Changes in population structure and household consumption inequality in Jakarta-West Java and Central Java

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Abstract

Indonesian income distribution measured in the Gini ratio has been improving since 1990 gradually. The paper tries to find out the factors that changed the ratio by using Jakarta, West Java and Central Java data of the Susenas survey. Firstly, using Susenas individual household data, variances in logarithm of individual household consumption level is calculated for years 1992, 1996, 1999, and 2003. Then, the paper tries to decompose changes in the variances from 1992 to 2003 into three components, population effect, income effect within same age groups, and income effect among different age groups. This decomposition indicates that the rises in variances were originated from the first effect, while the declines in variances were originated from the last two effects. Secondly, the paper investigates the population effect in detail and finds the following two important facts: (1) inequality increases gradually from age 23 to around age 55 and (2) inequality for ages 30 to 50 increases sharply. Due to the declining population growth rate and the expanding life expectancy rapidly since the 1980s, the population structure by age has been changing rapidly in Indonesia. The results imply that the shares of population for older generations will go up and their weights on inequality will get larger. The population structure shifting towards an aging society will push up inequality and will be a large factor to push up over-all inequality in the country.

Keywords: Income distribution, Indonesia, Population structure.
JEL Categories: D12, J14, O53

1. Introduction

The last three population censuses of Indonesia show that population growth rates were 1.97% from 1980 to 1990 and 1.49% from 1990 to 2000 (BPS [1980, 1990] and BPS [2000]). They also show that life expectancy went up to a great extent. As a result, the share of population below age 15 went down considerably. On the other hand, the share of population for ages 15 to 64 went up from 55.8% in 1980, to 59.6% in 1990, and to 65.0% in 2000. Also the share for ages 65 and over rose from 3.3% in 1980 to 4.5% in 2000 as this age group's number increased from 4.77 million in 1980 to 9.13 million in 2000 (BPS [2004], 49). These changes can be partly attributed to the decline in birth rate and partly expansion of life expectancy from 1980 to 2000. [1] These changes in population structure have not yet been reflected clearly on age structure of household heads, but they will be apparent sooner or later.

According to the analyses of Deaton and Paxson (1994) and Ohtake (2005), the effects of a changing population structure on inequality are as follows: As for inequality within an age group, inequality increases in a specific age group with advance in age and go up especially in ages 40 to 50. When people are in the twenties, their income levels are more or less same partly because their skill and experience levels are still low, and partly because their positions are still low in their work places. Even if there are some income differences among them, they do not think that the differences will persist forever and their consumption patterns will not differ considerably from others. As people enter their forties, their income levels will heavily depend on their educational attainment, what skills they obtained, which positions they attained, and what efforts they made when they were in twenties and thirties. Their income levels will also depend on their health conditions, employment situations and relationship with other people. Their lifetime income levels will also differ depending on disasters and accidents they go through. Also some people may obtain assets and property by inheritance from their parents when they are around in ages 35 to 45. For these reasons, inequality within an age group will get larger as the group ages.

[1] In the span of 20 years (from 1980 to 2000), birth rate declined from 34 to 22 persons per 1,000 people and life expectancy increased from 55 years to 66 years. As a result, population growth rate declined from 2.04 percent per annum in 1980 to 1.30 percent in 2000 (World Bank [2003]).

In the following, existing research works on inequality are briefly reviewed. The studies on inequality in Indonesia can be summarized into five areas. The first area pays attention to inequality between urban and rural income levels and investigates whether or not inequality has declined since 1980. The second area of the studies is related to inequality among provinces and investigates if inequality between provinces has declined with the development of Indonesian economy. Although the second one is closely related the first area of studies, the former puts more focus on inequality among provinces and especially between industrialized Jakarta and the other provinces. The second area's main concern is to investigate what factors lead to regional development. Contrary to the first and second areas which focus on regional inequality, the third one studies changes in inequality among different income groups during the rapid economic development in the 1980s and 1990s. It divides the entire Indonesian population into five deciles and analyzes which deciles get least income along with economic development The forth one, which can be classified as a part of the third one, puts an emphasis on the effects of the Asian financial crisis on inequality and which income groups suffer most in the 1997-1998 period. And finally, the last area studies effects of education and human capital on inequality.

Akita et al. (1999) investigate both within provincial inequality and inter-provincial inequality and describe that the inter-provincial inequality has not been a major factor in overall national inequality. Inter-provincial inequality accounted for only 4-5 percent of the total expenditure inequality. Instead, they point out the focus should be more on within-province inequality rather than inter–provincial inequality in order to reduce overall national inequality. They also indicate that inequality within a province originates mainly from the differences between urban and rural areas, and within-province inequality is the real issue which has to be dealt with.

Since the 1970s, importance of using price levels to deflate consumption expenditure for measuring inequality among provinces was already mentioned by Arndt and Sundrum (1975). This is mainly because consumption expenditure varies considerably from one province to another and between urban and rural areas. But due to the difficulty in obtaining price level statistics separately for each study area, the price levels were not taken into account in most of the studies. For example, the study done by Akita et al. (1999) mentioned above utilizes non-deflated nominal household consumption expenditure. Unlike previous studies, Suryadarma

et al. (2005) took regional price levels into account for their analysis. They found that (1) inequality between urban and rural areas was relatively lower than the inequality between the rich and the poor in each area; (2) the bottom deciles experienced the greatest positive growth from 1984 to 2002 and the growth rates were lower in the higher deciles; (3) inequality was the lowest in 2002, but total expenditure of the poorest 20 percent only accounted for 9 percent of entire household total expenditure. As indicated in their analysis, they obtained significantly different results form the studies based on the nominal prices.

Even though Susenas data is used for estimation of poverty lines, failure to account for cost of living differences between urban and rural areas properly may lead to inconsistent poverty lines (Asra [1999]). That in turn may result in misleading poverty figures and may suggest unwarranted policy interventions. The official statistics shows that the price difference between urban and rural areas was 28 to 52 percent in the 1987-96 periods. However, detailed investigation discloses that the difference was only 13 to 16 percent. The poverty line would be significantly different from the official ones if the above difference is used for estimation of poverty lines.

During the period of economic crisis in the 1997-1998, price levels changed extremely. Changes in price levels of food items were the most important factor which affected economic conditions for individual households and inequality. Using district level GDP and population data, Akita and Alisjahbana (2002) concluded that overall regional income inequality increased significantly over the years 1993 to 1997, when Indonesia achieved an annual average growth rate of more than 7 percent. The increase was mainly due to a rise in within-province inequality, while a quite stable regional inequality was maintained over the same period. Within-province inequality played an increasingly important role in the determination of overall regional income inequality. The results suggest that it would be very misleading to base a judgment about whether regional inequality is increasing or decreasing solely upon provincial data especially when economy is changing very rapidly. As for changes in inequality during the economic crisis, similar results are also obtained from the other studies. For example, Suryahadi and Sumarto (2003) indicated that not only did the poverty rate increase significantly, but much of the increase was due to the increase of the chronic poor category. As a result, the chronic poor who made up only 20 percent of total poor before the crisis increased to 35 percent of the total poor in 1999. Suryahadi et al. (2003) state that the poverty rate increased from the lowest point of approximately 15 percent at the onset of the crisis in the middle of 1997 to the highest point of approximately 33 percent nearing the end of 1998. The maximum increase in poverty of 18 percentage points during the crisis implies that appropriately 36 million additional people were

pushed into absolute poverty due to the crisis, albeit temporarily. Pradhan et al. (2000) and Skoufias et al. (2000) also found that there was a considerable drop in the welfare of Indonesian households during the first year of the economic crisis. Average per capita expenditures declined significantly and at the same time inequality increased.

As for the correlation between changes in inequality and growth, there are seemingly opposing positions between growth and equity. The poor typically do share in the benefits of rising affluence, but, at the same time, they typically suffer from economic contraction. The results may differ depending on the initial conditions between countries, and between regions, that create sizable differences in how much the poor share in aggregate growth or contraction (Ravallion [2001]). The data show that inequality in Indonesia has not increased markedly with development. Although urban inequality has increased, this change has largely been offset by declines in rural inequality. Indonesia can be considered to be lucky in the sense that the country's industrial center happens to be very close to rural Java where many of country's poorest families reside. These households have benefited from the off-farm employment opportunities that industrialization has offered. In this way the inequality between rural households in the Outer Islands and rural households in Java has been reduced (Cameron [2002]).

The studies indicated so far focused mainly on inequality between urban and rural areas, between provinces, and between the capital metropolitan area and the rest of the country. Inequality is not simply created by these spatial differences, but it is also created by economic variables the areas receive such as levels of private investment, levels of infrastructure investment, educational levels of people and others. Akita et al. (1999) found that education is a significant determinant of expenditure inequality and that education accounted for 30-33 percent of total inequality. Cmareon (2000) also obtained similar results. Increased educational attainment was the single largest determinant of the inequality increase, although its effects were tempered somewhat by the associated decrease in returns to education. The movement of workers out of agriculture was a further factor contributing to the higher level of inequality in 1990. Low productivity of the agricultural sector is one of the important factors which contributes inequality.

Akita et al. (1999) also investigated expenditure inequality among different age groups and described that expenditure disparity among them was not significant in the overall level of inequality because its component accounted for only 4-5 percent of total expenditure inequality. However, inequality with respect to this aspect has not been investigated intensively in studies partly because population growth rate is still high and partly because population share of elder

people is still low compared to the industrialized countries. In addition, because the directory observable issues with respect to inequality have been income differences between provinces and between urban and rural areas, major concerns are to deal with them. In the 1990s, inequality measured by the Gini index declined from 0.335 in 1993 to 0.308 in 1999. Although it increased slightly from the 1999 level to 0.329 in 2002, it has been basically on the declining trend since 1990. In this long-run trend, it is not clear how changes in population structure affect inequality. In this paper, we will investigate effects of a changing population growth rate and expansion of life expectancy on inequality in Indonesia.

So far few studies have seriously looked into an effect of changing Indonesian population structure on inequality. When population and GDP growth rates are still high like Indonesia in comparison to the industrialized countries, the effect of a changing population structure will not be very serious and clearly visible. But as indicated in the earlier part of this section, Indonesian population growth rate is slowing down rapidly and the country may face an inequality problem related to an aging population structure.

The following section describes possible effects of an aging population on inequality in detail and then develops an analytical framework to estimate effects of the population structure and consumption expenditure on inequality. The third section clarifies firstly the data sets to be used and the regions to be investigated. The section then decomposes changes in inequality from 1992 to 1996, from 1992 to 1999, and from 1992 to 2003 to population effects, income difference within age groups, and income difference between age groups. In section four, analysis will be focused on how inequality will change with advance in age for ages 23 to 75 for three different sets of data, namely household consumption expenditure, food expenditure, and nonfood expenditure. The conclusion and implications are summarized in the last section.

2. Effect of aging population structure on inequality

As described in the previous section, Indonesian population growth rate went down from 1.97% in the 1980s to 1.49% in the 1990s. Also life expectancy went up from 55 to 66 years old. As a result, the share of population below age 15 went down considerably from 40.9 percent in 1980 to 30.5 percent in 2000 as shown Figure 1-1. On the other hand, the share of population for ages 15 to 64 went up noticeably from 55.8%

in 1980 to 65.0% in 2000. Also the share for ages 65 and over rose from 3.3% in 1980 to 4.5% in 2000 as this age group's number increased from 4.77 million in 1980 to 9.13 million in 2000 (BPS [2004], 49). In relation to the above changes, the age structure of household heads has also been changing although it is not identified clearly yet (Figure 1-2). As shown in the figure, the share of household heads for ages 65 to 75 increased slightly from 1980 to 2000.

In Indonesia, there is neither household income nor individual personal income statistics readily available. Instead, the data of household consumption expenditure are reported since the 1960s in *Survei Sosial Ekonomi Nasional* (Susenas) core statistics. Although Susenas core contains social and health aspects of households, its main parts consist of household consumption expenditure statistics. There are some arguments with respect to using household consumption data as a measure of welfare levels of population for many years. On the both conceptual and practical grounds, consumption expenditure statistics is preferable to income statistics as a measure of household welfare levels. Microeconomic theory suggests that current consumption expenditure is an appropriate measure of both present and long-term well-being partly because welfare level is determined by life-cycle or permanent income and partly because current consumption expenditure is a good approximation of incomes from earnings of household members as well as assets. Indeed, measured consumption expenditure is typically less variable than measured income (Deaton [2001]). For practical purposes, it is less difficult to acquire accurate information on household consumption expenditure than the amount of household incomes, especially in developing countries where governance infrastructure is weak and local markets are relatively undeveloped.

Susenas survey was first conducted in the 1960s with sample size smaller in more restricted regions such as the Java provinces. In the 1970s areas covered by the survey were expanded to a nationwide scope except in the remote provinces of Eastern Indonesia. At the same time, the sample size was expanded to around 60,000, but its size was maintained at that level for almost 20 years. In 1994, the sample was enlarged to around 220,000 to measure poverty lines more accurately for urban and rural areas separately in each province. The original purpose of the increase was to obtain information about social and economic conditions of the population. Although some

other purposes were added in later years, the original purpose has been strictly maintained in the survey.

Although Susenas core contains a sample size of around 220,000 households since 1993, the author will utilize the data obtained in Jakarta, West Java and Central Java regions based on two reasons: (1) an analysis using entire samples requires a large processing capacity; and (2) inter-provincial inequality has not been a major factor in overall national inequality as mentioned by Akita et al. (1999). Jakarta is a rich and rapid growing economic center of the country and continues to attract huge amount of domestic and foreign direct investment in almost every economic sector. West Java consists of two distinctive areas, a rich rapidly growing industrial area in the north which is considered as a part of Jakarta metropolitan region, and a rather poor rural area in south. Because the economic activities in Jakarta and in the northern part of West Java are inseparable and the households in the northern part have benefited from the off-farm employment opportunities offered by industrialization, Jakarta and West Java will be treated as one region. On the other hand, Central Java consists mainly rural areas except a few medium-sized urban areas, which are rather homogeneous in the region compared to West Java. In the following analysis, the author investigates changes in inequality of Jakarta-West Java as a representative of a rapidly growing industrial region and Central Java as a representative of a rather homogeneous rural region of the country.

The two regions accommodated 77.3 million people, 45.5 million in Jakarta-West Java and 31.8 million in Central Java in the year 2000. They accounted for 36.5% of Indonesian entire population (BPS [2002a], 46). The population below the poverty line in the two regions was 17.5 million in 1999 and it was also 36.5% out of 48.0 million people below the poverty line in Indonesia (BPS [2002a], 583-584).[2] So the share of population below the poverty lines was almost same as that of total population in these regions. As shown in Table 1, inequality measured with Gini coefficient went up considerably in Jakarta and West Java from 1993 to 1996, whereas it went down in Central Java in the same period. After the financial crisis in 1997-1998, it came down

[2] Poverty lines of urban areas in 2000 were Rp109,184 in Jakarta, Rp94,217 in West Java, and Rp88,384 in Central Java, whereas those of rural areas were Rp73,855 in West Java and Rp72,210 in Central Java (BPS[2001], 593).

slightly lower than the 1993 level in Jakarta and West Java. But in the country as a whole, Gini coefficient in 1996 stayed at the same level of 1993. The two regions show different movements of Gini coefficient before the crisis.

Although the Gini coefficient is used to measure inequality often, the author will use the variance of the logarithm of household consumption expenditure ("variance of log household expenditure" for short) because its changes can be decomposed into three elements--change due to population structure, changes due to expenditure differences within each age group, and changes due to expenditure differences among different age groups. Moreover, they can be analyzed independently.

As an index of inequality, variance of log household expenditure used in our analysis can be expressed as follows:

$$Var \ln y_t = \sum (\ln Y_i)^2 - \left[\frac{\sum (\ln Y_i)}{n_t} \right]^2 \qquad (1)$$

where $Var \ln y$ is the variance of household expenditure for a set of observations, Y household expenditure of individual household, n number of observations, t survey year, and i individual households. This variance of log household expenditure will be calculated for each Susenas core of 1992, 1996 1999, and 2003. [3]

As a next step, observations of each Susenas core are divided into smaller groups by age of household head for ages 23 to 75. Then, the share of observations by age, the variance of log expenditure by age, and the average of log expenditure by age will calculated for ages 23 to 75. These statistics are shown in the following formulas:

Share of population by age	$s_{mt} = s_{23t}, s_{24t}, ...s_{75t}$	(2-1)
Variance of log expenditure by age	$\sigma^2_{mt} = \sigma^2_{23t}, \sigma^2_{24t}, ...\sigma^2_{75t}$	(2-2)
Average of log expenditure by age	$X_{mt} = X_{23t}, X_{24t}, ...X_{75t}$	(2-3)

[3] Originally the author planned to use data sets from Susenas core 1993 survey for the analysis because its sample size was almost same as Susenas core 1996 survey. But it was not available due to some technical problems. As a substitute, we used data sets from Susenas core 1992 survey are used instead.

where s indicates the share of observations, σ^2 the variance of log expenditure, and X *the* average of log expenditure for an age group. Next, m indicates age group, and t survey year. The number in suffix indicates age groups from 23 to 75.

By using above formulas s, σ^2, and X, the variance of log household expenditure in formula (1) can be decomposed as shown in the following.

$$Var \ln y_t = V(s_t, \sigma_t^2, Y_t) = \sum_{m=23}^{75} s_{mt}\sigma_{mt}^2 + \sum_{m=23}^{75} s_{mt}X_{mt}^2 - \left[\sum_{m=23}^{75} s_{mt}X_{mt}\right]^2 \qquad (3)$$

As shown on the right hand side of Formula (3), the equation can be divided into two elements: inequality within each age group and inequality among different age groups. The former is shown in the first term on the right hand side, while the latter is shown in the second and third terms. The changes in variance of log household expenditure from 1992 to 1996 in formula (1) can be divided into three factors by using formula (2) as shown in the following.

Changes due to s = $V(s_{1996}, \sigma_{1992}^2, Y_{1992}) - V(s_{1992}, \sigma_{1992}^2, Y_{1992})$ (4-1)

Changes due to σ^2 = $V(s_{1992}, \sigma_{1996}^2, Y_{1992}) - V(s_{1992}, \sigma_{1992}^2, Y_{1992})$ (4-2)

Changes due to X = $V(s_{1992}, \sigma_{1992}^2, Y_{1996}) - V(s_{1992}, \sigma_{1992}^2, Y_{1992})$ (4-3)

The first term can be named as "population effect," the second term as "within age effect," and the last term as "among age effect." Changes in variance of log household expenditure from 1992 to 1999 and from 1992 to 2003 can also be divided in the same way.

3. Variance of log household expenditure and its decomposition

In this section, variances of log household expenditure will be calculated for 1992, 1996, 1999, and 2003 Susenas surveys (BPS[1992, 1996, 1999a, 2003]) and then they will be decomposed to over time changes due to s, σ^2, and X using formula (2).[4] As

[4] Numbers of observation in Susenas core were 66,560 households in 1992, 206,597

shown in Table 2, Susenas core consists of 10,612 households in 1992, 25,664 in1996, 25,453 in 1999 and 22634 in 2003 in Jakarta-West Java, whereas it consists of 7,551 in 1992, 25,244 in 1996, 25,229 in 1999 and 25,249 in 2003 in Central Java. From these observations, two sets of households will be created for the analysis. The first set consists of whole households in a region in each survey year, namely, number of households indicated above. This type of sets shall be named "Type I data." The second set consists of whole households except (1) households with only one household member and (2) households whose heads are younger than 23 years old and older than 75 years olds. We name this type of set as "Type II data." Households consisting of only one household member were not included because the sole members of these households are usually younger people, university students, house maids, and seasonal workers staying away from their family temporarily and their expenditure patterns are extremely different from the households with two or more family members. On the other hand, the households whose heads are younger than age 23 and older than age 75 were not also included because household heads under these ages are very small in sample size in each age group and their variances and average of log household expenditure shown in formulas (2-2) and (2-3) vary widely from one age group to another. This type of wide variation in the variance and average will create errors and disturbances for estimating formula (4-1) to (4-3).

In Table 2, the variances of Type I data are shown in the first row, whereas those of Type II data are shown in the second row of each region. Sample size is indicated just below each variance. As shown in Table, there is no any large difference between two variances in each region. This indicates that the variance of Type II data is a good representative of survey data to show changes in inequality from 1992 to 2003. In the following analyses, only Type II data is used. Usually when a household size is big, its household expenditure becomes also large.[5] There are several methods to remove effects of household size from household expenditure as investigated by Slesnick (2001). After analyzing several methods, he proposes that dividing household expenditure by a

households in 1996, 207,747 households in 1999, and 222,791 households in 2003.

[5] The average household size was 3.9 persons in 2000. Population in rural areas accounted 58.0 percent and population below poverty lines was 19.0 percent in that year (BPS [2000b], 73-75 and BPS [2001a], 593).

square root of household size is a simple and workable method in removing effects of household size.[6] Ohtake (2005) also supports this method. For this reason, this method should be utilized in this study to remove effects of household size in variance estimation.

Table 2 shows that there are two major regional differences in variance of log household expenditure between Jakarta-West Java and Central Java. One of them is changes in variance in the former region. Variance increased sharply from 1992 to 1996, and then came down to a level slightly lower than the 1992 level in later years. In the mid 1990s, Indonesian economy was growing at around 8.0 percent annually (Takii [2006], 84), the highest growth rate ever attained since the country started modern economic development in 1960s. The economy of Jakarta and its vicinity was especially growing rapidly because they formulated a growth center of the country which received a large amount of domestic and foreign direct investment intensively. This situation created wide income gap between the center and the rest of the region. In 1997 to 1998, Indonesian economy collapsed during the financial crisis and went down by 13 percent in 1998. Jakarta and its vicinity had the hardest hit and their economy fell down more severely than the national average. It stayed at around 13 percent lower than the before crisis level in 1999 and the income gap between the center and the rest of the region lessened considerably. A very violent swing of the economy in Jakarta and its vicinity created a drastic change of inequality from 1992 to 1999. On the other hand, variance in Central Java declined gradually from 0.2153 in 1992 to 0.1696 in 2003 because its economy was mainly based on the rural sectors and did not receive a strong effect of the financial crisis.

Another important difference between the two regions is the level of variance. Variance is around 0.33 except in 1996 in Jakarta-West Java, while it is ranging from 0.17 to 0.21 in Central Java. The former contains partly a rich rapidly growing industrial area in north and partly poor rural areas in south. As described in Akita et al. (1999), a wide diversity among the areas created large variance of log household expenditure in

[6] This is used as a standard method in many international organizations such as OECD (Ohtake [2005], 27).

the former. On the other hand, the latter consists of mainly rural areas except a few medium-sized urban areas and those rather homogeneous areas in the region produced small variance of log consumption.

To decompose the changes in variance from 1992 to 1996, 1999, and 2003, the sample share by age (*s*), variances of log expenditure by age (σ^2), and averages of log expenditure by age (*X*) will be calculated for ages 23 to 75 separately. Before putting them into formula (3), we will take a look into σ^2 for ages 23 to 75 more closely. They are shown on Figure 2. There are two common aspects and a distinctively different aspect between Jakarta-West Java and Central Java regions. One of the former aspects is that the variance of log expenditure by age in 2003 is smaller than that of 1992 in most of the ages for 23 to 75. This indicates that inequality within each age has been getting smaller. Another one is that variances of log expenditure by age increase as the group ages up to 75 years old. In Central Java case, they get large slightly up to around age 57 and then remain the same at the age 57 level up to age 75. On the other hand, a distinctive difference is that the size of variance of log expenditure by age is far greater in Jakarta-West Java than in Central Java and the cause of this difference is already explained in the earlier part of this section. This difference indicates that age effects on inequality are much stronger in Jakarta-West Java than in Central Java.

After calculating for *s*, σ^2, and *X* for ages 23 to 75, the values are plugged into formula (3) in the way indicated in formula (4).The decomposed results can be obtained as shown in Table 3 and Figure 3. Panels A and B of Table 3 show effects of *s*, σ^2, and *X* on inequality separately other things being equal, while Figure 2 shows the same effects in a visible way. They show that the effect of *s* pushed up inequality slightly but steadily in Jakarta-West Java. Although σ^2 pushed up inequality tremendously from 1992 to 1996 in that region, it also pushed down inequality significantly in later years. On the other hand, *X* also pushed down inequality slightly but steadily. Next, Panel C shows that a change in $Var \ln y$ from 1992 to 1996, to 1999, and to 2003 is mainly explained by σ^2. The other two have smaller and limited effects on inequality.

In Central Java, as shown on Panels A and B, and also in Figure 3, population effect (*s*) pushed up inequality, while σ^2 and *X* pushed down inequality. Panel C indicates

that 77% to 97% of changes in $Var \ln y$ are explained with σ^2. The other two have also smaller and limited effects on inequality. Declining inequality from 1992 to 2003 is mainly explained by the decline of σ^2 in both regions. Although population effect (*s*) on inequality has been limited, it has definitely pushed up inequality. In the future, when population growth rate declines partly due to lower birth rate and partly due to expansion of life expectancy, it may have big effects on inequality.

4. Age coefficient of each age group

This section will investigate how changes in age structure of population will push up inequality by looking at inequality for ages 23 to 75. In usual situations, each household head will try to maximize his utility with his lifetime earnings and assets inherited from his relatives. When an interest rate is high, he will plan to reduce his present consumption, to save more, and to increase his future consumption. But he is not certain if he could allocate his lifetime income and maintain his consumption pattern as he planned. When he faces income losses due to serious illness, unemployment, disasters, and accidents, he may have to change his consumption pattern. If he could buy an insurance to cover such unexpected losses in the future, he can remove uncertainty of losing his lifetime income and maintain his consumption pattern as he planned (Ohtake [2005], 65-66).

In reality, one cannot buy insurances to cover these unexpected losses completely because such insurance policy is not available to anybody. One may lose a part of his lifetime income when he faces serious illness, unemployment, disasters, and accidents. In this case, he has to lower his consumption level after suffering from his income losses. Conversely, one may gain his lifetime income due to assets inherited from his parents, promotion in his work, improvement in his skills, and big profits in his business. The difference in lifetime income between people who gain and people who lose will widen with advances in age. In this situation, the variance of log household expenditure in an age group will get bigger as the age group ages (Deaton [1997], 383-384).

This change in variance of log expenditure by age for ages 23 to 75 will be identified in the following formula.

$$\sigma_{mt}^2 = a + \sum_{j=24}^{75} \alpha_j A_j + \sum_{n=2}^{4} \gamma_n T_n + \varepsilon_{mt} \qquad (5)$$

where σ^2 is variance of log expenditure by age as shown in formula (2-2), A age dummy variable, T survey year dummy variable, a a constant, α age coefficient, γ survey year coefficient, ε stochastic error to variance, *m* ages for 23 to 75, j ages 24 to 75 excluding age 23, and t survey year from 1 to 3 excluding 1992. When m is 40 and t is 3, σ^2 indicates variance of log expenditure for age 40 in 2003. A is attached to ages 24 to 75 excluding age 23. It has a value of unity for the respective age and zero in other ages. T_1, T_2, and T_3 are dummy variables for survey years of 1996, 1999 and 2003, respectively. They have a value of unity for the respective year and zero in other years.

By using formula (4), three sets of age coefficients will be estimated using three different sets of consumption data. They are (1) household food consumption expenditures ("food expenditure," for short), (2) household non-food consumption expenditures excluding expenditures on durable goods ("non-food expenditure," for short), and (3) household consumption expenditures ("household expenditure," for short) which consist of food and non-food expenditures together and which are same as used in the previous section. Firstly, variances of log household expenditure (σ^2) will be calculated for ages 23 to 75 from each set of data and then, they will be used to estimate age coefficients for ages 24 to 75 in formula (5). When none of the age coefficients for ages 24 to 75 are significantly different from zero, it indicates that inequality will not increase with advance in age. It implies that every household head is covered by the insurances in some way which compensates his losses due to serious illness, unemployment, disasters, and accidents. On the other hand, when age coefficients get larger along with the advance in age, this indicates inequality will increase with advance in age.

Estimation results

As the results of estimation by using formula (5), the coefficients for ages 24 to 75 are shown in Figure 4. The coefficients of Jakarta-West Java region (Figure 4-1) are apparently different from those of Central Java region (Figure 4-2) in a couple of aspects. First, let us look into estimated coefficients of food expenditure. There are two important points in Jakarta-West Java results. The first point is that they gradually get larger as they age up to the age of 75. Another point is that the coefficients of ages 24 to 49 are not significantly different from zero, but those for ages 50 to 75 are significantly different from zero except in ages 52, 56, 61, and 69. These two points indicate that inequality within a same age is getting large along with advance in age and inequality for ages 50 to 75 is significantly larger than that for age 23. In Central Java case on the other hand, none of the age coefficients are significantly different from that of age 23. This indicates food consumption expenditure level dose not change along as the household heads age and there is no big inequality in food consumption expenditure at any age for ages 23 to 75. In the rural based area like Central Java, this result may be originated partly from the food consumption pattern which is formulated mainly on a tradition way of life and partly from supplied food items which are mainly obtained in the local areas (BPS [1999b], 82-83).

Next, let us look into the coefficients of other expenditures. They get larger with advancement in age between 23 and 57 for non-food expenditure in Jakarta-West Java case. Then, they get smaller gradually to age 68 and stay at that level for ages 69 to 75. But those for ages 24 to 45, they are not significantly different from zero, whereas those of ages 46 to 75, they are significantly different from zero except in a few ages. For household expenditure wherein food and non-food expenditures are added together, the coefficients are almost same as those of non-food expenditure except in ages 68 to 75 and the coefficients for ages 24 to 40 are not significantly different from zero.

In Central Java case, the coefficients of non-food expenditure get larger as the household heads ages up to age 50 and remain at that level until age 75. But those for ages 24 to 29, they are not significantly different from zero, whereas those for ages 30 to 75, they are significantly different from zero. Similarly those of household expenditure get larger with advance in age up to around age 54 and then they become slightly smaller up to age 75. Those from age 24 to 40 are not significantly different

from zero, whereas those of age 46 to 75 are significantly different from zero excluding a few cases.

Except coefficients of food expenditure in Central Java, there is a common changing pattern of age coefficients. Namely, they get larger gradually as the household heads ages up to a certain age. After reaching that age, their levels stay more or less at same levels up to age 75. An important implication for this change is that inequality in consumption expenditure increase with advancement in age. But inequality is not large and not significantly different from zero for ages 24 to around those aged 30. After reaching the age of 30, the coefficient starts to increase considerably and becomes significantly different from the coefficient during the age 23. It gets larger as the household head ages especially between 35 and 50. After reaching the highest level at around the age fo 50, inequality stays more or less at that level up to the age of 75.

Why does inequality increase sharply in age between 35 and 50? When household heads are in their twenties, there will be no big variations in their wages and salaries because the skills, experiences, and promotion they obtained from their works are still limited. Although some of them get higher wages even when they are in their twenties, they think that their lifetime income may not differ significantly from other household heads in the same age and their consumption patterns are almost similar to the others. For this reason, inequality is not significantly larger than that of the age 23. As household heads enter their thirties, their incomes start to be more closely related to their educational background, experiences, skills, performance and promotion in their work. When they are promoted in their work in their thirties, they expect that their lifetime incomes will be larger than the others. Also their lifetime incomes are also closely related to their own health conditions, family's health conditions, the accidents they encounter, and their losses in a disaster. These unexpected risks and uncertainties will increase when they are in thirties and critically influence their lifetime income levels. Then, they start to realize that their lifetime incomes may vary considerably depending on those factors compared to other household heads. In addition, household heads may have greater chances to receive property and assets by inheritance from their parents when they are in their thirties, because age differences between them and their parents are 25 to 35 years.

When one estimates that his lifetime income goes up to a higher level due to skills, experiences and promotion in his work, he starts to increase his consumption expenditure. Also if one receives property from his parents, his lifetime income goes up and his household expenditure is likely to increase. Mainly due to employment situations in their work, losses of income due to their health conditions, and losses of assets due to unexpected accidents and disasters, inequality starts to increase at around the age of 35. When population growth rate slow down drastically, the shares of old age groups go up and inequality of a population as a whole goes up along with their shares. The effect of an aging population on inequality which is identified in formula (3-1) is not large as shown as shown in Table 3. But it will increase as population shares of older groups get large in the future in Indonesia. An analyzing population effect on inequality will become very important issue in future.

5. Summary and Conclusion

Indonesian income distribution measured by the Gini ratio has been gradually improving since 1990 gradually. First, this paper tried to find out the major factor that improved the income distribution. Using Susenas individual household data obtained from Indonesian Statistical Office, variances of log consumption expenditure of individual households are calculated as an alternative index of Gini coefficient for years 1992, 1996, 1999, and 2003, and the variances show similar trends in Gini coefficients. After this exercise, the paper decomposed changes in the variances from 1992 to 1996, 1999, and 2003 separately into three effects, changes due to population structure by age, changes due to consumption expenditure within same age groups, and changes due to consumption expenditure between different age groups. This exercise indicates that a decline in inequality is originated mainly from the changes due to consumption expenditure within same age groups. Among the three effects, only changes due to population structure pushed up inequality.

Second, the paper tried to find out how population pushed up inequality in detail. In this analysis, variances of log expenditure are calculated by age for ages 23 to 75 for each survey year and are scrutinized how these variances changed as the household

head ages. Then, by using a regression model, age coefficients are estimated for ages 24 to 75. As a result, the following facts are identified: (1) inequality increases gradually from age 23 to around age 55; (2) after around the age of 55, inequality level stays at the age 55 level and remains the same up to the age of 75; (3) inequalities for ages 24 to around 35 is not significantly different from that of age 23 and (4) inequality for ages 30 to 50 increases sharply and is significantly different from that of age 23.

Population growth rate has been declining and life expectancy has been expanding rapidly since the 1980s. These two factors have been changing population structure by age rapidly in Indonesia. The results imply that if population structure continues to change as in the present trend, the shares of population for older generations will go up and their weights on inequality will get larger. The population structure shifting towards an aging society will push up inequality and will be a large factor to push up over-all inequality in the country.

Table 1 Changes in Gini coefficient by province

Province	1993	1996	1999	2002
Aceh	0.293	0.259	0.240	—
North Sumatra	0.295	0.301	0.254	0.288
West Sumatra	0.305	0.278	0.256	0.268
Riau	0.266	0.300	0.224	0.292
Jambi	0.242	0.246	0.240	0.260
South Sumatra	0.296	0.300	0.260	0.291
Benkulu	0.281	0.273	0.254	0.253
Lampung	0.264	0.276	0.288	0.254
Bangka Belitung	—	—	—	0.247
Jakarta	0.326	0.363	0.317	0.322
West Jawa	0.299	0.356	0.286	0.289
Central Jawa	0.295	0.291	0.246	0.284
Jogjakarta	0.331	0.353	0.337	0.367
East Jawa	0.318	0.311	0.291	0.311
Banten	—	—	—	0.330
Bali	0.315	0.309	0.270	0.298
West Nusa Tenggara	0.274	0.286	0.261	0.266
East Nusa Tenggara	0.254	0.296	0.267	0.292
West Klimantan	0.302	0.300	0.271	0.301
Central Klimantan	0.259	0.271	0.237	0.245
South Klimantan	0.274	0.292	0.264	0.292
East Klimantan	0.313	0.318	0.277	0.304
North Sulawesi	0.291	0.344	0.272	0.270
Central Sulawesi	0.286	0.302	0.286	0.283
South Sulawesi	0.273	0.323	0.296	0.301
North Central.Sulawesi	0.272	0.311	0.276	0.270
Gorontalo				0.241
Maluku	0.300	0.269	0.241	—
Irian Jaya	0.370	0.386	0.360	—
Indonesia	0.335	0.335	0.308	0.329

Sources: BPS[1999c], 26-27 and BPS[2002b], 26-27.

Table 2 Variance of log whole consumption expenditure and numbers of household

	Type of sample		1992	1996	1999	2003
Jakarta-West Java	Whole samples	Variance	0.3445	0.4138	0.3276	0.3317
		Samples	10,612	25,664	25,453	22,634
	23-75 years old and 2 or more member household	Variance	0.3452	0.4114	0.3248	0.3308
		Samples	10,304	25,015	24,829	22,111
Central Java	Whole samples	Variance	0.2316	0.2082	0.1779	0.1816
		Samples	7,551	25,244	25,229	25,243
	23-75 years old and 2 or more member household	Variance	0.2153	0.1982	0.1695	0.1692
		Samples	6,923	23,227	23,008	22,828

Sources: BPS[1992, 1996, 1999a, 2003]

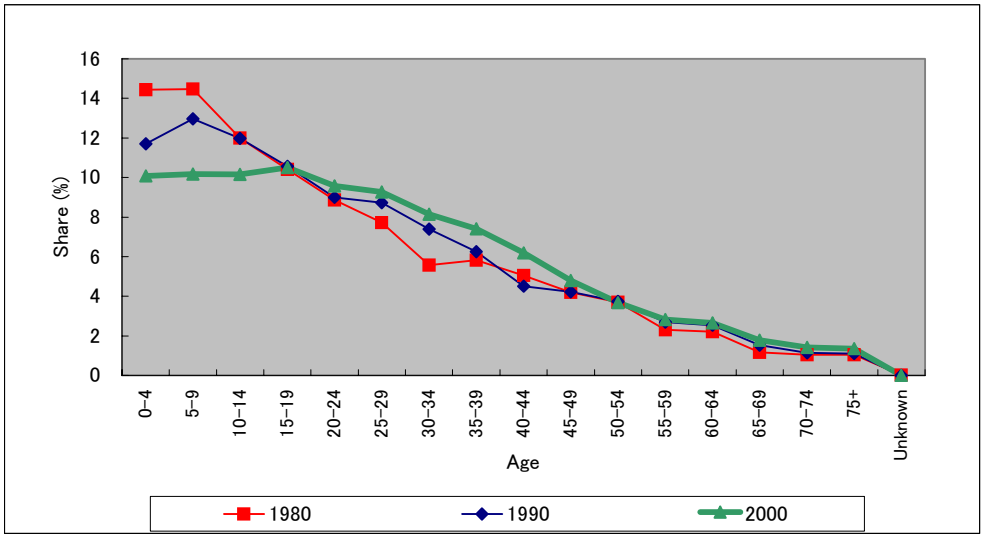
Table 3. Decomposition of variance

		Jakarta-West Java				Central Java			
		1992	1996	1999	2003	1992	1996	1999	2003
Panel A	Changes in variance								
	Variance	0.3452	0.4114	0.3248	0.3308	0.2153	0.1987	0.1694	0.1696
	Changes due to s	0.3452	0.3456	0.3492	0.3498	0.2153	0.2147	0.2173	0.2192
	Changes due to σ^2	0.3452	0.4128	0.3221	0.3282	0.2153	0.2025	0.1709	0.1710
	Changes due to X	0.3452	0.3432	0.3425	0.3430	0.2153	0.2133	0.2131	0.2127
			1996	1999	2003		1996	1999	2003
Panel B	Change from 1992 to respective year								
	Variance		0.0661	−0.0204	−0.0145		−0.0166	−0.0459	−0.0457
	Changes due to s		0.0003	0.0040	0.0045		−0.0006	0.0020	0.0039
	Changes due to σ^2		0.0675	−0.0231	−0.0170		−0.0128	−0.0444	−0.0443
	Changes due to X		−0.0020	−0.0027	−0.0022		−0.0020	−0.0022	−0.0026
			1996	1999	2003		1996	1999	2003
Panel C	Percent age explained by (%)								
	s		0.5	−19.7	−31.4		3.6	−4.4	−8.5
	σ^2		102.1	113.4	117.5		77.1	96.7	96.9
	X		−3.1	13.3	15.4		12.0	4.8	5.7
	$s + \sigma + X$		99.6	107.0	101.5		92.8	97.2	94.1

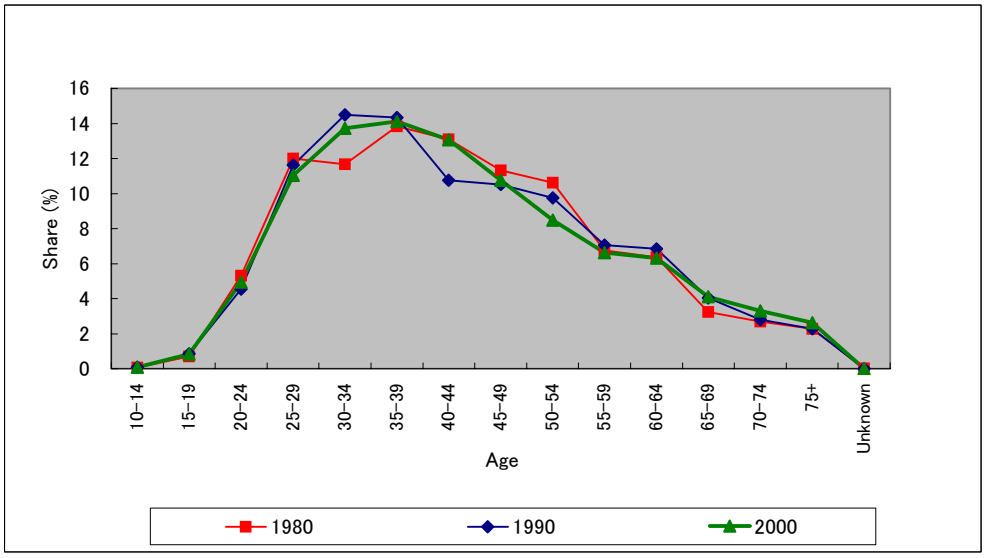
Sources: BPS[1992, 1996, 1999a, 2003]

Figure 1.Share of population by age group

1-1. Distribution of population by age group



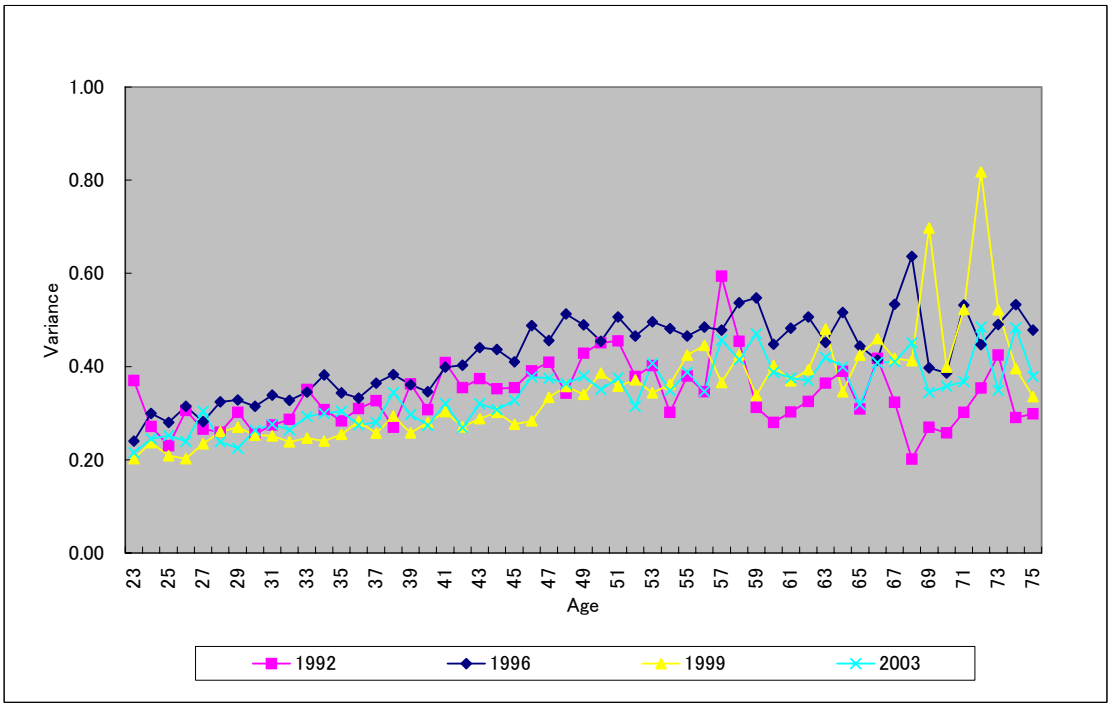
1-2. Household heads by age group



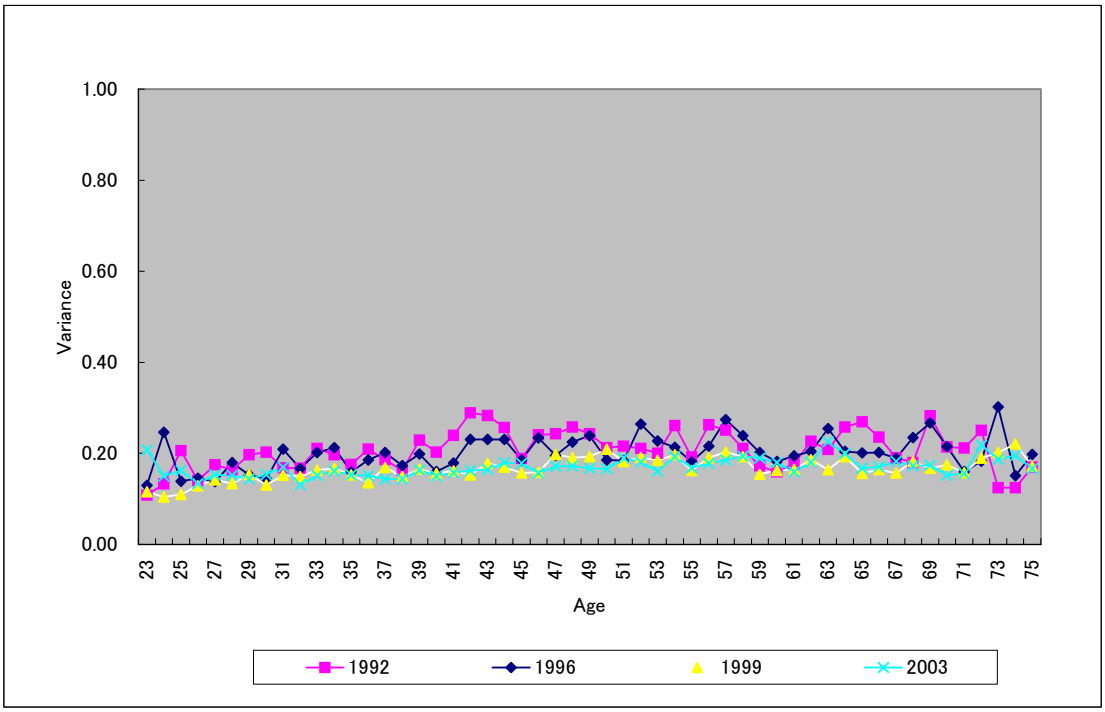
Sources: BPS[1980, 1990] and BPS[2000]

Figure 2. Variance of log consumption expenditure

2-1 Jakarta-West Java



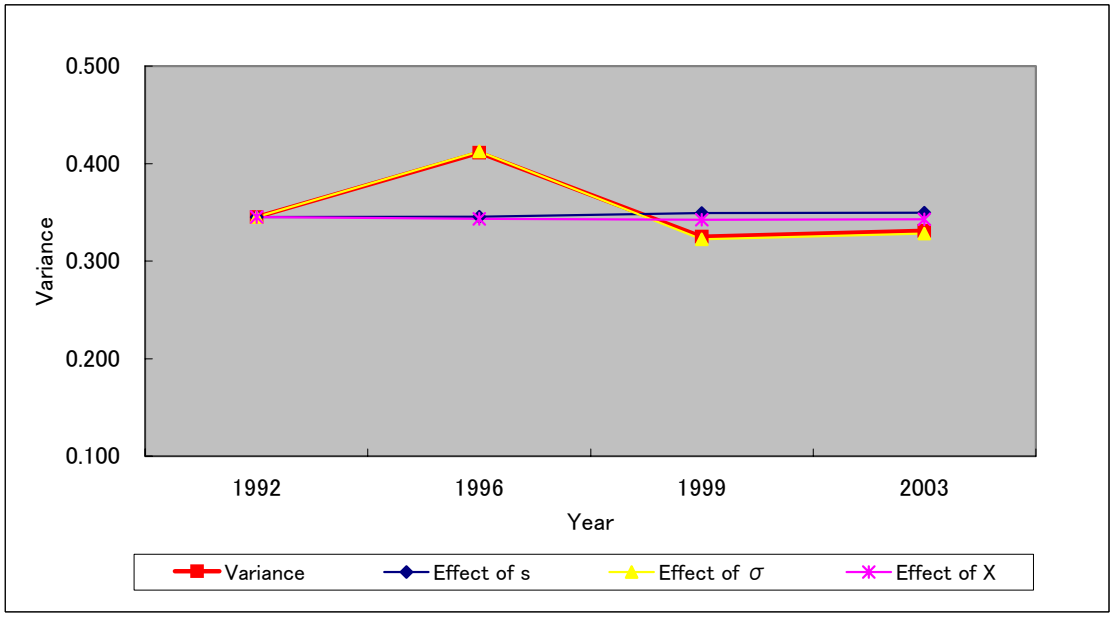
2-2. Central Java



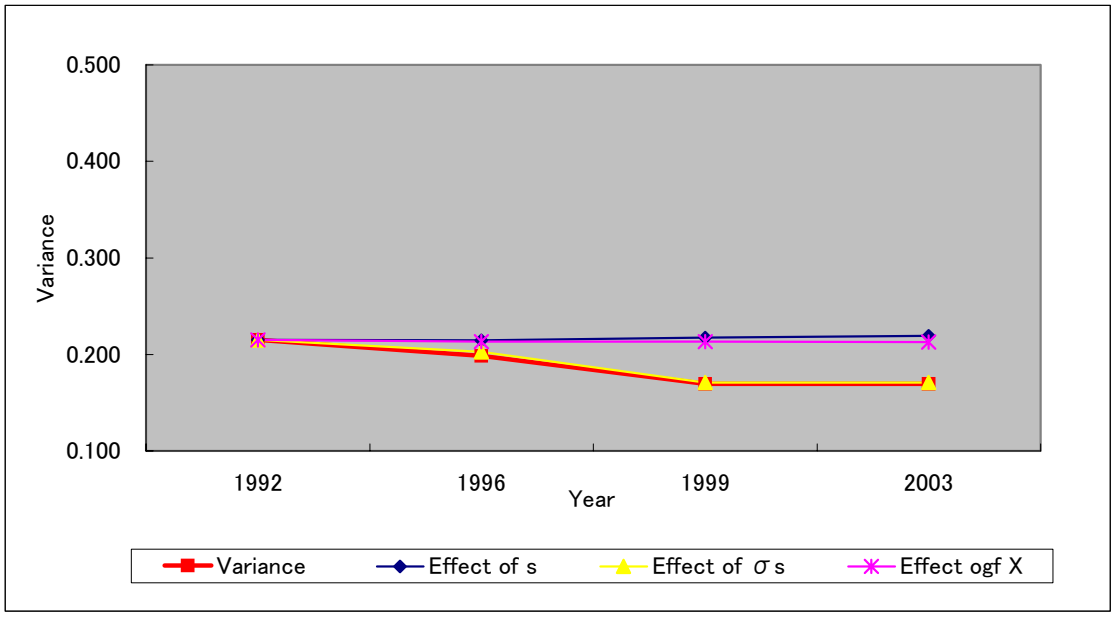
sources: BPS[1992, 1996, 1999a, 2003]

Figure 3. Decomposition of variance of log consumption expenditure

3-1. Jakarta-West Java



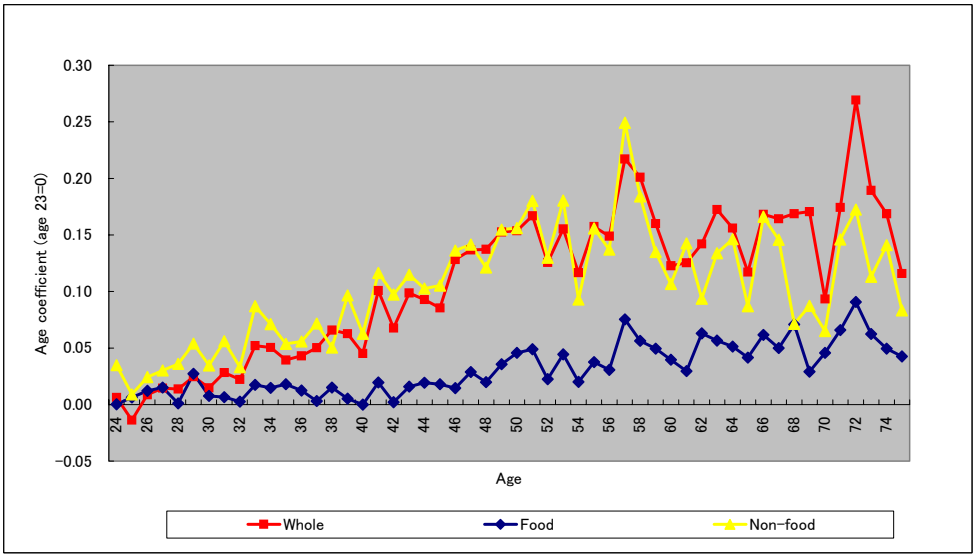
3-2. Central Java



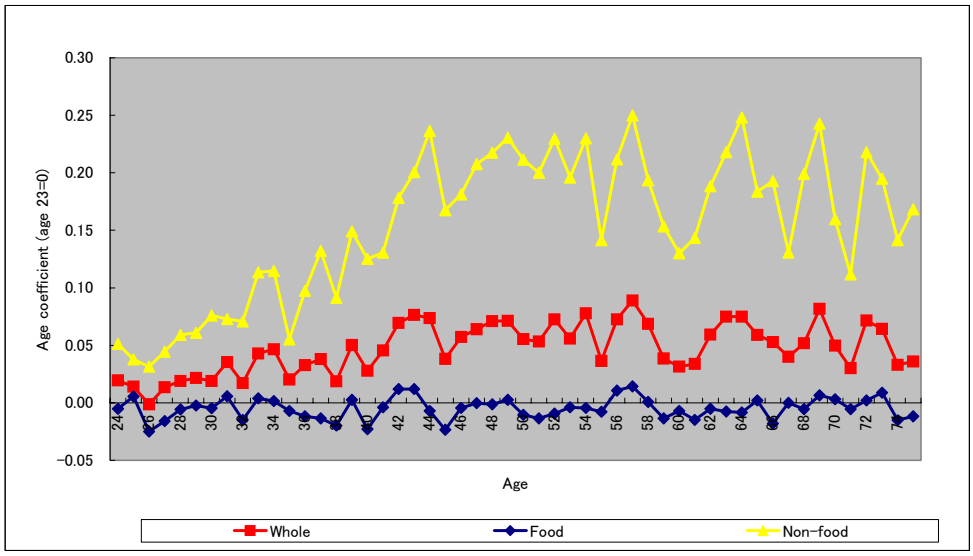
Source: BPS[1992, 1996, 1999a, 2003]

Figure 4. Age coefficient for variance of log consumption expenditure

4-1. Jakarta-West Java



4-2. Central Java



Sources: BPS[1992, 1996, 1999a, 2003]

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