On the re-assessment of inequality in Indonesia: household survey or national account?

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On the Re-Assessment of Inequality in Indonesia: Household Survey or National Account?*

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Abstract

This paper is motivated by the inconsistency between food and non-food expenditure estimated from household survey data (SUSENAS) and from national account (I-O table) and its possible implication on the issue of inequality in Indonesia. Since aggregate non-food expenditure calculated from household survey data tend to be under-estimated when compared with national account data, it may imply the under-representation of the highest income groups in the calculation of inequality in Indonesia. This paper applies an approach to reconciling household survey and national accounts data, by re-estimating the sampling weight using cross entropy estimation method taking initial household survey weight as prior, while satisfying some aggregation constraints. The estimated weight then is used to calculate standard indicator of inequality in Indonesia. The results indicates the under-estimation of inequality in Indonesia. The under-estimation seems to be insignificant in rural area, but it suggest that the inequality in urban area is highly under-estimated. The "Jakarta factor", the possible under-representation of the rich in the nation's capital seems to account mostly to this result.

1 Introduction

Indonesia is among the most equal nations, included in the 30 countries with highest equality (rank 26^{th}), together with, among others, former communist economies

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(e.g. Slovakia, Belarusia, Hungary), Scandinavian countries and western European welfare states[1] (see table 1) . This ranking is based on Gini coefficient, a standard indicator to measure inequality. As the table suggest, it seems that Indonesia is among the very few[2] of less developed countries with higher equality. Does it suggest disparity in welfare is that low in Indonesia, and we perform well in its equitable development policy? The answer depends on whether those number reflects the reality of income distribution in Indonesia.

Table 1. The Top 30 Most Equal Nations[3]

	Countries	Gini Index	Low 20%	High 20%		Countries	Gini Index	Low 20%	High 20%
1	Slovakia	19.5	11.9	31.4	15	Rwanda	28.9	9.7	39.1
2	Belarus	21.7	11.4	33.3	17	Croatia	29	8.8	38
3	Hungary	24.4	10	34.4	17	Ukraine	29	8.8	37.8
4	Denmark	24.7	9.6	34.5	19	Germany	30	8.2	38.5
5	Japan	24.9	10.6	35.7	20	Austria	31	6.9	38
6	Sweden	25	9.6	34.5	21	Romania	31.1	8	39.5
7	Czech Rep.	25.4	10.3	35.9	22	Pakistan	31.2	9.5	41.1
8	Finland	25.6	10	35.8	23	Canada	31.5	7.5	39.3
9	Norway	25.8	9.7	35.8	24	Korea, Sth.	31.6	7.5	39.3
10	Bulgaria	26.4	10.1	36.8	25	Poland	31.6	7.8	39.7
11	Luxembourg	26.9	9.4	36.5	26	Indonesia	31.7	9	41.1
12	Italy	27.3	8.7	36.3	27	Latvia	32.4	7.6	40.3
13	Slovenia	28.4	9.1	37.7	27	Lithuania	32.4	7.8	40.3
14	Belgium	28.7	8.3	37.3	29	Spain	32.5	7.5	40.3
15	Egypt	28.9	9.8	39	30	Netherland	32.6	7.3	40.1

When data may suggest that Indonesia has been successfull in implementing its one of the "development trilogy[4]", story could be different in the eye of the ordinary. Those who experiencd day-to-day economic life, or at least who are informed of current situation from popular media. Let's take these current stylized facts as examples.

[1] Countries with relatively low equality by design of their economic system.

[2] except Rwanda.

[3] Source: www.infoplace.com, as calculated from World Development Index, of the World Bank.

[4] Development trilogy or *Trilogi Pembangunan* include equality as one of the three development pilars which is economic growth and stability.

Indonesia (where cars is still one of the most expensive in the world) is one of many countries in Asia, including India, Singapore, Thailand, and China, where the market of luxury cars is growing rapidly. Data from the Association of Indonesian Automotive Industries (Gaikindo) showed 12 Jaguar fancy sport cars sold in November 2002, with only one less were sold in the following month. Buying luxury completely built up (CBU) cars has become a popular trend of affluent Indonesians, especially those living in big cities like Jakarta[5].

Sadly enough, malnutrition now is also a common story almost everywhere including Jakarta. Malnutrition for example killed 26 children in one month in Indonesia's Central Java province. According to the local Health Bureau's September 2004 report the deaths were caused by precarious economic conditions in which poor families find themselves. They are so poor that they cannot adequately feed their children[6]. Malnutrition is not only a story that used to be occasional in remote province such as Papua, it also occurs in one the most wealthy region, Jakarta[7]. Jakarta Heath Bureau records out of 923 thousand infants, 8,445 suffers from malnutrition. Seven of them, even, had to be treated at the hospital.

Is there any possibility that inequality as measured by standard indicator like Gini coefficient under-represent the reality? Yes, the reasons could be among the following. First, inequality measured using expenditure data rather than income tend to be lower, since upper-income groups usually save a larger proportion of their incomes, the distribution of consumption expenditure is generally more equitable than the distribution of income[8]. Secondly, when the data used to calculate inequality under-represent certain groups in the population i.e. the rich. The rest of the paper will try to discussed the latter, its possibility, and speculate its implication to the re-assessment of inequality in Indonesia.

The objectives of this paper is take into account the inconsistency between household survey data and national account, and analyze its implication to the re-assessment of inequality in Indonesia. More specifically, will apply an method called entropy-distance minimization to reconciling household survey (SUSENAS) and national accounts data (Input-Output table), by re-estimating the sampling weight, and used the re-estimated sampling weight in measuring standard inequality indicators, like Gini coefficient.

Section 2 of this paper, will briefly report some of the inconsistency between SUSENAS and national account, while methodology and data will be discussed in

[5] IBonWEB.com, June 2003.

[6] AsiaNews.it, November 2004.

[7] "Malnutrition threats Jakarta", Republika Daily, 11 June 2005.

[8] This will make cross-country comparison rather misleading.

section 3. Section 4 will be on the results and discussion, while section 5 concludes the paper.

2 Household Survey v.s. National Account

It starts when ones try to compare and reconcile consumption expenditure from Input-Output (I-O) Tables and from household survey (SUSENAS). I-O table is constructed using data that mainly come from the suply side of the economy[9]. Industry sales of output for example, is surveyed, as well as their sales by components (domestic, export, capital accumulation). When calculating sales to household final consumption, I-O division, not only used SUSENAS, but also attempt to reconcile with the suply side information. Consumption expenditure from SUSENAS, on the other hand, is directly surveyed to representated sample.

Ideally when total consumption from household survey is aggregated, taking into account sampling weight, the aggregate has to be close to the national aggregates. In fact, even in total (not by component of expenditure), it is rarely the case. Aggregate from SUSENAS will fall short of national account by quite significant factors. Akita et al (1999) [3] for example suggests that it is reported that there is a wide discrepancy between the total household expenditure estimated based on the Susenas data and the total private consumption expenditure from the national accounts.

The fact that the aggregate from SUSENAS fall short of the aggregate from I-O, does not imply anything to distribution of expenditure accross households, so long as, the discrepancy in its component of expenditure is more or less in the same magnitude. However, this is not the case. It is found, for example, that the aggregate expenditure of rice from the SUSENAS match closely, the aggregate rice expenditure from I-O table, while at the same time, the discrepancy in its total is high. This may suggest that the discrepancy in non-food expenditure is a lot wider than the discrepancy in food expenditure. This situation will be associated with distribution of expenditure since non-food consumption basket is higher among the top income class rather than among lower income class. Therefore, ones who believe that national account is more accurate, will speculate that non-food expenditure from household survey is under-estimated.

[9]This is based on I-O reference from the BPS as well as interview with I-O division of the BPS.

Table 1. Aggregate Food and Non-food Expenditure from I-O and SUSENAS[10]

	I-O		SUSENAS		
	Rp	Share	Rp	Share	Ratio
Food	326,001	0.23	187,225	0.36	1.74
Non-food	1,090,044	0.77	333,018	0.64	3.27
Total	1,416,045	1.00	520,243	1.00	2.72

Source: Author's calculation

The calculation using the most recent I-O table (2003) and SUSENAS (2002) shows that inconsistency (see table 1). While aggregate food expenditure from SUSENAS fall short of from I-O table by a factor of 1.7, non-food expenditure fall short a lot more by a factor of 3.7. While, non-food expenditure share calculated from SUSENAS is around 64%, national account data suggest it is around 77%, suggesting a markedly-different expenditure pattern.

Now, the question is, what can cause non-food expenditure from household survey is more under-estimated relative to food expenditure? The possible reasons among other, are under-reporting of non-food expenditure by the higher income groups, or the higher-income group are under-represented in the sample The under-representation of high income groups could be due to non-response rate or even the sampling frame itself[11]. In this sort of situation, inequality in expenditure per capita, as measured, for example by Gini coefficient, will be under-estimated. This is, for example, is suspected by Akita et al (1999) which suggest that there is a widely-held belief that, nonfood expenditures are progressively understated by larger-in-come households, especially in urban areas, and thus expenditure inequalities are underestimated if they are measured based on the Susenas data[12].

3 Method and Data

The method is originated from information theory (Shanon, 1948, and Jaynes, 1957) which suggest that we can use all and only the information available for the estimation at hand (Robilliard, and Robinson, 2003). In trying to re-estimates

[10] See section on Method and Data for detail calculation.

[11] A few interviews with BPS staffs suggests that this may be the case.

[12] It should be noted, however, the possibility that the source of discrepancy is at the national account side should not be exluded. Some component of expenditure, such as banking sectors, are sometimes imputed.

the sampling weight of a household survey, we will use the information available i.e. the already available sampling weight as prior information. In this prior sampling weight a lot of socio-demographic information contained. Another (new) information is extranous supply side information contained in national accounts data. Hence, intuitively, the problem is to find a new sampling weight, as close as possible to the prior, but also consistent with other information. The closedness to the prior, in information theory, is called the entropy distance of information[13]

More formally, suppose we have H households, including their prior sampling weight p_h, from which we can observe their expenditure on goods i (x_{ih}). On the other hand, we have from national account data, information about aggregations or weighted averages of those expenditure i.e. y_i. The estimation procedure is to minimize the Kullback-Leibler cross entropy measure of the distance between the new estimated probabilities and the prior. Following the notation of Golan, Judge, and Miller (1996)[14], the estimation procedure is:

$$\min_{p_h} \sum_h p_h \ln \left(\frac{p_h}{\tilde{p}_h} \right) \tag{1}$$

subject to

1. Aggregation constraint

$$\sum_h p_h x_{ih} = y_i \tag{2}$$

   where x_{ih} is observed household h's expenditure on commodity $i \in \{1, \ldots, I\}$ obtained from household survey (SUSENAS), and y_i is observed agregate (per capita) expenditure on commodity i, obtained from national account or Input-Output table. This constraint suggests that the weighted sum of expenditure on one commodities calculated from SUSENAS has to be consistent with its aggregate from national account data.

2. Normalization constraint

$$\sum_h p_h = 1 \tag{3}$$

   which suggests that the sum of sampling weight has to sum to one, or the sum of population represented by households surveyed has to be equal to

[13] The same approach, for example, is used by Robilliard and Robinson (2003) to re-estimate the sampling weight for Madagascar household survey, in an attempt to reconcile national account data and micro-data.

[14] As also applied by Robilliard and Robinson (2003) which also suggest that this application of information theory in a sense in line with bayesian estimation method in Statistics.

total population.

3. Provincial shares constraint, where $j \in \{\text{provinces}\}$

$$\sum_{h \in U_j} p_h = s_j^U \tag{4}$$
$$\sum_{h \in R_j} p_h = s_j^R \tag{5}$$

where $j \in \{1, \ldots, J\}$ is provinces, and U_j is set of households (observations) that live in urban area of province j, whereas R_j is set of households that live in rural area of province j. s_j^U and s_j^R are share of population living in urban and rural area of province j, respectively. These constraints suggests that the sampling proportion accross province, urban and rural area, in SUSENAS are maintained[15].

We can write the Lagrangian for this problem,

$$\begin{aligned} \mathcal{L} &= \sum_h p_h \ln\left(\frac{p_h}{\tilde{p}_h}\right) + \sum_i \lambda_i \left(y_i - \sum_i p_h x_{ih}\right) + \mu\left(1 - \sum_h p_h\right) \\ &\quad + \sum_j \gamma_j^U \left(s_j^U - \sum_{h \in U_j} p_h\right) + \sum_j \gamma_j^R \left(s_j^R - \sum_{h \in R_j} p_h\right) \end{aligned} \tag{6}$$

The first order conditions are

$$\frac{\partial \mathcal{L}}{\partial p_h} = \ln\left(\frac{p_h}{\tilde{p}_h}\right) + 1 - \sum_i \lambda_i x_{ih} - \mu - \sum_j \gamma_j^U - \sum_j \gamma_j^R = 0 \tag{7}$$
$$\frac{\partial \mathcal{L}}{\partial \lambda_i} = y_i - \sum_i p_h x_{ih} = 0 \tag{8}$$
$$\frac{\partial \mathcal{L}}{\partial \mu} = 1 - \sum_h p_h = 0 \tag{9}$$
$$\frac{\partial \mathcal{L}}{\partial \gamma_j^U} = s_j^U - \sum_{h \in U_j} p_h = 0 \tag{10}$$
$$\frac{\partial \mathcal{L}}{\partial \gamma_j^R} = s_j^R - \sum_{h \in R_j} p_h = 0 \tag{11}$$

[15] The 65,000 sample of Module SUSENAS is in fact only attempt to picture as far as provincial level.

which constitute a system of non-linear equation with $H + I + 1 + 2J$ variables i.e. $p_h, \lambda_i, \mu, \gamma_j^U, \gamma_J^R$, and the same number of equations.

The household survey data used is Consumption Module of 2002 National Socioeconomic Survey (SUSENAS). SUSENAS is a series of large-scale multi-purpose socioeconomic surveys initiated in 1963-1964 and fielded every year or two since then. Since 1993, SUSENAS surveys cover a nationally representative sample typically composed of 200,000 households. Each survey contains a core questionnaire which consists of a household roster listing the sex, age, marital status, and educational attainment of all household members, supplemented by modules covering about 60,000 households that are rotated over time to collection additional information such as health care and nutrition, household income and expenditure, and labor force experience. Meanwhile, for national account data, we use 2003[16] Input-Output Table, and Social Accounting Matix.

The reason for using SUSENAS 2002, instead of 2003, is that to reconcile between SUSENAS and I-O/SAM the same classification of expenditure is required. Detail classification of expenditure is a necessary in doing this, and this only available in SUSENAS consumption module. The latest SUSENAS data with expenditure an income module is for the year 2002. The sample size of this module is 65,000 households compared to the core SUSENAS which has a sample size of 200,000 households. This smaller sampling frame attempt to represent the population of provinces, while the core can be disaggregated to represent every districts [1].

The first task reconciling household expenditure between two different source of data is to reclassify commodity classification in SUSENAS into the classfication of I-O table. In SUSENAS, consumption expenditure is classified into 339 commodities, while I-O table only has 175 commodities[17]. It turns out[18] that the mapping of this classfication is not a simple some (from SUSENAS) to one (I-O) mapping. Since many of commodities purchased as final goods by households are considered sales from different type of industrt in I-O classification, the mapping is slightly more complex. Furniture that is purchased by household, for example, may come from sale of leather industry, wood product industry, or even metal industry.

[16]Different year in the househod survey data and national account data does not matter much, since only the ratio (or factor) between aggregate food consumption is used. Implicitly, it is assumed that the is no change in the expenditure pattern between 2002 and 2003. It is also implicitly assumed that, population growth accross province is uniform, so we don't need to take into account popuation growth during the same year.

[17]Later on it will be classified into 180 commodities including more detailed fuel consumption.

[18]As confirmed during the visit to BPS.

Suppose that x_j^{IO} is the target classfication of expenditure which is 175 I-O table, where $j = 1, \ldots, m$, $m = 175$. From SUSENAS, we can define the household expenditure x_i^{SUS}, where $i = 1, \ldots, n$, $n = 339$, $m < n$. Then the mapping can be represented by the following equation, by which we can calculate for each of 65,000 household, their consumption spending classified by I-O classfication.

$$x_j^{IO} = \sum_{i=1}^{n} \omega_{ij} \cdot x_i^{SUS} \tag{12}$$

such that,

$$\sum_{j=1}^{m} \omega_{ij} = 1 \tag{13}$$

where ω_{ij} is the contribution of consumption of good i to the consumption of good j which is the element of a weight matrix $\mathbf{W}_{m \times n}$. This matrix is based on special survey, carried out by BPS, and has been used in the process of I-O table and SAM construction.

This process of weighted mapping from SUSENAS to I-O classification was programmed in STATA. The optimization problem is solved using GAMS software, through non-linear program (NLP) using CONOPT solver. GAMS solved the optimization problem producing the new 60,657 sampling weight satisfying the constraints set above. Calculation of Gini coefficient, and other indicator of inequality was performed using STATA.

4 Result and Discussion

First, we have to bear in mind, that care should be taken in intepreting the results. This paper does not attempt to give estimate of the true inequality in Indonesia, nor to claim that the published inequality indicator calculated using SUSENAS data is wrong. Instead, given the belief that national account data give more accurate aggregate rather than household survey, how does this imply to inequality in Indonesia?

Comparing the Gini coefficient with prior sampling weight and with re-estimated sampling weight, it suggests that inequality in Indonesia is highly underestimated. The new Gini coefficient (all urban and rural combined) is 0.59 compared to 0.35, a jump by 0.24 point (see figure 1). Broken down into urban and rural inequality, it is found that the magnitude of the under-estimation is relatively very low in rural area than in urban area. Gini coefficient in rural area does not really change much, while in urban area, it change a lot. This result is quite intuitive, since, if the source of this under-estimation is the under-representation of the very rich in household survey, it is hard to find, the super rich in rural area, than in urban area like Jakarta.

The break down of calculating Gini coefficient among provinces suggests that, the magnitude of the under-estimation is highest in Jakarta (see table 3), where the under-estimation is as high as 0.24 point. This is again could be explained and intuitive, since ones may believe that the under-representation of top highest income group will be severe in the capital.

Given this finding, overall Gini coefficient excluding Jakarta, is calculated, to find out, how the "Jakarta factor" contribute to the under-estimation of inequality in Indonesia. The result suggest that, excluding Jakarta, the new Gini coefficient is higher by 0.9 point instead of 0.24 point. The overall Gini coefficient in Indonesia (urban and rural) is 0.42 compared to 0.33. Even with Gini coefficient of 0.42, Indonesia, will no longer belong to countries with highest equality and Gini coefficient higher than 0.5 will place us to the top highest inequality together among others with some Latin American countries like Brazil (0.61), African countries like Sierra Leone (0.63), or even our neighbours Malaysia (0.50)[19].

[19] World Development Indicator, 2002.

Table 3. Gini Coefficient by provinces

	Urban			Rural		
	Gini($\tilde{p}_h$)	Gini(p_h)	Δ	Gini($\tilde{p}_h$)	Gini(p_h)	Δ
North Sumatera	0.30	0.34	0.03	0.25	0.43	0.18
West Sumatera	0.29	0.36	0.07	0.26	0.28	0.02
Riau	0.30	0.19	-0.12	0.25	0.28	0.03
Jambi	0.28	0.27	-0.01	0.25	0.26	0.01
South Sumatera	0.32	0.31	-0.01	0.23	0.23	0.00
Bengkulu	0.27	0.27	-0.01	0.24	0.26	0.01
Lampung	0.29	0.37	0.07	0.23	0.29	0.06
Bangka-Belitung	0.29	0.29	0.00	0.21	0.22	0.02
Jakarta	0.37	0.61	0.24			
West Java	0.31	0.40	0.09	0.24	0.26	0.02
Central Java	0.31	0.34	0.03	0.26	0.30	0.05
Yogyakarta	0.40	0.46	0.06	0.26	0.28	0.02
East Java	0.34	0.39	0.05	0.27	0.33	0.05
Banten	0.30	0.35	0.05	0.24	0.25	0.01
Bali	0.31	0.32	0.01	0.25	0.31	0.05
NTB	0.30	0.35	0.05	0.24	0.26	0.02
NTT	0.31	0.33	0.02	0.25	0.33	0.08
West Kalimantan	0.34	0.33	-0.02	0.23	0.24	0.00
Cent. Kalimantan	0.28	0.30	0.02	0.23	0.24	0.01
South Salimantan	0.28	0.42	0.15	0.29	0.31	0.02
East Kalimantan	0.33	0.40	0.07	0.26	0.27	0.01
North Sulawesi	0.25	0.27	0.02	0.27	0.32	0.05
Central Sulawesi	0.30	0.39	0.09	0.27	0.29	0.02
South Sulawesi	0.31	0.39	0.07	0.27	0.29	0.02
SE Sulawesi	0.30	0.32	0.02	0.26	0.26	0.00
Gorontalo	0.27	0.29	0.02	0.23	0.24	0.01
Indonesia	0.35	0.63	0.28	0.26	0.31	0.05
Indonesia (no Jkt)	0.33	0.43	0.10	0.26	0.31	0.05

Table 4. Standard Indicator of Inequality (All Indonesia)

	Urban			Rural		
	$\tilde{p}_h$	p_h	Δ	$\tilde{p}_h$	p_h	Δ
Relative mean deviation	0.251	0.475	0.225	0.187	0.226	0.039
Coefficient of variation	0.985	2.547	1.562	0.604	0.714	0.110
Standard deviation of logs	0.584	0.923	0.339	0.450	0.524	0.073
Gini coefficient	0.348	0.631	0.283	0.264	0.314	0.050
Mehran measure	0.453	0.718	0.266	0.353	0.408	0.055
Piesch measure	0.295	0.587	0.292	0.220	0.267	0.047
Kakwani measure	0.108	0.330	0.222	0.065	0.089	0.024
Theil entropy measure	0.236	1.009	0.773	0.129	0.180	0.051
Theil mean log deviation	0.198	0.694	0.496	0.114	0.157	0.044

Table 5. Standard Indicator of Inequality (Indonesia without Jakarta)

	Urban			Rural		
	$\tilde{p}_h$	p_h	Δ	$\tilde{p}_h$	p_h	Δ
Relative mean deviation	0.237	0.315	0.079	0.187	0.226	0.039
Coefficient of variation	0.747	1.222	0.475	0.604	0.714	0.110
Standard deviation of logs	0.558	0.710	0.152	0.450	0.524	0.073
Gini coefficient	0.328	0.427	0.100	0.264	0.314	0.050
Mehran measure	0.431	0.542	0.111	0.353	0.408	0.055
Piesch measure	0.276	0.370	0.094	0.220	0.267	0.047
Kakwani measure	0.096	0.157	0.061	0.065	0.089	0.024
Theil entropy measure	0.193	0.363	0.170	0.129	0.180	0.051
Theil mean log deviation	0.173	0.300	0.127	0.114	0.157	0.044

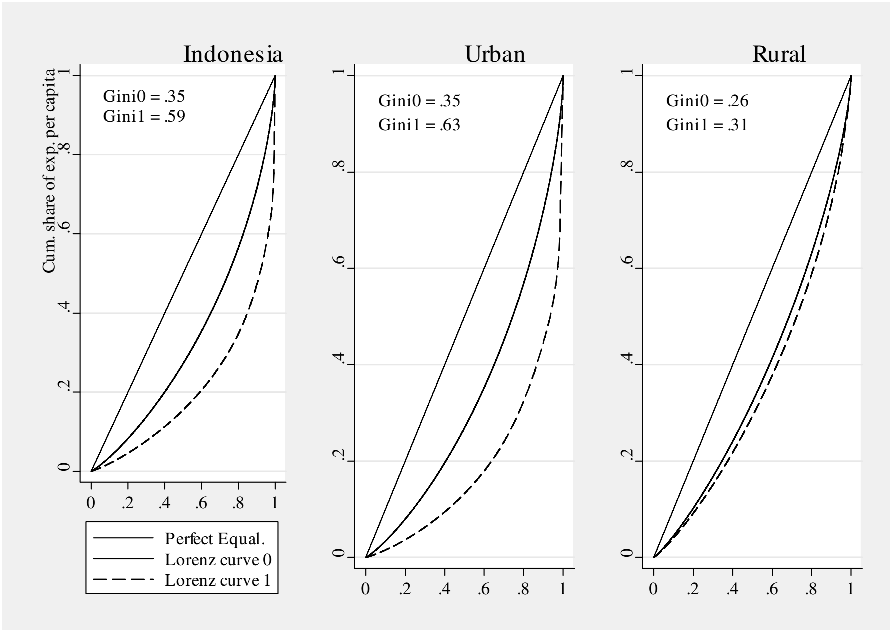

Figure 1. Lorenz Curve and Gini Coefficient (All Indonesia)

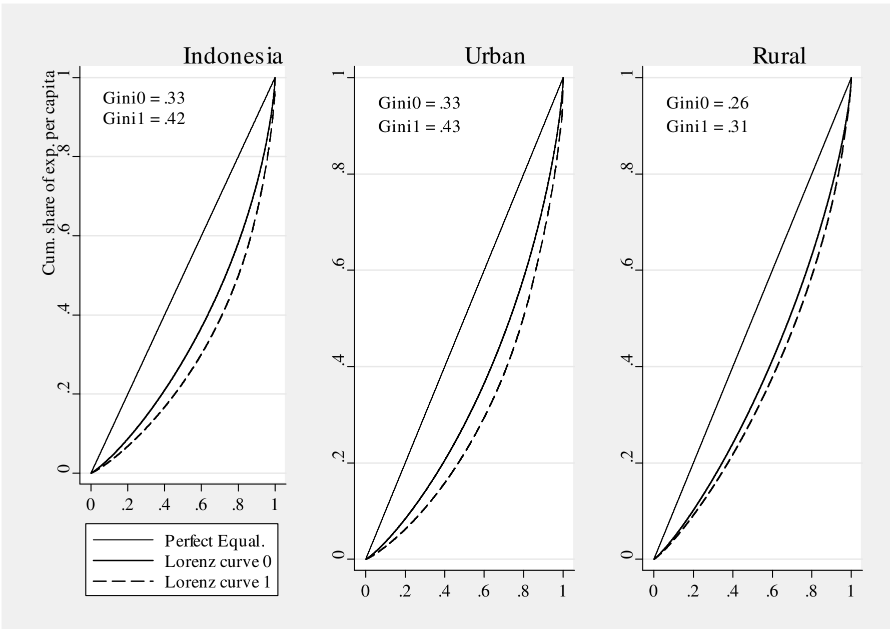

Figure 2. Lorenz Curve and Gini Coefficient (Indonesia, without Jakarta)

5 Concluding Remark

The inconsistency between food and non-food expenditure estimated from household survey data (SUSENAS) and from national account (I-O table) may imply that the inequality measured using household survey data is under-estimated if one believe that national account data give more accurate aggregate. Applying an approach to reconciling household survey and national accounts data, using a cross entropy estimation method, suggests that while under-estimation of inequality in rural Indonesia is not really significant, inequality in urban Indonesia is found to be highly under-estimated. The "Jakarta factor" i.e. the under-repsentation of the very rich in household survey in the nation's capital, seems to be biggest source of under-estimation of inequality in Indonesia.

Since, the under-estimation of inequality, as suggested by this exercise, is not merely a speculation, but based on the actual inconsistency between two source of data, and using a formal type of aproach, it may be used as a potential indication, that the inequality in Indonesia, especially in Jakarta, is a lot higher than anyone expected. This, off course, has a wide policy implication, but most importantly, Indonesia may not have been among the most equal nations.

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