Income Inequality, Income Growth and Government Redistribution in Malaysia: What Do We Know in the Long Run?

Soo Khoon Goh[a]
Universiti Sains Malaysia

Koi Nyen Wong[b]
Sunway University

Kartinah Ayupp[c]
University Malaysia Sarawak

You Wah Lai[d]
Universiti Sains Malaysia

Abstract: Malaysia has a good track record of reducing income inequality, especially between ethnic groups. In recent years, increasing attention has been paid to national inequality – notably by targeting the bottom 40% income group while sustaining growth with inclusivity. This paper uses the latest cointegration technique, namely, the augmented autoregressive distributed lag (A-ARDL) to examine the long-run determinants of income inequality in Malaysia. The long-run results suggest that income inequality is negatively driven by real GDP per capita and government redistribution of income. The findings provide some possible policy implications that could reduce income inequality in the long run, in particular, through the enhancement of the quality and skills of the workforce, and the government's benevolent role by using redistributive instruments such as progressive income tax and cash transfers to low-income groups.

Keywords: Income inequality, income growth, redistribution, Malaysia
JEL classification: O11

1. Introduction

Reduction in overall income inequality, in the long run, is vital to sustainable development in both developing and developed economies, and Malaysia is no exception. Since the Malaysian economy was transformed into export-led industrialisation as a growth

[a] Centre for Policy Research and International Studies, 11800 Universiti Sains Malaysia, Penang, Malaysia. E-mail: sookhoongoh@gmail.com; skgoh@usm.my (Corresponding author)
[b] Sunway Business School, Sunway University, 47500 Selangor, Malaysia. E-mail: koinyenw@sunway.edu.my
[c] Faculty of Economics and Business, University Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia. E-mail: akartinah@unimas.my
[d] School of Social Sciences, 11800 Universiti Sains Malaysia, Penang, Malaysia. E-mail: vivianlai9772@gmail.com
* This study is sponsored by the Ministry of Higher Education under the Long-Term Research Grant Scheme: New Housing Development Concept for B40 Group in Malaysia Based on Social-Spatial and Economic Integration. LRGS/1/2016/UKM/02/1/3.

Article Info: *Received* 11 March 2023; *Revised* 25 May 2023; *Accepted* 27 May 2023
https://doi.org/10.22452/MJES.vol60no1.4

engine in the 1980s, it has been stranded in the middle-income trap for a long time. For instance, its real GDP per capita in 2020 increased to USD10,412 from USD358 five decades ago and is yet to achieve the threshold of USD12,535 to become a high-income nation (see Figure 1). It is now standing at the crossroads, facing the challenge of competing with the low-wage countries on one hand and the advanced high-tech countries on the other in the face of skilled manpower shortage. Correspondingly, the nation's income distribution as measured by the Gini coefficient only improved partially from 0.513 in 1970 to 0.411 in 2020 (see Figure 2) despite five decades of continued rapid growth, predominately driven by international trade and investment. Closing the income gap has been given high priority in the 12th Malaysia Plan, and tackling income inequality through redistribution instruments is seen as the government's role in overcoming market imperfections while not undermining growth with fiscal incentives.

Retrospectively, Malaysia has been successful in eradicating poverty as well as reducing the income gap between ethnic groups. Although the ethnic income gap in Malaysia is narrowing in relative sense, the inequality between the income groups, in particular, the Top 20% (or T20), the Middle 40% (or M40), and the Bottom 40% (or B40), is yet to be resolved. In recent years, increasing attention has been paid to the participating B40 as beneficiaries in the growth process (Lee & Choong, 2019). Hence,

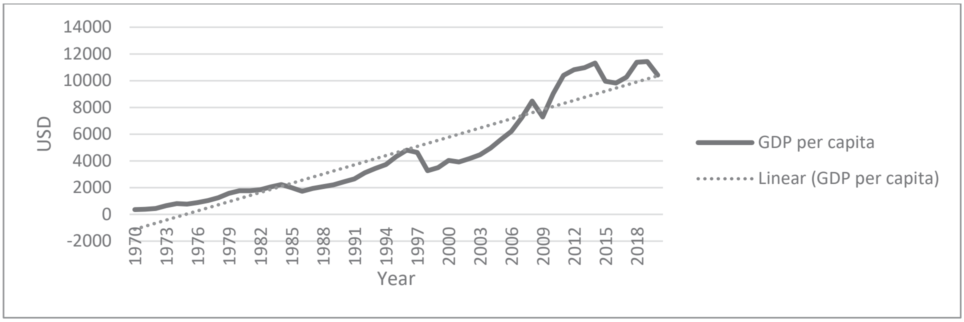

Figure 1. Malaysia's GDP per capita, 1970-2020
Source: World Bank Open Data.

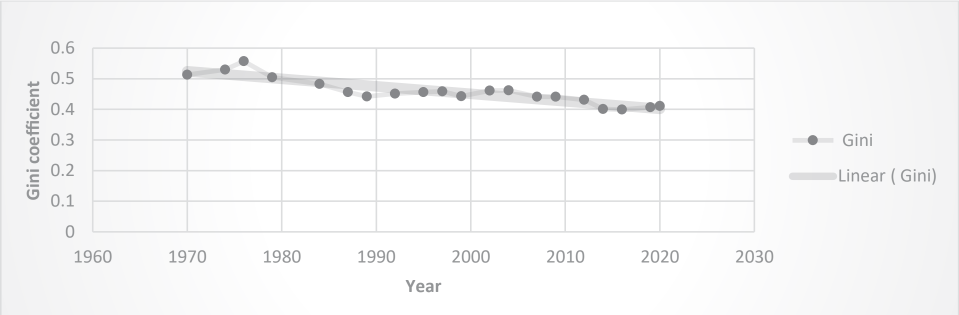

Figure 2. Gini coefficient in Malaysia, 1970-2020
Source: Department of Statistics, Malaysia.

the government implements strategies to expand the income share of the B40[1] as well as raising their purchasing power with supported inclusive programs to reduce the increasing cost-of-living pressure.

Among the most important government revenue redistribution mechanisms to address the issue of poverty and income imbalance is in the form of cash assistance to the target group through various ministries,[2] primarily funded through income tax collection from taxable income groups (Mokhzani, 2017). The incentives in the form of cash assistance provided to B40 to cope with the rising cost of living range from RM2.6 billion to RM4.7billion from 2012 to 2020 (see Figure 3). Various cash assistance has been implemented in which the recipients are the B40 of the Malaysian household income and have been divided into four categories. The categories are based on the number of household recipients with families, single recipients, and single senior citizens (Ministry of Finance Malaysia, 2020). The implementation of initiatives in the form of social and community services by the aforementioned ministries saw the government spend more than RM40 billion between 2012 to 2020.

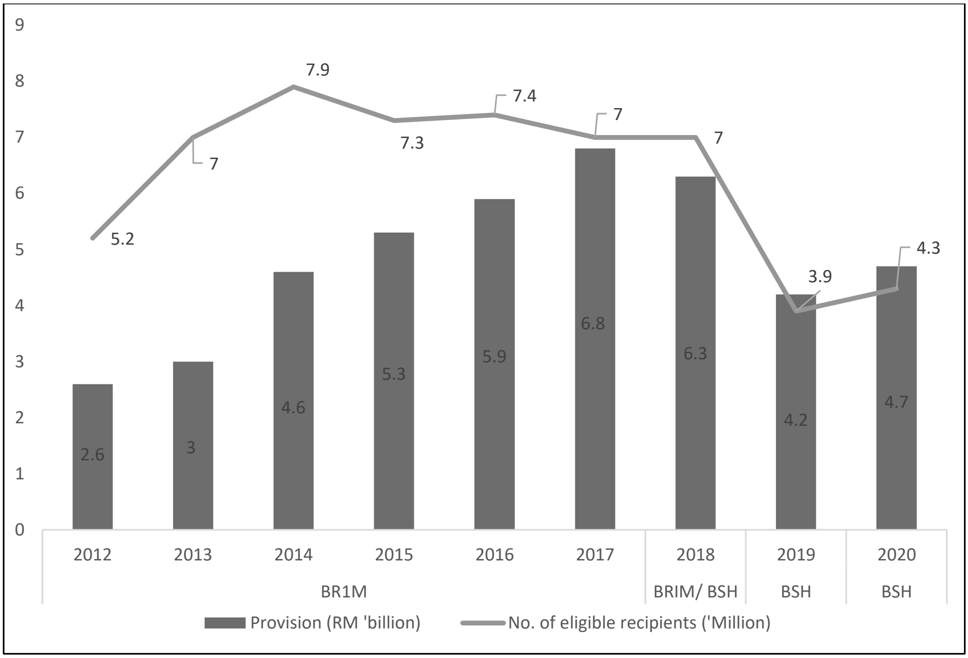

Figure 3. Government's provision for cash assistance for B40, 2012-2020

Note: BR1M (Bantuan Rakyat 1 Malaysia or 1 Malaysia People Aid) and BSH (Bantuan Sara Hidup Rakyat or Household Living Aid) were government aid programs to alleviate the burden of low-income groups as a result of the rising cost of living.

Source: Ministry of Finance Malaysia (2012, 2013, 2014, 2015, 2016, 2017, 2018).

1 B40 refers to Malaysian household with an income less than RM4,850 per month.

2 Such as the Ministry of Urban Wellbeing, Housing and Local Government, and the Ministry of Women, Family and Community Development.

The positive effect of the cash assistance program can be seen in the 2014 household income research, which showed an increase in the transfer contribution from RM2.6 billion in 2012 to RM4.6 billion in 2014 (Mokhzani, 2017).

Moreover, government redistribution is also available in '*non-cash*' form to the target group, better known as '*non-monetary social transfer*' such as clothing, dry food, etc. The non-monetary social transfer has recorded an upward trend at an average rate of 7.8% per annum (Department of Statistics Malaysia, 2020). The same source has also shown that the government's total final consumption expenditure to provide services to citizens increased to more than RM172 billion in 2018 compared to RM73 billion in 2016 (Department of Statistics Malaysia, 2020). Looking at the various forms of government assistance to the target group shows an ongoing commitment to creating a government income redistribution system that can reduce the income gap among the Malaysian population.

This paper examines whether government redistribution and income growth could reduce income inequality in Malaysia using time-series analysis. Theoretically, income growth may positively or negatively affect income inequality and vice versa with different development situations. As part of the sustainable development agenda, a country with high inequality would induce the government to reduce income inequality using income redistribution policies to create a more just society, as we can see in the case of Malaysia. Whether income growth and government redistribution of income could alleviate income inequality remain an empirical question. Our model also incorporates trade openness and foreign direct investment (FDI) as control variables. They are controlled because they might influence income inequality even though they are not the key variables of interest to the study objectives. We used the latest cointegration technique, augmented autoregressive distributed lag (A-ARDL), to examine the long-run relationship between the underlying variables in the model. Our findings show that income inequality is negatively related to real GDP per capita, implying that the level of economic development is a significant determinant of income distribution in the long run. Similarly, the redistribution of income is negatively significant, suggesting the income gap could be mitigated by implementing pertinent tax instruments and transfers in the long run for Malaysia. Our findings could formulate policies that could lead to more equitable distribution of income in the long run, which will be expounded on in the conclusion section.

The remaining of this paper is as follows. The literature review is presented in Section 2, followed by the data and methodology in Section 3. Section 4 presents the findings, and Section 5 discusses the policy implications of our findings.

2. Literature Review

In Malaysia, research on income inequality mainly focuses on income inequality among different ethnic groups (such as Khalid & Yang, 2021; Ragayah, 2008), rural and urban inequality (such as Ishak, 2000; Roslan 2003), state inequality (Tey et al., 2019) and gender inequality (Lee & Choong, 2019). Very few investigate the relationship between income inequality and income growth in Malaysia using time series modelling. Therefore, we review the existing literature on the relationship between income inequality, income growth and government redistribution.

Our literature search shows mixed findings on the relationship between income growth and income inequality. One possibility for such conflicting empirical results is that the impact of income growth on income inequality varies between developed and less developed countries, different model specifications, different types of datasets, and the choice of different estimation methods. As such, empirical studies examining the relationship between income growth and income inequality could be positive (Rubin & Segal, 2015; Wahiba & El Weriemmi, 2014); negative (Knowles, 2005; Wan et al. 2006); mixed (Bahmani-Oskooee & Gelan, 2008; Chambers, 2010; Malinen, 2012) or no relationship (Deininger & Squire, 1998; Niyimbanira, 2017).

Rubin and Segal (2015) analysed the intertemporal relation between growth and income inequality in the US from 1953 to 2008. The hypothesis is that income inequality depends on concurrent income growth and expectations about future growth, especially in the top income group. Given that the bulk of labour income of the top income earners is tied to performance, income equality is sensitive to wealth income. Therefore, the study found a positive relationship between income growth and income inequality in the US. Besides, Wahiba and El Weriemmi (2014) showed that in Tunisia, there is a positive relationship between income growth and income inequality when human capital and trade openness are included as determinants in the estimation of income inequality.

Knowles (2005) proclaimed that the Gini index measured by the distribution of expenditure is more equal to the distribution of income before and after tax if families could smooth their spending patterns over the life cycle. Using a cross-country dataset covering 1960 until 1990, when the Gini coefficient is measured by the expenditure data, the findings are significantly negatively correlated between income growth and income inequality. Wan et al. (2006) investigated the relationship between income inequality and economic development in China from 1987–2001 using three-stage least squares. The results indicate that the relationship between income inequality and income growth was nonlinear and negative, irrespective of the period applied.

Many studies use cross-section data when limited time series data for individual countries are available. However, cross-sectional data fail to capture country-specific characteristics. Using more extended data from the US from 1957 to 2002 and the ARDL method by Pesaran et al. (2001), Bahmani-Oskooee and Gelan (2008) found a positive relationship between income inequality and income growth in the short run but a negative relationship for these two variables in the long run.

Inquiring into a group of sample countries of developed and developing economies, Malinen (2012) analysed the relationship between income inequality and income growth using panel cointegration. It is shown that there is a long-run equilibrium relationship between income growth and income inequality in the sample countries and this relationship is positive in less developed economies but negative for middle and high-income economies. Moreover, the empirical work by Chambers (2010) using a semiparametric method shows that the income growth had a positive effect on income inequality for all countries, especially in the short- and medium-run. On the other hand, the outcome of the effect of income growth on income equality in the long run varies with the level of economic development. It tends to have a negative (positive) impact on the income inequality in developing countries (developed countries).

Using a new data set on the Gini index along with cross-country panel data from 108 countries, Deininger and Squire (1998) found per capita income is not associated with income inequality for the whole sample and the sub-sample periods regardless of whether the sample countries are developed or developing. Similar findings are reported by Niyimbanira (2017) when using pooled regression model from 1996-2014 to ascertain how income inequality is affected by income growth in the provinces of South Africa. The study found that income growth could reduce poverty, but not income inequality, suggesting the evidence points to no relationship between income inequality and economic development.

As Bahmani Oskooee and Gelan (2008) have noted, limited time-series analysis examines the relationship between income growth and income inequality. From our literature search, we found only one empirical study examining income growth and income inequality in Malaysia, i.e., Sulaiman et al. (2017). They investigated whether income growth is a long-run determinant of income equality in Malaysia from 1970 to 2014. Using the ARDL method by Pesaran et al. (2001), they found little evidence that GDP per capita growth is associated with income inequality, implying there is no relationship between income inequality and economic development. However, the empirical study by Sulaiman et al. (2017) suffered several methodological shortcomings in applying the ARDL test,[3] casting doubt on whether the results and the conclusion reported by the authors are robust and reliable.

Besides income growth, government redistribution is vital in impacting income inequality. Yet, the empirical studies examining the impact of redistribution income on income inequality are limited, which are only available from Caminada et al. (2012), Paulus et al. (2009) and Yang and Greaney (2017). Using the Engle-Granger two-step ECM approach, Yang and Greaney (2017) found that among Japan, the US, China and South Korea, redistributive measures[4] could only influence the income inequality significantly in the former country, whereas Paulus et al. (2009) supported the proposition that taxes and transfers could lower the income inequality across EU countries. Since transfers to the poor in the form of social assistance or income transfers could decrease poverty and reduce income inequality, Caminada et al. (2012) found a strong negative association between the level of social expenditure and poverty for Organisation for Economic Co-operation and Development (OECD) countries. These instruments *per se* could only relieve the poor in terms of less financial difficulties but they are not the solutions to assist them to acquire higher skills and to earn higher wages through investment in education and job training. Thus, a range of policies is

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[3] The authors reported only an F-test for joint significance of all lagged levels as the test for long-run cointegration. Nevertheless, Pesaran et al. (2001) proposed a long-run cointegration based on the standard F-test and t-test on the lagged of dependent variables. If the t-test on the lagged of the dependent variable is not significant, this implies there is no cointegration and the reported long-run coefficients are not reliable. Goh and McNown (2015) demonstrated that when using the ARDL test, it is insufficient to report the F-test to gauge the evidence of a long-run relationship between the underlying variables. The paper demonstrates that it is equally important to report the t-statistic associated with the coefficient on the lagged dependent variable.

[4] Yang and Greaney (2017) defined the redistribution index as the difference between the Gini market and Gini net index.

necessary to address the underlying skill and wage gaps that contribute to poverty and income inequality.

3. Analytical Framework

This study examines the effects of income growth and government redistribution on income inequality, while controlling for economic openness. Analytical considerations and the formulation of a long-run empirical model that links income inequality to these macroeconomic variables are discussed as follows.

3.1 Income Growth

Kuznets' hypothesis argues that a nation would experience a low level of inequality in the pre-industrial stage when most people live at subsistence levels. Income gap (between factory workers and farmers) starts to broaden due to the rising earnings of factory workers when industrialisation begins. However, the gaps may narrow as the government collects taxes and distributes them as a social benefit.

Graphically speaking, the Kuznets' hypothesis follows an inverted-U shape which shows the relationship between income growth and income inequality through changes in the production structure. When there is an economic expansion, a country develops, and its income per capita increases. The degree of income inequality also rises initially. After reaching the highest degree, income inequality starts to fall as income per capita increases further, thus, giving rise to a negative long-run relationship between per capita income and income inequality as a result of a migration of workers from the agricultural sector to the manufacturing industry when there is a structural change in the economy.

Many existing works have carried out studies to test the Kuznets' hypothesis. For instance, Vanhoudt (2000) shows that the higher the investment shares, the lower the inequality in industrialised countries, but the opposite holds for less developed countries. Huang et al. (2015) and Ogus Binatli (2012) have proved that higher growth volatility leads to higher income inequality. These studies support the Kuznets' hypothesis, which argues that the level of income inequality is affected by the income growth of a country. However, the findings by Castells et al. (2015) and Oczki et al. (2017) proved that there is a statistically significant U-shaped relationship between income inequality and income growth. Their conclusions indicate that income growth is not the only factor influencing income dispersion, as inequality is higher in more developed regions. Hence, the sign of the income growth on income inequality could be negative or positive.

3.2 Government Redistribution

In general, a government is not only concerned with the overall income growth but also the impact of growth on income distribution. Hence, redistribution via taxes and transfers is an important action that a government could take should income inequality deteriorate when the growth is not equitable. Based on this observation, Ostry et al.

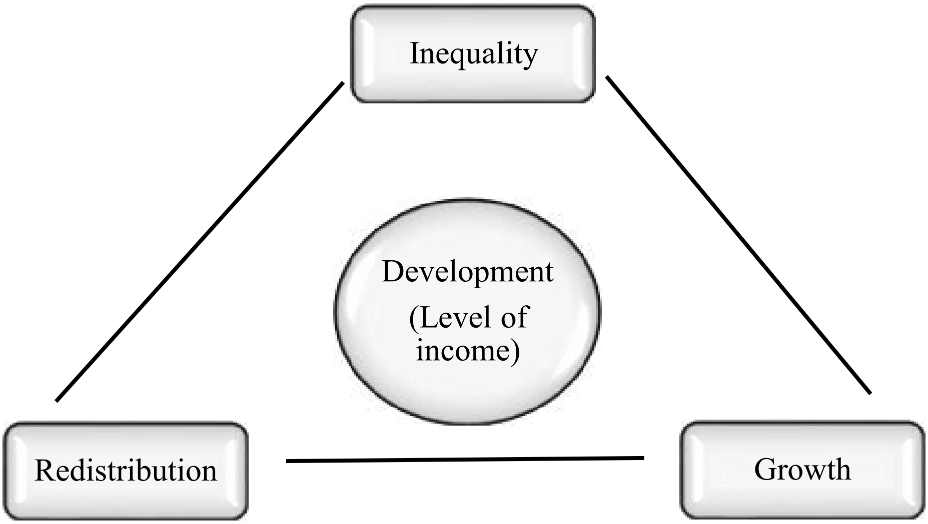

Figure 4. Inequality-growth-redistribution triangular nexus based on the level of economic development
Source: Yang and Greaney (2017).

(2014) built an inequality-growth-redistribution triangular nexus with a core to indicate their shared connection with the level of economic development (see Figure 4). Within this nexus, income growth could either be positively or negatively influenced by inequality or the other way around with different development situations. For instance, when a country experiences inequality, the government would adopt a redistribution strategy to achieve greater social equality. In turn, this has prompted concerns by policy makers that an increase in taxes and transfers may result in disincentive to work and invest, which may adversely affect income growth. However, Ostry et al. (2014) argued that redistribution may promote income growth if the government could close some tax loopholes or increase government spending on those in need. This shows that different development conditions may stand in the interactions among inequality, growth and redistribution (Yang & Greaney, 2017).

Empirically, there are studies that found redistributive fiscal policies could reduce inequality, such as Caminada et al. (2012), Paulus et al. (2009) and Yang and Greaney (2017) as we describe in the literature review. Hence, the sign of the redistribution is expected to be negative.

3.3 Economic Openness

The three primary variables measuring economic openness are trade openness, inward and outward FDI. Theoretically, trade openness can lead to better income distribution. As stated by Stolper and Samuelson's (1941) theorem, an increase in trade openness could redistribute incomes towards a country with abundant factors, while the incomes of its scarce factors would be shifted away. For a less developed country that is relatively labour abundant, it suggests that international trade would benefit its unskilled labour but it is harmful to the capital owners and skilled labour. Whereas the converse is true for a developed country (which is relatively capital abundant) where exports would benefit its skilled labour but are detrimental to the unskilled labour in the import-competing industries. As a result, more openness to trade could lead to a growth (decline) in relative wages of the unskilled to skilled labour, thus, improving (worsening) the income distribution of a less developed country (developed country) (see Reuveny & Li, 2003). The expected sign of trade openness on income inequality is positive.

With regard to the possible effects of FDI on income inequality, the host economy tends to benefit in terms of employment creation on top of technology transfer and more trade from the inbound FDI. In the case of the host being a labour abundant or less developed country (capital abundant or developed country), the presence of the capital-intensive (labour-intensive) foreign multinationals would promote the employment of the skilled labour (low-skilled labour), and this would worsen (improve) the income inequality in the host economy except if the low-skilled workers are willing to enhance their skills to meet the technological needs (Couto, 2018). Given that the inbound FDI is an important source of growth for a less developed country in particular, the host country is inclined to offer lower wages of low-skilled labour as an incentive to draw FDI into selected industries, which potentially could deteriorate the income inequality of the host economy. As the foreign firms find the multinational activities that can be performed cheaper in the host country, the outbound FDI from the developed country may result in an increased unemployment of low-skilled labour, worsening the income inequality within the parent country unless the low-skilled workers are willing to enhance their skills through the acquisition of education and training in order to cope with the change in technology (Çelik & Basdas, 2010). In sum, the expected sign of inward and outward FDI on income inequality could be positive or negative, which is very much dependent on the motive of FDI, the level of economic as well as educational development of the host and parent countries.

3.4 Model Specification

The long-run empirical model for the present study is:

$$Gini_t = \alpha_0 + \alpha_1 lrgdppc_t + \alpha_2 redi_t + \alpha_3 trade_t + \alpha_4 IFDI_t + \alpha_5 OFDI_t + \varepsilon_t \quad (1)$$

where Gini is the measurement of income inequality, *lrgdppc* represents the real per capita gross domestic product expressed in natural logarithm form, while *redi*, *trade*, *IFDI* and *OFDI* are the government redistribution, trade openness, foreign direct investment inflows and outflows, respectively, while ε_t is the regression residual.

4. Data and Methodology

In the analysis of the long-run relationship between income inequality and income growth, income inequality is the dependent variable, government redistribution is the independent variable, whereas income growth, trade openness, FDI inflows and FDI outflows are the control variables to take care of their latent effects on the dependent variable. The Gini index is the most well-known measure of income inequality. The data for the Gini index is adopted from the Standardized World Income Inequality Database (SWIID), version 9.1. Government redistribution is measured by the difference between Gini market (i.e., Gini index of inequality in equivalised household (pre-tax and pre-transfer) income) and Gini net (Gini index of inequality in equivalised household disposable (post-tax and post-transfer) income. The GDP per capita measures the economic development level, while trade openness, FDI inflows, and outflows are used to gauge the extent of economic openness. These data are available from the *World Development Indicators* (WDI). The estimation period is from 1970 to 2019.

4.1 Methodology

In analysing the long-run relationship between income growth, government redistribution, and economic openness with income inequality, this study employs the A-ARDL testing approach to cointegration proposed by McNown et al. (2018) and Sam et al. (2019). This method is the extension of the ARDL bounds test developed by Pesaran et al. (2001) to ascertain the presence of the long-run relationship between the variables under investigation. The A-ARDL testing approach has received much attention since it was published in 2018.

To determine whether there is a cointegration relationship, Pesaran, Shin and Smith (PSS) states when the overall *F*-test on all the lagged level variables and the *t*-test on the lagged dependent variable are significant. But this has to work with the assumption of *I*(1) dependent variables in order to avoid the fake cointegration or degenerate cases. Two degenerated cases may occur, which will cause no cointegration. Degenerate case #1 happens if the lagged of the dependent variable is insignificant; while degenerate case #2 happens if the lagged independent variable is insignificant (McNown et al., 2018; Pesaran et al., 2001). Therefore, these degenerate cases demonstrate no cointegration among the variables since the incomplete coefficients of the error-correction term do not help adjust to the equilibrium. To deal with this situation, the A-ARDL provides an additional test on the coefficients of the lagged independent variables to complement the existing overall F-test and also t-test on the lagged dependent variable for the cointegration analysis proposed by Pesaran et al. (2001). At the same time, this additional test is able to overcome the reliance on the assumption of the dependent variable to be I(1). Hence, this could minimise the risk of false conclusions made from the standard unit root tests. McNown et al. (2018) showed this additional test has reasonable size and power properties. Therefore, this new test provides a better insight on the cointegration status of the series in the model.

The ARDL model can be represented by the following specification:

$$Y_t = \sum_{i=1}^{p} \alpha_i^{'} Y_{t-i} + \sum_{j=0}^{q} \beta_j^{'} X_{t-j} + \sum_{k=0}^{r} \chi_k^{'} Z_{t-k} + \sum_{l=1}^{s} \eta_l^{'} D_{t,l} + \mu_t \qquad (2)$$

where *i,j,k* and *l* are the indices of lags: *i*=1,2, …, *p*; *j*=0,1,2, …, *q*; *k*=0,1,2, …, *r*; *l*=1,2, …, *s*; *t* represents the time periods *t*=1,2, …, *T*; Y_t refers to the dependent variable; while X_t and Z_t represent the independent variables; $D_{t,l}$ is the dummy variable; α_i, β_j, χ_k and η_l are their corresponding coefficients; and μ_t is the white noise residuals.

Equation (2) can be re-parameterised and expressed in the unrestricted error-correction model (ECM) as below since this model is able to make the inferences on the short-run and long-run relationships among the variables:

$$\Delta Y_t = \hat{c} + \hat{\phi} Y_{t-1} + \hat{\gamma} X_{t-1} + \hat{\varphi} Z_{t-1} + \sum_{i=1}^{p-1} \hat{\lambda}'_i \Delta Y_{t-i} + \sum_{j=1}^{q-1} \hat{\delta}'_j \Delta X_{t-j} + \sum_{k=1}^{r-1} \hat{\pi}'_k \Delta Z_{t-k} +$$

$$\sum_{l=1}^{s} \hat{\omega}'_l D_{t,l} + \varepsilon_t \quad (3)$$

where $\phi = -\left(1 - \sum_{i=1}^{p} \alpha_i\right); \gamma = \sum_{j=0}^{q} \beta_j; \varphi = 1 - \sum_{k=0}^{r} \chi_k;$ and λ_i, δ_j, π_k and ω_l refer to the function of original parameters in Equation (2). When there is evidence of cointegration, the long-run effects are extracted from the unrestricted ECM (Goh et al., 2020). In reference to Equation 3, the long run coefficient for X_t and Z_t are $-(\hat{\gamma}/\hat{\phi})$ and $-(\hat{\varphi}/\hat{\phi})$, respectively. The standard errors can be computed by the delta method.

McNown et al. (2018) developed the A-ARDL test with bootstrap techniques to generate critical values for the additional test of the lagged of independent variable. Sam et al. (2019) provided tables of the critical values for the additional test. In this paper, we use the critical values by Sam et al. (2019) for the additional test, whereas the level of significance for F_1 and t will refer to the critical values presented by Pesaran et al. (2001). The critical values shown in Sam et al. (2019) are similar to the bound test proposed by Pesaran et al. (2001), in which both of them consist of a lower bound as well as an upper bound in their critical values. If the F-statistic is higher (lower) than the upper bound, the null hypothesis is rejected (do not reject), and thus the estimation is cointegrated (not cointegrated). Following are the null and alternative hypotheses for all three cointegration tests in the A-ARDL test.

i. Overall *F*-test on error terms (denoted as F_1)	H_0: $\phi = \gamma = \varphi = 0$	H_1: any $\phi, \gamma, \varphi \neq 0$
ii. *t*-test on lagged of dependent variable (denoted as t_{DV})	H_0: $\phi = 0$	H_1: $\phi \neq 0$
iii. *F*-test on lagged of independent variable (denoted as F_2)	H_0: $\gamma = \varphi = 0$	H_1: any $\gamma, \varphi \neq 0$

Four possible outcomes will be obtained from the three tests. The first outcome occurs when F_1 and F_2 are significant but not t_{DV}, and this expresses the degenerate case #1. While the second outcome is when F_1 and t_{DV} are significant but not F_2, and this expresses as degenerate case #2. The third outcome happens when the F_1 is not significant, and lastly, the fourth outcome occurs when all three tests are significant in the estimation. In other words, the first and second outcomes can be classified as degenerate cases, whereas the third outcome implies no cointegration in the estimation. Only the fourth outcome suggests cointegration among the variables since all the tests are significant in the estimation.

5. Results

Before proceeding to the cointegration test, a unit root test for all variables must be carried out. The existence of unit roots can lead to spurious regression results in multivariate frameworks. Hence, a unit root test is necessary in the analysis to identify a correct underlying time-series model. The unit root tests adopted in this study are the augmented Dickey-Fuller (ADF) test and Philips-Perron (PP) test. Both test the null hypothesis that a unit root is present in a time series variable against the alternative hypothesis that states that a variable is either stationary or trend-stationary. Before conducting the unit root test, the graph of the variable is plotted to gauge whether a constant or a trend to include in the test. Next, the unit root test of the variable will be examined in level. If the null hypothesis is rejected, the series is stationary at the integration level of zero, *I*(0). Nevertheless, if the null hypothesis is not rejected, the series is not stationary at *I*(0). This implies that the unit root test is necessary to proceed with the first difference. The series is then stationary at an integration level of one, *I*(1), when the null hypothesis is rejected after the test is first differenced. If the null hypothesis is still not rejected, the series then tests at the higher order differencing. Usually, economic variables are either *I*(0) or *I*(1).

Table 1 demonstrates the ADF and PP unit root test results for all the variables. The variables are examined at the level and first difference to determine the stationarity of the variables. From the unit root test results, the Gini coefficient and the FDI inflows to Malaysia are *I*(0), indicating that both are stationary in level. The log real GDP per capita, trade and FDI outflows are stationary when they are at the first differenced, implying that the variables are *I*(1). The outcome of the PP test is similar to the ADF test, where the Gini coefficient and the FDI inflows to Malaysia are *I*(0), while the other variables are stationary after first differencing, *I*(1). To satisfy the bounds test assumption of the ARDL models, the dependent variable (Gini Coefficient here) should

Table 1. Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests

	ADF		PP test	
	Level	1st differenced	Level	1st differenced
Gini coefficient (*gini*)	-3.47*		-4.21***	
Log of real income per capita (*lrgdppc*)	-2.31	-3.43**	-2.39	-6.07***
Trade openness per GDP (*trade*)	-1.40	-4.95***	-1.35	-4.95***
Foreign direct investment inflows per GDP (*ifdi*)	-3.54**		-3.54**	
Foreign direct investment outflows per GDP (*ofdi*)	-2.04	-7.45***	-1.99	-7.40***
Government redistribution (*redi*)	0.22	-2.79*	-0.28	-10.47***

Notes: *, **, *** indicate statistical significance at 10%, 5% and 1% levels, respectively. The optimal lag length is determined by the modified Akaike. The Newey-West bandwidth is used in the PP test to determine the truncation lags of the variables used to obtain white-noise residuals.

be $I(1)$ to rule out the possibilities of degenerate cases. However, as pointed out by McNown et al. (2018) and Sam et al. (2019), even if the dependent variable is found to be $I(0)$ by the standard unit root tests, they proposed that one should proceed to test for cointegration using the A-ARDL. This is because the A-ARDL would be able to detect a degenerate case if the dependent variable is indeed $I(0)$.

5.1 Estimation Using the A-ARDL

The main objective of this study is to determine whether there is a long-run relationship between the dependent variable and the independent variables in the model. Table 2 presents the estimated long-run and short-run relationships between the income inequality (*gini*) and other explanatory variables such as log real GDP per capita (*lrgdppc*), government redistribution (*redi*), trade openness (*trade*), FDI inflows (*ifdi*) and FDI outflows (*ofdi*) in Malaysia. In the estimation, a maximum lag length of four is imposed to prevent over parameterisation, and the Akaike's Information Criterion (AIC) is used to select the optimal lag length. The final empirical equations are the result of general-to-specific specification searches, eliminating variables or lagged terms with statistically insignificant coefficients. The final specifications are accepted into the empirical model only after passing standard diagnostic tests.

Diagnostic checking is conducted to ensure the model is free from biased estimation. The diagnostic tests conducted in this study are the correlogram Q-statistic test, histogram-normality test, and serial correlation Lagrange Multiplier (LM) test to check for autocorrelation and normality. Table 2 shows the correlogram Q-statistic up to lag 12 is insignificant with a larger *p*-value, which reveals that the residuals are white noise. The residuals are normally distributed, as shown from the Jarque-Bera test. The Breusch-Godfrey LM test result implies no serial correlation problem since the *p*-value is greater than the critical value.

Dummies are added to the model since the data shows sudden peaks or drops. The value of each dummy is either zero (which indicates the absence of an economic shock in the particular year) or one (which means the presence of an economic shock for the specific year). Adding the dummies captures the structural breaks that have significant coefficients in the model. A break may occur after the event, depending whether a specific event or economic shock has an immediate or lagging effect.

The A-ARDL results in Table 2 show that there is strong evidence of a cointegration between the Gini index and its key determinants, viz. log real GDP per capita (*lrgdppc*), government redistribution income (*redi*), and the economic openness variables, namely, outward FDI (*ofdi*), inward FDI (*ifdi*) and trade openness (*trade*). The calculated overall *F*-statistic is 38.29, higher than the upper bound value [3.41, 4.68] at a 1% significance level.[5] Besides, the calculated *t*-statistic on the coefficient of lagged level of the dependent variable is -5.99, which exceeds the upper bound value [-3.43, -4.79] at a 1% significance level.[6] Lastly, the *F*-statistic on the coefficient of the lagged levels of the independent variables is 33.61, which is greater than the value of the upper

[5] See Pesaran et al. (2001), Table CI(iii), p. 300.
[6] See Pesaran et al. (2001), Table CII(ii), p. 303.

Table 2. A-ARDL for cointegration test

	Coefficient	Standard error	p-value	ARDL test	Statistic
C	18.875	2.261	0.000	F_1	38.29***
$gini_{t-1}$	-0.140	0.023	0.000	t_{DV}	-5.99***
$lrgdp_{t-1}$	-0.930	0.133	0.000	F_2	33.61***
$redi_{t-1}$	-1.246	0.179	0.000		
$ofdi_{t-1}$	-0.027	0.007	0.000	Diagnostic checking	Statistic
$trade_{t-1}$	0.001	0.000	0.018	R^2	0.957
$ifdi_{t-1}$	-0.005	0.004	0.189	Adjusted R^2	0.904
$\Delta gini_{t-3}$	0.435	0.113	0.001	AIC	-4.228
$\Delta gini_{t-4}$	0.598	0.094	0.000	*LM*(1)	1.07(0.3)
$\Delta lrgdp_{t-3}$	-0.794	0.217	0.002	*LM*(2)	3.80(0.14)
$\Delta ofdi_{t-1}$	0.040	0.007	0.000	JB	0.795(0.671)
$\Delta ofdi_{t-2}$	0.038	0.006	0.000	Q(12)	14.67(0.26)
$\Delta ofdi_{t-3}$	0.041	0.007	0.000	BPG	22.27(0.44)
$\Delta ofdi_{t-4}$	0.045	0.005	0.000		
$\Delta redi_{t-1}$	2.403	0.195	0.000		
$\Delta redi_{t-2}$	1.960	0.185	0.000		
$\Delta redi_{t-3}$	1.401	0.172	0.000		
$\Delta redi_{t-4}$	0.870	0.148	0.000		
*DU*80	-0.112	0.031	0.002		
*DU*83	0.100	0.033	0.008		
DU84	0.100	0.033	0.009		
DU03	-0.069	0.032	0.051		
DU00	-0.077	0.035	0.044		

Notes: DU## is the dummy variable defined as one at a specific year and zero for other years. Q(12) indicates the Q-statistic at lag 12; JB represents the Jarque-Bera statistic for the normality test, LM(p) refers to the Breusch-Godfrey Lagrange Multiplier at lag p, BPG refers to the Breusch-Pagan-Godfrey test for heteroskedasticity. F_1 is the overall F-statistic; *t* is the t-statistic for lagged of the dependent variable; F_2 is the *F*-statistic for lagged of the independent variable. *, **, *** represent 10%, 5% and 1% level of significance, respectively.

bound [3.53, 5.83] at a 1% significance level.[7] There is no evidence of degenerate case, suggesting that the Gini index is not stationary in level, as indicated by the ADF and PP unit root tests. This reinforces our earlier statement that the A-ARDL does not require to impose the assumption that the dependent variable is *I*(1), as required in the PSS test. Therefore, by completing all the three tests for cointegration, the A-ARDL provides additional information on the integration order of the dependent variable, as compared to the PSS test.

[7] See Sam et al. (2019), Table II, Case III, p. 134.

Since there is a cointegration, we can proceed to examine the long-run equilibrium relation as shown by the following:

$$\underset{}{Gini_t} = -\underset{(0.70)}{6.63}\ lrgdppc_t^{***} - \underset{(2.21)}{8.96}\ redi_t^{***} + \underset{(0.002)}{0.0072}\ trade_t^{**} - \underset{(0.06)}{0.193}\ ofdi_t^{***} - \underset{(0.03)}{0.04}\ ifdi_t \qquad (4)$$

where the parentheses are the standard errors. *, **, *** represent 10%, 5% and 1% level of significance, respectively.

The estimated long-run coefficients from the cointegration regression provide further insights between the Gini index and its key determinants. It appears that the government redistribution (i.e., *redi*) is not only negatively significant but also has an enormous effect on the Gini coefficient with a value of -8.96, suggesting a 1% increase in *redi* would reduce the Gini index by 8.96 percentage point. Therefore, the implementation of income redistribution policies is instrumental in reducing Malaysia's income inequality in the long run. As for the log of real GDP per capita (i.e., *lrgppc*), it is negatively significant with a magnitude equal -0.063,[8] implying the *lrgdppc* is one of the key drivers of the reduction in income inequality in the long run. The negative sign of *lrgdppc* conforms to the downward sloping portion of the Kuznets curve, that is rising per capita real income would reduce the income inequality of a country.

On the other hand, even though the coefficient of trade openness is significant and positive, the long-run coefficient is very small, 0.007,[9] a value closer to zero. This suggests that opening the economy to more trade may widen income inequality in the long run. This is because the increase in trade liberalisation could force domestic firms to be more competitive and innovative, affecting income inequality between high- and low-skilled workers. On the other hand, the outward FDI is negative and statistically significant. Owing to its estimated value of 0.19, its long-run effect on income inequality is marginal because the cross-border investment abroad by Malaysian firms is predominantly in the services sector, which is largely non-tradable (Goh et al., 2013) that tends to have limited employment spill-over effects on the home economy. Moreover, the insignificance of *ifdi* tells that the presence of multinational corporations (MNCs) operating in Malaysia has no significant impact on income inequality in the long run. A tenable explanation for this empiric is that labour shortage persists in the country and the pre-existence of the Malaysian brain drain phenomenon (outward migration of highly skilled workers), which amounts to a double whammy on the labour force. In sum, we found that the components of globalisation – trade openness, FDI inflows and outflows have mixed effects on income inequality in Malaysia.

6. Conclusion

Growth with income inequality is a socio-economic concern, and addressing the disparities of income is a crucial socio-economic agenda of the Malaysian government, which remains committed to pursue various programs to help expand the income

[8] As the real GDP per capita appears in log form in Equation (4) but other variables are not, the coefficient of *lrgdppc* will be divided by 100. Hence, the coefficient of the *lrgdppc* is -0.063, i.e., a 1% change in *lrgdppc* is associated with a change in the Gini index by 0.063 percentage points.

[9] This means that a 1% increase in the trade per GDP increases the Gini index by 0.007 percentage point.

share of the B40 as well as raising their purchasing power. In this respect, this paper employs the latest cointegration technique, namely, the augmented ARDL, to examine whether the government redistribution and income growth could drive Malaysia's Gini coefficient in the long run. The cointegration results suggest there is strong evidence of a long-run relationship between the Gini coefficient and real GDP per capita and government redistribution. We found the real GDP per capita, which has a negative influence on the Gini coefficient, could play a more positive role in terms of reducing the income inequality in the long run. In particular, it has policy implications on how to raise the real income per capita for Malaysia through the enhancement of the quality and skills of the workforce. In this regard, it is vital for the government to provide equal access to quality education and training as well as on-the-job-training of specific skills that are commensurate with core and emerging technologies. These measures not only could lead to higher skilled human capital but also are instrumental in boosting the real GDP per capita. Similarly, the estimate of the government redistribution variable is significant and negative, suggesting the income inequality could be alleviated in the long run through government's benevolent role by using redistributive instruments such as progressive income tax and cash transfers (which are specially targeted to the lower income group) to improve the overall income inequality.

Our study shows that trade openness is far from being the driver of increased income inequality in the long run owing to the perceived counteracting effect of the economic gains from an increase in trade liberalisation (e.g., new jobs are created for the unskilled workers arising from more trade) and the nation's mission to move the economy up the value chain to compete globally (which could lead to an increase in demand for skilled workers relative to the unskilled ones, resulting in widening the skill and wage gaps). Hence, to address the skill gap, the government should develop programs focusing on critical skills needed by industry for manpower training, which could raise the productivity and income of the unskilled workforce. Last but not least, to mitigate the limited long-run negative impact of outward FDI on the Gini index, the government should design policies to develop the homegrown firms' capacity and capability in manufacturing so that they can integrate themselves into the global and regional production networks, which could offer trade-related benefits in terms of the creation of employment and income through sourcing of local inputs via intra- and inter-firm trade.

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