Household Net Wealth in Indonesia: Inequality Measurements and the Determinants

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Abstract

This thesis is a collection of seven chapters on household net wealth in Indonesia, focusing on the measurement of inequality and the determinants of household net wealth.

Chapter 1 provides an Introduction and Motivation for the thesis and Chapter 7 comprises an overall conclusion with some possible policy recommendations. The remaining five Chapters provide the substantive contributions of the thesis which are mainly drawn from the empirical analysis of several iterations of the *Indonesian Family Life Survey*.

Chapter 2 presents, by way of background and motivation, an overview of the relevant literature and the main methodological approaches taken in the literature.

Chapter 3 uses a three-parameter model to estimate the Dagum Type III approach to show the condition of inequality of household net wealth in Indonesia and to decide whether the influence of negative, zero, and positive household net wealth in Indonesia influences the data distribution. Findings show a decline in inequality of household net wealth in Indonesia during the period 1993-2014 with high inequality caused by the high inequality in the lower, middle, and upper household classes and less dispersed net wealth distribution.

Chapter 4 aims to uncover the interprovincial inequality of household net wealth in Indonesia using the inequality decomposition approach. This Chapter shows that the declining inequality in Indonesia is largely caused by inequality within the province where education is the largest equalising contributor. This Chapter also uses the Club Convergence approach to show the trend of growth of household net wealth in Indonesia. Results show the growth of household net wealth in Indonesia is converging over time with two clubs having formed. In particular a group of high-performing members dominates the Provinces in Java Island and the other group of lower-performing members consist of Provinces outside Java Island.

Chapter 5 uses a quantile regression approach to model the occurrence of heterogeneity across classes in the Indonesian population, for example, age, ethnicity, family structure, and human capital, that can affect household net wealth in Indonesia. Empirical findings show that the estimates derived from the from quantile regression that permit heterogeneity across classes, provide different results from the standard regression models that concentrate on the average value. In particular, they show that the occurrence of variables that have a positive effect on household net wealth have an increasing pattern, with a higher return for higher classes, for example, education aspect and household live in urban areas, while other variables have a negative effect on household net wealth with an increasing influence of higher classes, for example, household size and dependency ratio.

Chapter 6 focuses on the influence of spatial aspects in the estimation of the determinants of household net wealth, where the occurrence of spatial autocorrelation leads to household net wealth in one region being spatially correlated with other households in the same region and neighbouring regions. Empirical findings show a declining trend of spatial autocorrelation of household net wealth in Indonesia during the period 1993-2014 with the change of household net wealth in the region largely caused by spillover effects, i.e., the change of variables in neighbouring regions. The heterogeneity of the effect of variables is a by-product of economic progress and is influenced by the heterogeneity of the endowment at the sub-national level.

Note on Publication

The following chapters are in preparation for submission to academic journals:

Chapter 3. An Application of the Dagum Type III Model to Measure Household Net Wealth Inequality in Indonesia—under preparation for submission to *Review of Income and Wealth*.

Chapter 4. Interprovincial Wealth Inequality by Factor Components in Indonesia—under preparation for submission to *Bulletin of Indonesian Economics Studies*.

Chapter 5. The Role of Household Characteristics and Intergenerational Transfer in Households Net Wealth in Indonesia—under preparation for submission to *Asian Economic Journal*.

Chapter 6. Estimating Spatial Panel Data Model for Households Net Wealth Determinants in Indonesia— under preparation for submission to *Spatial Economic Analysis*

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Chapter 1. Introduction

1.1. Motivation of the Study

This thesis investigates the measurement and determinants of household net wealth inequality in Indonesia with particular emphasis on interprovincial inequality and the effects of spatial factors. It uses the Indonesian Family Life Survey (IFLS) as the main data source. The Survey is representative of approximately 83% of the Indonesian population and covers 13 of the 34 provinces in Indonesia that are provinces in Java Island, Sumatera Island, Bali and Nusa Tenggara, Kalimantan, and Sulawesi Islands. Data from five waves of IFLS are utilised with data collected in 1993 (wave1) to 2014 (wave 5).

Indonesia has achieved an impressive record of growth in Gross Domestic Product (GDP) over the last two decades, averaging over 5% for the period 2000-2019 (World Bank, 2019a). Indonesia has also been able to increase its Human Development Index (HDI) score from 0.523 in 1990 to 0.718 in 2019, showing that improvements in wellbeing go beyond simple measures of material wealth, for example, GDP, with improvements in the health, education and income measures (UNDP, 2021b).

However, the benefits of growth have not been shared equally, in part due to the challenges faced by Indonesia as the world's largest archipelago with more than 17,000 islands. This leads to Indonesia's population being unequally distributed, with for example, Java Island, which comprises 7% of Indonesia's land area being home to more than half of the country's population. The National Development Strategy implemented in Indonesia during the 1960s-1990s focused upon achieving high levels of economic growth in certain regions or 'economic growth centres' with the result that a widening gap in the standard of living emerged, as demonstrated by the increasing trend of Indonesia's income Gini coefficient, from 0.324 in 1984 to 0.345 in 1996 and 0.382 in 2019 (World Bank, 2020b). In another study, (World Bank, 2016a) they found that the expenditure Gini coefficient was increasing in Indonesia during the period 1993-2014, that is from 0.341 to 0.414. Other studies related to interregional differences in the household standard of living in Indonesia discuss inequality from the perspective of income (for example Akita, 2002; Kharisma & Saleh, 2013; Suryadarma, Widyanti, Suryahadi, & Sumarto, 2006) and expenditure (for example Akita & Lukman, 1999; Tadjoeddin, Suharyo, & Mishra, 2003; Yusuf, Sumner, & Rum, 2014).

The growing gap in the standard of living can also be illustrated by using a household wealth measure where several studies have documented unequal wealth ownership in Indonesia. A report by Credit Suisse (2019) showed that in Indonesia, the wealth ownership is unequally distributed by showing that the vast proportion of the population that have low wealth levels whereas a small number of adults have high wealth levels. A study by the World Bank (2014) reported that Indonesia's richest 20% have enjoyed much higher growth in their incomes and consumption than other groups (World Bank, 2014). Gibson (2017) showed that Indonesia has the sixth-worst inequality of wealth in the world, where, in 2016, the wealthiest 1% of the Indonesian population owned nearly half of total wealth.

The gap in the standard of living can also be seen by considering the differences in development across regions where Java Island, as Indonesia's economic growth centre, is where we will find the biggest cities including Indonesia's capital, Jakarta. Better economic opportunities in cities have helped many Indonesians escape poverty and join the middle class, as illustrated by the high rate of urbanisation growth in Indonesia, which is considered much higher than other South East Asia countries (World Bank, 2020h). A report by the World Bank (2018b) shows that despite the reduction in disparities between places (e.g. urban and rural areas) and districts in Indonesia, inequality remains, with the highest proportion of inequality explained by inequality 'within places' (that accounted for close to 86% of total inequality) and inequality 'within district' (more than 78% of total inequality).

The estimation of household wealth allows the use of alternative measures of differences in the standard of living to those of simple income measurement and removes some of the inherent problems of the latter approach, where the transitory nature of income means that past income does not necessarily reflect future income or well-being, (Oliver & Shapiro, 1990). People with higher incomes may have more wealth, but these measures are not interchangeable (Filmer & Pritchett, 2001; Gibson, 2017; Oliver & Shapiro, 1990). The use of wealth measurement also removes some of the biases in expenditure measurement, where the population at the bottom of the wealth distribution have expenditure that is higher than income with contrary findings found at the top of the wealth distribution (Clementi, Dabalen, Molini, & Schettino, 2018; McKenzie, 2005; Senik, 2014).

The existence of household debt also influences the household standard of living as debts that are higher than total wealth lead to negative household net wealth. Such negative values are one characteristic that is not found in income or expenditure measurements. Liabilities can affect a household's consumption and investment as they reflect a financial commitment to other parties that may lead to a partial or full loss of assets due to a sudden drop in earnings that can influence debts repayment (OECD, 2015). Such debts are also often recognised as an important component that enables households to enable expenditure even though they have very low or zero income (Meyer & Sullivan, 2004).

This thesis provides an insight into the measurement of household net wealth inequality in Indonesia, as well as the determinants of household net wealth. More specifically, the thesis aimed to answer four research questions as follows.

- The first research question relates to the benefits of using household net wealth to reflect the standard of living. In particular, what is the size, scale and distribution of inequality of household net wealth in Indonesia?
- The second research question relates to interprovincial inequality of household net wealth in Indonesia. Is total inequality caused by inequality 'within province' or inequality 'between provinces'? Further, does the growth of household net wealth in Indonesia converge or diverge over time?
- The third research question considers which factors influence the heterogeneity of Indonesian households across classes and how they affect the determinants of household net wealth in Indonesia?
- The fourth research question asks whether there is a significant spatial concentration of household net wealth in Indonesia and do spatial interactions exist between regions?

Each research question listed above is answered and explained via each of the four papers that constitute the main body of this thesis.

Chapter 2 comprises a literature review that seeks to place the overall thesis into perspective and facilitates a discussion of how the thesis fits into the existing literature and what contributions it makes to that field of analysis.

Chapter 3 provides an answer to the first research question relating to measures of inequality in Indonesia based upon household net wealth. Due to the possibility of negative values resulted from debts being higher than total wealth, estimation methods used in the measurement of inequality of income or expenditure are no longer applicable. To overcome this condition, I use the Dagum Type III model (Dagum, 1990) as it can address negative, zero, and positive values. The use of this model also reveals the shape of the data distribution, hence, allowing us to decide whether the inequality is caused by inequality in the low, middle, or high household classes.

Chapter 4 addresses the second research question by expanding the analysis from the first chapter by including estimation of the differences in household net wealth between regions. More specifically, by using the decomposition of the half squared coefficient of variation ($\frac{1}{2}CV^2$), the chapter investigates the interprovincial household net wealth inequality in Indonesia to seek to measure the contribution of inequality 'within' and 'between' provinces to total inequality. Furthermore, this chapter applies the 'club convergence approach' to ascertain whether the growth of household net wealth across regions are converging or diverging and to decide which group of provinces have formed a 'club' as part of any convergence process.

Chapters 5 and 6 consider which factors influence household net wealth in Indonesia. Chapter 5 seeks to address the third research question and investigates which factors affect household net wealth in Indonesia by considering the influence of heterogeneity across classes, for example, in demographic, education, and household characteristics, among the Indonesian households that potentially bring the different effects of the variables across various classes. To achieve this purpose, quantile regression methods are utilised as they can capture unobserved heterogeneity across classes that cannot be observed from estimation based on average values. The use of quantile regression provides an approach to consider whether the interactions of household net wealth and their covariates have an increasing return (as one moves from the lower to the higher end of the distribution that indicates the richest population enjoy the largest benefits from the change of covariates), decreasing return (where the poorest households enjoy higher benefits than the richer households), or whether there is no distinct pattern across classes.

Chapter 6 addresses the final research question by including spatial analysis to consider the determinants of household net wealth in Indonesia. More specifically, this chapter tests for and observes the existence of spatial autocorrelation of household net wealth in Indonesia by using Moran's I estimation (Anselin, 1993). Further, this chapter considers whether there are spatial spillovers of household net wealth to/from households in the same area and neighbouring areas. Considering the archipelagic nature of Indonesia, we might expect that there are limited spatial interactions between regions separated by water or sea and that the contiguity matrix used as a spatial weighting matrix to represents the interactions between regions may be problematic. The distance-based matrix is then applied in the Spatial Durbin Model (SDM) (Elhorst & Fréret, 2009) as the more appropriate model to represent spatial interaction compared to linear regression model approach that ignores spatial aspects.

The thesis differs from other reports of the measurement of wealth inequality in Indonesia in three respect. Firstly, the unit of analysis, secondly, the data period, and thirdly the use of a spatial aspect. Different to Credit Suisse (2019), this thesis focuses on the household as the unit of analysis as assets owned by households that are registered against family members can also be enjoyed by other household members. The use of the household as the unit of analysis leads to more accurate wealth ownership estimation as one household can have a lower per capita wealth ownership than other households due to being part of a larger household even though they have a similar level of household level.

Second, unlike Credit Suisse (2019) and the World Bank (2014), which use cross-section data to investigate wealth ownership in Indonesia, this thesis uses panel data or longitudinal data to allow observation for the same households to be tracked over time to capture the dynamics of wealth ownership as a result of socioeconomic events in Indonesia. The use of panel data allows us to distinguish 'inter-individual' differences from 'intra-individual' differences that cannot be obtained from a single time series data or a single cross-section of data. In a single time series, data can show a trend over time, but lack data with regard to inter-individual differences. While the cross-sectional data reflect inter-individual differences, but cannot show intra-individual differences (Hsiao, 1985).

Third, this thesis includes spatial interactions in the estimation of the determinants of household wealth in Indonesia. Considering the uniqueness of Indonesia's geographical areas being an archipelago nation, the interaction of regions separated by water or sea is more limited than regions that share a land border (Nijkamp, Rietveld, & Salomon, 1990). Unlike regions that share land borders, regions separated by water/sea see water/sea transportation as the most affordable way to transport passengers and commodities, which, however, requires a more complex infrastructure than roads, e.g., a need to build seaports, requiring complex regulations, and less reliable due to bad weather and limited operational hours. Hence, this condition may influence the economic activities between regions and therefore influence the level of household wealth in the region, as indicated by the interaction between households shown from direct effect (from other households in the same region) and spillover effect or indirect effects (from other households in neighbouring regions)

Furthermore, the thesis uses the Indonesian Family Life Survey (IFLS) as the main data source. The IFLS is the longest ongoing longitudinal survey in Indonesia (21 years period, from 1993 to 2014) that collects extensive socioeconomic information on the lives of the respondents who live in 321 enumeration areas in 13 provinces in Indonesia and representative of 83% of Indonesian population in 1993. Currently, there are five waves of IFLS. The first wave of IFLS (IFLS1) was administered in 1993 and covers 7,224 households. These households were spread, both urban and rural areas, across 13 provinces, from the island of Java, Sumatera, Bali, Kalimantan, Sulawesi, and Nusa Tenggara (see Figure 1.1). In total, these 13 provinces comprised 83 percent of the Indonesian population at the time of the survey. The subsequent waves of surveys sought to re-interview all the IFLS1 households and new households formed from split-off households from the origin IFLS1 households. The second wave of IFLS (IFLS2) interviewed 7,698 households in 1997[1], the third wave of IFLS (IFLS3) was fielded in 2000 and interviewed 10,574 households, the fourth wave of IFLS (IFLS4) was fielded in 2007 on 13,995 households, and the fifth wave of IFLS (IFLS5) was fielded in 2014 and interviewed 16,931 households.

Figure 1.1. *Map of 13 IFLS Provinces in Indonesia*

Source: RAND (2014a)

Some strengths of using IFLS as the dataset are explained as follows. First, the IFLS is the longest longitudinal study in Indonesia that contains rich information on socioeconomic conditions, health, and community characteristics among individuals, households, and communities in Indonesia (Strauss, Witoelar, & Sikoki, 2016; Thomas, Frankenberg, & Smith, 2001). Second, although not all households in subsequent waves of the IFLS were in in the 1993 wave, the attrition rate of IFLS is considered very low, with the contact rate in each wave ranging from 90.2% to 95.3% from total households from the previous waves (Thomas et al., 2001). Third, in addition to the information for individuals and households, the IFLS provides

[1] A follow up survey IFLS2+ was conducted in 1998 with 25% of the sample, almost one year after IFLS2, to measure the immediate impact of the economic and political crisis in Indonesia. This survey is a scaled-down survey of IFLS2 due to limited time and resources to mount a survey of the same magnitude of IFLS2 (Frankenberg, Thomas, & Beegle, 1999).

detailed information on the community from the 321 enumeration areas where IFLS households are located and cover aspects of physical and social environment, infrastructure, and accessibility. Hence, by linking data from IFLS households to data from their communities, observations related to the effects of social, economic, and environmental change on the population can be incorporated (Strauss et al., 2016).

Attrition in the IFLS is very low; in each of the follow-up waves, more than 90 percent of the IFLS1 dynasty households were successfully re-contacted (Strauss & Witoelar, 2019). In IFLS2, 94.4% of IFLS1 households were re-contacted. In IFLS3 the re-contact rate was 95.3% of IFLS1 dynasty households. In IFLS4 the recontact rate of original IFLS1 dynasties was 93.6%. In IFLS5 the dynasty recontact rate was 92%. Among IFLS1 dynasties, 87.8% were either interviewed in all 5 waves, or died, some 6,341 households, of which 6,275, or 86.9% are actually interviewed in all 5 waves. These re-contact rates are as high as or higher than most longitudinal surveys in the United States and Europe, which contribute to reducing the risk of bias due to non-random attrition in studies using the data (Strauss & Witoelar, 2019).The IFLS can be seen as an ideal alternative to the Survei Sosial Ekonomi Nasional (Susenas)[2] and satisfactorily serve as a nationally representative dataset (Chongvilaivan & Kim, 2016). In comparison to *Susenas*, IFLS is a better alternative as it has a more extensive set of questions regarding the household economy (Dong, 2018; Erlangga, Ali, & Bloor, 2019; Roy & Tiongco, 2008) and contains more detailed community characteristics in terms of the remoteness, infrastructure, and local economy (Dong, 2018). The *Susenas* accurately measure household consumption or expenditure but lack detailed information regarding household wealth (Dong, 2018; Johar, Soewondo, Pujisubekti, Satrio, & Adji, 2019; Joshi, Subramanian, & Swaminathan, 2019).

1.2. Contribution of Thesis and Organisation of Thesis

This thesis contributes to the economic literature in several ways. First, it uses a Dagum Type III model to estimate the inequality of household net wealth, using a developing country as a case study. This particular approach overcomes problems associated with negative values which, by design, do not arise in the estimation of inequality of income or expenditure, but are endemic when it comes to net wealth in Indonesia. The use of the Dagum Type III model also

[2] The *Susenas* is a nationally representative socioeconomic survey conducted by National Statistics Office/BPS. The *Susenas* dataset consists of three main datasets: core (records large number of the sample but low-depth of questions), module (contains more detailed questions but cover smaller sample), and panel (collected information from consistent households but only covers data from 2005).

shows whether Indonesia has typical characteristics of inequality observed from inequality in the low, middle, or high classes that are different from those found in developed countries.

Second, the thesis relates to an archipelago nation. The existence of water or sea boundaries that separate regions, potentially leads to more limited interactions between regions compared to regions with shared land boundaries. Hence, the contiguity matrix that is usually used to consider spatial interaction between regions separated by a simple land border is no longer relevant. Instead, the thesis uses a distance-based matrix to show the interaction between regions that are separated by water or sea boundaries.

Using Indonesia as the study area, this thesis contributes to the importance of considering heterogeneity in the population in the policymaking process, where it can lead to different effects and magnitudes on different household classes. Furthermore, the use of spatial analysis allows for tests of direct and spillover effects in the estimation of the determinants of household net wealth and raises the importance of development that considers space and location as factors that can increase the standard of living in the region, which may be influenced by changes in variables in neighbouring regions.

This thesis consists of seven chapters. Chapter 1 presents the motivation of this thesis, the contextual framework, and the data used in this thesis. Chapter 2 provides a review of the literature. Chapter 3 to Chapter 6 are the major body of this thesis, which contain four empirical papers. In Chapter 3, I discuss the measurement of inequality of household net wealth in Indonesia. Chapter 4 presents the discussion of the investigation of interprovincial household net wealth inequality. Chapter 5 contains an investigation of the determinants of the household net wealth in Indonesia with considering the unobserved heterogeneity across classes. In Chapter 6, the discussion of the determinants of the household net wealth with considering spatial aspect takes place. Lastly, Chapter 7 presents the conclusions and implications for future research and policy.

Chapter 2. Literature Review and Methodological Overview.

2.1. Household Net Wealth as Measurement of Standard of Living

This chapter uses the existing literature to provide an overview of the approaches, methods, and tools used in this thesis to address the research questions in each chapter and identify the research gaps in the estimation of inequality of household net wealth in Indonesia. The existing literature is therefore allocated to various categories to consider the pros and cons of various previous approaches to the consideration of inequality, and in so doing, provide the basis for choices made in terms of measurement or estimation methods used in subsequent chapters.

Compared to income and expenditure measurements, household net wealth is more suitable for reflecting the standard of living. Unlike income measurement, household wealth reflects a more persistent condition of purchasing power where current wealth represents past and future ability to purchase commodities (Fitzsimmons & Leach, 1994; Wakita, Fitzsimmons, & Liao, 2000). Compared to income, household net wealth better reflects the standard of living as households tend to conceal their income (e.g. for security reasons or to avoid tax) or prefer not to report irregularly received income (Birdsall, 2010; Brown & Gray, 2014; Ward, 2013). Household wealth is also an indicator of people with high incomes generally having more wealth, but these measures are not interchangeable; people with more wealth do not always have a high income; for example, the pensioner who has a higher wealth level but low income (Filmer & Pritchett, 2001; Oliver & Shapiro, 1990). Further, in contrast to income, household wealth can be passed from one generation to another generation (Keister, Benton, & Moody, 2019; Oliver & Shapiro, 1990).

Compared to expenditure measures, wealth measurement provides unbiased calculations of the standard of living as the bottom of the distribution, where expenditure often exceeds income while at the top of the distribution, the reverse condition occurs (Meyer & Sullivan, 2004; OECD, 2015). More specifically, households at the bottom of distribution can have expenditures higher than income; to pay their expenses, households convert their assets into money or through withdrawing their savings (Clementi et al., 2018). At the top of the distribution, downward estimation of expenditure is caused by high-value assets usually owned by the richest households (McKenzie, 2005; Ward, 2013).

The focus of attention should be aimed at the household net wealth as household debts; for example, in the form of home loans, vehicle debts, or consumption/personal loans; reduce total wealth. It also indicates to what extent one household can achieve the financial security that can affect its consumption and investment (OECD, 2015). In mathematical form, net wealth measurement is (Cowell & Van Kerm, 2015):

$$NW = W - D \quad (1)$$

where NW = net wealth, W = total wealth, and D = debts. While W is the market value of each type of asset, thus

$$NW = \sum_{j=1}^{m} \pi_j A_j - D \quad (2)$$

where $A_j \geq 0$ is the amount held of asset type j and π_j is its price.

Since total value is reduced by debts, net wealth can have negative values (when debts are higher than total wealth), zero (total wealth equals debts), and positive values (when total wealth is higher than debts). The existence of zero value is the important component that differentiates household net wealth measurement from the income or expenditure. Additionally, the possibility of negative values can lead to a sparse and heavy-tailed distribution which indicates a relatively small proportion of the population has extremely high value and a large proportion of the population has low value, therefore, this condition can lead to a higher level of inequality than income or expenditure measurements (Cowell & Van Kerm, 2015; Jenkins & Jäntti, 2005; Jordá & Niño-Zarazúa, 2019).

Refering to the IFLS data as the main data source in this thesis, information related to household wealth is in Book 2 Section HR (Household Assets) while information on debts is found in Book 2 Section BH (Borrowing). In the IFLS, total wealth is composed of the value house and land occupied by the household, other house/building, land (not used for farm/nonfarm), poultry, livestock/fishpond, hard stem plant that is not used for farm or non-farm business, vehicles (cars, boats, bicycles, motorbikes), household appliances (radio, tape recorder, tv, etc.), savings/certificate of deposit/stocks, receivables, jewellery, household furniture and utensils, and other assets. While household debts are any loan obtained from non-family members, e.g., from banks, cooperatives, employers, landlords, store owners, non-government organizations, money lenders, office, pawnshops, and non-bank financial institutions.

This chapter discusses four methodological approaches used in the investigation of household net wealth in Indonesia, each to answer the four research questions articulated in the previous chapter. The first approach is used to help solve the problem of the measurement of inequality of household net wealth in Indonesia. Since household net wealth can have negative values, the typical estimation used in the measurements of income or expenditure inequality is no longer applicable as these can only calculate positive and zero values. To solve this issue, I use Dagum Type III model to estimate household net wealth inequality in Indonesia. This model provides parameters that represent the shape of distribution, and by converting the parameters into a single Gini Coefficient, we observe the trend of inequality and make a comparison across regions and time.

The second approach helps to find a solution to the problem of the interprovincial net wealth inequality in Indonesia where it is still unknown whether the total inequality is caused by differences within or between regions. To solve this problem, I use decomposition of the half squared coefficient of variation ($\frac{1}{2}CV^2$) as unlike the decomposition of the Gini Coefficient, this method is additively decomposable and gives no residual component. Further, I use club convergence approach to discover whether the growth of household net wealth across regions is converging to a certain point or diverging from their initial condition. This procedure is more advanced than the traditional convergence method as it can reveal, not only the convergence of one region towards others but also the convergence within group of regions.

The third approach provides a solution to the problem of unobserved heterogeneity across clasess in the estimation of the determinants of household net wealth that may be obscured by the estimation from the average value. To solve this issue, I use quantile regression to show whether the interactions of the household net wealth and the covariates have an increasing return (moving from the lower to the higher end of the distribution indicates that the richest population enjoys the largest benefits from the change of covariates), the decreasing return (where the poorest households enjoy higher benefits than the richer households), or even show no distinct pattern across classes.

The fourth approach helps identify an explanation for efforts to find determinants of household net wealth with the influence of spatial aspect. By using Moran's I estimation, I show the household net wealth in Indonesia is spatially concentrated with a declining concentration existing during 1993-2014. The existence of spatial interaction, showed in in a spatial weighting matrix, indicates that household net wealth in one region is influenced by the change of variables in the same area and in neighbouring areas. Due to the archipelagic condition of Indonesia, the contiguity matrix normally used in the estimation of spatial model for regions that share land borders is no longer applicable. Instead, I use a distance-based matrix to represent spatial interactions and apply it in the Spatial Durbin Model (SDM), that unlike linear regression model ignores the spatial aspect, the SDM contains the spatial lag of dependent variable and spatial lag of independent variables.

2.2. Dagum Type III Model to Measure the Inequality of Household Net Wealth

Some studies show the strength of using the Dagum Type III model in inequality measurements that include negative, zero, and positive values. Studies by McDonald and Mantrala (1995) and Kleiber (1996) showed the Dagum Type III model is better than Generalized Beta II (GB2) and Singh- Maddala model in measuring inequality without the cost of an additional parameter and without losing closed-form (and invertible) expressions for the distribution function. The Dagum Type III model also has a density of distribution that has a more flexible shape than Singh-Maddala (Kleiber, 1996). Other studies that show the reliability of the Dagum Type III model to explain inequality are found in Jenkins and Jäntti (2005) and Cowell and Van Kerm (2015).

The ability for Dagum Type III model to explain inequality that contains negative, zero, and positive values can be shown in its components that contain one atomic and two continuous distributions, symbolically (Dagum, 1990):

$$F(x) = b_1F_1(x) + b_2F_2(x) + b_3F_3(x), \quad (3)$$

$$|x| < \infty, b_1 \geq 0, b_2 < 1, b_3 > 0, b_1 + b_2 + b_3 = 1, b_1 + b_2 = \propto, 1-\propto = b_3, 0 \leq \propto < 1$$

where x is the net wealth variable, then $F_1(x)$ accounts for the negative net wealth observations, $F_2(x)$ reflects the unit mass of economic agents at $x = 0$, and $F_3(x)$ accounts for the positive value of net wealth.

For $F_1(x)$:

$$F_1(x) = \exp(-c|x\_|^s), \quad (4)$$

$$x\_ = min(x, 0), (c, s) > 0,$$

$$f(x) = \frac{dF_1}{d|x\_|}\frac{d|x\_|}{dx} = cs|x\_|^{s-1}exp(-c|x\_|^s)(-1)\min\left\{\frac{x}{|x|}, 0\right\}$$

For $F_2(x)$:

$$F_2(x) = \max\left\{0, \frac{x}{|x\_|}\right\} \quad (5)$$

For $F_3(x)$, also being the Dagum Type 1:

$$F_3(x) = (1 + \lambda x_+^{-\delta})^{-\beta}, x_+ = \max\{x, 0\}, (\beta, \lambda) > 0, \delta > 1 \quad (6)$$

Then,

$$F(x) = b_1 \exp(-c|x\_|^s) + b_2 \max\left\{0, \frac{x}{|x|}\right\} + b_3(1 + \lambda x_+^{-\delta})^{-\beta} \quad (7)$$

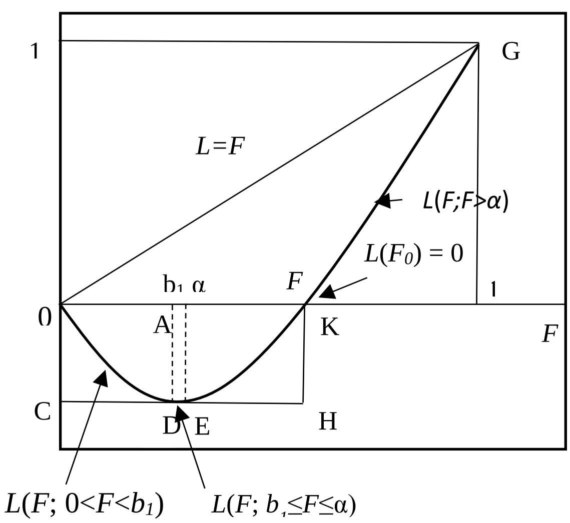
where c and λ are scale parameters and all the other parameters, b_1, b_2, b_3, s, β, and δ, are inequality parameters.

The parameters obtained from the Dagum Type III model represent the shape of the distribution curve. More specifically, the parameter α is sensitive to negative- and zero-net wealth households, parameter β reflects net wealth held by low- and middle-net wealth households, and parameter δ is sensitive to changes in the upper-net wealth households; while λ reflects the dispersion of net wealth. Parameters α, δ, and λ are also indicators for the tails of the net wealth distribution, as they reflect the length and thickness of the distribution tails (Brzeziński, 2013).

The parameters above are difficult to interpret individually and should be interpreted as a contingency, therefore, conversion to other single coefficients is needed for easier interpretation (Jenkins & Jäntti, 2005). Conversion to the Gini Coefficient is popular as this coefficient has properties that make it convenient to compare inequality across regions and time: as it is not affected by changes in the unit of measurement (currency), allowing researchers to avoid issues of inflation and purchasing power, and can be expressed mathematically in terms of the distributional parameters (Bandourian, McDonald, & Turley, 2002). Some applications of the conversion of the parameters of Dagum Type III to the Gini Coefficient are found in Bandourian et al. (2002), Brzeziński (2013), Graf and Nedyalkova (2014), and Cowell and Flachaire (2014).

As the Gini coefficient is obtained from the ratio of areas in the Lorenz Curve, the existence of negative values is shown by the Lorenz curve beneath the horizontal axis (see Figure 2.1).

***Figure 2.1**. Lorenz Curve*



Source: Dagum (1999)

From Figure 2.1, taking into account the presence of negative values in the interval (0, F_0), the Gini ratio is defined as twice the area between the equidistribution line $L=F$ and the Lorenz curve, divided by one plus the area of the rectangle $\propto |L(b_1)|$, that is (Dagum, 1999):

$$G = \left[2\int_0^1 (F-L)dF\right] / [1 + \propto |L(b_1)|] \quad (8)$$

$$G = \left[1 - 2\int_0^1 LdF\right] / [1 - \propto L(b_1)]$$

where $\int_0^1 LdF = \int_0^{b_1} LdF + \int_{b_1}^{\propto} LdF + \int_{\propto}^1 LdF$

Then the Gini ratio becomes (Clementi, et.al., 2012):

$$G = \frac{1 - 2\left\{(1-\alpha)\beta\alpha\left[B\left(\alpha+\frac{1}{\delta}, 1-\frac{1}{\delta}\right) - B\left(2\alpha+\frac{1}{\delta}, 1-\frac{1}{\delta}\right)\right] - cb_1\left(1-b_1\left(1-b_1 2^{-1-1/s}\right)\Gamma\left(1+\frac{1}{s}\right)\right)\right\}}{1+\alpha c b_1 \Gamma\left(1+\frac{1}{s}\right)} \quad (9)$$

Gini ratio is twice the integral between the equi-distribution function L=F and the Lorenz curve divided by one plus the area of the rectangle OCHK in Figure 2.1.

2.3. Interprovincial Inequality of Household Net Wealth

Examination to discover the location of the cause of the inequality, whether caused by inequality within or between regions, is needed to overcome the limitation of inequality measurement in the previous section that lacks information regarding the location of the cause of inequality. To achieve this purpose, the inequality decomposition of the half squared coefficient of variation (½CV^2) is used as it can overcome the existence of residuals in the estimation of inequality of decomposition of the Gini Coefficient.

In the inequality decomposition of the Gini Coefficient, two components can take form: Gini within (G_W) and Gini between (G_B). Mathematically, the inequality decomposition of the Gini Coefficient is (Lambert & Aronson, 1993):

$$G = G_B + \sum a_k G_k + R \quad (10)$$

where the population subgroups are indexed by $k = 1, 2, \ldots, n$, G_B is the between-groups Gini Coefficient, defined as the one which would obtain if every value in every subgroup were to be replaced by the relevant subgroup mean, a_k is the product of population share and value share to subgroup k, G_k is the Gini Coefficient for value within subgroup k and R is a residual which is zero if the subgroup income ranges do not overlap.

Some studies show the occurrence of residuals in the decomposition of the Gini Coefficient should be deprecated as this obscures the role of inequality within and between provinces (Bellù & Liberati, 2006; Costa & Pérez-Duarte, 2019). Therefore, the half squared coefficient of variation (½CV^2) should be used as it is additively decomposable and there is no residual component (Abdi, 2010; Villar, 2017). As a group of Generalised Entropy measured, the half squared coefficient of variation can be shown mathematically (Irawan, 2014):

$$GE(\propto) = \frac{1}{\propto(\propto-1)}\left[\frac{1}{N}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{\propto} - 1\right] \quad (11)$$

where $\bar{y}$ is the mean of a given variable per capita (regional per capita GDP). The value of *GE* measures takes between 0 and infinity, with 0 representing an equal distribution and higher values representing higher levels of inequality. The parameter α can take any real value and defines the weight given to distances between values of the variable at different parts of the distribution. For lower values of α, *GE* is more sensitive to changes in the lower tail of the distribution, and for higher values of α, *GE* is more sensitive to changes in the upper tail.

The commonly used values of α are 0, 1, and 2. The *GE*(0) is also known as the mean log deviation or Theil's L, and the *GE*(1) is Theil's T. The *GE*(2) is equal to half the square of the coefficient of variation. While the Theil index is additively decomposable by regions and cannot be decomposed by factor sources, the *GE*(2) can be additively decomposed as the sum of within-group inequality, *GE_w*(α) and between-group inequality, *GE_b*(α) (Akita, Riadi, & Rizal, 2020).

Estimation of the interprovincial inequality above brings results showing whether interprovincial household net wealth inequality is largely caused by inequality within or between provinces, therefore leading to the need to compare the household net wealth growth among regions over time. More specifically, a need to test whether the growth of household net wealth is converging to a certain level or diverging from their steady state.

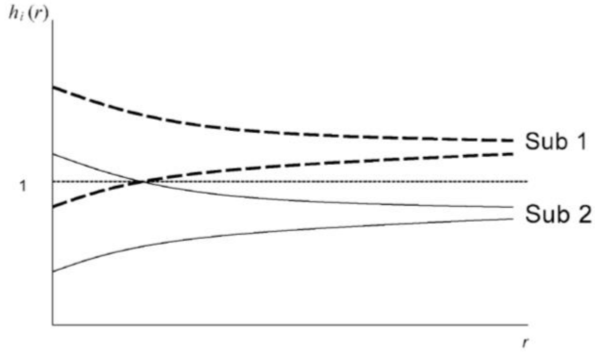
The most common method of convergence analysis is based on classical models such as σ-convergence and β-convergence. The σ-convergence refers to the decrease in growth dispersion (in most cases, the growth of income per capita) across countries or regions over time. Differently, β-convergence is seen in the negative correlation between the initial level of income capita and its growth. Implicitly, this means that low-income countries tend to grow relatively faster than high-income countries and thus can catch up (Barro, 1991; Barro & Sala-i-Martin, 1992). The concept of β-convergence can be differentiated into unconditional and conditional convergence where the unconditional or absolute β-convergence assumes convergence of regions from their initial condition towards a unique (global) steady-state growth path. In contrast, the conditional β-convergence analysis assumes that regions converge to different steady-state growth paths, depending on their initial conditions as well as other (local) factors that are important for economic growth, for example, human and physical capital accumulation, and population growth (Islam, 2003).

Some concerns regarding the traditional convergence application are explained by Chatterji (1992) who said the traditional convergence that is the existence of a set of economies that are steady-state in the long run implies the traditional division in the convergence is no longer relevant. A further comment by Phillips and Sul (2009) showed the possible convergence may be biased and inconsistent because of omitted variables and endogeneity as the convergence analysis typically divides all individuals into subgroups based on some prior information (geographical location, institution), then tested the convergence hypothesis for each subgroup respectively.

To overcome these limitations, Phillips and Sul (2007) developed a distribution-based measure (the log t-test) that can be applied within a time series framework to measure the occurrence of club convergence. The procedure retains the distribution of incomes as the functional parameter but attempts to go beyond transitional dynamics to identify long-term trends. It is also less restrictive than β-convergence as it allows for, and endogenises, club convergence as a likely result. Furthermore, it is relatively straightforward in both implementation and interpretation compared to other time series methods (Zhao, 2015). Du (2017) mentioned two advantages of the convergence club model proposed by Phillips and Sul (2007): first, it accommodates heterogeneous agent behaviour and evolution in that behaviour; and second, the proposed test does not impose any assumptions concerning trend stationarity or stochastic non-stationarity, thereby being robust to the stationarity property of the series.

Phillips and Sul (2007) explained how the club convergence approach works by showing the transition curves for four different regions that form two subgroups. The four regions differ in their initial conditions as well as in their transition paths. Two regions in Subgroup 1 have relative transition curves converging into the same value, in comparison, regions in Subgroup 2 have their transition paths converging (Figure 2.2).

Figure 2.2. *Stylised Club Convergence with Two Subgroups*



Source: Phillips and Sul (2007)

To achieve the estimation of club convergence, Phillips and Sul (2007) developed the clustering algorithm of club convergence explained: First, ordering, that is sorting the data based on the last observation in the sample. Second, selecting a core group of the region, that is conducted through adding the observation one by one and perform the log-*t* regression until a core group can be formed. If a core group cannot be formed, then there are no convergence clubs. Third, screening data for new members by including the new region in the convergence group if the *t*-statistic is greater than the criterion value. Fourth, recursion and stopping rule, that is achieved through running the log-*t* regression to determine whether the group is converging to achieve the second group of regions from the regions that were not grouped into the first group. Fifth, testing for club merging for the existing clubs and merge them into a new club if the convergence hypothesis is satisfied to achieve the smallest number of clubs.

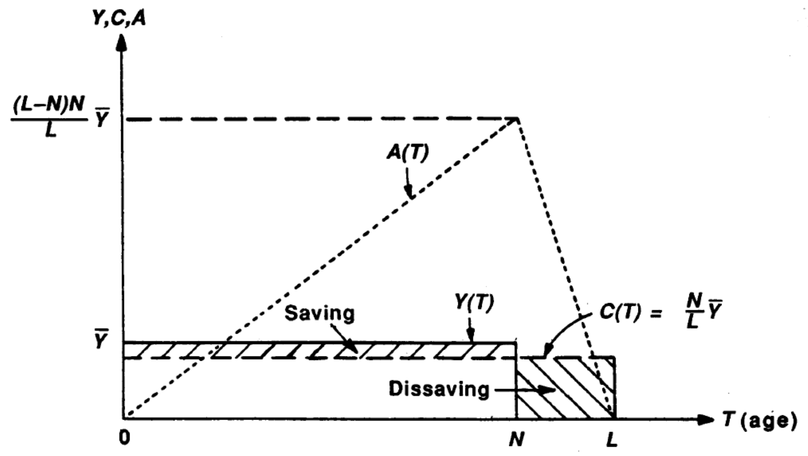
Apergis, Christou, Gupta, and Miller (2015) confirmed that the procedure by Phillips and Sul (2007) has several advantages over other methodological approaches to test for convergence. First, no specific assumptions concerning the stationarity of the variable of interest and/or the existence of common factors are necessary. Second, the method relies on a quite general form of a nonlinear time-varying factor model, where the common stochastic trends are employed to allow for long-run co-movements in aggregate behaviour without requiring the presence of cointegration. Third, it also permits the estimation of transitional effects. Fourth, the most substantial advantage of this method over all the previous convergence approaches is that it avoids the assumption that the convergence process needs further modelling as a time-varying transition path to long-run equilibrium.

2.4. Determinants of Household Net Wealth

The analysis to identify the determinants of household net wealth is related to the life cycle hypothesis (LCH), developed by Modigliani and Brumberg in the 1950s, that describes the spending and saving habits of people throughout their lifetime. In this theory, individuals seek to smooth consumption throughout their lifetime by borrowing when their income is low and saving then their income is high (Ando & Modigliani, 1963; Modigliani & Brumberg, 1954).

The LCH assumes that individuals plan their spending over their lifetimes, taking into account their future income. Accordingly, they take on debt when they are young, assuming future income will enable them to pay it off. They then save during middle age to maintain their level of consumption when they retire. A graph of an individual's spending over time thus shows a hump-shaped pattern in which wealth accumulation is low during youth and old age and high during middle age. Because the retirement span follows the earning span, consumption smoothing leads to a humped-shaped age path of wealth holding (Modigliani, 1986) (see Figure 2.3).

Figure 2.3. *Income, Consumption, Saving, and Wealth as a Function of Age*



Note: *A*(*T*) is net wealth at age *T*, *C* is consumption, *A* is net wealth, *Y*(*T*) is income at age *T*, *N* is retirement age, *L* is the length of life, and *r* is the level of income throughout the working span. Source: Modigliani (1986)

The wealth aspect plays an important role in the short-run consumption function meaning that aggregate demand is affected not only through the traditional channel of investment but also the market value of assets and consumption. In the long run, expenditures financed by deficit tend to be paid by future generations and saving will help households to maintain current and future demand. The LCH assumes some variables that could affect wealth and saving that include demographic characteristics like the dependency ratio, the rate of return on wealth, household access to credit, and the bequest motive (Modigliani, 1986, 1988).

While the standard linear regression model provides valuable information regarding the effect of determinants on households' net wealth through estimating conditional mean $E(y|x)$, the partial effect of an explanatory variable can have very different effects across different segments (Cameron & Trivedi, 2005; Wooldridge, 2015). A more complete picture would provide information about the relationship between the outcome *y* and the regressors *x* at the different points in the conditional distribution of *y* provided by quantile regression, known as the quantile regression developed by Koenker and Bassett Jr (1978). Cameron and Trivedi (2009) explained the quantile regression has considerable benefits; they are more robust to outliers than is mean regression, allow the study of the impact of regressors on both the location and scale parameters of the model thereby allowing a richer understanding of the data and its semi-parametric approach in the sense that it avoids assumptions about the parametric distribution of regression errors.

According to Koenker and Bassett Jr (1978), the quantile regression model is:

$$y_{it} = x_{it}\beta_\theta + u_{\theta it} \text{ with } Quant_\theta\left({}^{y_{it}}/_{x_{it}}\right) = x_{it}\beta_\theta \qquad (12)$$

where y is the dependent variable, x is a vector of regressors, β is the vector of parameters to be estimated, u is a vector of residuals. $Quant_\theta\left({}^{y_{it}}/_{x_{it}}\right)$ identifies the Θ^{th} conditional quantile of y given x. The quantiles and percentiles are synonymous, where the 0.99 quantile is the 99th percentile.

The quantile regression can be divided into conditional quantile regression (CQR) and unconditional quantile regression (UQR). The difference between the approaches is the CQR control variables essentially redefine each quantile, while the UQR models can be used to estimate varying associations between predictors and outcomes at different points of the outcome distribution (Chamberlain, 1994; Korom, 2017).

Some studies show the model selection of CQR and UQR is largely caused by the research question. For example, Killewald and Bearak (2014) used the UQR method to test whether the decision of Budig and Hodges (2010) that used CQR is suitable to discover the answer of whether is it true that the motherhood penalty is larger for low-waged women. Although using the same dataset and trying to answer the same research question, each studies shows contrary findings. Budig and Hodges (2010) showed the control variables have the additional effect of redefining quantiles therefore the motherhood penalty at the 75th percentile estimates the motherhood penalty for women at the 75th percentile of the wage distribution for women who are otherwise identical on all covariates. In contrast, Killewald and Bearak (2014) defined quantiles with reference to the unconditional wage distribution, therefore the motherhood penalty at the 75th percentile indicates the association between motherhood and wages at the 75th percentile of the unconditional wage distribution, with the association adjusted for confounding effects as measured by the control variables

Estimation of the determinants of household net wealth should also be achieved through the spatial aspect as it provides a more comprehensive understanding of the factors of household net wealth with respect to space. More specifically, Skoufias and Olivieri (2013) showed the importance of spatial aspects by indicated regions with better endowment (measured from infrastructure and basic services) can have higher productivity levels and economic returns, hence, if there are two individuals with identical attributes, the one living in an area with a lower endowment is more likely to face economic stagnation and poverty.

Some studies found some geographical factors that influence the differences in household standard of living in Indonesia are related to natural resources and human resources (Akita & Miyata, 2018; McCulloch & Sjahrir, 2008; Nazara & Hewings, 2004), infrastructure (Akita & Lukman, 1999; Akita & Miyata, 2018; Skoufias & Olivieri, 2013), education facilities (Akita & Miyata, 2018; Nazara & Hewings, 2004; Skoufias & Olivieri, 2013), telecommunications infrastructures (Sujarwoto & Tampubolon, 2016), and health facilities (Skoufias & Olivieri, 2013). Other contributors are related to the local condition, for example, the presence of agglomeration (Akita, Kurniawan, & Miyata, 2011) and proximity to large cities or distance from the capital (McCulloch & Sjahrir, 2008).

One key component in spatial analysis is the occurrence of a spatial weight matrix that represents the spatial interaction between regions shown in the value of the elements of the matrix. The spatial weight matrix can be structured as follows:

$$\begin{bmatrix} w_{11} & w_{12} & \dots & w_{1N} \\ w_{21} & w_{22} & \cdots & w_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ w_{N1} & w_{N2} & \cdots & W_{NN} \end{bmatrix}$$

A spatial weights matrix is an N by N positive and symmetric matrix W which expresses for each observation (row) those locations (columns) that belong to its neighbourhood set as non-zero elements (Anselin & Bera, 1998). More formally, $w_{ij} = 1$ when *i* and *j* are neighbours, and $w_{ij} = 0$ otherwise. The diagonal elements of the weight matrix are set to zero, and the elements of a row sum to one. The elements of row-standardized weights matrix thus equal $w_{ij}^{s} = {w_{ij}}\big/{\sum_j w_{ij}}$. This ensures that all weights are between 0 and 1 and facilitates the interpretation of operations with the weight matrix as an averaging of neighbouring values.

Two kinds of spatial weight matrices are contiguity and distance-based matrices. In the contiguity matrix, the element $w_{ij} = 1$ when two regions *i* and *j* share the same border and 0 otherwise while the element in the distance-based matrix contains information of the distance between regions (Kondo, 2016; Mustajab, 2009; Vidyattama, 2014).

The use of a distance-based matrix is to overcome the limitation of the contiguity matrix as it does not include boundaries defined by water or sea, such as an island. Hence, if contiguity is used as a measurement for areas separated by water boundaries, one island may have no neighbours. In the distance-based matrix, the distance from one region to others is obtained from the coordinates of centroids or geometric centres of the geographical areas of interest, where the centroid is defined as a weighted average of the vertices of a polygon that approximates the centre of the polygon (Waller & Gotway, 2004).

By using the constructed weighting matrix, I calculate Moran's I test to observe the degree of spatial interaction between regions. This measurement is to indicate the degree of linear association between a vector of observed values y and the weighted average of the neighbouring values, or spatial lag, Wy (Anselin, 2001). In mathematical form, the Moran's I is (Anselin, 2001):

$$I = \left(\frac{N}{S_0}\right)\frac{y'Wy}{y'y} \tag{13}$$

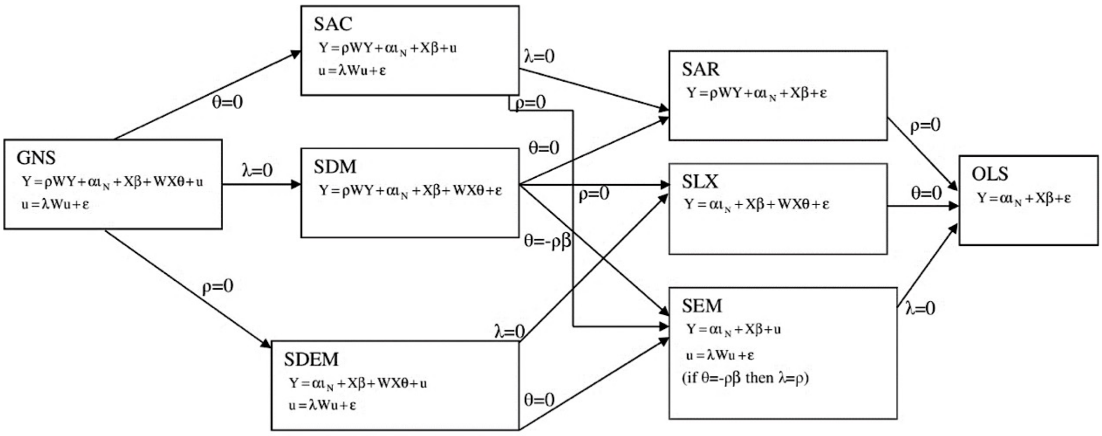
where N stands for the number of observations, S_0 is the sum of all elements in the spatial weight matrix ($S_0 = \sum_i \sum_j w_{ij}$), y is the observations in deviations from the mean, and Wy is the associated spatial lag. When the spatial weights matrix is row-standardised such that the elements in each row sum to 1, since in this case, $S_0 = N$, this expression simplifies to:

$$I = \frac{y'Wy}{y'y} \tag{14}$$

The null hypothesis of the Moran's I test is the data is randomly disbursed (there is no spatial autocorrelation in the model). The alternative hypothesis is the data is more spatially correlated. Moran's I vary between -1 and 1 with a positive value meaning that a point in question is prone to be clustered by adjacent points, while a negative value means the opposite. Values close to 0 indicate that the data are randomly distributed. For this statistical hypothesis testing, Moran's I can be transformed into z-scores. The positive Z-scores indicate that data are spatially clustered in some way. Positive coefficients mean positive spatial autocorrelation occurs, that is, the regions neighbouring a region with high value also show higher value. The zero coefficient has no autocorrelation (perfect randomness), while negative means clustering of dissimilar values. (Anselin, 1993; Réquia, Koutrakis, & Roig, 2015).

The spatial weight matrix that represents the spatial dependence is then applied in the spatial econometric models to help to identify the determinants of household net wealth in Indonesia with regard to spatial aspect. Unlike the linear regression model that ignores the existence of the spatial aspect, each spatial model can include one or more spatial dependences in the analysis (see Figure 2.4).

Figure 2.4. *Comparison of Different Spatial Econometric Model Specifications*



Note: GNS = general nesting spatial model, SAC = spatial autoregressive combined model (SARAR), SDM = spatial Durbin model, SDEM = spatial Durbin error model, SAR = spatial autoregressive model (spatial lag model), SLX= spatial lag of X model, SEM = spatial error model, OLS = ordinary least squares model

Source: Elhorst and Vega (2013)

The first model to represent spatial correlation is the spatial lag or spatial autoregressive model (SAR) that consists of the spatial lag of dependent variable and is appropriate when the focus of interest is the assessment of the existence and strength of spatial interaction (Anselin, 2001; LeSage & Pace, 2009):

$$Y = \rho WY + X\beta + \varepsilon \quad (15)$$

where ρ is a spatial autoregressive coefficient, ε is a vector of error terms. *WY* is the spatial lag for *Y* at *i*. *X* is an n × k matrix of observations on *k* right-hand-side exogenous variables, and β is the corresponding k × 1 parameter vector.

The second model, the spatial error (SEM), is referred to as nuisance dependence where a spatial autoregressive process is specified in the error terms, which is defined as:

$$y = X\beta + u \quad (16)$$

$$u = \lambda Wu + \varepsilon$$

where Wu_t is the spatial lag in errors and ε is a vector of error terms.

The third model is the spatial lag of *X* model (SLX) that contains exogenous interaction effects of independent variables (WX_t).

$$Y = X\beta_1 + WX\beta_2 + \varepsilon \quad (17)$$

The fourth model is the spatial autoregressive combined spatial lag model (SAC):

$$Y = \rho WY + X\beta + u \quad (18)$$

$$u = \lambda Mu + \varepsilon$$

where W and M are n × n spatial-weighting matrices (with 0 diagonal elements); WY and Mu are n × 1 vector typically referred to as spatial lags, and λ and ρ are the corresponding scalar parameters typically referred to as SAR parameters.

The fifth model is the Spatial Durbin Model (SDM) that can advocate both spatially lagged dependent variables and spatially lagged explanatory variables. This model is a solution to a great degree of similarity between a spatial lag and a spatial error model, as suggested by the error covariance structure (Anselin & Bera, 1998). The equation for the SDM is:

$$Y = \rho WY + X\beta_1 + WX\beta_2 + \varepsilon \tag{19}$$

where WX is the spatial lag of independent variables

The sixth model is Spatial Durbin Error Model (SDEM) that contains both spatial lags in covariates/independent variables (WX_t) and spatial lag in errors (Wu_t). The equation is:

$$Y = X\beta_1 + WX\beta_2 + u \tag{20}$$

$$u = \lambda Wu + \varepsilon$$

The seventh model, the General Nesting Spatial (GNS) model is used where everything is spatially lagged. The equation of SDM is:

$$Y = \rho WY + X\beta_1 + WX\beta_2 + u \tag{21}$$

$$u = \lambda Wu + \varepsilon$$

where WY_t is the spatial lag of a dependent variable, WX_t is a set of spatial lags of explanatory variables, and Wu_t is the spatially auto-correlated error term (Drukker, Prucha, & Raciborski, 2013; Kopczewska, Kudła, & Walczyk, 2017). Even though the GNS is the least restrictive, the GNS is over-parameterised, as a result of which the significance levels of all variables tend to drop (Elhorst, 2014, 2017). More specifically, the GNS is seldom used in empirical research because a formal proof under which conditions the parameters of this model are identified is not yet available, and, the problem of overfitting that it causes even if the parameters are not identified, can be estimated, but have the tendency either to inflate each other or to become insignificant, as a result of which this model does not help to choose among simpler models with less spatial interaction effects (Elhorst, 2017).

To estimate the determinants of household net wealth by considering the influence of the spatial aspect, this thesis uses a spatial panel model with fixed effect. Following Elhorst (2014), the fixed effects model is generally more appropriate than the random effects model since spatial econometrics tend to work with space-time data of adjacent spatial units located in unbroken study areas, such as all counties of a state or all regions in a country. More specifically, the spillover effect of the influence of determinants of household net wealth can be achieved through the inclusion of exogenous interaction effects, $\boldsymbol{X}$=[$\boldsymbol{X}$ $\boldsymbol{WX}$], make any spatial model that includes spatial error term unable produce the spillover effect by construction (Elhorst, 2014).

2.5. Concluding Remarks

This chapter provides an overview of the approaches, methods, and tools used in this thesis to answer the research questions. The use of the Dagum Type III model is to estimate inequality of household net wealth which is different from income or expenditure measurement as it can contain negative values. The use of the decomposition of the half squared coefficient of variation (½CV^2) is to estimate whether the interprovincial inequality is caused by inequality within or between provinces. Club convergence analysis is used to show whether the growth of household net wealth in Indonesia is converging or diverging over time. This chapter also shows the use of quantile regression that is more appropriate to estimate the determinants of household net wealth as it can deal with the unobserved heterogeneity. Moran's I is used to find out the pattern of spatial autocorrelation of household net wealth in Indonesia with Spatial Durbin Model being applied to estimate the determinants of household net wealth considering the existence of spatial interaction between regions.

Chapter 3. An Application of the Dagum Type III Model to Measure Household Net Wealth Inequality in Indonesia

Abstract
The measurement of the household standard of living from the aspect of net wealth requires estimation tools other than income or expenditure measurements due to the existence of negative values. This paper applies the Dagum Type III model in measuring the inequality of household net wealth in Indonesia. By using data from the Indonesian Family Life Survey (IFLS), this paper finds the distribution of household net wealth in Indonesia is right-skewed with long and sparse-hand tails that reflect a large proportion of households which have very low net wealth and a small proportion of households which have very high net wealth. During 1993-2014, the inequality of household net wealth in Indonesia was declining as shown by the decrease of the Gini Coefficient. This paper finds high inequality of household net wealth in Indonesia as being characterised by high inequality among the groups of negative and zero, low and middle, and the richest households and less dispersed net wealth distribution. The reduction of overall inequality should be achieved by reducing inequality within classes through promoting economic activities and preventing households from being dragged down to lower classes.

Keywords: household net wealth, negative values, Dagum Type III.

JEL Classifications: C14, C55, D63, I31

3.1. Introduction

As the world's largest archipelago nation, Indonesia faces an extraordinary challenge to distribute the results of development to its 270 million population spread across more than 17,000 islands. In the 1960s-1990s, Indonesia implemented the unequal development strategy to achieve high economic growth but focusing development only on certain regions or sectors. Some studies show this strategy brings a development gap between regions, for example, between Java Island and outside Java or between western Indonesia and the eastern part of Indonesia (Aspinall & Berger, 2001; Tadjoeddin et al., 2003; Vidyattama, 2013). The gap also exists in the differences of the household standard of living, where, if measured on a wealth level, only 0.1 percent of the adult population in Indonesia has wealth greater than USD1 million while more than 80 percent of the adult population has wealth less than USD10,000 (Credit Suisse, 2017). This finding is also supported by a report by World Bank (2016a) that shows 1 percent of the wealthiest households hold more than 50 percent of total wealth in Indonesia.

Efforts to reduce the gap in the household standard of living in Indonesia is important as ignoring this condition may lead to many consequences. As found by World Bank (2019b), the gap in the household standard of living brings differences of accessibility between rich and poor, where poor households have more limited access to education facilities, early education, and health service, making them unable to achieve the outcomes in the education (shown in the educational attainment) and health aspect (e.g. in health status) achieved by richer households. Worse, when the gap in household standard of living is wide, the practice of monopoly, corruption, and cronyism will be hard to diminish as rich people see those practices as the way to secure and increase their wealth and poorer households use those practices as the way to increase their standard of living[3] (Oxfam, 2018; Strand, 2010).

The focus of the research should be aimed at the investigation of inequality of household net wealth as Jenkins and Jäntti (2005) found, household net wealth can have negative values (because of debts that are higher than total wealth) that is different from than measurement of income or expenditure that can only take positive and zero values. Further, the existence of negative and zero values brings to the concentration of density mass—that reflect a large number of households who have low values—and right-skewed distribution with long and sparse right-hand tails—that indicates a relatively small number of households who have very high net wealth level.

This chapter contributes to the body of knowledge of the measurement of inequality of household net wealth by applying Dagum Type III model as this model can handle the existence of negative, zero, and positive values. Since the measurements of household net wealth can have those values, the measurement commonly used in the measurement of income or expenditure inequality is no longer applicable as the measurements can only handle positive and zero values. The Dagum Type III model is also considered superior to other inequality measurement that is also able to calculate negative, zero, and positive values, for example, Singh-Maddala and Generalized Beta II models as found in Brzeziński (2013), Clementi et al. (2018), and Cowell and Van Kerm (2015).

This chapter also contributes to the measurement of inequality of household net wealth in the context of Indonesia as a developing country. Recent studies investigating the inequality of household net wealth took place in developed countries, for example, Dagum (1999) who calculates the inequality in Ireland, the United Kingdom, Italy, and the United States of America, Jenkins and Jäntti (2005) who used data for Finland, and Jäntti, Sierminska, and Van Kerm (2015) who investigate inequality of household net wealth in the United States, Germany,

[3] In 2020, Indonesia has a score of 37 in the Corruption Perception Index, with score 0 perceived as most corrupt and 100 as the least corrupt, making Indonesia rank as 102 out of 180 countries.

Italy, Luxembourg, and Spain. All that research concluded that a high inequality of net wealth is caused by the high percentages of economic units with negative and zero net wealth and a small number of the population who have very high net wealth.

This chapter investigated whether the features of inequality of net wealth distribution as found in other countries are also applicable for Indonesia and if there are differences in the features of inequality of household net wealth between developing and developed countries. More specifically, this paper seeks an answer for the question of what the condition of the inequality of household net wealth in Indonesia is, focusing on the inequality across classes, low, middle, and high classes. To answer this question, this paper applies the Dagum Type III model to measure inequality of household net wealth by utilising household data from the Indonesian Family Life Survey (IFLS). The IFLS is considered the longest longitudinal survey in Indonesia that collects socioeconomic information of the Indonesian population who live in 13 out of 34 provinces in Indonesia and is representative of approximately 83 percent of the population (RAND, 2014a; Thomas et al., 2001). The remainder of this paper is organised as follows. Section 2 provides a theoretical background to the research; Section 3 describes the method and data used; Section 4 presents the results and Section 5 provides conclusions.

3.2. Measurement of the Inequality of Household Net Wealth

Measuring the household standard of living from a wealth perspective is adopted here to overcome the many known limitations related to using only income and expenditure. Wealth indicates the level of future purchasing power while income measurement has a transitory character where current income does not always reflect future income (Claus & Claus, 2015; Nam, Huang, & Sherraden, 2008; Oliver & Shapiro, 1990). Wealth measurement minimises biases where households with high income usually have high wealth levels, but it is often the case that households with high wealth levels also have low income, for example, retirees and the receivers of bequests (Keister & Moller, 2000; Wolff, 1995). Wealth measurement also minimises the under-reporting issue as households tend to conceal some of their income or often report income from wage or market income only and households only report expenditure from market transactions, ignoring home-production (Ward, 2013). The wealth measurement also accommodates a non-similarity pattern of the joint estimation of income and expenditure where at the bottom of the distribution, expenditure is often exceeding income while at the top of the distribution, the reverse condition occurs (Meyer & Sullivan, 2004; OECD, 2015).

The flipside of wealth is debts that can occur in many levels of household classes, (e.g. in the form of home loans, vehicles debts, or consumption/personal loans). At some level, financial liabilities can affect consumption and investment for households because of sudden changes in earnings, unexpected drops in asset prices, or natural disasters that cause partial or full loss of assets (OECD, 2015). These debts are often recognised to be the important component that enables the households to have expenditure even though they have very low or zero income (Meyer & Sullivan, 2004).

Unlike income or expenditure measurements that do not allow negative values, the measurement of household net wealth has the possibility to take on negative values, (when debts are higher than total wealth). Zero value of household net wealth is when debts equal total wealth and positive net wealth occurs when debts are lower than total wealth. The occurrence of negative and zero net wealth can lead to a sparse and heavy-tailed distribution, which indicates a large number of households have a small value and in contrast, a small number of households have high values. Hence, the condition of a sparse and heavy-tailed distribution found in the measurement of inequality of household net wealth brings worse inequality than measurement of inequality from income or expenditure (Cowell & Van Kerm, 2015; Jenkins & Jäntti, 2005; Jordá & Niño-Zarazúa, 2019).

To estimate data distribution that contains negative zero, and positive observations, Dagum (1990, 1999) suggested a model combining an atomic and two continuous distributions:

$$F(x) = b_1F_1(x) + b_2F_2(x) + b_3F_3(x), \quad (1)$$

$$|x| < \infty, b_1 \geq 0, b_2 < 1, b_3 > 0, b_1 + b_2 + b_3 = 1, b_1 + b_2 = \propto, 1-\propto = b_3, 0 \leq \propto < 1$$

where $F_1(x)$ accounts for the negative observations, $F_2(x)$ reflects the unit mass of economic agents at $x = 0$, and $F_3(x)$ accounts for the positive observations.

For $F_1(x)$:

$$F_1(x) = exp(-c|x\_|^s), \quad (2)$$

$$x\_ = min(x, 0), (c, s) > 0,$$

$$f(x) = \frac{dF_1}{d|x\_|}\frac{d|x\_|}{dx} = cs|x\_|^{s-1}exp(-c|x\_|^s)(-1)min\left\{\frac{x}{|x|}, 0\right\}$$

For $F_2(x)$:

$$F_2(x) = max\left\{0, \frac{x}{|x\_|}\right\} \quad (3)$$

For $F_3(x)$:

$$F_3(x) = (1 + \lambda x_+^{-\delta})^{-\beta}, x_+ = max\{x, 0\}, (\beta, \lambda) > 0, \delta > 1 \quad (4)$$

Then,

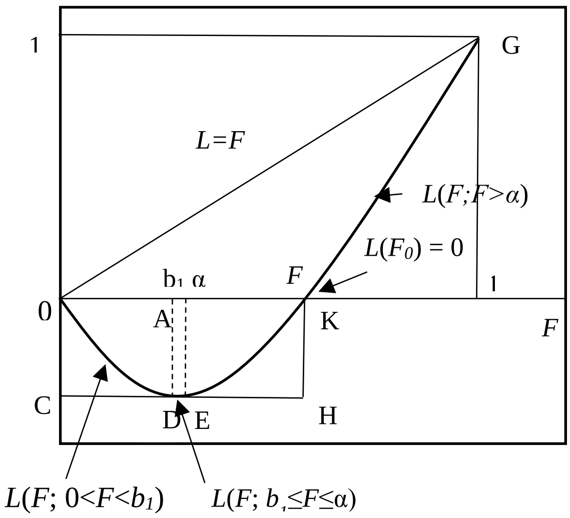
$$F(x) = b_1\, exp(-c|x\_|^s) + b_2\, max\left\{0, \frac{x}{|x|}\right\} + b_3(1 + \lambda x_+^{-\delta})^{-\beta} \quad (5)$$

where c and λ are scale parameters and all the others, b_1, b_2, b_3, s, β, and δ, are inequality parameters.

Estimation of the Dagum Type III model produces parameters that lead to a certain shape of net wealth distribution and an interpretation of net wealth inequality (Dagum, 2006). The parameters α, β, and δ are the shape parameters and λ is a scale parameter. The parameter α is sensitive to negative- and zero-net wealth households, while parameter β reflects net wealth held by low- and middle-net wealth households, and parameter δ is sensitive to changes in the upper-net wealth households, while λ reflects the dispersion of net wealth. Parameters α, δ, and λ are also indicators for the tails of the net wealth distribution as they reflect the length and thickness of the distribution tails (Brzeziński, 2013).

The occurrence of negative and zero observations can be seen from the shape of the Lorenz Curve that is located underneath the horizontal axis (Figure 3.1).

Figure 3.1. *Lorenz Curve*



Source: Dagum (1999)

Taking into account the presence of negative values for the Lorenz curve in the interval (0, F_0), the Gini Coefficient is defined as twice the area between the equi-distribution line $L=F$ and the Lorenz curve, divided by one plus the area of the rectangle $\propto |L(b_1)|$ in Figure 3.1., that is (Dagum, 1999),

$$G = \left[2\int_0^1 (F-L)dF\right] / [1 + \propto |L(b_1)|] \quad (6)$$

$$G = \left[1 - 2\int_0^1 LdF\right] / [1 - \propto L(b_1)] \quad (7)$$

where $\int_0^1 LdF = \int_0^{b_1} LdF + \int_{b_1}^{\propto} LdF + \int_{\propto}^1 LdF$

By using parameters provided by Dagum Type III model, the Gini Coefficient becomes (Clementi, et.al., 2012):

$$G = \frac{1-2\left\{(1-\alpha)\beta\alpha\left[B\left(\alpha+\frac{1}{\delta},1-\frac{1}{\delta}\right)-B\left(2\alpha+\frac{1}{\delta},1-\frac{1}{\delta}\right)\right]-cb_1\left(1-b_1\left(1-b_1 2^{-1-1/s}\right)\Gamma\left(1+\frac{1}{s}\right)\right)\right\}}{1+\alpha c b_1 \Gamma\left(1+\frac{1}{s}\right)} \quad (8)$$

that is, twice the integral between the equidistribution function L=F and the Lorenz curve divided by one plus the area of the rectangle OCHK in Figure 3.1. Due to the occurrence of negative values, the observation of the Lorenz Curve can be underneath the horizontal values. Hence, the Gini Coefficient can exceed 1 which is theoretically feasible but gives less meaning in the practical sense (Clementi, Gallegati, & Kaniadakis, 2012)

3.3. Methodology and Data

Measurement of household net wealth is achieved through calculating the monetary value of total wealth with debts deducted. Total wealth consists of the market values of three asset groups, farm business, non-farm business, and household assets (e.g. house, land, vehicles, savings, and furniture). In mathematical form, total wealth is (Cowell & Van Kerm, 2015):

$$NW = W - D \quad (9)$$

where NW = net wealth, W = total wealth, and D = debts. W is the market value of each type of asset, thus

$$NW = \sum_{j=1}^{m} \pi_j A_j - D \quad (10)$$

where $A_j \geq 0$ is the amount held of asset type j and π_j is its price.

The value of household net wealth is then adjusted to find the real value by using the GDP deflator based on World Bank (2018a) (see Table 3.1). A correction is then needed to adjust the household size as the unadjusted household wealth level does not reflect an individual standard of living, that is, by dividing household net wealth by the square root of the number of household members[4].

[4] In the studies of the wealth distribution, the household size can be ignored if households are assumed to have perfect returns to scale in the use of wealth or that access to wealth of one member of the household has no effect on the access of other members, as wealth is a public good within the unit. When the economies of scale are taken into account, each member is assigned per capita household wealth and everything is split amongst them (W/S^{ε}). The notation of S^{ε} refers the economies of scale, S=size, and ε=the economies of scale parameter with the value between 0 and 1. There is no consensus for determining the economies of scale, although ε=0.5 is widely used (Atkinson, Rainwater, & Smeeding, 1995; Clementi et al., 2012; OECD, 2020; Sierminska & Smeeding, 2005; Stats NZ, 2019).

Table 3.1. *GDP Deflator Indonesia*

Year	GDP Deflator
1993	9.657
1997	13.991
2000	33.718
2007	67.818
2014	123.408

Source: World Bank (2018a)

To estimate the inequality household net wealth in Indonesia, I used Dagum Type III model as suggested by Brzeziński (2013), Clementi et al. (2018), and Cowell and Van Kerm (2015). I used the maximum likelihood procedure developed by Jenkins and Jäntti (2005) to estimate inequality of household net wealth based on the Dagum Type III model as it is superior to the estimation of Dagum Type III model developed by Jenkins (1999)[5] that only represents the shape of data distribution for positive values. The procedure developed by Jenkins and Jäntti (2005) also can convert the parameters of Dagum Type III model that reflect the condition of the distribution into a single Gini Coefficient to allow a straightforward interpretation and comparison across time and place.

This research uses household data from the Indonesian Family Life Survey (IFLS) for 1993-2014. The IFLS is considered the largest longitudinal survey in Indonesia that is rich in information on household characteristics, health, demographic, and socio-economic status as well as community characteristics (Strauss et al., 2016). The attrition rate of the IFLS is considered low where the contact rate in each wave ranged from 90.2 percent to 95.3 percent from total households in the previous waves (Thomas et al., 2001). The IFLS is also representative of 83 percent of the Indonesian population living in 13 of the 34 provinces in Indonesia, that is, provinces in Java, Sumatera, Bali and Nusa Tenggara, Kalimantan, and Sulawesi Islands[6] (RAND, 2014b) (see Figure 3.2).

[5] In Stata, the Jenkins (1999) command is `dagumfit`.

[6] The IFLS also has two sister surveys; the IFLS2+ that was administered in 1998 to measure the direct impact of the Asian financial crisis and collect information from around 25% of IFLS1. The next sister survey is the IFLS East that was conducted in 2012 to collect information on 2,500 households living in seven provinces in eastern Indonesia.

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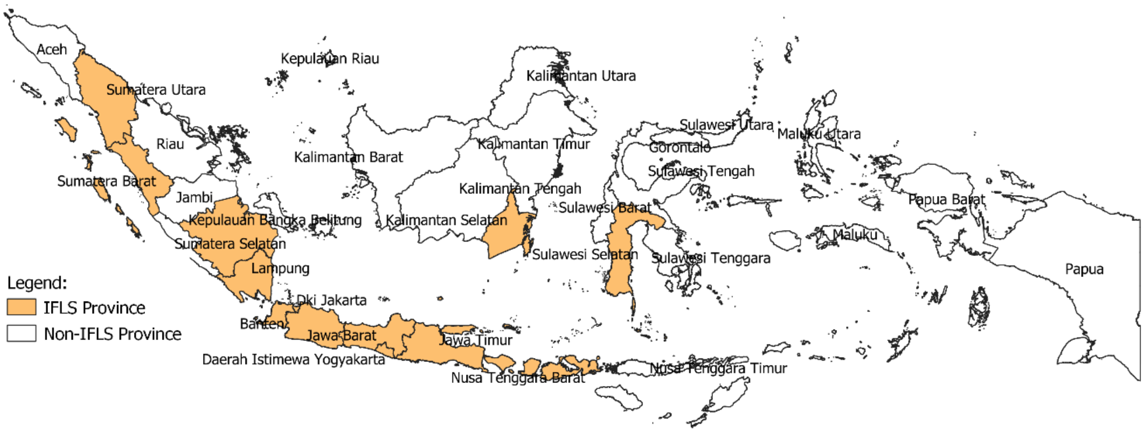
Figure 3.2. *Map of IFLS Provinces*



The first wave of IFLS (IFLS1) surveyed 7,224 households in 1993. The subsequent waves of surveys sought to reinterview all the IFLS1 households and split-off households. The second wave of IFLS (IFLS2) was conducted in 1997 and included 7,698 households. The third and fourth waves of IFLS (IFLS3 and IFLS4) were held in 2000 and 2007 for 10,574 and 13,995 households, respectively. The fifth wave of IFLS (IFLS5) was conducted in 2014 to survey 16,931 households.

3.4. Results

3.4.1. Household Net Wealth Distribution in Indonesia

Table 3.2 provides descriptive statistics for household net wealth in Indonesia for 1993-2014. The table, shows household net wealth is distributed unequally with a decreasing trend during 1993-2014, indicated by the declining ratio between mean and median and the decline in standard deviation (Table 3.2). The declining trend of inequality is also shown by the declining proportion of households who have negative and zero value, this implies their ability to increase net wealth and their ability to climb to higher household classes. A similar finding is also shown by the estimation of the Gini Coefficient that shows a decline in coefficient from 0.806 in 1993 to 0.603 in 2014.

High inequality in 1993 is likely to have been caused by the unequal development strategy in Indonesia during the 1960s-1990s that focused development on Java Island, the location of some of the biggest Indonesian cities, including the capital of Jakarta and neglecting the eastern part of Indonesia. This development strategy in Indonesia is a result of its archipelagic condition of more than 17,000 islands and their spread across an area of 5.9 million km^2, this required the priority of development should be aimed at certain islands (Akita et al., 2011; Daimon, 2001).

***Table 3.2**. Household Net Wealth in Indonesia, 1993-2014*

Variable	1993	1997	2000	2007	2014
Net Wealth (Rp.)(x10^3) (Constant 2010)					
Mean	40,000	89,400	73,000	74,700	86,400
Median	8,301	31,300	29,900	35,400	45,100
Std. Dev.	143,000	362,000	159,000	150,000	123,000
Min.	-158,000	-19,400	-27,500	-511,000	-206,000
Max.	5,950,000	13,300,000	3,330,000	3,640,000	1,790,000
HH have NW<0 (%)	10.784	0.767	0.565	1.515	0.626
HH have NW=0 (%)	10.481	0.969	0.222	0.929	0
HH have NW>0 (%)	78.736	98.263	99.212	97.557	99.374
Skewness	19.173	25.396	8.453	10.377	4.075
Kurtosis	644.419	820.582	113.920	202.837	35.521
Gini Coefficient	0.806	0.713	0.666	0.644	0.603

Note: Net wealth is in constant price 2010, adjusted with household size. Gini Coefficient is obtained by using Jenkins (1999) estimator.

The change of development pattern occurs after the 1997/1998 Asian Financial Crisis that not only brought economic crisis for Indonesia but also political change, marked by the implementation of the regional autonomy process (*otonomi daerah*). This process delivered wider authority and responsibilities for local government, allowing them to have greater opportunities to develop their regions (Akita et al., 2020; Tadjoeddin, 2019). The development in the regions enabled a narrowing of the gap in household's standard of living in Indonesia, shown by lower standard deviation and lower Gini Coefficient over 2000-2014 in Table 3.2.

***Table 3.3.** Household Total Wealth in Indonesia, 1993-2014*

Variable	1993	1997	2000	2007	2014
Total Wealth (Rp.)(x10^3)					
Mean	41,000	91,100	73,300	75,700	88,000
Median	8,962	32,100	30,000	35,900	45,700
Std. Dev.	144,000	369,000	159,000	149,000	124,000
Min.	0	0	0	0	47
Max.	5,950,000	13,300,000	3,330,000	3,640,000	1,790,000
HH have TW=0 (%)	14.8	00.8	0.2	1.0	0.0
HH have TW>0 (%)	85.2	99.2	99.8	99.0	100.0
Skewness	18.959	25.384	8.450	10.466	4.043
Kurtosis	633.180	818.187	113.872	204.593	34.459
Gini Coefficient	0.791	0.710	0.664	0.631	0.599

Note: Total wealth is in constant price 2010, adjusted with household size. Gini Coefficient is obtained by using Jenkins (1999) estimator.

Table 3.3 shows the condition of household total wealth in Indonesia, comparing this to Table 3.2, the inequality of household net wealth is worse than the inequality in household total wealth, shown by a higher ratio between mean and median. Less inequality is also shown by the smaller value of total wealth Gini Coefficient than net wealth Gini Coefficient. This illustrates that isolating household debts from the measurement of the household standard of living may obscure the real condition of the standard of living.

To confirm whether the data distribution is statistically abnormally distributed, an estimation of the Jarque-Bera (JB) was conducted. The null hypothesis is that data is normally distributed. Results show the p-value is lower than 0.05 bringing us to reject the null hypothesis. Thus, the data is not normally distributed (Table 3.4).

Table 3.4. *Jarque-Bera (JB) Normality Test*

Year	JB Statistic	Chi-square	JB p-value
1993	85192642	5.991	0.000
1997	1.385e+08	5.991	0.000
2000	2597517.2	5.991	0.000
2007	8328719.3	5.991	0.000
2014	231935.23	5.991	0.000

Figure 3.3 shows the graphical form of the inequality of household net wealth in Indonesia as indicated from the right-skewed and heavy-tailed shape of the distribution curve. A right-skewness distribution, which indicates the mean is higher than the median, reflecting a relatively large number of households who have low wealth levels and a small percentage of households who have high net wealth. While the heavy-tailed distribution, which shows that the value of skewness is higher than the reference value 1 and the measure of kurtosis that is higher than skewness, reflecting the thickness tails of the distribution where a certain proportion of high values are found in the distribution. Therefore, the combination of right-skewness and heavy-tailed distribution of the household net wealth in Indonesia reflects an asymmetrical long upper tail and, and therefore, large top-wealth shares (Benhabib & Bisin, 2018).

__Figure 3.3__. Kernel Density for Indonesian Net Wealth, 1993-2014

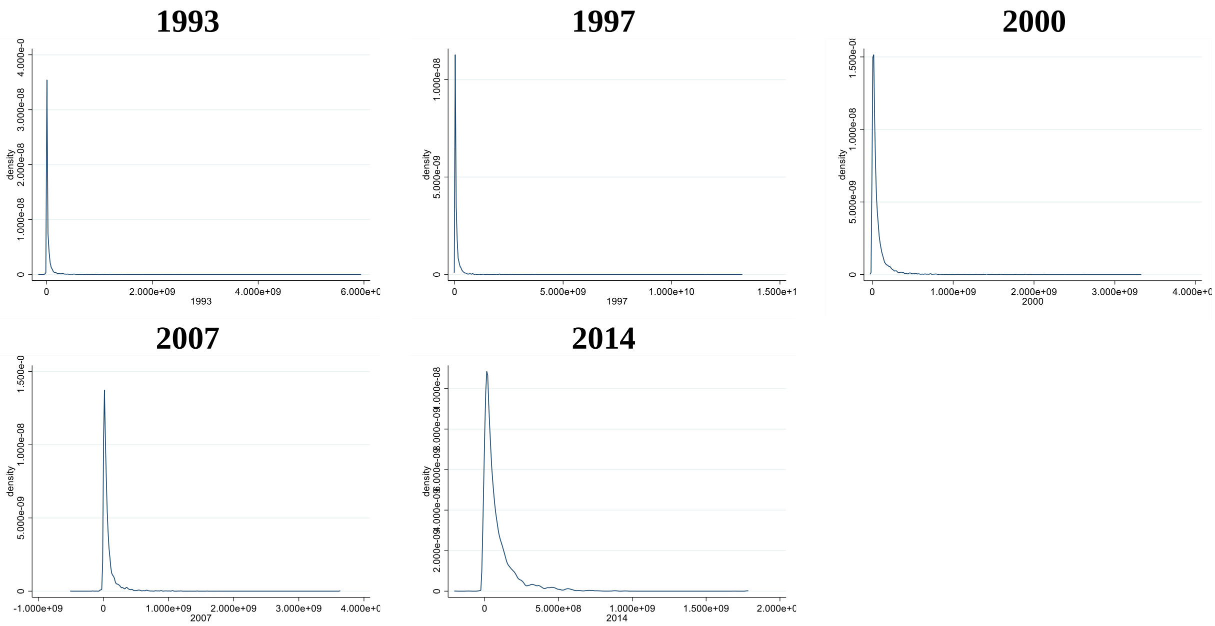
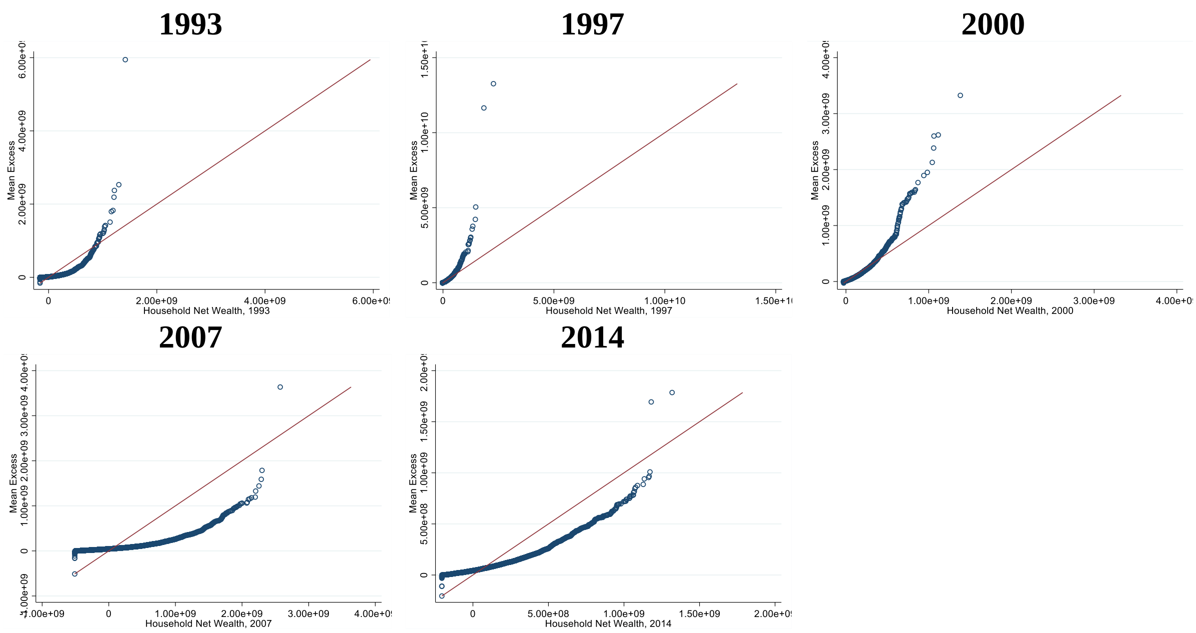


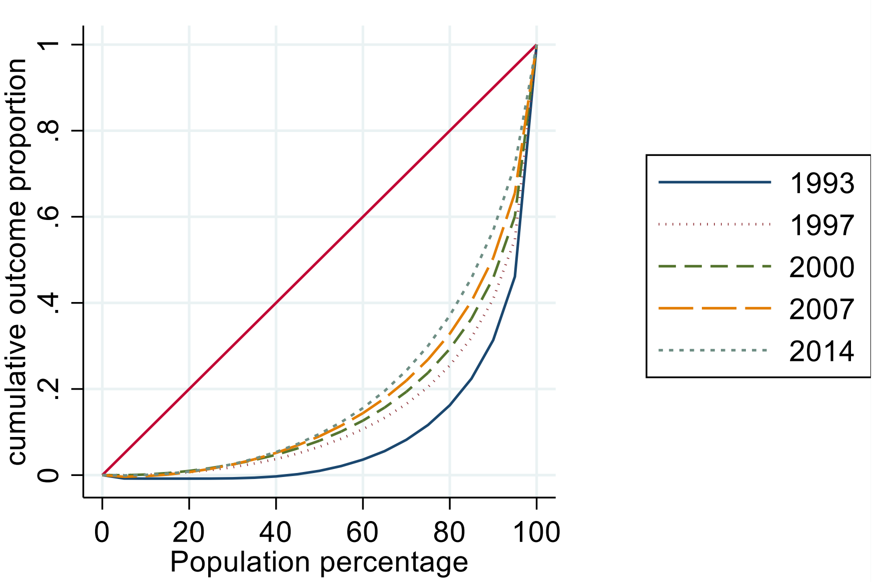
Figure 3.4 presents a mean excess plot, where, if the mean exists, assists in distinguishing light-tailed data sets from heavy-tailed ones (Ghosh & Resnick, 2010). In 1993-2007, a large concentration of household net wealth in Indonesia is located in near-zero values that are relevant to the concentration of household net wealth as shown in Table 3.2. In contrast, the large dispersion occurring in 2007 and 2014 suggests more dispersed data and indicates a reduction in inequality.

***Figure 3.4.** Mean Excess Net Wealth in Indonesia, 1993-2014.*



Additional evidence of the unequal distribution of household net wealth in Indonesia can be shown by using Lorenz Curve, where the further curve from the diagonal indicates data are more unequally distributed. During 1993-2014, the furthest Lorenz Curve from the diagonal occurs in 1993 indicating the highest inequality occurs in this year, while the nearest curve from the diagonal is found in 2014 showing that the lowest inequality occurs in this year (Figure 3.5).

Figure 3.5. *Lorenz Curve*



A further identification of the inequality of household net wealth is by examining the net wealth ownership by deciles. Following Palma (2011), when the population is divided into 10 equal groups where decile 1 refers to the poorest households and decile 10 to the richest, simpler class division can be formed by distinguishing classes into three groups: low class (deciles 1-4), middle class (deciles 5-9), and high class (decile 10). Table 3.5 shows household net wealth in Indonesia is mostly held by the high class with an increasing trend of net wealth ownership found in the low and middle class over 1993-2014.

Table 3.5. Distribution of Net Wealth in Indonesia by Deciles

	1993	1997	2000	2007	2014
Average Net Wealth by Deciles (Rp.)(x10^3)(Constant 2010)					
1	-24	3,095	4,031	3,957	3,562
2	0	8,369	9,467	11,000	11,000
3	779	14,600	15,200	17,600	20,600
4	3,462	22,600	22,400	26,100	31,400
5	8,030	33,200	31,800	36,500	45,900
6	14,800	46,600	45,200	50,800	65,900
7	25,900	68,800	66,400	72,100	94,500
8	44,900	110,000	102,000	106,000	141,000
9	93,400	210,000	184,000	191,000	230,000
10	5,950,000	13,300,000	3,330,000	3,640,000	1,790,000
Shares of Net Wealth by Deciles (%)					
1	-0.6	0.104	0.176	-0.32	0.094
2	0	0.632	0.863	1.014	0.875
3	0.103	1.278	1.588	1.858	1.872
4	0.565	1.96	2.378	2.864	2.925
5	1.465	2.962	3.45	4.068	4.349
6	2.874	4.184	4.856	5.529	6.162
7	4.938	5.943	6.955	7.524	8.754
8	8.506	9.029	10.186	10.539	12.622
9	15.201	15.164	16.662	16.975	19.251
10	66.948	58.744	52.887	49.949	43.095
Share of Net Wealth (%)					
Low	0.068	3.974	5.005	5.416	5.766
Middle	32.984	37.282	42.109	44.635	51.138
High	66.948	58.744	52.887	49.949	43.095

From the explanation above, the household net wealth ownership in Indonesia has a skewed distribution where the household net wealth is concentrated in the high class rather than in the lower class. Examining the condition of inequality, the most unequal household net wealth distribution occurs in 1993 and the least unequal distribution is in 2014. A change of household net wealth during 1993-2014 is indicated by the shift of net wealth ownership from the high class to the middle and low classes.

3.4.2. Measuring Net Wealth Inequality with the Dagum Type III Model

Results of the estimation of inequality of household net wealth in Indonesia in the previous section requires further examination because of the existence of negative values that are also shown in the position of Lorenz Curve that underneath horizontal curve. A more specific approach to handle the negative, zero, and positive values by implementing Dagum Type III model as this model outperforms other potential models: the Singh-Maddala and Generalized Beta II as shown in the model selection in the Appendix.

Estimation of Dagum Type III model provides values of parameters that reflect the condition of various classes in the distribution where α indicates inequality among negative and null net wealth households, β reflects inequality among low and middle net wealth households, δ shows the condition inequality among the richest households, and λ shows the dispersion of net wealth (Table 3.6).

Table 3.6. *Estimates Dagum Type III Parameters, 1993-2014*

	1993	**1997**	**2000**	**2007**	**2014**
α	1.329***	1.333***	1.42***	1.627***	1.865***
	(0.05)	(0.038)	(0.039)	(0.046)	(0.068)
β ($x10^6$)	45.9***	54.8***	50.6***	73.6***	127***
	(3.459)	(3.96)	(3.554)	(4.084)	(7.4)
δ	0.43***	0.646***	0.667***	0.532***	0.369***
	(0.026)	(0.036)	(0.039)	(0.028)	(0.021)
λ ($x10^{-6}$)	0.29***	0.283***	0.104***	0.039**	0.093***
	(0.062)	(0.079)	(0.04)	(0.019)	(0.033)
b_1 (NW<0)	0.106***	0.009***	0.006***	0.014***	0.006***
	(0.006)	(0.002)	(0.001)	(0.002)	(0.001)
b_2 (NW=0)	0.105***	0.009***	0.002**	0.009***	0.002**
	(0.005)	(0.002)	(0.001)	(0.002)	(0.001)
b_3 (NW>0)	0.789***	0.982***	0.992***	0.977***	0.992***
	(0.007)	(0.002)	(0.002)	(0.003)	(0.002)
Log-likelihood	-83,639.58	-94,073.72	-94,209.16	-94,478.63	-95,608.44
Mean (Rp.) ($x10^6$)	59.050	124.300	100.100	92.381	105.900
Median (Rp.) ($x10^6$)	8.550	32.500	32.700	38.600	49.900
Mean NW>0 (Rp.) ($x10^6$)	75.283	126.700	100.900	94.955	106.800
Mean NW<0 (Rp) ($x10^6$)	-3.454	-3.529	-9.599	-25.606	-10.723
Gini	0.811	0.778	0.733	0.671	0.644

Note: ***=p<0.01, **=p<0.05, *=p<0.1. Parentheses show robust standard errors. Estimates parameters and Gini Coefficient is using Stata procedure provided by Jenkins and Jäntti (2005). Coefficient α reflects inequality among negative and null net wealth households, β reflects inequality among low and middle net wealth households, δ indicates the condition inequality among the richest households, and λ shows the dispersion of net wealth. Coefficients of b_1 means proportion of households who have negative net wealth, b_2 reflects shares of households who have negative zero wealth, and b_3 reflects shares of households who have positive net wealth.

Table 3.6 covers the 1993-2014 period, illustrates inequality among the negative and zero net wealth household groups is declining shown by the increasing α with the lowest α in 1993 indicating the highest inequality and the highest α in 2014 indicating the lowest inequality. The condition of high inequality in 1993 is relevant to the explanation in the previous section that the unequal development in Indonesia during the 1960s-1990s leads to households in the lowest class holding small shares of household net wealth, resulting in high inequality occurring among them.

A similar condition occurs in the low and middle classes where during 1993-2014, the inequality among the low and middle classes is declining, shown by the increasing β. This declining condition reflects a more visible middle class, which might be caused by more poor households that can access the higher classes or rich households that face a reduction in net wealth which reduces them to the lower classes. The result of the rising middle class is consistent with the recent World Bank (2020a) study which shows that the middle class consumption has grown at 12 percent annually since 2002 and represents close to half of all household consumption in Indonesia.

In contrast, inequality in the richest household group in Indonesia is increasing during 1993-2014, shown by decreasing δ. This condition might be caused by more households from the lower classes that reach the highest class due to higher economic participation and better development results distribution since the economic recovery after the 1997/1998 Asian Financial Crisis. The increasing inequality in the richest household class in Indonesia is also identified from the existence of a very high household net wealth level, shown by the value of $\delta \leq 2$ that reflects an infinite variance where the end of the upper tail of the distribution does not exist and implies the odds of extreme values are high (Benhabib & Bisin, 2018; Dagum, 2006).

Another feature in the estimation of the Dagum Type III model is its ability to show data dispersion, shown in the parameter of λ. During 1993-2014, household net wealth in Indonesia is more widely dispersed with the least dispersed data occurring in 1993 (highest λ) and the most dispersed data occurring in 2007 (lowest λ). This indicates the development results that were initially concentrated in the upper class at the beginning of the observation are distributed more to the households in the lower classes in the following years.

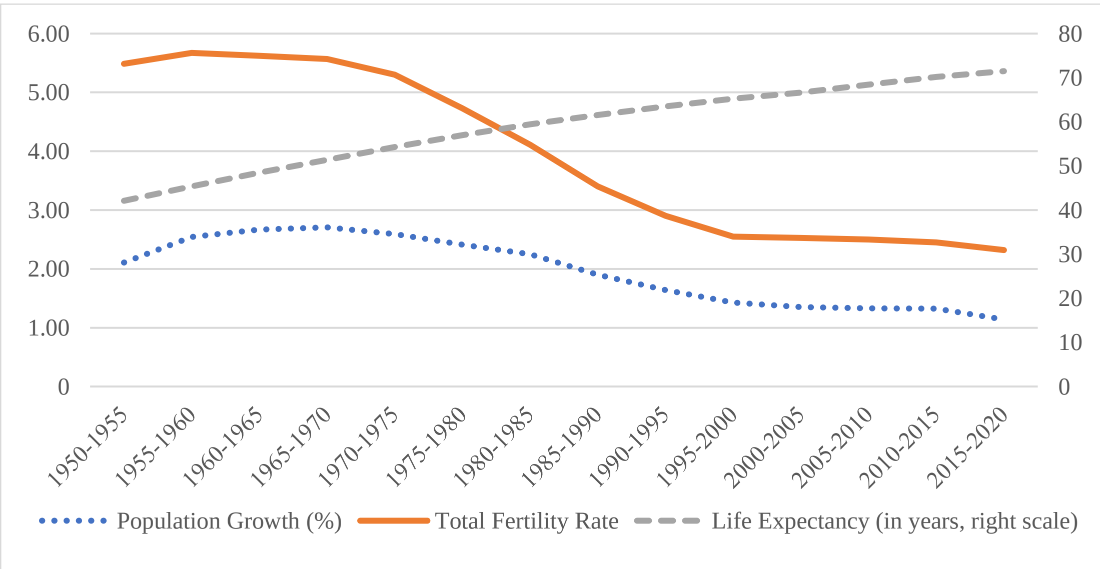
The value of the parameters of α, β, δ, and λ above is beneficial in showing the inequality condition within classes over time. However, the parameters are hardly able to reflect the condition of overall inequality and have difficult providing a comparison between years. For example, even though the years 1993-2014 show a decline in inequality within classes, it is still unclear whether the year 2000 follows the trend or creates an anomaly since it has a sudden drop in β and a sudden increase in δ. To overcome this condition, the estimations of the parameters are then transformed into a Gini Coefficient to make a straightforward interpretation and comparison across time and place. Following the Jenkins and Jäntti (2005) procedure, estimation of the Gini Coefficient shows a declining trend of household net wealth inequality in Indonesia during 1993-2014 with the highest coefficient being found in 1993 and the lowest coefficient in 2014. While the year 2000, as mentioned above, has a lower Gini

Coefficient (that reflects lower inequality) even though it has higher inequality among low and middle net wealth households (lower β) and lower inequality among the richest households (higher δ) than in 1997.

Findings of the estimation of the Gini Coefficient and the value of parameters of the Dagum Type III model provide the conclusion that high inequality of household net wealth in Indonesia (high Gini Coefficient) is characterised by high inequality among negative and null net wealth households (low α), high inequality among low and middle net wealth households (low β), high inequality among the richest households (low δ), and less dispersed net wealth distribution (high λ). In contrast, low inequality (low Gini Coefficient) is shown by low inequality among negative and null net wealth households (high α), low inequality among low and middle net wealth households (high β), low inequality among the richest households (high δ), and more dispersed net wealth distribution (low λ).

The change of inequality of household net wealth in Indonesia in 1993-2014 might be influenced by two factors: the increasing economic activities especially after the 1997/1998 economic crisis that followed by the decentralisation era (Hill, 2021; McCulloch & Sjahrir, 2008; Pepinsky & Wihardja, 2011), and the demographic changes in Indonesia, which are indicated by lower fertility rate, lower population growth, and higher life expectancy, (see Figure 3.6), and cause an increasing proportion of the working-age population, giving higher economic benefits for individuals than previously (Abrianty & Sujarwoto, 2017; Frankenberg, Beegle, Sikoki, & Thomas, 1999; Qibthiyyah & Utomo, 2016).

Figure 3.6. *Population Growth, Fertility Rate, and Life Expectancy in Indonesia, 1950-2020.*



Source: United Nations (2020)

Since the estimation of Dagum Type III model above is for national-level data, the estimation of sub-national data is then achieved to confirm its consistency and show provinces with the most unequal household net wealth distribution in Indonesia are North Sumatera, Jakarta, and Bali, shown by high Gini Coefficient in Table 3.7.

Table 3.7. *Gini Coefficient for Provinces, 1993-2014*

	1993	**1997**	**2000**	**2007**	**2014**
North Sumatera	0.933	0.662	0.677	0.722	0.654
West Sumatera	0.817	0.703	0.642	0.644	0.613
South Sumatera	0.820	0.708	0.668	0.645	0.627
Lampung	0.607	0.698	0.620	0.599	0.542
West Java	0.802	0.740	0.698	0.673	0.624
Jakarta	0.834	0.747	0.670	0.654	0.629
Central Java	0.792	0.641	0.623	0.613	0.580
Yogyakarta	0.787	0.678	0.683	0.583	0.572
East Java	0.792	0.645	0.642	0.604	0.601
Bali	0.825	0.708	0.689	0.616	0.559
West Nusa Tenggara	0.788	0.666	0.608	0.622	0.586
South Kalimantan	0.778	0.660	0.618	0.559	0.584
South Sulawesi	0.789	0.641	0.604	0.643	0.606

Notes: estimated by using Jenkins (1999) estimator

High inequality in North Sumatera, Jakarta, and Bali might be related to their role as the economic growth centres for Indonesia where the Indonesian Investment Coordinating Board (BKPM) recorded the province of North Sumatera as the largest investment place in Sumatera Island, Jakarta as the largest recipient for Java Island and also the largest investment place in Indonesia, and Bali as receiving the largest investment in the eastern part of Indonesia (Badan Koordinasi Penanaman Modal, 2020). However, the economic benefits are not equally distributed to the population in the regions resulting in a large disparity among the population, shown by the disparity of development between areas within the province. The west coast of North Sumatera is more developed than other areas as it has Medan as the provincial capital and serves as the largest trading port in the province. The southern part of Bali is more developed than its counterpart in the northern area due to high tourism activities that create the economy. The Indonesian capital of Jakarta suffers slum problems, due to the inability of the population to access housing; and traffic congestion, due to inadequate public transportation that pushes the population to use private vehicles. Relevant to the explanation in the previous section, the year 1993 is considered as being the worst year for those provinces incurring the highest Gini Coefficient of all other years (Akita et al., 2011; Asra, 2000).

***Table 3.8**. Dagum Type III for Three Selected Provinces*

	North Sumatera, 1993	**Jakarta, 1993**	**Bali, 1993**
α	1.264***	1.07***	1.22***
	(0.229)	(0.199)	(0.189)
β (x10^6)	19.1**	82.8*	103***
	(7.702)	(46.3)	(35)
δ	0.392***	0.508***	0.404***
	(0.108)	(0.163)	(0.098)
λ (x10^{-6})	0.254**	0.529***	0.25***
	(0.114)	(0.191)	(0.077)
b_1 (NW<0)	0.156***	0.111***	0.138***
	(0.022)	(0.021)	(0.024)
b_2 (NW=0)	0.135***	0.174***	0.125***
	(0.021)	(0.021)	(0.028)
b_3 (NW>0)	0.709***	0.715***	0.737***
	(0.028)	(0.027)	(0.034)
Log-likelihood	-5,889.551	-6,658.707	-4,824.611
Mean (Rp.) (x10^6)	23.625	445.400	161.200
Median (Rp.) (x10^6)	1.120	7.234	9.941
Mean NW>0 (Rp.) (x10^6)	-3.940	-1.890	-4.006
Mean NW<0 (Rp) (x10^6)	34.178	623.500	219.400
Gini	0.849	0.949	0.868

Note: ***=p<0.01, **=p<0.05, *=p<0.1. Parentheses show robust standard errors. Estimates of Dagum Type III and Gini Coefficient are using Stata procedure provided by Jenkins and Jäntti (2005). Coefficient α reflects inequality among negative and null net wealth households, β reflects inequality among low and middle net wealth households, δ indicates the condition inequality among the richest households, and λ shows the dispersion of net wealth. Coefficients of b_1 means proportion of households who have negative net wealth, b_2 reflects shares of households who have negative zero wealth, and b_3 reflects shares of households who have positive net wealth.

Focusing on the provinces with the most unequal household net wealth distribution in Indonesia as found in Table 3.7, (North Sumatera, Jakarta, and Bali), estimations of Dagum Type III model give consistency with the findings from the national level in Table 6 that show high inequality of household net wealth being characterised by high inequality among negative and null net wealth households (low α), high inequality among low and middle net wealth households (low β), high inequality among the richest households (low δ), and less dispersed net wealth distribution (high λ) (Table 3.8).

3.4.3. Policy Implications

Estimations of Dagum Type III model to estimate the inequality of household net wealth indicates Indonesia has characteristics of the inequality of household net wealth in developing countries. In Developing countries, here appear to be only a few studies that investigate wealth inequality by using the Dagum Type III approach, especially those which provide parameter estimates. Some studies investigated inequality in Argentina, Brazil, and China in 2016 (Jacobi & Tzur, 2020) and in China in 2010 and 2012 (Li & Wan, 2015) provide results that are comparable, in terms of Gini Coefficients, to Indonesia for those years. For instance, in China, the wealth Gini Coefficient for 2002, 2010, and 2016 are 0.538, 0.739, and 0.819 which are similar to Indonesia's Gini's for 2000, 2007, and 2014 reported in this thesis, which are 0.733, 0.671, and 0.644. While in 2016, Argentina and Brazil produce reported wealth Gini Coefficients of 0.787 and 0.829 – again close to Indonesia's Gini in 2014 reported here as 0.644.

Table 3.9. shows the estimates of the Dagum Type III for net wealth inequality in Indonesia, 1993-2014, that can also be compared to the development process of inequality reduction in developed countries, that show the reduction of the Gini Coefficient and the changes in the parameters. For example, some countries that show a reduction in Gini Coefficeint also show the changes in the parameters. Since one should not interpret the parameters individually, it should be in one contingency, instead, the differing parameters between countries show different characteristics between them, e.g., differences in the concentration of capital ownership, the inequality in labour income, and differences in equalising impact, that is, in taxation and cash transfers (Piketty & Saez, 2014).

Table 3.9. *Comparison of Net Wealth Inequality between Countries*

	Year	**α**	**β (x10^6)**	**δ**	**λ (x10^{-6})**	**b1**	**b2**	**b3**	**Gini**
Finland	1994 [a]	3.916	159,355	0.168	0.788	0.127	0.009	0.864	0.56
	1998 [a]	3.428	189,723	0.182	0.625	0.105	0.008	0.888	0.572
United Kingdom	1970 [b]	0.518	0.379	1.856	24.257	0	0.518	0.481	0.828
	1992 [b]	0.033	0.387	2.318	127.983	0	0.033	0.966	0.553
Italy	2000 [b]	0.055	0.222	2.835	87,336.8	0.038	17	0.945	0.577
	2008 [c]	0.840	5,431,515	12.940	1,193	0.038	0.070	0.892	0.628
United States of America	1983 [b]	0.056	0.207	2.182	463.85	0.056	0	0.943	0.681
	2007 [c]	0.730	756,007	2.630	544	0.067	0.020	0.913	0.774
Germany	2007 [c]	0.730	3,519,022	10.380	327	0.123	0.208	0.669	0.809
Luxembourg	2007 [c]	0.980	4,999,554	8.690	0	0	0.116	0.884	0.591
Spain	2008 [c]	0.970	3,358,732	10.040	531	0.047	0.009	0.944	0.565
Indonesia	1993 [d]	1.329	45.9	0.43	0.29	0.106	0.105	0.789	0.811
	1997 [d]	1.333	54.8	0.646	0.283	0.009	0.009	0.982	0.778
	2000 [d]	1.42	50.6	0.667	0.104	0.006	0.002	0.992	0.733
	2007 [d]	1.627	73.6	0.532	0.039	0.014	0.009	0.977	0.671
	2014 [d]	1.865	127	0.369	0.093	0.006	0.002	0.992	0.644

Source: [a] Jenkins and Jantti (2005), [b] Dagum (2006), [c] Jantti, et.al. (2015), [d] Author's calculation. . Coefficient α reflects inequality among negative and null net wealth households, β reflects inequality among low and middle net wealth households, δ indicates the condition inequality among the richest households, and λ shows the dispersion of net wealth. Coefficients of b_1 means proportion of households who have negative net wealth, b_2 reflects shares of households who have negative zero wealth, and b_3 reflects shares of households who have positive net wealth..

Focus on the increase of household net wealth level is needed as the inequality of household net wealth in Indonesia is worse than the inequality of income or expenditure (Table 3.10). Therefore, wider access and opportunities for Indonesian households in all classes is needed to allow them to increase their net wealth and reduce inequality within classes which contributes to the reduction of overall inequality.

Table 3.10. shows that during 1993-2014, there is a declining trend in wealth inequality in Indonesia and an increasing trend of income and expenditure inequality. This somewhat unexpected finding might be caused by the structural change in Indonesia during 1993-2014. In particular, during the period 1993-1997, there was a decreasing trend of income and expenditure inequality that was mainly caused by the effect of the development distribution strategy conducted via the New Order (1965-1998) in the form of infrastructure and human quality development that allowed the population to increase their income (and expenditure). In contrast, during the period 1997/1998, the Asian Financial Crisis brought about economic and political reformation in Indonesia where political power was transferred from central government to local government. As a result, more people were able to obtain greater authority, political power, and financial resources, resulting in increased income and expenditure inequality during the period 2000-2014. On the other hand, the declining trend in inequality of household wealth in Indonesia during 1993-2014 might have been caused by Indonesia's economic growth that came from the development of infrastructure that reduced the associated costs of access; greater information transfer to the population which therefore allowed more of the Indonesian population to accumulate higher assets and select asset that give high returns.

Table 3.10. *Income, Expenditure, and Net Wealth Inequality in Indonesia, 1993-2014*

	1993	**1997**	**2000**	**2007**	**2014**
Income Gini Coefficient [a]	0.32	0.31.1	0.286	0.357	0.394
Expenditure Gini Coefficient [b]	0.341	0.335	0.295	0.376	0.414
Total Wealth Gini Coefficient [c]	0.791	0.710	0.664	0.631	0.599
Net Wealth Gini Coefficient [c]	0.811	0.778	0.733	0.671	0.644

Source: [a] World Bank (2020b), [b] World Bank (2016a), [c] Author's calculation

Policies regarding the reduction of inequality should be aimed at a specific class, for example, low inequality among the poorest households can be achieved through creating higher net wealth ownership. Some studies show efforts to support poor households to escape poverty or join the higher classes are related to opportunities for household members to gain employment, a promotion or education, or if the infrastructure is improved (Bryan & Morten, 2019; Dartanto, Moeis, & Otsubo, 2020; Widyanti, Suryahadi, Sumarto, & Yumna, 2009). Further, increasing local attractiveness should be achieved to prevent over-urbanisation (Bryan & Morten, 2019; Firman, Kombaitan, & Pradono, 2007; Lewis, 2014). Furthermore, focusing on efforts to avoid debts, should be taken into account as it can prevent the creation of negative net wealth, for example by controlling the growth of consumer credit (like credit cards, online loans, and pay later facilities) and illegal online loans.

Lower inequality in middle-class households can be achieved by creating a more visible middle class. This can be achieved by creating greater economic opportunities for these poor- and low-classes to join the higher classes faster (Bah, 2013; Dartanto et al., 2020). The middle class is important to support Indonesia’s development and if a middle class fails to appear, a more polarised society may result and bring a higher level of total inequality (World Bank, 2018b, 2020a). At the same time, the middle class should be prevented from falling into the lower classes due to economic crisis, crop loss, job loss or death, or other income shocks (Dartanto et al., 2020). In addition, due to the characteristic of high consumption shares, middle-class households should be able to manage their debts carefully as noted by Bank Indonesia (2018), the growth of consumption debts, that are largely consumed by the middle class in Indonesia rise 25-28 percent annually.

Regarding the richest households, efforts to achieve low inequality among them can be achieved through providing wider access for poorer households to contribute to economic activities because when the poorer households make higher economic contributions, they prevent a situation where all the trades are between the richest individuals only, and thus, increase their chances of gaining profits from poorer agents (Cieśla & Snarska, 2020; Credit Suisse, 2020). To prevent wealth condensation, a significant proportion of unspent income that converted is into assets, the income tax should be enforced as well as wealth tax, e.g. taxes on luxury goods (Cieśla & Snarska, 2020).

3.5. Conclusions

This chapter applies the Dagum Type III model to estimate the inequality of household net wealth in Indonesia and finds the distribution of household net wealth in Indonesia is right-skewed with long and sparse-hand tails that reflect a large proportion of households who hold very low net wealth and a small proportion of households who hold very high net wealth. During 1993-2013, the inequality of household net wealth was declining as indicated by the decrease of the Gini Coefficient. High inequality of household net wealth in Indonesia is attributed to high inequality among negative and null net wealth households, high inequality among low and middle net wealth households, high inequality among the richest households, and less dispersed net wealth distribution. Hence, reduction of inequality within classes is needed to support the reduction of overall inequality.

Owing to the data availability, this chapter cannot claim to provide a comprehensive picture of the inequality of household net wealth in Indonesia as some components are potentially hidden from the wealth report, including bias in the calculation and sample, therefore leading to under-reporting issues. Some improvements can be made for future studies, including, first, testing the sensitivity of the reduction of inequality in certain classes on overall inequality as policies related to inequality reduction can have heterogeneous effects on different classes and therefore may require a certain degree of policy for the different target groups; second, discovering the contribution of the population group in affecting the overall inequality, for example, by isolating the influences of gender, location, or occupation; third, the analysis of inequality can be disaggregated into analysis based on debts versus assets as it potentially provides a more nuanced analysis as to whether inequality is mainly due to differences in assets or differences in debts.

Chapter 4. Interprovincial Wealth Inequality by Factor Components in Indonesia

Abstract

This paper investigates three issues related to interprovincial inequality of household net wealth in Indonesia, that is, to identify whether the inequality is dominated by inequality within or between provinces, to identify the determinants of inequality, and the possible region groups formed as a result from the convergence or divergence in the household net wealth growth in Indonesia. Using data from the Indonesian Family Life Survey, the results suggest a declining inequality in household net wealth in Indonesia, dominated by the inequality within province with a decreasing trend over time. Next, education is the biggest equalising contributor to inequality of household net wealth in Indonesia. Finally, the growth of household net wealth in Indonesia is converging with two clubs being formed, where provinces in Java dominate the first group being the high-performance members, with the other group being other provinces outside Java being low-performance members.

Keywords: inequality within province, household net wealth, club convergence
JEL Classification: I32, O47, R11

4.1. Introduction

The occurrence of interregional inequality in Indonesia is realised by many scholars as dominated by inequality within Indonesian provinces that reflects inequalities among population groups, for example, between the rich and the poor, people living in urban and rural areas, or educated and low-level education groups (De Silva & Sumarto, 2014; Tadjoeddin, Suharyo, & Mishra, 2001).

One example of the difference between subgroups of population is the different contribution of regions to the Indonesian economy where in 2010, provinces on Java Island contribute more than half of Indonesian's Gross Domestic Product (GDP) (57.27%). This is much greater than Sumatera Island (22.38%) and provinces in other islands (20.32%). In 2019, the role of Java Island increased further, where its contribution to Indonesian GDP reached 58.89% while provinces on Sumatera Island contributed 21.27% and the rest of Indonesia contributed to only 19.85% in terms of Indonesian's GDP. The differences between subgroups can also be seen from the differences in the human development index between Western Indonesia (that consist of provinces in Java, Sumatera, and Kalimantan Islands) and Eastern Indonesia (that is provinces in Nusa Tenggars, Sulawesi, Maluku, and Papua Islands). In 2013, the human development disparity in the western regions was 7.66 points while in the eastern regions it was 11.11 points (Sihombing, 2019). The range of disparities is smaller compared to 2011, where they were 8.32 points (western regions) and 11.18 points (eastern regions) (Sihombing, 2019).

The differences of the condition among population subgroups above may bring many negative consequences, for example, differences in opportunities for individuals to access good education, health, and sanitation (World Bank, 2016a, 2019b) and widening the gap in the society as the rich households can easily generate higher wealth through inheritance, monopoly, and cronyism (Strand, 2010). The decentralisation process that commenced in Indonesia in 2001 that give more responsibilities for regions to develop their regions through attracting investment, trade, and infrastructure development is expected to give higher opportunities to increase a regional population standard of living, and therefore can reduce inequality among subgroup populations (World Bank, 2016a, 2016b). Therefore, examination related to the condition of inequality within the region is increasingly important, especially that related to the potential determinants of inequality so regions can make policies to increase their population standards of living, reduce inequality among population subgroups within their region, and reduce the inequality gap with other regions.

Most studies related to interregional differences in the household standard of living in Indonesia discuss inequality from the aspect of income (for example Akita, 2002; Kharisma & Saleh, 2013; Suryadarma et al., 2006) and expenditure (for example Akita & Lukman, 1999; Tadjoeddin et al., 2003; Yusuf et al., 2014). Both measurements are popular for measuring the household standard of living as they are easily obtained and can be interpreted straightforwardly; however, those measurements cannot fully reflect the household standard of living. Firstly, income has a transitory character that means past income does not necessarily reflect future income; and secondly, consumption data is usually biased downward for the top and bottom of the distribution where the richest households tend to underestimate their actual consumption due to a large proportion of savings and investment and the poorest households usually have a positive value of consumption even though they have no income (Jordá & Niño-Zarazúa, 2019). However, the estimation of Gross Domestic Product (GDP) or Gross Regional Domestic Product (GRDP) is not suitable for measuring the economic welfare of households as it is intended to measure the production process (Iyoda, 2011; Stiglitz, Sen, & Fitoussi, 2009). Instead, estimation of the household standard of living should focus on the net wealth aspect as it can indicate the results of the development progress (Stiglitz et al., 2009), reflecting household’s purchasing power (Filmer & Pritchett, 2001), and reflecting future consumption as households can convert their assets, either accumulated from their income or obtained from the inheritance, into money (Wakita et al., 2000).

This chapter seeks to contribute to our understanding of interprovincial inequality in Indonesia measured from the household net wealth aspect, by pursuing three main objectives. The first is to identify the location of the source of household net wealth inequality in Indonesia whether caused by inequality within or between Indonesian provinces. After identifying the location of the source of inequality, our second objective is to explain the drivers of these changes. In particular, I am interested in determining what set of forces influence inequality focusing on three aspects: household size, education (measured from the household head years of schooling), and household composition (measured from the number of non-productive household members, that is, aged 0-14 and more than 65 years that must be supported by each productive household members, that is, aged 15-65). Some considerations of the inclusion of those variables are explained as follows. Household net wealth is influenced by household size as families with higher household size will have a higher level of consumption to achieve a similar level standard of living as those families with smaller household size, all else being equal, which makes it difficult to save and accumulate wealth (Hao, 1996; Keister, 2003). Also, people with higher educational attainment are expected to have the capability to earn a higher income and have better financial literacy, therefore having the ability to generate higher wealth levels than those who have a lower educational level (Behrman, Mitchell, Soo, & Bravo, 2012; Benton & Keister, 2017). Lastly, families with more dependents will have a lower ability to generate savings and accumulate wealth than families with fewer dependents (Han & Cheng, 2020; Lee, Mason, & Miller, 1997).

To try and understand the potential determinants of inequality of household net wealth in Indonesia, I use decomposition by factor sources and regression-based decomposition. The results of these objectives will lead to the third objective of the research, which is to examine whether there is an increasing or decreasing gap between provinces in the evolution of the growth of the standard of living. More specifically, we need to identify the high-performing and low-performing provinces based on their net wealth growth over time. Here, I use the club convergence approach to shed light on the identification of the convergence process and the occurrence of the convergence clubs.

I begin the following section by summarising the literature on inequality, paying particular attention to interprovincial inequality. Section 3 presents methods and data sources used in the analysis. Section 4 presents the empirical results and discussion of the findings. Lastly, Section 5 concludes with policy recommendations and suggestions for future research.

4.2. Literature Review

4.2.1. Interprovincial Inequality by Factor Components

The Gini Coefficient can be used to show the interprovincial inequality by distinguishing its components into Gini within (G_W) and Gini between (G_B). The decomposition of the Gini Coefficient into Gini within (G_W) and Gini between (G_B) takes the form (Lambert & Aronson, 1993):

$$G = G_B + \sum a_k G_k + R \quad (1)$$

where the population subgroups are indexed by $k = 1, 2, \ldots, n$, G_B is the between-groups Gini Coefficient, defined as the one which would be obtained if every value in every subgroup were to be replaced by the relevant subgroup mean, a_k is the product of population share and value share to subgroup k, G_k is the Gini Coefficient for value within subgroup k and R is a residual which is zero if the subgroup income ranges do not overlap.

More specifically, Stark, Taylor, and Yitzhaki (1986) show the influence of any components of the Gini Coefficient upon total inequality depends on how important the factor source is with respect to the total value (S_k), how equally or unequally distributed the factor source is (G_k), and how the factor source and the distribution of total value are correlated (R_k). In mathematical form (Stark et al., 1986):

$$G = \sum_{k=1}^{K} S_k G_k R_k \quad (2)$$

The decomposition of half squared coefficient of variation (½CV^2) is used as it is additively decomposable and contains no residual component like that in Gini Coefficient (Abdi, 2010; Villar, 2017). Some studies show the occurrence of residuals in the decomposition of the Gini Coefficient should be depreciated as it obscures the role of inequality within and between provinces (Bellù & Liberati, 2006; Costa & Pérez-Duarte, 2019). As a group of Generalised Entropy measured, the half squared coefficient of variation can be shown mathematically (Irawan, 2014):

$$GE(\propto) = \frac{1}{\propto(\propto-1)}\left[\frac{1}{N}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{\propto} - 1\right] \quad (3)$$

where $\bar{y}$ is the mean of a given variable per capita (e.g. regional per capita GDP). The value of *GE* measures takes between 0 and ∞, with 0 representing an equal distribution and higher values representing higher levels of inequality. The parameter α can take any real value and defines the weight given to distances between values of the variable at different parts of the distribution. For lower values of α, *GE* is more sensitive to changes in the lower tail of the distribution, and for higher values of α, *GE* is more sensitive to changes in the upper tail.

The commonly used values of α are 0, 1, and 2. The *GE*(0) is also known as the mean log deviation or Theil's L, and the *GE*(1) is Theil's T. The *GE*(2) is equal to half the square of the coefficient of variation. While the Theil index is additively decomposable by regions and cannot be decomposed by factor sources, the *GE*(2) can be additively decomposed as the sum of within-group inequality, $GE\_w(\alpha)$ and between-group inequality, $GE\_b(\alpha)$ (Akita et al., 2020).

In the Indonesian context, recent studies in the decomposition of inequality by factor components show inequality within provinces plays a dominant role in total inequality with education as the biggest contributor to inequality, in particular in the sociodemographic components, as found by Wicaksono, Amir, and Nugroho (2017) and De Silva and Sumarto (2014). Other sociodemographic factors that influence inequality in Indonesia are wealth (Wicaksono et al., 2017) and demographic characteristics like number of dependents in the family, and employment factors, like agriculture work type and self-employment work type (De Silva & Sumarto, 2014)

4.2.2. Review of the Convergence Literature

In the economic literature, the term convergence refers to the condition of the poorer economies that can catch up to richer economies (Islam, 2003). The convergence issue is related to the neoclassical growth theory by Solow (1956) that specifies economies with lower capital per worker tend to grow faster. Convergence in this Solow model has been empirically shown to be conditional, meaning that economies have their steady-state and that the distance from the steady-state depends on some unobserved economic characteristics (Rothe, 2018).

Islam (2003) provides a review of different concepts of convergence, with one most important distinction being unconditional convergence versus conditional convergence. The unconditional convergence or the absolute β - convergence assumes convergence of countries from their initial condition towards a unique (global) steady-state growth path. In contrast, the conditional β - convergence analysis assumes that countries converge to different steady-state growth paths, depending on their initial conditions as well as other (local) factors that are important for economic growth like human and physical capital accumulation, and population growth. Further, Islam (2003) distinguishes club convergence from conditional convergence based on the uniqueness of the equilibrium. In the case of unconditional convergence, there is only one equilibrium level to which all economies approach. In the case of conditional convergence, equilibrium differs by economy, and each particular economy approaches its own, but unique, equilibrium. In contrast, the idea of club-convergence is based on models that yield multiple equilibria.

Phillips and Sul (2007) develop a distribution-based measure (the log *t*-test) that can be applied within a time series framework to measure the occurrence of club convergence. It retains the distribution of incomes as the functional parameter but attempts to go beyond transitional dynamics to identify long-term trends. It is also less restrictive than β-convergence as it allows for, and endogenises, club convergence as a likely result. It is also relatively straightforward in both implementation and interpretation compared to other time series methods (Zhao, 2015).

For the Indonesian context, recent literature shows the use of the procedure by Phillips and Sul (2007) can reject the occurrence of a single equilibrium steady-state path, for example, in the study of Kurniawan, de Groot, and Mulder (2019) that reject the single equilibrium steady-state path for the indicators of per capita gross regional product, the Gini Coefficient, the school enrolment rate, and the fertility rate and show the occurrence of two convergence clubs, with one club consisting mostly of provinces that are more developed than others. Further research shows the rejection of a single equilibrium steady-state path in per capita income and shows the formation of five convergence clubs (Aginta, Gunawan, & Mendez, 2020). Lastly, Mendez and Kataoka (2021) show no single equilibrium steady-state path in the aspect of labour productivity and capital accumulation and indicate that three and two convergence clubs are formed.

4.3. Method and Data

4.3.1. Empirical Method

To achieve the outcomes for the three research purposes mentioned in the first section, I use three separate approaches in the analysis. First, I estimate the household net wealth inequality within and between Indonesian provinces by using the decomposition of the Gini Coefficient. This approach is widely used to show the decomposition by population subgroup into components representing inequality within groups, inequality between groups, and a residual term, where each component is non-negative (Jenkins, 2019). The decomposition of the half squared coefficient of variation is used as an alternative for the decomposition of the Gini Coefficient as Lambert and Aronson (1993) indicate that the occurrence of residuals that reflect the overlapping condition of each subgroup can obscure the role of inequality within and between groups. In Stata, the Gini Coefficient and half squared coefficient of variation decomposition are estimated by using the Jenkins (2019) and Jenkins (1999) estimator[7], respectively.

Second, I examine the contribution of household characteristics on the interprovincial net wealth inequality by using the decomposition analyses of inequality following Lerman and Yitzhaki (1985) by using the Lopez-Feldman (2006) estimator[8]. Lerman and Yitzhaki (1985), extending the approach by Shorrocks (1982), show that their method can estimate the effect of small changes in a specific inequality source on total inequality, holding all other sources constant. More specifically, this marginal effect can be used to explain three important aspects: how important the wealth source above is with respect to total wealth (*Sk*); how equally or unequally distributed the wealth source is (*Gk*); and how the wealth source and the distribution of total wealth are correlated (*Rk*) (Lopez-Feldman, 2006). For robustness check, the regression-based decomposition of the inequality following Fields (2003) is used by using the Fiorio and Jenkins (2007) estimator[9] as it presents decomposition based on causal analysis and can explain the source of inequality conditions in a certain region, group, or period and factors that explain the difference of inequality between one region and other, between one group and another, or between one time period and another (Fields, 2003).

Third, I examine the occurrence of convergence club of household net wealth in Indonesia by using the club convergence approach following Phillips and Sul (2007) as this approach is not only able to justify whether household net wealth is converging or diverging over time but can also identify the high and low performance club members. As explained by Du (2017), the club convergence procedure by Phillips and Sul (2007), which is based on a non-linear time-varying factor model, has the merits of an ability to accommodate heterogeneous agent behaviour and evolution in that behaviour, and the test does not impose any particular assumptions concerning trend stationarity or stochastic non-stationarity, thereby being robust to the stationarity property of the series.

The log *t* regression test proposed by Phillips and Sul (2007) above overcomes the limitations of the traditional convergence tests. In the traditional convergence studies, the possible existence of convergence clubs is typically handled by dividing all individuals into subgroups based on some prior information (e.g. geographical location, institution), then testing the convergence hypothesis for each subgroup, which potentially cannot accommodate

[7] In Stata, Jenkins (2019) estimator is `ineqdecgini` and Jenkins (1999) estimator to estimate inequality indices is `ineqdeco`. If there are observations with negative or zero values on the variable of interest, inequality indices are estimated with `ineqdec0`.
[8] In Stata, the Lopez-Feldman (2006) estimator is `descogini`
[9] In Stata, the Fiorio and Jenkins (2007) estimator with `ineqrbd`

heterogeneous agent behaviour evolution in that behaviour by the time-varying factor (Phillips & Sul, 2007).

Du (2017) explained the procedure of the club convergence following Phillips and Sul (2007) as follows:

1. *Cross-section sorting.* Sort individuals in the panel decreasingly according to their observations in the last period. If there is substantial time-series volatility in the data, the sorting can be implemented based on the time-series average of the last fraction (e.g. 1/2, 1/3) of the sample. Index individuals with their orders (Parker & Liddle, 2017);
2. *Core group formation.* Two steps are involved.
   2.1. Find the first k such that the test statistic of the log t regression $t_k > -1.65$ for the subgroup with individuals {k, k + 1}. If there is no k satisfying $t_k > -1.65$, exit the algorithm, and conclude that there are no convergence subgroups in the panel.
   2.2. Start with the k identified in step 2.1., perform log t regression for the subgroups with individuals {k, k + 1,...,k + j}, $j \in \{1,...,N-k\}$. Choose j* such that the subgroup with individuals {k, k + 1,...,k + j∗} yields the highest value of the test statistic. Individuals {k, k + 1,...,k + j∗} form a core group;
3. *Sieve individuals for club membership.* There are two steps involved.
   3.1. Form a complementary group G_{j*}^{c} with all the remaining individuals not included in the core group. Add one individual from G_{j*}^{c} at a time to the core group and run the log t-test. Include the individual in the club candidate group if the test statistic is greater than the critical value c*.
   3.2. Run the log t-test for the club candidate group identified in step 3.1. If the test statistic $\widehat{t_b}$ is greater than −1.65, the initial convergence club is obtained. If not, Phillips and Sul (2007) advocated raising the critical value c* and repeating steps 3.1 and 3.2 until $\widehat{t_b} > -1.65$. Schnurbus, Haupt, and Meier (2017) proposed adjusting this step as follows:

   > If the convergence hypothesis does not hold for the club candidate group, sort the club candidates w.r.t. decreasing $\widehat{t_b}$ obtained in step 3.1. If there are some $\widehat{t_b} > -1.65$, add the individual with the highest value of $\widehat{t_b}$ to form an extended core group. Add one individual at a time from the remaining candidates, run the log *t*-test, and denote the test statistic

$\widehat{t_b}$. If the highest value of $\widehat{t_b}$ is not greater than -1.65, stop the procedure; the extended core group will form an initial convergence club. Otherwise, repeat the procedure above to add the individual with the highest $\widehat{t_b}$.

4. *Recursion and stopping rule.* Form a subgroup of the remaining individuals that are not sieved by step 3. Perform the log t-test for this subgroup. If the test statistic is greater than -1.65, the subgroup forms another convergence club. Otherwise, repeat steps 1–3 on this subgroup.
5. *Club merging.* Perform the log t-test for all pairs of the subsequent initial clubs. Merge those clubs fulfilling the convergence hypothesis jointly. Schnurbus et al. (2017) advocated conducting club merging iteratively as follows:

> run the log *t*-test for the initial clubs 1 and 2; if they fulfil the convergence hypothesis jointly merge them to form the new club 1, then run the log *t*-test for the new club 1 and the initial club 3 jointly; if not, run the log *t*-test for initial clubs 2 and 3, etc. The new club classifications would be obtained by the procedure above. Then, also the procedure can be repeated on the newly obtained club classifications until no clubs can be merged, which leads to the classifications with the smallest number of convergence clubs.

Phillips and Sul (2007)[10] suggested L(t) = log t and r = 0.3 for sample sizes below T = 50. Then, using $b = 2\alpha$ they suggest a one-sided t-test for the null hypothesis $\alpha \geq 0$. The null hypothesis of convergence is rejected if $t_b < -1.65$ at the 5 percent significance level. In Stata, the procedure of club convergence analysis following Phillips and Sul (2007) uses a package of commands introduced by Du (2017)[11].

4.3.2. Data

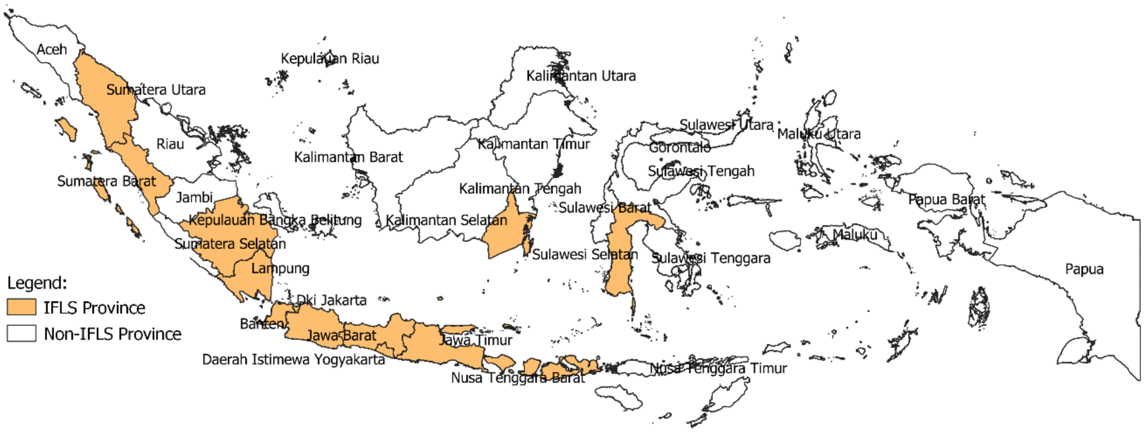
Data used in this research were obtained from the Indonesian Family Life Survey (IFLS), the longitudinal survey that collects information on the health, demographic, and

[10] Phillips and Sul (2007) indicate $r \in [0.2, 0.3]$ achieves a satisfactory performance in the log-*t* regression, specifically, it is suggested to set r = 0.3 for the small or moderate T(≤ 50) sample and set r = 0.2 for the large T(≥ 100) sample.

[11] Du (2017) introduced five commands in Stata for club convergence. The `logtreg` command performs the log(*t*) regression test. The `psecta` command implements the clustering algorithm to identify convergence clubs. The `scheckmerge` command conducts the log(*t*) regression test for all pairs of adjacent clubs. The `imergeclub` command tries to iteratively merge adjacent clubs. The `pfilter` command extracts the trend/cyclical component of a time series of each individual respectively in panel data,

socioeconomic status of the Indonesian population[12]. The IFLS population of 13 provinces in Indonesia, that is, all provinces in the islands of Java, Sumatra, Bali and West Nusa Tenggara, Kalimantan, and Sulawesi and representative of about 83 percent of the population (see Figure 4.1).

Figure 4.1. *Map of IFLS Provinces*



The first wave of IFLS (IFLS1) was administered in 1993 to 7,224 households; the second (IFLS2) in 1997 with 7,698 households, and the third (IFLS3) in 2000 with 10,435 households. The fourth wave (IFLS4) was in 2007 and covered 13,535 households, while the fifth wave (IFLS5) in 2014 covered 16,204 households. The sample size used in this research is 5,707 households who consistently were included in all waves of the survey.

In this research, household net wealth is obtained from total wealth deducting debts. The total wealth consists of market value farm business assets (farmland, poultry, and house/building used for farm activities), non-farm business assets (land, vehicle, and building used for non-farm activities), and household assets (house, land, vehicle, savings, and furniture). The household net wealth is then converted into real value, by adjusting it using the consumer price index following World Bank (2018a). As the variation of the household's wealth is also related to their family size, the unadjusted household wealth level does not reflect individual well-being, therefore, net wealth is adjusted to fit with the household size by dividing net household wealth by the square root of the number of household members[13].

[12] The IFLS has two cross-sections sister study. First, the IFLS 2+ that fielded in 1998 covers only 25% sample of the 1997 survey to portray immediate impact of the 1997/1998 Asian financial crisis. Second, the IFLS East that conducted in 2012 that cover around 2,500 households living in seven provinces in Eastern Indonesia.

[13] When the economies of scale are put into account, each member is assigned per capita household wealth and everything is split amongst them (W/S^{ε}). The notation of S^{ε} refers the economies of scale, S=size, and ε=the

During 1993-2014, household net wealth in Indonesia has an increasing trend with a significant increase in 1993-1997, mainly due to high economic growth during this period, that is, from 6.496 percent in 1993 to 7.818 percent in 1996 (Badan Pusat Statistik, 2020a). The IFLS2 between August 1997 and December 1997, occurred when Indonesia was at the beginning of the Asian Financial Crisis that started mid-1997, increasing the calculation of assets value from the previous years (see Table 4.1).

Table 4.1. *Average Values of Variables, 1993-2014*

Provinces	Variable	1993	1997	2000	2007	2014
Sumatera Utara	Net Wealth (Rp.)(x10^3)	14,500	73,600	70,600	81,200	76,100
	Household Size	4.643	4.643	5.035	5.304	5.302
	Years of Schooling	7.445	7.307	6.656	5.932	8.065
	Dependency Ratio	1.058	0.916	0.847	0.660	0.546
Sumatera Barat	Net Wealth (Rp.)(x10^3)	28,600	83,300	71,200	88,200	88,900
	Household Size	4.423	4.423	4.772	4.835	4.665
	Years of Schooling	7.551	7.496	6.331	6.926	8.140
	Dependency Ratio	0.932	0.777	0.728	0.600	0.604
Sumatera Selatan	Net Wealth (Rp.)(x10^3)	31,300	42,200	43,900	72,300	90,100
	Household Size	4.763	4.759	5.087	5.336	5.067
	Years of Schooling	7.233	7.016	6.320	6.202	7.625
	Dependency Ratio	0.984	0.845	0.784	0.523	0.508
Lampung	Net Wealth (Rp.)(x10^3)	29,300	64,000	54,500	59,500	88,700
	Household Size	4.540	4.540	4.938	5.102	4.942
	Years of Schooling	5.925	5.752	5.058	6.159	6.903
	Dependency Ratio	1.038	0.867	0.728	0.569	0.495
DKI Jakarta	Net Wealth (Rp.)(x10^3)	101,000	253,000	155,000	109,000	98,200
	Household Size	4.338	4.340	4.690	4.776	4.562
	Years of Schooling	8.214	7.917	6.521	6.143	8.157
	Dependency Ratio	0.733	0.626	0.585	0.509	0.490
Jawa Barat	Net Wealth (Rp.)(x10^3)	51,000	108,000	75,300	63,300	73,000
	Household Size	4.108	4.105	4.421	4.659	4.524
	Years of Schooling	6.192	6.026	5.337	5.912	6.861
	Dependency Ratio	0.890	0.852	0.777	0.628	0.567
Jawa Tengah	Net Wealth (Rp.)(x10^3)	28,800	79,900	68,800	70,200	74,500
	Household Size	3.842	3.839	4.159	4.386	4.318
	Years of Schooling	5.987	5.765	5.275	5.459	7.086
	Dependency Ratio	0.873	0.810	0.721	0.675	0.639
Yogyakarta	Net Wealth (Rp.)(x10^3)	61,700	125,000	129,000	99,500	118,000
	Household Size	3.557	3.554	3.834	4.026	3.904
	Years of Schooling	6.899	6.891	5.308	5.650	7.516
	Dependency Ratio	0.712	0.704	0.671	0.637	0.673
Jawa Timur	Net Wealth (Rp.)(x10^3)	38,900	75,100	74,200	81,500	88,600
	Household Size	3.672	3.673	3.884	4.122	4.031
	Years of Schooling	5.642	5.388	4.919	4.971	6.145
	Dependency Ratio	0.807	0.784	0.703	0.613	0.599
Bali	Net Wealth (Rp.)(x10^3)	75,900	155,000	160,000	156,000	154,000

economies of scale parameter with the value between 0 and 1. There is no consensus for determining the economies of scale, although ε=0.5 is widely used (Atkinson et al., 1995; Clementi et al., 2012; OECD, 2020; Sierminska & Smeeding, 2005; Stats NZ, 2019).

	Household Size	3.986	3.986	4.247	4.514	4.389
	Years of Schooling	6.444	6.590	5.406	6.000	5.646
	Dependency Ratio	0.778	0.747	0.713	0.597	0.585
Nusa Tenggara Barat	Net Wealth (Rp.)($x10^3$)	27,700	55,500	50,500	56,500	96,900
	Household Size	4.431	4.429	4.962	5.073	4.833
	Years of Schooling	5.801	5.518	4.642	5.135	5.078
	Dependency Ratio	1.031	0.975	0.904	0.628	0.533
Kalimantan Selatan	Net Wealth (Rp.)($x10^3$)	24,500	55,800	52,500	64,000	89,900
	Household Size	3.989	3.989	4.476	4.669	4.442
	Years of Schooling	6.662	6.647	5.654	5.911	5.710
	Dependency Ratio	0.834	0.729	0.685	0.586	0.535
Sulawesi Selatan	Net Wealth (Rp.)($x10^3$)	37,800	71,300	67,500	74,700	109,000
	Household Size	4.575	4.575	4.779	4.906	4.679
	Years of Schooling	5.334	5.607	4.617	6.010	5.893
	Dependency Ratio	0.946	0.816	0.711	0.605	0.547
Indonesia	Net Wealth (Rp.)($x10^3$)	40,000	89,400	73,000	74,700	86,400
	Household Size	3.692	3.691	4.040	4.371	4.340
	Years of Schooling	6.059	5.908	5.200	5.485	6.735
	Dependency Ratio	0.832	0.845	0.809	0.696	0.634

Note: Net wealth is in constant price 2010, adjusted with household size.

I focus on the sociodemographic factor that affects interprovincial inequality in Indonesia, in particular household size, education (measured from the household head years of schooling), and household composition (measured from the number of non-productive household members, that is, aged 0-14 and more than 65 years that must be supported by each productive household members, that is, aged 15-65). Those contributors are considered as important to be investigated for these reasons. First, Indonesia achieved a success story in controlling population growth in the last decades, with one of the indicators being the reduction in household size (e.g. shown in the reduction of household size from 3.692 in 1993 to 3.691 in 1997), however, the slower progress of the population planning (*Keluarga Berencana*) programme occurs after 2001, mainly due to the lack of political support from local government (Herartri, 2005; Purwaningsih, 2016). However, in the longer period, Qibthiyyah and Utomo (2016) showed that the average household size in Indonesia has declined gradually over the last 40 years, from 4.9 in 1971 to 4.8 (1980), 4.5 (1990). 4.3 (1995), 4.0 (2000), 3.8 (2010), and 3.9 (2013). Data from the Population Census, managed by Indonesian Statistics, shows the declining trend in the number of household members, from 4.9 in 1980 to 4.5 in 1990. Data from Indonesian Statistics show that the average number of household members in Indonesia decreased during 2000 to 2014, from 3,9 in 2000, 4,00 in 2007, and 3,9 in 2014 (Badan Pusat Statistik, 2017).

Second, in the education aspect, Indonesia achieved increasing participation in education, shown from the increasing trend of the household years of schooling in Table 4.1, but a significant drop in education performance during 2000-2007, that might be related to the decrease in household wealth (World Bank, 2019b). As found by World Bank (2019b), considerations related to costs of education is the main factor for parents to decide not to send their children to pursue higher education. Third, in the dependency ratio aspect, Indonesia experienced a decreasing trend of dependency ratio that might be related to the change of demographic pattern in Indonesia where the families tend to have a smaller household size, resulting in fewer young age dependents (aged 0-14) but higher old-age dependents (aged 65 and older) (UNDP, 2021a).

In the relationship with the inequality of household net wealth, those contributors will give an important contribution in influencing the level of household net wealth as families with higher household size will have a higher level of consumption to achieve a similar level standard of living as those families with smaller household size, all else being equal, which makes it difficult to save and accumulate wealth (Hao, 1996; Keister, 2003). Also, people with higher educational attainment are expected to have the capacity to earn a higher income and have better financial literacy, therefore having the ability to generate higher wealth levels than those who have a lower educational level (Behrman et al., 2012; Benton & Keister, 2017). Lastly, families with more dependents will have a lower ability to generate savings and accumulate wealth than families with fewer dependents (Han & Cheng, 2020; Lee et al., 1997).

4.4. Results and Discussion

4.4.1. Net Wealth Inequality Between and Within Indonesian Provinces

Household net wealth in Indonesia is unequally distributed, with a declining trend occurring during 1993-2014, shown from half squared coefficient of variation (½CV^2), Gini Coefficient, and Theil Index (see Table 4.2). This declining condition might be caused by the development results that are more distributed throughout the nation due to the decentralisation since 2001 (Badrudin & Siregar, 2015; Hill & Vidyattama, 2016). The declining inequality in Indonesia is accompanied by the rising importance of the middle class in Indonesia, shown on the Foster-Wolfson (FW) Polarisation Index. This index measures polarisation, that is the degree to which observations move from the middle of the distribution to the tails with higher index showing the more polarised data and, thus the middle class is disappearing more (Birdsall & Meyer, 2015). Hence, high inequality in 1993 seemed to be caused by the unequal household net wealth that is mostly owned by the upper class, leaving a small proportion of net wealth to be owned by the other groups. In contrast, the rising of the middle class in the next years is in line with the declining inequality condition in Indonesia (see Table 4.2).

Table 4.2. *Households' Net Wealth Characteristics, 1993-2014*

	1993	1997	2000	2007	2014
Indices of Inequality					
½CV^2, or GE(2)	6.443	8.202	2.369	2.010	1.005
Gini Coefficient	0.806	0.713	0.666	0.644	0.603
Theil Index, or GE(1)	1.276	1.247	0.919	0.796	0.649
Polarisation					
FW Polarisation Index	0.788	0.426	0.400	0.351	0.373

Note: Mean and median are in constant price 2010

The measurements above provide inequality conditions among the Indonesian population but are unable to provide the cause of inequality with respect to space, that is, whether influenced by inequality within a province or inequality between provinces. Using the Gini Coefficient decomposition method shows that the household net wealth inequality in Indonesia is dominated by inequality between provinces with a declining proportion over time, from approximately 31 percent in 1993 to 13 percent in 2014. Only about 16 percent of inequality in Indonesia can be explained by inequality within provinces. Similar findings of the location of source inequality are found in a sub-national level where inequality between provinces dominates inequality in Java Island (that consist of Jakarta, West Java, Central Java, Yogyakarta, and East Java) and outside of Java Island (North Sumatera, West Sumatera, South Sumatera, Lampung, Bali, West Nusa Tenggara, South Kalimantan, and South Sulawesi) (see Table 4.3).

Table 4.3. *Gini Coefficient Decomposition, 1993-2014*

Year	**Decomposition**				**Decomposition (Percent of Total)**		
	Gini	**Gini within**	**Gini between**	**Residual**	**Gini within**	**Gini between**	**Residual**
Java Island							
1993	0.806	0.134	0.253	0.418	16.680	31.465	51.855
1997	0.711	0.172	0.205	0.334	24.220	28.881	46.899
2000	0.662	0.161	0.135	0.366	24.271	20.457	55.272
2007	0.634	0.163	0.082	0.389	25.736	12.915	61.349
2014	0.598	0.157	0.064	0.377	26.271	10.702	63.027
Outside Java Island							
1993	0.826	0.125	0.310	0.391	15.073	37.553	47.374
1997	0.712	0.121	0.201	0.391	16.967	28.181	54.853
2000	0.682	0.118	0.210	0.354	17.253	30.858	51.889
2007	0.673	0.118	0.183	0.372	17.583	27.197	55.220
2014	0.614	0.108	0.099	0.407	17.591	16.083	66.326
Indonesia							
1993	0.806	0.134	0.253	0.418	16.680	31.465	51.855
1997	0.713	0.116	0.214	0.382	16.336	30.052	53.611
2000	0.666	0.106	0.156	0.405	15.903	23.379	60.718
2007	0.644	0.104	0.111	0.429	16.148	17.218	66.634
2014	0.603	0.100	0.079	0.425	16.513	13.035	70.451

Note: Gini decomposition is obtained by using Jenkins (2019) estimator

Estimation of the decomposition of half squared coefficient of variation (½CV^2) makes it possible to eliminate the residuals found in the Gini Coefficient decomposition, hence, unlike Gini Coefficient decomposition, the decomposition of the ½CV^2 resulting only components of inequality within and between provinces (Abdi, 2010; Villar, 2017). The decomposition of half squared coefficient of variation (½CV^2) shows findings contrary to the Gini Coefficient decomposition where the inequality within provinces comprises the largest proportion of total inequality, approximately 96-98 percent of total inequality in Indonesia with an inclining trend during 1993-2014 (see Table 4.4). By using this approach, we can conclude that the interprovincial inequality of household net wealth in Indonesia is dominated by inequality within provinces. The domination of inequality within provinces in Indonesia is also found by Akita et al. (2011), who use the income approach, and Yusuf et al. (2014), who the use expenditure approach, and found the differences in inequality among Indonesia's region groups, for example, Java-Bali and Sumatera-Kalimantan-Papua are small compared to the levels of inequality within those regions. The increasing trend of the share of inequality within provinces in Indonesia might be related to the changing economic pattern in Indonesia, indicated by the increased role of the service sector but declining importance of the industrial sector (Suryahadi, Hadiwidjaja, & Sumarto, 2012).

Table 4.4. *Half Squared Coefficient of Variation Decomposition, 1993-2014*

Year	Decomposition			Decomposition (Percent of Total)	
	½CV²	**Within**	**Between**	**Within**	**Between**
Java Island					
1993	6.286	6.186	0.100	98.409	1.591
1997	8.693	8.584	0.110	98.746	1.265
2000	2.365	2.300	0.065	97.252	2.748
2007	2.142	2.126	0.016	99.253	0.747
2014	1.020	1.013	0.008	99.314	0.784
Outside Java Island					
1993	6.527	6.260	0.267	95.909	4.091
1997	4.642	4.552	0.090	98.061	1.939
2000	2.369	2.259	0.110	95.357	4.643
2007	1.606	1.525	0.081	94.956	5.044
2014	0.941	0.912	0.028	96.918	2.976
Indonesia					
1993	6.443	6.312	0.131	97.967	2.033
1997	8.202	8.090	0.112	98.634	1.366
2000	2.369	2.294	0.074	96.834	3.124
2007	2.010	1.975	0.034	98.259	1.692
2014	1.005	0.990	0.015	98.507	1.493

Note: ½CV² decomposition is obtained by using Jenkins (1999) estimator

The domination of inequality within provinces is also shown in the analysis of inequality in the Java Island and outside Java with an inclining trend in Java but a declining trend outside Java (see Table 4.4). This contradictory trend might be related to the disproportional benefits distributed to the population with a changing pattern of households' involvement in economic activities due to the changing economic pattern in Indonesia as mentioned above. The decreasing industrial sector that is concentrated in Java Island has a significant impact on the population in the island, making households face higher competition in economic activities, reducing economic benefits received, and therefore increasing inequality in the region. While the increase in the price of estate crops and mining commodities that are mostly located outside Java mean more households are involved in the economic activities and benefit more from them (Andriyani & Irawan, 2018; Grabowski & Self, 2020; Yusuf et al., 2014).

4.4.2. Decomposition of Inequality using Household Characteristics

The existence of household net wealth inequality in Indonesia that is dominated by the inequality within provinces is then raising the need to identify the contributors of the inequality through the decomposition approach. By breaking down the factor source, we can address some aspects that are relevant to the policy analysis, especially those related to the size of the contribution of the variable to the total inequality, how equality or inequality of the distribution of the inequality source, and how the inequality source and the distribution of data are correlated (Lopez-Feldman, 2006).

Table 4.5. *Decomposition by Household Characteristics*

Source	***Sk***	***Gk***	***Rk***	**Share**	**Percent Change**
	(1)	(2)	(3)	(4)	(5)
1993					
Ln HH size	0.006	0.178	0.087	0.000	-0.006
Ln HH head years of schooling	0.009	0.078	0.097	0.000	-0.009
Ln Dependency ratio	0.004	0.435	-0.069	0.000	-0.004
1997					
Ln HH size	0.004	0.178	-0.086	0.000	-0.004
Ln HH head years of schooling	0.006	0.079	0.400	0.001	-0.005
Ln Dependency ratio	0.002	0.440	-0.155	-0.001	-0.003
2000					
Ln HH size	0.004	0.154	-0.104	0.000	-0.005
Ln HH head years of schooling	0.006	0.065	0.312	0.000	-0.005
Ln Dependency ratio	0.002	0.464	-0.153	-0.001	-0.003
2007					
Ln HH size	0.004	0.169	-0.038	0.000	-0.004
Ln HH head years of schooling	0.006	0.078	0.144	0.000	-0.006
Ln Dependency ratio	0.002	0.457	-0.102	0.000	-0.002
2014					
Ln HH size	0.004	0.173	-0.016	0.000	-0.004
Ln HH head years of schooling	0.006	0.077	0.169	0.000	-0.005
Ln Dependency ratio	0.002	0.447	-0.075	0.000	-0.002

Note: Decomposition is estimated using Lopez-Feldman (2006) estimator. *Sk* = share of source *k* in total wealth; *Gk* = the source Gini corresponding to the distribution of wealth from source *k*; *Rk* = the Gini correlation of net wealth from source *k* with the distribution of total net wealth; Share = the share of contributors in total inequality; Percent Change = the impact of 1 percent change in the respective wealth contributors will have on inequality, all else being equal

Focusing on the household size, household head years of schooling, and dependency ratio aspects, findings from *Sk* column in Table 4.5 show the variable of years of schooling is the biggest contributor to the inequality of household net wealth in Indonesia. It reflects the positive impact of education that is beneficial for households allowing them to earn higher net wealth level and being able to reduce inequality of household net wealth (Akita, Lukman, & Yamada, 1999). Table 4.5 also can show an estimation of the characteristics of variables in their relationship to the inequality decomposition. For example, compared to other variables, the years of schooling has the biggest contribution to inequality (highest *Sk*), least unequally distributed (smallest *Gk*), and flows disproportionally toward those at the top of the distribution (*Rk* is positive). In contrast, the variable of dependency ratio is considered to have the smallest contribution to the inequality (smallest *Sk*), most unequally distributed (biggest *Gk*), and flows disproportionally toward the bottom of the distribution (*Rk* is negative).

Table 4.5 shows the equalising effect on the inequality of education, shown in column (5). A 1 percent increase in the variable of years of schooling, all else being equal, reduces the inequality of household net wealth by 5-9 percent during 1993-2014. The unexpected findings are found in the negative coefficients of the variables of household size and dependency ratio in column (5). A 1 percent increase in the variable of household size and dependency ratio reduces the inequality of household net wealth by 4-7 percent and 2-3 percent, respectively. Those negative coefficients for the variables; household size and dependency ratio, might be caused by the characteristics of variables that disproportionally flow to the bottom of the distribution as shown in column (3) where high household size and a high dependency ratio are mostly found at the bottom of data distribution. Hence, households in low classes can benefit most from public spending in the form of public health service (*puskesmas*) or public schooling, hence will increase their net wealth level and reduce inequality (Akita et al., 1999; Lanjouw, Pradhan, Saadah, Sayed, & Sparrow, 2002). In contrast, the increase of household size and dependency ratio among middle and upper classes households provide low benefits from them as, instead of public facilities, they prefer to use private health services and send their children to private schools as they can give higher quality than public health and education facilities provided by government.

A similar pattern of the equalising effect of the variables in Table 4.5 is also found in the analysis of decomposition by subgroups for Java and Outside Java and for urban and rural areas (Table 4.6-4.9). Comparison between Java and Outside Java show the variables in variables outside Java have a bigger contribution (higher *Sk*), less unequally distributed (lower *Gk*), and flow toward those at the end of the distribution (lower *Rk*) than in Java, resulting in a higher equalising factor of the change of variables than in Java. This condition might be related to the unequal economic activities that mostly concentrated in Java and make household net wealth outside Java relatively lower than inside Java, hence making interventions in education or demography will make a higher impact outside Java (Andriyani & Irawan, 2018; Grabowski & Self, 2020). Therefore, focus on outside Java should be given higher priority.

Similar findings occur in a comparison between urban and rural status, where variables in rural areas have a higher equalising effect than in urban areas, either in Java or outside Java. This condition might be related to the more deprived condition in the rural than in urban areas, hence making an effort to reduce inequality in rural areas will yield a higher impact than in urban areas, for example, in the education aspect through the application of teacher certification, build more schools and increase the quality of the facilities, and increase dana incentive for schools(Bantuan Operasional Sekolah/ BOS) (Brinkman, Hasan, Jung, Kinnell, & Pradhan, 2017; Hondai, 2005). A further aspect that needs to be developed is to enhance the quantity and quality of healthcare services in rural areas so that households living in rural areas can receive health care services with the same standard to their counterparts in urban areas (Laksono, Wulandari, & Soedirham, 2019). Finally, the population in rural areas should receive sufficient information exposure to allow them to contribute to development programmes that produce positive impact to them, e.g., creating a small household size through a population control (KB) programme where households in rural areas are commonly influenced by tradition and culture that frequently prohibit them to have select a small household size (Onitsuka, Hidayat, & Huang, 2018).

Table 4.6. *Decomposition by Household Characteristics for Java and outside Java Island*

Source	Java Island					Outside Java Island				
	Sk	Gk	Rk	Share	Percent Change	Sk	Gk	Rk	Share	Percent Change
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1993										
Ln HH size	0.006	0.182	0.143	0.000	-0.005	0.007	0.169	0.033	0.000	-0.007
Ln HH head years of schooling	0.009	0.078	0.119	0.000	-0.009	0.010	0.078	0.078	0.000	-0.010
Ln dependency ratio	0.004	0.438	-0.048	0.000	-0.004	0.005	0.428	-0.081	0.000	-0.005
1997										
Ln HH size	0.003	0.182	-0.049	0.000	-0.004	0.004	0.170	-0.100	0.000	-0.005
Ln HH head years of schooling	0.005	0.079	0.433	0.001	-0.005	0.006	0.078	0.376	0.001	-0.005
Ln dependency ratio	0.002	0.446	-0.143	0.000	-0.002	0.003	0.431	-0.155	-0.001	-0.003
2000										
Ln HH size	0.004	0.156	-0.062	0.000	-0.004	0.005	0.148	-0.134	0.000	-0.005
Ln HH head years of schooling	0.006	0.066	0.352	0.001	-0.005	0.006	0.065	0.262	0.000	-0.006
Ln dependency ratio	0.002	0.464	-0.106	0.000	-0.002	0.002	0.461	-0.197	-0.001	-0.003
2007										
Ln HH size	0.004	0.178	-0.017	0.000	-0.004	0.004	0.153	-0.065	0.000	-0.005
Ln HH head years of schooling	0.006	0.079	0.154	0.000	-0.006	0.006	0.078	0.131	0.000	-0.006
Ln dependency ratio	0.002	0.462	-0.113	0.000	-0.002	0.002	0.450	-0.089	0.000	-0.002
2014										
Ln HH size	0.004	0.175	0.009	0.000	-0.004	0.004	0.167	-0.061	0.000	-0.004
Ln HH head years of schooling	0.006	0.076	0.200	0.000	-0.005	0.005	0.078	0.118	0.000	-0.005
Ln dependency ratio	0.002	0.449	-0.058	0.000	-0.002	0.001	0.440	-0.100	0.000	-0.002

Note: Decomposition is estimated using Lopez-Feldman (2006) estimator. *Sk* = share of source *k* in total wealth; *Gk* = the source Gini corresponding to the distribution of wealth from source *k*; *Rk* = the Gini correlation of net wealth from source *k* with the distribution of total net wealth; Share = the share of contributors in total inequality; Percent Change = the impact of 1 percent change in the respective wealth contributors will have on inequality, all else being equal

Table 4.7. *Decomposition by Household Characteristics for Urban and Rural Areas*

Source	Urban					Rural				
	Sk	Gk	Rk	Share	Percent Change	Sk	Gk	Rk	Share	Percent Change
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1993										
Ln HH size	0.006	0.176	0.119	0.000	-0.006	0.006	0.180	0.057	0.000	-0.006
Ln HH head years of schooling	0.009	0.084	0.116	0.000	-0.009	0.009	0.071	0.084	0.000	-0.009
Ln dependency ratio	0.004	0.445	-0.047	0.000	-0.004	0.004	0.426	-0.092	0.000	-0.005
1997										
Ln HH size	0.004	0.185	-0.067	0.000	-0.004	0.004	0.171	-0.120	0.000	-0.004
Ln HH head years of schooling	0.005	0.089	0.386	0.001	-0.005	0.006	0.060	0.386	0.001	-0.005
Ln dependency ratio	0.002	0.454	-0.143	0.000	-0.002	0.003	0.426	-0.146	-0.001	-0.003
2000										
Ln HH size	0.004	0.159	-0.103	0.000	-0.004	0.005	0.150	-0.120	0.000	-0.005
Ln HH head years of schooling	0.006	0.076	0.306	0.001	-0.005	0.006	0.049	0.259	0.000	-0.006
Ln dependency ratio	0.002	0.472	-0.140	0.000	-0.002	0.002	0.454	-0.139	-0.001	-0.003
2007										
Ln HH size	0.004	0.166	-0.055	0.000	-0.004	0.005	0.171	-0.037	0.000	-0.005
Ln HH head years of schooling	0.006	0.078	0.109	0.000	-0.006	0.006	0.073	0.119	0.000	-0.006
Ln dependency ratio	0.002	0.469	-0.102	0.000	-0.002	0.002	0.446	-0.086	0.000	-0.002
2014										
Ln HH size	0.004	0.172	0.006	0.000	-0.004	0.004	0.175	-0.052	0.000	-0.004
Ln HH head years of schooling	0.006	0.079	0.170	0.000	-0.005	0.005	0.069	0.155	0.000	-0.005
Ln dependency ratio	0.002	0.445	-0.091	0.000	-0.002	0.002	0.450	-0.046	0.000	-0.002

Note: Decomposition is estimated using Lopez-Feldman (2006) estimator. *Sk* = share of source *k* in total wealth; *Gk* = the source Gini corresponding to the distribution of wealth from source *k*; *Rk* = the Gini correlation of net wealth from source *k* with the distribution of total net wealth; Share = the share of contributors in total inequality; Percent Change = the impact of 1 percent change in the respective wealth contributors will have on inequality, all else being equal

Table 4.8. Decomposition by Household Characteristics for Urban and Rural in Java Island

Source	Urban					Rural				
	Sk	**Gk**	**Rk**	**Share**	**Percent Change**	**Sk**	**Gk**	**Rk**	**Share**	**Percent Change**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1993										
Ln HH size	0.006	0.180	0.175	0.000	-0.005	0.006	0.184	0.101	0.000	-0.006
Ln HH head years of schooling	0.009	0.084	0.121	0.000	-0.009	0.009	0.068	0.126	0.000	-0.008
Ln dependency ratio	0.003	0.451	-0.011	0.000	-0.003	0.004	0.423	-0.092	0.000	-0.004
1997										
Ln HH size	0.003	0.192	-0.048	0.000	-0.003	0.004	0.167	-0.072	0.000	-0.004
Ln HH head years of schooling	0.005	0.090	0.399	0.001	-0.005	0.006	0.049	0.453	0.001	-0.005
Ln dependency ratio	0.002	0.460	-0.139	0.000	-0.002	0.002	0.428	-0.118	-0.001	-0.003
2000										
Ln HH size	0.004	0.162	-0.088	0.000	-0.004	0.004	0.148	-0.056	0.000	-0.004
Ln HH head years of schooling	0.005	0.076	0.326	0.001	-0.005	0.006	0.042	0.340	0.000	-0.005
Ln dependency ratio	0.002	0.471	-0.108	0.000	-0.002	0.002	0.453	-0.079	0.000	-0.003
2007										
Ln HH size	0.004	0.175	-0.036	0.000	-0.004	0.004	0.180	-0.024	0.000	-0.004
Ln HH head years of schooling	0.006	0.077	0.117	0.000	-0.006	0.006	0.071	0.126	0.000	-0.006
Ln dependency ratio	0.002	0.472	-0.091	0.000	-0.002	0.002	0.449	-0.111	0.000	-0.003
2014										
Ln HH size	0.004	0.177	0.026	0.000	-0.004	0.004	0.168	-0.037	0.000	-0.004
Ln HH head years of schooling	0.006	0.078	0.192	0.000	-0.005	0.005	0.064	0.237	0.000	-0.005
Ln dependency ratio	0.002	0.452	-0.101	0.000	-0.002	0.002	0.443	0.047	0.000	-0.002

Note: Decomposition is estimated using Lopez-Feldman (2006) estimator. *Sk* = share of source *k* in total wealth; *Gk* = the source Gini corresponding to the distribution of wealth from source *k*; *Rk* = the Gini correlation of net wealth from source *k* with the distribution of total net wealth; Share = the share of contributors in total inequality; Percent Change = the impact of 1 percent change in the respective wealth contributors will have on inequality, all else being equal

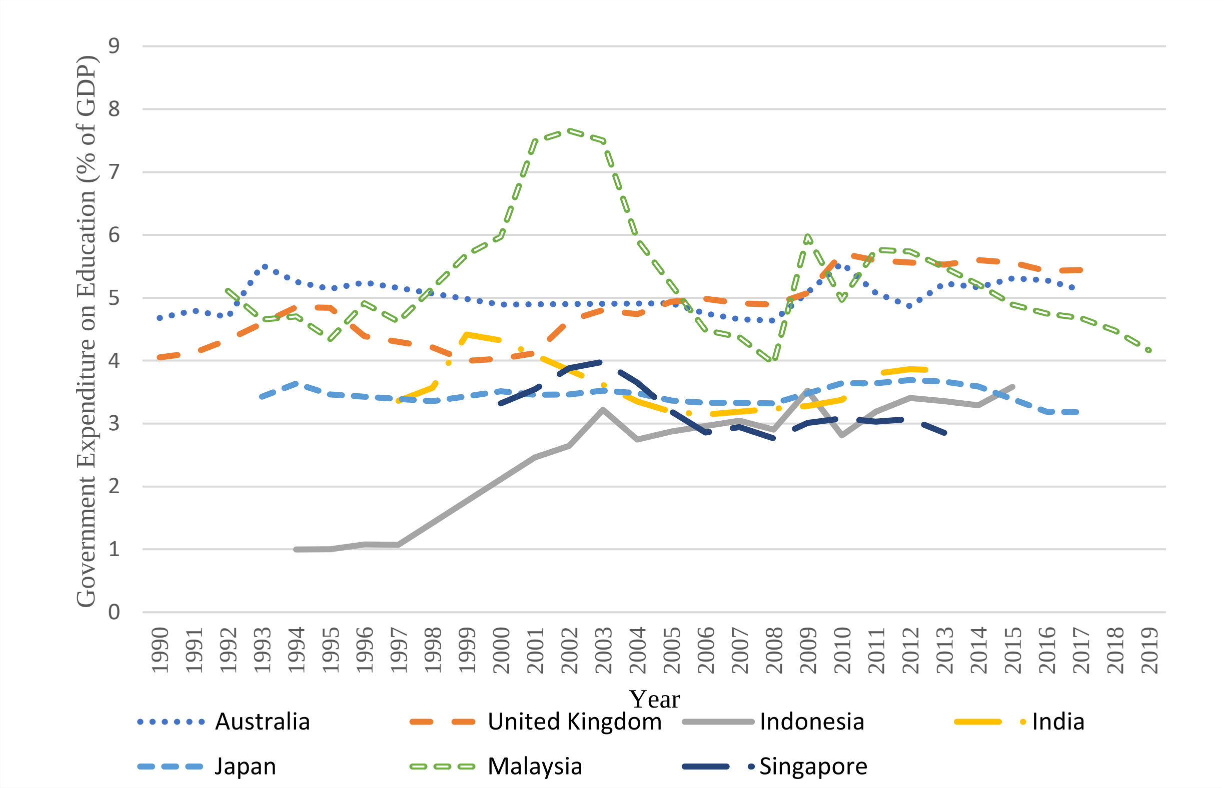
Table 4.9. *Decomposition by Household Characteristics for Urban and Rural Areas Outside Java Island*

Source	**Urban**					**Rural**				
	Sk	**Gk**	**Rk**	**Share**	**Percent Change**	**Sk**	**Gk**	**Rk**	**Share**	**Percent Change**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1993										
Ln HH size	0.008	0.165	0.048	0.000	-0.008	0.007	0.172	0.030	0.000	-0.007
Ln HH head years of schooling	0.011	0.082	0.115	0.000	-0.011	0.010	0.074	0.061	0.000	-0.010
Ln dependency ratio	0.005	0.431	-0.088	0.000	-0.005	0.005	0.426	-0.080	0.000	-0.005
1997										
Ln HH size	0.004	0.170	-0.053	0.000	-0.004	0.004	0.169	-0.142	0.000	-0.005
Ln HH head years of schooling	0.006	0.087	0.363	0.001	-0.005	0.006	0.069	0.382	0.001	-0.006
Ln dependency ratio	0.002	0.441	-0.128	0.000	-0.003	0.003	0.423	-0.165	-0.001	-0.003
2000										
Ln HH size	0.004	0.150	-0.114	0.000	-0.005	0.005	0.147	-0.157	0.000	-0.005
Ln HH head years of schooling	0.006	0.075	0.267	0.000	-0.005	0.006	0.055	0.217	0.000	-0.006
Ln dependency ratio	0.002	0.473	-0.187	-0.001	-0.003	0.003	0.452	-0.181	-0.001	-0.003
2007										
Ln HH size	0.004	0.148	-0.097	0.000	-0.004	0.005	0.155	-0.051	0.000	-0.005
Ln HH head years of schooling	0.006	0.078	0.101	0.000	-0.006	0.006	0.074	0.112	0.000	-0.006
Ln dependency ratio	0.002	0.464	-0.120	0.000	-0.002	0.002	0.440	-0.056	0.000	-0.002
2014										
Ln HH size	0.004	0.158	-0.058	0.000	-0.004	0.004	0.177	-0.066	0.000	-0.004
Ln HH head years of schooling	0.005	0.079	0.117	0.000	-0.005	0.006	0.073	0.092	0.000	-0.005
Ln dependency ratio	0.001	0.426	-0.061	0.000	-0.002	0.002	0.455	-0.142	0.000	-0.002

Note: Decomposition is estimated using Lopez-Feldman (2006) estimator. *Sk* = share of source *k* in total wealth; *Gk* = the source Gini corresponding to the distribution of wealth from source *k*; *Rk* = the Gini correlation of net wealth from source *k* with the distribution of total net wealth; Share = the share of contributors in total inequality; Percent Change = the impact of 1 percent change in the respective wealth contributors will have on inequality, all else being equal

Looking more deeply into the role of the single most important variable, education, even though Indonesia has been able to significantly increase the enrolment rate in the last decades (Badan Pusat Statistik, 2021), the government spending on education, measured from the share of Gross Domestic Product (GDP), is still low compared to other countries (see Figure 4.2).

Figure 4.2. *Government Expenditure on Education, Percentage of GDP.*



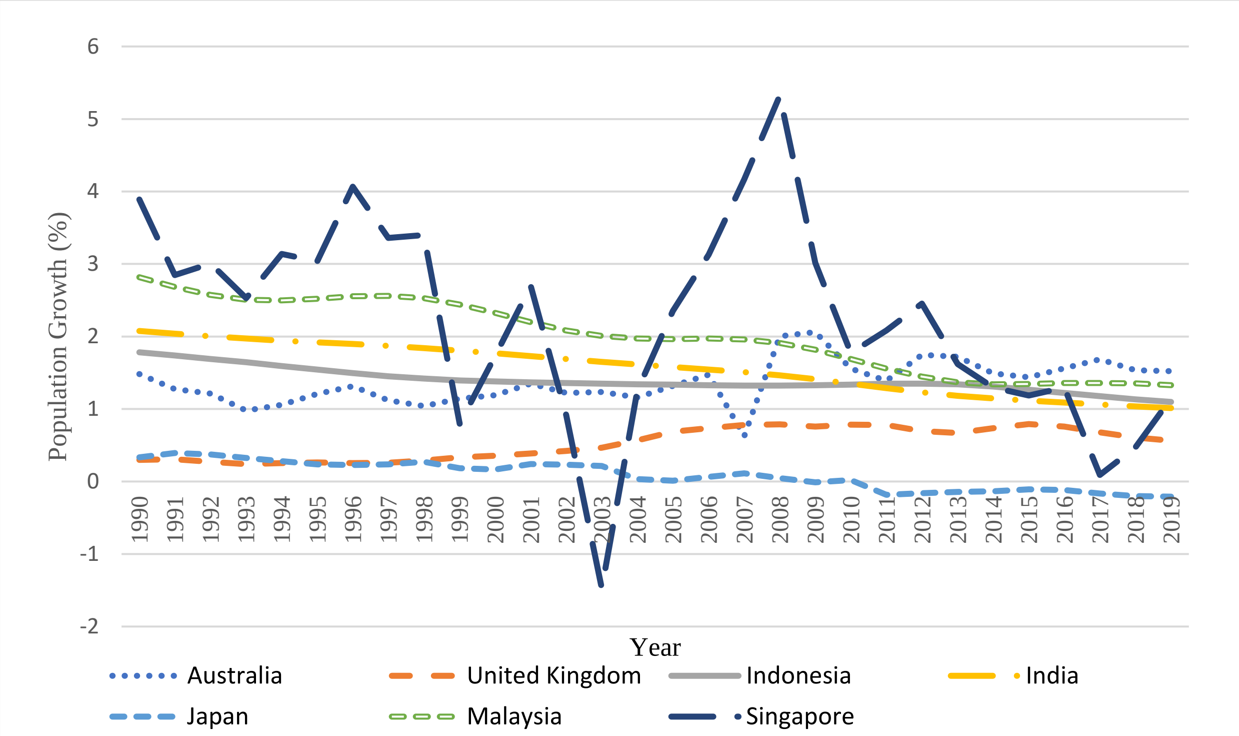
Source: World Bank (2020c)

The low government expenditure on education as the percentage of GDP in Indonesia is also followed by the low government expenditure per student, either for primary, secondary, or tertiary, as the percentage of GDP per capita. This low government expenditure per student which is considered as the lowest comparing to Australia, United Kingdom, Japan, Malaysia, Singapore, and India. (World Bank, 2020d, 2020e, 2020f).

The low spending in education might be related to the population growth issue in Indonesia as with a population of more than 270 million, the Indonesian government faces challenges in the development of the quantity and quality of education (World Bank, 2019b).

Even though Indonesia can reduce population growth, it is still relatively high comparing to other countries (World Bank, 2020g). Even worse, efforts to reduce population growth in Indonesia is slower in the last two decades where the decentralisation weakens the political support of the family planning (*Keluarga Berencana*) programme in Indonesia (Purwaningsih, 2016; Triana, Wilopo, & Sumarni, 2011; World Bank, 2016a) (Figure 4.3).

Figure 4.3. *Population Growth*



Source: World Bank (2020g)

Considering urban and rural areas, a focus on policy interventions on education aspect and population growth control should be given in rural areas as the change of variables in the rural areas give a greater equalising effect on interprovincial inequality than in urban areas. Both aspects are considered strongly related to each other and should be consistently achieved as a higher education level will lead to higher knowledge about family planning (Angeles, Guilkey, & Mroz, 2005). More specifically, policy interventions in the education sector in rural areas should be made for expanding access to early childhood education (Brinkman et al., 2016; Brinkman et al., 2017). While supporting the promotion of population growth control, especially in rural areas, the government should increase access to community health centre considering its important role as the basic health service provider (Laksono et al., 2019).

Table 4.10. *Regression-based Decomposition.*

Source	Level		Percent of Change in Inequality Explained by the Decomposition Using:
	100*s_f	**S_f**	**100*m_f/m**
	(1)	**(2)**	**(3)**
1993			
Ln HH size	35.393	0.004	34.808
Ln HH head years of schooling	35.259	0.004	55.964
Ln dependency ratio	29.347	0.003	-13.452
Total	100.000	0.012	100.000
1997			
Ln HH size	4.882	0.001	-11.225
Ln HH head years of schooling	84.399	0.017	117.850
Ln dependency ratio	10.719	0.002	-7.214
Total	100.000	0.020	100.000
2000			
Ln HH size	10.753	0.001	-16.536
Ln HH head years of schooling	74.350	0.009	97.323
Ln dependency ratio	14.897	0.002	-6.488
Total	100.000	0.012	100.000
2007			
Ln HH size	19.542	0.001	-13.568
Ln HH head years of schooling	44.822	0.002	39.742
Ln dependency ratio	35.636	0.001	-6.004
Total	100.000	0.004	100.000
2014			
Ln HH size	6.854	0.000	-7.213
Ln HH head years of schooling	78.319	0.002	45.977
Ln dependency ratio	14.827	0.000	-3.482
Total	100.000	0.003	100.000

Note: Regression-based decomposition is obtained by using Fiorio and Jenkins (2007) estimator.
Proportionate contribution of composite var f to inequality of Total,
s_f = rho_f*sd(f)/sd(Total). S_f = s_f*I2(Total).
m_f = mean(f). sd(f) = std.dev. of f. I2_f = .5*[sd(f)/m_f]^2.
Total = household netwealth

The equalising effect of the variables in Table 4.5 is then re-checked using a robustness test with the regression-based inequality decomposition following Fields (2003). Findings shown in Table 4.10 column (1) are consistent with those shown in Table 4.5 that show education is the largest contributor of inequality with an increasing role comparing to other aspects over the next years. In 1993, education is as important as the household size aspect in influencing inequality (35.259 vs 35.393) and slightly more important than the dependency ratio (35.259 vs 29.347) but in the next years, the role of education is increasingly important, shown from the ratio factor inequality weight of education to other variables. For example, in 2014, education is more than 10 times more important than the variable of household size and more than 5 times more important than the dependency ratio variable.

The consistency with findings from previous analysis is also shown in column (3) of Table 4.10 that explains the condition of how much of the increase in household net wealth inequality is due to each of the factors. Results show education is the largest contributor, accounting for more than half of the increase in inequality. The variables of household size and dependency ratio have relatively small and negative coefficients, reflecting their relatively small effects and do not contribute to the explanation; because although their changes are in the equalising direction, inequality is increasing. Therefore, results from the regression-based decomposition in Table 4.10 confirm the findings from the decomposition by using Lopez-Feldman (2006) estimator in Table 4.5 above and shows the importance of the variable of years of schooling as the biggest contributor in influencing household net wealth inequality in Indonesia.

4.4.3. Convergence in Indonesia: Evidence from the Club of Provinces

We can now consider the analysis to discover whether the gap of household net wealth in Indonesia is narrowing over time and to identify the regions based on their household net wealth growth over time. The results are useful for policymakers making suitable policies, especially to help low performance regions to catch up with other regions in terms of household net wealth. Estimation of log-*t* regression and clustering algorithm shows the value of *t*-statistic (t_b) is -2.452.Since $t_b < -1,65$, we reject the null hypothesis, thus, there is evidence of overall convergence which opens opportunities for club convergence (Table 4.11).

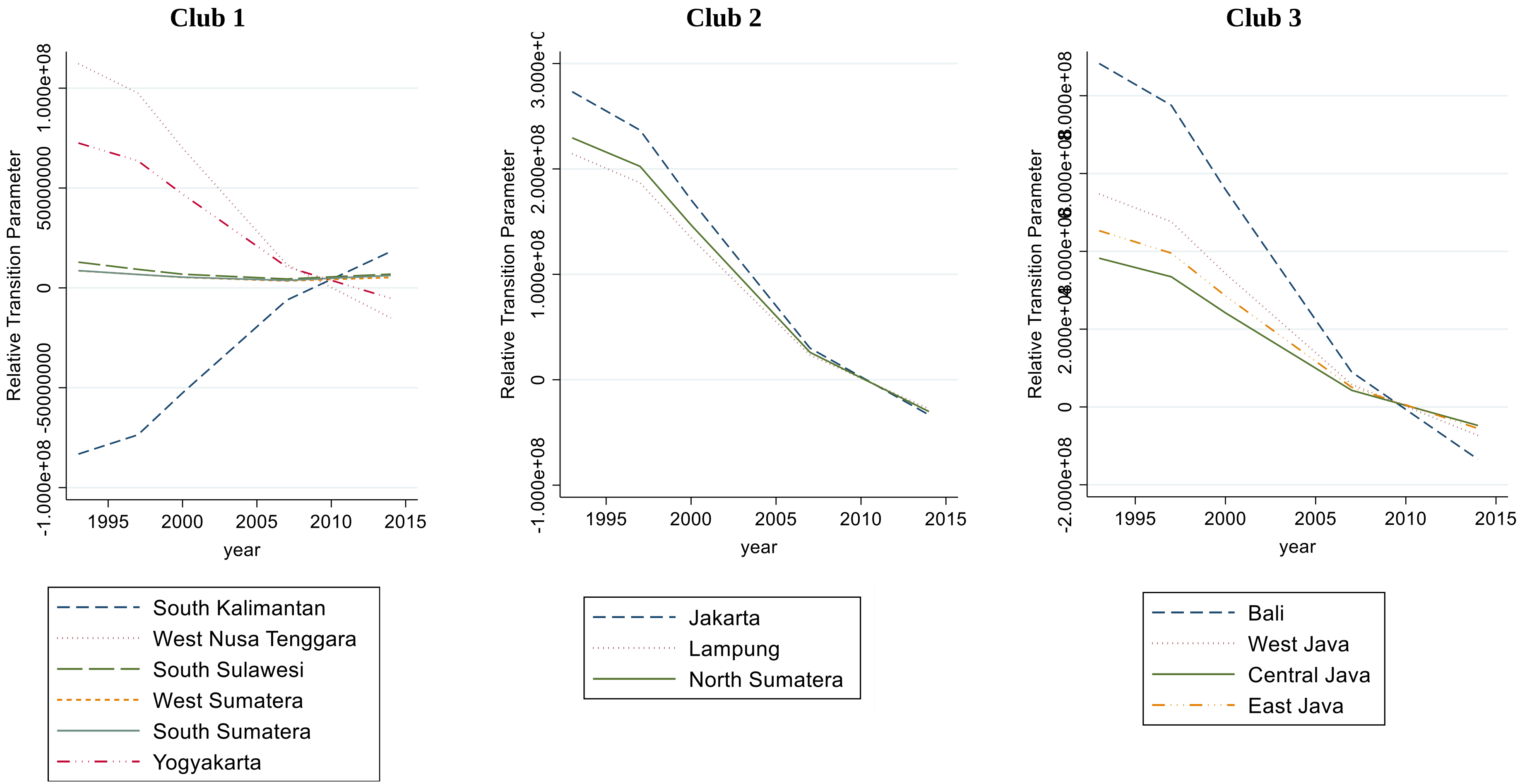
The convergence process shows, at the national level and across time, province *i*'s relative position relates to other provinces' relative positions. The relative position of a province may change over time because of its performance in terms of the household net wealth indicators. Using the club convergence algorithm provided by Du (2017) resulting in the three convergence clubs. The log *t* regression for Club 1 produces a *t*-statistic of 0.336 that is bigger than -1,65, therefore the null hypothesis of convergence is not rejected. Similar results are found for Club 2. While in the Club 3, the log *t* test gives result t_b = -1.453 which is slightly bigger than critical value t_b =-1,65, hence, we cannot reject the null either. Even though estimation of the log *t* regression provides a *t*-statistic that leads to the rejection of null of convergence as mentioned above, Phillips and Sul (2009) note that rejection of the null of convergence does not imply there is no evidence of convergence in subgroups of the panel because many possibilities exist as we move away from a strict null of full panel convergence. Examples include the possible existence of convergence clusters around separate points of equilibria or steady state growth paths, as well as cases where there may be both convergence clusters and divergent members in the full panel. While observations from the coefficients show a non-negative coefficient found in Club 1 and Club 2 that show an indication of convergence for that club specification; in case of negative coefficients as found in Club 3, null of convergence is rejected. From this initial findings, there are three initial clubs formed in this step, namely Club 1 that consists of some provinces in Sumatera, Kalimantan, and Sulawesi Islands, Club 2 that consists of a few provinces in Java and Sumatera, and Club 3 that is dominated by provinces in Java Island(Table 4.11).

***Table 4.11**. Results from the log-t Regression Test and Clustering Algorithm*

	All	**Club 1**	**Club 2**	**Club 3**
Coeff.	-1.514	0.316	0.183	-1.263
t-stat	-2.452	0.336	0.336	-1.453
Members		South Kalimantan, West Nusa Tenggara, South Sulawesi, West Sumatera, South Sumatera, Yogyakarta	Jakarta, Lampung, North Sumatera	Bali, West Java, Central Java, East Java

By observing changes in this indicator over time, a track of the evolution paths of the individual provinces can be obtained. Provinces in Club 1 converging within the class with Yogyakarta and West Nusa Tenggara have a decline of relative position over years, provinces of South Sulawesi, West Sumatera, and South Sumatera have a relatively constant position in relation to other provinces, while South Kalimantan has an increasing relative position over years. In contrast, members in Clubs 2 and 3 are converging with a declining relative growth over time (see Figure 4.4). The convergence process in Figure 4.4 might be related to the decentralisation process that commenced in Indonesia in 2001 and allows the increasing role of regions outside economic growth centres, mostly located in Java Island, in economic activities, for example, in the form of the rising role of the industrial sector, mining, and plantations (Andriyani & Irawan, 2018; Grabowski & Self, 2020).

Figure 4.4. The Relative Transition Curves



The existence of convergence clubs that reflect different speeds of convergence, is reported by Egger and Pfaffermayr (2006) as being caused by the spillover effect that can contribute a biased analysis of convergence. Hence, the last step of the clustering algorithm of club convergence by Phillips and Sul (2009), namely the club merging, is conducted as a robustness check to avoid over-determination in the club convergence formation, that is, where the convergence club methodology tends to find more members of clubs than their true number (Phillips & Sul, 2009). By using Phillips and Sul (2009) procedure, we assess whether any evidence exists to support the merging of smaller clubs into larger clubs. The results show the new convergence test trial for the club merging that drives result club merging is able to reduce the number of groups, from three groups to two groups (see Table 4.12).

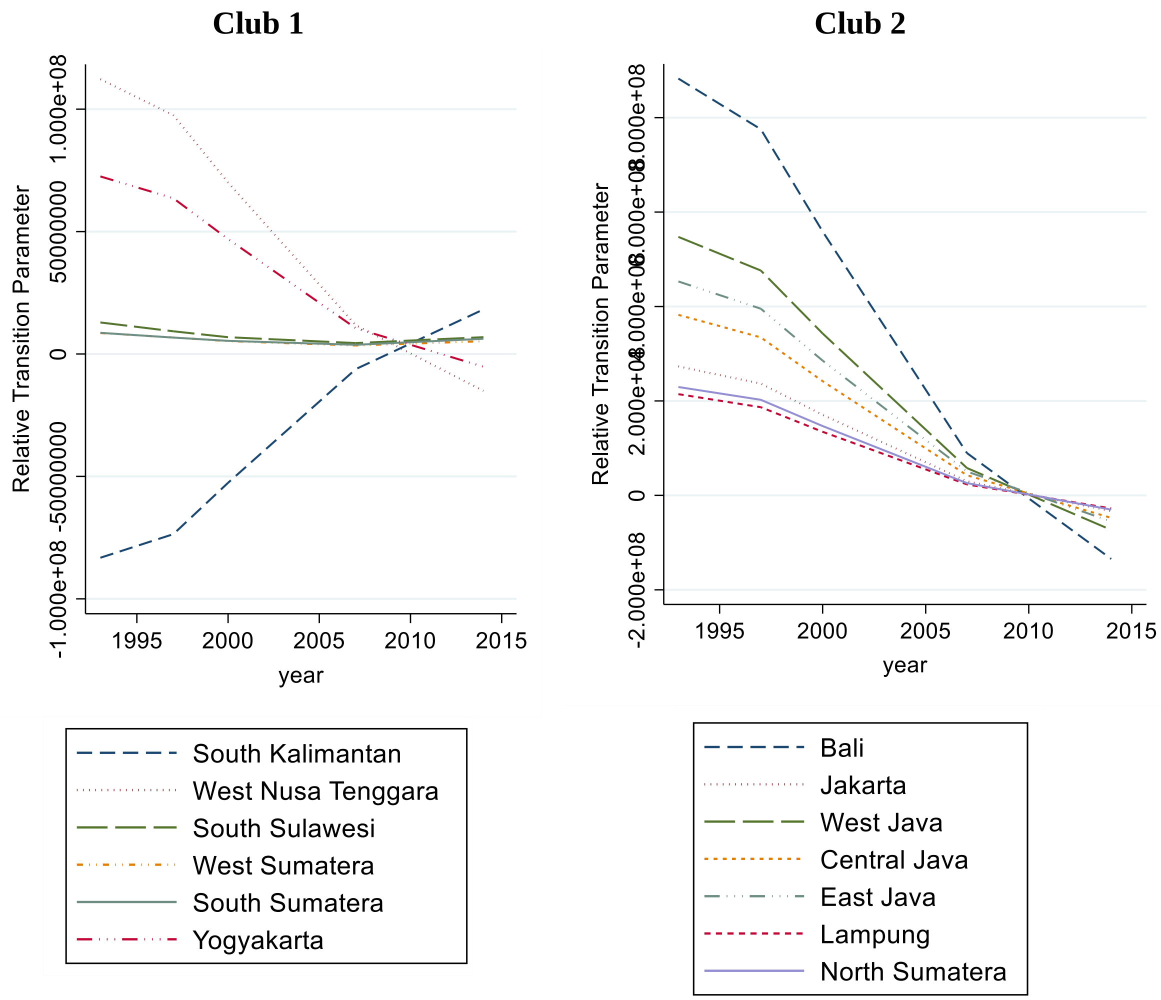
Table 4.12. *Results from the robust log-t Regression Test and Clustering Algorithm*

	Club 1	**Club 2**
Coeff.	-10.371	-3.538
t-stat	-1.996	-1.500
Members	South Kalimantan, West Nusa Tenggara, South Sulawesi, West Sumatera, South Sumatera, Yogyakarta	Bali, Jakarta, West Java, Central Java, East Java, Lampung, North Sumatera

Findings from the club merging provide more robust club convergence estimation that is indicated by the occurrence of two new clubs. The new Club 1, that consist of the same members that resulted before this reduction process, has t statistic of -1.996 that is less than critical value of -1.65. Therefore, the null hypothesis of convergence is rejected. While for the new Club 2 which is a new club formed from the merging of Club 2 and Club 3 in the previous stage, the t statistic is -1.500 that is slightly bigger than critical value which implies that we cannot reject the null hypothesis. Hence, there is weak evidence of convergence for this club.

Club 1 consists of provinces with low household net wealth growth relative to other provinces and consists of the same members that resulted before this reduction process, while Club 2 that consists of provinces with high household net wealth growth relative to other provinces is a new club from the merging of Club 2 and Club 3 in the previous stage. Therefore, this club contains all members in Clubs 2 and 3 from the previous stage.

__Figure 4.5__. The Relative Transition Curves after Club Merging



The new transition paths from individual provinces as a result of the club merging in the robust convergence estimation show the evolution paths for unchanged members of Club 1 and the newly formed Club 2 as seen in Figure 4.5. The comparison of the formation of the group of provinces and the newly formed clubs resulted from the robust estimation can be seen in Figures 4.6 and 4.7.

Figure 4.6. *Club Convergence*

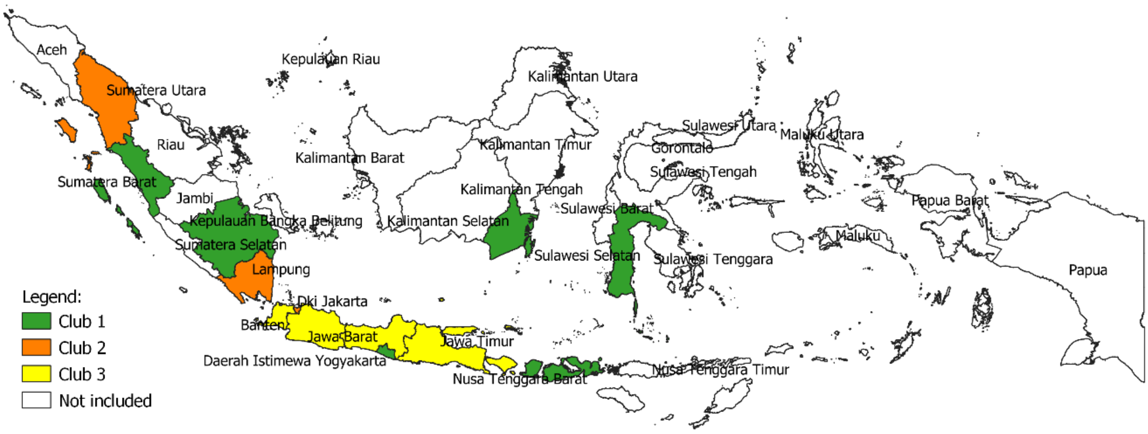
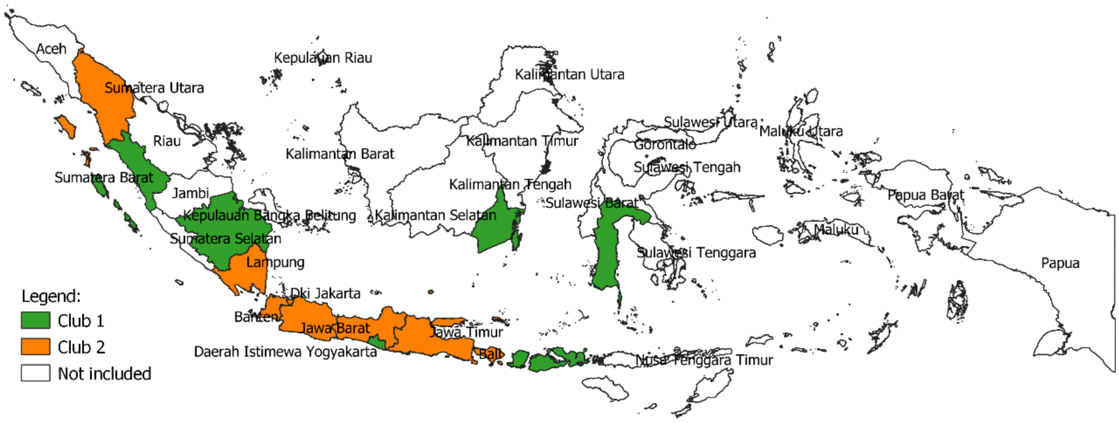


Figure 4.7. Club Convergence with robust log-t Regression Test



Figures 4.6 and 4.7 show provinces in Club 1 that comprise provinces with low household net wealth growth relative to other provinces that are mostly located outside Java Island. On the other hand, Club 2 consists of provinces with high household net wealth growth relative to other provinces, are mostly located in Java Island. The concentration of provinces with high growth of household net wealth in Java Island are caused by their role in the Indonesian economy where more than half of gross domestic product (GDP) is produced in Java Island, with Sumatera Island as the second biggest contributor with more than 20 percent of national GDP and the rest are distributed to other regions (Badan Pusat Statistik, 2020a). Similar findings are found by World Bank (2016a) that showed Java Island as the national economic growth centre drives infrastructure development, absorbs most investments, and widens the

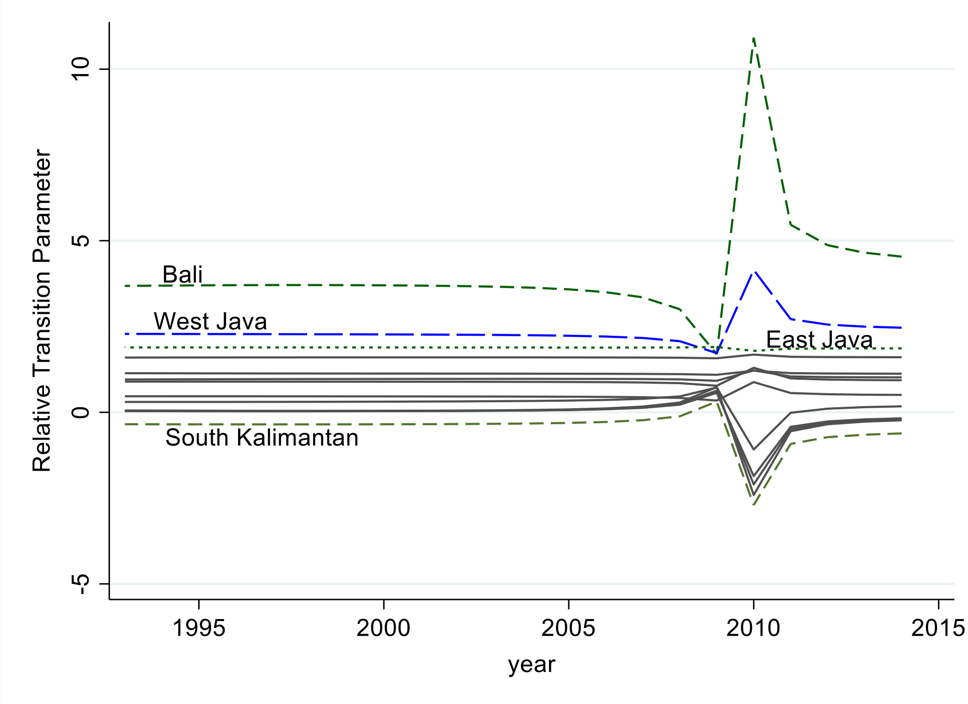
welfare gap with other areas. Other findings from Kurniawan et al. (2019) showed the clustering of provinces is mostly driven by regions that are rich in natural resources and the concentration of manufacturing sectors.

For Lampung and Bali, with their proximity to Java Island, enables them to gain economic spillovers, allowing its households to have a level of growth of net wealth similar level to that of Java Island. More specifically, with its vast land area, Lampung supplies agricultural products for industries in Jakarta and West Java. Bali, known for the tourism sector, uses its proximity with Java to gain benefits from tourism, labour movements, and commodities exchange. Lastly, North Sumatera, as the main economic growth hub for Sumatera, is able to achieve a similar level of net wealth growth as Java Island due to a strong economic sector that is dominated by agriculture, mining, and trade, and supported by its strategic location near global trade routes in Malaka Strait to provide a locational competitive advantage.

Yogyakarta is the only province in Java Island that is grouped into Club 1. Relatively low growth of household net wealth in this province might be influenced by typical characteristics among its residents, that is, strong collective sense, social relationship, and risk avoidance, that make them reluctant to make investments (Casmini & Sandiah, 2019). The existence of sultanates in Yogyakarta is considered as another contributor to providing well-being to the population by imposing very low rent for commercial and dwelling purposes on land areas owned by the sultanates. This uniqueness makes Yogyakarta considered a low performer in the economic measures but a high performer in non-economic measurements, for example, Yogyakarta has the lowest regional wage in Indonesia, (less than half that of Jakarta), has the highest Gini ratio in Indonesia but the second-highest human development index in Indonesia (after Jakarta) and the highest happiness index in Java Island (Badan Pusat Statistik, 2019a, 2020b, 2020c).

The clustering of provinces above also indicates the occurrence of the neighbourhood effect, where the higher economic growth in regions in Java Island is surrounded by provinces with lower economic growth. This suggests that provinces with high economic growth in Java Island create spillovers to surrounding areas (Vidyattama, 2013). Results found by Egger and Pfaffermayr (2006) show the neighbourhood effect can also produce a biased analysis of convergence, indicated from the speed of convergence that varies across regions. This is confirmed by the existence of two distinct groups of household net wealth growth in this paper. While the relative transition curve for all club members shows a convergence process during 1993-2007, followed by a divergence process during the next three years and convergence until the end of the observation period (Figure 4.8).

Figure 4.8. *The Relative Transition Curves All Clubs*



The convergence process during the first 15 years of observation is a result of the decentralisation process in Indonesia that allows regions to have greater control over their regions (Irawan, 2014; Kuncoro & Murbarani, 2016). The divergence process at the end of the 2000s shows the negative effect of the 2008 global financial crisis. This started with the housing bubble crisis in the United States of America that brought a rapid decrease in financial sectors, contraction in trade, and major falls in commodity prices in Indonesia, bringing a decline in net wealth growth in Indonesian provinces (Djaja, 2009; Nezky, 2013)

Findings from the analysis of the club convergence provide additional information on inequality between provinces from previous sections. The existence of the high and low performance provinces in terms of net wealth growth drives the need to focus the development on the low performance provinces, that are mostly located outside Java Island. Hence, more work is needed to be done to enable them to catch up with the condition of other provinces that are considered high performers. Some potential issues that should be anticipated to reduce inequality within and between regions are that the disparity of development between regions may lead to economic concentration and spillover effect. Another issue is related to institutional transformation to allow local government to have a higher capability to manage endowments factors in the regions.

4.5. Conclusions

The decreasing inequality in Indonesia during 1993-2014 is accompanied by the increasing inequality within provinces, which plays a dominant role in influencing total inequality comparing inequality between provinces. Using analysis distinguishing between Java Island and outside Java, inequality within provinces in Java Island is worsening; in contrast, inequality within provinces outside Java Island shows a declining trend over time. The development process after the decentralisation process that commenced in 2001 was able to reduce the gap between households within the province with the education variable as the biggest contributo, followed by household size and dependency ratio variables. Their ability to reduce inequality is dominant in rural areas in both Java and outside Java Island. While the estimation of club convergence shows the occurrence of convergence in household net wealth growth in Indonesia with two clubs are formed, that is, provinces with relatively high net wealth growth that mostly consist of provinces in Java Island and provinces with relatively low net wealth growth that mainly consist of provinces outside Java.

In the effort to reduce the gap in household net wealth, the increasing investment in the education aspect, especially in rural areas, is needed in the form of, for example, construction of new schools or increasing the quality of school infrastructure and educators. The assessment of the regional convergence of household net wealth in Indonesia for the two decades shows some promising trends in the increasing standard of living measured from the net wealth aspect but a challenging condition in the net wealth components. It has not, however, examined the crucial components in the household net wealth formation that affect the convergence process outside the sociodemographic aspect, for example, related to the labour market and global or macro-forces like technological change and international trade. Owing to the heterogeneity of wealth components, an observation for household wealth in the long period potentially underestimates the value of assets due to a lack of accuracy in the valuation. Hence, a more robust analysis can be achieved in future studies by considering sub-period analysis. It also provides opportunities for researchers to explain shocks due to global, national, or local events that potentially affect household net wealth.

Chapter 5. The Role of Household Characteristics and Intergenerational Transfer in Households Net Wealth in Indonesia: Evidence from a Quantile Regression Approach

Abstract

The heterogeneity in the household characteristics, for example, in demography and education, can vary across classes and make the estimation of the average value unsuitable for analysis as it can mislead the interpretation. This paper controls for such unobserved heterogeneity in the relationship with the efforts to increase household wealth by applying quantile regression using Indonesian household data. Empirical findings show the existence of the heterogeneity of household characteristics across classes that can influence household wealth. Some variables that show an increasing pattern with a higher return for higher classes are education and households living in urban areas while other variables show a decreasing return, for example, household size and married household head. This paper suggests the importance of policy interventions in influencing household wealth should consider the characteristics of classes as these can create different effects and magnitude across classes.

Keywords: Indonesia, Unobserved Heterogeneity, Quantile Regression, Household Wealth
JEL Classifications: C33, I31, J12, J13

5.1. Introduction

Indonesia's diversity, which can be shown in the form of more than 300 ethnic groups who live in the archipelagic condition that consists of more than 17,000 islands, can bring heterogeneity in the socioeconomic aspects across classes, for example, in human capital and household characteristics (Behrman & Deolalikar, 1993; Grootaert, 1999). Since the heterogeneity makes a considerable contribution to the economy, the policy-making process should not omit the heterogeneity of variables and have the analysis rely on the average values only as, potentially, this could bring misinterpretation of the results (Bazzi, 2013; Grootaert, 1999; Okten & Osili, 2004). One example of the potential misinterpretation of results was found by Patrinos, Ridao-Cano, and Sakellariou (2006) when the estimation of return schooling in Indonesia showed a positive relationship with the earnings, estimated from linear regression model which capture average values, but show a decreasing pattern across quantiles with higher return found at the bottom of the distribution if observed from quantile regression. This condition implies the average estimation may not be useful for the policy as significant variation in returns of education across classes reflects differences in an individual's ability to utilise skills obtained from education so that investment in education can generate more inequality (Patrinos et al., 2006).

Considering the importance of unobservable effects in the estimation to support the increase of household standard of living that can potentially lead to misinterpretation of results of analysis, estimation of quantile regression that can capture the unobserved heterogeneity across classes is needed to illustrate the pattern of relationship between household wealth as the dependent variable and the covariates. Some studies found the household wealth can be caused by the variation in age, ethnicities, and job type (Conley & Galenson, 1994), family structure and human capital (Bernardi, Boertien, & Geven, 2019) and intergenerational transfers (Korom, 2017). Further, Patrinos et al. (2006) explained when the interactions of the household wealth and the covariates show the increasing return as it moves from the lower to the higher end of the distribution, this suggests that the creation of household wealth largely benefits the richest population. In contrast, a negative relationship between household wealth and the covariates with a decreasing effect for the upper classes may be interpreted as the poorest households enjoying a greater proportion of benefits than the richer households. Finally, if there is no distinct pattern, the estimation from the average value, shows the overall effect is considered sufficient to explain the relationship between household wealth and the covariates. From the explanation above, the questions are is empirical: which patterns are shown in the relationship between household wealth and household characteristics among Indonesian households? Are there variations across groups?

The aim of this study is to investigate the pattern of the relationship between household wealth and household characteristics among Indonesian households, where the variation across classes is taken into consideration. This chapter contributes to the existing body of knowledge of the investigation of the determinants of household wealth within a developing country. Indonesia is taken as a context as it has a large diversity that potentially drives to heterogeneity in the demography and socioeconomic aspects that can influence household wealth, for example, in the variables of education (Filmer, Pritchett, Filmer, & Pritchett, 1998; Hartog & Oosterbeek, 1998); household size (Hao, 1996; Keister, 2004); marital status and gender of household head (Lyons & Fisher, 2006; Yamokoski & Keister, 2006; Zagorsky, 2005); and intergenerational transfers (Frankenberg, Lillard, & Willis, 2002; Kreager & Schroder-Butterfill, 2008). This chapter further contributes to supporting the policy-making process to support the effective policies, for example, if the relationship between household wealth and a certain household characteristic shows a pattern where higher benefits are enjoyed by households at the top of the distribution than at the bottom of the distribution, then certain interventions are needed to increase the household wealth focusing on households at the bottom of distribution so as to avoid an increase of inequality due to the poorest households being largely neglected.

The rest of this chapter is structured as follows. Section 2 presents a literature review for the potential determinants of household net wealth and an explanation of the need to observe the heterogeneity across classes in the variables. Section 3 describes the methodology and data. Section 4 presents the result of estimation, robustness check, and the policy implications. Section 5 presents the conclusion and recommendations for future studies.

5.2. Unobserved Heterogeneity Across Classes in the Household Wealth Measurement

This section discusses the causes and the implications of the unobserved heterogeneity across classess in the measurement of household wealth as a method of estimating the household standard of living. Benton and Keister (2017) explained that household wealth can be influenced by human capital and family formation. On one hand, human capital, indicated by educational attainment, can affect household wealth as it allows households to earn higher income and obtain higher financial literacy (Behrman et al., 2012; Benton & Keister, 2017; Lusardi, Mitchell, & Curtis, 2010). On the other hand, family formation influences wealth through different levels of expenditure that must be faced by households due to differences in household size, number of dependents, and marital status (Benton & Keister, 2017; Filmer et al., 1998; Lusardi et al., 2010).

Related to the marital status, marriage is considered as a contributor to household wealth as marriage allows the two persons, male and female, to be better off (that is to increase their utility) that depends not only on the goods and services purchased in the market place but on the commodities produced by each household (Becker, 1973). This condition implies the reduction of costs per person as household members can obtain non-marketable or nontransferable commodities from other members in the same household (Becker, 1973; Zagorsky, 2005).

Another additional factor that affects household wealth is intergenerational transfers, which can be in two forms: *inter-vivos* transfer (transfer between living people) and a bequest (a transfer that occurs at the death of the donor) (Frankenberg et al., 2002; Gale & Scholz, 1994; Kreager & Schroder-Butterfill, 2008) Particular focus is in the *inter-vivos* transfer, which can be in form of monetary and non-monetary measures (Frankenberg et al., 2002) as they are motivated by the traditional pattern or ethnicity and a perceived norm where the transfer is not strongly related to parental need or the ability of the child to give and financial matters, for example, transfers as a source of insurance, the exchange of money of time, and repayments to parents for educational loans (Frankenberg & Kuhn, 2004; Kreager & Schroder-Butterfill, 2008; Mason & Lee, 2018).

In Indonesia, one example of monetary *inter-vivos* transfer is when parents send money to their children during financial hardship, e.g., after job loss, disaster, moving to a new place. The non-monetary *inter-vivos* transfers can be in form of days dedicated by parents to look after their children's family as a temporary helper for the family (e.g., after sickness or in *postpartum* period) or to babysit their grandchildren. It is expected that parents who look after their children's family will help relieve pressure to find professional help and to reduce financial pressure for the family, hence will allow them to save expenses and increase their wealth level.

Since the changes of the aspects above can be different for each household class, estimation of the average value can hide the heterogeneity and create misinterpretations of the effect. For example, in Indonesia, the heterogeneity in household classes who enjoy the benefits of the *Keluarga Berencana* (family planning) programme occurred. Jensen et al. (1994) observed that the programme is largely accepted by the middle and upper classes due to higher awareness and knowledge exposure of the programme, therefore gives them higher benefits but largely neglects the poorest households. Other studies investigating the heterogeneity of household characteristics across classes in the relationship with the household wealth among the Indonesian population find the occurrence of the variations in classes in the variables of human capital (Behrman & Deolalikar, 1993; Widyanti, 2018); intergenerational transfers (Frankenberg et al., 2002; Kreager & Schroder-Butterfill, 2008); and migration (Bazzi, 2017).

To capture the unobserved heterogeneity of variables across classes, the quantile regression techniques can be used, especially to help in obtaining a more complete picture of the underlying relationship, robust to outliers, and can describe the entire conditional distribution (Abrevaya & Dahl, 2008; Coad & Rao, 2011; Koenker & Bassett Jr, 1978). The quantile regression overcomes limitations by the ordinary least square, as since this method provides an average term, it provides an incomplete picture for a set of distributions and hides the underlying relationship between the independent and dependent variable (Abrevaya & Dahl, 2008).

The quantile regression model, first introduced in the seminal contribution by Koenker and Bassett Jr (1978) can be written as:

$$y_{it} = x'_{it}\beta_\theta + u_{\theta it} \text{ with } Quant_\theta(y_{it}|x_{it}) = x'_{it}\beta_\theta \qquad (1)$$

where y_{it} is the dependent variable, x is a vector of regressors, β is the vector of parameters to be estimated, u is a vector of residuals. $Q_\theta(y_{it}|x_{it})$ identifies the θ^{th} conditional quantile of y_{it} given x_{it}.

The quantile regression can be divided into conditional quantile regression (CQR) and unconditional quantile regression (UQR). In both approaches, the coefficient on the independent variable of interest can be interpreted as the association between the independent and dependent variables, net of spurious association due to their joint association with the control variables. While the key difference is that the CQR controls variables essentially redefine each quantile, while the UQR models can be used to estimate varying associations between predictors and outcomes at different points of the outcome distribution (Chamberlain, 1994; Korom, 2017).

The different approaches used by CQR and UQR, and therefore different estimates, can be shown in the following example. Killewald and Bearak (2014) used the UQR method to test whether the decision of Budig and Hodges (2010) that used CQR is suitable to discover the answer to whether it is true that the motherhood penalty is larger for low-wage women. Both studies use the same dataset, obtained from 1979 to 2004 waves of the National Longitudinal Survey of Youth. By using CQR, Budig and Hodges (2010) showed the control variables have the additional effect of redefining quantiles therefore the motherhood penalty at the 75th percentile estimates the motherhood penalty for women at the 75th percentile of the wage distribution for women who are otherwise identical on all covariates. By contrast, by using UQR, Killewald and Bearak (2014) defined quantiles with reference to the unconditional wage distribution, therefore the motherhood penalty at the 75th percentile indicates the association between motherhood and wages at the 75th percentile of the unconditional wage distribution, with the association adjusted for confounding effects as measured by the control variables. The results of CQR and UQR show the contrary findings. In the UQR, the motherhood penalty does not decrease monotonically from the bottom to the top of the unconditional wage distribution as in CQR, rather, the UQR provides a pattern of women with high wages and low wages tend to pay smaller motherhood penalties than do women close to the median of the wage distribution.

Since these examples provide different results of estimates of UQR and CQR, the model selection of either CQR or UQR largely depends on the research questions. Some applications of using CQR and UQR to explain the relationship between dependent and independent variables across classes can be explained below. Chamberlain (1994) used CQR to analyse the association between union membership and wages. Using data from the 1987 Current Population Survey (CPS), estimates show among more experienced workers, that the union wage effect declines sharply from low to high quantiles. It indicates union membership is more beneficial for individuals at lower conditional quantiles than for those at higher conditional quantiles, indicating that union membership compresses wages among individuals with similar observed wage-relevant characteristics.

D’Ambrosio, Jäntti, and Lepinteur (2020) examine the application of CQR in explaining heterogeneity in terms of household class. Using data from the German Socio-Economic Panel for 2002-2012 surveys, D’Ambrosio et al. (2020) estimated the relationship between money and happiness by using linear regression model and compare the results with the CQR. Using linear regression model, estimates showed permanent income (that defined as mean per-capita-adjusted disposable household income over 5 years) and permanent wealth (defined as mean per-capita-adjusted household wealth over 5 years) have similar (although different sized) effects on life satisfaction, but that transitory income and wealth do not. In contrast, estimation of CQR showed, that permanent income and permanent wealth are better predictors of life satisfaction than current income (the sum of permanent income and transitory shocks) and current wealth (the sum of permanent wealth and transitory shocks) with a higher impact found in the household classes with a lower level of life satisfaction.

Another application of CQR is Binder and Coad (2015) who investigated to what extent the negative impact of unemployment varies along with the conditional subjective well-being distribution. Using data from British Household Panel Survey data (1996–2008), they found an estimate of the standard panel model showed unemployment has a stronger effect on mental well-being than on life satisfaction. On the other hand, the estimate of CQR showed the heterogeneity across classes, for example, lower decile has the strongest effect of becoming unemployed and the highest decile groups have a weaker association between unemployment and well-being.

On the other hand, some applications of the UQR are shown in the studies below. Korom (2017) estimates the role of gifts and bequests to household wealth. By using data from 11 European countries, the estimate of UQR showed households that receive gifts and bequests own considerably more wealth than non-receiving households, all other things being equal. Further analysis finds evidence that the impact of wealth transfers on household wealth follows an inverted U-shaped pattern: gifts and bequests contribute the most to the stock of private wealth in the broad mid-section and less so at the lower and upper ends of the distribution. Another example of the UQR is Firpo, Fortin, and Lemieux (2009) who used data from the Current Population Survey (CPS) and found the association between unionisation and wages rises over about the first one-third of the wage distribution, then declines and is negative for workers in the top wage quintile.

5.3. Method and Data

We used quantile regression to estimate the household net wealth determinants in Indonesia as it can capture the unobserved interaction between classes that cannot be analysed by using the linear regression model. More specifically, we used conditional quantile regression (CQR) for the analysis since this research investigated to what extent the impact of the household characteristics varies with the (conditional) household net wealth distribution [14].

The variations in the household characteristics might be influenced by the existence of the intra-cluster correlation, where the clusters can be defined, for example, by regions or islands. In the estimation with data sampled from the number of groups or clusters, it is assumed that observations from different groups are conditionally independent, but the intra-cluster correlation is not ruled out. We used the intra-cluster correlation test following Parente and Santos Silva (2016) to detect the occurrence of intra-cluster correlation with the null hypothesis that there is no intra-cluster correlation. For the robustness check, we compared the results of estimation above with the estimate of whether the time fixed effects (year) influence the increase of household net wealth by using quantile regression for panel data with non-additive fixed effects by using Powell (2016) estimator[15].

This paper uses data from the Indonesian Family Life Survey (IFLS), a longitudinal survey used to capture households' socioeconomic and health conditions in Indonesia and is representative of about 83 percent of the population living in 13 out of 34 provinces in Indonesia[16]. We used data from five waves of IFLS, with the first wave of IFLS (IFLS1) that was conducted in 1993 and collected information from 7,224 households. The IFLS2 and IFLS3 fielded in 1997 and 2000 interviewed 7,698 and 10,574 households, respectively. The IFLS4 conducted in 2007 interviewed 13,995 households. The IFLS5 fielded in 2014 collected information of 16,931 households. We restricted attention to original households in 1993's survey that continuously participated in the next surveys. This gives a sample of 5,707 households.

We used household net wealth as the dependent variable, which was obtained from total wealth deducted by debts. Total wealth was calculated from components of farm business, non-farm business, and household assets (house, land, vehicle, savings, and furniture). We adjusted

[14] In Stata, the quantile regression with the bootstrapped standard error using the Koenker (2005) estimator of `bsqreg` and quantile regression with clustered standard errors using Machado, Parente, and Santos-Silva (2011) estimator of `qreg2`

[15] In Stata, the Powell (2016) estimator is `qregpd`

[16]The two sister surveys of IFLS are the IFLS2+ administered in 1998 to measure direct impact of the Asian financial crisis and collect information from around 25% of IFLS1 and IFLS East conducted in 2012 to collect information on 2,500 households living in 7 provinces in eastern Indonesia.

the household net wealth using an equivalence scale, so each household member was considered to have a certain share of household wealth, by dividing household net wealth by the square root of the number of household members[17]. In order to make it comparable over time, household net wealth was then adjusted with a GDP deflator from World Bank (2018a) to obtain real value.

Since the household net wealth can have negative values, due to total wealth being lower than debts, data transformation used cube root as this method as it provides a fairly strong transformation with a substantial effect on distribution shape, weaker than the logarithm, but still handling zero and negative values very well (Cox, 2011). Data transformation for other variables that contain non-negative values used the natural logarithm.

[17] When the economies of scale are taken into account, each member is assigned per capita household wealth and everything is split amongst them (W/S^{ε}). The notation of S^{ε} refers the economies of scale, S=size, and ε=the economies of scale parameter with the value between 0 and 1. There is no consensus for determining the economies of scale, although ε=0.5 is widely used (Atkinson et al., 1995; Clementi et al., 2012; OECD, 2020; Sierminska & Smeeding, 2005; Stats NZ, 2019).

Table 5.1. *Variable Description*

Variable	1993		1997		2000		2007		2014	
	Mean	**Std.Dev**	**Mean**	**Std.Dev**	**Mean**	**Std.Dev**	**Mean**	**Std.Dev**	**Mean**	**Std.Dev**
Netwealth (Rp. million) (Constant 2010)	40.000	143.000	89.400	362.000	73.000	159.000	74.700	150.000	86.400	123.000
HH size	4.118	1.784	4.118	1.784	4.442	1.820	4.641	1.902	4.502	1.892
HH head age	46.726	16.187	46.570	15.877	46.163	16.001	46.685	15.946	46.567	15.914
HH head years of schooling	6.428	4.147	6.286	4.237	5.456	3.854	5.739	4.501	6.818	3.823
Dependency ratio	0.879	0.754	0.805	0.692	0.735	0.665	0.613	0.580	0.574	0.530
Intergenerational transfers (days)	3.299	40.552	8.257	62.430	8.142	47.044	20.619	101.501	17.897	82.906
Intergenerational transfers (money) (Rp. million) (Constant 2010)	0.619	9.581	0.605	3.134	2.366	8.722	1.738	5.859	2.321	9.294
	Freq.	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
HH is in urban	2,516	44.09	2,414	42.3	2,428	42.54	2,711	47.5	3,501	61.35
HH head is married	4,932	86.42	4,681	82.02	4,443	77.85	3,764	65.95	3,023	52.97
HH head is male	4,925	86.3	4,920	86.21	4,810	84.28	3,608	63.22	4,447	77.92
HH head is migrated	2,738	47.98	2,691	47.15	2,778	48.68	2,718	47.63	2,699	47.29
HH head employment in agriculture	2,209	38.71	1,798	31.51	1,932	33.85	2,028	35.54	2,028	35.54

Table 5.1 shows the increasing trend of the average household net wealth in Indonesia with a significant jump in 1993-1997. This condition reflects the increase of the standard of living during the New Order era, shown from high economic growth from 6.496 percent in 1993 to 7.818 percent in 1996 (Badan Pusat Statistik, 2020a) then followed by the period of recovery after the 1997/1998 Asian Financial Crisis. Table 5.1 also shows the independent variables in the form of household characteristics that potentially influence household net wealth. A particular focus is on the household demographic conditions and human capital as well as intergenerational transfer aspects. While most variables are easily explained, the variable of dependency ratio is defined as the ratio of non-productive-age household members (0-15 & more than 64 years old) for each productive-age household member (15-64 years). This measurement is taken to distinguish the impact of the increase of the household size due to additional non-productive household members per productive household member that cannot be captured by the variable of household size, which is defined as the number of persons living under one roof. Further, labour is assumed to be mobile throughout Indonesia, as shown from the IFLS dataset (more specifically in questionnaire in Book 3A) that captures migration history (e.g., current location that is different than birthplace, current location is different than in the previous 6 months), with various reasons, e,g., education, work-related, family reasons. In this research, household head is migrated for reasons mentioned above is used to show the influence of migration to household net wealth in Indonesia.

5.4. Results

5.4.1. Regression Results

The initial attempt to identify the determinants of household net wealth in Indonesia was by using the standard panel model and showing the two approaches can be achieved, either by using fixed effect and random effect. To select the best model, the Hausman test was used, with the null hypothesis as the preferred model as random effects and the alternate hypothesis is the preferred model as fixed effects. Results of the Hausman tests show that the p-value is small (0.011 which is smaller than 0.05), thus H0 is rejected. The fixed effect is more appropriate for the analysis (see Table 5.2).

Findings from the standard panel model with fixed effect show three variables that significantly influence household net wealth: household size, intergenerational money transfers, and households located in urban areas. Looking at the sign of coefficients among those variables, the increase of household net wealth is caused by the reduction in household size, higher intergenerational money transfers, and the household living in the urban area. However, since the findings from the standard panel model above provide estimation from the average value, they are unable to provide comprehensive estimation regarding the effect of the variables on different classes.

Table 5.2. *The Determinants of Household Net Wealth*

Variable	FE	RE
Ln HH size	-46.768**	-35.747***
	(20.357)	(8.268)
Ln HH head age	12.690	2.448
	(20.181)	(9.851)
Ln HH head years of schooling	12.585	70.722***
	(23.185)	(11.002)
Ln Dependency ratio	2.711	-26.282***
	(8.946)	(4.7)
Ln Intergenerational transfers (days)	-2.845	-2.524
	(3.233)	(1.81)
Ln Intergenerational transfers (money)	8.181**	9.027***
	(3.439)	(1.986)
HH is in urban	44.854***	35.510***
	(16.653)	(7.449)
HH head is married	-13.313	4.624
	(21.558)	(8.133)
HH head is male	-3.195	15.946*
	(15.001)	(8.728)
HH head is migrated	0.157	-6.153
	(12.204)	(6.59)
HH head employment in agriculture	26.929	-16.539
	(31.891)	(7.992)
Constant	225.872**	99.312*
	(104.98)	(52.867)

Note: *p<0.1, **p<0.05, ***p<0.01.

Table 5.3 shows findings from the quantile regression with the bootstrapped standard error and show the heterogeneity of explanatory variables across quantiles, either in the sign or in the degree of the coefficients. Table 5.3 also shows that the variable of the household head being married has a positive effect in the lower and middle classes but a negative effect in the upper class. The positive effect of marriage in the low and middle classes might be related to the theory of preferences where marriage reflects individuals' expectation to raise their utility level above what it would be were they to remain single (Becker, 1973). In contrast, the negative effect of variable of the household head being married in the upper class might be correlated with the importance of career and income-earning activities, hence making any disruptions due to family matters negatively affecting household wealth (Heaton, Cammack, & Young, 2001) (Table 5.3).

Table 5.3. *Quantile Regression with Bootstrapped Standard Error*

Quantile	Ln HH size	Ln HH head age	Ln HH head years of schooling	Ln Dependency ratio	Ln Interge-nerational transfers (days)	Ln Interge-nerational transfers (money)	HH is in urban	HH head is married	HH head is male	HH head is migrated	HH head employment in agriculture	Constant
10	-13.649	6.825	30.952**	-11.934*	0.125	8.971***	5.551	37.664***	14.133	-4.384	-1.268	-60.224
	(10.041)	(13.89)	(12.19)	(6.632)	(2.522)	(3.302)	(11.397)	(13.883)	(16.334)	(7.535)	(12.313)	(51.832)
20	-7.08	6.093	46.113***	-15.215***	-0.619	8.954***	17.276***	15.129	0.334	-1.418	-5.842	-24.375
	(10.093)	(11.677)	(10.436)	(4.122)	(2.81)	(2.273)	(6.426)	(10.809)	(9.98)	(7.668)	(6.952)	(61.334)
30	-16.64**	-1.186	76.302***	-17.677***	-1.799	8.073***	24.42***	9.865	11.348	2.647	-2.119	1.358
	(7.27)	(10.787)	(15.35)	(5.897)	(1.47)	(1.398)	(8.252)	(11.625)	(9.64)	(6.841)	(9.86)	(38.636)
40	-21.033**	0.675	82.67***	-17.817***	-2.707	9.124***	24.058***	10.173	10.775	0.631	-5.5	6.898
	(9.214)	(10.604)	(9.81)	(5.831)	(1.778)	(1.833)	(6.308)	(6.327)	(8.323)	(5.622)	(5.634)	(59.307)
50	-43.849***	-3.495	89.221***	-24.426***	-2.424	11.39***	32.12***	-0.765	19.943*	-1.5	-9.167	42.74
	(9.083)	(8.673)	(13.428)	(5.661)	(1.905)	(1.963)	(9.181)	(8.696)	(10.368)	(6.005)	(7.371)	(36.549)
60	-49.686***	7.939	106.994***	-26.29***	-3.038	12.345***	29.462***	-10.968	18.159*	-1.372	-15.531**	7.3
	(12.984)	(11.408)	(10.796)	(4.871)	(2.103)	(2.084)	(7.98)	(11.941)	(10.38)	(7.042)	(7.721)	(61.75)
70	-58.156***	-0.969	99.74***	-27.769***	-2.5	10.697***	35.561***	-14.611	18.017	-1.005	-21.295***	137.88**
	(11.456)	(11.901)	(14.108)	(4.82)	(1.897)	(3.272)	(10.766)	(12.905)	(11.814)	(7.998)	(6.857)	(62.716)
80	-45.07***	-12.847	117.338***	-32.68***	-4.208	11.023***	34.787***	-18.333	15.981	-1.171	-36.237***	188.818***
	(14.613)	(12.321)	(18.959)	(9.174)	(3.089)	(2.588)	(13.231)	(11.791)	(11.504)	(11.455)	(10.765)	(69.595)
90	-72.718***	-17.737	124.808***	-45.067***	-5.113	6.148	53.207***	-7.594	30.658	1.688	-44.208***	360.425***
	(15.328)	(22.347)	(31.272)	(11.112)	(3.788)	(3.977)	(19.714)	(19.37)	(23.542)	(10.418)	(16.551)	(129.512)

Note: *$p<0.1$, **$p<0.05$, ***$p<0.01$

Results from the quantile regression show that the different magnitude of the effect from the change of variables can be felt across classes. For example, the variable of years of schooling has a positive and significant coefficient across quantiles, with increasing coefficients for higher quantiles. This suggests the higher return on education is enjoyed by the upper rather than the lower classes due to the capability for higher classes to find jobs with higher earnings, have a wider network, and wider access to upgrade skills and technology. These cannot easily be accessed by the lower-class households.

The variations in the variables above might be influenced by the existence of the intra-cluster correlation, where the clusters can be defined, for example, by regions or islands. We used the procedure by Parente and Santos Silva (2016) to test for intra-cluster correlation. The null hypothesis is that there is no intra-cluster correlation. Table 5.4 shows for each percentile except for percentile 50 the probability is higher than 0.05, hence, the Parente and Santos Silva (2016) test rejects the null hypothesis of no intra-cluster correlation. Therefore, there is an intra-cluster correlation.

Table 5.4. *Parente-Santos Silva test for intra-cluster correlation*

Quantile	**T**	**P>|T|**
10	1.381	0.167
20	0.708	0.479
30	0.160	0.873
40	1.096	0.273
50	3.231	0.001
60	0.550	0.582
70	0.880	0.379
80	1.524	0.127
90	0.118	0.906

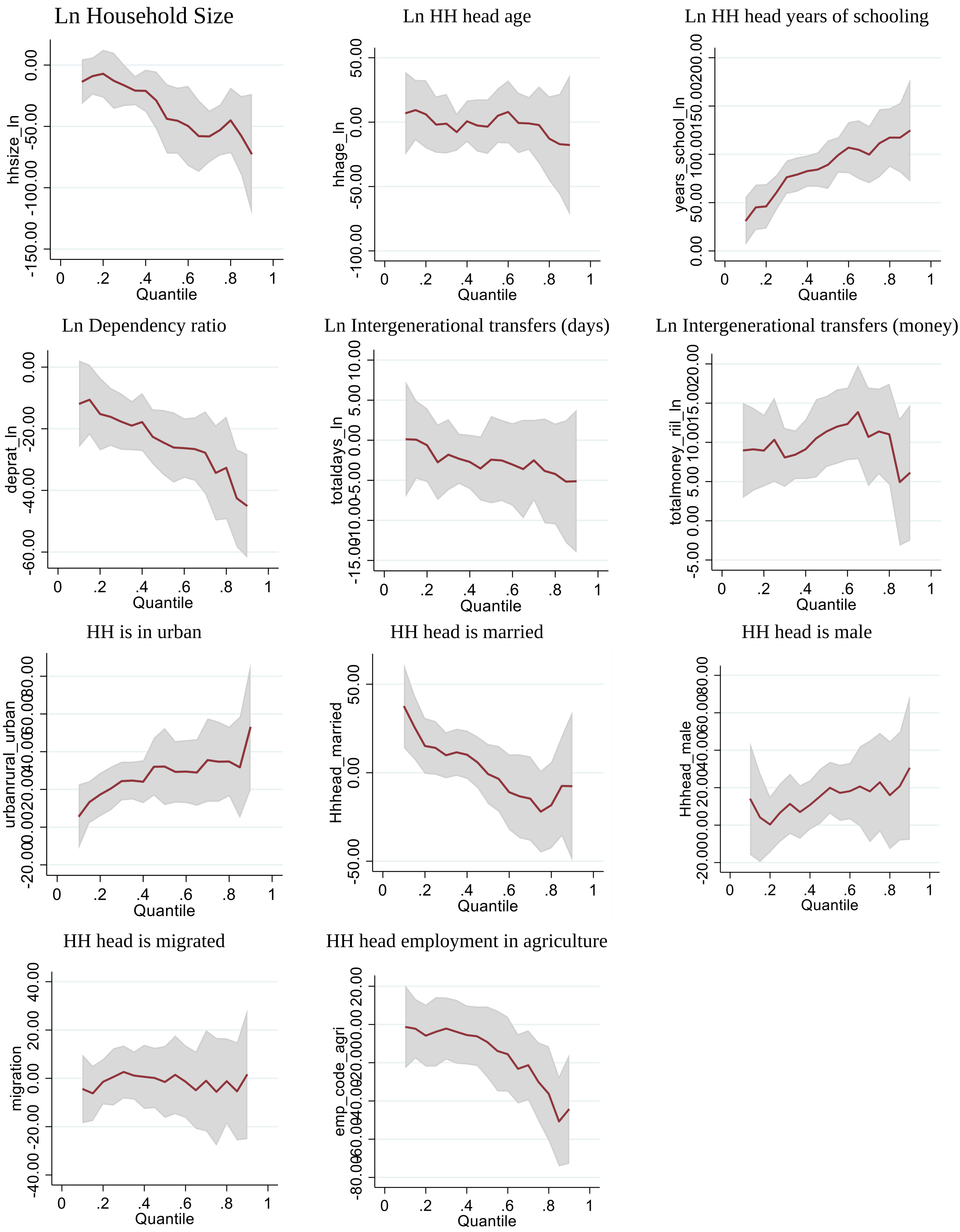
As the findings in Table 5.4 suggest the occurrence of intra-cluster correlation in most percentiles, the consistency of the quantile estimator with the bootstrapped standard error above was questioned and required re-estimation of the data by using quantile regression with clustered standard errors (Table 5.5). Table 5.5 presents results from quantile regression with clustered standard errors and robust intra-cluster correlation. The pattern of the variables in Table 5.5 can be shown in graphical form in Figure 5.1 with the grey shadow depict 95 percent confidence intervals.

Table 5.5. *Quantile Regression with Robust and Clustered Standard Error*

Quantile	Ln HH size	Ln HH head age	Ln HH head years of schooling	Ln Dependency ratio	Ln Interge-nerational transfers (days)	Ln Interge-nerational transfers (money)	HH is in urban	HH head is married	HH head is male	HH head is migrated	HH head employment in agriculture	Constant
10	-13.649	6.825	30.952**	-11.934***	0.125	8.971**	5.551	37.664***	14.133	-4.384	-1.268	-60.224
	(12.082)	(6.715)	(15.755)	(3.659)	(2.583)	(4.229)	(9.743)	(14.122)	(8.577)	(4.783)	(10.42)	(82.716)
20	-7.08	6.093	46.113***	-15.215***	-0.619	8.954***	17.276*	15.129	0.334	-1.418	-5.842	-24.375
	(9.381)	(5.931)	(16.952)	(3.463)	(2.109)	(2.079)	(10.071)	(10.872)	(7.385)	(3.818)	(7.247)	(79.89)
30	-16.64**	-1.186	76.302***	-17.677***	-1.799	8.073***	24.42***	9.865	11.348**	2.647	-2.119	1.358
	(7.936)	(3.314)	(26.664)	(1.671)	(1.371)	(2.289)	(8.653)	(12.993)	(4.747)	(2.398)	(6.209)	(65.297)
40	-21.033***	0.675	82.67***	-17.817***	-2.707*	9.124***	24.058**	10.173	10.775***	0.631	-5.5**	6.898
	(5.305)	(8.291)	(19.848)	(3.746)	(1.604)	(2.392)	(10.858)	(12.16)	(3.678)	(2.863)	(2.602)	(41.834)
50	-43.849***	-3.495	89.221***	-24.426***	-2.424	11.39***	32.12**	-0.765	19.943***	-1.5	-9.167***	42.74
	(6.721)	(11.801)	(20.607)	(3.559)	(1.269)	(1.952)	(13.856)	(10.047)	(4.329)	(3.128)	(2.883)	(30.53)
60	-49.686***	7.939	106.994***	-26.29***	-3.038***	12.345***	29.462***	-10.968	18.159***	-1.372	-15.531***	7.3
	(6.708)	(24.97)	(20.285)	(3.388)	(0.977)	(1.522)	(11.015)	(10.085)	(6.062)	(3.899)	(4.73)	(39.733)
70	-58.156***	-0.969	99.74***	-27.769***	-2.5	10.697	35.561	-14.611	18.017	-1.005	-21.295	137.88
	(9.298)	(17.082)	(12.095)	(4.736)	(0.975)	(2.545)	(9.317)	(9.641)	(5.76)	(5.379)	(6.16)	(37.815)
80	-45.07***	-12.847	117.338***	-32.68***	-4.208**	11.023***	34.787**	-18.333**	15.981	-1.171	-36.237***	188.818***
	(7.255)	(20.147)	(15.718)	(7.873)	(1.746)	(3.772)	(15.689)	(7.199)	(10.119)	(6.18)	(12.535)	(26.607)
90	-72.718***	-17.737	124.808***	-45.067***	-5.113*	6.148	53.207***	-7.594	30.658**	1.688	-44.208***	360.425***
	(6.889)	(17.494)	(24.116)	(8.992)	(2.705)	(4.231)	(18.696)	(11.817)	(13.407)	(21.041)	(10.522)	(66.007)

Note: *p<0.1, **p<0.05, ***p<0.01

Figure 5.1*. Quantile Regression for Household Net Wealth Determinants.*



Note: Estimated using Azevedo (2011) module

Comparison between quantile estimation in Table 5.5 and estimates from linear regression model that ignore the heterogeneity across classes in Table 5.2 show some variables have variations of effects across quantiles that cannot be captured by estimation of linear regression model. In the demography aspect, the variables of household size, dependency ratio, and married household head have decreasing patterns with a lower effect found in the higher quantiles which means households in higher quantiles benefits more from changes of variables than households in lower quantiles. Interestingly, if the unobserved heterogeneity across classes is considered, the variable of household size makes no significant effect on the quantiles 10 and 20, indicating the existence of the perception among the poorest households that more children are the way to exit from poverty, for example, through looking after their siblings or older generations, contributing financially to the family (Judiasih, Susilowati Suparto, & Yuanitasari, 2018; Unicef, 2020).

This reason might also relate to the variable of the married household head when estimated, as heterogeneity shows a positive effect of marriage in the quantiles 10-40 but negative coefficients in the quantiles 50-90. This contrasting condition might be caused by the perception of child marriage among some of the poor households as a feasible way to solve poverty as they can reduce costs associated with raising children (Rumble, Peterman, Irdiana, Triyana, & Minnick, 2018; Unicef, 2020).

Another important finding in the demography aspect is the variable dependency ratio that has a decreasing and significant effect with a higher effect in higher deciles. This might be related to two kinds of expenditures that must be faced by households in relationship with an increasing number of non-productive household members (age 0-14 and more than 65): education, where a higher proportion of expenditure is spent on education in higher than lower classes (Akita & Miyata, 2008; Kadir & Sukma, 2019; Widyanti, 2018); and health where people in the lower classes are less likely to seek treatment (inpatient and outpatient) and when the elderly poor seek the treatment, they do so at lower cost facilities, such as public hospitals and community health centre (*puskesmas*), while most of the better-off elderly prefer to receive treatment from private healthcare professionals (Priebe & Howell, 2014).

In the education aspect, the variable of years of schooling has a positive and significant contribution to household net wealth with a higher effect in higher quantiles. This condition might be caused by the variation in the rate of return to education in different quantiles that brings wage dispersion within the same education level (Widyanti, 2018). This heterogeneity might be related to the gender pay gap which is wider in the lower classes than in middle and upper classes, meaning women workers in low classes earn less than their counterparts in higher classes even though they have the same education level (Taniguchi & Tuwo, 2014; UN Women Indonesia, 2020). Kadir and Sukma (2019) found for each gender group in Indonesia, the presence of both the between-groups wages inequality associated with the difference in educational levels among individuals and the within-groups wages inequality was caused by the difference in ability among individuals in the same level of education

In the intergenerational transfers aspect, more days dedicated by parents to look after their children' families give a positive (and not significant) effect on the quantile 10 but a negative effect on other classes, with significant negative effects found in only the middle classes. Unlike other classes, the poorest households (quantile 10) can receive positive (but not significant) impact from parents who spend time to look after them, e.g., to look after their grandchildren as the parent can save money tcompared to providing a professional babysitter and can focus on jobs to earn income. In contrast, for other household classes, similar activities to the poorest households as mentioned above will reduce their net wealth as the family tend to focus on the quality over the quantity of needs received by the family members, hence pushing households to spend more and therefore reduce their net wealth.

In contrast, intergenerational transfers in the form of money given by parents for their children has a positive and significant effect on household net wealth in all classes with the biggest effect found in the middle class. Those conditions reflect the two sides of the households in the middle class in Indonesia, where, on one side, their role as the major spender in the Indonesian economy make financial help from parents of significant help (World Bank, 2020a) but on the other side, they are considered as the missing population or the population who are not eligible for social net protection like the poor but still unable to pay private pension or insurance schemes like the rich, shown in the parents' attention to their children's family in form of intergenerational transfers (days) bring significant economic consequences for them (Kidd et al., 2019).

The estimates of quantile regression in Tables 5.3 and 5.5 were then re-estimated to check the robustness of the effect of the variables on the household net wealth. We used quantile regression for panel data with non-additive fixed effects by using Powell (2016) for a robustness check and compare the results with estimates of quantile regression with the robust and clustered standard error that includes additive fixed effect (Table 5.6).

Table 5.6. *Quantile Regression for Panel Data with Non-additive Fixed Effects.*

Quantile	Ln HH size	Ln HH head age	Ln HH head years of schooling	Ln Dependency ratio	Ln Interge-nerational transfers (days)	Ln Interge-nerational transfers (money)	HH is in urban	HH head is married	HH head is male	HH head is migrated	HH head employment in agriculture
10	-0.213	0.107	0.484	-0.186	0.002	0.140	0.087	0.589	0.221	-0.069	-0.020
	(68.079)	(45.192)	(92.817)	(18.299)	(10.217)	(7.014)	(59.232)	(88.504)	(58.362)	(34.356)	(103.155)
20	4.929	0.346	1.600	-0.295	-0.172	2.336	0.438	0.635	0.176	0.101	-0.737
	(43.935)	(46.086)	(40.556)	(14.21)	(4.061)	(4.406)	(20.605)	(45.968)	(26.463)	(20.221)	(27.369)
30	-2.479	-0.490	10.028	2.505	0.740	1.974	2.740	5.415	1.302	-0.198	0.331
	(46.361)	(29.94)	(33.271)	(16.763)	(5.031)	(4.362)	(21.965)	(45.012)	(21.107)	(14.26)	(35.946)
40	-5.258	0.169	20.667	-3.985	-0.677	2.281	6.014	11.918	2.694	0.158	-1.375
	(56.827)	(26.99)	(25.705)	(18.269)	(4.064)	(4.069)	(19.798)	(46.331)	(21.124)	(16.823)	(36.19)
50	-1.370	1.141	2.788	-0.763	-0.076	0.356	1.004	2.476	0.623	-0.047	-0.286
	(64.329)	(19.771)	(29.442)	(17.217)	(5.085)	(4.582)	(20.231)	(34.22)	(19.013)	(17.708)	(24.38)
60	-5.558	1.371	14.874	-1.887	-5.331	7.631	5.133	-0.411	3.139	0.139	-0.760
	(43.336)	(18.07)	(26.42)	(15.298)	(4.613)	(5.543)	(21.32)	(25.265)	(22.629)	(15.083)	(36.894)
70	-24.078	0.765	49.870	-13.885	-1.250	5.349	17.780	-7.305	9.009	-0.502	-10.647
	(54.303)	(42.016)	(42.035)	(22.73)	(4.622)	(9.253)	(29.072)	(42.868)	(36.803)	(20.418)	(68.326)
80	-5.631	0.174	8.127	-0.230	3.223	5.819	7.822	-1.388	0.212	-3.212	-4.456
	(37.855)	(45.469)	(39.582)	(14.557)	(5.853)	(8.189)	(28.083)	(53.296)	(19.468)	(28.025)	(89.576)
90	-36.359	-8.869	62.404	-22.534	-2.557	3.074	35.354	-3.797	15.329	0.844	-22.104
	(97.076)	(121.247)	(99.897)	(75.589)	(36.797)	(36.092)	(78.87)	(238.466)	(144.153)	(88.793)	(227.222)

Notes: *p<0.1, **p<0.05, ***p<0.01

Results from the robustness check suggest the coefficient of estimation from using non-additive fixed effects is lower than estimations of quantile regression with the robust and clustered standard error that include a fixed effect. This discrepancy is sufficient to indicate the robustness of estimation of quantile regression with bootstrapped standard error and quantile regression with the robust and clustered standard error that include additive fixed effect to estimate the determinants of household net wealth in Indonesia.

5.4.2. Policy Discussions

As well as the aggregate effect of the variables in increasing household net wealth as found in the standard panel model, there are important consequences of unobserved heterogeneity across classes as found in the quantile regression estimations. Wrong inferences due to the unobserved heterogeneity across classes might have implications for policymakers in their efforts to increase household net wealth. Policy discussion in this section focuses on three aspects of policy related to demography, education, and the economic gap of urban and rural. This focus these three aspects is for three reasons. The first is variables related to demography, for example, household size, dependency ratio, and married household head, have a decreasing pattern with a lower effect found in the higher quantiles. This indicates that only the higher quantiles gain benefits from the change of demographic variables above on their household wealth compared to households in lower quantiles. This condition suggests the need to strengthen the implementation of the *Keluarga Berencana* (family planning) programme in Indonesia, which shows slow progress after 2000 due to a lack of political support from the local government (Abrianty & Sujarwoto, 2017). Additionally, the programme should reach the poorest households which are considered as being excluded due to limited access and low awareness from parents (Abrianty & Sujarwoto, 2017; Warwick, 1986; World Bank, 2016a).

The second reason is the education aspect where, if estimated from the standard panel model, has a positive and no significant effect on household net wealth but if the unobserved heterogeneity across classes is taken into consideration, it has a significant effect on household net wealth in all quantiles, with a higher effect found in higher classes. Therefore, an increasing return of education on household wealth among the poorest households should be achieved through investment in education. This would be achieved through increase government spending on education (World Bank, 2020c), widening access to quality education (Patrinos et al., 2006; World Bank, 2019b) including widening access to early childhood education, which is considered inaccessible for low classes in Indonesia (Brinkman et al., 2017).

The third reason is related to the urban-rural gap; in the variable of the household living in urban areas, the unobserved heterogeneity across classes causes the different estimation results than from the standard panel model where in the standard panel model, the variable gives a positive and significant contribution to household net wealth but if an observation is achieved through quantile regression, it has a positive and significant effect in the middle and upper classes only. Households in the quantile 10 do not gain any significant increase to their net wealth from living in urban areas, mainly because of an inability to achieve sufficient earnings, and therefore pushes them to live in substandard living conditions, which are also associated with high costs (Nastiti et al., 2013; Semba et al., 2009; Sholihah & Shaojun, 2018). Therefore, reducing the rate of rural-to-urban migration is important (Pardede, McCann, & Venhorst, 2020; Wajdi, van Wissen, & Mulder, 2015) and can be achieved by increasing the return of economic activities in rural areas (Rozaki, 2020) and expand opportunities through more development initiatives, for example, by the establishment of village-owned enterprises (BUMDes) (Jayasooria, 2020).

5.5. Conclusions

By using quantile regression, this chapter identifies the occurrence of the heterogeneity across classes in the determinants of household net wealth in Indonesia that cannot easily be detected by the standard panel model using mean estimation. This heterogeneity, therefore, implies different interventions are needed for different household classes as any intervention to increase household net wealth in Indonesia may create different effects and magnitude across classes.

This study therefore cannot claim to provide a comprehensive explanation regarding the determinants of household net wealth in Indonesia due to limited sample and variables selection since the observation on social characteristics and individual behaviour are hardly isolated from the influence of other variables. The existence of the intra-cluster correlation in this study suggests future researchers should consider discussion of the influence of spatial aspects on household well-being. Also, in the context of regional autonomy in Indonesia, observation related to the effectiveness of regional autonomy, for example, in the formation of new administrative regions or the change of governmental structure and authority, is interesting for future discussions.

Chapter 6. Estimating Spatial Panel Data Model for Households Net Wealth Determinants in Indonesia

Abstract

The economic activities that were heavily concentrated in certain areas in Indonesia in the pre-decentralisation period (before 2001) bring a need to consider the spatial aspect in the investigation of household net wealth as households in one region can be influenced by a change of variable in the same region and the spillover of a change of variables in neighbouring regions. In this paper, the Moran's I and the Spatial Durbin Model (SDM) are used to find evidence of the spatial autocorrelation of household net wealth in Indonesia and the determinants of household net wealth where households in one region are spatially correlated with other households in the same and the neighbouring regions. Findings show the declining trend of spatial autocorrelation of household net wealth in Indonesia during 1993-2014, with household net wealth in one region being largely influenced by the change of variables in neighbouring regions.

Keywords: Indonesia, net wealth, household, spatial autocorrelation, spillover
JEL Classification: C31, O18, R12

6.1. Introduction

Indonesia, in 2001 replaced the previous centralised government with a wide range of decentralisation programmes. The reforms gave greater authority, political power, and financial resources directly to local government. In the economic sector, higher authority and responsibilities obtained by the local government allow them to attract investment, increase economic activities, and create the local economic growth centres (Tadjoeddin et al., 2003; Vidyattama, 2013). Despite the greater power given to regions, as the world's largest archipelago with more than 17,000 islands, Indonesia faces an enormous challenge to distribute development and the increase of standard of living to its uneven distribution of population, where more than half of the population lives on t 7 percent of the land area that comprises Java and Bali Islands (Drake, 1981; Mustajab, 2009; Vidyattama, 2014).

Indonesia's geographical nature as an archipelago nation makes the spatial aspect an important issue, especially in the development planning process. Under the New Order administration (1966-1998), the national economic growth is largely supported by economic activities in some economic growth centres, for example, Jakarta, Surabaya, and Medan. As a result, the economic benefits, in the form of infrastructure development or human quality development, are mostly enjoyed by the population in those areas only, leading to the issue of regional inequality, for example, measured using the differences in household standard of living between Java Island and outside Java, or Eastern Indonesia and Western Indonesia (Garcia & Soelistianingsih, 1998; Suryadarma et al., 2006; Tadjoeddin et al., 2003).

Previous studies of the household standard of living in Indonesia that take account of spatial dimension use either an income or an expenditure approach. The use of the income approach in the estimation is mostly for technical reasons where households can be made to indicate the flow of income received in one period relatively easily, for example, in the studies of Drake (1981), McCulloch and Sjahrir (2008), Skoufias and Olivieri (2013). While income measurement is easily calculated, consumption expenditure provides a more comprehensive estimation of the household standard of living in a longer period as it also includes seasonal activities or self-produced economic activities, for example, in the studies of Akita and Lukman (1999) and Akita and Miyata (2018). Observation of the spatial dimension of the household standard of living by using household net wealth aspect is rarely occurring in Indonesia, even though it plays an important role in determining household ability to smooth consumption where saving during the period of high income and not saving when income is low (Frankenberg, Smith, & Thomas, 2000).

This chapter contributes to the existing body of knowledge by filling the gap in the application of the influence of spatial dimension in an effort to find the determinants of household net wealth in a developing country, within the context of Indonesia as an archipelago nation. More specifically, this chapter investigates the occurrence of spatial autocorrelation of household net wealth in Indonesia and identifies the contributors of household net wealth when households are spatially correlated with other households in the same region and neighbouring regions. To find evidence of the spatial autocorrelation of household net wealth, Moran's I estimation is used. To identify the determinants of household net wealth, the spatial models are applied as they can combine spatial error, spatial lags, or both, to accommodate the interactions within the region and between the regions. These spatial models outperform the standard panel model with a clustered design where, even though households in the same cluster are assumed to have neighbourhood inferences within the cluster, this approach does not control for the size of the cluster and assumes the cluster sizes are equal and does not allow for spatial correlation between observations in different clusters.

6.2. Literature Review

6.2.1. Households Net Wealth as a Measurement of Standard of Living in Indonesia

Skoufias and Olivieri (2013) have explained that the primary cause of the low level of household standard of living in one region is the low economic return achieved by households.

In better-endowed areas (e.g. in better infrastructure or basic services), households tend to have higher productivity levels and economic returns, allowing them to exit from poverty. In their argument, geographical advantages drive the clustering of new activities or jobs and attract people from other regions. Thus, regions that do not have geographical advantages mentioned earlier will face a condition of a low household standard of living and a high poverty rate (Bird, Higgins, & Harris, 2010).

Some studies found the geographical factors that influence the differences in the household standard of living in Indonesia. Some of the factors are related to natural resources and human resources (Akita & Miyata, 2018; McCulloch & Sjahrir, 2008; Nazara & Hewings, 2004); infrastructure (Akita & Lukman, 1999; Akita & Miyata, 2018; Skoufias & Olivieri, 2013); education facilities (Akita & Miyata, 2018; Nazara & Hewings, 2004; Skoufias & Olivieri, 2013); telecommunications infrastructures (Sujarwoto & Tampubolon, 2016); and health facilities (Skoufias & Olivieri, 2013). Other contributors are related to the local conditions, for example, the presence of agglomeration (Akita et al., 2011); and proximity to large cities; or distance from the capital (McCulloch & Sjahrir, 2008).

In the effort to measure the standard of living, estimation of household net wealth should be used for several reasons. First, the household net wealth includes the calculation of liabilities that can reduce the value of assets, reflecting household financial strength (Cowell & Van Kerm, 2015; Wakita et al., 2000). Second, the net wealth inequality is usually worse than income inequality as wealth reflects more the persistent economic power than the flow of income (Cowell & Van Kerm, 2015; Dagnes, Filandri, & Storti, 2018; Ward, 2013). Third, wealth can also be inherited, which makes children of wealthy parents tend to be well off themselves (Keister et al., 2019; Oliver & Shapiro, 1990).

Compared to income, household net wealth better reflects the standard of living as households tend to conceal their income (e.g. for security reasons or to avoid tax) or prefer not to report irregularly received income (Birdsall, 2010; Brown & Gray, 2014; Ward, 2013). Additionally, income has a transitory character, meaning that past income does not necessarily reflect future income or well-being (Oliver & Shapiro, 1990). Also, people with higher incomes generally have more wealth, but these measures are not interchangeable as people with more wealth do not necessarily always have a high income (Filmer & Pritchett, 2001; Gibson, 2017; Oliver & Shapiro, 1990).

Household net wealth is also better than expenditure to reflect a standard of living as households will always have expenditure even though they have zero income; to pay their expenses, households can convert their assets (Birdsall, 2010; Clementi et al., 2018). The reported consumption expenditures also generally only capture market transactions, and therefore ignore the value of non-market transactions and the self-produced goods and services (Brown & Gray, 2014; Clementi et al., 2018; Ward, 2013). In addition, the measurement of expenditure only provides a snapshot or short-term standard of living as many goods purchased have useful lives beyond just the current period (Ward, 2013).

6.2.2. Spatial Interaction between Economic Units

The spatial interaction between economic units can be reflected in the spatial autocorrelation, which is defined as the distribution of the variable of interest that exhibits a systematic pattern (Cliff & Ord, 1981). The interaction creates a variation in economic status, labour market opportunities, and different patterns of economic praxis across regions so may drive differences in the standard of living across individuals or households that can be mapped on to spaces (George & Patrick, 2017).

While the linear regression model is useful as a reference, it has some methodological drawbacks in explaining spatial autocorrelation. First, each unit of observation represents a region located in space that makes spatial dependence between the observations a likely scenario, therefore, in the presence of spatial dependence, the linear regression model is no longer the best linear unbiased estimator. Second, there is an existence of unobserved regional characteristics that potentially influence the dependent variable, and, if any of those omitted factors correlate with the explanatory variables, their influence is erroneously attributed to the covariates included (Lerbs & Oberst, 2014).

The spatial autocorrelation as mentioned above can be divided into global and local spatial autocorrelation. The global spatial autocorrelation is the correlation among data values, strictly due to the relative location proximity of the objects that the data refer to. However, the measures of global spatial autocorrelation offer an average perspective of the spatial distribution of the variable of interest and, therefore, may hide interesting features of the phenomenon under study. To overcome this condition, the local spatial autocorrelation is measured as it has two advantages. First, when applied to datasets lacking global spatial autocorrelation, local statistics may be able to reveal one or more limited areas exhibiting significant deviation from spatial randomness. Second, when applied to datasets where global spatial autocorrelation is present, local statistics may help identify the locations that contribute most to the overall pattern of spatial clustering (Sokal, Oden, & Thomson, 1998).

The interaction between regions can be mathematically reflected in a spatial weight matrix with the weight structure as follows:

$$\begin{bmatrix} w_{11} & w_{12} & \cdots & w_{1N} \\ w_{21} & w_{22} & \cdots & w_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ w_{N1} & w_{N2} & \cdots & W_{NN} \end{bmatrix}$$

A spatial weights matrix is a N by N positive and symmetric matrix W which expresses for each observation (row) those locations (columns) that belong to its neighbourhood set as non-zero elements (Anselin & Bera, 1998). More formally, $w_{ij} = 1$ when i and j are neighbours, and $w_{ij} = 0$ otherwise. While the diagonal elements of the weights matrix are set to zero, and the elements of a row sum to one. The elements of row-standardized weights matrix thus equal $w_{ij}^{s} = {w_{ij}}/{\sum_j w_{ij}}$. This ensures that all weights are between 0 and 1 and facilitates the interpretation of operations with the weighting matrix as an averaging of neighbouring values.

Three ways to incorporate autocorrelation in a regression model are the spatial lag model/ spatial autoregressive model (SAR), spatial Durbin model (SDM), and General Nesting Model (GNS) (Elhorst, 2014).

The first model, the spatial lag or spatial autoregressive model (SAR), is appropriate when the focus of interest is the assessment of the existence and strength of spatial interaction. Formally, the SAR model is (Elhorst, 2014):

$$y = \rho W y + X\beta + \varepsilon \qquad (1)$$

where ρ is a spatial autoregressive coefficient, ε is a vector of error terms. Wy is the spatial lag for y at i.

The second model, the Spatial Durbin Model (SDM), can advocate both spatially lagged dependent and independent variables (Elhorst, 2010; LeSage & Pace, 2009). The spatial dependence in the explanatory variables can influence the performance of spatial models about linear regression model models substantially. Only in the special case that the dependent variable does not exhibit spatial dependence, and there are no spatially dependent omitted variables correlated with the included covariates, linear regression model, and SDMs should yield similar parameter estimates. SDM is also a way to solve a great degree of similarity between a spatial lag and a spatial error model, as suggested by the error covariance structure (Anselin & Bera, 1998). Another strength is that it imposes a spillovers effect (whether global or local) and can be different for different explanatory variables. The equation for the SDM is (Elhorst, 2014):

$$y = \rho W y + X\beta + WX\theta + \varepsilon \qquad (2)$$

where *WX* is the spatial lag of independent variables.

The third model is the most general model, a General Nesting Spatial (GNS) model. In this model, everything is spatially lagged, that is the spatial lag of a dependent variable, the spatially auto-correlated error term, and a set of spatial lags of explanatory variables. The equation for the GNS is (Elhorst, 2014)::

$$y = \rho W y + X\beta + WX\theta + u \qquad (3)$$
$$u = \lambda W u + \varepsilon$$

where ρ is called the spatial autoregressive coefficient, λ is spatial autocorrelation coefficient, while θ, just as β, represents a K x 1 vector of fixed but unknown parameters to be estimated. W is a non-negative N x N matrix describing the spatial configuration or arrangement of the units in the sample.

6.2.3. Challenges in the Analysis of Spatial Interaction in Indonesia

The application of spatial interaction in Indonesia faces two unique facts about Indonesia. First, the archipelagic condition of Indonesia creates natural boundaries in the form of water. These water boundaries create a barrier that limits interaction between two regions (Mustajab, 2009; Nijkamp et al., 1990; Vidyattama, 2014). The contiguity matrix cannot be used to represent the interaction between regions as this matrix does not include boundaries defined by the sea (Kondo, 2016; Waller & Gotway, 2004). If a contiguity matrix is applied for regions that have water boundaries, some regions will have no neighbours. Instead, the distance-based matrix is used as the interaction between regions is translated into distance from one region to others, obtained from the coordinates of centroids or geometric centre of the geographical areas of interest (Kondo, 2016; Waller & Gotway, 2004).

Table 6.1. *Number of Administrative Units in Indonesia*

	1993	**1997**	**2000**	**2007**	**2014**
Provinsi (Province)	27	27	26	33	34
Kabupaten/Kota (District)	303	314	341	465	514
Kecamatan (Sub-district)	3,836	4,028	4,049	6,131	7,024
Desa/Kelurahan (Village/Urban Communities)[18]	65,554	66,545	69,050	73,408	81,626

Source: Badan Pusat Statistik (1994-2015)

The second issue is related to the *pemekaran* (fragmentation) due to the implementation of *otonomi daerah* (regional autonomy) that commenced in Indonesia in 2001 that resulted in the

[18] Even though *desa* and *kelurahan* are in the same administrative level, *desa* has higher autonomy than *kelurahan*, for instance in the official structures and financial aspect (Faoziyah & Salim, 2020)

change of boundaries at provinces and districts in Indonesia. While the number of provinces increased from 26 (excluding Timor Leste which gained its independence) to 34 during 2000-2014, the number of districts increased from 341 to 514 (Table 6.1). These frequent boundary changes have greatly complicated the analysis of trends in sub-national economic development. Given that our analysis requires a geographic definition of administrative units that is consistent over time, we used the pre-1997s boundaries combining districts that split up to form of final parents district (Hill, 2008; Hill & Vidyattama, 2016; Talitha, Firman, & Hudalah, 2019).

6.3. Method and Data

6.3.1. Spatial Econometric Panel Analysis

We estimate the determinants of household net wealth in Indonesia with respect to the spatial aspect by using spatial econometric models as they can capture the possible spillover of the variables. One important component in the application of spatial econometric models is the weighting matrix, which is used to represent the interaction between regions in the matrix form. The matrix has dimensions 280x280, which indicates the interactions of 280 enumeration areas (EAs). These 280 enumeration areas are the result of the boundaries consolidation to pre-1997 administrative boundaries that had 321 EAs. In reference to the nature of the area of study, the contiguity matrix is no longer relevant and thus, the distance-based matrix with an inverse power function is used, following Vidyattama (2014). By using the Drukker, Peng, Prucha, and Raciborski (2013) procedure[19] to construct the weighting matrix, the average distance between EAs is 280.002 km (inverse of 0.0035714), with a minimum distance of 1.966 km (inverse of 0.5085292) and a maximum distance of 8,598.452 km (inverse of 0.0001163).

By using the constructed weighting matrix, we can calculate the Moran's I test to observe the spatial interaction between regions. This measurement indicates the degree of linear association between a vector of observed values *y* and the weighted average of the neighbouring values, or spatial lag, *Wy* (Anselin, 2001). In mathematical form, the Moran's I is (Anselin, 2001):

$$I = \left(\frac{N}{S_0}\right)\frac{y'Wy}{y'y} \qquad (4)$$

where N stands for the number of observations, S_0 is the sum of all elements in the spatial weight matrix ($S_0 = \sum_i \sum_j w_{ij}$), *y* is the observations in deviations from the mean, and *Wy* is the associated spatial lag. When the spatial weights matrix is row-standardised such that the elements in each row sum to 1, since in this case, $S_0 = N$, this expression simplifies to:

[19] In Stata, the command for Drukker, Peng, et al. (2013) procedure is `spmat`

$$I = \frac{y'Wy}{y'y} \quad (5)$$

The null hypothesis of the Moran's I test is that the data is randomly disbursed (there is no spatial autocorrelation in the model). The alternative hypothesis is that the data is more spatially correlated. Moran's I vary between -1 and 1 with a positive value meaning that a point in question is prone to be clustered by adjacent points, while a negative value means the opposite. Values close to 0 indicate that the data are randomly distributed. For this statistical hypothesis testing, Moran's I can be transformed into z-scores. The positive Z-scores indicate that data are spatially clustered in some way. Positive coefficients mean positive spatial autocorrelation occurs, that is, the regions neighbouring a region with high value also show higher value. The zero coefficient is no autocorrelation (perfect randomness), while negative means clustering of dissimilar values. (Anselin, 1993; Réquia et al., 2015).

Based on the Moran's I estimation, we can construct the Moran scatter plot, first outlined by Anselin (1993). This graphical form consists of a plot with the spatially lagged variable on the y-axis and the original variable on the x-axis and the slope of the linear fit to the scatter plot equals Moran's I. The scatter plot can be decomposed into four quadrants with different interpretations for each of them. The upper-right quadrant is the location of high values surrounded by high values (*high-high* spatial autocorrelation) and the lower-left quadrant refers to locations of low values surrounded by low values (*low-low*). Both quadrants correspond with positive spatial autocorrelation or similar values at neighbouring locations. The lower-right quadrant corresponds to locations of high values surrounded by low values (*high-low*) and the upper-left quadrant is locations where low values are surrounded by high values (*low-high*). These last two quadrants correspond to negative spatial autocorrelation (dissimilar values at neighbouring locations).

This spatial autocorrelation estimation can be divided into the global and local spatial autocorrelation where the global spatial autocorrelation measures the extent to which regions are interdependent and the local spatial autocorrelation captures spots showing high spatial autocorrelation locally. For cross-section data, the global and local spatial autocorrelation is estimated by using Pisati (2001) estimator[20] while the global autocorrelation for panel data is estimated by using Kondo (2018) estimator[21].

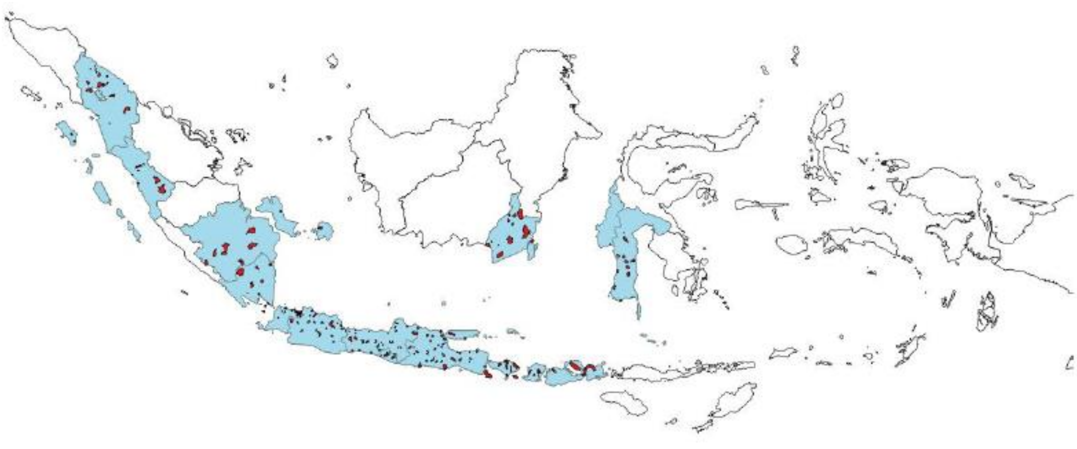
[20] In Stata, the commands for Pisati (2001) estimator are `spatgsa` and `spatlsa` to compute cross section global and spatial autocorrelation, respectively.
[21] The global spatial autocorrelation for panel data is calculated with Kondo (2018) estimator with `moransi` command. This command endogenously constructs spatial weighting matrix to difficulties of constructing weighting matrix.

The spatial econometric models that incorporate the spatial autocorrelation (in the form of spatial lag of variables) in the regression model are used to identify the determinants of household net wealth in Indonesia. Each model can include one or more spatial lags. For example, the spatial lag model/ spatial autoregressive model (SAR) includes the spatial lag of the dependent variable, the spatial Durbin model (SDM) includes the spatial lag in the dependent and independent variables, and the General Nesting Spatial model (GNS) includes the spatial lag in the dependent, and independent variables, and the error term (Elhorst, 2014). These models are then estimated by using the maximum likelihood approach for panel data using `spxtregress` command that has been available since Stata 15. In contrast, the estimation of Generalised Two-Stage Least Square for panel data using Shehata (2012) estimators cannot be attained as they require a spatial weight matrix based on a contiguity matrix that is not achievable in this research. Another maximum likelihood approach-based command for the panel data using Belotti, Hughes, and Mortari (2017) estimator has limitations only being able to estimate SAR and SDM.

6.3.2. Data

The data used in this paper are drawn from the Indonesian Family Life Survey (IFLS), an ongoing longitudinal survey that collects extensive socioeconomic information on the lives of the respondents who live in 321 enumeration areas (EAs) in 13 provinces in Indonesia (Figure 6.1). We use data from the five waves of the IFLS conducted in 1993, 1997, 2000, 2007, and 2014.

***Figure 6.1**. Map of IFLS Provinces*



Note: 321 EAs in IFLS are shown by red areas located in 13 provinces included in the IFLS

The first wave of IFLS (IFLS1) was administered in 1993 and covered 7,224 households. These households were spread, in both urban and rural areas, across 13 provinces, from the island of Java, Sumatera, Bali, Kalimantan, Sulawesi, and Nusa Tenggara (see Figure 6.1). In total, these 13 provinces held 83 percent of the Indonesian population at the time of the survey. The subsequent waves of surveys sought to re-interview all the IFLS1 households and split-off households. Attrition in IFLS is very low; in each of the follow-up waves, more than 90 percent of the IFLS1 dynasty households were successfully re-contacted (Strauss & Witoelar, 2019). In total, the IFLS2 collected information on 7,698 households, IFLS3 contains information on 10,574 households, IFLS4 has information on 13,995 households, and IFLS5 collects information on 16,931 households (Strauss et al., 2016). The sample size of this research is 5,707 households that consistently participate in all waves of IFLS and live in 280 enumeration areas (EAs) which are the result of the boundaries consolidation to pre-1997 administrative boundaries that achieved 321 EAs.

The IFLS can be an ideal alternative to the Survei Sosial Ekonomi Nasional (Susenas)[22] and satisfactorily serve as a nationally representative dataset (Chongvilaivan & Kim, 2016). In comparison to *Susenas*, IFLS is a better alternative as it has a more extensive set of questions regarding the household economy (Dong, 2018; Erlangga et al., 2019; Roy & Tiongco, 2008) and contains more detailed community characteristics in terms of the remoteness, infrastructure, and local economy (Dong, 2018). The *Susenas* accurately measure household consumption or expenditure but lack detailed information regarding household wealth (Dong, 2018; Johar et al., 2019; Joshi et al., 2019).

This paper uses household net wealth as the dependent variable. The value of household net wealth is obtained from the total value of the household's wealth less the household debts. Total wealth includes the value of farm business (e.g. farmland, poultry, and house/building used for farm activities), non-farm business (e.g. non-farm land, vehicle, and non-farm building), and household assets (e.g. house, land, vehicle, savings, and furniture). To obtain the real value, the value of net wealth is then adjusted with a GDP deflator obtained from World Bank (2018a). A correction is established to adjust the household's net wealth using the household members, as households vary in size and the unadjusted household wealth usually

[22] The *Susenas* is a nationally representative socioeconomic survey conducted by National Statistics Office/BPS. The *Susenas* dataset consists of three main datasets: core (records large number of the sample but low-depth of questions), module (contains more detailed questions but cover smaller sample), and panel (collected information from consistent households but only covers data from 2005).

over-estimates individual wellbeing. This equivalence scale is conducted by dividing household net wealth by the square root of the number of household members[23].

[23] The equivalence scale indicates the return of scale of each household member. Per capita wealth is the division of wealth based on the equation of W/ S^{ε} with S^{ε}=economies of scale, S=size, and ε=the economies of scale parameter with the value between 0 and 1. There is no consensus for determining the economies of scale, although ε=0.5 is widely used (Atkinson et al., 1995; Clementi et al., 2012; OECD, 2020; Sierminska & Smeeding, 2005; Stats NZ, 2019)

Table 6.2. *Variable Description*

Variable	1993		1997		2000		2007		2014	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Total wealth (Rp. x10^6)(Constant 2010)	47.300	180.000	95.400	282.000	78.800	160.000	82.600	149.000	95.600	134.000
Debts (Rp. x10^6)(Constant 2010)	1.390	7.768	1.860	17.300	0.332	2.780	1.059	11.400	1.395	8.706
Net wealth (Rp. x10^6)(Constant 2010)	45.900	180.000	93.600	277.000	78.500	160.000	81.500	149.000	94.200	133.000
Household Characteristics										
HH size	4.138	0.673	4.138	0.674	4.444	0.678	4.685	0.700	4.561	0.746
HH head age	45.230	3.765	48.721	3.589	48.471	4.220	39.018	5.938	52.819	4.352
HH head years of schooling	6.369	1.639	6.253	1.610	5.437	1.301	5.640	1.394	6.857	1.593
HH head is married (%)	86.451	9.410	81.557	11.043	77.082	11.787	65.296	12.778	52.415	13.786
HH head is male (%)	85.650	10.282	85.572	10.320	83.277	10.852	63.554	12.889	78.068	11.565
HH head employment is agriculture (%)	38.975	25.784	31.343	22.898	34.097	22.349	35.437	22.886	35.437	22.886
Dependency ratio	77.308	24.259	67.975	18.742	59.240	14.405	50.455	11.580	48.480	10.386
HH head migrate (%)	62.008	18.508	61.102	17.775	40.882	16.108	35.613	13.746	36.848	15.195
HH head migrate for work (%)	14.243	14.060	10.266	9.477	10.782	8.754	6.747	7.204	6.590	6.064
Intergenerational transfers (days)	2.563	7.478	9.553	24.209	9.161	13.014	20.711	29.121	18.633	24.655
Intergenerational transfers (Rp. x10^6) (Constant 2010)	0.473	2.231	0.538	0.759	2.288	2.330	1.738	5.859	2.321	9.294
Community Characteristics										
Distance to bus stop/ terminal (km)	6.452	6.527	5.997	7.648	9.822	53.610	9.822	53.610	8.386	11.216
Distance to market (km)	3.829	3.982	3.222	3.628	3.820	5.430	3.820	5.430	3.313	3.997
Distance to a bank (km)	12.074	68.638	5.807	9.140	4.186	4.264	4.186	4.264	4.028	4.340
Distance to district capital/ kabupaten (km)	25.011	31.022	21.699	29.670	22.730	50.774	22.730	50.774	19.488	21.312
Travel time to bus stop/ terminal (minutes)	50.101	426.303	18.849	51.114	22.136	68.429	22.136	68.429	23.000	101.384
Travel time to market (minutes)	56.716	494.404	10.171	18.996	8.520	11.947	8.520	11.947	9.505	34.430
Travel time to a bank (minutes)	95.119	667.277	20.690	82.743	17.063	58.390	17.063	58.390	59.262	499.228
Travel time to district capital/ *kabupaten* (minutes)	147.091	728.947	49.335	71.272	44.990	46.441	44.990	46.441	42.846	62.841
Households who use electricity (%)	61.825	34.590	81.877	24.268	85.640	20.639	89.314	21.364	93.860	16.125
Electricity availability (hours)	23.414	3.106	23.352	3.323	23.504	2.796	23.878	1.335	23.681	2.330
Number of elementary schools/ SD	2.966	0.371	4.293	2.973	3.057	0.481	4.767	2.656	5.358	3.477

Number of junior high school/ SMP	2.836	0.526	3.006	1.758	3.047	0.612	3.627	1.879	4.904	3.159
Number of senior high school/ SMA	1.737	0.570	3.418	7.513	2.003	0.615	3.354	2.114	5.251	3.749
Number of community health centre/ *puskesmas*	3.170	0.961	4.961	5.823	1.966	0.830	6.966	5.681	8.131	7.178
Number of integrated healthcare posts/ *posyandu*	2.796	0.581	5.254	4.479	1.544	0.619	2.166	1.082	2.125	1.356

The independent variables used in this research represent the characteristics of the Indonesian households and communities. In the household characteristics aspect, variables selected are focused on the demographic, education, employment, and intergenerational transfers features. While in the community characteristics, the variables used are to represent accessibility and the availability of public facilities (Table 6.2).

While most variables are easily interpreted, some require further explanation. The variable of dependency ratio is measured from the number of non-productive-age household members (0-15 and more than 64 years old) for each productive-age household member (15-64 years). The migration experience, either for work, study, or family reasons, that potentially affect individuals' performance in income-earning activities is captured by the variable of whether the household head has migrated. Lastly, the intergenerational transfer aspect contains information regarding the contribution of parents to their children's family, either in financial (money transferred by parents for their children) or non-financial aspects (days dedicated by parents to look after their children).

In the community characteristics aspect, accessibility covers variables of distance to destination (which reflects the remoteness of one household in the region) and time needed to reach a destination (that indicates the reliability of road condition: land/water/sea) and mode of transportation chosen.

6.4. Results

6.4.1. Spatial Autocorrelation in Indonesia

Household net wealth in Indonesia is concentrated in certain areas, with high average net wealth located mainly in the provinces Java Island and the provinces of North Sumatera and South Sulawesi. This is a result of the unequal development in Indonesia that started in the 1960s. Due to the limited budget and vast area of Indonesia, the government focusing development only in certain places, once those places are well developed, they spillover into surrounding areas. In Java Island, the spatial development is shaping belts, which connect large cities especially on the northern side of Java Island, with Jakarta (the Indonesian capital) and Surabaya as the growth centres for the western and eastern part of Java. The other economic growth centre, North Sumatera, plays an important role as the growth engine for Sumatera Island, due to its rich natural resources and strategic location in Malaka Strait while Sulawesi Selatan plays a role as an economic and connectivity hub for eastern Indonesia (Akita, 2002; Hill, Resosudarmo, & Vidyattama, 2008; Kuncoro, 2013). The p-values lower than 0.05 indicate we can reject Ho and thus data are spatially correlated (Table 6.3).

***Table 6.3**. Moran's I of Household Net Wealth in Indonesia, 1993-2014*

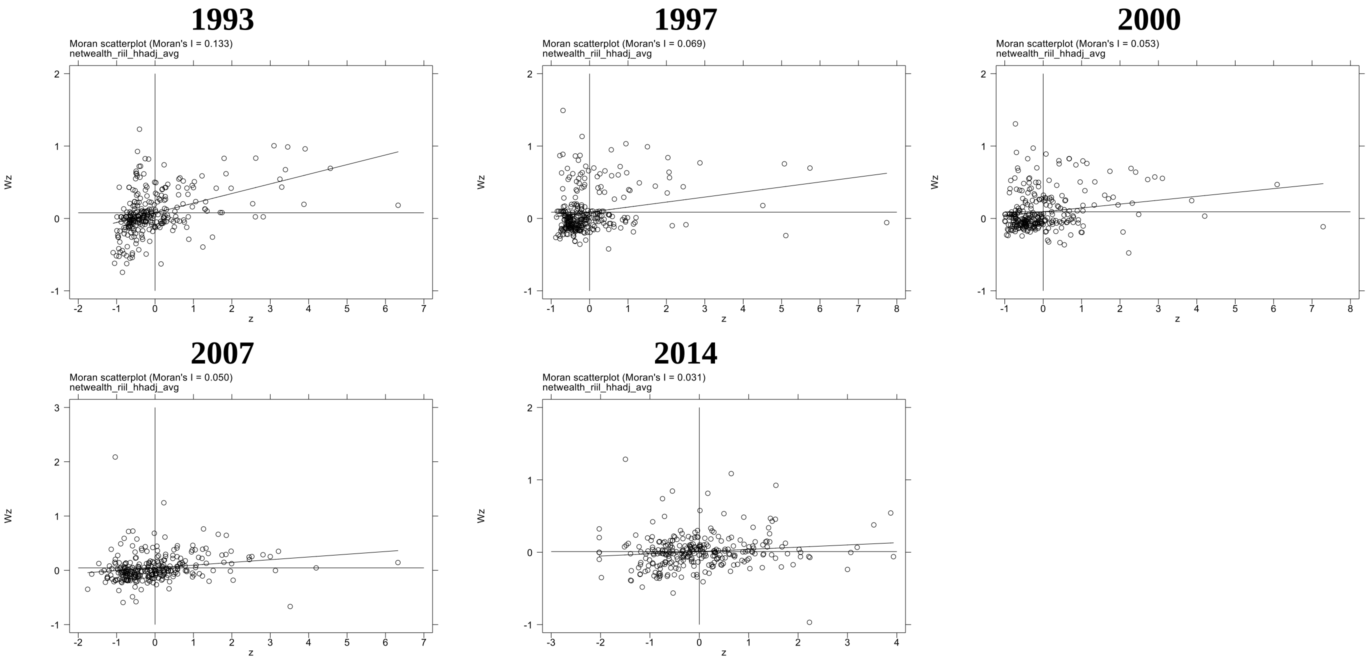
Year	Moran's I	z	p-value
1993	0.133	8.779	0.000
1997	0.069	4.794	0.000
2000	0.053	3.702	0.000
2007	0.05	3.438	0.001
2014	0.031	2.168	0.03

Note: Estimated with Pisati (2001) estimator

During 1993-2014, there is a decrease in spatial autocorrelation of household net wealth in Indonesia, mainly due to the implementation of *otonomi daerah* (regional autonomy). This process, preceded by the 1997/1998 Asian financial crisis, brought a dramatic change in the Indonesian political structure that gives higher authority and responsibilities for regions. As a result, regions were encouraged to attract more investment and solve socio-economic problems (e.g. poverty, poor health and nutrition, lack of infrastructure) so they can increase population wellbeing in the region. This process also shifts the economic concentration from Jakarta- or Java-centred to being region-centred (Firman et al., 2007; Hill et al., 2008; Talitha et al., 2019). The change of the concentration of household net wealth in Indonesia can be shown in the decrease of coefficients that indicate lower spatial autocorrelation (Table 6.3).

Comparison of cloud density between years shows the decreasing of density during 1993-2014. The densest cloud, that occurs in 1993-1993, indicates household net wealth in Indonesia is highly concentrated. It might be related to the economic pattern in Indonesia largely benefiting certain regions or sectors, possibly causing household net wealth to be concentrated only in some areas. After the 'bing bang' of decentralisation in 2001, more regions were able to increase their economy, enabling more households to increase their standard of living. As a result, household net wealth is more spread out throughout the regions, shown by less dense cloud formation in 2000-2014 (see Figure 6.2).

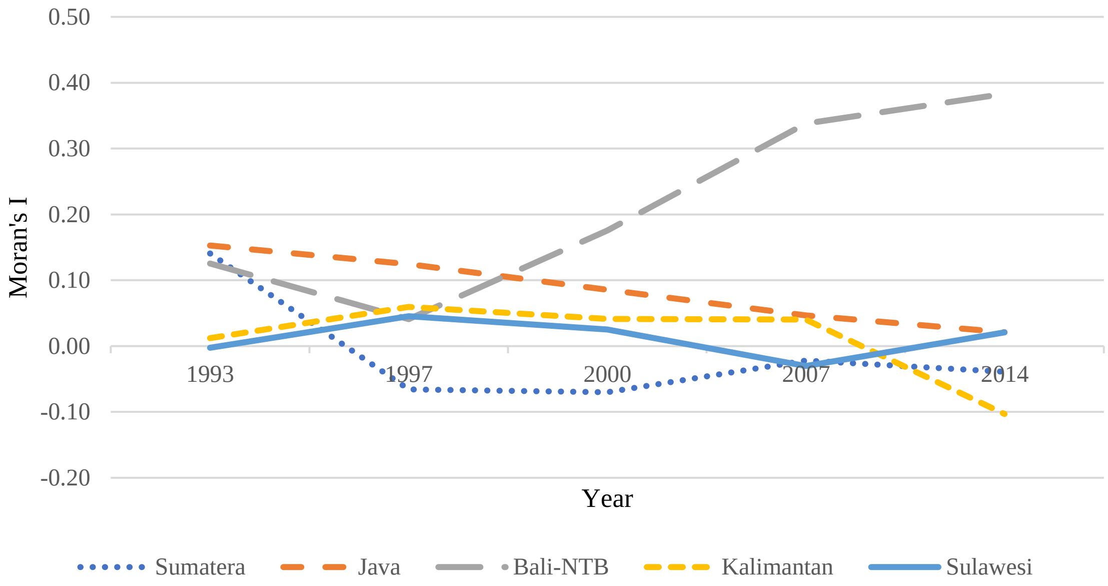
Figure 6.2. Moran Scatter Plots for Household Net Wealth in Indonesia, 1993-2014



A significant proportion of the 1993-2000 clouds are located in the lower-left quadrants and reflecting the low-low spatial autocorrelation. This suggests the existence of a pocket of poverty, where households with low household net wealth are living surrounded by other households who have a low level of net wealth. In the next decade, clouds are more scattered to lower-right quadrants which indicate more households could have increased their wellbeing, leaving other households in a low condition of net wealth (see Figure 6.2).

Observation of spatial autocorrelation at the national level above is then continued to find the local spatial autocorrelation to identify the condition of spatial relationship in the island groups. Estimates show the reduction of spatial autocorrelation of household net wealth exists in most island groups, with only Bali-Nusa Tenggara Barat experiencing an increase of autocorrelation. The decrease of spatial autocorrelation of household net wealth in Java and Sumatera can be explained within spatial context by the more dispersed economic activities shown by the expansion of cities (Marwasta, 2019; World Bank, 2012). Urban expansion that is indicated by the rise of the urban population, the change of land use, and the expansion of urban activities contributes to household wellbeing in the area. Then, the rise of economic activities in Java and Sumatera brings spillovers mainly to Kalimantan and Sulawesi, bringing positive economic contribution (Arman, Hadi, Achsani, & Fauzi, 2016) (see Figure 6.3).

__Figure 6.3.__ Moran's I for Household Net Wealth in Indonesia by Island Groups. 1993-2014



In contrast, only the regions of Bali and West Nusa Tenggara experience an increasing spatial autocorrelation. This indicates the isolation of Bali and West Nusa Tenggara from spillover effect from Java and Sumatera regions, mainly because Bali's tourism is the main economic sector that is less resistent to the economic development in Java and Sumatera. Tourism in Bali comprises approximately 40 percent of Indonesia's international visitors (Badan Pusat Statistik, 2019b; Badan Pusat Statistik Provinsi Bali, 2009, 2021), while West Nusa Tenggara enjoys economic spillover from Bali due to its proximity. However, its geographical condition (two main islands and many smaller islands) limit economic interaction between regions and leads to unequal development that focuses on Lombok Island, the location of the provincial capital of West Nusa Tenggara (Hipziwaty, Karismawan, & Ismiwaty, 2019; Primadianti & Sugiyanto, 2020).

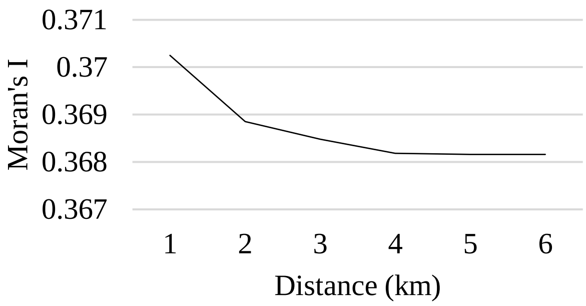
__Table 6.4__. Global Spatial Autocorrelation for Household Net Wealth in Indonesia

Distance (km)	Moran's I	Z(I)	p-value
1	0.370	19.812	0.000
2	0.368	19.783	0.000
3	0.368	19.779	0.000
4	0.368	19.767	0.000
5	0.368	19.767	0.000
6	0.368	19.767	0.000

Note: Estimated with Kondo (2018) Estimator

Since the estimation of cross-section global spatial autocorrelation above is isolating the time influence, further estimation is needed when the aspects of space and time are included in the analysis. By using Kondo (2018) estimator, results of global spatial autocorrelation for panel data in Table 6.4 and Figure 6.4 show the declining Moran's I as the distance becomes greater.

Figure 6.4. *Global Spatial Autocorrelation for Household Net Wealth in Indonesia*



Note: estimated with Kondo (2018) Estimator

As the households are more distance-separated, the spatial autocorrelation between them is further reduced. As the economic activities take place in one region, households in the region will accrue benefits from them in the form of the increase of household net wealth, therefore helping other households enjoy benefits from the increase. This effect becomes smaller when the distance between them increases and is relevant to the First Law of Geography by Waldo Tobler where "everything is related to everything else, but near things are more related than distant things" (Tobler, 1970. p.236).

6.4.2. Contributors of Household Net Wealth in Indonesia

The existence of spatial autocorrelation in the above section then raises the importance of identifying the potential determinants that cause the increase of household net wealth in Indonesia. Estimation of standard panel model with a clustered standard error shows the key determinants that relate to the household characteristics which increase household net wealth in Indonesia are household head age and intergenerational money transfers (positive and significant), married status and (negative and significant), and intergenerational transfer in form of days dedicated by parents (negative and weakly significant). On the other hand, some community characteristics that significantly affect household net wealth are electricity coverage (positive) and the development of community health centres or *puskesmas* (negative).

While other contributors are weakly significantly affect household net wealth, for example, distance to bus stop/terminal (has positive effect) and distance to market, distance to district capital/*kabupaten*, travel time to bus stop/terminal, and number of junior high schools/ SMP (negative effect).

The limitation of the standard panel model above cannot capture the interaction between households with the change of variables in the same region and neighbouring regions. Therefore, the spatial models are used to overcome these limitations as they can capture endogenous interactions, interactions among the error terms, or both. As mentioned in Elhorst (2014), a spatial model with endogenous interaction effects posits that the household net wealth in one region depends on that in other regions, and on a set of regional characteristics. In contrast, a model with interaction effects among the error terms assumes that the household net wealth in one region depends on a set of observed regional characteristics and unobserved characteristics omitted from the model that regions have in common. The three proposed spatial models that consist of these features are the spatial autoregressive model (SAR) that includes spatial lag in the dependent variable, the spatial Durbin model (SDM) that involves spatial lag in the dependent and independent variables, and the General Nesting Spatial (GNS) model that includes spatial lag in the dependent, independent, and error terms.

The Lagrange Multiplier (LM) test is required to test whether the model contains an endogenous spatial lag or spatial autocorrelation indicating that Ordinary Least Square estimation is sufficient to explain the data. The null hypothesis is that variances across entities are zero. That is, no significant difference or no spatial effect across units. The estimation result of the LM-test is 254,77 and significant (less than generally used criterion of 0.05), results in rejection of the null hypothesis and concludes there is a difference across units and therefore linear regression model is not appropriate for this study.

Results from the log-likelihood estimation show the best model is the GNS model as it maximises the log-likelihood while results from Akaike's Information Criteria (AIC) support the previous finding and show the GNS model is the best model as it has the smallest value (Table 6.5).

Table 6.5. *Log-likelihood and AIC Values*

Model	SAR	SDM	GNS
Log-likelihood	-6,264.31	-6,224.97	-6,191.09
AIC	12,584.63	12,557.96	12,492.19

To confirm these findings, the likelihood ratio (LR) test is used to compare the nested (GNS) and non-nested models (SAR and SDM). The first null hypothesis has no difference between GNS and SAR means the GNS can be simplified to the SAR model. The second null hypothesis is there is no difference between GNS and SDM, implying that GNS can be simplified to SDM. If both hypothesises are rejected, then the GNS best describes the data. Conversely, if the first hypothesis cannot be rejected, then SAR best describes the data, provided that the (robust) LM tests also pointed to the SAR. Similarly, if the second hypothesis cannot be rejected, then the SDM best describes the data, provided that the (robust) LM tests also pointed to the SDM. If one of these conditions is not satisfied, then the GNS should be adopted. The result of the LR test that has probability is less than the generally used criterion 0.05, allowing us to reject the first and the second null hypotheses. Therefore, the GNS model is best to describe the data (see Table 6.6).

Table 6.6. *LR test for SAR, SDM, and GNS*

Model	GNS vs SAR	GNS vs SDM
LR test	146.44	67.77
Prob>chi2	0.0000	0.0000

Results of estimates show a general pattern. First, the differences between the direct effect in Table 6.8 and the coefficient estimates reported in Table 6.7 are relatively small. These interaction effects cause feedback effects, that is, impacts affecting household net wealth in a certain region that pass on to surrounding regions and back to the region instigating the change. For example, the direct effect of the household size variable in the GNS model amounts to 35.593, while the coefficient estimate of this variable is 37.960. This implies the feedback effect is 37.960-35.593=2.367. This feedback effect corresponds to 6.24 percent of the coefficient estimate.

Second, the differences between the estimates of the direct effect in the different models appear to be relatively large. Similarly to the estimates of the direct effect, the differences between the spillover effects are extremely large. There are two explanations for this. One is that the significance level of the spatial autoregressive coefficient of the WY variable (the endogenous interaction effects) in the GNS models falls considerably because this variable competes with the spatial autocorrelation coefficient of the Wu variable (interaction effects among the error terms). Another explanation is the large standard error in the GNS model that indicates the sample may not closely represent the population.

The explanation above indicates the GNS is unable to represent the population properly, even though it is superior in the log-likelihood and AIC tests to other models. As argued by Gibbons and Overman (2012), the explanation for this finding is that interaction effects among the dependent variable on the one hand and interaction effects among the error terms, on the other, are only weakly identified. Considering them both, as in the GNS model, strengthens this problem; it leads to a model that is over-parameterised, as a result of which the significance levels of all variables tend to go down (Elhorst, 2014, 2017).

More specifically, the full model with all possible spatial interaction effects, or the General Nesting Spatial model (GNS), is seldom used in empirical research for two reasons (Elhorst, 2017). First, a formal proof under which conditions the parameters of this model are identified is not yet available. Second, there is a problem of overfitting. Even if the parameters are not identified, they can be estimated, but have the tendency either to inflate each other or to become insignificant, as a result of which this model does not help to choose among simpler models with less spatial interaction effects.

From the reasons above, the SDM is selected to represent the spatial interaction of the determinants of household net wealth in Indonesia as it outperforms the SAR model in the log-likelihood and AIC tests. The SAR model also suffers from the problem that the ratio between the spillover and the direct effect is the same for every explanatory variable, consequently, this model is too rigid to model spillover effects adequately (Elhorst, 2014) (Table 6.8).

Table 6.7. *Estimation of Households' Net Wealth Determinants*

Main estimation	**Main Estimation**				**Spatial Lags**	
	Standard Panel Model	**SAR**	**SDM**	**GNS**	**SDM**	**GNS**
	(1)	(2)	(3)	(4)	(5)	(6)
HH size	44.259	37.579	17.723	37.960	-24.195	-70.924
	(26.606)	(23.738)	(25.772)	(26.605)	(92.387)	(70.593)
HH head age	81.373***	32.102**	15.227	11.873	-72.716	-47.290
	(16.62)	(16.337)	(23.887)	(22.203)	(54.364)	(36.824)
HH years of schooling	-21.970	-9.300	-9.325	-19.824*	-63.107	39.746
	(22.314)	(11.194)	(11.965)	(11.316)	(49.973)	(32.868)
HH head is married	-62.173***	-17.676	15.851	22.045	-132.732***	-32.188
	(7.333)	(11.802)	(16.459)	(15.879)	(47.101)	(30.903)
HH head is male	32.435**	3.036	1.648	-4.768	137.196**	-24.403
	(10.255)	(14.68)	(15.608)	(14.834)	(63.093)	(37.857)
HH head employment is agriculture	-13.897	-10.052**	-9.712**	-11.667**	-26.220	22.079
	(9.166)	(4.78)	(4.797)	(4.619)	(24.723)	(15.898)
Dependency ratio	-62.980***	-37.105***	-17.056*	-9.713	-73.422	-58.673*
	(10.378)	(8.851)	(9.906)	(9.486)	(45.753)	(30.713)
HH head is migrate	-5.002	-3.803	-2.817	3.590	11.668	4.212
	(12.784)	(5.312)	(5.812)	(5.476)	(25.205)	(15.293)
HH head is migrate for work	5.441	9.989***	13.250***	2.552	-7.927	26.680***
	(6.258)	(3.355)	(3.417)	(3.402)	(14.793)	(9.781)
Intergenerational transfer in days	-2.357**	-1.085	-1.155	-0.681	-2.449	-0.868
	(0.604)	(1.099)	(1.104)	(1.052)	(5.548)	(3.511)
Intergenerational transfer in money	4.406**	1.136	0.206	0.467	10.232*	-3.539
	(1.409)	(1.322)	(1.402)	(1.317)	(5.918)	(3.621)
Distance to bus stop/terminal	5.408*	4.342	2.559	3.052	-0.505	7.113
	(2.49)	(2.715)	(2.706)	(2.513)	(17.215)	(11.17)
Distance to market	-5.638**	-8.190***	-7.595***	-6.879*	-1.583	-1.441
	(1.743)	(2.934)	(2.892)	(2.727)	(17.686)	(11.012)
Distance to bank	-0.514	-0.382	-0.382	1.444	-34.085*	-24.300*
	(2.981)	(3.026)	(3.003)	(2.811)	(17.667)	(12.45)
Distance to district capital/ *kabupaten*	-7.827**	-5.294*	-4.671	-5.252	1.204	10.939

	(2.311)	(3.062)	(3.025)	(2.884)	(17.475)	(11.916)
Travel time to bus stop/terminal	-6.592**	-6.277*	-5.425	-6.007	-4.137	-5.467
	(2.125)	(3.358)	(3.348)	(3.099)	(22.434)	(13.718)
Travel time to market	-0.164	4.029	4.379	5.828	22.465	24.516
	(3.808)	(3.852)	(3.822)	(3.546)	(25.077)	(15.755)
Travel time to bank	0.416	1.537	2.105	0.602	39.797**	15.417
	(2.962)	(2.92)	(2.878)	(2.671)	(19.482)	(12.928)
Travel time to district capital/ *kabupaten*	3.144	3.218	1.998	1.714	-40.009**	-16.771
	(1.637)	(3.524)	(3.475)	(3.385)	(19.612)	(14.296)
Electricity coverage	0.586***	0.276***	0.193**	0.245***	0.736	-0.757**
	(0.038)	(0.095)	(0.096)	(0.089)	(0.551)	(0.347)
Electricity duration	-0.577	0.281	0.785	-0.023	17.967**	16.247***
	(1.589)	(0.892)	(0.888)	(0.797)	(8.786)	(5.842)
Number of primary schools/SD	7.177	4.061	1.704	1.376	5.623	-9.905
	(6.257)	(5.143)	(5.162)	(4.856)	(24.211)	(14.941)
Number of junior high schools/SMP	-3.363**	0.767	-0.302	2.272	-11.660	7.402
	(1.1)	(5.353)	(5.488)	(5.215)	(28.427)	(18.239)
Number of senior high schools/SMA	5.987	0.281	-2.458	-2.546	47.373*	4.456
	(5.007)	(4.571)	(4.613)	(4.318)	(28.035)	(17.45)
Number of community health centre/ *puskesmas*	-7.286***	-3.664	1.824	-1.814	-40.446***	-5.027
	(1.02)	(2.953)	(3.6)	(3.239)	(10.374)	(6.564)
Number of integrated healthcare posts/ *posyandu*	3.685	2.673	2.054	3.714	29.731	0.206
	(3.159)	(3.626)	(3.931)	(3.657)	(18.102)	(11.108)
Spatial lag of dependent variable		0.649***	0.232***	1.191***		
		(0.049)	(0.084)	(0.027)		
Spatial lag of error				-2.074***		
				(0.044)		
Constant	408.194***					
	(179.995)					
sigma_e	66.783	64.422	62.686	54.797		
		(1.365)	(1.325)	(1.17)		

Note: ***=p<0.01, **= p<0.05, *= p<0.1. Parentheses represents standard error. Parentheses in standard panel model represents clustered standard error.

Table 6.8. *The Spillovers Effects of Estimation of Households' Net Wealth Determinants*

Variables	Direct Effect			Indirect Effect			Total Effect		
	SAR	SDM	GNS	SAR	SDM	GNS	SAR	SDM	GNS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
HH size	38.353	17.554	35.593	68.853	-25.979	136.713	107.206	-8.426	172.306
	(24.216)	(25.728)	(25.474)	(44.922)	(118.709)	(286.365)	(68.289)	(120.418)	(290.993)
HH head age	32.764**	14.643	8.821	58.819**	-89.486	176.309	91.583**	-74.843	185.129
	(16.641)	(23.705)	(21.974)	(29.513)	(67.437)	(119.453)	(45.214)	(62.034)	(123.105)
HH years of schooling	-9.492	-9.876	-18.338*	-17.041	-84.422	-85.799	-26.533	-94.298	-104.137
	(11.419)	(11.905)	(11.083)	(20.36)	(63.237)	(144.181)	(31.665)	(62.978)	(144.503)
HH head is married	-18.041	14.761	21.500	-32.387	-166.926***	31.516	-50.428	-152.165***	53.015
	(12.025)	(16.39)	(15.993)	(20.801)	(58.277)	(129.718)	(32.431)	(57.91)	(128.78)
HH head is male	3.099	2.810	-7.538	5.563	177.949**	160.016	8.662	180.759**	152.478
	(14.981)	(15.563)	(14.909)	(26.803)	(79.108)	(167.497)	(41.775)	(79.912)	(166.547)
HH head employment is agriculture	-10.259**	-9.953**	-10.913**	-18.417**	-36.826	-43.511	-28.676**	-46.779	-54.424
	(4.874)	(4.815)	(4.581)	(9.214)	(31.491)	(73.67)	(13.79)	(32.398)	(73.312)
Dependency ratio	-37.870***	-17.710*	-16.183*	-67.986***	-100.082*	373.648**	-105.856***	-117.792**	357.465**
	(9.002)	(9.879)	(9.354)	(19.434)	(57.542)	(151.644)	(26.452)	(57.788)	(152.676)
HH head is migrate	-3.881	-2.724	4.372	-6.968	14.247	-45.155	-10.849	11.523	-40.783
	(5.421)	(5.787)	(5.409)	(9.778)	(32.45)	(67.614)	(15.159)	(32.395)	(67.607)
HH head is migrate for work	10.195***	13.209***	5.290	18.302**	-6.279	-158.091***	28.497***	6.930	-152.801***
	(3.428)	(3.413)	(3.347)	(7.581)	(18.879)	(50.019)	(10.677)	(19.143)	(50.557)
Intergenerational transfer in days	-1.108	-1.178	-0.835	-1.989	-3.514	8.932	-3.096	-4.692	8.096
	(1.122)	(1.101)	(1.027)	(2.058)	(7.143)	(16.084)	(3.165)	(7.186)	(16.076)
Intergenerational transfer in money	1.159	0.292	0.192	2.081	13.296*	15.869	3.240	13.588*	16.061
	(1.349)	(1.398)	(1.301)	(2.385)	(7.529)	(15.933)	(3.719)	(7.566)	(15.937)
Distance to bus stop/terminal	4.432	2.560	4.042	7.956	0.114	-57.177	12.388	2.674	-53.135
	(2.77)	(2.728)	(2.601)	(5.22)	(22.33)	(56.112)	(7.893)	(22.976)	(55.548)
Distance to market	-8.359***	-7.623***	-7.766***	-15.006**	-4.325	51.257	-23.365***	-11.948	43.490
	(2.994)	(2.911)	(2.748)	(6.268)	(22.88)	(53.856)	(8.979)	(23.502)	(53.466)
Distance to bank	-0.390	-0.671	-0.635	-0.700	-44.201*	120.104*	-1.090	-44.872*	119.468*
	(3.088)	(3.023)	(2.876)	(5.54)	(22.963)	(65.247)	(8.627)	(23.631)	(64.951)
Distance to district capital/ *kabupaten*	-5.403***	-4.670	-4.820*	-9.700	0.157	-24.906	-15.104*	-4.513	-29.726
	(3.125)	(3.042)	(2.875)	(6.007)	(22.654)	(57.585)	(9.008)	(23.27)	(57.2)

Travel time to bus stop/terminal	-6.406***	-5.470	-7.169**	-11.500**	-6.978	67.144	-17.906*	-12.448	59.975
	(3.427)	(3.387)	(3.253)	(6.613)	(29.144)	(69.715)	(9.881)	(30.121)	(68.878)
Travel time to market	4.112	4.577	8.725**	7.382	30.371	-167.336**	11.494	34.948	-158.611**
	(3.932)	(3.857)	(3.735)	(7.287)	(32.913)	(79.903)	(11.159)	(33.835)	(79.296)
Travel time to bank	1.569	2.445	2.088	2.817	52.106**	-85.827	4.386	54.551**	-83.738
	(2.98)	(2.895)	(2.756)	(5.368)	(25.231)	(66.922)	(8.336)	(25.827)	(66.361)
Travel time to district capital/ *kabupaten*	3.284	1.664	0.358	5.895	-51.150**	78.347	9.179	-49.486*	78.705
	(3.598)	(3.491)	(3.329)	(6.615)	(25.972)	(69.216)	(10.17)	(26.642)	(68.973)
Electricity coverage	0.282***	0.200**	0.202**	0.505***	1.010	2.474	0.787***	1.209*	2.675
	(0.097)	(0.096)	(0.09)	(0.187)	(0.707)	(1.719)	(0.273)	(0.717)	(1.707)
Electricity duration	0.287	0.938	1.470	0.515	23.475**	-86.272**	0.801	24.413**	-84.802**
	(0.911)	(0.903)	(0.985)	(1.641)	(11.408)	(33.927)	(2.55)	(11.676)	(33.667)
Number of primary schools/SD	4.145	1.755	0.615	7.441	7.784	43.967	11.586	9.539	44.582
	(5.247)	(5.148)	(4.792)	(9.388)	(31.068)	(68.219)	(14.588)	(31.251)	(68.082)
Number of junior high schools/SMP	0.783	-0.401	3.203	1.405	-15.172	-53.768	2.187	-15.573	-50.566
	(5.463)	(5.496)	(5.197)	(9.822)	(36.622)	(85.679)	(15.284)	(37.345)	(85.184)
Number of senior high schools/SMA	0.287	-2.063	-2.415	0.516	60.537*	-7.567	0.803	58.474	-9.982
	(4.665)	(4.635)	(4.385)	(8.37)	(36.462)	(85.485)	(13.035)	(37.338)	(84.657)
Number of community health centre/ *puskesmas*	-3.740	1.486	-2.476	-6.714	-51.767***	38.232	-10.454	-50.281***	35.757
	(3.011)	(3.568)	(3.172)	(5.274)	(12.72)	(25.329)	(8.217)	(11.919)	(25.949)
Number of integrated healthcare posts/ *posyandu*	2.728	2.309	4.140	4.897	39.072*	-24.630	7.625	41.380*	-20.490
	(3.7)	(3.92)	(3.659)	(6.668)	(22.744)	(52.148)	(10.339)	(22.869)	(51.858)

Note: ***=p<0.01, **= p<0.05, *= p<0.1.

The focus of interpretation from a spatial model cannot be directly interpreted from the coefficient of estimation due to the non-linearity of the data generating process, hence, interpretation is from the marginal effect of the dependent variable from its regressors (LeSage & Pace, 2009). Comparison between direct and indirect effects in the SDM show the spillover effect has a higher influence than the direct effect. It indicates when considering spatial lag in the covariate and outcome, the change of household net wealth in one region is largely influenced by the change of variables in neighbouring regions, averaging from all neighbouring values.

Comparing the significance of variables, more variables have a significant contribution in the direct effect than in the indirect effect. This pattern raises the importance of the development of indicators in one region as it significantly influences households in the region and, at the same time, creates a spillover effect to neighbouring regions.

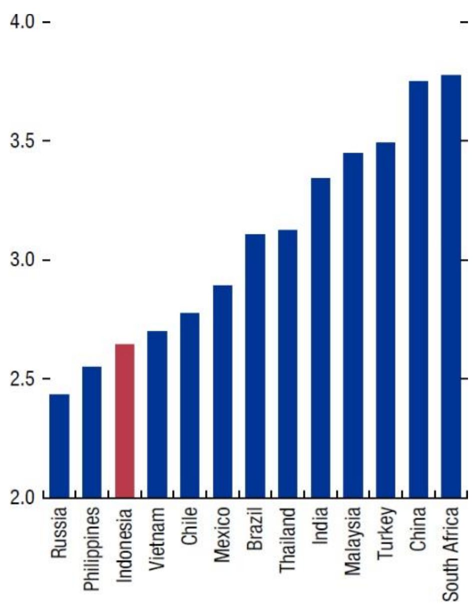
Comparison of the signs of the coefficient shows some variables have different directions in the direct and indirect effects. The condition might be caused by the heterogeneity of regions that give a variety of effects from the change of variables. This heterogeneity in the sub-national level then gives no discernible effect on the country's national-level economic performance (Pepinsky & Wihardja, 2011).

One example is the variable of household size has a positive direct effect, but a negative effect in the indirect effect. This condition might be caused by the heterogeneity at the sub-national level in form of the high prevalence of child marriage in some areas of Indonesia (Badan Pusat Statistik & Kementerian PPN/Bappenas, 2020; Unicef, 2001, 2020). Hence, the high prevalence of child marriage, which seemed like a way to exit poverty, will give a positive effect on household well-being in a certain region but have a negative impact on other households in neighbouring regions due to higher competition to access resources, therefore raising the commodities price.

The next example is the variable of the number of the community of health centres/ *puskesmas* that has a positive direct effect but a negative (and significant) indirect effect. This different effect might be related to the unequal distribution of the community health centres due to the large area and low population number outside Java and Bali Island but dense population and the availability of private healthcare services in Java and Bali as an alternative for government-owned community health centres/ *puskesmas* (Kementerian Kesehatan Republik Indonesia, 2016, 2020). Hence, the population in certain areas gain benefits from the community of health centres in the area which can benefit them by reduced healthcare costs, but has a negative impact on the development of the community of health centres in the other areas as this can be an indicator of the availability of private healthcare services and therefore can raise healthcare costs.

The heterogeneity is a by-product of economic progress and the influence of the endowment, and it is difficult to isolate a single factor that is solely responsible for its existence. Among the combination of factors, the first is Java-centrist development. For decades, Java has been a centre for political and governmental activities and economic growth centres. As a result, there is an infrastructure gap between Java and outside Java where Java enjoys a more advanced infrastructure than its counterparts. The infrastructure gap increases distribution costs, inhibits industry competitiveness, weakening macroeconomic conditions, limiting foreign direct investment flows, and reducing export competitiveness (World Economic Forum, 2018). Curristine, Nozaki, and Shin (2018) found the logistics costs in Indonesia are among the highest in Asia, reaching 25 percent of GDP (compared with peer's 13-20%) because of weak connectivity within the island and to other islands. Indonesia's infrastructure gap remains large compared with other countries, especially related to trade and transportation infrastructure (see Figure 6.5).

Figure 6.5. *Trade and Transport-Related Infrastructure, 2016. (Index: 1=low, 5=high)*



Source: Curristine et al. (2018)

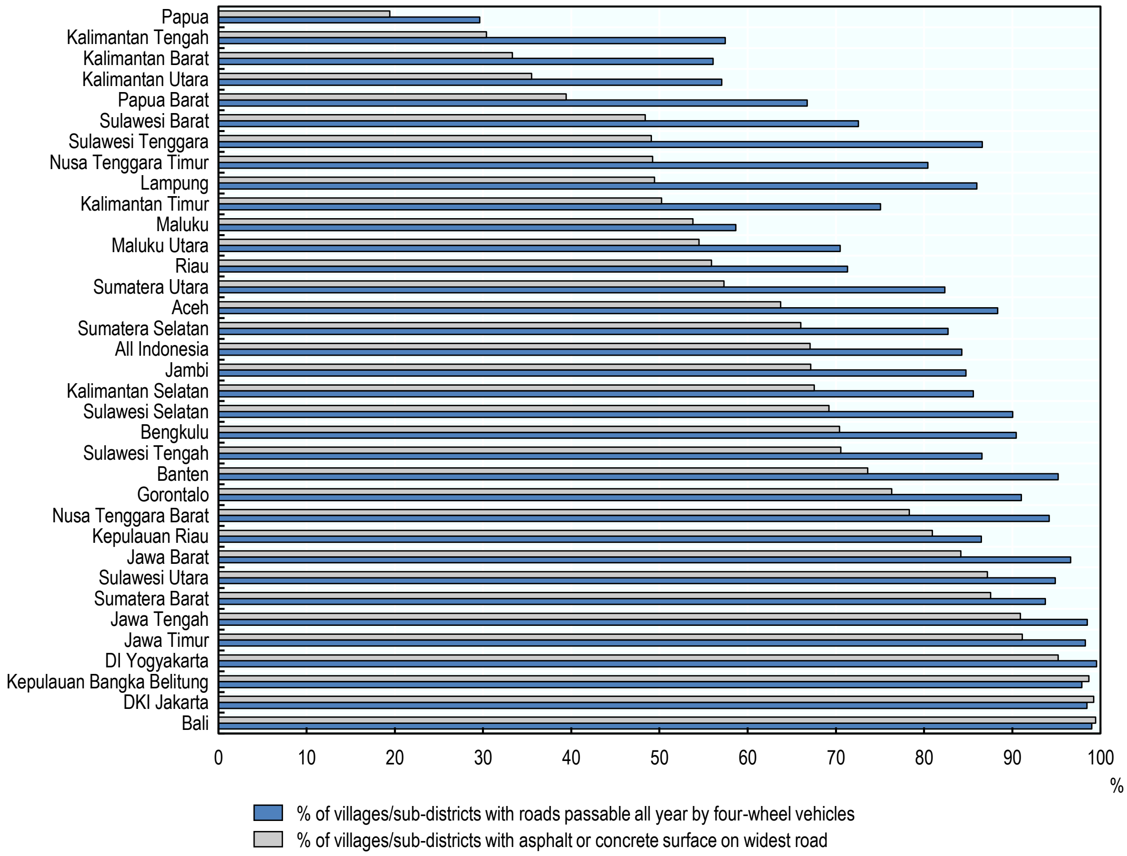
The second factor is the unequal distribution of population in Indonesia. With only 7 percent of the total Indonesian area, Java is home to more than half of the Indonesian population and has the highest population density in Indonesia of 1,055 people per km^2. Java Island is culturally, politically, and economically Indonesia's most important island. Its fertile land comes from more than 30 active volcanoes along Java's central ridge. From time to time the volcanoes erupt, spewing out lava that eventually becomes fertile soil in the warm and humid valleys and on the coastal plains. The dense population in Java reflects a potential market for firms and a potential source for labour. However, this condition also brings high pressure and competition for its population to find proper jobs, sufficient earnings, and adequate nutrition and education (Franke, 1974; Rahayu & Mardiansjah, 2018; Suryadarma et al., 2006). The combination of unequal population distribution and the infrastructure gap leads to the different magnitudes of deprived conditions between regions. For example, provinces in eastern Indonesia suffer a high rate of poverty compared to its counterparts in western Indonesia with a poverty rate of 20 percent in Maluku, West Nusa Tenggara, East Nusa Tenggara, and around 30 percent in Papua. However, only 11 percent of Indonesia's poor live in these provinces. In Java, where poverty is just over 10 percent on average, 55 percent of the Indonesian population live (Alatas & Wai-Poi, 2015).

The third factor is the inequality in the distribution of land tenure and ownership (Firdausy, 1986; Rachman, 2013; Shohibuddin, 2019). Data from the United States Department of Agriculture (2020) shows Sumatera Island contributes 58 percent of the world's palm oil production, and of that 60 percent comes from only three provinces in Sumatera. Java Island supplies more than 51 percent of national rice production and causes Indonesia to produce 7 percent of rice world's production. The inequality in the distribution of land tenure and ownership in Sumatera is shown by large corporations which control a large proportion of farmland for monocultural plants, for example, oil palms, rubber, and coconut. In Java, inequality occurs as a result of the patron-client relations that have lasted for centuries (Subroto, 1985). The inequality brings the economic benefits of agriculture in Java and Sumatera to be largely enjoyed by only a few parties (Firdausy, 1986; Shohibuddin, 2019).

The fourth factor is the heterogeneity in ethnicities and cultures in Indonesia that can bring different perceptions and responses to a certain policy. For example, the implementation of *keluarga berencana* (family planning) programme in Indonesia enabled to halve the total fertility rate (TFR) in four decades, from 5.666 in 1960 to 2.512 in 2000 but is disrupted with the high prevalence of women aged 20-24 who are married or living together before age 18 generally found in the provinces in eastern Indonesia (Badan Pusat Statistik & Kementerian PPN/Bappenas, 2020; Unicef, 2001). One main driver of the practice of child marriage is the perception that, in terms of economic and financial consideration as well as family honour, the sooner women are married the better (Salenda, 2016).

The fifth factor is the change of economic structure in Indonesia in recent years that is indicated by the declining role of the industrial sector in Java and the increasing role of natural resource extraction outside Java (Kuncoro, 2006; Mansur, 2008; Tadjoeddin, 2019). Kuncoro (2013) identified the better performing provinces are those that are resource-rich, densely populated, or better connected to the global economy. All those factors, except the last, are considered endowment factors. Hence, regions with limited resources and less dense populations will rely on connection for information exchange (e.g. through internet and cellular coverage), and commodity transportation (e.g. sea, air, and land transport). However, some regions are unable to enjoy high economic growth due to a lack of connectivity, shown by adequate roads. Villages or sub-districts with a low percentage of adequate roads are commonly found outside Java and Sumatera Islands. As a result, the gap also brings differences in well-being, for example, measured by income, wealth or access to health and education (Suryadarma et al., 2006; Tadjoeddin, 2019) (Figure 6.6).

__Figure 6.6.__ Villages and Sub-districts in Indonesia with Access to Quality Roads by Province, 2014.



Source: OECD (2018)

Based on empirical results, this paper has not been able to achieve a solid conclusion on the effects of household and community characteristics that directly and indirectly influence household net wealth in Indonesia with respect to spatial aspect. As this condition might be caused by the heterogeneity of the endowment at the sub-national level, the focus of policy should be given to variables that do not give a solid conclusion of the effect of direct and indirect effect. This condition is also an indicator of the development gap between regions. Thus, development in the local context is an important dimension for Indonesia, as one of the world's most diverse economies, to achieve higher well-being at the national level.

6.5. Conclusions

This chapter provides an example of an investigation of the contributors of household net wealth when households are spatially concentrated, and the determinants of household net wealth are spatially correlated with other households in the same region and neighbouring regions. Results of development in the last decades bring the household net wealth in Indonesia spatially concentrated in certain areas, with a declining concentration existing during 1993-2014 with the change of household net wealth, largely caused by the distributional effect. Some variables give no solid conclusions about their direct and indirect effect on household net wealth. This is likely to be caused by the heterogeneity at the sub-national level.

This research is not free from limitations. Related to the data source, even though the IFLS contains rich information regarding household and community characteristics, it is considered to have a smaller sample size than *Susenas* (Dong, 2016) and to have excluded most eastern Indonesian provinces, which are considered underdeveloped compared to their western counterparts (Erlangga et al., 2019). While the observation of 21 years provides a comprehensive picture of Indonesian household well-being in a long period, sub-period analysis is interesting as it facilitates an examination of the period-specific events, for example, 1997/1998 Asian Financial Crisis and general election would be obscured in a longer-period analysis. Future studies may consider including potential determinants that influence household net wealth in sub-national level, for example, labour market, political aspect, local tax and regulations, and geographical features.

Chapter 7. Conclusion

The thesis comprises four interrelated chapters that help provide an up-to-date understanding of the measurement of household net wealth in Indonesia, as a proxy for the standard of living, and the consequential effects on the distribution of net wealth. Observations of the measurement of inequality and the examination of the determinants of household net wealth in Indonesia is important, particularly for a developing country that needs strategies to increase both household standard of living, and the equitable distribution of that economic development, in a geographically challenged archipelagic area.

The thesis helps fill a number of research gaps and provide some evidence-based policy options. Firstly, the thesis the applies Dagum Type III model to measure the inequality of household net wealth when some observations involve negative values. Secondly, it uses decomposition of the half squared coefficient of variation (½CV^2) to measure interprovincial inequality and considers whether the 'club convergence' approach shows that, although not all areas are converging to one point (or place), clubs or groups are converging to a range of outcomes (places) over time. Thirdly, the thesis uses quantile regression methods to consider how the influence of unobservable heterogeneity in the form of age, ethnicities, family structure, and human capital, may influence the determinants of household net wealth. Fourthly, the thesis utilises a Spatial Durbin Model (SDM) to estimate the spatial interaction of the determinants of household net wealth in Indonesia that can be influenced not only by changes in the same region but also in neighbouring regions.

Results from Chapter 3 show that estimation of the Dagum Type III model produces results that show the condition of classes and can be converted into a Gini Coefficient interpretation. By considering the Gini Coefficient and the value of the relevant parameters, the inequality of household net wealth in Indonesia was found to be declining during the period 1993-2014, with high inequality associated with high inequality in the lower, middle, and upper household classes with less dispersion of net wealth distribution, which also a common pattern for developing countries. Comparing to the Gini Coefficient of income and expenditure, the Gini Coefficient of household net wealth is larger, indicating that the inequality of household net wealth in Indonesia is worse than the inequality of income or expenditure. Hence, policymakers should give more attention to the inequality of household net wealth and give priority to reducing inequality in the lower, middle, and upper household classes as it can support the reduction of total inequality.

By using the decomposition of the half squared coefficient of variation (½CV^2), Chapter 4 shows that declining inequality in Indonesia during the period 1993-2014 is accompanied by increasing inequality within provinces. This plays a dominant role in influencing total inequality rather than inequality between provinces. By distinguishing analysis by *on* or *outside* Java Island, inequality within provinces in Java Island is shown to be worsening, in contrast, inequality within provinces outside Java shows a declining trend during the period 1993-2014. Further, the application of the club convergence approach shows the convergence of growth of household net wealth in Indonesia is generated by a 'two clubs' explanation where the first club is dominated by provinces on Java Island that have relatively higher household net wealth growth than the second club, that consists of provinces outside Java. Therefore, efforts to reduce total inequality could be achieved through reducing inequality within province focusing on regions outside Java Island.

In Chapter 5, the use of quantile regression methods highlights the role of unobservable heterogeneity (e.g. in the form of age, ethnicities, family structure, and human capital) in influencing household net wealth and reveals variations in the effect of change across different classes. This Chapter considers the importance of interventions to increase household net wealth in Indonesia, considering the effects on household classes focusing on three important contributors, namely demographic, education, and the development of urban and rural areas. In the demographic space, household size has a negative effect on household net wealth with a higher effect found in higher deciles. While in the education space, years of schooling positively contribute to household net wealth with an increasing effect for higher deciles. Finally, living in an urban area is beneficial for household net wealth with an increasing effect for higher deciles. Therefore, policy interventions to increase household net wealth should use estimations that permit observation for classes than models that concentrate on the average value as the change in one aspect can give different effects and magnitude on net wealth across household classes.

Chapter 6 considers the influence of spatial factors in the estimation of the determinants of household net wealth in Indonesia. Estimation of spatial autocorrelation using Moran's I show that the concentration of household net wealth in Indonesia led to a decline in concentration during the period 1993-2014. If we consider Moran's scatter plot that shows the cloud of distribution, a high proportion of household net wealth is concentrated in the lower-left quadrants and reflects the low-low spatial autocorrelation during the period 1993-2000. The cloud becomes even more scattered to the lower-right quadrants during the period 2007-2014 which suggests that more households can increase their net wealth and leave other households in a low condition of net wealth. Comparison of Moran's I between island groups shows a declining coefficient for Java, Sumatera, and Kalimantan, suggesting a reduction in the spatial autocorrelation of household net wealth, in those islands.

By applying the Spatial Durbin Model (SDM), the Chapter shows that the effect of the change of household net wealth in a certain area, due to a change of variables in neighbouring regions, is higher than the change of variables in the same regions. The application of the SDM also reveals the heterogeneity in the regions that can give a variation in effects on household net wealth, shown from the signs, degree, and significance of the coefficient. For example, the variable 'household size' has a positive direct effect, but a negative effect via the indirect effect that might be caused by the heterogeneity in the households' perception of head of a large household, due to children and marriage, and the socio-economic effect among Indonesian households. For these reasons, policymakers should consider the inclusion of spatial aspect in the policy-making process related to efforts to increase household net wealth to capture spatial interactions between regions, as the existence of spatial interactions and heterogeneity in the regions cannot be captured if estimation ignores spatial aspects.

Putting the empirical findings from Chapter 3 to 6 together, I find that differences in household net wealth in Indonesia, which represents the standard of living, is caused by the heterogeneity of socio-economic conditions across household classes and space and location. Therefore, policies to reduce inequality of household net wealth in Indonesia should be aimed to reduce the gap between household classes and between regions that can be achieved through development in sectors (e.g., education, health) and interregional relationship (e.g., build infrastructure to connect regions). Further, findings from this thesis can be extended beyond the case of Indonesia as other developing countries should also be aware with the existence of households debts as they can lead to household's negative net wealth and worsening the inequality.

As with any research on the frontiers of knowledge, it is not free from limitations. The dataset used exclusively in this thesis is the Indonesian Family Life Survey (IFLS). The IFLS is rich in information on households and on community-level effects but lacks information on the condition of the regions in the eastern part of Indonesia. When the first wave of IFLS was first fielded in 1993, the baseline survey covered 13 provinces of Indonesia and excluded most of the eastern part of Indonesia primarily based on cost and security considerations. An attempt to survey Eastern Indonesia was only undertaken in IFLS EAST in 2012, based upon information from 2,500 households in 7 provinces of Nusa Tenggara Timur, Kalimantan Timur, Sulawesi Tenggara, Maluku, Maluku Utara, Papua Barat, and Papua. In the future, therefore, the availability of high-quality longitudinal household data for the eastern part of Indonesia would be a valuable resource to provide a deeper understanding of the characteristics and dynamics of the Indonesian population.

Secondly, not all measurements in the analysis of inequality in income or expenditure can be used in the analysis of net wealth inequality due to the occurrence of negative values. An example is the Palma Ratio that enables the detection of the precise location of the household classes where worsening inequality would provide a more interesting story than the popular Gini Coefficient but is only applicable for positive values. Hence, room to implement measures that can include negative values in the inequality estimation is still open for future studies.

Thirdly, the thesis suggests findings at the macro-level and long-term periods in Indonesia. While the observation of the condition, at the national level, for the 21 years provides a comprehensive picture of Indonesian household well-being, analysis at the sub-national and subperiods will give an interesting story, as it facilitates the examination of the period-specific events in certain regions, considering the heterogeneity of Indonesia as a case study. Future studies may include region-specific features that potentially influence household net wealth in the region, for instance, social capital, labour markets, tax and regulations, and geographical features.

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Appendix A. Model Selection

Measurement of household net wealth inequality should choose the one model that is most suitable to represent the data from common models used to measure net wealth inequality, that is Dagum Type III, Singh-Maddala, and Generalized Beta II, as suggested in Brzeziński (2013), Clementi et al. (2018), and Cowell and Van Kerm (2015). The model selection is achieved through visual and numerical tests. The visual test compares graphs produced by each model with the graphs from the empirical data with the best model being the model that gives the closest estimation to the data. The closer the prediction, the more reliable the model is to predict wealth inequality. However, this approach makes it difficult to distinguish between many graphs precisely, especially if they have quite similar results (Figure A.1)

The numerical test using the maximum likelihood method following Brzeziński (2013) is made to overcome the limitation of visual tests that hardly distinguish between very similar graphs. In the maximum likelihood method, the Dagum model has the smallest log-likelihood, therefore this model is suitable to predict household net wealth inequality in Indonesia (see Table A.1).

To confirm the findings of the maximum likelihood method, the Wald test is conducted, that is to test the unrestricted and restricted model (Brzeziński, 2013). The null hypothesis is that Generalized Beta II is no different from Dagum Type III or Singh-Maddala. When comparing Generalized Beta II and Dagum Type III, we reject H_0 because of p-value < 0.05 only for 2000. Thus, Generalized Beta II is different from Dagum Type III for 2000 and Generalized Beta II is not different from Dagum Type III for other years. For comparison between Generalized Beta II and Singh-Maddala, we reject H_0 because p-value < 0.05 for 1993 and 2007, meaning that Generalized Beta II is different from Singh-Maddala in 1993 and 2007. For 1997 and 2000 we cannot reject H_0, which means Generalized Beta II is not different from Singh-Maddala (Table A.2)

Figure A. 1. *Adaptive kernel density Indonesian wealth distribution, 1993-2014*

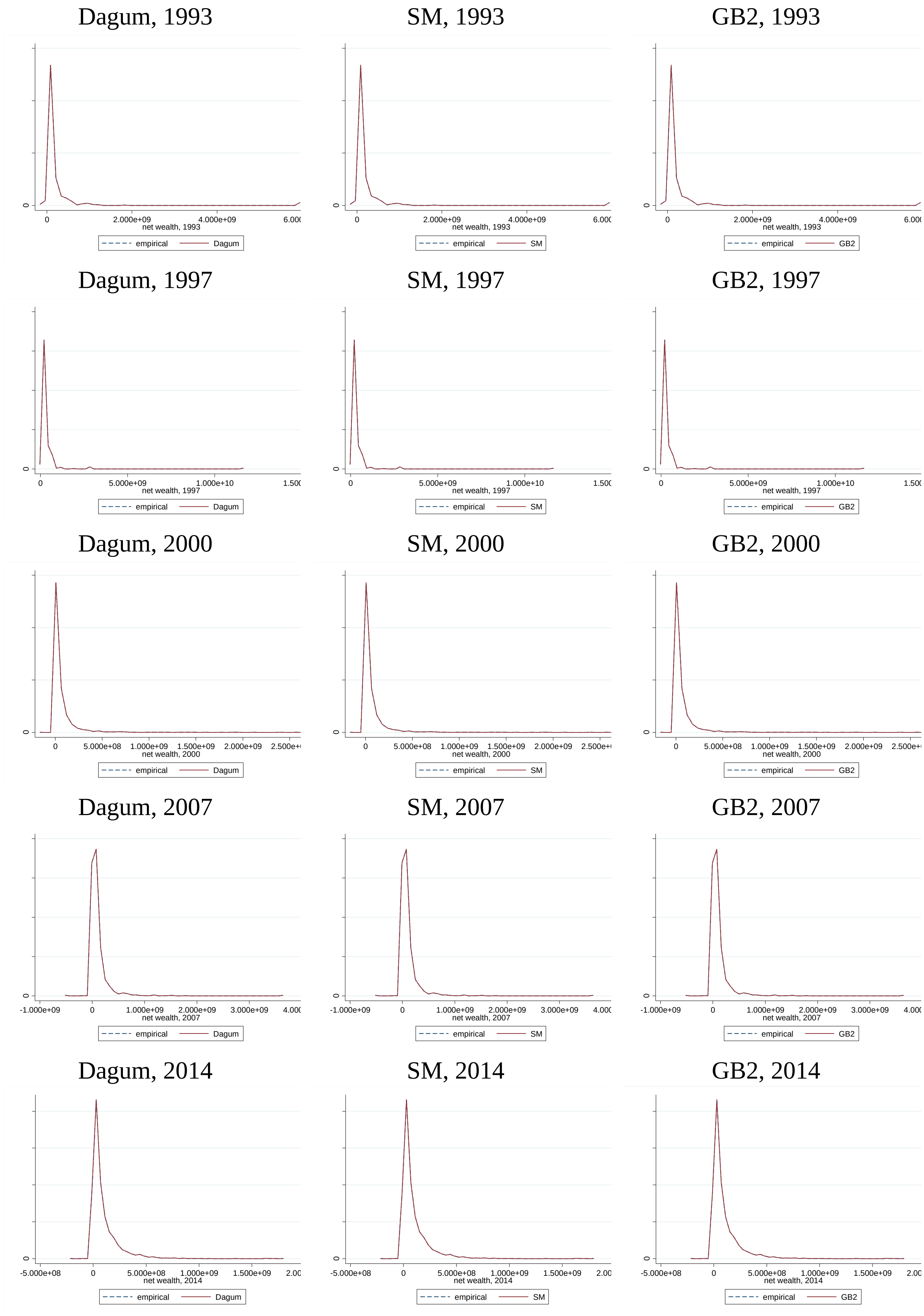

Table A. 1. *Maximum Likelihood Estimates*

Years	Parameters	Dagum	SM	GB2
1993	a	1.329***	0.682***	1.048***
		(0.041)	(0.014)	(0.141)
	b	45,878,375***	133,900,000***	59,322,757***
		(2,833,200)	(29,544,272)	(11,437,564)
	p	0.43***		0.571***
		(0.021)		(0.095)
	q		3.384***	1.485***
			(0.369)	(0.348)
	Log-likelihood	-71,687.423	-71,690.729	-71,685.833
1997	a	1.333***	0.942***	0.887***
		(0.033)	(0.019)	(0.101)
	b	54,782,265***	76,419,957***	67,108,864***
		(3,221,494)	(8,616,006)	(7,968,501)
	p	0.646***		1.14***
		(0.031)		(0.194)
	q		1.836***	1.892***
			(0.131)	(0.359)
	Log-likelihood	-93,014.799	-93,005.729	-93,007.016
2000	a	1.42***	1.023	0.874***
		(0.035)	(0.021)	(0.098)
	b	50,569,229***	69,557,072	81,352,849***
		(2,812,207)	(7323300)	(15,015,891)
	p	0.667***		1.248***
		(0.032)		(0.198)
	q		1.805	2.387***
			(0.13)	(0.527)
	Log-likelihood	-93,409.529	-93,398.772	-93,397.683
2007	a	1.627***	0.983***	1.252***
		(0.041)	(0.02)	(0.13)
	b	73,555,099***	127,400,000***	93,996,102***
		(3,321,726)	(16,005,336)	(12,435,217)
	p	0.532***		0.728***
		(0.024)		(0.096)
	q		2.509***	1.589***
			(0.216)	(0.306)
	Log-likelihood	-92,523.790	-92,522.994	-92,520.367
2014	a	1.865***	0.802***	148.615***
		(0.058)	(0.015)	(0.008)
	b	126,800,000***	1,579,000,000***	134,200,000
		(5,612,186)	(707,100,000)	(0)
	p	0.369***		-479.801
		(0.018)		(0)
	q		11.653***	0
			(3.54)	(0)
	Log-likelihood	-94,992.255	-94,942.912	467,100,000.000

***Table A. 2**. Test for Unrestricted Model (GB2) and Nested Model (Dagum and Sing-Maddala)*

Years	GB2 vs Dagum		GB2 vs Singh-Maddala	
	Chi-square	**p-value**	**Chi-square**	**p-value**
1993	1.95	0.1627	20.22	0.0000
1997	6.18	0.0129	0.52	0.4695
2000	6.92	0.0085	1.57	0.2100
2007	3.71	0.0540	8.08	0.0045
2014	-	-	-	-

Note: ***=p<0.01, **=p<0.05, *=p<0.1

Table A.1 shows no results available for the year 2014 indicating Generalized Beta II failed to provide estimation (convergence is not achieved). Lack of convergence is an indication that the model did not fit the data well, hence the Generalized Beta 2 is not suitable to explain data (Kleiber, 1996). Findings shown in Table A.2 support results in Table A.1 that Generalized Beta II is not better than Dagum Type III or Singh-Maddala in describing data. Therefore, Dagum Type III is the most suitable model to measure the inequality of household net wealth in Indonesia.

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Chapter 3: An Application of the Dagum Type III Model to Measure Net Wealth Inequality in Indonesia

Nature of contribution by PhD candidate	Conceptualising idea, designing the study, cleaning data, estimating data, writing draft
Extent of contribution by PhD candidate (%)	85

CO-AUTHORS

Name	Nature of Contribution
Professor Les Oxley	Guidance, critical feedbacks
Dr. Susan Olivia	Guidance, critical feedbacks on writing technique, data cleaning, chapter presentation

Certification by Co-Authors

The undersigned hereby certify that:

- the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co-authors; and

Name	Signature	Date
Professor Les Oxley	[signature]	16/10/21
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Chapter 4: Interprovincial Wealth Inequality by Factor Components in Indonesia

Nature of contribution by PhD candidate	Conceptualising idea, designing the study, cleaning data, estimating data, writing draft
Extent of contribution by PhD candidate (%)	85

CO-AUTHORS

Name	Nature of Contribution
Professor Les Oxley	Guidance, critical feedbacks
Dr. Susan Olivia	Guidance, critical feedbacks on writing technique, data cleaning, chapter presentation

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Chapter 5: The Role of Household Characteristics and Intergenerational Transfer in Households Net Wealth in Indonesia: Evidence from a Quantile Regression Approach

Nature of contribution by PhD candidate	Conceptualising idea, designing the study, cleaning data, estimating data, writing draft
Extent of contribution by PhD candidate (%)	85

CO-AUTHORS

Name	Nature of Contribution
Professor Les Oxley	Guidance, critical feedbacks
Dr. Susan Olivia	Guidance, critical feedbacks on writing technique, data cleaning, chapter presentation

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Chapter 6: Estimating Spatial Panel Data Model for Households Net Wealth Determinants in Indonesia

Nature of contribution by PhD candidate	Conceptualising idea, designing the study, cleaning data, estimating data, writing draft
Extent of contribution by PhD candidate (%)	85

CO-AUTHORS

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