INTERNATIONAL TRADE AND INEQUALITY

A Thesis

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Master of Science

by

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ABSTRACT

As Indonesian government is planning to increase production and export of manufacturing products through tax break that improve human capital to escape from the middle-income trap, this thesis aims to investigate the effect of manufacturing export and tax break on manufacturing sectors to income inequality and trade balance. Using IRSAM in 2008 between Indonesia and the Rest of the World, we found that trade overall does not necessarily improve income distribution. This thesis also counters the report by Ministry of National Planning Development that suggest promoting manufacturing sector through tax break. Promoting manufacturing sectors through tax break can only produce positive result both on income distribution and trade balance under extremely restrictive conditions, which are that government has to implement selective financing scheme, and that the manufacturing firms has to translate the received-tax-break by increasing the productivity of unskilled labor only. Under a more-realistic assumption, in which firms respond the tax break policy by adjusting their investment level, we found that tax break on agriculture or food industry, financed by mining sector promotes both equality and efficiency issues at the same time. The use of foreign loan will worsen trade balance, generating inferior results compare to domestic financing, or running constant government budget. Secondly, we also show that improving labor productivity abruptly without targeting will deprive income distribution, as the consumption pattern between skilled and unskilled labor affects the inter-linkages from labor income to household welfare. At the end of this thesis, we provide policy recommendations based on the analysis, which is to target tax break to

agriculture sector and food industry and focus on improving productivity of agriculture labor and manual labor of food industry.

BIOGRAPHICAL SKETCH

Edith Zheng Wen Yuan was born in 1994 in Jakarta. She finished elementary school in St. Theresia, and continued high school in St. Ursula in Jakarta. Then, she joined the Economics major in University of Indonesia in 2012. After taking one-year gap post-graduation, Edith went to Cornell University to join the master program in Regional Science major.

Edith actively participates in student organizations during her studies. While studying in University of Indonesia, she joined the economic student association called KANOPI (Economic Development Studies Indonesia Association) in its research division for the first 3 years, and took the role of General Secretary on her fourth year of undergraduate study. During her graduate study at Cornell, she also joined International Planning Student Organization (IPSO) in her second year at Cornell. She became a teaching assistant in her third year of undergraduate study, and she continued doing so before she left for Cornell University. While working as a teaching assistant in Department of Economics in University of Indonesia, she also worked as a research assistant in Institute for Economic and Social Research.

Edith enjoys volunteering as a teacher which she has been doing since high school. She voluntarily taught math courses for the disenfranchised elementary students during high school in Jakarta, and joined a free school organization known as MASTER FEUI in her second year in University of Indonesia and taught math and economic courses for high school students. During her studies at Cornell University, she was sponsored by DEEP Operations Organizations to go to Anhui, China, and teach elementary school and junior high school students there during the summer.

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TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION

Indonesia is one of many developing countries that is experiencing development progeria, whereby manufacturing sector prematurely subsides while agriculture sector persistently dominates the economy and service sector grows prematurely. This phenomenon entails many other problematic issues, one of the biggest issues being a shackle for Indonesia to take off from middle income to higher income economy. Another issue that entails development progeria is international trade stagnancy, if not decline, as service goods are not considered as tradeable as manufacturing goods or agriculture goods. Figure 1 shows the ratio of trade value (export and import) to GDP of Indonesia

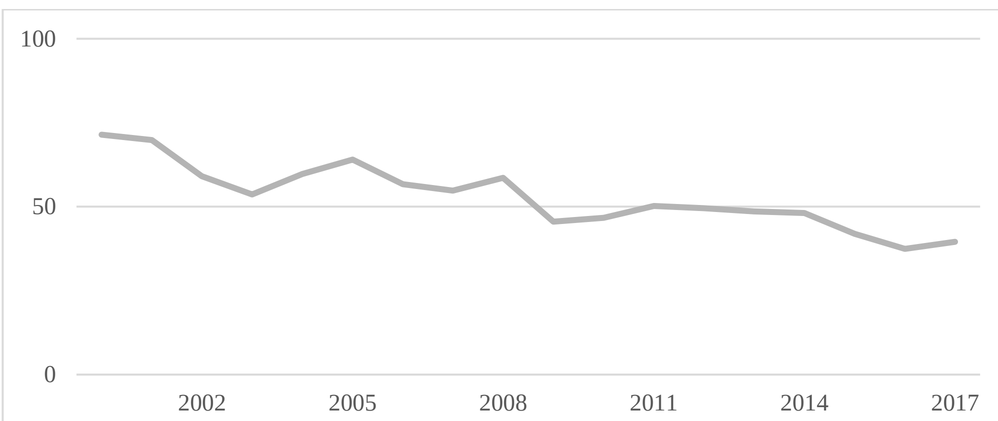

Figure 1. Indonesia: Percentage of trade in GDP
Source: Central Bureau of Statistics Indonesia

Figure 1 shows that the percentage of trade to GDP in Indonesia has been declining since 2000, even though its nominal value might have gone up during this period. This issue challenges the government to boost manufacturing sector and also to promote manufacturing export along the way. Since 2014, the government has released a handful of economic packages in which most of the content are targeting manufacturing sectors' growth, with the goal of achieving 7% economic growth in order to escape from the middle-income trap. The government's policy includes not only fiscal policy, but also bureaucracy, such as ease of doing business, tax holiday, to import tariff reduction for intermediate input goods, and increase human capital. Increasing interconnectedness to global economies with globalization and globalization and global supply chain also needs to be taken into account when implementing policy since it emerged in the beginning of 21st century.

The ever-decreasing labor productivity growth since 2008 has urged the government to promote productions and exports of manufacturing through human capital improvement, which will be reflected from increase in labor productivity. Figure 2 shows that the sources of labor productivity's negative growth in 2008-2014 are both structural- and within- sectoral productivity decrease. The negative structural growth that is evident since 2000 confirms the phenomena of progeria development, where labor has been moving to low-skilled service sector in which labor productivity is lower than in manufacturing sector. However, prior to 2008, the positive growth of within-sectoral productivity induced the overall labor productivity growth to also be positive, regardless of negative structural growth. The within-sectoral productivity growth took turn since 2008, where it shows negative growth that leads to negative overall labor productivity growth. These growth decompositions show that the labor movement from agriculture to low-skilled service sector and the declining sectoral productivity have been the reason of falling labor productivity, pressing the government to promote manufacturing sector as well as to upgrade human capital.

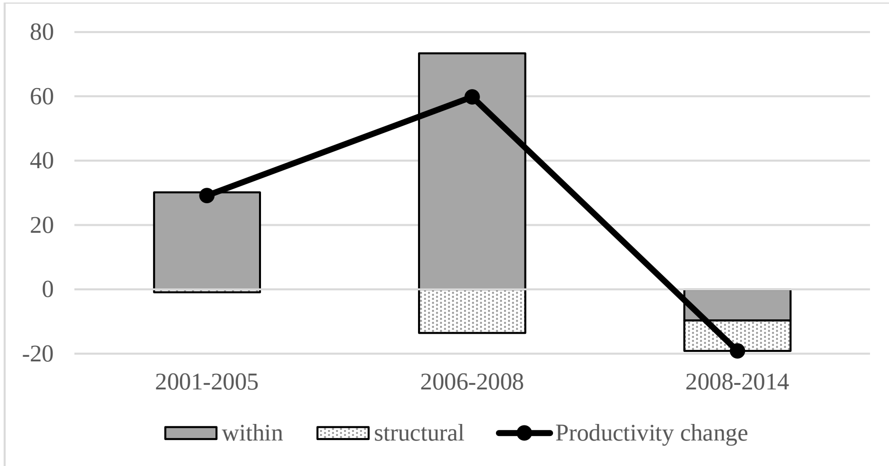

Figure 2. Decomposition of labor productivity growth in Indonesia
Source: Socio-Economic Accounts of World Input-Output Database
Notes: Labor productivity is estimated by dividing gross output with number of worked hours.

On the other hand, the relationship between income inequality and labor productivity in Indonesia has changed over the time. Figure 3 shows the trend in labor productivity since 1975 and inequality in Indonesia, measured by the income ratio between the richest and the poorest household class from Social Accounting Matrix table. In the beginning, increase in labor productivity was accompanied by falling inequality until 1990. This phenomenon was famously known as Asian Miracle, where economic growth reached 7 percent and at the same time the world witnessed economic stability in terms of price and inequality. However, this relationship broke down post 1990, where the inequality spiked in 1995, fell in 2000 before it steadily increased until 2008 even though the labor productivity kept showing significant growth. These phenomena indicate that increase in labor productivity was absorbed evenly among the society only in the onset of economic development, but the benefit of labor productivity increased in the latter stage was only beneficial for upper households. Hence, labor productivity increase does not necessarily improve income equality among households.

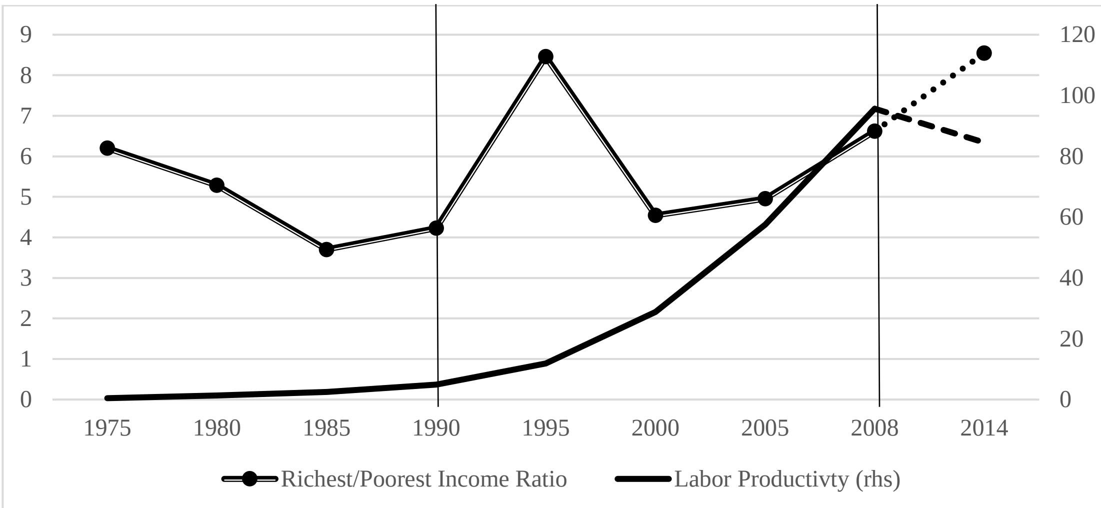

Figure 3. Labor productivity and income inequality in Indonesia
Source: Indonesia Social Accounting Matrix (*Sistem Neraca Sosial Ekonomi 1975 – 2008)*
Notes: The income ratio is calculated between the urban-high household and agriculture-labor households. The dotted lines are estimations from WIOD and Indonesian Statistics[1]

Given Indonesian government's plan to increase production and export of manufacturing products through increasing human capital and tax break, and the fact that income inequality has been worsening within the last two decades, it is then essential to find out if income inequality will be improved or worsened as a consequence, and its impact to trade balance. In fact, the issue of trade openness and its impact to inequality has been of interest to many economists around the world for a long time. Among many of trade theories, three stands out from the rest: Hecksher-Ohlin model, also known as the neo-classical trade theory; firm heterogeneity by Helpman,

[1] Estimation on inequality in 2014 are calculated by applying the income ratio growth between top 20 and bottom 40 to Richest/Poorest income ratio in 2008.

Itskhoki, and Muendler (2017); and global production sharing model by Feenstra and Hanson (2001). Hecksher-Ohlin model emphasizes the difference in comparative advantage between countries that will be the reason of beneficial trade relationship between countries. Helpman, Itskhoki, and Muendler introduced the firm heterogeneity to the model between trade and wage inequality, which found the opposite result from Hecksher-Ohlin model. Feenstra and Hanson analyzed the trade pattern after the globalization and acknowledged the phenomenon of off-shoring that introduced the concept of global production network.

Albeit these theories are sophisticated and near-holistic, none of these consider the inter-sectoral and inter-regional linkages to be included in the equation. Thus, this study will contribute to this strand of literature by taking into account the inter-sectoral and inter-regional linkages whilst analyzing the impact of international trade to inequality. Specifically, this paper addresses the following question: With Indonesian government's plan to increase export of manufacturing products through human capital increase and tax break, how does trade impact inequality through labor productivity, taking into account the inter-sectoral and inter-regional linkages?

In order to take the inter-sectoral and inter-regional linkages into account, this study performs simulations using Inter-Regional Input-Output (IRIO) model and Inter-Regional Social Accounting Matrix (IRSAM) model, to analyze the effect of increasing international trade to income inequality between institutions.

By utilizing IRIO model of Indonesia, China, and Rest of the World (ROW), we found that Indonesia's trade is vulnerable, featured by inferior and deteriorating labor productivity; while the world is becoming more and more integrated. Given the current characteristics of the economy, increase of manufacturing sector's exports will worsen income inequality in Indonesia. We also found that government policies such as tax break and arbitrary human capital improvement to boost export and production from manufacturing sectors are, in fact, raising income inequality, by which we argue that the policy recommendations by Ministry of National Development Planning in Felipe, et.al. (2019), e.g. tax break and human capital improvement, do not yield the best result in terms of improving or even maintaining income equality level. We show that both polices will raise inequality, how ever the government funds the policy – through both foreign loan and raising firms' tax. The simulation results also show that these policy recommendations can only improve equality i.e. income distribution, and efficient, i.e. trade balance and investment to GDP ratio, under extremely restrictive conditions: first, that government has to implement a selective financing scheme for the tax break, i.e. raising tax break fund from only forestry and mining sector to manufacturing sectors; and secondly, the firms need to respond the policy in extremely positive manner by translating the tax break to productivity improvement of unskilled labor. Hence, at the end of the simulations, this thesis identifies that only agriculture sector and food industry which gives the best results in terms of both equality and efficiency when the government promotes these sectors through tax break.

This thesis paper will be constructed as follows: the following chapter will elaborate more the literatures on trade and its impact to inequality, and the empirical evidences around the world and Indonesia. The third chapter explains the data and methodology used in this paper, which is simulations on Inter-Regional Input-Output (IRIO) model and Inter-Regional Social Accounting Matrix (IRSAM) model. The next chapter describes the stylized facts in Indonesia on inter-sectoral linkages, trade structure, and income inequality. The fifth chapter scrutinizes data and measurement of labor productivity in Indonesia, and how it is linked to human capital. The simulation results analysis is divided into two chapters, the simulation results of how export affects inequality, and the results for policy simulations. The last chapter concludes.

CHAPTER II
LITERATURE REVIEW

Literatures on impact of trade upon income distribution have been abundant, from theoretical research to empirical work. Among many theoretical works on international trade and its impact to inequality, three stand out from the rest. One of the earliest and most commonly known theory is the Hecksher-Ohlin model and Stolper-Samuelson theorem. Trade between capital-intensive economy and labor-intensive economy will equalize the relative returns on factor, e.g. rents over wage, therefore the difference in comparative advantage between the countries is the key to a beneficial trade between the two.

The Hecksher-Ohlin model and Stolper-Samuelson theorem was the foundation for many pro-liberalization’s argument on how trade will decrease inequality in both countries. Some empirical works, such as ones conducted by Bourguignon and Morrison (1990), Wood (1994) and Wood (1997), Aldaba (2013), Daumal (2013), and McNabb and Said (2013) support this theorem.

Wood (1994) classified all countries (where data is available) into two categories, North (the developed countries) and South (the developing countries). He further categorized labor into three division, uneducated, basic-educated, and more educated. He found that developing countries are dominated with unskilled labor, and their exports are intensive in basic-education-skills goods. Wood also found that higher manufactured exports, both in North and South, will tend to equalize the distribution of wages. In Wood (1997), he focused on a variety of evidence for Taiwan, Korea, Hong Kong, and Malaysia.

Again, he found evidence there is negative association between inequality and relative wages with exports of manufacturers and export promotion policies.

Aldaba (2013) also found evidence of declining wage gap in manufacturing sector in Philippines as the government opened the economy. Using firm level dataset that covers four years: 1996 – 1998, and 2000, he estimated the impact of trade to variability in wage using econometrics. The trade variables used are MFN output tariff, ASEAN tariff, exports, and EPR (Effective protection rates).

McNabb and Said (2013) used panels of sectoral data in 1984, 1989, 1992, 1995, and 1997 in Malaysia to examined the impact of trade liberalization that happened in Malaysia since 1960 and found that, unlike other developing countries that adopt liberalization policies and facing increasing inequalities, the impact of trade liberalization in Malaysia to wage inequality have significantly negative, e.g. relative wages fell dramatically, equalizing inter-sectoral wage.

Daumal (2013) analyzed the impact of trade openness to regional inequality in Brazil in 1980 – 2003. She used trade to GDP ratio as a proxy of Brazil's openness and Gini index of each region as proxy of regional inequality. Her time series analysis using econometrics showed that trade openness had a statistically significant negative impact on regional inequality, which means that increasing trade openness that Brazil experienced reduces the regional inequality there. She suggested that this finding is due to the fact that a large part of Brazilian exports is of agricultural products, which are grown in relatively poor regions, hence increasing in exports raises the income in poor regions relative to the richer regions.

However, the world also witnessed increasing inequality in countries that just open their doors to international trade, such as China and India. Many other empirical works found the opposite evidence of Hecksher-Ohlin model and Stolper-Samuelson theorem, whose number is not less than the number of literatures supporting these neoclassical theorems. Some of them are Robbins, Gonzalez, and Menendez (1997), Gindling and Robbins (2001), Zhu and Treffler (2001), Goldberg and Pavcnik (2001), Zhang and Zhang (2003), Pal and Ghosh (2007), Thangavelu (2013), and Daumal (2013).

Robbins, Gonzalez, and Menendez (1997) used time – series analysis to observe the dynamics of relative wages and relative supply of labor in 1974 – 1994, associating the trade liberalization that happened in 1978 in Argentina. They found relative supply of labor rose while relative wages began to rise after trade liberalization, from which they argued that there were skill-biased relative demand shifts. Raising relative wages after trade liberalization shows rising wage gap between more-skilled and less-skilled worker, hence indicating increasing inequality.

Opposite evidence of Hecksher-Ohlin model and Stolper Samuelson theorem is also found in Costa Rica by Gindling and Robbins (2001). Using nonparametric approach and applying time series data of 1970 - 1993, they found that trade liberalization in Costa Rica has led to an increase in relative demand of skilled labor to unskilled labor, hence increasing the relative wage. Additionally, they also argued that trade liberalization induces an acceleration of physical capital imports, whereby it raises relative demand through capital-skill complimentarily.

Zhu and Treffler (2001) examined the evidence of Stolper-Samuelson theorem in 29 developing and newly developing countries. They found evidence of dichotomy, by which of those countries, 16 experienced rising inequality and 12 experienced falling inequality after trade liberalization. Of those countries that experienced rising inequality, they proposed that technological spill-over as the cause of positive relationship between rising inequality and export growth.

Goldberg and Pavcnik (2001) examined the impact of trade liberalizations in Colombia, proxied by tariffs, to relative wages between skilled and unskilled workers for the period 1984 – 1998, using Least Squares and Weighted Least Squares approach. Without industry fixed effect, they found that trade protection decreases wage premiums on skilled workers, indicating that the demand for skilled workers increases as the government liberated the economy. With fixed effect, however, they found the opposite results: trade protection increases wage premiums in protected sectors.

Zhang and Zhang (2003) used econometric analysis on panel data set of 28 provinces in China over the period 1986- 1998 and decomposed the growing regional Gini coefficient to several variables, in which they found that foreign trade contributes 11.1% to the growth of regional Gini coefficient and foreign capital contributes 8.1%. Thereby, they concluded that globalization through foreign trade and FDI played an important role in worsening regional inequality in China.

Pal and Ghosh (2007) also examined the regional inequality in India using descriptive observations of time series data from 1980 to 2000. They observed worsening regional inequality, as opposed to widely accepted claims that inequality has decreased in India in the post-liberalization period.

Daumal (2013) confirmed the findings in Pal and Ghosh (2007) by empirically tested through econometrics approach using the same datasets as Pal and Ghosh. The trade openness is proxied by the ratio of trade to GDP for each region, and inequality is proxied by Gini coefficient. She argued that India's export shifted from agricultural products to manufacturing products, which caused the richer regions to experience higher growth than poorer regions that are dominated by agriculture sector.

Similar evidence is found in Vietnam by Thangavelu (2013), where he used econometrics approach to panel of enterprise level dataset. He found that firms adopting new technologies as a response to liberalized trade and investment regime were likely to experience increase in wage gap between skilled and unskilled workers.

Feenstra and Hanson (2001) then initiated the strand of studies focusing on trade in intermediate inputs as a result of global production sharing phenomena, in which they used a simple model of heterogeneous activities within an industry as the potential explanation of increasing wage gap between skilled and unskilled workers in the US. In line with this work, Zhu and Treffler (2005) empirically found the evidence of Feenstra and Hanson's theory in both developed and developing countries.

In contrast to Feenstra and Hanson (2001)'s work, Grossman and Hansberg (2008) conceptualized global production process with improvements in transportation and communication technology, which initiated offshoring phenomena and how it affects factor prices. They argued that productivity effect of 'trading tasks' – as a result of offshoring – benefits the factor whose tasks are more easily moved offshore. Hence, reductions in the cost of trading tasks can generate shared gains for all domestic factors, and wage inequality might fall when the low-skill intensive sector is offshored. Empirical evidence of Grossman and Hansberg (2008)'s theoretical work was conducted by Gonzalez, Kowalski, and Achard (2015), which showed that Global Value

Chain (GVC) participation can reduce wage inequality when it concerns participation related to low-skilled segments of the labor force. They used panel data from World Input Output Database and found that a greater degree of low-skill task offshoring is associated with lower levels of wage inequality, as the wages of low skilled workers rise faster than those of high skilled workers.

Helpman and Itskhoki (2010) then provided the theoretical foundation of the trade's negative impact on wage equality by introducing firm heterogeneity and labor market rigidity. In neoclassical theories of trade offered by Hecksher-Ohlin model and Stolper-Samuelson theorem, wage equalizes as labors move from less-productive sectors to sectors that the country's possesses comparative advantage in. However, rigid labor market is a common phenomenon in many countries, not exclusively only in developing countries, but also in some developed countries, which nullifies the validity of assumptions that labors move freely between sectors. Another constrictive assumption in Hecksher-Ohlin model and Stolper-Samuelson theorem is that there is one firm that represents the whole sector, implying firm homogeneity in one sector. Yet, even within sector, firms differ in their performance, and within firm, skilled and unskilled labors also differ in their performance. Better performing firms are more likely to survive the selection forces of pro-competitive effects of import competition, as well as more likely to engage in international trade, through exporting or importing of production inputs (Pavcnik, 2017).

Nevertheless, even after taking firm heterogeneity into considerations of trade's impact to inequality, empirical evidences vary across countries and cases. Helpman, Itskhoki, Muendler, and Redding (2017) empirically showed the negative effect of trade to wage equality using econometrics on linked employer-employee data for Brazil after extending the heterogenous-firm model of trade and inequality.

Amiti and Cameron (2012) investigated impact of tariff reductions to wage inequality within firms in Indonesia using firm level dataset from 1991 – 2000 in manufacturing sector. They have separated firms that import intermediate inputs, however, they still found that reducing input tariffs reduces the wage skill premium within firms that import intermediate input. However, within each sector, cuts in output or final goods tariffs reduce wages at firms oriented exclusively to the domestic market, but raise wages at firms that export a sufficient share of their output (Amiti and Konings, 2007; Amiti and Davis, 2008).

To sum up, the impact of trade to inequality is nuanced and context specific. They depend on the nature of trade policy changes, trade patterns, as well as the mechanism involved; on the mobility of workers and capital across firms, industries, and geographic locations; and on the position of affected individuals in the income distribution of a country (Pavcnik, 2017). Thus, the impact of trade to inequality is different for each country, as each country has distinct characteristics.

Empirical work on impact of trade to inequality in Indonesia have been shown in Resosudarmo and Vidyattama (2006), Agusalim and Pohan (2018), the aforementioned Amiti and Konings (2007), Amiti and Davis (2008), and Amiti and Cameron (2012). Resosudarmo and Vidyattama (2006) investigated the source of regional income disparity using provincial panel data set for 1993 – 2002 and estimated the model using OLS and fixed effect panel data. Trade openness for each province is proxied by total value of export and import divided by provincial GDP. Other variables included in the model are population growth, financial development, foreign direct investment, and contribution of oil and gas sector. Although they did not explain further, they found evidence of trade's negative impact on regional inequality, e.g. regions with higher trade have lower inequality.

Agusalim and Pohan (2018) analyzed the effect of international trade openness to income inequality at national level using Vector Error Correction Model (VECM). Similar to Resosudarmo and Vidyattama, they also used the ratio of export and import to GDP as a proxy of international trade openness. The results showed that in the short term, trade openness has negative impact significantly on the income inequality, that is, trade reduces income inequality. In the long-run, however, it does not show any significant effect. Additionally, they also showed that the economic growth worsens income inequality, implying the trade-off between growth and inequality.

Both the theoretical works and empirical evidences that had been conducted do not take the inter-sectoral and inter-regional linkages into consideration to analyze the impact of trade to inequality, all the more the empirical evidences found in Indonesia. This study then contributes to the literature of international trade by taking into account inter-sectoral and inter-regional linkages and applies them to find the evidence of how more trade affect income inequality in Indonesia.

CHAPTER III
DATA AND METHODOLOGY

To include inter-sectoral and inter-regional linkages into the equation of international trade and income inequality, this study uses Inter-Regional Input-Output (IRIO) model and Inter-Regional Social Accounting Matrix (IRSAM) model and performs simulations on how increased international trade will affect income inequality through labor productivity link.

The data used in the analysis are obtained from World Input Output Database (WIOD) published by European Commission and Indonesian Social Accounting Matrix published by the Central Bureau of Statistics in Indonesia. WIOD are available from 2000 – 2014, while the most recent Indonesian SAM is 2008. Hence, the Indonesian's profile on international trade will be based on WIOD 2014, while the analysis of its impact on inequality will be based on Inter-regional SAM (IRSAM) Indonesia and Rest of the World (ROW) in 2008. The IRSAM Indonesia-ROW is constructed by integrating Indonesia SAM data and WIOD in 2008. The number of sectors is reduced from 56 sectors in WIOD and 24 sectors in Indonesia SAM to 19 sectors in IRSAM Indonesia-ROW during this integration process as a result of sectoral classification concordance between the two data source (see Appendix). Data on labor productivity in Indonesia is scrutinized on another separated, subsequence chapter.

3.1. Input – Output and Inter-regional Input Output Model

The structure of basic I-O model is in matrix form, with rows representing sectors and factors of production which outputs are consumed by the sectors on columns as intermediate input and consumed by the institutions as final consumptions. Table 1 below displays the I-O table.

Table 1. Input – Output Table

	Sector 1	Sector 2	…	Sector *j*	Direct Consumption	Total Output
Sector 1	x_{11}	x_{12}	…	x_{1j}	Y_1	X_1
Sector 2	x_{21}	x_{22}	…	x_{2j}	Y_2	X_2
:	:	:	⋱	:	:	:
Sector *i*	x_{i1}	x_{i2}	…	x_{ij}	Y_i	X_i
Labor	L_1	L_2	…	L_j		
Capital	K_1	K_2	…	K_j		
Total Input	X_1	X_2	…	X_j		

With: x_{ij} represents the unit of intermediate input from sector *i* consumed by sector *j*

L_j represents the labor input used by sector *j*

K_j represents the capital input used by sector *j*

Y_i represents the direct consumption of goods produced by sector *i*

X_i represents the total input and total output of sector *i*.

It is apparent that the number of *i* should be equal to the number of *j*, since *i* and *j* are both representing sectors within a region or country. Let **X** be a vector of total output, and **Y** be a vector of direct consumption. And suppose there are *N* number of sectors. Hence, both **X** and **Y** are (n x 1) vectors.

The elements of input-output coefficient matrix, or technological coefficient matrix, known as matrix **A**, is calculated by dividing x_{ij} with X_j, which represents the units of intermediate goods from sector *i* required to produce one unit of sector *j*'s output. Thus, **AX** is the matrix of goods for intermediate use. The relationship between total output vector **X**, direct consumption vector **Y**, and intermediate consumption matrix **AX** are shown on the equation 1 below:

$$\mathbf{AX + Y = X}$$

$$\mathbf{Y = X - AX}$$

$$\mathbf{Y = (I - A)\,X}$$

$$\mathbf{X = (I - A)^{-1}\,Y} \qquad (1)$$

The inverted matrix of **(I – A)** is known as Leontief inverse matrix, which elements represent output multiplier that captures the total effect (consists of direct and indirect effect) of 1 additional unit output in sector *j* to sector *i*.

The above I-O model only captures the interaction between sectors within region, but interactions between sectors in different regions are captured in Inter-regional I-O (IRIO) model. In IRIO model, there are G number of regions, and N number of sectors.

Table 2. Inter-regional Input-Output Table

		Region 1			…	Region *r*			Region 1 Final Cons	…	Region *r* Final Cons	Total Output
		Sector 1	…	Sector *j*		Sector 1	…	Sector *j*				
Region 1	Sector 1	x_{11}^{11}	…		…		…	x_{1j}^{1r}	Y_1^{11}		Y_1^{1r}	X_1^1
	:											
	Sector *i*	:						:				
:		:			⋱			:	:		:	:
Region *s*	Sector 1	:						:				
	:											
	Sector *i*	x_{i1}^{s1}	…		…		…	x_{ij}^{sr}	Y_i^{s1}		Y_i^{sr}	X_i^s
Labor		L_1^1			…			L_j^r				
Capital		K_1^1			…			K_j^r				
Total input		X_1^1			…			X_j^r				

Where, x_{ij}^{sr} denotes the amount of intermediate input from sector *i* in region *s* used in sector *j* in region *r*

Y_i^{sr} denotes the region *r*'s final or direct consumption of sector *i* in region *s*.

L_j^r denotes the amount of labor used as input in sector *j* in region *r*

K_j^r denotes the amount of capital used as input in sector *j* in region *r*

X_i^s denotes the total output of sector *i* in region *s*.

It is then clear to calculate regional's export and import from the table above. In regards of global production network, however, it is important to estimate the value-added trade instead of simple export-import trade balance. To calculate foreign value-added (FVA) and domestic value-added, another matrix has to be drawn from IRIO table, which is commonly known as **V** matrix, or matrix of value-added coefficient matrix. **V** matrix can be obtained by summing across rows of the **A** matrix, or technological input-output matrix, putting these elements on the diagonal of a square matrix, and subtracting it from an identity matrix of size *GN* x *GN:*

$$\boldsymbol{V} = I_{GN\times GN} - diag\left(\sum_{s}^{GN} A_{s1} \cdots \sum_{s}^{GN} A_{sGN}\right) \tag{2}$$

After obtaining **V** matrix, matrix of export-value added, **T,** is obtained from the following formula:

$$\boldsymbol{T} = \{(t_{ij}^{sr})\} = \boldsymbol{V} \times (\boldsymbol{I} - \boldsymbol{A})^{-\mathbf{1}} \times diag(e_1 \dots e_{si}) \tag{3}$$

Where e_{si} is the total export of sector *i* in region *s*. The DVA and FVA for each region can be calculated from **T** matrix. One restrictive assumption needed to be underlined in constructing value-added matrix **T** is that region applies similar technology between domestic production and export production.

The DVA for sector *j* in region *r* can be calculated by summing the elements in **T** matrix across rows of all sectors in region *r* under column *j* and region *r*, and the FVA for sector *j* in region *r* can be calculated by summing the elements in **T** matrix across rows of all sectors in other regions (*r'*) under the column of sector *j* and region *r*.

$$DVA_j^r = \sum_i \boldsymbol{t}_{ij}^{sr}\,; \quad s = r \tag{4}$$

$$FVA_j^r = \sum_s \sum_i \boldsymbol{t}_{ij}^{sr}\,; \quad s \neq r \tag{5}$$

3.2. Social Accounting Matrix

Input – Output model or Interregional Input-Output model capture both the direct and indirect impact on outputs in the economy(ies) of a particular shock. But neither of the model shows the impact of a shock on the people, which is captured by Social Accounting Matrix (SAM) model. SAM is defined as an organized matrix representation of all transactions and transfers between different production activities, factors of production, and institutions (households, corporate sector, and government) within the economy and with respect to the rest of the world (Kim, 2008).

Table 3. Structure of Social Accouting Matrix Table

	Factor of Production (F)	**Institution (I)**	**Production sector (P)**	**Capital (K)**	**ROW**	**Total**
Factor of production	0	0	$\mathbf{X_{13}}$	0	$\mathbf{E_{15}}$	$\mathbf{Y_1}$
Institution	$\mathbf{X_{21}}$	$\mathbf{X_{22}}$	0	0	$\mathbf{E_{25}}$	$\mathbf{Y_2}$
Production sector	0	$\mathbf{X_{32}}$	$\mathbf{X_{33}}$	$\mathbf{E_{34}}$	$\mathbf{E_{35}}$	$\mathbf{Y_3}$
Capital	0	$\mathbf{R_{42}}$	0			
ROW	$\mathbf{R_{51}}$	$\mathbf{R_{52}}$	$\mathbf{R_{53}}$			
Total	$\mathbf{Y_1'}$	$\mathbf{Y_2'}$	$\mathbf{Y_3'}$			

Where matrix $\mathbf{X_{13}}$ represents the value-added input for each of the production sectors

Matrix $\mathbf{X_{21}}$ represents the allocation of factor income for each institution

Matrix $\mathbf{X_{22}}$ represents the transfer between institutions

Matrix $\mathbf{X_{32}}$ represents the consumption of final good by each institution

Matrix $\mathbf{X_{33}}$ represents the intermediate input consumption by each production sector

Vector $\mathbf{R_{42}}$ shows the savings by each institution

Vector $\mathbf{R_{51}}$ shows foreign factor productions used by domestic sectors.

Vector $\mathbf{R_{52}}$ shows the transfer abroad by domestic institutions

Vector $\mathbf{R_{53}}$ shows the import by production sectors

Vector $\mathbf{E_{34}}$ shows the investment for each production sector

Vector $\mathbf{E_{15}}$ shows the domestic factor income from abroad

Vector $\mathbf{E_{25}}$ shows income transfer originated from abroad

Vector $\mathbf{E_{35}}$ shows the export

Column vector $\mathbf{E_{ij}}$ and row vector $\mathbf{R_{ij}}$ are commonly considered as exogenous variables in a typical SAM model. By similar procedures as output multiplier calculation in I-O, the multiplier from SAM data, known as accounting multiplier, can also be calculated. Let $\mathbf{A_{ij}}$ to be the technological matrix, obtained by dividing each element by the total column in SAM table. Hence, we have $\mathbf{A_{13}}$, $\mathbf{A_{21}}$, $\mathbf{A_{22}}$, $\mathbf{A_{32}}$, and $\mathbf{A_{33}}$. The multiplier generated from SAM table, known as accounting multiplier[2], is generated by the similar procedure as in I-O model:

$$\boldsymbol{X}_{13} + \boldsymbol{E}_{15} = \boldsymbol{y}_1$$

$$\boldsymbol{A}_{13}\boldsymbol{y}_1 + \boldsymbol{E}_{15} = \boldsymbol{y}_1$$

$$\boldsymbol{y}_1 = (I - \boldsymbol{A}_{13})^{-1}\boldsymbol{E}_{15} \tag{6}$$

$$\boldsymbol{X}_{21} + \boldsymbol{X}_{22} + \boldsymbol{E}_{25} = \boldsymbol{y}_2$$

$$\boldsymbol{A}_{21}\boldsymbol{y}_1 + \boldsymbol{A}_{22}\boldsymbol{y}_2 + \boldsymbol{E}_{25} = \boldsymbol{y}_2$$

$$\boldsymbol{y}_2 = (I - \boldsymbol{A}_{22})^{-1}\boldsymbol{A}_{21}\boldsymbol{y}_1 + (I - \boldsymbol{A}_{22})^{-1}\boldsymbol{E}_{25} \tag{7}$$

$$\boldsymbol{X}_{32} + \boldsymbol{X}_{33} + \boldsymbol{E}_{34} + \boldsymbol{E}_{35} = \boldsymbol{y}_3$$

$$\boldsymbol{A}_{32}\boldsymbol{y}_2 + \boldsymbol{A}_{33}\boldsymbol{y}_3 + \boldsymbol{E}_{34} + \boldsymbol{E}_{35} = \boldsymbol{y}_3$$

$$\boldsymbol{y}_3 = (I - \boldsymbol{A}_{33})^{-1}\boldsymbol{A}_{32}\boldsymbol{y}_2 + (I - \boldsymbol{A}_{33})^{-1}\boldsymbol{E}_{34} + (I - \boldsymbol{A}_{33})^{-1}\boldsymbol{E}_{35} \tag{8}$$

3.3. Interregional SAM

Social accounting matrix that also captures all those transactions between economies or regions are called interregional SAM. The structure of IRSAM is similar to SAM, with additional regional blocks that shows transfer between regions.

Table 4. IRSAM Indonesia – Rest of the World

[2] For the purpose of this paper, only unconstrained multiplier is calculated.

		Indonesia (1)			ROW (2)			Exogen C	Total
		F	I	P	F	I	P		
Indonesia (1)	F			X_{fp}^{11}	X_{ff}^{12}				Y_f^1
	I	X_{if}^{11}	X_{ii}^{11}			X_{ii}^{12}		E_i^{C1}	Y_i^1
	P		X_{pi}^{11}	X_{pp}^{11}		X_{pi}^{12}	X_{pp}^{12}	E_p^{C1}	Y_p^1
ROW (2)	F	X_{ff}^{21}					X_{fp}^{22}		Y_f^2
	I		X_{ii}^{21}		X_{if}^{22}	X_{ii}^{22}		E_i^{C2}	Y_i^2
	P		X_{pi}^{21}	X_{pp}^{21}		X_{pi}^{22}	X_{pp}^{22}	E_p^{C2}	Y_p^2
Exogen R			E_i^{R1}	E_p^{R1}		E_i^{R2}	E_p^{R2}		
Total		Y_f^1	Y_i^1	Y_p^1	Y_f^2	Y_i^2	Y_p^2		

Similar procedures to calculate accounting multiplier in SAM model are applied in IRSAM to calculate accounting multiplier in IRSAM model. As aforementioned, IRSAM Indonesia-ROW are built by integrating the national Indonesia SAM in 2008 and WIOD 2008. The concordance for production sectors between the two datasets is provided in the Appendix. Some assumptions are applied in the IRSAM construction:

1. Wealth transfer between institutions in ROW are to have the same pattern as domestic transfer between institutions in Indonesia

2. ROW's institutional pattern of final good consumption from ROW's production follows Indonesia's institutional pattern of final good consumption from Indonesia's production. Its total value is obtained from WIOD.

3. ROW's institutional pattern of imported final good consumption from Indonesia follows Indonesia's institutional pattern of imported final good consumption from ROW. Its total value is obtained from WIOD.

4. Sectoral value-added distribution between production factors in ROW follows the pattern in Indonesia.

5. The value of ROW's total saving is obtained from Indonesia's total saving, scaled by the ratio of total ROW's factor income to total Indonesia's factor income.

6. Tax on sectors in Indonesia is obtained from tax rate implied in SAM Indonesia (estimated by sectoral tax divided by total domestic output, added with sectoral import tax divided by total imported commodities), multiplied by total output in Indonesia.

7. Tax on institutions in ROW is estimated by taking the total tax in Indonesia, scaled by the ratio of total ROW's factor income to total Indonesia's factor income.

8. Sectoral tax in ROW is calculated by percentage of sectoral subsidy to total subsidy, multiplied by total tax of ROW calculated previously.

In order to improve the accuracy of the simulations for policy recommendations, financial accounts are added to the matrix: capital accounts of each institutions, government bonds, and other financial instruments. The data is obtained from Indonesian FSAM, for which the latest data is 2005; hence we use the proportions of each account to apply to the IRSAM Indonesia-ROW on table 4. [3]

[3] Additional assumption on this IRSAM modification is that there is no pattern change in capital holdings across institutions, savings, institutional investment across sectors, financial instrument holdings across institutions between 2005 and 2008.

3.4. Model Simulations

This paper will analyze the impact of international trade to inequality taking into account the inter-sectoral and inter-regional linkages. Hence, two initial simulations are performed to capture the effects: increase final good exports to each sector and increase export of intermediate input goods. Further simulations are performed to analyze the effect of the recommended government policies by Ministry of National Development Planning (2019), which are tax break to manufacturing sectors that promotes human capital improvement. First, we assume that the firms respond by adjusting their investment level, for which this scenario is called ‘Business as usual’. Then, we assume that the firms respond the tax break in an extremely positive manner, where they translate the tax break from the government to productivity improvement of all labor (called non-targeting labor improvement), or only unskilled labor (called targeting labor improvement). Afterwards, we also simulate additional scenarios if the government gives the tax break to other sectors than manufacturing sectors, to identify which sectors that generate the best results in terms of equality and efficiency. Table 5 shows the model simulations specifications for each simulation.

Table 5. Model simulations specifications

No	Simulations	Exogenous Variable
1	Export of final good: Indonesian's export of final good increases by 1 billion USD for each sector	Institutions in ROW (all at once)
2	Export of intermediate input: Indonesia's export of intermediate input increases by 1 billion USD for each sector's export to Forestry sector in ROW	ROW's Forestry sector
3	Selective tax break to promote manufacturing sectors	
3a	Business-as-Usual i. Constant government budget: Tax payment for manufacturing sectors are reduced by 1 billion USD which is responded by investment increase in manufacturing sectors, tax payment for forestry or mining sectors are raised by the same amount to fund the tax break and responded by the firms in the opposite manner. ii. Government budget deficit: Tax payment for manufacturing sectors are reduced by 1 billion USD, foreign loan through government bonds are increased by the same amount.	Indonesian firms' capital. Indonesian firms' capital, ROW firms' capital, Indonesia's government
3b	Guided tax break without targeting i. Constant government budget: Tax payment for mining or forestry sectors are raised, responded by decreasing investment in these sectors. Tax break to manufacturing sectors are responded by productivity improvement of all types of labor. ii. Government budget deficit: Tax payment for manufacturing sectors are reduced by 1 billion USD, responded by productivity improvement of all types of labor, foreign loan through government bonds are increased by the same amount.	Indonesian firms' capital, Indonesia's production sectors (Manufacturing sector) Indonesia's production sectors (manufacturing sectors), and ROW firms' capital
3c	Guided tax break with targeting i. Constant government budget: Tax payment for mining or forestry sectors are raised, responded by decreasing investment in these	Indonesian firms' capital, Indonesia's production

	sectors. Tax break to manufacturing sectors are responded by productivity improvement of unskilled labor. ii. Government budget deficit: Tax payment for manufacturing sectors are reduced by 1 billion USD, responded by productivity improvement of unskilled labor, foreign loan through government bonds are increased by the same amount.	sectors (Manufacturing sector) Indonesia's production sectors (manufacturing sectors), and ROW firms' capital
4 4a 4b	<u>Unselective tax break</u> *Constant government budget:* i. Stage 1: tax payment from firms are raised by 1 billion USD, firms' investment to all sectors decreases by the same amount in total ii. Stage 2: labor compensation for agriculture labor and manual labor is increased by 1 billion USD in total, and government revenue decreases by the same amount *Government budget deficit:* Manufacturing sectors receive tax break of 1 billion USD from the government and the firms responded by improving labor productivity. Foreign loan through government bonds are increased by the same amount.	 Indonesia's firms Indonesia's production sectors and government's tax ROW firms' capital and Indonesia manufacturing sectors.
5 5a 5b	<u>Selective tax break to promote other sectors</u> Constant government budget: tax payment from mining sector is increased by 1 billion USD for the funding of tax break to other sectors. Firms respond to tax payment by adjusting their investment to each respective sector. Government budget deficit: Tax payment from each sector is reduced by 1 billion USD, which is responded by the firm with increasing their investment level to their associating sectors.	 Indonesia firms' capital Indonesia firms' capital, Indonesia's government, and ROW firms' capital.

The first simulation, increasing export of final good by 1 billion USD, is to be performed for each tradeable sector. Because there are 19 production sectors in the IRSAM built for this study, only 9 of them are tradeable sectors, hence the simulations are performed for 19 times, giving each sector 1 billion USD increased in export of final goods. The second simulation on intermediate good export increase only simulates the increase of intermediate good export from each tradeable sector to only forestry sector abroad, in other words, the exogenous column for this simulation is only ROW's forestry sector. This was done for technical reason: to increase the intermediate good export, ROW's production sectors need to be held exogenous, which means that the inter-regional linkages cannot be captured in the simulation result. Hence, the simulation only holds forestry sector, which has the least backward- and forward- linkages between Indonesia and ROW.

The third simulation calculates the impact of government's selective tax break to promote manufacturing sectors. The term 'selective' represents government intention to implement tax break to only a certain sector, and in this third simulation, it is manufacturing sectors. The underlying basic assumption on these simulations is that firms that adjust their investment behavior according to government tax policy. Hence, under 'Business-as-Usual' scenario, tax break given to manufacturing sector will increase firm's investment in manufacturing sectors, and if it is funded by mining or forestry sectors' tax payment, then firm's investment in mining or forestry sectors decreases by the same amount. However, if the government provides guidance along with tax break and the firms respond in extremely positive manner, hence the tax break will translate directly to improve labor productivity in manufacturing sectors. The manner in which labor type whose productivity is improved refers to the term either 'targeting' or 'non-targeting'. If the firms improve the productivity of all labor type, both skilled and unskilled, through tax break, then it is a non-targeting labor productivity improvement. But if the firms improve the productivity of only the unskilled labor type, consisting of agriculture labor and manual labor only, then it is a targeting labor productivity improvement.

The fourth simulation calculates the impact of government's unselective tax break, which means that the tax breaks are implemented to all sectors, and responded by the firms in an extremely positive manner by improving human capital or labor productivity value added uniformly or non-uniformly across labor types for 1 billion USD in total. This simulation is run also under two different assumptions, constant government budget and government budget deficit. Under constant government budget, the simulation is conducted with three stages of exercises. New IRSAM is generated after every stage using RAS[4] method.

The fifth simulation then calculates the implementation of tax break to promote other sectors than manufacturing sectors in comparison with manufacturing sectors. These simulations are conducted for the reason of policy recommendations: identifying the sector in which firms' realistic behavior towards government tax break generates the best results in terms of income distribution and trade balance.

Figure 4 shows the hypothesized mechanism of how change in one node affects the others. First, increase in export implies there is demand increase from ROW to

[4] RAS is a method to balance out the matrix, detailed explanation and procedure can be read from Parikh (1979)

production sectors. Then, increase in production sectors' output means increase the use of production factors across all types: non-labor input or capital, skilled labor, and unskilled labor, which implies increasing factor income, and thus the total income of the households, which is obviously varies across household types, hence the change in income inequality.

If the government implements tax break under constant budget account, it will affect production sectors' patterns, and hence the use of production factors. On the other hand, if the government implements tax break by receiving foreign loan, there will be flow of money coming from ROW node to government, and from government to production sectors, without the government imposing any additional tax payment from any of the production sectors. Hence, there will be differences in which production factors are affected, and with that, which household categories are affected the most.

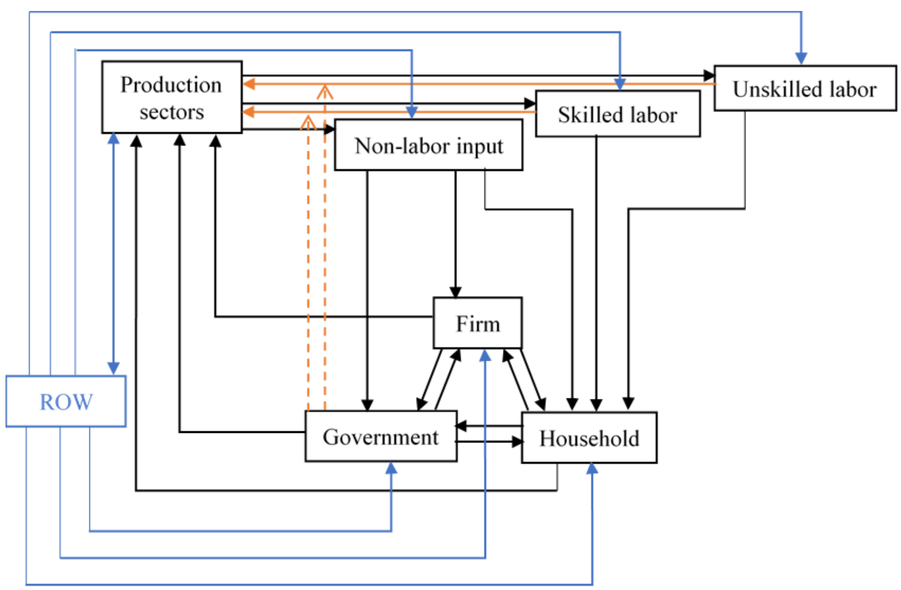

Figure 4. Interrelationship between factor input, production sectors, institutions, and ROW

Human capital improvement dictated by the government will affect the contribution of labor input to sectoral outputs, shown red colored line in figure 4. Then, it will affect the factor income to households, hence the income inequality changes. If the government decides to improve the human capital by raising the tax from firms, the firm will reduce its investment on production sectors, and thus will also affect the output level of production sectors. On the other hand, if the government receives foreign loan to fund the human capital improvement, then there is only positive effect on the production sectors since there will be no agents within the economy that reduces their final demand on outputs.

Lastly, it is important to note that, simulation by using matrix operations are all linear, hence the amount of increase for export and labor productivity does not matter as much, as I only intend to analyze the *pattern*, not the *level* of changes, should there be a change in trade policy.

CHAPTER IV
STYLIZED FACTS OF INDONESIA

This chapter describes of Indonesia's trade structure, inter-sectoral and inter-regional linkages with countries abroad, sectoral labor productivity in 2014, and income inequality in 2008. In addition to give the backgrounds of Indonesian economic characteristics relevant for this study, this chapter is also intended to give rationalization of using IRSAM to analyze the trade impacts to income inequality in Indonesia.

4.1. Trade Structure in Indonesia

In 2014, the biggest exporting sector in Indonesia is mining, accounting for 28.4% of the total export, followed by metal industry, food, chemical, and textile industries, with each account for 23.2%, 15.7%, 13.5%, and 9.5% respectively. Intuitively, primary sectors should have lower foreign value added (FVA) in their export compare to secondary sectors such as manufacturing, which is apparent in Figure 5: agriculture, forestry, fishing, and mining sectors all have relatively lower FVA component in their export compare to food, textile, wood, metal, and chemical industries. Among the primary sector, FVA component in mining sector is the highest, 8.3% of its export; while agriculture, forestry, and fishing sector's FVA are only 4.1%, 3.3%, and 3.2% respectively. On the other hand, manufacture of textiles, metal, and chemical products have relatively high FVA component, reaching 28.3%, 26.9%, and 24.3% of their export respectively. Manufacture of food and wood products, despite being secondary sectors, have considerably lower FVA, accounting for 10.5% and 10.9% of their exports. All of these sectors' FVA component, however, have been increasing since 2009.

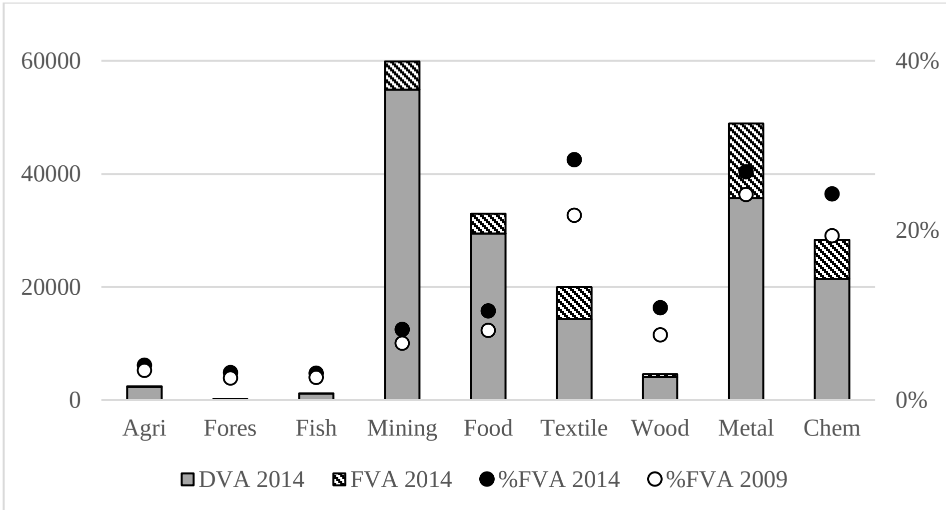

Figure 5. Value added component in Indonesia’s Export (billion USD)
Source: Author’s calculation on WIOD

In addition to the increasing FVA since 2009 for all sectors, all of these sectors also contain high percentage of FVA-Service (figure 6), meaning that the service input in these sectors are mostly originated from abroad, which indicates the gloomy future for these sectors to develop or improve their quality. Activities such as research and development, marketing, advertisement, transportation, etc. – which are included in service sector – are the key for product complexity enhancement and improvement in competitiveness. Dependence on foreign-service sector on these activities will hamper such potential, and unfortunately, we observe increasing trend of FVA-Service percentage in export for all sectors in Indonesia.

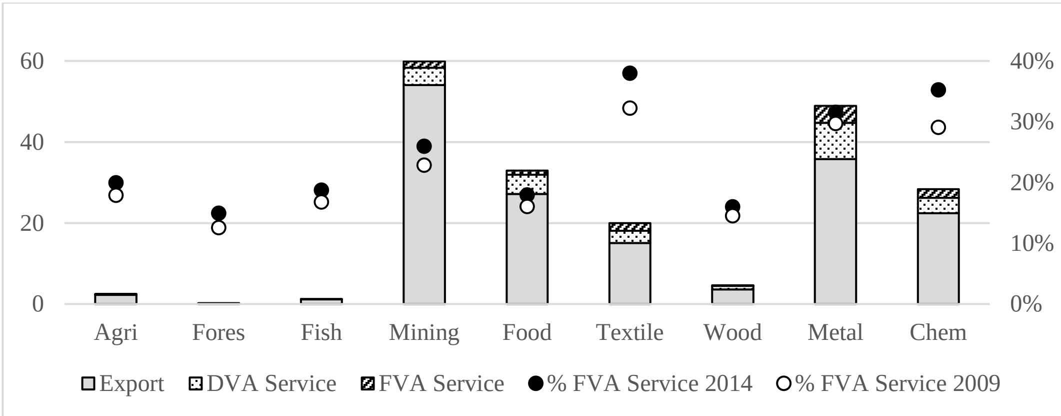

Figure 6. Service value added component in Indonesia's export (billion USD)
Source: Author's calculation on WIOD

In terms of the type of goods that these sectors export, manufacture of wood product sector exports mainly final goods, reaching a ratio between final good to input good of 38.3; followed by mining sector, with ratio final goods to input good exports of 17.2 (figure 7). Among the primary sector, fishing sector produce the lowest ratio of final good to input good export, only reaching to 0.92. On the other hand, manufacture of textile product's ratio is as low as 0.32; followed by ratio of 1.45 by manufacture of metal product and 2.73 by manufacturing of food products. These ratios on forestry, fishing, manufacture of food product, metal product, and chemical product have been decreasing since 2009, while the ratio of final good to input good export in fishing sector, manufacture of wood product, and manufacture of textile has been volatile, with a hint of increasing trend.

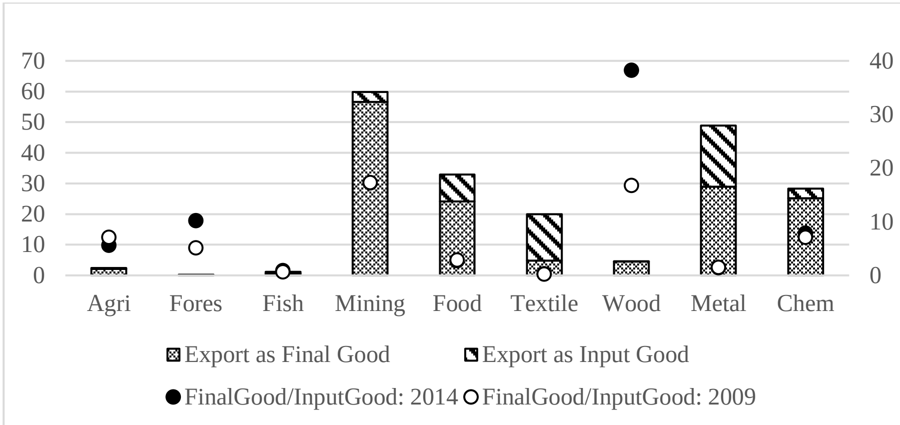

Figure 7. Export of final goods and intermediate input of Indonesia (billion USD)
Source: Author's calculation on WIOD

To sum up, there are significant portion of FVA in most of sectoral exports, and it has been increasing since 2009 for all sectors. There is not much potential for these sectors to improve their quality or competitiveness in the future as high portion of service inputs they use are foreign input. The types of exported goods are also dominated by intermediate goods, and the portion of final good in export have declined for most of the sectors.

As for Indonesia's import, the five biggest importing tradeable sectors in Indonesia in 2014 is metal industry, chemical industry, food industry, mining, and textile industry (figure 8). Metal industry dominates as high as 19.2% of total import by sector, and a considerably high percentage, 45.3% of it is used for exporting. However, the highest percentage of import used for export are contained by textile industry, in which 69.9% of its import are used for exporting. Manufacture of wood and chemical products also have high percentage of import-to-export (I2E), reaching 53.06% and 47.07% respectively.

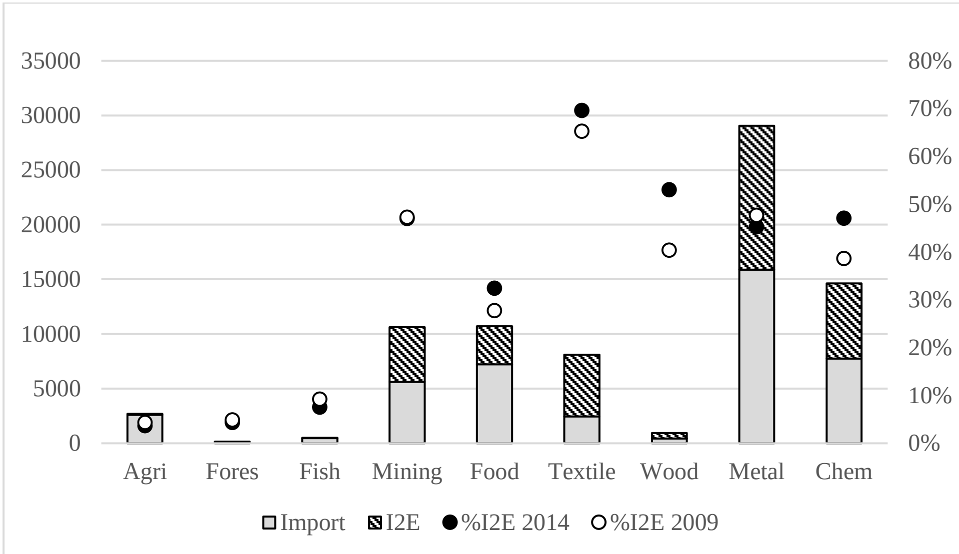

Figure 8. Sectoral import and import-to-export component in Indonesia (billion USD)
Source: Author's calculation on WIOD

However, manufacture of food products, even though its import is the third biggest among other sectors, only a small amount of its import is used for export, 32.43% of I2E. Also, the percentage of I2E in import have been declining for almost of all sectors, with exceptions on food, textile, wood, and chemical industry. These imply that most of the sectors are increasing their focus more on domestic market, instead of selling their output abroad, which also indicate that they are losing competitiveness to sell globally. Meanwhile, if we look at the types of good imported (figure 8), the top five most imported goods to Indonesia are metal goods, mining products, chemical products, food, and textile products. Unfortunately, most of the imported fish are consumed directly as final good, only 54.21% are used for production, even though Indonesia should have advantage over resource-intensive products. Similar analysis applies for imported food products. Indonesia imports food products, which are resource-based manufacturing products, mostly as final goods, not intermediate goods that can be processed further.

Unfortunately, except for metal products, these numbers have been declining since 2009, which implies that Indonesia have been importing more final goods instead of importing goods that are more productive.

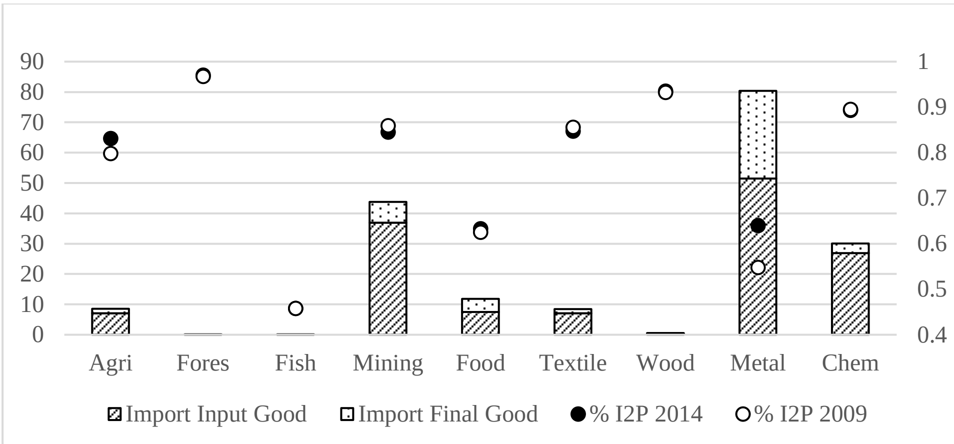

Figure 9. Total import based on origin sectors and import-to-produce component in Indonesia (billion USD)
Source: Author’s calculation on WIOD

Given the preceding description on Indonesia’s trade structure, I simulated the increase of final good export to China by 1 billion USD to observe the resulting balance of trade. One billion USD increase in final good export to China does not straightly translate to one billion USD improvement in Indonesia’s trade balance, as Indonesia’s export productions require imported input also from China. In 2014, Indonesia experienced deficit trade balance against China by 2905.65 billion USD. Figure 10 shows the change in Indonesia’s balance of trade after final good export to China increased by 1 billion USD.

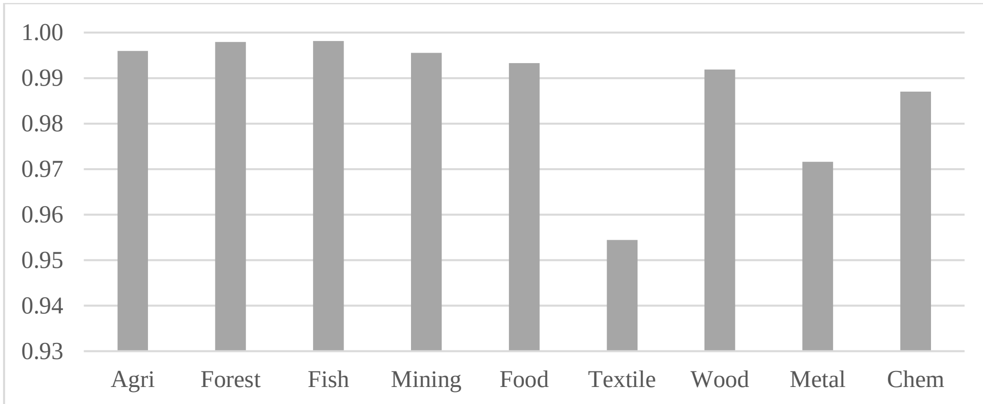

Figure 10. Change of balance of trade after additional one billion USD final export to China
Source: Author's calculation on WIOD

In line with the previous findings on FVA component in export and I2E in import, increase final good export of manufacturing sectors such as food, textile, wood, metal, and chemical products are not translated directly to improvement in balance of trade by 1 billion, in particular for textile, metal, and chemical products. Increase in textile final good export by 1 billion only improves balance of trade by 954 million USD; increase in metal final good export by the same amount improves balance of trade by 972 million USD; increase in chemical final good export will improve balance of trade by 987 million USD. These numbers seem modest in comparison with improvement in balance of trade when final good export increases in agriculture, forestry, fishing, and mining sector: increase of final good exports in these sectors by 1 billion USD improve the balance of trade by 996 million USD, 998 million USD, 998 million USD, and 996 million USD respectively. These results, combined with decomposition of Indonesia's export, indicate the vulnerability of Indonesia's trade structure.

4.2. Inter-Sectoral and Inter-Regional Linkages in Indonesia

One indicator that can capture the inter-sectoral and inter-regional connectedness and therefore, the linkages, is Coefficient of Interdependence (COI), which can be calculated by summing the backward linkages weighted by the sectoral output size as a percentage of total output. Hence, higher COI implies higher connectivity between sectors. Figure 11 shows the Coefficient of Interdependence (COI) between sectors in Indonesia, between Indonesia and China, and between Indonesia and China. The COI within Indonesia has been decreasing since 2000, while COI between Indonesia and China, and also between Indonesia and ROW have increasing trend since 2000.

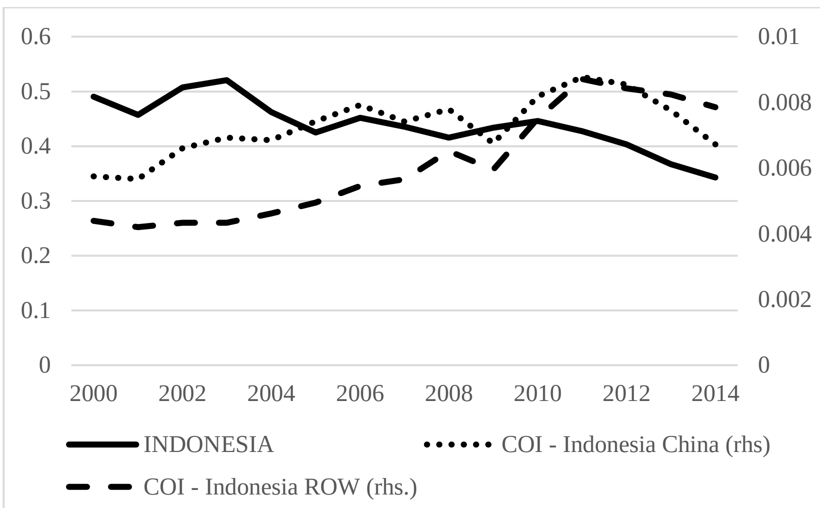

Figure 11. Coefficient of Interdependence
Source: Author's calculation using WIOD

The COI between Indonesia and China, and between Indonesia and ROW seem to move in parallel with agriculture raw material global price, coal price, and metal price index (figure 12). As price of agriculture raw material, coal, and metal show increasing trend before it fell in 2009, COI of Indonesia-China and Indonesia-ROW also increased.

Furthermore, decreasing commodity price in the period of 2011-2014 is also followed by decreasing COI of both Indonesia-China and Indonesia-ROW. The seemingly-associated COI and commodity prices can be explained by looking at the products that Indonesia mostly trades with China and ROW. As shown in figure 5 and figure 9, Indonesia exports mainly mining products, metal and food products; and imports mainly metal product. China being the main importer of Indonesia – 22% of the total import, and one of export destination – 18% of the total export, are the main importer for metal products, and main export destination also for metal products, its COI with Indonesia shows more linearity with metal price index.

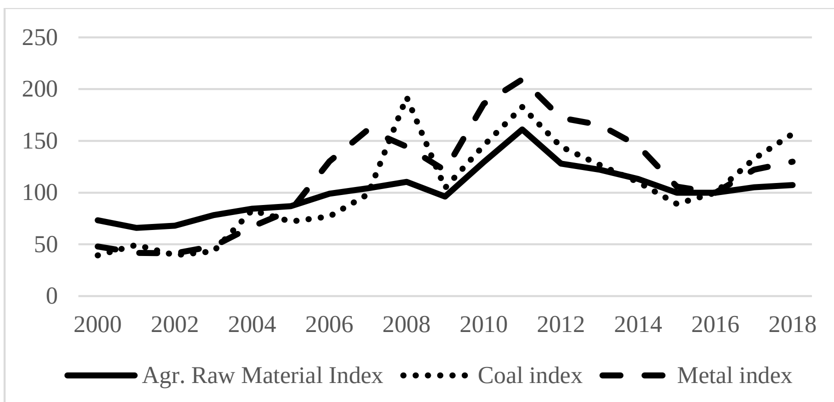

Figure 12. Global Primary Commodity Price
Source: International Monetary Fund, Global Price Index, retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/PALLFNFINDEXQ, April 28, 2019.

One possible explanation of linearity between COI and price index is that price increase raises the trade value, given the trade volume constant. Hence, price changes also seemingly affect the connectivity between two countries, even though the volume might not change. Nevertheless, the fact that COI within Indonesia falls at the same time COI between Indonesia-ROW and Indonesia-China increases shows that inclusion of inter-sectoral and inter-regional linkages to the analysis of trade's impact on inequality is integral and relevant to the current economy.

Another way to utilize IRIO data in regards to trade is to analyze which country gains more from liberalization of the economy, defined as the country that has larger backward linkage from the opposite country than the opposite country's backward linkage from the latter. Since backward linkage of a sector from another sector is case-specific, hence identification of country that gains more from trade is also case-specific. Figure 13 shows the number of cases where Indonesia gains more than China and vice versa from trade between Indonesia and China[5]. Starting from 2000, the number of cases where Indonesia gains more than China from the bilateral trade between the two countries has already been far behind China, and unfortunately for Indonesia, this number keeps falling, from 514 cases in 2000 to only 289 cases in 2014; as opposed to China's increasing number of winning cases: 1968 cases in 2000 to 2193 cases in 2014.

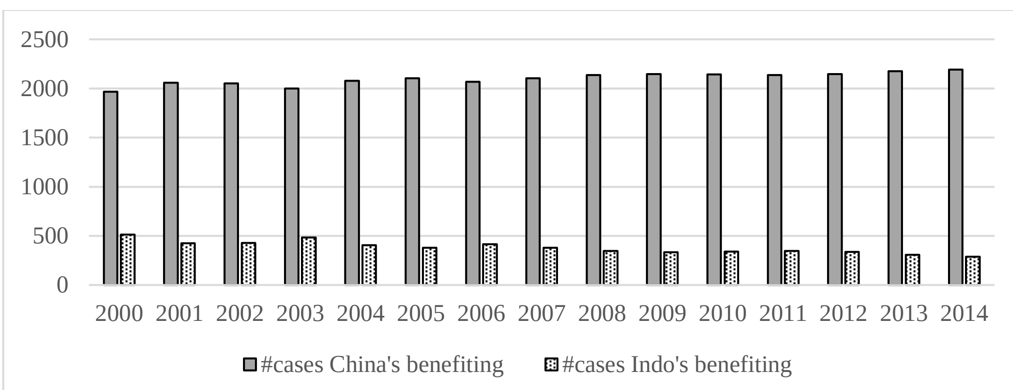

Figure 13. China VS. Indonesia: Number of winning cases
Source: Author's calculation on WIOD

[5] For accuracy, the number of sectors used in this particular analysis is 59, as provided directly by WIOD.

Sectors in which Indonesia won over China for at least 3 cases (out of 56 cases in each sector) in 2000 are Forestry, Mining, Manufacturing of Food, Textile, Wood, Paper, and Coke products. In 2008, it shrank to only Agriculture, Forestry, Fishing, Mining, Manufacturing of Food, and Paper products. And in 2014, only three sectors in Indonesia that receive higher backward linkage from China than the other way around, Fishing, Mining, and Manufacturing of Food products.

4.3. Income Distribution in Indonesia

The baseline of the income distribution in Indonesia among institution is captured from the original IRSAM. The institutions recorded in IRSAM are: 1) labor agriculture (henceforth, agri-labor); 2) entrepreneur agriculture (agri-entrepreneur); 3) lower class entrepreneur, peddler, unskilled labor, and small proprietaries in rural areas (rural-low); 4) not in labor force and unclassified categories in rural areas (rural-other); 5) upper class, non-agriculture entrepreneur, managers, military, professional, technician, teachers, and large proprietaries in rural areas (rural-high); 6) lower class entrepreneur, peddler, unskilled labor, and small proprietaries in urban areas (urban-low); 7) not in labor force and unclassified categories in urban areas (urban-other); 8) upper class, non-agriculture entrepreneur, managers, military, professional, technician, teachers, and large proprietaries in urban areas (urban-high); 9) Firms; and 10) Governments.

Table 6. Income Distributions among Households in Indonesia

Household category	Population	Total Income (in billion USD)	Income per capita (in thousand USD)
Agri – labor	29,528,312	19.25	0.65
Agri – entrepreneur	64,059,279	76.33	1.19
Rural – low	36,823,295	56.43	1.53
Rural – other	11,512,932	18.38	1.60
Rural – high	16,040,849	49.98	3.12
Urban – low	37,854,941	78.49	2.07
Urban – other	12,456,635	26.82	2.15
Urban – high	20,247,059	92.19	4.55

Source: Social Accounting Matrix Indonesia, published by Statistics Indonesia

Among the households, the rural-other has the smallest total expenditure in aggregate levels, US$ 18.38 billion; while urban-high has the highest total expenditure in aggregate levels, US$ 92.19 billion in 2008. However, taking the expenditure per capita of each category reveals that households with lowest expenditure per capita is agri-labor, while households with highest expenditure per capita is still urban-high. Table 6 above shows the income on every household category, both in aggregate terms and per capita level.

Table 7. Income Distribution Indices and Baseline Levels

Inequality	Indicators	Baseline
Gini index		0.289
MLD		0.141
MLD Decomposition – Between group inequality		0.0907
MLD Decomposition – Within Agriculture inequality		0.0361
MLD Decomposition – Within Rural inequality		0.0509
MLD Decomposition – Within Urban inequality		0.0677
General	$\frac{urban\_high}{agri\_labor}$	7.0
Within agriculture	$\frac{agri\_entrepreneur}{agri\_labor}$	1.8
Between Urban and Rural	$\frac{\mu_{urban}}{\mu_{rural}}$	1.4
Within Urban	$\frac{urban\_high}{urban\_low}$	2.2
Within Rural	$\frac{rural\_high}{rural\_low}$	2.0

Source: Author's calculation

As aforementioned, there are two types of inequality measures that are used in in this paper to analyze the income distribution: inequality indexes using Gini index, MLD, and MLD decomposition, and income ratios: general inequality, within agriculture, between urban and rural, within urban, and within rural. Table 7 shows that regarding the decomposition of MLD, between-group inequality dominates the overall inequality, accounting for 64.3% of the overall inequality. This is predictable because the limited variation within the partitions by construction of the data availability and the formula.

As of income ratios, because the general inequality is proxied by taking ratio of the highest per capita expenditure to the lowest per capita expenditure among the household categories, the indicator for general inequality are calculated by dividing urban-high to agri-labor. Table 7 shows the formula for each inequality indicators and their baseline levels.

CHAPTER V

LABOR PRODUCTIVITY IN INDONESIA

While labor productivity is the central argument of this thesis, the author noticed that there is an issue of difference in Indonesia labor productivity trends depending on the data source. This chapter scrutinizes further the sources of those data, and precedingly, the connection between human capital, labor productivity, and labor compensation, which will explain why human capital improvement is reflected by increasing labor value added.

5.1. Measurement of Labor Productivity

Labor productivity is a measure of economic performance that show the level of goods and services (output) produced by each labor input, which also equals to the average product of labor. Assume that there are only two factor productions, capital and labor, in production function *F(K, L),* to produce output *Y*. In the short run, it is easier for the firm to adjust the number of labors hired, *L*, rather than capital, *K*. Focusing on the labor factor, the average product of labor, or the labor productivity is formulated as the following:

$$APL = \frac{F(K,L)}{L} = \frac{Y}{L} \tag{9}$$

Another measure of production is marginal productivity, which measure the additional output that can be produced by adding 1 unit of labor input:

$$MPL = \frac{\Delta F(K,L)}{\Delta L} = \frac{\Delta Y}{\Delta L} \tag{10}$$

Then, the law of diminishing marginal returns, which holds for most of production functions, states that as the use of an input increases in equal increments (with other input fixed), a point will eventually be reached at which the resulting additions to output decrease (Pindyck & Rubinfeld, 2014). This point is reached when MPL equals APL or labor productivity. When MPL is less than APL, MPL will continue to increase, and when MPL is more than APL, MPL will decrease, which can be shown in figure 14.

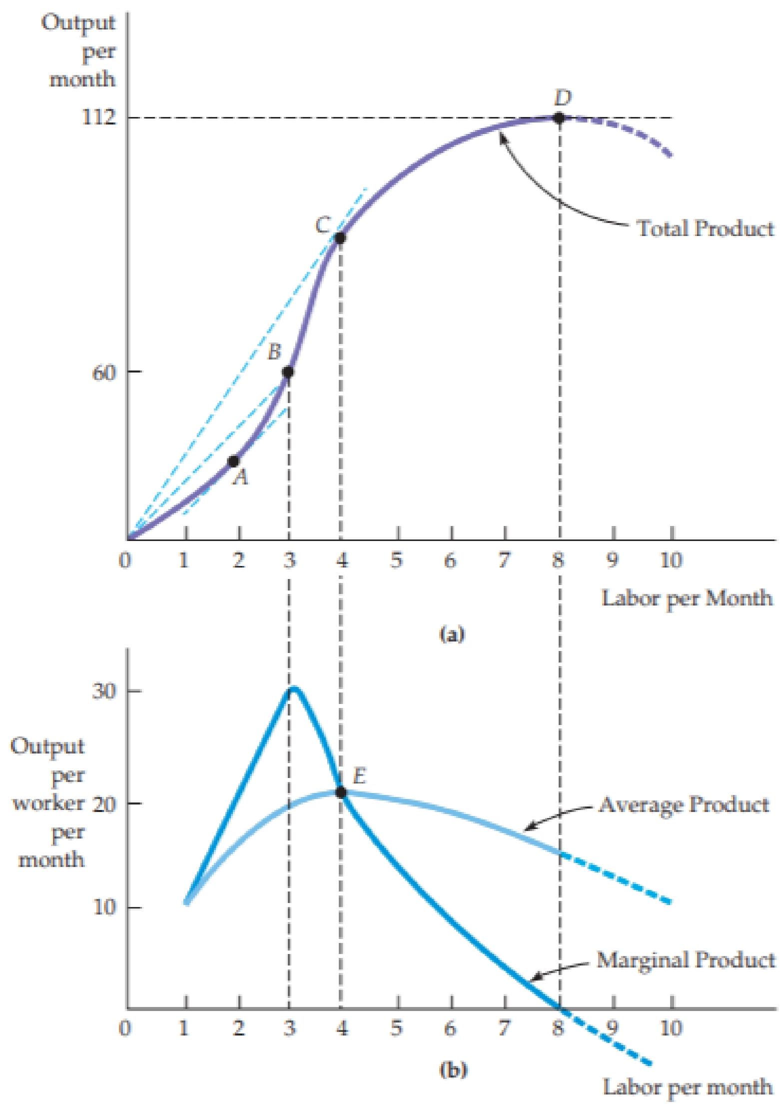

Figure 14. Average Product of Labor and Marginal Product of Labor
Source: Pindyck and Rubinfeld (2014)

To connect the concept of labor productivity with wages or labor compensation, we assume that the firm follows profit maximization. Let firm's profit be π, price of output be P, labor compensation or wage be W, and capital compensation or rent be R. With the same production function of two inputs, we can derive the number of labors hired by the firm to maximize its profit by the following:

$$\max \pi = P.F(K, L) - W.L - R.K$$

First Order Condition of optimization:

$$\frac{d\pi}{dL} = 0$$

$$P.\frac{dF(K, L)}{dL} - W = 0$$

$$P.MPL = W$$

$$MPL = \frac{W}{P} \tag{11}$$

Hence, the number of labors hired by the firm to maximize its profit will be at the point where the marginal labor productivity equals the real wage. Connecting the concept of APL, MPL, and wage, we see that in theory, the real wage of a worker equals the amount of output the worker can produce, which is the average product per labor, hence the labor productivity. If the real wage is lower than labor productivity, firms will benefit by hiring more labor, thus adjusting the real wage until it equals the APL. Hence, as human capital improves[6], labor productivity increases accompanied by increasing labor compensation, as simulated on Simulation 5 and 6.

[6] Many researches have already proven the relationship between human capital and labor productivity, among them are Fischer, et. al. (2009), and Sahn and Alderman (1988).

5.2. Data on Indonesia's Labor Productivity

There are at least four sources of labor data on Indonesia that can be used to measure labor productivity in Indonesia: Statistics Indonesia, Indonesia Social Accounting Matrix, World Input Output Database, and Asia Pacific Organization (APO). Table 8 shows the details for each data source on Indonesia's labor.

Table 8. Data Sources on Indonesian Labor Productivity

Data Source	Variables Available	Periods
World Input-Output Database	Gross output, value added, number of labors, number of worked hours.	2000 – 2014
Indonesia SAM	Gross output, value added, worker equivalent.	1975 – 2008, every 5 years
Indonesian Statistics	Value added, number of labors.	1971 – 2018
Asia Pacific Organization – Labor Productivity Book	Value added, number of labors, number of worked hours	1971 - 2016

The labor input used as denominator can be number of labors, number of worked hours, and worker equivalent. Figure 15 shows the comparison between WIOD, SAM, Indonesian Statistics, and APO data on labor productivity with base year 2000, with WIOD, Indonesian Statistics, and APO data measured by value added per number of labors and SAM data measured by equivalent labor factor. Labor productivity data from Indonesian Statistics and APO show the same trend, as APO data is based directly from Indonesian Statistics. However, labor productivity level Indonesia from WIOD data is in fact showing decreasing trend after 2011. WIOD also obtained the data from Indonesian Statistics, but after 2009 the number of employees is estimated by holding the several ratios between wage and value added, and number of labor and value added are hold fixed.

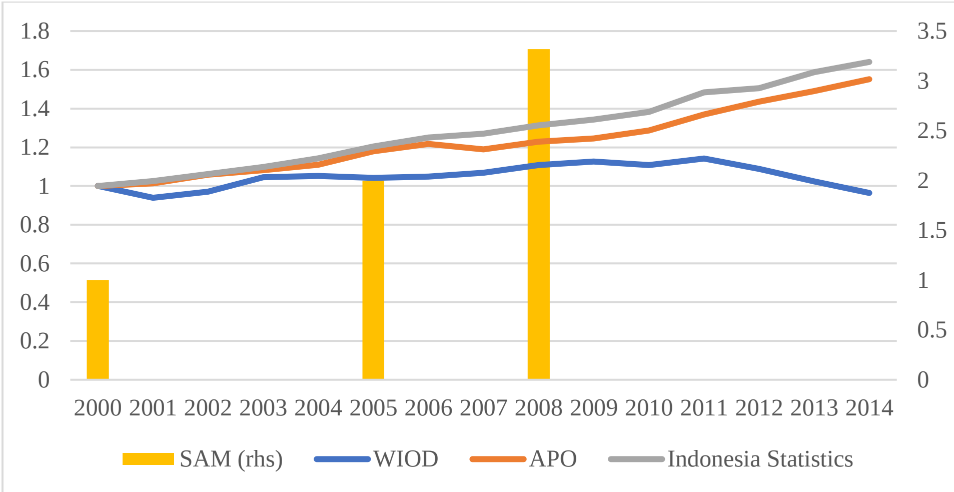

Figure 15. Labor Productivity Trend Comparison Across Data Sources
Source: Indonesian Social Accounting Matrix 2008, World Input Output Database 2016, Asia Pacific Organization 2018, Indonesian Statistics.

However, as this paper needs the calculation for intersectoral linkages, DVA, and FVA, the analysis uses labor productivity data from WIOD for consistency. It is, however, as aforementioned on chapter 3, the data has been integrated with SAM 2008, before the assumptions are applied to WIOD data.

5.3. Labor Productivity in Indonesia

In the period of 2000 – 2008, labor productivity in manufacturing sectors had increased (figure 16), despite mining sector and agriculture sectors decrease, which is the source of increase in within-sector shown in figure 1. Mining sector shows the highest labor productivity out of all tradeable sectors, and among manufacturing sectors, Food manufacturing shows the highest labor productivity, while Wood manufacturing and Textile manufacturing show the lowest labor productivity. However, since 2009, labor productivity in all sectors has been declining.

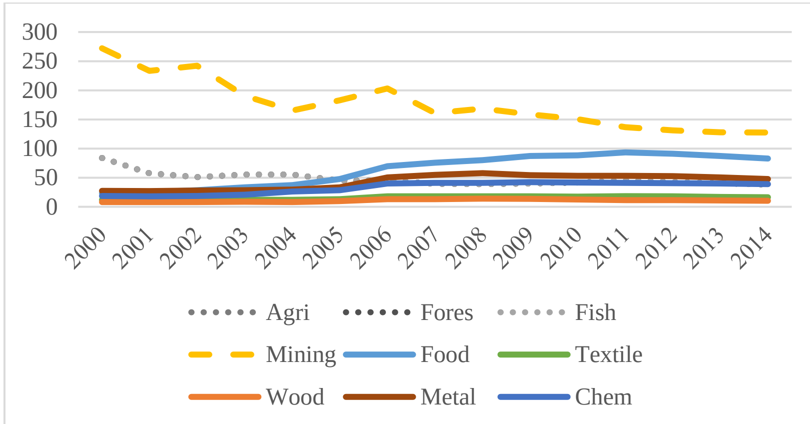

Figure 16. Sectoral Labor Productivity in Indonesia
Source: Author's calculation on WIOD

With regard to DVA in export, figure 17 and figure 18 show that DVA and labor productivity in manufacturing sectors are facing time series-cross sectional paradox in Indonesia. Time series-wise, DVA shows similar pattern as labor productivity, e.g. when labor productivity increases, so does DVA proportion in exports. However, cross-sectionally, sectors with high DVA tend to have low productivity, while manufacturing sectors with low DVA tend to have higher productivity.

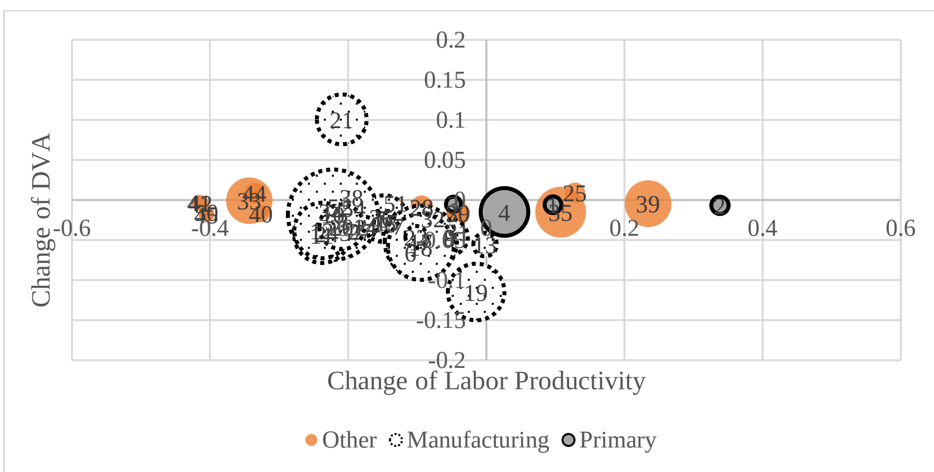

Figure 17. Change in Labor Productivity and DVA: 2009-2014
Source: Author's calculation on WIOD

Notes: Bubble size represents the size of labor productivity relative to total labor productivity

From the period of 2009-2014, all manufacturing sectors are losing labor productivity, and at the same time, are relying more and more on imported goods for export, indicated by decreasing DVA in exports since 2009 (figure 17). Logically, decline in labor productivity leads to increased domestic cost of production, forcing firms to import intermediate input instead of domestic input, which decreases DVA, hence the positive correlation between DVA and labor productivity. Only manufacture of transport equipment (21) experienced increasing DVA while declining labor productivity.

As aforementioned, sectors with high DVA tend to have low productivity, while sectors with low DVA tend to have higher productivity, cross-sectionally (Figure 18). Resource-based sectors such as food (5) and wood (7) manufacturing have high DVA but low productivity, on the other hand, more complex sectors such as machinery (19), computer (18), electrical (17) manufacturing have low DVA but high productivity relative to other sectors in Indonesia. Only manufacturing of coke and petroleum (10) shows high labor productivity and high DVA component. However, even for these two sectors, their DVA component in export and labor productivity have also been decreasing, as shown in figure 17.

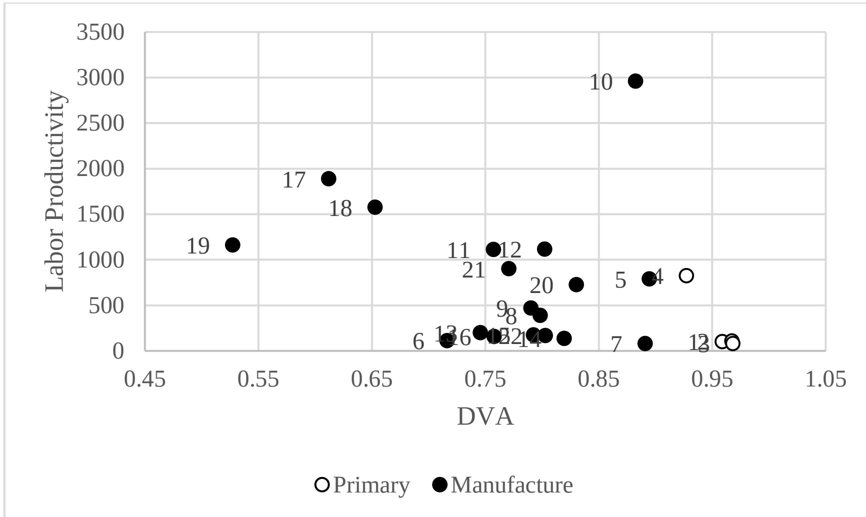

Figure 18. Labor Productivity Level and Proportions of DVA in Exports, 2014
Source: Author's calculation on WIOD

The negative relationship between DVA and labor productivity across sectors can be explained by the following reasoning: complex sectors in which high-skilled labors are required have higher labor productivity, but because of the complexity of products that they produce, these sectors need more imported input as Indonesia still has not possess the technology to produce the goods holistically, hence they have higher FVA components. On the other hand, resource-based sectors such as manufacture of food and wood, require less high-skilled workers than those more complex sectors. This takes part in the fact that labor productivity is low in these uncomplex sectors.

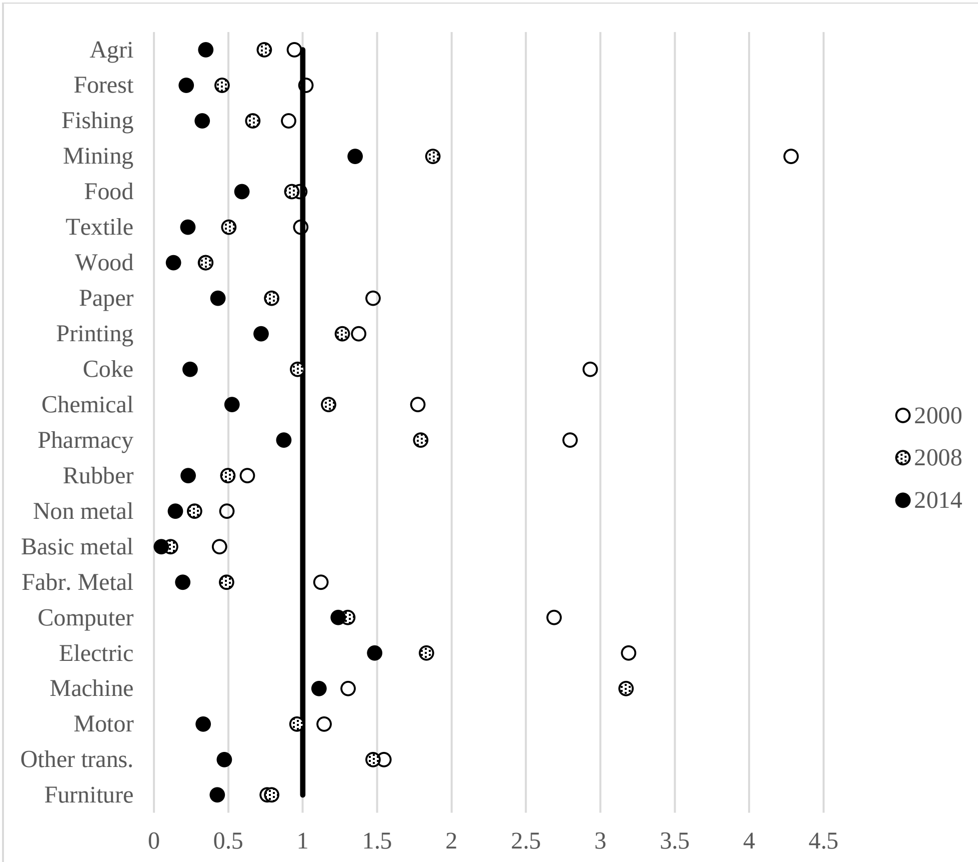

Figure 19. Ratio of Labor Productivity Indonesia to China
Source: Author's calculation on WIOD and Socio-Economic Accounts of WIOD
The bullet points show the ratio of Indonesia's labor productivity to China's labor productivity. Ratio that takes value more than 1 shows that Indonesia's labor productivity is larger than China.

In these low-productivity-but-high-DVA manufacturing sectors, including Fishing and Mining sectors, Indonesia benefits more than China from the bilateral trade as mentioned in the previous subsection. Hence, Indonesia has the potential of benefiting from trade with China in these sectors. However, Indonesia's leverage over China in these sectors happen precisely because Indonesia is resource-rich country, not because of Indonesia's competitiveness that is born from labor productivity. Figure 19 shows that in these sectors, except for Mining, Indonesia's labor productivity is less than

China, and its difference with China's labor productivity is widening from 2000 to 2014, indicated by decreasing ratio of labor productivity Indonesia to China. As labor productivity represents the wage of the labor, the low level of productivity in these sectors in Indonesia is wasting the opportunity to raise the labor's income through bilateral trade with China.

CHAPTER VI
SIMULATION RESULT: TRADE OPENNESS TO INEQUALITY

6.1. Final Good Export Increases to Income Inequality in Indonesia

To simulate the impact of increase in each tradeable sector's final good export to inequality in Indonesia, we considered ROW-institutions columns as exogenous variables, and increase Indonesia's productions that are consumed by institutions abroad by 1 billion USD. Figure 20 and 21 show the changes in MLD and Gini index when there are 1 billion USD increases in different tradeable sectors, with the horizontal lines represent the baseline level of MLD. It is apparent that not all sectors in which increase in export of final good will decrease inequality, as it was claimed by the classical theory of trade. For example, increase of final good export in forestry and mining sector, and textile, wood, metal, and chemical industries will increase MLD and Gini index significantly. Only increase of final good export in agriculture, fishing sectors, and food industry decreases the MLD and Gini index.

The fall in MLD as agriculture sector increases final good export is dominated by the fall in between-group inequality. As aforementioned, the partition used for MLD decomposition is agriculture households, rural, and urban households. Figure 22 – 25 shows that, after export of final good increases in agriculture sector, the within-group inequality in all groups increase, only between-group inequality decreases, which implies that the fall in MLD is caused by the fall in between-group inequality. These are also shown from the fall in ratios between the richest and poorest from 6.9829 to 6.9630, and fall in ratios between urban and rural from 1.4440 to 1.4418; but increase in ratios of agriculture entrepreneur to labors, ratios between richest and poorest in the urban area, and ratios between richest and poorest in the rural areas (figure 19 – 23).

On the other hand, increase in final good export in forestry sector raises MLD as it increases both within- and between- group inequalities. This is also confirmed by the increases in all ratios between the richest and the poorest in general, in rural, in urban, and in agriculture sector, and also between urban and rural.

Similar to the effect of increased final good export in agriculture sector, the effect in fishing sector also decreases overall MLD, and it is also dominated by between-group inequality. However, while inequality within rural and within urban areas are increasing, the inequality within-agriculture declines, which is also shown by falling ratios of agriculture workers from 1.8275 to 1.8270.

Meanwhile, increase in mining export of final good will increase the overall MLD as a result of increase in both between- and within- inequality, except for inequality within rural areas. The ratios between the richest and the poorest in urban area also shows inequality decrease, and the ratio between workers in agriculture sector shows increase inequality after mining sector export increase, which are in-line with the findings from MLD index decomposition. However, the ratio between urban and rural show no effect of such shock to the gap between urban and rural, even though there is increase in MLD's between-group inequality. This implies that the source of between-group inequality in MLD decomposition is the inequality between agriculture and non-agriculture.

Figure 20 – 25 also shows that food industry has the opposite effect on inequality compare to other manufacturing industries. Increase of final good export in food

industry decreases overall MLD, which is dominated by the fall in between-group inequality; while increase of final good export in food, textile, wood, metal, and chemical industries all raise overall MLD, with increasing between-group inequality. Positive shock in food industry only raises inequality within urban and within rural areas. The ratio between the richest and the poorest in urban area increase from 2.1960 to 2.1972; and from 2.0329 to 2.0344 in rural areas. Meanwhile the ratio between the richest to the poorest in general drops from 6.9829 to 6.9729.

Export increase in textile, wood, and metal industries, while raising overall MLD, between-group, within rural, and within agriculture's MLD; it decreases inequality within urban. As opposed to the simulations on agriculture sector, simulation on chemical industry increases MLD and it is dominated by the increase of all within-group inequalities, having between-group inequality decreasing.

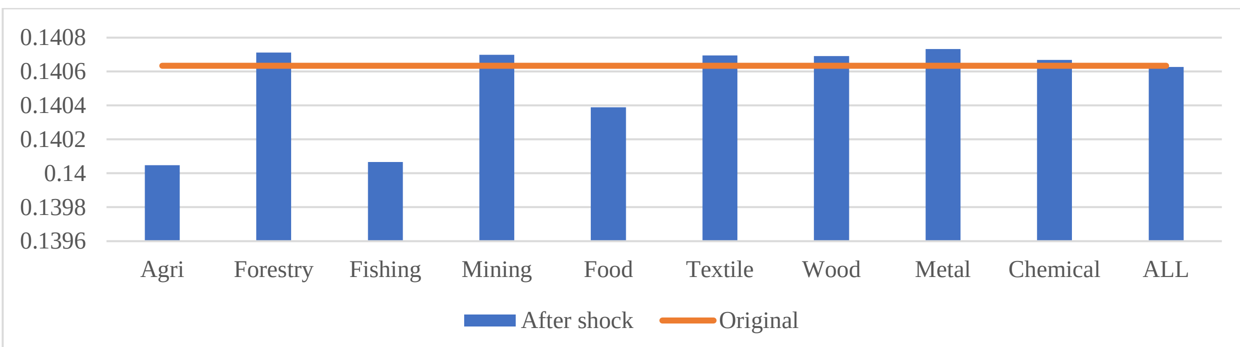

Figure 20. MLD after Final Good Increases

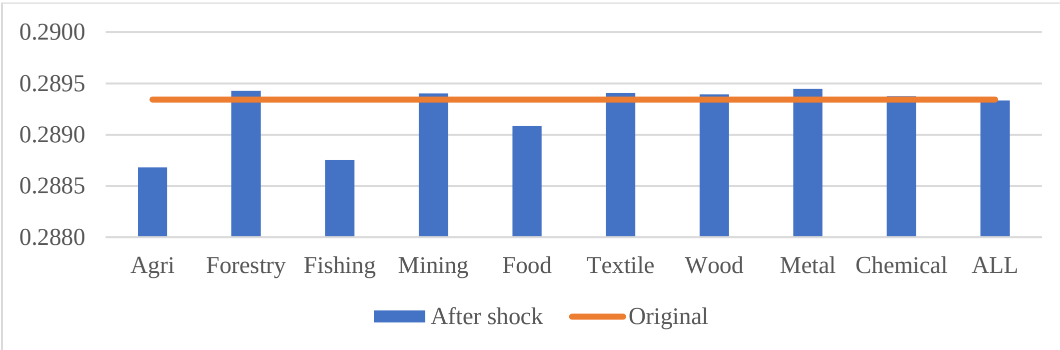

Figure 21. Gini Index after Export Final Good Increases

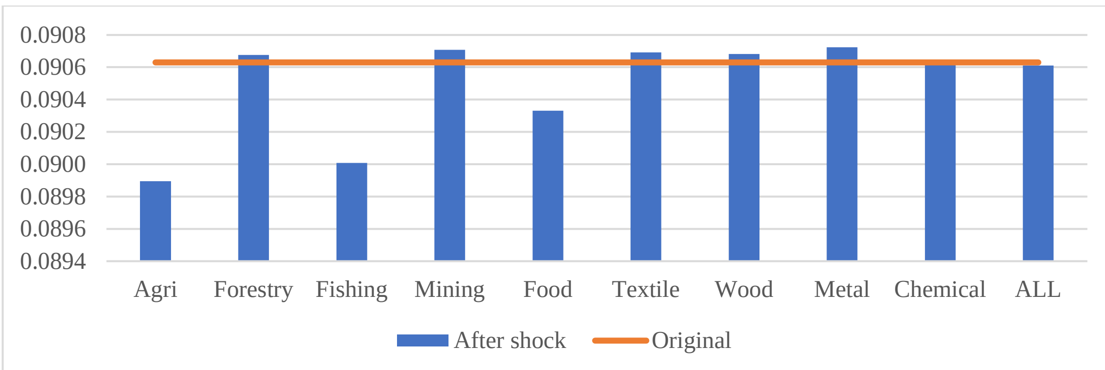

Figure 22. MLD Decomposition: Between-Group Inequality after Export Final Good Increases

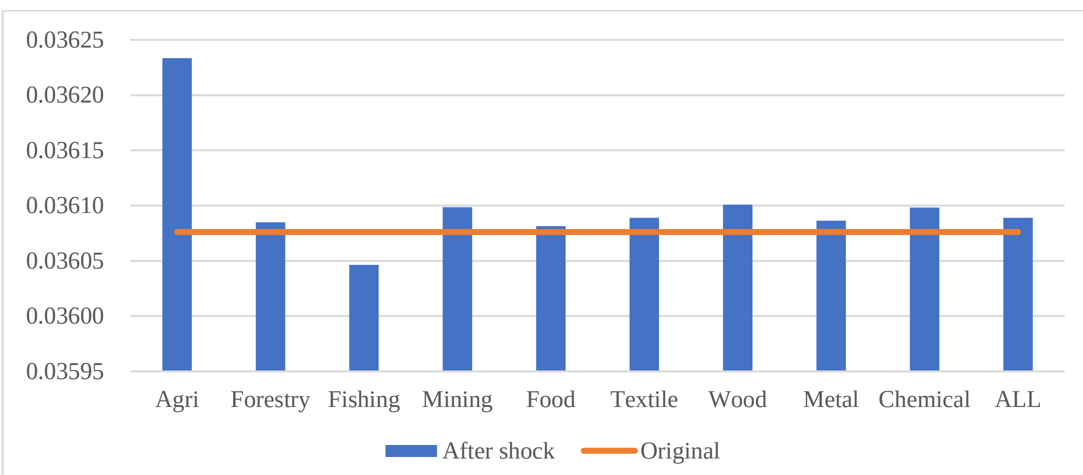

Figure 23. MLD Decomposition: Within-Agriculture Inequality after Export Final Good Increase

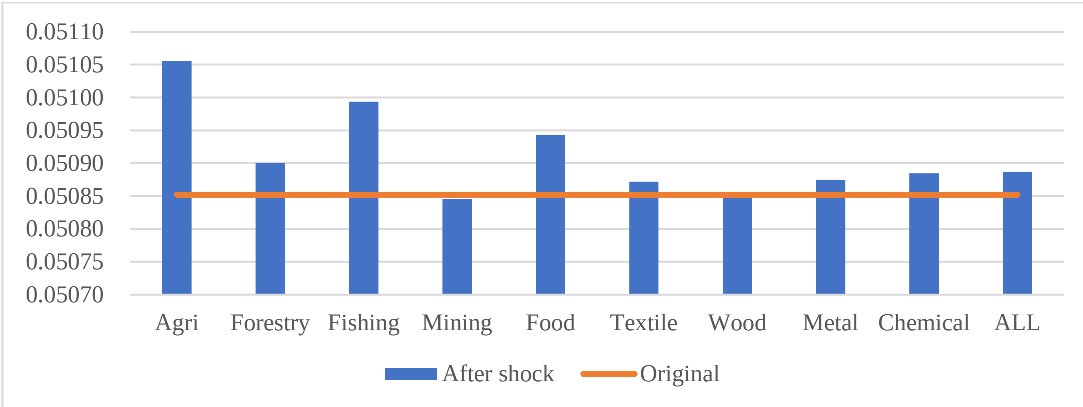

Figure 24. MLD Decomposition: Within-Rural Inequality after Export Final Good Increase

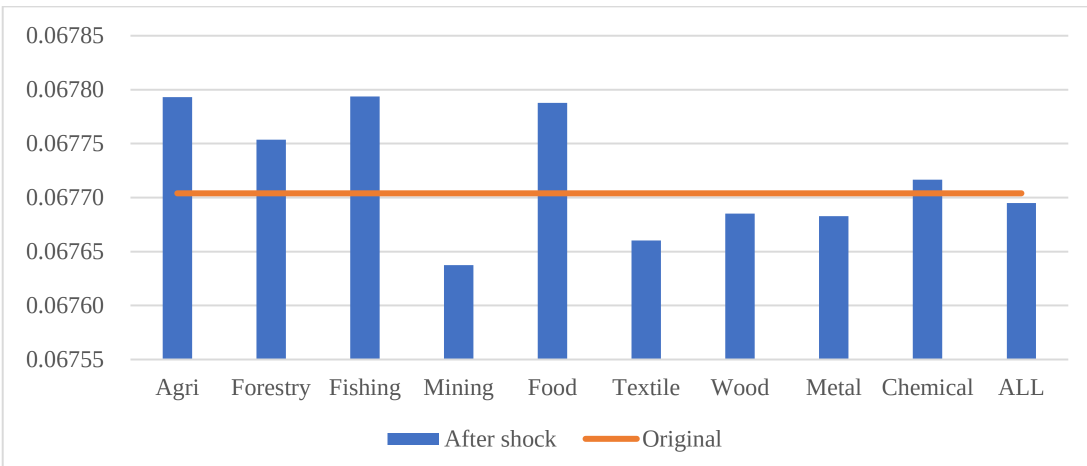

Figure 25. MLD Decomposition: Within-Urban Inequality after Export Final Good Increase

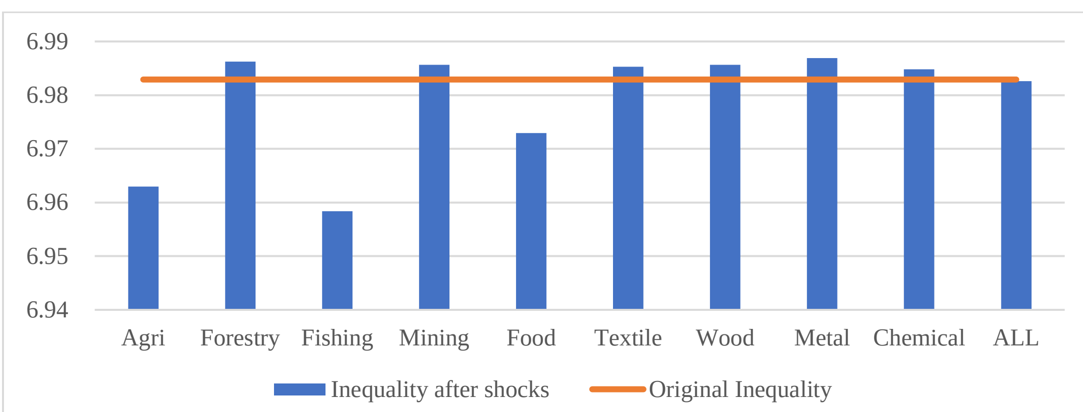

Figure 26. General Inequality after Final Good Export Increases

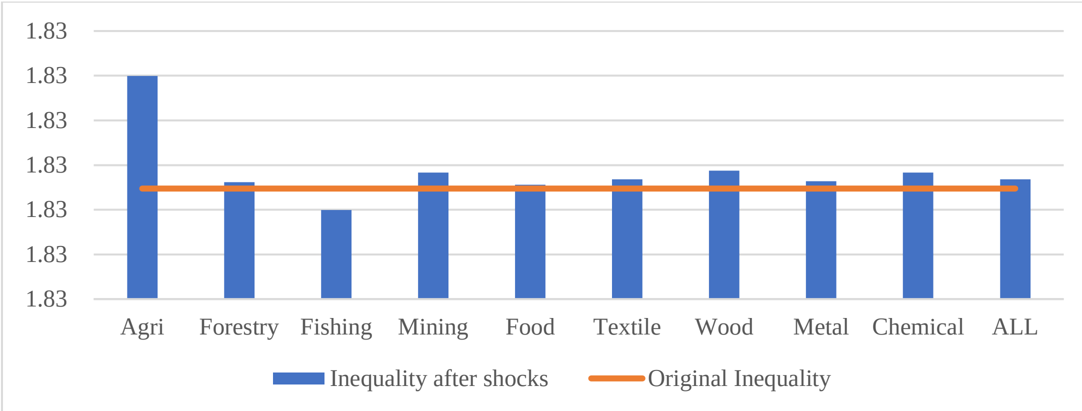

Figure 27. Inequality in Agriculture sector after Final Good Export Increases

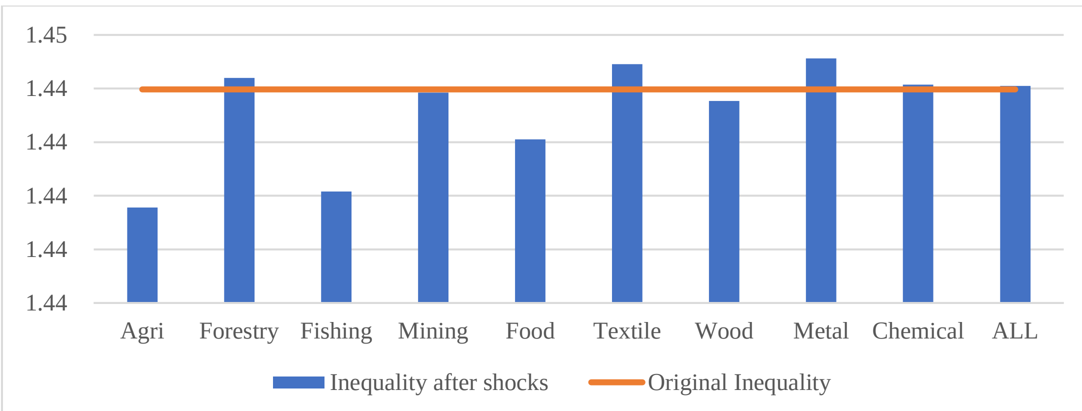

Figure 28. Inequality between Urban and Rural areas after Final Good Export Increases

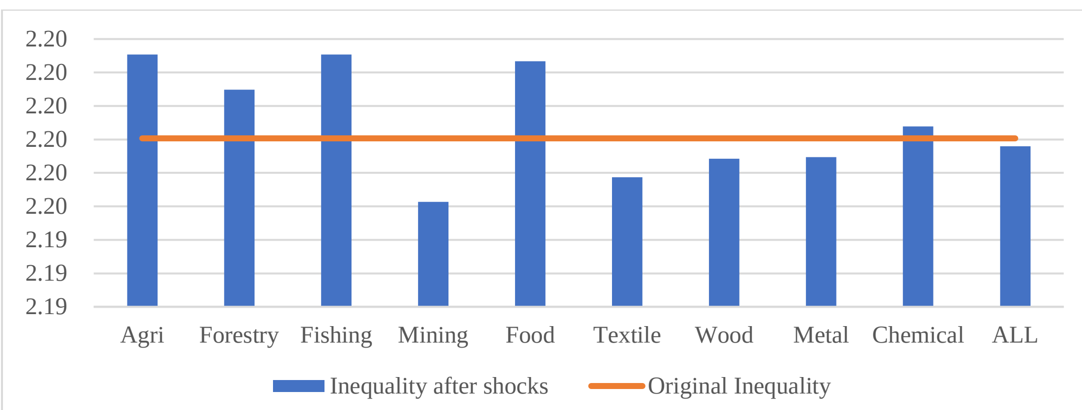

Figure 29. Inequality within Urban areas after Final Good Export Increases

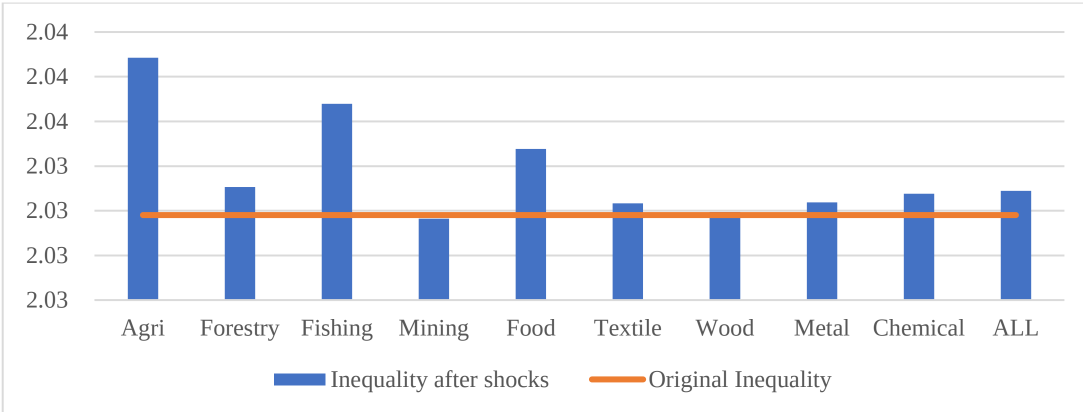

Figure 30. Inequality within Rural areas after Final Good Export Increases

6.2. Intermediate Input Export to Income Inequality in Indonesia

As the analysis of international trade in this paper includes the inter-sectoral linkages between countries, shocks of intermediate input export are also introduced in the simulations to each of the tradeable sector. Figure 31 – 35 show the effect of increase in input good export for each tradeable sector to inequality indices and figure 37 – 41 show its effect to inequality ratios. In general, we see no significant difference between the effect of increase in final good export and increase in input good export to inequality. Increase of input good export in agriculture, fishing, and food industry decrease the overall inequality, as MLD and Gini index fall, and income ratio between the richest and the poorest decrease by 0.0199, 0.0245, and 0.0100 respectively for each sector. While increase of input good export in forestry, mining, textile, wood, metal, and chemical industries all raise the overall inequality.

The inequality change for each sector is also similar to the simulation on final good export for each sector: falls in overall inequality after input good export increase in agriculture sector and food industry are dominated by between-group inequality decrease; food industry shows the opposite effect compare to other manufacturing industries on inequality; textile, wood, and metal industries increases all types of inequality except for within-urban inequality; and chemical industry increase both within- and between- inequality.

The pattern similarity of inequality between final good export and input good export simulations are caused by the inevitable assumption used in this IRSAM analysis, in that the technology used to produce domestically-consumed good, exported good as final consumption, and exported good as intermediate input are all the same. Hence, the impact to production factor and the income for each household are the same for both simulations.

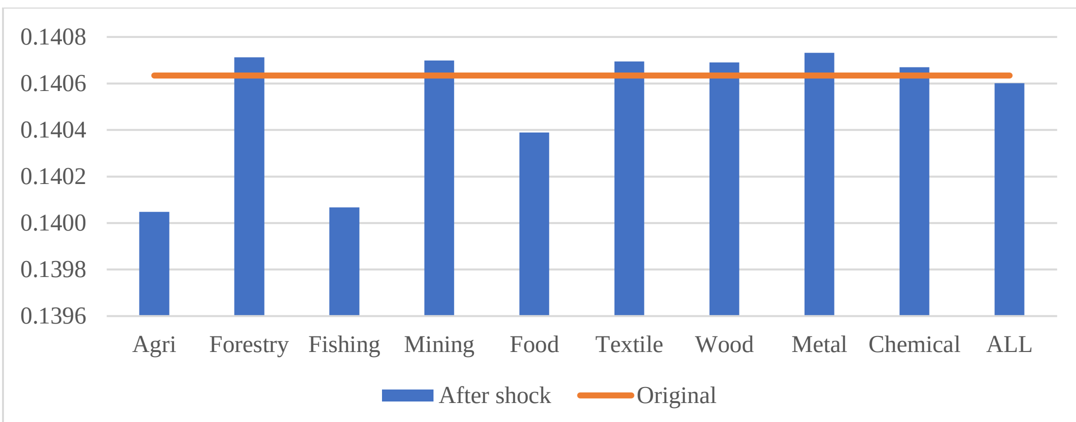

Figure 31. MLD after Intermediate Input Export Increases

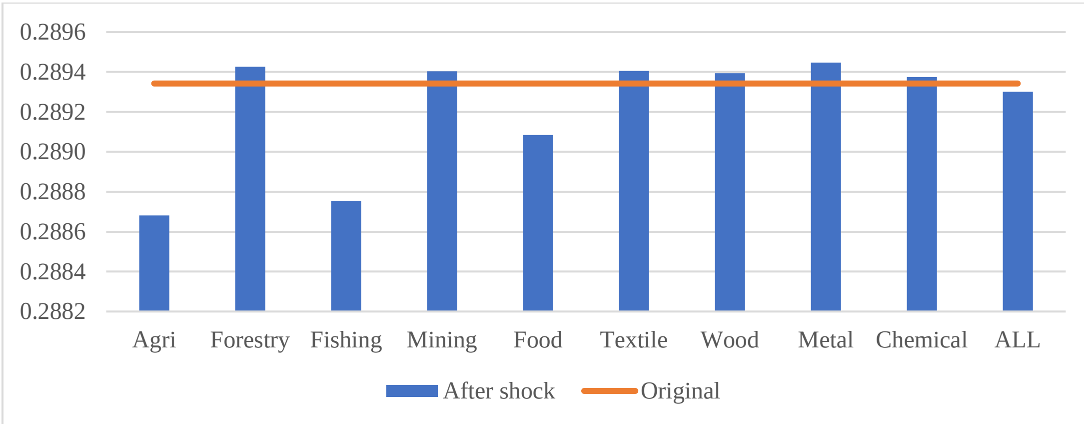

Figure 32. Gini Index after Intermediate Input Export Increases

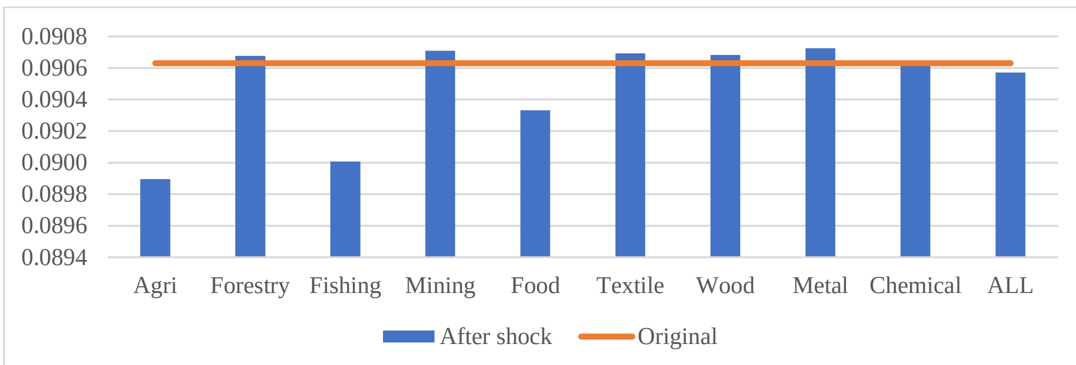

Figure 33. MLD Decomposition: Between-Group Inequality after Export Input Good Increase

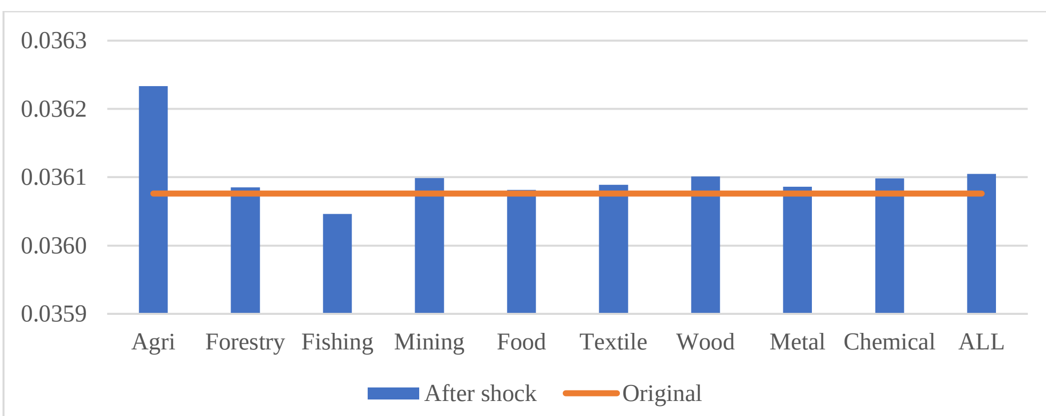

Figure 34. MLD Decomposition: Within Agriculture Inequality after Export Input Good Increase

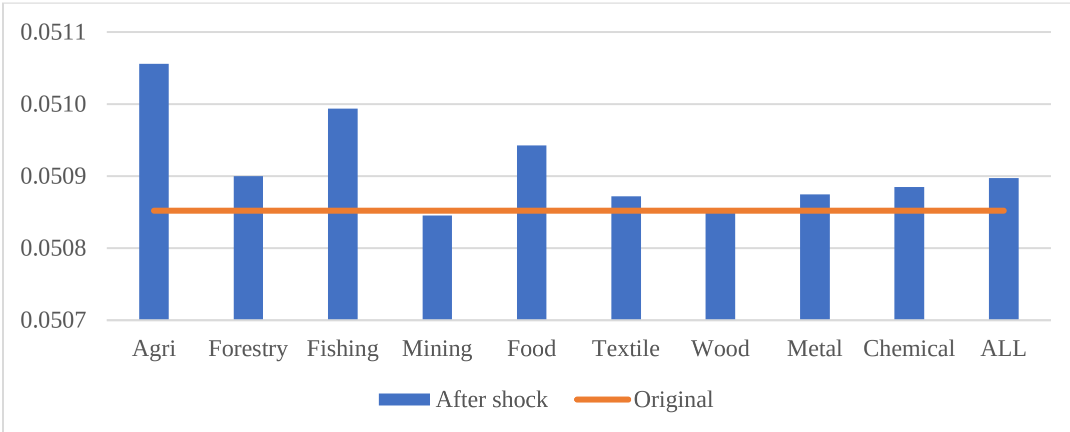

Figure 35. MLD Decomposition: Within Rural Inequality after Export Input Good Increase

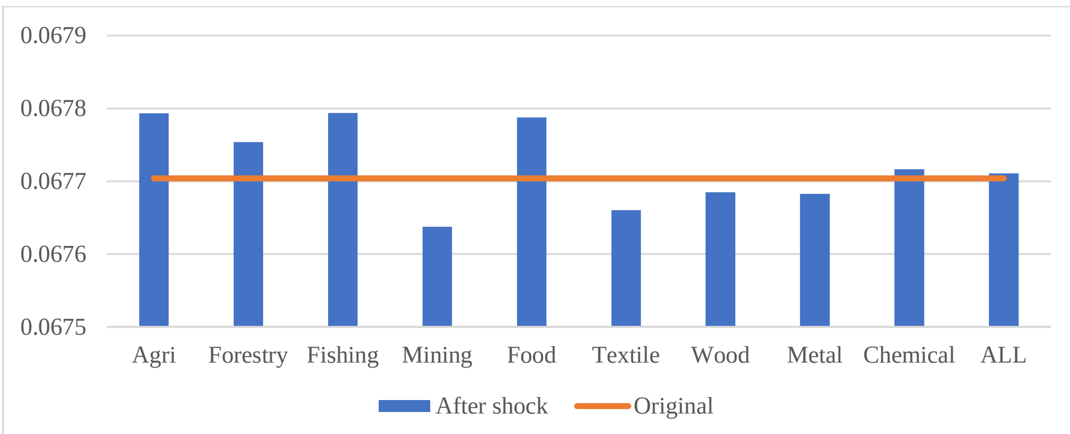

Figure 36. MLD Decomposition: Within Urban Inequality after Export Input Good Increase

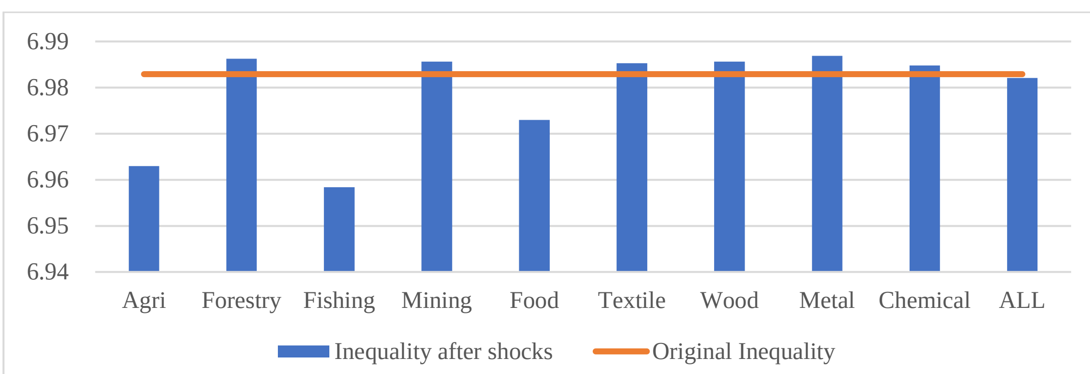

Figure 37. General Inequality after Intermediate Input Export Increases

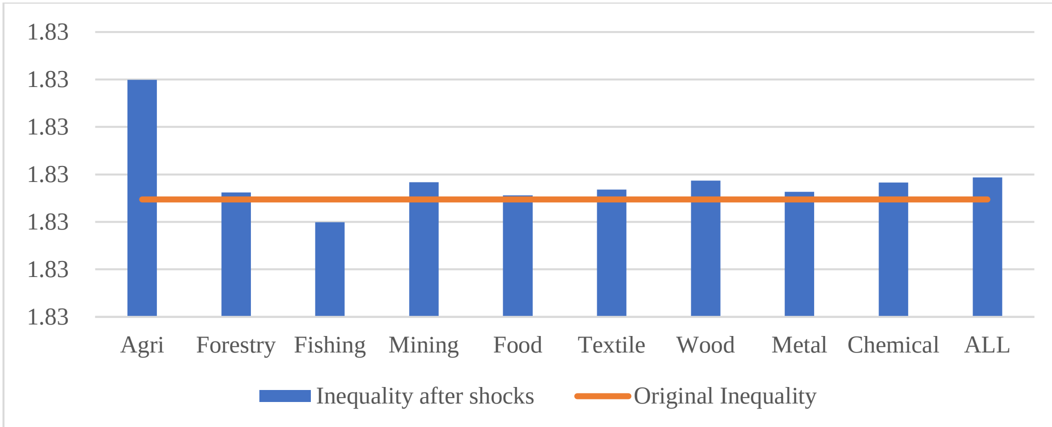

Figure 38. Inequality in Agriculture sector after Intermediate Input Export Increases

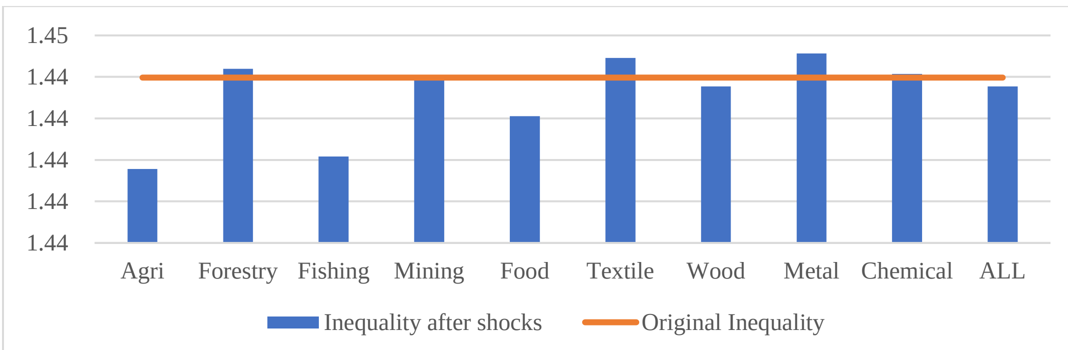

Figure 39. Inequality between Urban and Rural areas after Intermediate Input Export increases

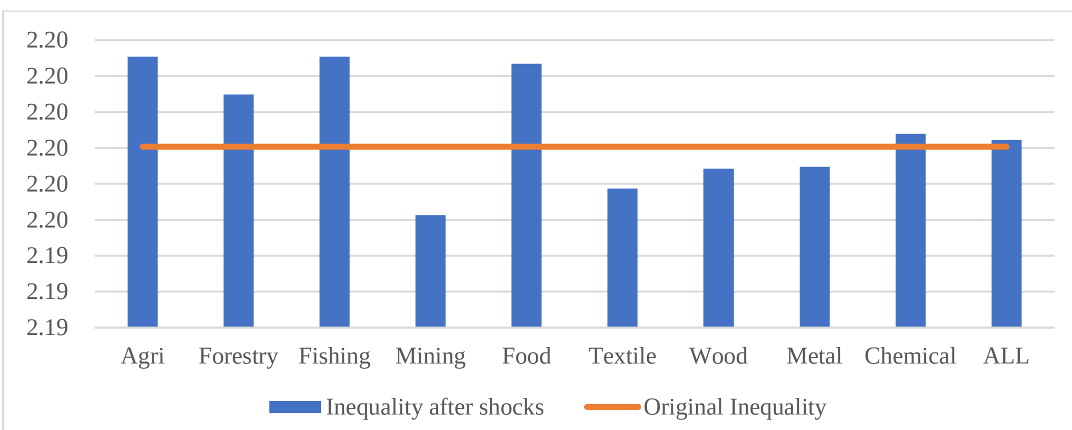

Figure 40. Inequality within Urban areas after Intermediate Input Export increases

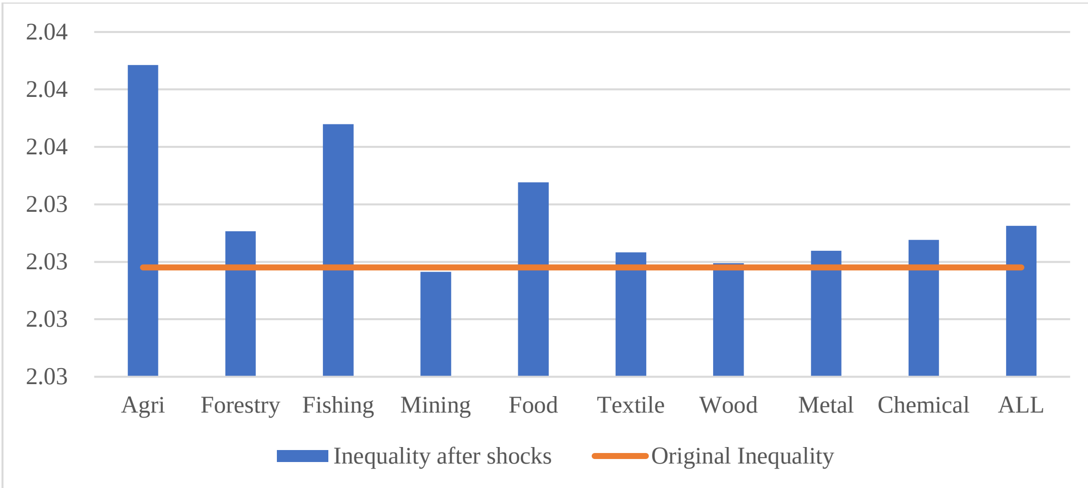

Figure 41. Inequality within Rural areas after Intermediate Input Export increases

6.3. Structural Path Analysis of Export Increases to Households' Income

As hypothesized on figure 4, shocks in production sectors, which is caused by increase in final demand and input demand from abroad, will affect not only domestic factors of productions, but also demand for input goods from abroad. The effects on factors of productions, which consist of all unskilled, skilled labors, and capital will in turn change factor income that affects household incomes. Because shocks in domestic production sectors also affect demand for input goods from abroad, it will also affect income factors abroad, especially for production sectors such as metal, textile, and chemical industry in which FVA are high. Using Structural Path Analysis shown in figure 42 – 46, we see that the mechanism holds.

The path analysis shown only show the top three and bottom three household categories that are affected on each simulation, and the node are ranked from the top according to their total effect. The black colored nodes are Indonesia's nodes, and blue colored nodes are ROW. The highlight of this analysis is that the differences of export impacts on inequality across sectors are caused by the variation of which factors of productions are affected, across labor skill types and between Indonesia's or ROW's factor of productions, hence heterogenous impact across household categories.

We can observe that shocks in sectors which exports are dominated by FVA such as Textile industry, metal industry, and chemical industry have high impacts on ROW's production sectors, hence the highest beneficiaries from increase productions in these sectors are households abroad. This confirms Indonesia's trade vulnerability as Indonesia's production sectors are not competitive enough that its manufacturing sectors are not highly inter-linked with each other and they are mostly linked to production sectors abroad instead.

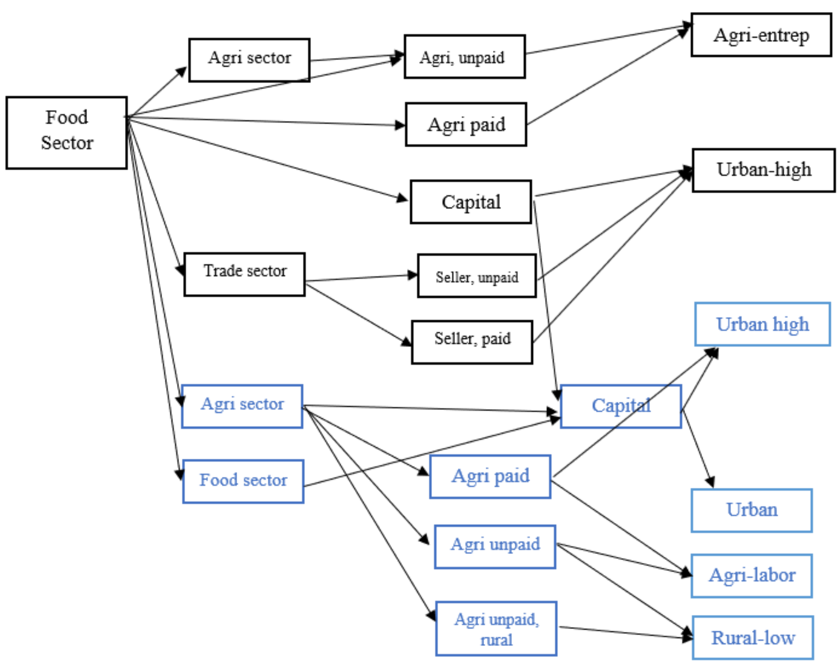

Figure 42. Path Analysis from Food Industry to Households

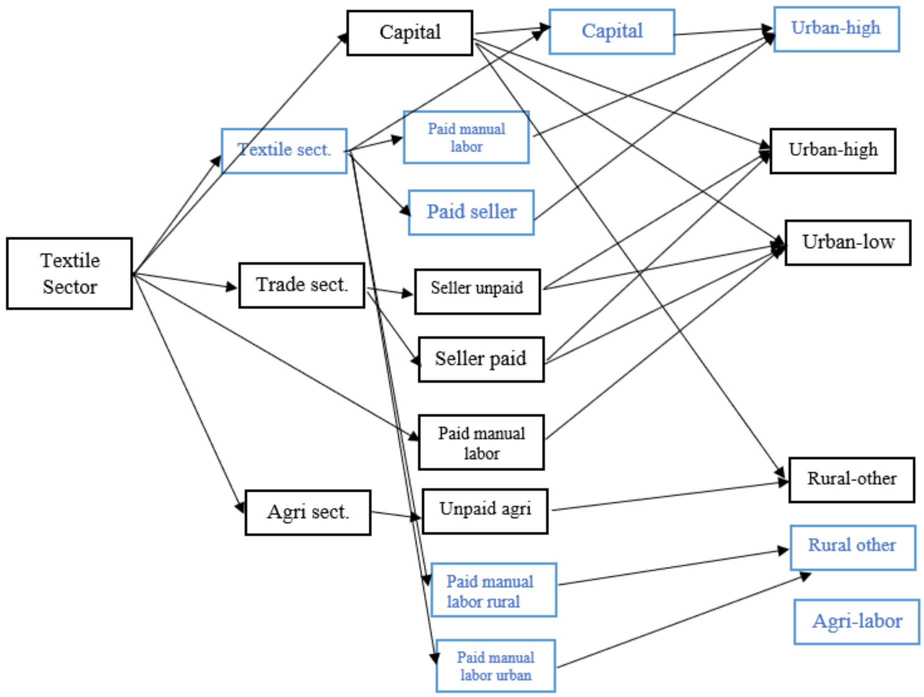

Figure 43. Path Analysis from Textile Industry to Households

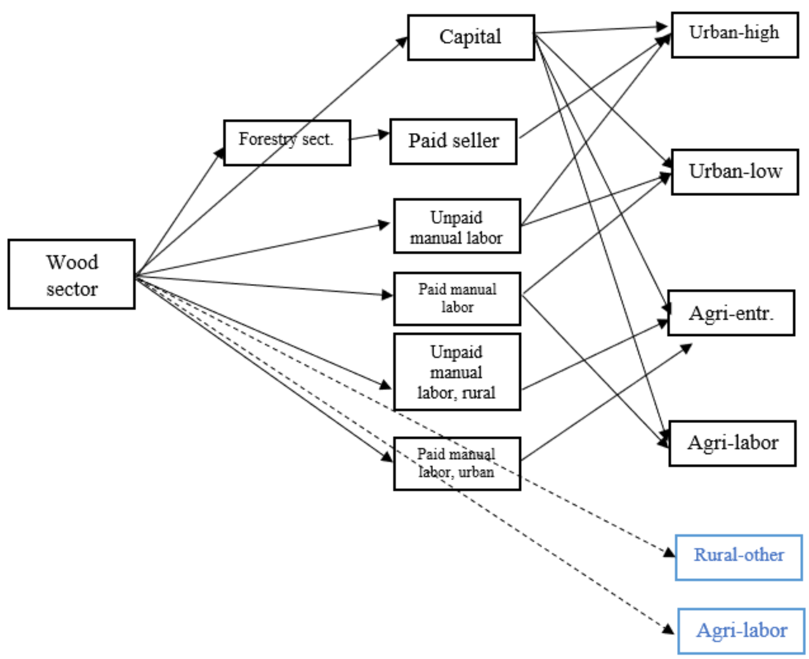

Figure 44. Path Analysis from Wood Industry to Households

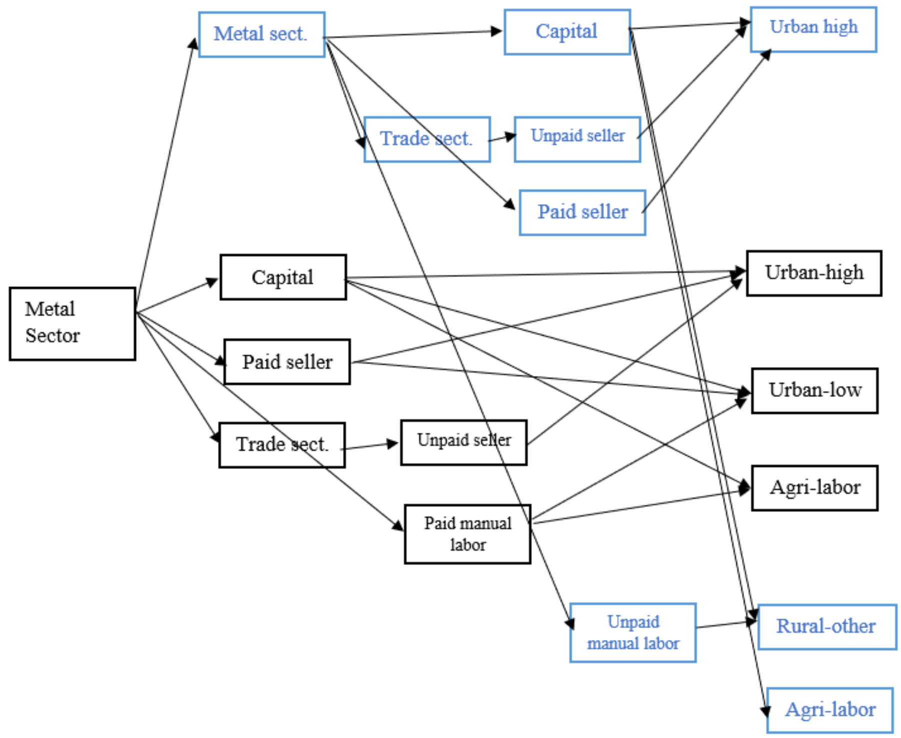

Figure 45. Path Analysis from Metal Industry to Households

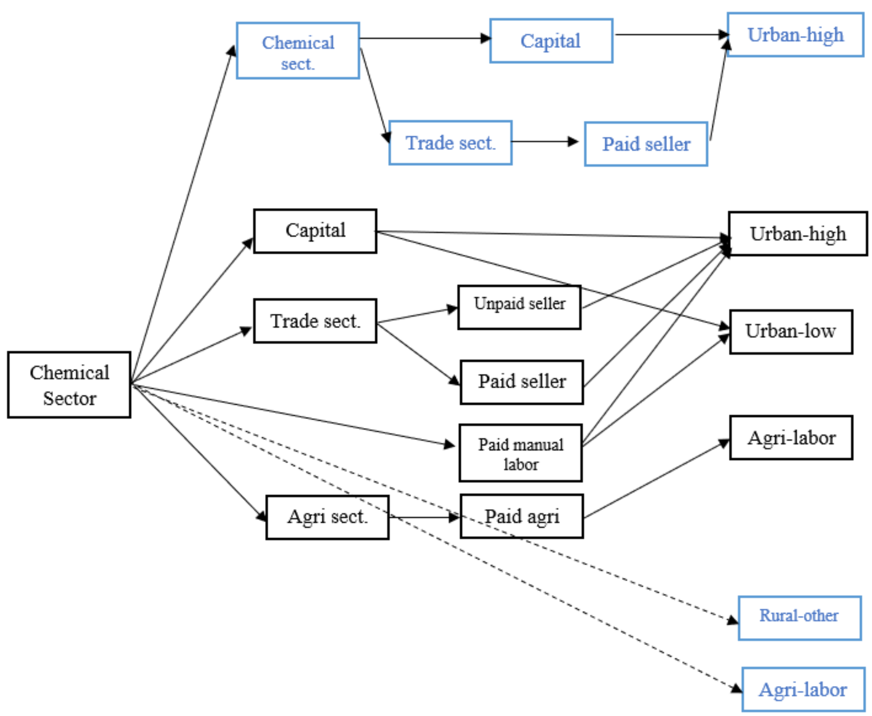

Figure 46. Path Analysis from Chemical Industry to Households

CHAPTER VII
SIMULATION RESULTS: POLICY IMPLEMENTATION

This chapter shows and scrutinizes the results from simulation 3 – 5, which focuses on the policy implementation in regards to the report by Ministry of National Development Planning (2019). As aforementioned in Chapter III, the simulations are divided into 3 different categories, each category with their sub-categories that works under different assumptions. Table 9 shows the summary of simulation result of all policies from simulation 3 – 4.

7.1. Selective Tax Break Promoting Manufacturing Sector

Under the assumption that the firms behave 'business-as-usual', where their tax payment to government will affect their investment level, tax break targeting manufacturing sector at the expense of forestry or mining sector, which implies investment reallocation from mining or forestry sector to manufacturing sectors, will not improve inequality overall. Additionally, it also worsens the trade balance and investment over value added.

Investment reallocation from mining or forestry sector, which contribute greatly to Indonesia's export causes export to fall, while investment flow to manufacturing sector pushes export of manufacturing products upwards, but as the FVA component of manufacturing sector is considerably high (see Chapter IV), it also increases Indonesia's import of intermediate input. Therefore, the force that pushes export upwards, e.g. investment in manufacturing sector, are taken over by the force that pulls down export, e.g. capital outflow from mining or forestry sector, and pushes up intermediate input import, which is production of manufacturing industries. Hence the worsening trade balance.

Investment reallocation from mining/forestry sector to manufacturing sector also yields negative value added (or GDP) change as the investment over change in value added is negative, which implies that mining and forestry sectors generate value added greater than manufacturing sectors, or in other words, mining and forestry sectors have better efficiency than manufacturing sectors.

If the government finances the tax break policy that promotes manufacturing sectors through foreign loan, it produces an even worse result in terms of equality. In terms of efficiency, trade balance also worsens, but the investment over value-added change shows positive results. This is in-line with economic intuitive, since there is nothing taken from Indonesian economy as opposed to the simulations under constant budget assumption; but increases in value-added is obtained at the expense of worsening both income distribution and trade balance, not to mention the public debt occurred to finance this policy scheme.

Table 9. Simulation Result on Selective Tax Break on Manufacturing Sector and Unselective Tax Break

	Assumption	Target	Source		Inequality: Overall	Inequality: Within Agri	Inequality: Within Urban	Inequality: Within Rural	Inequality: Between U/R	Trade Balance	Inv/ΔY
SIMULATION 3 - SELECTIVE TAX BREAK FOR MANUFACTURING SECTOR											
a	Business as Usual										
	i. Constant budget	Manuf	Forestry		Worsen	Improve	Improve	Improve	Worsen	Worsen	-880.818
			Mining		Constant	Improve	Worsen	Worsen	Constant	Worsen	-660.025
	ii. Budget deficit	Manuf	Foreign loan		Worsen	Worsen	Worsen	Worsen	Worsen	Worsen	133.149
b	Guided tax without targeting										
	i. Constant budget	Manuf	Forestry		Improve	Improve	Improve	Improve	Worsen	Worsen	412.335
			Mining		Improve	Improve	Improve	Improve	Worsen	Improve	403.711
	ii. Budget deficit	Manuf	Foreign loan		Worsen	Worsen	Worsen	Worsen	Worsen	Worsen	171.767
c	Guided tax with targeting										
	i. Constant budget	Manuf	Forestry		Improve	Improve	Improve	Improve	Improve	Improve	419.221
			Mining		Improve	Improve	Improve	Improve	Improve	Improve	412.485
	ii. Budget deficit	Manuf	Foreign loan		Improve	Improve	Improve	Improve	Improve	Worsen	171.767
SIMULATION 4 - UNSELECTIVE TAX BREAK											
a	Constant budget	All sector	All firms	Stage 1	Improve	Improve	Improve	Improve	Improve	Improve	-274.367
				Stage 2 – nonTgt	Worsen	Worsen	Worsen	Worsen	Worsen	Improve	452.182
				Stage 2 - Tgt	Worsen	Worsen	Improve	Worsen	Improve	Improve	-309.125
b	Budget deficit	All sector	Foreign loan	Non-targeting	Worsen	Worsen	Worsen	Improve	Worsen	Worsen	171.767
			Foreign loan	Targeting	Improve	Improve	Improve	Constant	Improve	Worsen	171.767

Another possibility of tax break implementation by the government to promote manufacturing sector is the addition of guidance provided by the government for the receiving firms to utilize the tax break as a means to improve labor productivity. Simulation 3b. shows this scenario when the manufacturing firms improve the productivity of all labor types. The scenarios where the government funds the policy package by raising tax to firms in forestry or mining sectors show better results in terms of equality and value added over investment, but inequality between urban and rural areas still worsens. Furthermore, financing the policy package by raising tax for forestry sector will still worsen the trade balance.

If the manufacturing firms improve the productivity of only unskilled labor, which are agriculture labor and manual labor, it produces the best results in terms of income distribution, trade balance, and investment over value-added. However, the investment over value-added of this scenario is higher than the non-targeting labor productivity above. Higher investment over value-added implies that with targeting labor productivity, investment needed to produces the same level of value added as non-targeting labor productivity is higher, hence inefficient. This shows that under guided tax break policy and constant budget assumption, there is an efficiency-equality trade off.

However, if this policy of guided tax break with targeting labor productivity is financed through foreign loan, while income inequality is not an issue as this improves income distribution of any type, but trade balance worsens. Hence, under the umbrella of selective tax break towards manufacturing sectors, the only scenario where this category of policy can improve income distribution, trade balance, and efficiency in Indonesia is when the government moves under constant government budget and the firms respond by improving the productivity of their unskilled labor only.

7.2. Unselective Tax Break

The fourth category of simulation works under the assumption that the government implements tax breaks to firms in all sectors, to improve the labor productivity of all firms, targeted and non-targeted. Under constant government budget, as the government raises tax from firms and firms reduce their investment level as a response, the new GDP, measured by total value added, decreases from 539.35 billion USD to 538.73 billion USD on the first stage (Table 10). The Balance of Trade (BoT), however, experiences a slight increase as the import falls deeper than the exports. The income inequality, measured by income ratio between the richest and the poorest, falls significantly on stage 1, which is caused by the raising tax for the firms, mostly affecting the higher-expenditure-household types rather than the lower-expenditure-households.

On the second stage, if the government spreads the human capital improvement uniformly across labor skill type, the inequality worsens from 6.969 on the first stage to 6.982, which is still slightly lower than the original income ratio of 6.982. On the other hand, if the government implements targeting labor productivity improvement towards the unskilled labor, inequality still slightly worsens compare to the first stage, from 6.969 to 6.975, but is lower than the non-targeting labor productivity improvement. In both cases (non-targeting and targeting), GDP and BoT improve compare to the first stage, but targeting labor productivity achieves lower GDP and BoT compare to non-targeting labor productivity. This shows that there is a trade-off between inequality and economic efficiency.

Table 10. GDP and Balance of Trade under Constant Government Budget

	Baseline	*Stage 1: Firm Taxed*	*Stage 2a: LP uniform*	*Stage 2b: LP targeted*
Export	141.30	141.25	141.64	141.42
Import	131.04	130.88	130.49	130.67
BoT	10.26	10.37	11.14	10.75
GDP	539.35	538.73	539.73	538.80

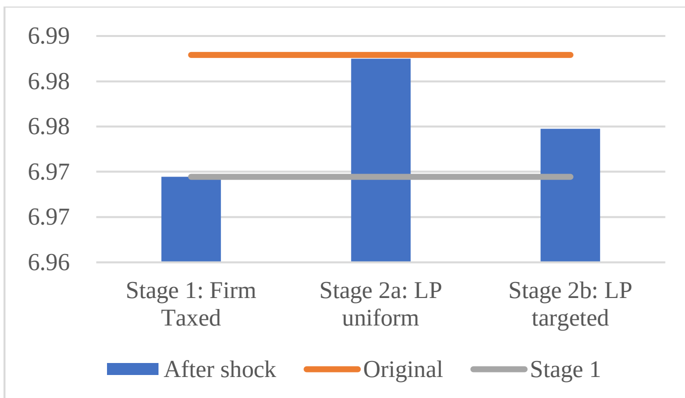

Figure 47. General Inequality: Income Ratio Richest to Poorest for Each Stage

If the government decides to fund the improvement of labor productivity using foreign loan, its impact to equality depends fully on which labor type whose productivity is improved by the firms (Table 10). Inequality will worsen significantly if the firms improve all types of labor productivity, whereas if the firms improve the productivity of only the unskilled labor, income distribution could still improve, even though the trade balance worsens for both cases.

These results show that improving labor productivity uniformly surprisingly will worsen the income inequality, even though the use of IRSAM as a model, as aforementioned in Chapter 3, implies linearity in the simulations. The source of inequality in the event of uniform labor productivity improvement is the inter-linkages feature of the IRSAM model.

Figure 48 and Figure 49 shows the comparison of SPA between unskilled labor and skilled labor to income across households. Shock in unskilled labor income will increases their consumptions of food industry sectors the most, which in turn increases the income of manual labor, and its backward linkages to agriculture sector also increases agriculture labor even more. These type of labors, agriculture labor and manual labor, are considered as unskilled labor. However, shock in professional and technical labor will increase their consumption of metal products, and services sectors, which in turn gives spill over to the income of administrative worker and professional and technical labor themselves. This pattern of polarization is what causes uniform improvement in human capital increasing inequality instead.

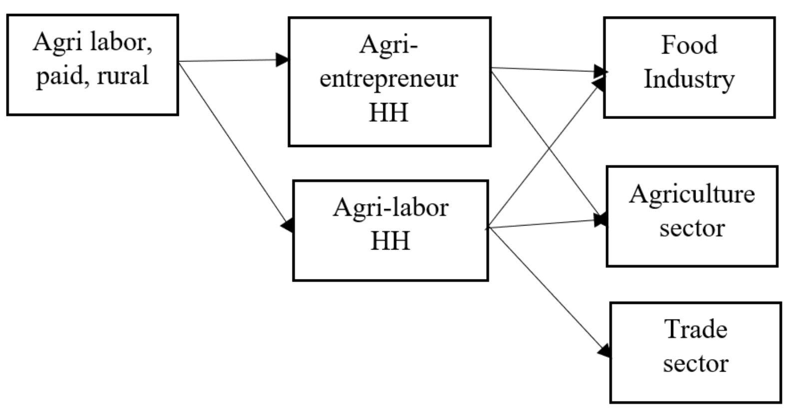

Figure 48. Structural Path Analysis: Agriculture labor's consumption pattern

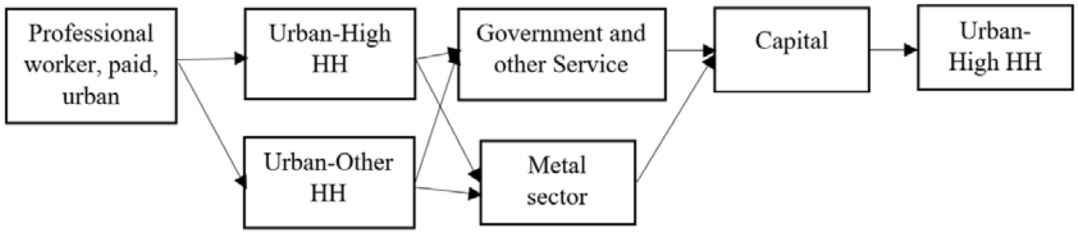

Figure 49. Structural Path Analysis from Professional worker

From the results of selective tax break to manufacturing sectors and unselective tax break above, some conclusions can be drawn: first, tax break implementation financed domestically yields better results than if it is financed through foreign loan. However, even when it is financed domestically, or in other words, while holding the government budget constant, the simulation results show that inequality still tend to worsen if the manufacturing firms respond by improving all types of labor's productivity. Hence, should the government decide to support manufacturing sectors through tax break, improvement in income distribution, trade balance, and investment efficiency can only be achieved under extremely rigid and almost-unrealistic conditions:

1. The government has to implement selective financing scheme for the tax break to manufacturing sectors (i.e. raise the fund from only forestry and mining sectors, instead of taxing all sectors), and
2. The firms need to respond in extremely positive manner by increasing the productivity of unskilled labor only.

These findings bring us to the subsequent simulations, where the tax break is implemented by the government to each sector at a time, in order to identify which sectors and which realistic scenarios that will yield the best result in terms of equality and efficiency.

7.3. Selective Tax Break Promoting Other Sectors

This subchapter then addresses the above issue: to identify the sectors that the government should promote instead of manufacturing sectors. Under the constant budget, the simulations assume that the government financed the tax break to each sector by raising the tax of firms in mining sector. Figure 50 to 51 show the changes in trade balance, overall inequality, and investment efficiency when the government applies tax break to each sector by raising the tax of mining sector, which implies investment reallocation from mining sector to each sector.

Figure 50 shows that tax break targeting agriculture sector, fishing sector, and food industry will improve income distribution in Indonesia, while tax break targeting forestry, textile industry, wood industry, and chemical industry will not change income distribution. In terms of trade balance, tax break targeting forestry sector, food industry, wood industry, and bank and telecommunication services will improve trade balances, while tax break targeting agriculture and fishing sectors will not, at least, worsen the trade balance (figure 51).

Figure 52 then shows the changes in sectoral investment over sectoral value-added after tax-break. The smaller the change of this variable, the more efficient the sector, as the investment in these particular sectors generate higher value-added than other sectors with higher value of this variable. Investment in agriculture, food industry, metal industry, chemical industry, construction and trade services, and bank and telecommunication services are the sectors which are efficient.

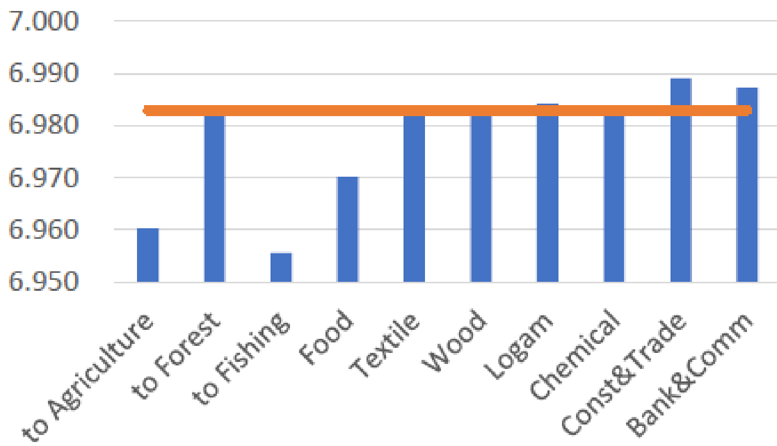

Figure 50. Overall Inequality under Selective Tax Break Promoting Other Sectors

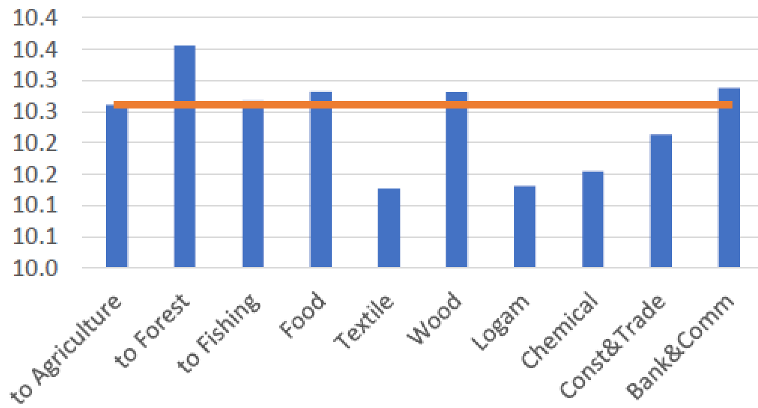

Figure 51. Trade Balance under Selective Tax Break Promoting Other Sectors

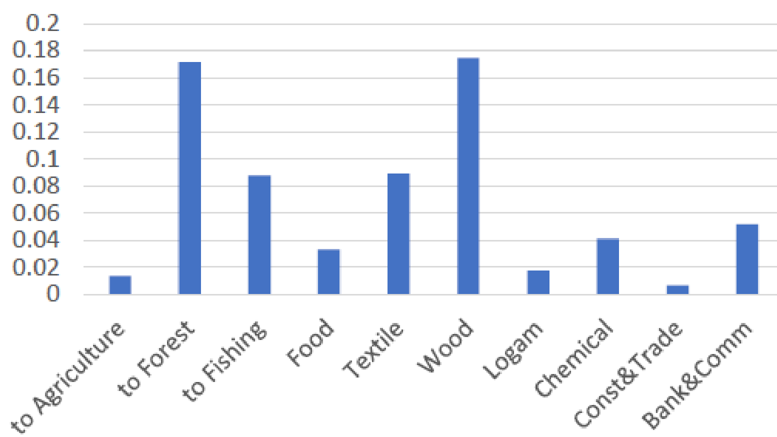

Figure 52. Investment over GDP Changes under Selective Tax Break Promoting Other Sectors

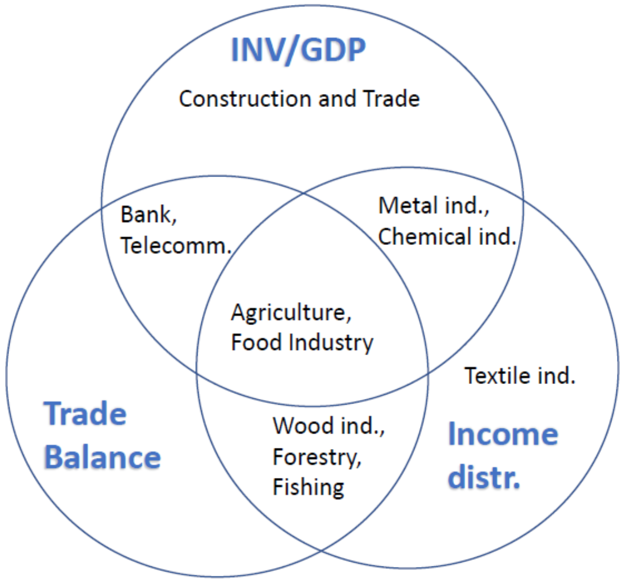

Figure 53. Diagram Venn of Sectoral Mapping Based on Equality and Efficiency Impacts

According to the sectoral assessment of their efficiency and their impact to overall inequality, figure 53 then shows the mapping of the sectors in which tax break policy by the government can result in the best way possible in all equality, investment efficiency, and trade balance point of view. Tax break targeting agriculture sector and food industry turns out to be the best option for the government to achieve the optimal result in terms of efficiency and equality.

Investment reallocation from mining to agriculture sectors reduces overall inequality, as labor employed and capital owner in agriculture sectors are mostly from lower income households, whereas labor employed and capital owner in mining sector are mostly from higher income households. Even though overall inequality is reduced, inequality within agriculture raises, as the capital owner income raises higher than the labor employed in agriculture sector.

Investment in agriculture sector instead of mining sector is also beneficial in terms of efficiency, which are low changes in investment over value-added and insignificant changes in trade balance. Low changes in investment over value-added implies that investment in agriculture sector generate higher value added than in mining, which increases the productivity, then increases the value-added of labor in turn. Intuitively, however, investment in agriculture should improve the trade balance considering low FVA component in this sector. However final good import of metal product increases significantly as a result of agriculture sector investment boosts, that it offsets the initial export increase.

Investment in food industry shows the best result out of all scenarios, in which it improves the income distribution overall, has low changes of sectoral investment over GDP, and it also improves trade balance. Investment in food industry improves the overall income distribution through its interlinkages to agriculture sectors. Hence, similar negative implication to inequality within agriculture sector is also apparent in this scenario.

Unlike investment in agriculture sector, investment in food industry improves trade balance significantly, as it contains low FVA thus the increase in export and in productions is more than the increase in imports.

CHAPTER VIII
CONCLUSION AND POLICY RECOMMENDATION

This study analyzes the impact of trade on income inequality, taking into account inter-sectoral and inter-regional linkages in Indonesia, in particular through labor productivity link. While there has been abundance of studies, both theoretical and empirical works, on how trade affects income inequality, but to the author's knowledge, only few takes into account the inter-sectoral and inter-regional linkages, especially for study in Indonesia. This study hypothesizes that in addition to inter-sectoral and inter-regional linkages that have been increasing in the last 15 years, the fact that labor productivity in Indonesia is inferior and is deteriorating affects the relationship between trade and income inequality.

Declining labor productivity induces FVA to increase as domestic cost of production relatively increases compare to cost of import. Hence, increase of export in Textile, Metal, and Chemical industries, where FVA component in total export are higher than other manufacturing sectors, increase overall inequality more than increase of export in Food and Wood industries. Increase of exports in other sectors might reduce overall inequality, but it also increases other type of inequality, such as within-agriculture inequality, or inequality within urban or rural areas.

To also study the impact of government trade policy to promote manufacturing production and export, this paper also analyzes the impact of tax break to promote manufacturing sectors, integrating it with human capital improvement, and possible policy recommendations on income inequality and trade balance. The use of foreign loan as source of fund for tax break promoting either only manufacturing sectors or any sector will worsen both income distribution and trade balance, if the government does not focus on improving the productivity of the unskilled labor. If the government follows policy recommendation suggested in the report by the Ministry of National Development Planning, which is to promote manufacturing sector through tax break, it can achieve positive results in income distribution and trade balance under very restrictive conditions, which are: the government has to implement selective financing scheme for the tax break from mining or forestry sector, and the manufacturing firms need to respond in an extremely positive manner in which they increase the productivity of the unskilled labor only.

Abruptly improving labor productivity is shown not improving income inequality as a result of the difference of consumption pattern in skilled and unskilled labor, which is captured in the consumption – value-added – and sectoral inter-linkages, which causes the difference size of impact between shock in skilled labor income and unskilled labor income, hence the widening inequality if the productivity of all labor is increased by the same amount.

If the firms behave more realistically in which they respond government policy through their investment behavior, tax break should be targeted to agriculture sector and food industry instead. Targeting tax break to these sectors will trigger the firms to reallocate their investment in these sectors instead of mining sectors, reducing income inequality and improving trade balance. However, it should also be highlighted that inequality within agriculture sector is very likely to be worsened under these policy implementations, as the gap between the capital owner and labor in agriculture sector will be widened.

Based on the analysis, this paper criticizes the policy recommendation to boost manufacturing sectors in Indonesia by Ministry of National Development Planning reported in Felipe, et al (2019) e.g. tax break for manufacturing sectors and arbitrary human capital improvement for several reasons. First, it does not touch upon inequality issues. In fact, the recommended policies, such as tax break to promote manufacturing sectors and improve human capital, are the result of partial analysis that does not take into account the cost of the policy, both in terms of financing, and the impact of the policy on social welfare as a whole, one of the measure being income inequality.

Therefore, this thesis encounters the report by suggesting to implement tax break to agriculture and food industry instead, and the type of human capital improvement to be enforced by the government should be focusing on improving productivities of agriculture labors and manual labors in food industry, such as educating agriculture labors and entrepreneurs to improve farming system and technology and providing technical advices especially to agriculture entrepreneur to improve the productivity of agriculture labors; and for manual labor productivity improvement can be done by providing on-the-job training and improving vocational education to meet the market needs. The government could also provide scholarships for lower-middle-income households to attain vocational education. The government should also encourage firms to participate by contributing to vocational school's curriculum development and by providing job training to their labors.

This study, however, is not without limitations that must be acknowledged. First, the use of IRIO and IRSAM as model ignore the element of price and agent's behavior in the simulation[7]. Second, the inequality measured in this study omits the intra-household inequality, since the only data available from IRSAM is income per household category. Hence, should there be a change in intra-household distribution after a shock, it is not captured by the resulting inequality shown in this study.

Further studies can be conducted to improve the quality of this study by developing models and using Computable General Equilibrium to assess how trade will affect income inequality while also take into account price changes and agents' behavior.

Having said that, this study contradicts trade theories by showing how trade does not always improve income inequality, taking into account inter-sectoral and inter-regional linkages. As per current government plan on promoting manufacturing production and export by improving human capital and implementing tax break for manufacturing sectors, these two trade-promoting policies worsens at least one type of income inequality. The only way to promote trade while improving income inequality is by implementing tax break to agriculture and food industry, and at the same time focusing on improving the productivity of unskilled labor in these sectors.

[7] Further and a more detailed explanation on drawbacks of IRIO and IRSAM are to be referred to Azis (2019).

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Appendix

Concordance sectors

	WIOD		SAM	
1 –Agri	r1	Crop and animal production, hunting and related service activities	1 2 5	Crop agriculture Animal production Other agricultures
2 – Fores	r2	Forestry and logging	6	Forestry and hunting
3 – Fish	r3	Fishing and aquaculture	3	Fisheries
4 – Mining	r4 r10	Mining and quarrying Manufacture of coke and refined petroleum	7 8	Coal mining, metal ore, and petroleum Other mining and quarrying
5 – Food	r5	Manufacture of food products, beverages and tobacco products	4	Food, beverage, and tobacco industry
6 – Textile	r6	Manufacture of textiles, wearing apparel and leather products	9	Textile, clothing, and leather industry
7 – Wood	r7	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	10	Wood and wood product industry
8 – Metal	r8 r9 r15 r16 r17 r18 r19	Manufacture of paper and paper products Printing and reproduction of recorded media Manufacture of basic metals Manufacture of fabricated metal products, except machinery and equipment Manufacture of computer, electronic and optical products Manufacture of electrical equipment Manufacture of machinery and equipment n.e.c.	11	Paper, Printing, Transportation equipment, Metal products, and other industries

	r20 r21 r22 r23	Manufacture of motor vehicles, trailers and semi-trailers Manufacture of other transport equipment Manufacture of furniture; other manufacturing Repair and installation of machinery and equipment		
9 – Chemi-cal	r11 r12 r13 r14	Manufacture of chemicals and chemical products Manufacture of basic pharmaceutical products and pharmaceutical preparations Manufacture of rubber and plastic products Manufacture of other non-metallic mineral products	12	Chemical industries, product of clays, cements products
10	r24 r25 r26	Electricity, gas, steam and air conditioning supply Water collection, treatment and supply Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	13	Electricity, gas, and water
11	r27	Construction	14	Construction
12	r28 r29 r30	Wholesale and retail trade and repair of motor vehicles and motorcycles Wholesale trade, except of motor vehicles and motorcycles Retail trade, except of motor vehicles and motorcycles	15	Trade
13	r36	Accommodation and food service activities	16 17	Restaurant Hotels
14	r31	Land transport and transport via pipelines	18	Land transportation

15	r32 r33 r39	Water transport Air transport Telecommunications	19	Air transportation, water transportation, and communication
16	r34 r35	Warehousing and support activities for transportation Postal and courier activities	20	Support services for transportation, warehousing
17	r38	Motion picture, video and television programme production, sound recording and music publishing activities; programming and broadcasting activities	21	Individual services, household services, and other services
	r50	Administrative and support service activities	24	Government and defense, education, health, movies, and other social services
	r51	Public administration and defence; compulsory social security		
	r52	Education		
	r53	Human health and social work activities		
	r54	Other service activities		
	r55	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use		
	r56	Activities of extraterritorial organizations and bodies		
18	r41	Financial service activities, except insurance and pension funding	22	Bank and Insurance
	r42	Insurance, reinsurance and pension funding, except compulsory social security		
	r43	Activities auxiliary to financial services and insurance activities		
19	r37	Publishing activities	23	Real Estate and other company’s services
	r40	Computer programming, consultancy and related activities; information service activities		

	r44	Real estate activities		
	r45	Legal and accounting activities; activities of head offices; management consultancy activities		
	r46	Architectural and engineering activities; technical testing and analysis		
	r47	Scientific research and development		
	r48	Advertising and market research		
	r49	Other professional, scientific and technical activities; veterinary activities		