MEASURING INCOME INEQUALITY IN MALAYSIA BASED ON HOUSEHOLD INCOME SURVEYS

(Pengukuran Jurang Pendapatan di Malaysia Berdasarkan Tinjauan Pendapatan Isi Rumah)

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ABSTRACT

Several policies have been introduced by Malaysian government with the aim of reducing the income inequality among the citizens. This study examines the changes in income inequality based on three different indices, which are Gini, Atkinson and generalized entropy using the household incomes data available from the surveys conducted in 2007, 2009, 2012 and 2014. Modification for each index is employed by taking sample weights into account for better measurement. Lorenz curves are fitted to the data to describe how the incomes of different household income groups are distributed over the time period. All the indices show a decreasing trend from 2007 to 2014, indicating an overall improvement of income distribution. The proportions of income earned by the low income groups have increased from 14.25% in 2007 to 16.28% in 2014 after taking economic pie from the higher income group while the middle class remains unchanged.

Keywords: Atkinson index; generalized entropy index; Gini index; Lorenz curve; inequality measure

ABSTRAK

Pelbagai dasar telah diperkenalkan oleh kerjaaan Malaysia dengan tujuan untuk mengurangkan jurang pendapatan dalam kalangan rakyat. Kajian ini melihat perubahan jurang pendapatan pada tiga indeks yang berbeza iaitu Gini, Atkinson dan entropi umum menggunakan pendapatan isi rumah yang didapati daripada kaji selidik yang dijalankan pada tahun 2007, 2009, 2012 dan 2014. Pengubahsuaian terhadap setiap indeks telah dibuat dengan mengambil kira maklumat pemberat sampel untuk pengiraan yang lebih baik. Lengkung Lorenz dipadankan pada data untuk memerihalkan bagaimana pendapatan kumpulan pendapatan isi rumah berbeza dalam tempoh masa yang diukur. Hasil kajian mendapati, semua indeks menunjukkan trend menurun dari tahun 2007 hingga 2014, menjelaskan peningkatan keseluruhan pengagihan pendapatan. Perkadaran pendapatan yang diperoleh oleh kumpulan berpendapatan rendah telah meningkat daripada 14.25% pada tahun 2007 kepada 16.28% pada tahun 2014 setelah mengambil kira pai ekonomi dari kelompok pendapatan tinggi sementara kelas pertengahan tetap tidak berubah.

Kata kunci: indeks Atkinson; indeks entropi umum; indeks Gini; lengkung Lorenz; ukuran ketidaksamaan

1. Introduction

Income inequality is a matter of concern in any society. This issue is of interest to be discussed, particularly for developing countries such as Malaysia, since high income inequality could be detrimental to the economic growth of a country (De Dominicis *et al.* 2008; Qin *et al.* 2009). Castelló-Climent (2010) has argued that both income and human capital inequality can cause a negative effect on the economic growth in low and middle-income countries. Castilla (2012)

has found that two subjective well-being indicators, which are income satisfaction and income adequacy, are positively correlated with the society's absolute level of income. It is clear that the income disparity that exists in a society can be observed based on the different pattern of expenditures among the society members. Fisher *et al*. (2015) have shown that the expenditure inequality is affected by income inequality. The high-income groups are more likely to spend more in absolute terms as compared to the middle and lower-income groups, even though in general, each community intends to maintain a stable standard of living by avoiding excessive spending in the daily life.

The negative impacts of income inequality have been discussed in many works. For example, Graham and Felton (2006), and Ferrer-i-Carbonell and Ramos (2014) have found that income inequality correlates negatively with happiness in Latin America and Western societies. In addition, studies on the relationship between income inequality and crime have found that income inequality is positively associated with crime, in particular, violent crime such as burglary and robbery (Brush 2007; Choe 2008; Kelly 2000; Patterson 1991; Wu & Wu 2012). This finding is consistent with Merton's strain theory which states that the society which puts pressure on individuals to attain socially accepted goals though they lack the means, would leads to strain that could drive the individuals to commit crimes, thereby crime is a social cost of inequality (Merton 1938). Therefore, the efforts to narrow the income disparity among people are essential to ensure the improvement of society's well-being and economic development in a country.

In Malaysia, the efforts have been made by the government to address the problem of income inequality and poverty through the establishment and implementation of government policies. One of the main policies introduced by the government is the New Economic Policy (NEP) which began in 1970 and ended in 1990 (Khalid & Abidin 2014). The main aim of the NEP was to narrow the income gap and eradicate poverty among the Malaysians. This policy has been extended with the implementation of the National Development Policy (NDP) from 1991 to 2000, the National Vision Policy (NVP) from 2001 to 2010 and the latest policy, the New Economic Model (NEM) from 2011 to 2020. All these policies play an important role in ensuring that the distribution of income to be carried out fairly and effectively among Malaysians. The NEP was acclaimed as a successful model in assisting the government for redistributing income without sacrificing growth (Ragayah 2008). Although the concept of "growth with equity" was applied in the NDP and NVP, Ragayah (2008) has shown that income inequality has increased among Malaysians in the early 90s.

The Malaysian Department of Statistics publishes the Gini index to measure income inequality among Malaysians. However, the Gini index is very much influenced by the middle part of income distribution (Atkinson 1970; De Maio 2007). In addition, the statistical analysis of survey data which involves neglecting the sample weights can produce a bias result and eventually lead to inaccurate conclusions (Pfeffermann 1993; Chambers 2003). In the survey data, the unequal sample weights reflect unequal sample inclusion probabilities for the observation in the population (Chambers 2003; Pfeffermann 1993; Tillé 2011).

The effectiveness of government policies aimed at reducing inequality in a given time period, either supportive or perverse, can be determined by measuring the income inequality (Gounder & Xing 2012; Kaplow 2005). The aim of this study is to provide empirical evidence on the income inequality in Malaysia based on data available for the years of 2007, 2009, 2012 and 2014. This study employed Lorenz curve and several modifications of income inequality indices such as Gini index, Atkinson index, generalized entropy index by taking sample weights into accounts for more representative. Alfons *et al.* (2013) have suggested that sample weights need to be considered when measuring income inequality based on survey samples so that the true distribution of the population is accurately determined. The Atkinson and generalized entropy (GE) indices with different values of sensitivity parameters are used to measure income

inequality. These two indices are alternatives to the Gini index. This paper is organized as follows. Section 2 will describe the data sources and the sampling methods used. Section 3 introduces the income inequality measures applied in this study. Section 4 presents the results of descriptive statistics, income inequality indices as well as the discussion of the results while Section 5 concludes the paper.

2. Data Sources and Sampling Method

The household income data used to measure the income inequality in Malaysia from 2007 to 2014 are derived from official surveys known as Household Income Surveys (HIS). These official surveys were carried out by the Departments of Statistics, Malaysia (DOSM). This survey was first carried out in 1973 and has then been conducted twice in every five years, implying that two surveys were carried out within each MDP period with the latest one being in 2016. The objectives of HIS are to measure the economic well-being of the Malaysian population, collect information on household incomes and socio-economic backgrounds, and to provide the database for calculating the Poverty Line Income (PLI). The statistics of household income and poverty are used for formulating policy and development of economic plan for Malaysia, particularly in terms of eradicating of poverty and developing strategies for fair income distribution.

The sample in HIS is selected based on the Household Sampling Frame which consists of Enumeration Blocks (EB). As explained by DOSM (2013), the EB are geographical contiguous areas of land, identifiable by boundaries which are created for the purpose of survey operation, which is on the average, contains about 80 to 120 living quarters (LQ). Generally, all EB are formed within gazetted boundaries, i.e. within administrative districts, territorial divison or local authority areas. The EB in the sampling frame are divided and classified by urban and rural areas. Urban areas are gazetted areas with their adjoining built-up areas which have a combined population of 10,000 or more. While, gazetted area with the population of less than 10,000 and is classified as rural area.

Two-stage stratified sampling design was adopted in HIS. The first level of stratification is primary strata which covered administrative district for all state in Malaysia. The second level of stratification is secondary strata which covered urban and rural strata. The selections of samples have been done at EB level using the method of probability sampling proportionate to size. Then, sample for LQ were selected from the selected EB by using systematic method that generate random number and interval class to ensure every LQ have an equal probability to be selected in the sample. This procedure is performed in order to produce unbiased sample which can represent the entire population of households in Malaysia. The procedure of the survey is shown in Figure 2. In this study, we use the Malaysian household monthly gross incomes to estimate and investigate income in Malaysia from 2007 to 2014. Table 1 shows the reported sample size for HIS, total number of household and PLI values from 2007 to 2014.
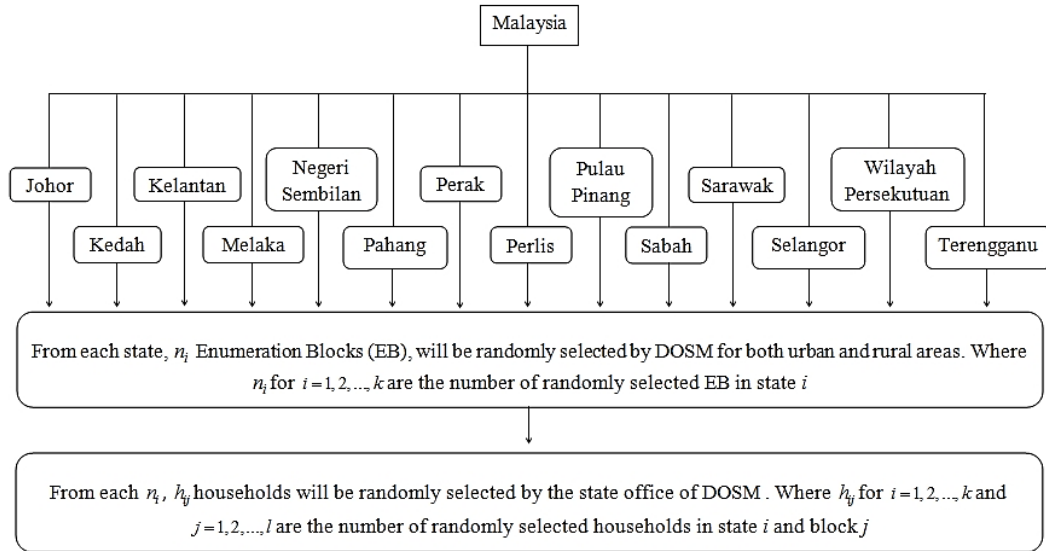
Figure 2: Illustration of the procedure of Household Income Surveys (HIS)

Table 1: Household Income Surveys (HIS) 2007-2014

Year	Sample size	Total number of household	Poverty Line Income (RM)
2007	12,136	6,195,682	750
2009	12,908	6,557,880	800
2012	13,232	6,943,203	860
2014	24,463	7,108,210	950

Source: Economic Planning Unit (2016), Department of Statistics Malaysia (2016)

3. Income Inequality Measurement

There are many methods that could be used to measure income inequality (Champernowne & Cowell 1998; Cowell & Flachaire 2015; Safari *et al.*, 2018; Sen 1973). Three different income inequality measures, including the Gini, Atkinson and generalized entropy indices are applied to measure the income inequality in Malaysia. We also made some modification for each index by taking sample weights into account. The results found based on these methods are later used to examine the changes in the income distribution, over the period from 2007 to 2014.

3.1. *Lorenz Curve and Gini Index*

Lorenz curve is a graphical representation of income distribution developed by Lorenz (1905). In Figure 3, the line of equality represents a perfectly even distribution of income and the Lorenz curve shows the actual distribution of income. The more uneven the distribution of income, the more the Lorenz curve deviates from the line of equality (Lorenz 1905). Hence, the Lorenz curve is a graphical tool of assessing the inequality of income in a population group (Champernowne & Cowell 1998; Kleiber & Kotz 2003; Masseran *et al.* 2019). As given by Cowell and Flachaire (2015), the Lorenz curve denoted by $L(q)$, where $q \in [0,1]$, can be as (1).

$$L(q) = \frac{1}{\hat{\mu}n} \sum_{i=1}^{\kappa(q)} y_{(i)} \tag{1}$$

where $y_{(i)}$ is the i-th order statistics of household income for $i = 1, 2, ..., n$, $\hat{\mu}$ is the sample mean of household incomes and $\kappa(q) = \lfloor i - q + 1 \rfloor$ is the largest integer less than i-q+1. The modified weighted Lorenz curve $L_w(q)$, such that $q \in [0,1]$, can be written as,

$$L_w(q) = \frac{1}{\hat{\mu}_w} \frac{\sum_{i=1}^{\kappa(q)} w_{(i)} y_{(i)}}{\sum_{i=1}^{n} w_{(i)}} \tag{2}$$

where $y_{(i)}$ is the i-th order statistics of household income for $i = 1, 2, ..., n$, $w_{(i)}$ is the sample weights attached to $y_{(i)}$, $\hat{\mu}_w$ is the weighted sample mean of household incomes and $\kappa(q) = \lfloor i - q + 1 \rfloor$ is the largest integer less than i-q+1.
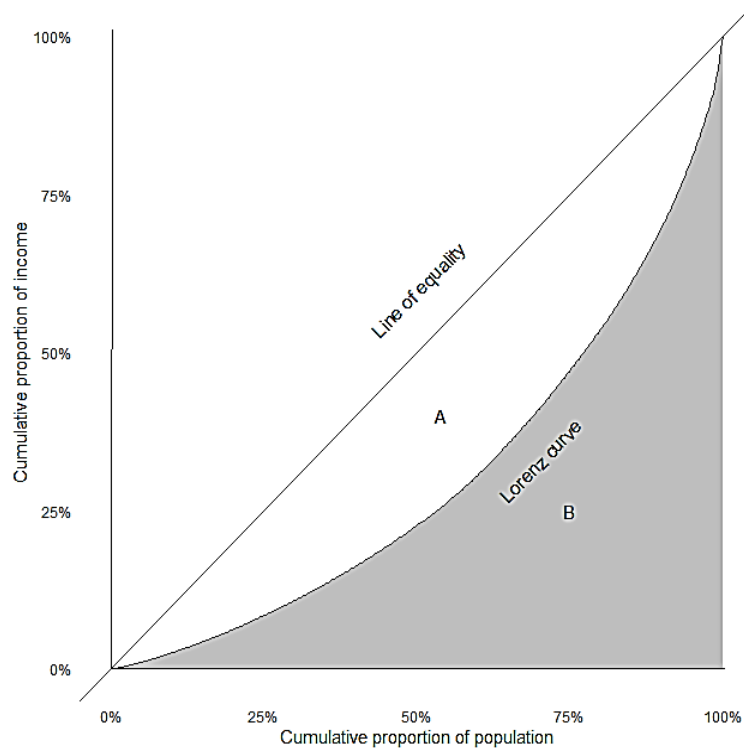

Figure 3: Example of Lorenz curve

The Gini index is the most popular and widely used measure of inequality (Campano & Salvatore 2006; Champernowne & Cowell 1998; Sen 1973). The Gini index is the ratio of the area between the $45°$ line of equality and the Lorenz curve to the area of the triangle below the

45° line of equality. In Figure 3, the Gini index is equal to A/(A+B). The Gini index ranges from 0 to 1, denoted as $I_{Gini} \in [0,1]$. A Gini index of 0 indicates a perfect income equality, while a Gini index of 1 indicates a perfect income inequality because only one person or household is earning 100 percent of the income (Campano & Salvatore 2006; Champernowne & Cowell 1998; Sen 1973). There are many different formulas for calculating the Gini index (Ceriani & Verme 2012). However, in this study a bias-corrected estimator of the Gini index is used. According to Cowell and Flachaire (2015), it can be written as (3).

$$I_{Gini} = \frac{2\sum_{i=1}^{n} i y_{(i)}}{(n-1)\sum_{i=1}^{n} y_{(i)}} - \frac{n+1}{n-1} \tag{3}$$

where $y_{(i)}$ is the i-th order statistics of household income for $i = 1, 2, ..., n$. The modified weighted Gini index, denoted as $I_{w.Gini} \in [0,1]$, can be expressed as (4).

$$I_{w.Gini} = \frac{2\sum_{i=1}^{n} \left(w_{(i)} y_{(i)} \sum_{j}^{i} w_{(j)} \right)}{\left(\sum_{i=1}^{n} w_{(i)} \right) \left(\sum_{i=1}^{n} w_{(i)} y_{(i)} \right)} \frac{n}{n-1} - \frac{n+1}{n-1} \tag{4}$$

where $y_{(i)}$ is the i-th order statistics of household income for $i = 1, 2, ..., n$ and $w_{(i)}$ is the sample weights attached to $y_{(i)}$ for $i = 1, 2, ..., n$. The correction factor $n/(n-1)$ ensures that (4) reduces to (3) if all sample weights are equal.

3.2. *Atkinson index*

The Atkinson index is based explicitly on a social welfare evaluation of income distribution (Atkinson 1970). For a given total income, the welfare function underlying the Atkinson measure captures a greater equality in income distribution as higher social welfare. According to Atkinson (1970), the Atkinson's inequality measure is defined as (5).

$$I_A^{\xi} = 1 - \frac{y_{EDE}}{\hat{\mu}} \tag{5}$$

where y_{EDE} is the equally distributed equivalent income and $\hat{\mu}$ is the sample mean of household incomes. In the case involving sample weights, the Atkinson's inequality is defined as (6).

$$I_{w.A}^{\xi} = 1 - \frac{y_{EDE}}{\hat{\mu}_w} \tag{6}$$

where y_{EDE} is the equally distributed equivalent income and $\hat{\mu}_w$ is the weighted sample mean of household incomes. Given the index is mean-independent[3] and that each household has the same utility function, the Atkinson index $I_A^{\xi} \in [0,1]$ can be expressed as (7).

$$I_A^{\xi} = \begin{cases} 1 - \left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\hat{\mu}}\right)^{1-\xi}\right]^{\frac{1}{1-\xi}} & \text{for } \xi \neq 1 \\ 1 - \prod_{i=1}^{n}\left(\frac{y_i}{\hat{\mu}}\right)^{\frac{1}{n}} & \text{for } \xi = 1 \end{cases} \tag{7}$$

where y_i is the *i*-th household income and $\hat{\mu}$ is the sample mean of household incomes. When sample weights are taken into a account, we now have the modified weighted Atkinson index $I_{w.A}^{\xi} \in [0,1]$ that can be written as (8).

$$I_{w.A}^{\xi} = \begin{cases} 1 - \left[\dfrac{\sum_{i=1}^{n} w_i \left(\dfrac{y_i}{\hat{\mu}_w}\right)^{1-\xi}}{\sum_{i=1}^{n} w_i}\right]^{\frac{1}{1-\xi}} & \text{for } \xi \neq 1 \\ 1 - \prod_{i=1}^{n}\left(\dfrac{y_i}{\hat{\mu}_w}\right)^{\frac{w_i}{\sum_{i=1}^{n} w_i}} & \text{for } \xi = 1 \end{cases} \tag{8}$$

where y_i is the *i*-th household income, w_i is the *i*-th sample weights associated with y_i and $\hat{\mu}_w$ is the weighted sample mean of household incomes. The Atkinson index is an income inequality measure that allows for varying sensitivity to inequalities in different parts of the income distribution (Atkinson 1970). This measure depends on a sensitivity parameter (ξ) which ranges from 0 to infinity, i.e. $\xi \in [0,\infty)$. The sensitivity parameter is also known as inequality aversion parameter which giving more weight to the small incomes as it increases (Atkinson 1970; Champernowne & Cowell 1998; Kleiber & Kotz 2003). Atkinson (1970) suggests that the value of ξ should between 1.0 and 2.5. Stern (1977) reviews the literature on elasticity of marginal utility of income and suggests the value of ξ between 1.5 and 2.5. In practice, ξ values of 0.5, 1, 1.5 or 2 are used to measure inequality (De Maio 2007; Du *et al.* 2015). The Atkinson index could be presented as a value between 0 and 1, with 0 reflecting a state of equal income distribution.

3.3. *Generalized entropy index*

Similar to the Atkinson index, the GE index also acts as an important family of inequality measures which incorporates a sensitivity parameter (ε) that assigns the weight to distances between incomes in different parts of the income distribution (Shorrocks 1980). The more positive (negative) ε is, the more sensitive is the GE index to income inequality at the top (bottom) of the income distribution (Cowell & Flachaire 2015). When $\varepsilon = 0$, the index is called the mean logarithmic deviation (MLD) index which can be denoted as I_{GE}^{0}. When $\varepsilon = 1$, the index is called the Theil index indicated and can be denoted as as I_{GE}^{1}. Another key feature of the GE measure is that it is fully decomposable (Shorrocks 1980), i.e., it may be broken down by population subgroups. The GE index ranges from 0 to infinity, i.e. $I_{GE}^{\varepsilon} \in [0,\infty)$, with 0 being a state of equal distribution and values greater than 0 indicates increasing levels of inequality.

The GE index is given by Shorrocks (1980), Zanvakili (1992), and Cowell and Flachaire (2015) that can be written as (9).

$$
I_{GE}^{\varepsilon} = \begin{cases} \left[n\left(\varepsilon^2 - \varepsilon\right)\right]^{-1} \sum_{i=1}^{n} \left[\left(y_i / \hat{\mu}\right)^{\varepsilon} - 1\right] & \text{for } \varepsilon \neq 0,1 \\[3mm] -n^{-1} \sum_{i=1}^{n} \log(y_i / \hat{\mu}) & \text{for } \varepsilon = 0 \\[3mm] n^{-1} \sum_{i=1}^{n} (y_i / \hat{\mu}) \log(y_i / \hat{\mu}) & \text{for } \varepsilon = 1 \end{cases}
\tag{9}
$$

where y_i is the *i*-th household income for $i = 1, 2, ..., n$ and $\hat{\mu}$ is the sample mean of household incomes. The modified weighted GE index denoted as $I_{w.GE}^{\varepsilon} \in [0,\infty)$ is given by (10).

$$
I_{w.GE}^{\varepsilon} = \begin{cases} \dfrac{\sum_{i=1}^{n} w_i \left(\dfrac{y_i}{\hat{\mu}_w}\right)^{\varepsilon}}{\left(\sum_{i=1}^{n} w_i\right)\left(\varepsilon^2 - \varepsilon\right)} - \dfrac{1}{\varepsilon^2 - \varepsilon} & \text{for } \varepsilon \neq 0,1 \\[6mm] -\dfrac{\sum_{i=1}^{n} w_i \log(y_i / \hat{\mu}_w)}{\sum_{i=1}^{n} w_i} & \text{for } \varepsilon = 0 \\[6mm] \dfrac{\sum_{i=1}^{n} w_i (y_i / \hat{\mu}_w) \log(y_i / \hat{\mu}_w)}{\sum_{i=1}^{n} w_i} & \text{for } \varepsilon = 1 \end{cases}
\tag{10}
$$

where y_i is the *i*-th household income for $i = 1, 2, ..., n$, w_i is the sample weights attached to y_i and $\hat{\mu}_w$ is the weighted sample mean of household incomes.

4. Results and Discussion

This section provides some descriptive statistics and an overview of the distribution of household incomes in Malaysia over the period from 2007 to 2014. In addition to the descriptive statistics, Lorenz curves are determined for describing the income data for these years. Indices based on Gini, Atkinson and GE are computed and used to explain the changes in income inequality for the country.

4.1. *Descriptive statistics*

It is important to evaluate the descriptive statistics in order to obtain some preliminary information about the data before a more detailed analysis is made. Table 2 shows the descriptive statistics for household income data from 2007 to 2014, which involves mean, median, variance, maximum, minimum and coefficient of skewness. Based on the reported mean and median values for the different years, it is clear that household incomes show an increasing trend, where the highest values were observed in the year 2014. The variance of household incomes appears to increase from year to year, indicating that the data spread is getting wider about the mean. Based on the calculated coefficient of skewness, it could be observed that all the coefficients are positive, indicating that the distribution of Malaysian household incomes does not follow a normal distribution and skews to the right. Also as shown in Figure 4, the household incomes appear to be skewed to the right, which explains why the mean is always greater than the median. It can further be explained that there exist some households in Malaysia which actually earn extremely large incomes compared to others. In fact, the minimum Malaysian household income in each year ranged between 59.10 and 213.00, while the maximum household income ranged between 102,083.30 and 186,892.00. From these values, it is shown that the range of Malaysian household incomes was extremely large, which indicated a large dispersion of the data. The proportion of non-poor households increased from 2007 to 2014 showing that a remarkable progress has been achieved in poverty eradication among Malaysian households. However, more detailed analysis should be done to investigate the change in poverty among Malaysian households.

Table 2: The descriptive statistics of Malaysian household incomes

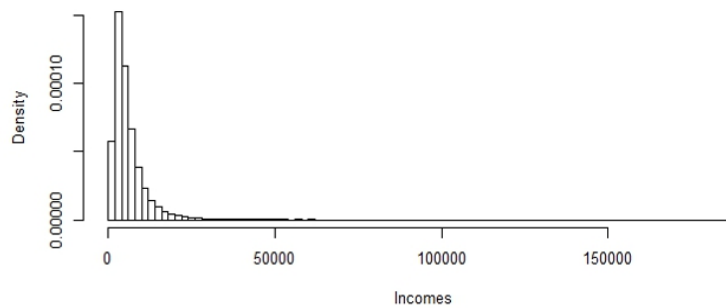| Year	Mean (RM)	Median (RM)	Variance	Minimum (RM)	Maximum (RM)	Coefficient of skewness	Non-poor household (%)
2007	3588.82	2450.00	16004620	59.17	109036.00	6.1509	94.32
2009	4008.60	2842.71	17218972	100.00	102083.30	5.0548	95.50
2012	4981.02	3606.72	26884145	150.00	105958.00	5.7244	96.91
2014	6268.99	4608.00	39520117	213.00	186892.00	6.1625	98.63
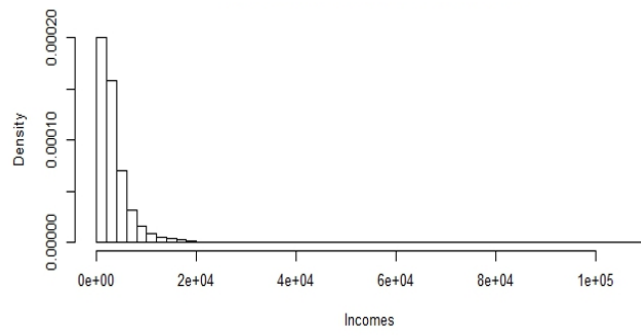
(a)
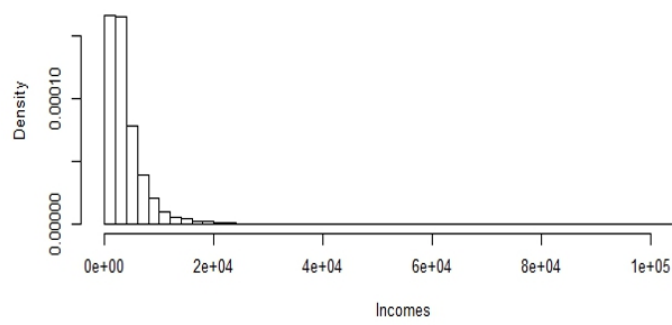
(b)
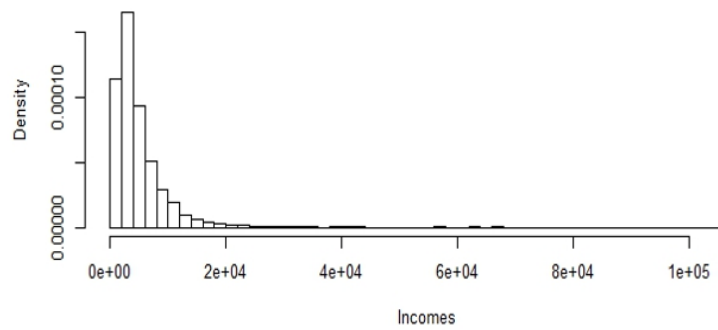
(c)

(d)

Figure 4: The empirical distribution of Malaysian household incomes in (a) 2007, (b) 2009, (c) 2012 and (d) 2014

4.2. *Income inequality*

The Lorenz curves of Malaysian household incomes from 2007 to 2014 that are shown in Figure 5 are used for our initial comparison of income distributions. In Table 3, we summarize the readings of the Lorenz curves and the proportion of households are divided into three subgroups, namely the low, middle and high income groups following the existing income category in Malaysia (Malaysia 2001).

Based on Figure 5 and Table 3, from 2007 to 2014, it could be seen that the low income household group only earned around 14.3% to16.3% of the total household income indicating a small gradual increase in these proportions over the period. The middle income household group earned around 35.5% to 36.5% of the total household income in each of the year. However, the high income household group earned around 50.3% of the total household income for the year 2007 and this percentage reduced to 47.4% for the year 2014 indicating that the richest household group earned half of the total household income in 2007 and nearly half of the total household income from 2009 to 2014.

The increasing and decreasing of income shares for low and high household groups from 2007 to 2014 showing that the distribution of household incomes seems to be getting better. In fact, the calculated differences between the high and low income household groups decreased from 36.0% to 31.1% of the total household income within these years. Nevertheless, from these differences, it is shown that there were huge differences in the household income proportions between the high and low income household groups that might lead to income inequality in Malaysia. As shown in Figure 5, since the Lorenz curves of Malaysian household incomes from 2007 to 2014 cross each other, we cannot rank the distributions over the years.

Table 3: Income shares of households for bottom 40%, middle 40% and top 20%

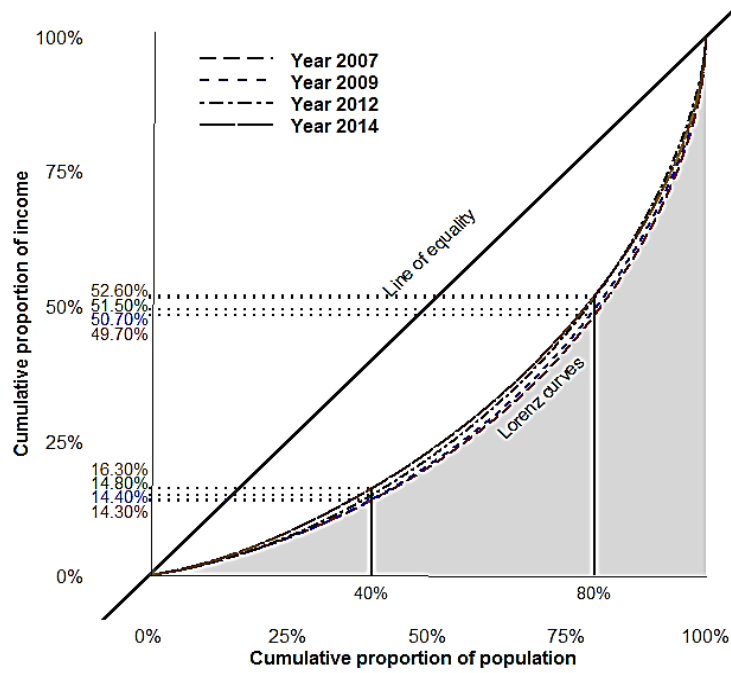| Cumulative percent of household (%)	Percent of household (%)	Percent of income (%)				Cumulative percent of income (%)			
		2007	2009	2012	2014	2007	2009	2012	2014
40	40 (Low)	14.3	14.4	14.9	16.3	14.3	14.4	14.8	16.3
80	40 (Middle)	35.5	36.3	36.7	36.4	49.7	50.7	51.5	52.6
100	20 (High)	50.3	49.3	48.5	47.4	100.0	100.0	100.0	100.0

Figure 5: The Lorenz curve of Malaysian household incomes

Table 4 shows the computed income inequality measures for 2007 to 2014 while Figure 6 shows the graphs which indicate the changes in the household income distributions over this period. From Table 4, the range of Gini indices is from 0.409 to 0.447, corresponding to the year 2014 and 2007 respectively, showing a slight decrease in the measure of income inequality. This value indicates that for the year 2007, 55.3% of the households shared the total income while other 44.7% gained nothing. For the year 2014, the income inequality slightly reduces as 59.1% of the households shared the total income while the other 40.9% got nothing. Based on these results, as a whole we could say that the distribution of incomes among households continued to improve. To support this conclusion, we applied the Atkinson and generalized entropy indices with different values of sensitivity parameters (ξ and ε) to see the changes of these indices for the years 2007 to 2014 since this Gini index is quite sensitive to changes in the middle part of the income spectrum (Atkinson 1970; De Maio 2007).

Table 4: Values of income inequality indices

Index	2007	2009	2012	2014
$I_{w.Gini}$	0.447	0.438	0.429	0.409
$I_{w.A}^{0.5}$	0.162 (3006.00)	0.155 (3386.06)	0.151 (4230.88)	0.138 (5407.00)
$I_{w.A}^{1}$	0.290 (2547.34)	0.282 (2878.98)	0.274 (3616.72)	0.248 (4711.77)
$I_{w.A}^{2}$	0.480 (1865.11)	0.474 (2108.52)	0.465 (2663.35)	0.422 (3625.35)
$I_{w.GE}^{0}$	0.343	0.331	0.320	0.284
$I_{w.GE}^{1}$	0.369	0.345	0.336	0.310
$I_{w.GE}^{2}$	0.621	0.536	0.542	0.503

Table 4 also presents the Atkinson inequality index and the equally distributed income y_{EDE} (in parentheses) for three different values of the sensitivity parameters, $\xi = 0.5, 1, 2$. In 2007, for $\xi = 0.5$, $y_{EDE} = 3006.00$, which means that if income were equally distributed, it would only have required RM 3006.00 per household per month to achieve the same level of social welfare as the existing distribution with a mean income of RM 3588.82 per month. Thus a proportionate income loss of $(\mu - y_{EDE})/\mu = 16.2\%$ arises from the inequality in the distribution of income, which gives a value of 0.162 for $I_A^{0.5}$. In other words, the same level of social welfare could be reached with only 83.8% $(1 - 0.162)$ of the existing total income while the potential welfare gain from redistribution is 16.2% of the existing income distribution in 2007. As the inequality aversion parameter ξ increases, y_{EDE} decreases and the corresponding values of inequality indices I_A also increase, thus indicating larger losses of welfare due to inequalities in the distribution of income. Based on Table 4, it could be seen that for each value of $\xi = 0.5, 1, 2$, the Atkinson inequality index replicated the Gini index trend from 2007 to 2014, indicating that the distribution of household incomes has improved from 2007 to 2014.
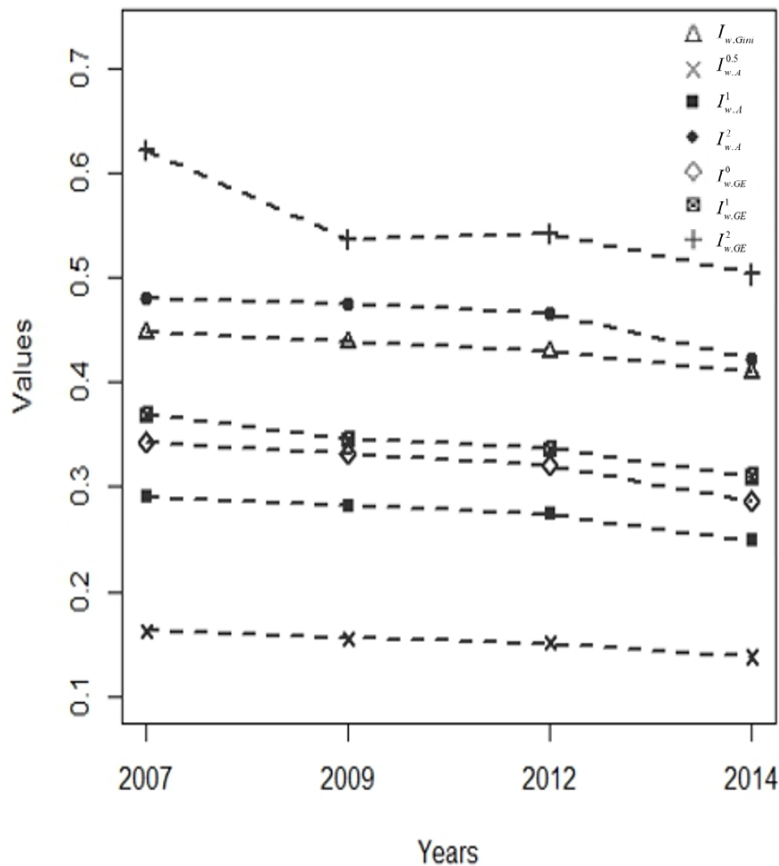

Figure 6: Income inequality indices plot from 2007 to 2014

To assess the sensitivity of the GE indices to income differences at the different position of the income distribution, sensitivity parameter $\varepsilon = 0, 1, 2$ are considered. According to Shorrocks (1980) the more positive the ε is, the more sensitive the index is to the income

differences among the higher income earners. From Table 4, both $I^0_{w.GE}$ and $I^1_{w.GE}$ slightly reduced over the period from 2007 to 2014. The value of $I^2_{w.GE}$ is found highest for the year 2007. In addition, the reduction in the value of $I^2_{w.GE}$ over time is slightly greater as opposed to $I^0_{w.GE}$ and $I^1_{w.GE}$, indicating that the income differences among the high income earners had slightly reduced over the study period. The gap in term of income differences among the rich people seem to be narrower. Based on Figure 6, it could be seen that the trend of $I^0_{w.GE}$, $I^1_{w.GE}$ and $I^2_{w.GE}$ followed the same pattern as Gini index showing that the Malaysian income distribution has improved from 2007 to 2014.

Ragayah (2008) investigated the changes of household incomes among Malaysian from 1970 to 2004. She reported that the overall inequality in Malaysia rose between 1970 and 1976, and then fell between 1979 and 1990. After that, the overall inequality rose in 1997 but then moderated in 1999. Since then, the overall inequality has increased until 2004. From the results found in this study, we could say that the overall income distribution from 2007 to 2014 has improved. The overall inequality fell between 2007 and 2014, indicating an improvement of the income distribution in the end of the NVP and the early root of NEM period. From these results, we could say that the government's efforts in terms of the broad policy frameworks to address the problem of income inequality among households from 2007 to 2014 were fruitful.

5. Concluding Remarks

The government action such as the implementation of specific policies is one of the solutions to reduce income inequality (World Bank 2000). With respect to this idea, through national policies, the government of Malaysia has introduced strategies with the aim of reducing income inequality. Since Malaya gained its independence in 1957, the government has always been concern with the issue of income inequality. As a result, many national policies such as NEP, NDP, NVP and NEM have been introduced with one of the main aim, among others, is to reduce income inequality among the citizens of the country. As mentioned by Ragayah (2008) for example, the policies which include NEP, NDP and part of NVP have been effectively in closing the gap between the rich and the poor in the period up to the year 2004. This study further investigates the income distribution beyond the year 2004 by analyzing the household income data for the period from 2007 to 2014. Over the period 2007 to 2014, Malaysia had through two long-term policies which are the NVP and NEM.

This paper provides the empirical study of the income inequality among Malaysian households using samples from the survey carried out over the period from 2007 to 2014. Three different income inequality indices namely the Gini, Atkinson and generalized entropy are applied to measure income inequality in Malaysia. For both Atkinson and GE indices, three different values of the sensitivity parameter ($\xi = 0.5, 1, 2$ for Atkinson and $\varepsilon = 0, 1, 2$ for GE) have been considered as alternative measure to Gini index. In addition, Lorenz curves are fitted to the data for describing how the incomes of different household income groups are distributed over the time period. In survey context, nevertheless, sample weights need to be considered so that the true distribution on the population level is accurately reflected. Thus, some modifications of these indices are made in order to take sample weights into account. The results of these indices were used to examine the change of income distribution in Malaysia.

Based on the Lorenz curve, it was found that, over the period from 2007 to 2014, the proportions of total household income earned by low household income group had slightly increased while for the high household income group, these proportions had slightly decreased.

In addition, the middle income household group earned around 35.5% to 36.5% of the total household income in each year indicating that the middle class remains unchanged over this period. Based on these results, the Malaysian income distribution seems to be improved within these years. However, since the Lorenz curves of Malaysian household incomes from 2004 to 2014 cross, we cannot rank the distributions over the years.

Moreover, based on all the inequality indices found, Malaysia had experienced a decreasing trend in income inequality. This decreasing trend indicates that the overall income distributions from 2007 to 2014 had improved. The improvement in income distribution among Malaysian households from 2007 to 2014 could be looked upon as the signs that the NVP and NEM had been successful models in addressing inequality issue among Malaysian households.

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