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The living standard inequality in Vietnam: A statistical analysis

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ABSTRACT

This paper is to analyse income inequality in Vietnam in the 2000s based upon the Gini coefficient method. Compared with other conventional measures (i.e. the Lorenz curve, the Atkinson and the Theil's approach), the Gini coefficient draws a clearer picture of inequality since it provides unique results irrespective of varying social attitude to inequality (inequality aversion). In contrast, the measures with the Atkinson and Theil indices are strictly subject to changes in inequality aversion which, however, still has ambiguities due to data source constraints. The study shows a moderate level of, and stability in, inequality during 2002–2010. Equitable economic growth with respect to geographical dimensions, migration from rural to urban areas and migrants' remittance are the main reasons behind the results.

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1 INTRODUCTION

It has been increasingly concerned with inequality in various disciplines including, but not exclusive to, philosophy, sociology, politics and economics. In the realm of economics, an obvious reason for analyses of inequality is that equality causes equitable economic growth with improvements in the quality and quantity of the poor's workforce. Evidence from developing countries where poverty is persistent shows that excessive inequality offsets the positive influences of economic growth on poverty alleviation (Ravallion, 2005; World Bank, 2005); anti-poverty programs in conjunction with attacking inequality strategies are a prerequisite for successful socio-economic policies. Therefore, research on inequality with sufficient attention to the methodological perspective is essential for a harmonic and prosperous economy.

This paper firstly introduces several well-known measures of inequality which are applied by the vast majority of economic researchers, international institutions (e.g. the World Bank, the Asian Development Bank) and national reports. Among them, the Gini coefficient and the Lorenz curve published in the early 1900s, are likely to be the most widely used. The two other measurements of inequality, namely the Theil and Atkinson indices, were developed in the later phase of the 20th century. Using the theory of information, Theil (1967, 1979) suggested two estimates of inequality, called Theil L and Theil T indices. A compelling application of the Theil's method is the decomposition technique, which identifies the contribution of different components to a total inequality. On measuring inequality based upon the social welfare function, Atkinson (1970) argues that inequality damages social products (e.g. national income). In other words, individuals living in unequal communities should receive a smaller amount of wealth than they could have done if living in the completely equal ones.

The paper then applies the Gini coefficient for a computation of inequality in Vietnam using the

data extracted from the Vietnam Household Living Standard Surveys (VHLSS) 2002–2010. There is a dearth of research in the extent to which a measurement can be used. The literature on inequality evidences that measures are commonly adopted with limited analytical assessments on the methodological foundation, advantages and shortcomings. As a result, it is still far from a consensus on the trend in inequality in a particular country. To fill this gap, the paper sheds light on the appropriate measurements which lead to a better interpretation of the income distribution status in Vietnam.

2 MEASUREMENTS OF INCOME INEQUALITY

Quantitative research on inequality has been significantly developed in the 20th century. This section highlights several major statistical methods of inequality measurements.

2.1 The Lorenz curve

A unique graphical method is the Lorenz curve which depicts the cumulated percentage of a population corresponding to the cumulative income distribution. In particular, Lorenz (1905) plotted the population ordered from the least to the most well-off on one axis against the cumulative income on the other axis. An equal income distribution occurs if and only if all individuals gain the same amount of the social wealth that lets the Lorenz curve lie on the straight diagonal line from the bottom-left to the top-right corner (Figure 1, This figure is depicted based on the artificial data for discussion purpose). In contrast, an unequal income distribution bends the Lorenz curve; the more it is bent, the more unequal the society will be.

A trouble of the Lorenz's method is about the possibility of intersections among different Lorenz curves that create disputable interpretations of inequality comparisons. For instance, despite both A and A' are less unequal than B, these two curves should not clarify which one undergoes a higher level of unequal distribution (In fact, A' is more equitable than A at the bottom and *vice versa)*. A solution to this shortcoming with an adjustment to Lorenz's measurement of inequality is based on a social welfare approach (Atkinson, 1970); however, it cannot totally solve the intersectional problem, and thus, the Lorenz curve provides only a partial ordering of distribution (Kawani, 1980).

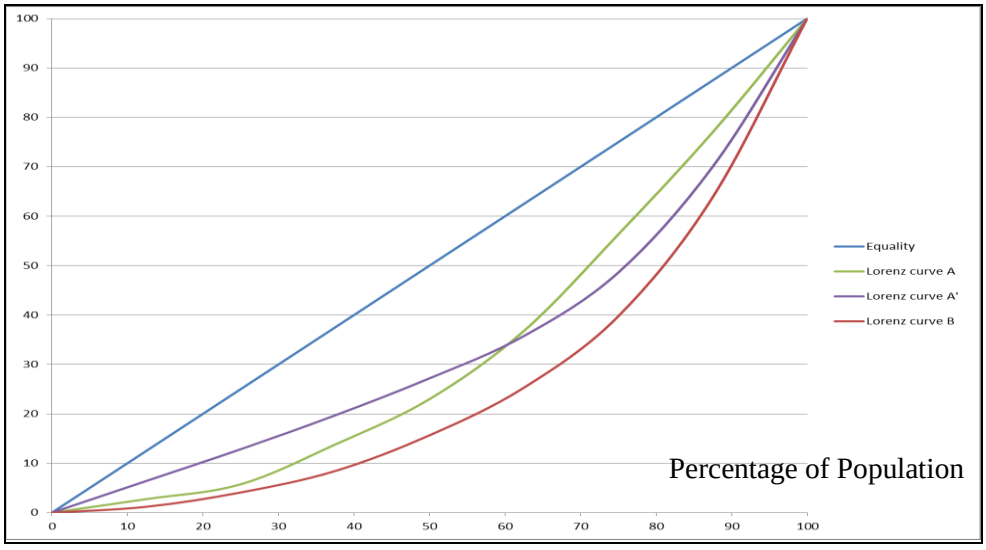

Fig. 1: The Lorenz curves and the intersectional problems

Source: Phan Van Phuc (2016, Figure 4.1 p. 60)

2.2 The Gini coefficient

Gini's statistical estimate of inequality shares an identical idea with Lorenz's method. It calculates inequality with the hypothesis for an equal income distribution when each member receives the same proportion of a total national income. Interestingly, although the Gini coefficient is presented in various ways which lead to the same results, it is half of the relative mean difference in income (Sen, 1973), so that inequality is estimated as follows:

$$G = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n}|y_i - y_j|}{2n^2\bar{y}}; \in [0; 1] \quad (2.1)$$

where:

G is the Gini coefficient;

n is the number of population; and

$\bar{y}$ is the average income.

A strength of the Gini coefficient is that it offers unambiguous and unconditional results without a variety of axioms. This concise estimate of inequality could explain for its highly frequent applications in research in inequality.

However, the Gini coefficient has several matters. One cannot find out any clue of the inequality's causes from the results of the measure (Ward, 1978). Sen (1973) additionally critiqued that this measurement does not consider relative sensitivity although it satisfies the Pigou–Dalton transfer principle[1]. Regarding the case of an intersection of the Lorenz curves, one value of the Gini coefficient may fit with different points in the Lorenz curves or it is possible to find more than one curve for a given Gini value (Atkinson 1970). Cowell (1988) added that Gini's method is an inconsistent measurement when inequality is disaggregated in its components. This problem occurs when all subgroup mean incomes are invariant; subgroup inequality rises but overall inequality falls. Despite these drawbacks, it is a mistake to ignore the Gini coefficient when discussing inequality as it contains a huge intuitive appeal (Temkin, 1993).

2.3 The Theil indices

Theil (1967) introduced his measurement of inequality as follows:

$$T(\alpha) = \frac{1}{\alpha(\alpha-1)}\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right] \quad if \quad \alpha \neq 0; 1; \quad (2.2)$$

$$T_T(\alpha = 1) = \frac{1}{n\bar{y}}\sum_{i=1}^{n}[\ln(\frac{y_i}{\bar{y}})y_i]; \quad (2.2a)$$

or

$$T_L(\alpha = 0) = \frac{1}{n}\sum_{i=1}^{n}\ln(\frac{\bar{y}}{y_i}) \quad 2.2b)$$

where:

T is the Theil index; T_L is Theil L and T_T is Theil T; all indices range from zero to infinity;

n is the total members of a subgroup;

α is the inequality parameter;

$\bar{y}$ is the average income of the subgroup; and

y_i is the income of the i^{th} member.

The Theil indices can be used for the decomposition of a total inequality in various components (e.g. urban–rural, within and between regions in a country, within and between countries) so that one can investigate the drivers of income distributional changes. The parameter α or the weight is given differently across an income distribution. Lower weights mean that the measurement is more sensitive for changes in the lower tail. The Theil L index is also called the mean log deviation.

Using the Theil indices, Bourguignon and Morrisson (2002) scrutinise the world inequality during 1820–1992. While the contribution of within-inequality dramatically reduced from 89% in 1820 to 40% in 1992, the between-inequality rapidly expanded and thus, shared six-tenths of overall inequality. Another analysis using the Theil indices is in Chotikapanich *et al.* (2012) who measured the world inequality in the 1990s. The contemporary world was highly unequal, albeit a marginal fall from 0.81 to 0.79 over the period 1993–2000. A decomposition of within-inequality and between-inequality highlighted an increase in the within-inequality contribution, but a sharp decline in the between-inequality component of the total inequality until 2000. The results of inequality disaggregation are, however, influenced by the size of sub-groups (Minot *et al.*, 2003). Between-inequality can increase when total inequality is decomposed into larger numbers of sub-groups (e.g. from province to district unit).

Irrespective of its advantages of inequality decomposition, it is not 'exactly overflowing with intuitive sense' because the foundation forming the Theil indices $(x_i\ log(1/x_i))$ entirely differs from an individual welfare function (Sen, 1973).

2.4 The Atkinson index

Atkinson (1970) illustrated his measurement of inequality based on the concept of 'the equally distributed equivalent income' as follows:

$$I_A = 1 - \frac{y_{EDE}}{\mu} \quad (2.3)$$

where:

I_A is the Atkinson index;

y_{EDE} is defined as 'the equally distributed equivalent income' and measured;

μ is the average income.

Calculation of the Atkinson Index

[1] The Pigou–Dalton transfer principle states that an income transfer from a wealthier to a poorer person leads to a reduction in inequality.

According to Araar and Duclos (2013), the *equally distributed equivalent income* in Eq. 2.3 is computed as follows:

$$y_{EDE} = \begin{cases} \left[\frac{1}{\sum_{i=1}^{n} w_i} \sum_{i=1}^{n} w_i (y_i)^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} & if\ \varepsilon \neq 1\ and\ \varepsilon > 0 \\ Epx\left[\frac{1}{\sum_{i=1}^{n} w_i} \sum_{i=1}^{n} w_i \ln(y_i)\right] & if\ \varepsilon = 1 \end{cases} \quad (*)$$

Where:

n: number of total members;

w_i: individual welfare of member *i*;

y_i: individual income of member *i*;

$\mathcal{E}$: inequality aversion, indicating the social behaviour to inequality

The equally distributed equivalent income means that if income is equally shared, a society obtains the greatest total social welfare (an aggregation of all individual welfares); it only happens when 'the equally distributed equivalent income', y_{EDE}, is equal to the mean income. An absence of this ideal condition implies that y_{EDE} deviates from the mean, μ; the larger the difference between y_{EDE} and μ, the higher the inequality level. The result of this is that the social wealth losses proportionately to the level of inequality. For example, if $I_A = 0.2$, a society requires 80% of its actual income to achieve the welfare level associated with a completely equal income distribution.

Using the social welfare function, inequality can be measured as follows:

$$I_A = 1 - \left[\sum_i \left(\frac{y_i}{\mu}\right)^{1-\varepsilon} f(y_i)\right]^{\frac{1}{1-\varepsilon}} \quad if \quad \varepsilon \geq 0\ and\ \varepsilon \neq 1$$

or

$$I_A = 1 - Exp\left[\sum_i \frac{y_i}{\mu} \ln(f(y_i))\right] \quad if \quad \varepsilon = 1 \quad (2.3')$$

where: y_i is individual *i*'s income; and

$\mathcal{E}$ is the inequality aversion degree, ranging from zero to infinity.

The level of inequality is subject to changes in the inequality aversion degree – $\mathcal{E}$. The greater is the $\mathcal{E}$, the larger the weight is dedicated to the lower end of the distribution, or the society concerns more about inequality; it approaches infinity when the society only considers its very poorest group.

The Atkinson index outperforms others in favour of evaluations of the lost welfare due to inequity. This approach presents a series of results depending upon the social attitude to inequality. The more a community is concerned about inequality, the higher the inequality aversion parameter ($\mathcal{E}$) is. Subsequently, the index will be greater regardless of the same distribution. However, Atkinson's measurement is unable to analyse inequality attributions to different subgroups as the Theil indices do; thus, it cannot be used as a decomposition technique for understanding within- and between-inequality (Gisbert *et al.*, 2009). Parameter choices are also challenging as it varies over time and across countries.

3 DATA AND VARIABLES

3.1 Data

The biennial cross-sectional data from VHLSS 2002–2010 are exploited in this study. VHLSSs provide major aspects of household characteristics, demographic information, education, employment, health, income and household production, expenditure, durable goods, asset, housing and poverty. An important characteristic of the surveys is that all information is collected biennially from approximately 9,000 households (except the 2002 wave with about 29,500 household units) across the country. Each wave encompasses retrospective data from the households who participated in the previous way and those from the households who were the first-time participants.

3.2 Variables

In this study, household expenditure is chosen as a proxy for the living standard. Despite no consensus on the appropriate variable used for inequality analysis, in developing countries, consumption expenditure is widely accepted as a proxy for the living standard compared with income indicator for two main reasons: income underreporting and transitory shocks to income (Deaton and Zaidi, 2002; Nguyen *et al.*, 2007; Glewwe and Dang, 2011). A plethora of research claims that the interviewees do not honestly report their income to the interviewers who work for governments. The household heads may not remember exactly their all sources of income as well. Furthermore, annual income is more seasonal and less reliable than consumption expenditure and thus, it generates problematic proxy for the living standard (Moser and Felton, 2009).

4 RESULTS AND DISCUSSION

4.1 Descriptive statistics

The VHLSSs show that, on average, household expenditure increased tremendously in the 2000s. Starting at approximately 14.5 million Vietnamese dong (VND hereafter), it doubled in six years and then grew even faster in the final two-year period, which reached 49 million VND in 2010. The original data of VHLSS 2010, however, contains outliers that affect the computation of inequality. To tackle the outlier problems, the data are amended by by removing the number of households whose income ranks at the top 0.25% and the bottom 0.25% of the population. Thanks to this adjustment, the mean, standard deviation and max expenditure values decline whereas the min value dramatically rises (Table 1).

Table 1 reveals preliminary evidence of an unequal expenditure distribution over the 2000s, albeit a rather stable deviation between the mean and median compared with the mean expenditure. For instance, the gap between the mean (14.5 million VND) and the median (11.2 million VND) implies a significant income dispersion in 2002. This relative gap remained fairly unchanged in the following years irrespective of an increase in the absolute differences between the mean and median.

Table 1: Real household consumption expenditure in the period 2002–2010 (thousand VND)

Year	Mean	Median	SD	Min	Max	Observation
2002	14,491.0	11,279.3	11,904.6	365.1	224,063.3	29,530
2004	18,202.3	14,340.4	14,555.9	608.7	178,944.9	9,189
2006	23,305.3	18,574.4	18,199.3	1,241.0	309,501.1	9,189
2008	29,993.0	24,160.1	24,118.9	1,039.5	399,883.4	9,189
2010	49,028.8	39,148.1	42,873.8	*250.6*	*817,496.6*	9,399

Source: VHLSS 2002–2010; author's calculation

4.2 Trends in inequality

4.2.1 Results from the Lorenz curve and the Gini coefficient

A close distance between the equality line and the Lorenz curves reaffirm that neither is inequality high nor low; therefore, Vietnam stands in the middle of the world inequality (World Bank, 2014). The Lorenz curves cannot, however, enable the current research to further scrutinise inequality because of their intersections (Figure 2) in spite of highlighting a fluctuated inequality in the examined period.

The Gini coefficient is superior to the Lorenz curve with respect to reflecting the modest inter-temporal changes in inequality. Figure 3 shows that the Gini coefficient of expenditure minorly varies between 0.36 and 0.37. Inequality increased slightly in the first two years and reached a peak at 0.372 in 2004 before monotonically decreased until 2008. It then went upward over the last two years and climbed back to 0.37 in 2010.

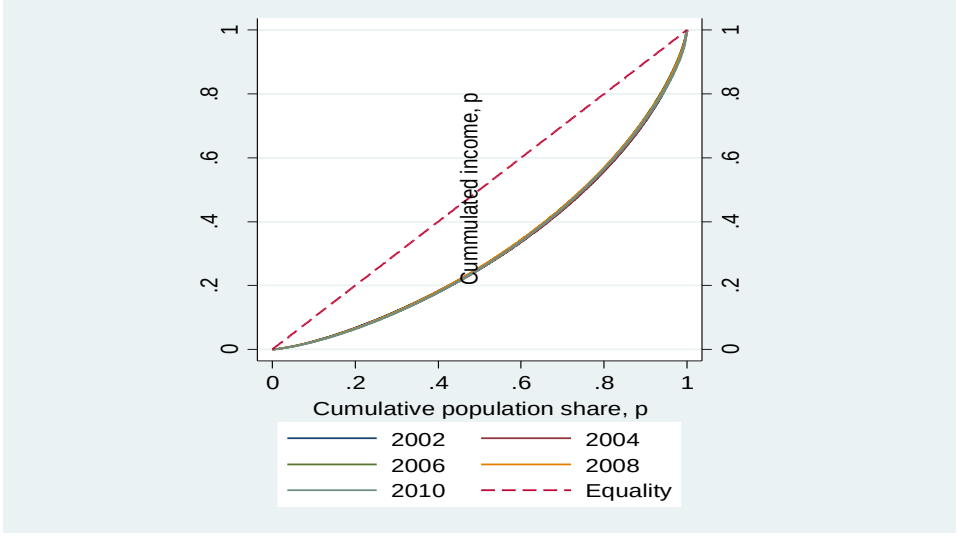

Fig. 2: Lorenz curves on household consumption expenditure during 2002–2010

Source: VHLSS 2002–2010; author's calculation

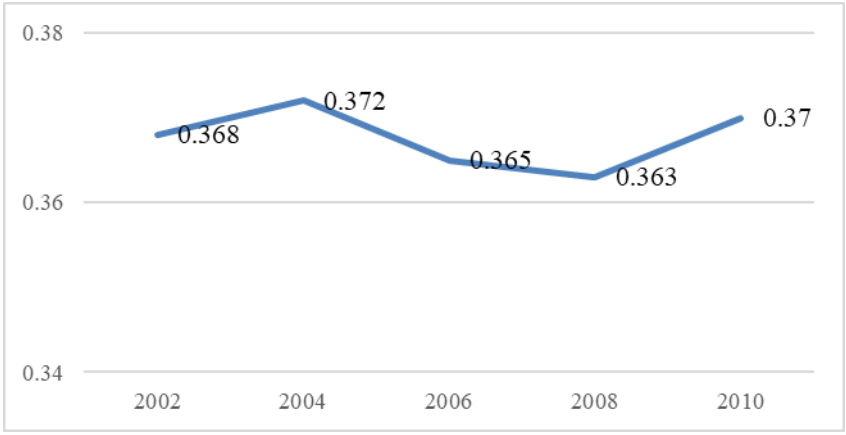

Fig. 3: The Gini coefficient of consumption expenditure

Source: VHLSS 2002–2010; author's estimation

4.2.2 Results from the Atkinson and Theil indices

Apart from the Gini coefficient and Lorenz curve, the measures of inequality with the Atkinson and Theil's methods depend notably on the inequality aversion $(\mathcal{E})$. Table 2 reports the results of inequality measured by the Atkinson index with four various values of the inequality aversion. These parameters proportionally contribute to the inequality level. If $\mathcal{E}$ is equal to 0.5, meaning that Vietnamese people do not negatively behave strongly to the unequal distribution, inequality fluctuates around 0.10. However, the level of inequality scales up to 0.21, over 0.29 and nearly 0.4 corresponding to three values of the parameter (1, 1.5 and 2) respectively. These choices of parameter also lead to differences in inequality trajectory. In the first case, inequality stabilised in 2002–2004, followed by a slight fall in inequality that recorded the lowest point at 0.107 in 2006. It rose significantly and hit the top at 0.114 in the final year. In contrast, with the values equal one or greater, an increased inequality in the first two years was more sizeable and the least inequity could be in 2008 rather than 2006.

Table 2: Inequality measured by the Atkinson index

Year	$\mathcal{E}$			
	0.5	**1**	**1.5**	**2**
2002	0.110	0.205	0.290	0.370
2004	0.111	0.209	0.297	0.379
2006	0.107	0.204	0.292	0.374
2008	0.108	0.203	0.290	0.373
2010	0.114	0.212	0.302	0.392

Source: VHLSS 2002–2010; author's estimation

Inequality is finally compared with the results from the Theil indices as demonstrated in Table 3. Similar to the Atkinson index, this measurement computes inequality in relation to the inequality aversion (α). The results show two contrast trajectories in the living standard dispersion. The trend in the living standard distribution which is calculated by the Theil index with zero inequality aversion is robust to the Gini method. However, the two other trajectories corresponding to α =1 and 2 form the U-shaped curves of inequality with the lowest point in 2006. There is an increasing gap in the living standard across the waves of VHLSS with α = 2, which induces a growth in inequality for the whole period.

Table 3: Inequality measured by the Theil indices

Year	α		
	0	**1**	**2**
2002	0.230	0.241	0.337
2004	0.235	0.240	0.319
2006	0.228	0.229	0.304
2008	0.227	0.233	0.323
2010	0.238	0.250	0.382

Source: VHLSS 2002–2010; author's estimation

4.3 Discussion

The Gini coefficient is applied for the measurement of inequality in this paper as it is superior to the others in two main ways. Firstly, it draws an apparent picture of inequality which negligibly changed in the 2000s. The overlap of the Lorenz curves is robust to the results of inequality measured by the Gini coefficient. Secondly, with independence from the social welfare function, the Gini method provides unique results of inequality re-

gardless of the values of inequality aversion or the attitude towards inequality of the mass population which requires a complicated evaluation procedure.

The Gini coefficient shows a stability in inequality in Vietnam in the period 2002–2010. The absolute inequality varied from 0.36 to 0.37. The World Bank (2014) found that in Vietnam, the benefits from fast economic growth are more equally distributed among different cohorts of the population compared with several emerging Asian economies such as China, Thailand and Indonesia. An important reason behind this equitable growth is that the agricultural sector expanded, albeit at a low rate, during 2002–2010.

The Atkinson and Theil indices are used as benchmarks in this current research. The Atkinson and Theil indices are conditional on the inequality aversion which depends on individual behaviour to inequality. In fact, insufficient evidence of adopting its value since inequality aversion reflects individuals' attitude towards inequality which varies over time and across regions. In Vietnam, an exclusive research related to inequality aversion only dwells on personal attitude classifications between tolerable and unacceptable inequality. A gap in the living standard tends to be acceptable as long as sources of inequality are fair and legitimate (Badiani *et al.*, 2013). Yet, establishing an inequality aversion is at a premature stage and still far from a consensus on a development of a parameter reflecting the Vietnamese people's responses to inequality.

5 CONCLUSION

This paper surveyed several key measurements of inequality. The Gini coefficient and its consistent graphical method – the Lorenz curve – pioneer the research in inequality. The Gini coefficient provides unambiguous results of inequality measured while the Lorenz curve results in a difficult interpretation in the case of the intersection. Atkinson (1970) alternatively analysed inequality in relation to social welfare function; unequal distribution in an economy proportionally reduces the total social welfare. Finally, Theil's measurement of inequality is the best well-known instrument for inequality decomposition, which investigates a variety of the contributors to inequality.

Applying the Gini coefficient to the VHLSS data, the paper has found that the level of inequality in living standard is moderate and steady in the 2000s. This result is in line with the literature on income inequality (e.g. Badiani *et al.*, 2013; World Bank, 2014). The Atkinson and Theil indices were used for robustness checks.

Several directions for the future research are suggested. Firstly, as the main goal of this paper is an introduction to measurements of inequality, this study inadequately discussed the causes of inequality in-depth and the extent to which income inequality affects economic and non-economic aspects of the Vietnamese people's wellbeing. Secondly, Badiani *et al.* (2013) critiqued that there were insufficient analyses on non-income dimensions of inequality; the gap, however, has not been filled since then. Thus, future research should pay more attention to the relationship between income and non-income inequality and how to incorporate the contribution of plausible dimensions of inequality in a single index.

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