           | General government      | 0.76                              |
| 2   | 152           | Education services      | 0.67                              |
| 3   | 154           | Other community services| 0.66                              |
| 4   | 11            | Rubber                  | 0.52                              |
| 5   | 127           | Musicals instruments    | 0.51                              |
Table 4. Top five Indonesian industrial sectors viewed from the value of simple household income multiplier, 2005.

| No. | Sector number | Sector name                                         | Simple household income multiplier |
|-----|---------------|-----------------------------------------------------|------------------------------------|
| 1   | 151           | General government                                   | 0.64                               |
| 2   | 154           | Other community services                             | 0.60                               |
| 3   | 152           | Education services                                   | 0.60                               |
| 4   | 11            | Rubber                                              | 0.48                               |
| 5   | 155           | Private motion picture and its distribution         | 0.45                               |

Figure 1. Values of simple household income multiplier of all Indonesian industrial sectors, 1990.

Figure 2. Values of simple household income multiplier of all Indonesian industrial sectors, 1995.
Figure 3. Values of simple household income multiplier of all Indonesian industrial sectors, 2005.

Figure 4. The pattern of values of simple household income multiplier of all Indonesian industrial sectors, 1990.

Figure 5. The pattern of values of simple household income multiplier of all Indonesian industrial sectors, 1995.
The role of Indonesian ICT sectors on the national economy, and the patterns of Indonesian 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. Besides, expanding the period of analysis of current study is also a proposed further research from this study. This expansion can describe in more details the role of analyzed sectors on and a pattern of the national economy of Indonesia.

The other suggested further research is to use the value-added multiplier to analyze the role of ICT sectors on the national economy of Indonesia from 1990-2005. This analysis can explore in more details the contribution of these sectors on Indonesian national economy during the period. 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 can describe in more details the structural changes of these sectors for each analyzed country. The example of objects for the comparison is developed and developing countries.

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