International Journal of Business and Economics, 2020, Vol. 19, No.3, 301-317

Effects of FDI Flows and Trade Openness on Income Inequality: Evidence from Australia and the G7 Countries

Anna Ploszaj[*]

Griffith Business School, Griffith University, Australia

Tarlok Singh

Griffith Business School, Griffith University, Australia

Jen-Je Su

Griffith Business School, Griffith University, Australia

Abstract

This study uses the time-series data to examine the long-run effects of FDI and trade openness on income inequality in Australia as well as in the G7 countries. The model is estimated using annual data for the period 1984–2014 (Canada: 1981–2011). The estimation is carried out using the ARDL-Bounds test. The results, which suggest a long-run relationship among the model variable, would be useful for the policy makers who seek to promote the international trade and expand the flow of foreign investment, while at the same time attempting to have more equal income distribution within the country.

Key words: ARDL Model, FDI, Income Inequality, Trade Openness.

JEL classification: D63, F16, F21, F60.

1. Introduction

Income inequality is a socio-economic issue that is of interest to both academics and policy makers. Understanding the factors that contribute to income inequality is becoming increasingly important. Many countries have rising concerns about increasing income inequality as they make their way into the main public policy agenda (OECD, 2015). The upsurge of economic inequality within a country presents a major threat to democratic capitalist society. It is also harmful to the economy, as it slows economic growth and causes a number of other problems (Solt and Ritakallio, 2008). For example, lower economic growth reduces government tax revenues and makes solving other economic and social problems such as of crime or of health (e.g. obesity and addiction) more difficult (Kanbur *et al*., 2001; Solt and Ritakallio, 2008). Therefore, identifying the potential sources of income inequality is the first step towards resolving these socio-economic issues (Alesina and Perotti, 1996).

[*]Corresponding author.
E-mail address: anna.ploszaj@griffithuni.edu.au.
Address: Department of Accounting, Finance and Economics, Griffith Business School, Griffith University, Queensland 4111, Brisbane, Australia.

Fast-growing globalization gives new dimensions to the analysis of poverty. The foreign direct investment (FDI) and the international trade have grown vastly over the last 20 years, becoming two engines of world prosperity. Undeniably FDI improves growth and productivity in the host country, but it also increases the demand for skilled labour, resulting in increased wage inequality (Aghion *et al*., 2002; Acemoglu and Autor, 2011). An increase in openness not only allows more FDI into the country, but also affects the income inequality, as a boost in imports will hurt the un-skilled labour wages in developed countries (Wood, 1994).

Most of the studies on income inequality are based on a cross-section of panel data from both developed and developing countries. However, this approach produces an average estimate for the sample group as a whole and, as a result, the country-specific effects may be omitted. The panel data technique is based on the assumption that the countries in the sample are homogenous and have the same structural relationship (Singh, 2017). The effects of FDI inflows and trade openness on income inequality may be different, even across a homogenous group of countries. Therefore, country-specific studies are essential to address this issue. Furthermore, not many studies concentrate on a single country, especially a developed country like Australia or one of the G7 countries.

Although G7 are relatively homogenous industrialized countries, each country has its own approaches to the social protection and the tax and benefits for both individuals and firms. The G7 countries also vary in the treatment of foreign suppliers with respect to public procurement, taxes and subsidies or entry regulation as well as behind-the-border complications (OECD, 2017b). Same can be said about Australia different approaches to taxes and social benefits as well as the treatment of foreign suppliers of FDI. The restrictiveness of FDI regarding categories such as foreign equity restrictions, discriminatory screening or approval mechanisms, operational restrictions and restrictions on key foreign personnel in Australia is around double of the FDI restrictiveness of the OECD-average (OECD, 2017a). In spite of that, Australia remains in the top ten countries according to the A. T. Kearney Foreign Direct Investment Confidence Index, with the score above the index average (Laudicina & Peterson, 2017). However, increased foreign investment in a host country usually means increased foreign control and various researchers (see Tsai, 1995; Choi, 2006; Wu & Hsu, 2012) argue that the higher the direct foreign control within the host country, the higher the income inequality is within that country.

Income inequality in all G7 countries and across many (but not all) advanced economies, has been on the rise since the 1980s. For example, since 2004, with the exemption of Japan and Canada, the poorest 20 percent of the G7 population received, on average, only 5 percent of all income earned from work, in contrast to the richest 20 percent, who received about 45 percent (International Labour Organisation, 2019). In OECD countries, the data from the Social and Welfare Statistics database (OECD, 2017c) suggest that Australian's income inequality is higher than in most developed countries. Furthermore, according to the same dataset, Australia's income inequality has continued to be larger than the G7-average in both 2007 and 2014. This highlights

the need to examine the effects of both FDI and trade openness on income inequality within a given single developed country.

This study uses the autoregressive distributed lag (ARDL) bounds test for cointegration to examine the long-run relationship between FDI inflows, trade openness and income inequality in Australia and in the G7 countries (Canada, Germany, France, Italy, Japan, the UK and the US). The data for this study covers a period of 31 years, from 1984 to 2014, for most of these countries. The exception is Canada, whose income inequality data covers the same time period, 31 years, from 1981 to 2011. The study makes three main contributions. First, it concentrates solely on factors contributing to income inequality in an individual developed country, while most existing studies on determinants of income inequality largely address cross-country experiences for both developed and developing countries. Second, this is the first study to undertake a time-series analysis to examine the determinants of income inequality of a large set of developed countries by concentrating mostly on the effects of globalization, such as FDI inflows and the trade openness. Third, this analysis is a systematic statistical study of the long-term relationship between the effects of various factors and the income inequality in a large developed economy such as Australia and the G7 countries. The rest of this paper is structured as follows: Section 2 presents a review of the literature and identifies the research gap; Section 3 discusses the model specification, methodology and data used in the study; Section 4 discusses the empirical results; Section 5 concludes the paper.

2. Literature Review

The Kuznets Curve (Kuznets, 1955) suggests that when a country moves from a low development level to a higher one, income inequality first increases then begins to decrease once a certain point of development is reached. Nonetheless, this hypothesis is not strongly supported by the empirical evidence. The literature seems to be unable to reach consensus on the relationship between income inequality and economic growth, although some principles have been established. For example, foreign direct investment (FDI), considered to be a crucial factor influencing the income inequality in the host country, can contribute towards economic growth and the transfer of new technologies (Feenstra and Hanson, 1997; Sylwester, 2005; Basu and Guarliglia, 2007; Figini and Görg, 2011).

New technology leads to an industrialization process that causes an increased demand for high-skilled labour but, at the same time, decreasing demand for low-skilled labour. This development raises the high-skill premiums, leading to a greater inequality in the host country (Feenstra and Hanson, 1997; Krugman, 2000; Acemoglu, 2002; Acemoglu and Autor, 2011). Aghion and Howitt (1998) argue that the introduction of new technology into a host country increases skill premiums and leads to an increase in income inequality, yet they see this as only a temporary phenomenon. When a new technology is introduced by the FDI into the host country, domestic firms try to duplicate the technology, training workers accordingly. By doing so they educate the workforce and reduce the skill-gap between skilled and un-skilled workers,

thus reducing income inequality in the society (Aghion *et al*., 2002; Acemoglu and Autor, 2011; Figini and Görg, 2011).

The lessened demand for low-skilled labour, in sectors such as manufacturing, results in an increase in importation of the products manufactured in the low-income countries. The Hackscher-Ohlin model suggests that this increase in imports in the developed countries will further affect the wages of the low-skilled workers, whereas the increase in imports in the developing countries will negatively affect the skilled labour wages. Furthermore, the increase in exports in the developed countries will benefit skilled labour, whereas in the developing countries it will benefit un-skilled labour.

An increase in trade in the developing countries will lead to a decrease in income inequality, due to the increasing returns to labour (wages) and the reduction in the returns of capital (profits). In advanced economies (with a large endowment of capital), this trade increases income inequality by increasing the returns of capital and by decreasing the returns to labour (Stolper and Samuelson, 1941; Wood, 1994). Studies by Calderon and Chong (2001) and Roser and Cuaresma (2016) support this theory; however, many argue otherwise (Tsai, 1995; Barro, 2000; Reuveny and Li, 2003; Figini and Görg, 2011; Jaumotte *et al*., 2013).

Most of these studies used panel data from both developed and developing countries. An equivalent consensus exists between researchers regarding the effects of factors that may increase income inequality in a given country, such as past years' income inequality, level of unemployment, inflation, agriculture sector or government involvement. However, among researchers, the consensus is mixed regarding the effects of FDI flows, trade openness, level of economic development and level of human capital and how these all affect income inequality in the host country. This issue clearly deserves research attention. The effects of FDI inflows and trade openness on income inequality in developing countries have attracted the attention of many researchers; however, few studies have been made of developed countries, for example Australia and the G7 countries, concerning the effects of globalization factors like FDI inflows and trade openness on income equality. This study adds to the literature in two ways: because it examines the long-run relationship of these factors in a single developed host country and because its longer period of data, including the GFC, covers more than previous studies.

3. Model Specification and Data

3.1 Model Specification

FDI and trade openness can have a significant impact on income inequality in the host country. Inward FDI increases the inequality by increasing the demand for skilled labour, leading to an increased gap between the incomes of high- and low-skilled labour (Aghion *et al*., 2002; Acemoglu and Autor, 2011). The more open the economy is in the host country, the more attractive it is for foreign investment by the multinational corporations. The openness not only attracts more FDI into the country

but can also increase income inequality in the developed countries. An increase in imports will hurt un-skilled labour wages, wherein the export will be beneficial for skilled labour wages (Stolper and Samuelson, 1941). Better education improves the workforce qualification and attracts more FDI into the country (Wu and Hsu, 2012; Jaumotte *et al.*, 2013). Better education, however, can add to income inequality in that country (Barro, 2000; Herzer *et al.*, 2014).

The model used to examine the effects of these factors on income inequality is specified as follows.

$$Gini_t = \beta_0 + \beta_1 t + \beta_2 FDI_t + \beta_3 openness_t + \beta_4 \log(gdp\_cap)_t + \beta_5 education_t + \mu_t \quad (1)$$

where $Gini$ represents the income inequality in a given country; FDI denotes the foreign direct investment inflows calculated as a ratio of the FDI inflows to the GDP; $openness$ indicates the trade openness calculated as the ratio of imports and exports to GDP; gdp_cap represents the economic growth per capita in a given country; $education$ represents the human capital in a given country; and μ_t denotes the error-term.

The bounds test, based on the autoregressive distributional lag (ARDL) model of Pesaran *et al.* (2001), is used to test the null hypothesis of no cointegration between the model variables. The ARDL-bounds test has the advantage that it can be used to test the long-run relationship, irrespective of whether the regressors are integrated of order zero, *I*(0), or integrated of order one, *I*(1), or fractionally integrated. The error correction model (ECM) specification allows for the incorporation of the short-run adjustments with the long-run equilibrium without losing any long-run information. Pesaren and Shin (1998) demonstrate that the problem associated with serial correlation and endogeneity is removed with the simultaneous estimation of the long-run and short-run components. The error correction form of the ARDL model is specified as follows.

$$\begin{aligned}\Delta Gini_{\mathrm{t}} = {} & \alpha_0 + \alpha_1 t + \sum_{i=1}^{p_1} \beta_i \Delta Gini_{\mathrm{t}-i} + \sum_{i=1}^{p_2} \gamma_i \Delta FDI_{t-i} + \\ & \sum_{i=1}^{p_3} \delta_i \Delta\, openness_{\mathrm{t}-i} + \sum_{i=1}^{p_4} \varphi_i \Delta log(gdp\_cap)_{\mathrm{t}-i} + \\ & \sum_{i=1}^{p_5} \omega_i \Delta education_{\mathrm{t}-i} + \theta_1 FDI_{t-1} + \\ & \theta_2 openness_{t-1} + \theta_3 \log(gdp\_cap)_{t-1} + \theta_4 education_{t-1} + \mu_t\end{aligned} \quad (2)$$

In model (2), α_0 represents the drift term, t denotes the linear trend, and μ_t stands for the white noise residuals. The F-test, which has a non-standard distribution, is used to test the null hypothesis of no cointegration, H_0: $\theta_1 = \theta_2 = \theta_3 = \theta_4 = 0$, against its alternative, H_1: $at\ least\ one\ of\ \theta_i \neq 0$, for $i = 1,2,3,4$. Pesaran *et al.* (2001) provide two sets of asymptotic critical values. One set (lower bound) assumes that all variables are *I*(0), the other set (upper bound) assumes that they all are *I*(1). If the calculated F-statistics fall above the upper critical value (upper bound), the null hypothesis of no cointegration is rejected. In the case when the calculated F-statistics fall below the lower critical value, the null hypothesis cannot be rejected. If the F-

statistic falls between the lower and upper critical value bounds, the test becomes inconclusive.

3.2 Data Description

The income inequality is measured in terms of the Gini coefficient. The Gini coefficient, which represents the distribution of income that is held by a particular share of the population, ranges between 1 to 0, where 0 denotes perfect equality and 1 represents perfect inequality. The higher the Gini coefficient for a particular country, the higher is the income inequality in that country. This study uses the income inequality data, recorded in the World Income Inequality Database (WIID), that was reported by UNU-WIDER (2018). The choice of sample period is based on the availability of data at the time of the research. The data on the Gini coefficient covers the period of 31 years from 1984 to 2014 for the sample countries (except Canada, with its data period from 1981 to 2011).

The main independent variables are the FDI inflows and trade openness. The control variables used in the ARDL model are the level of development (represented by logarithm of the GDP per capita and expressed in US$) and the level of human capital (represented by secondary education). The FDI inflows represent the net inflows of foreign direct investment, expressed as the percentage of a given country's GDP. The trade openness variable, calculated as the sum of the given country imports and exports of goods and services, is expressed as a percentage of GDP. The secondary education variable represents the ratio of gross enrolment of the secondary equation, for both of the sexes, to the total population of a given country. The data for the independent and control variables is taken from the World Bank Indicators Database to the extent of availability (The World Bank, 2018a; The World Bank, 2018b), where feasible the gaps in data were filled using the average method illustrated by Stamatel (2009).

4. Analysis of Results

4.1 Unit Root Tests

The Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979) and Phillips-Perron (PP) (Phillips and Perron, 1988) unit root tests were used to test the order of integration of the model series. Both tests were performed using an intercept and a trend in the model, both in the levels and in the first differenced series. The results obtained from the ADF test suggest that some of the series are stationary at levels; at first difference, the ADF test illustrates that most of the variables are stationary at a 1% level of significance (Table 1). The PP test cross-validates most of the results obtained from the ADF test.

Table 1. Unit Root Tests
[Null Hypothesis: Unit Root; Alternative Hypothesis: No Unit Root]

Variable	**Augmented Dickey-Fuller Test** ADF- statistics (k)		**Phillips-Perron Test** PP- statistics [BW]	
	Level	**First difference**	**Level**	**First difference**
		Australia		
Gini	-6.0632 (0) ***	-5.9795 (2) **	-6.2646 [7] ***	-16.5205 [14] ***
FDI	-7.5160 (0) ***	-10.8773 (0) ***	-8.1620 [5] ***	-39.1794 [28] ***
openness	-3.0275 (0)	-6.4417 (0) ***	-3.0962 [2]	-7.0967 [4] ***
lgdp_cap	-1.8555 (0)	-4.0524 (0) ***	-1.8555 [0]	-3.9178 [4] **
education	-1.9283 (0)	-2.1307 (1)	-1.9897 [2]	-3.7614 [6] **
		Canada		
Gini	-1.7363 (0)	-0.4782 (7)	-1.7785 [1]	-5.0189 [2] ***
FDI	-3.1996 (0) *	-5.7001 (0) ***	-2.6215 [12]	-11.9905 [28] ***
openness	-0.6259 (0)	-4.1831 (0) ***	-1.0707 [3]	-4.1748 [1] ***
lgdp_cap	-1.1763 (0)	-3.9831 (0) ***	-1.4696 [2]	-3.9662 [2] ***
education	-4.2364 (0) ***	-2.6336 (1)	-3.6412 [2] **	-3.3887 [3] *
		France		
Gini	-2.8514 (1)	-6.2752 (0) ***	-2.9211 [1]	-6.2800 [1] ***
FDI	0.3821 (4)	-5.5412 (0) ***	-0.9024 [4]	-9.0624 [25] ***
openness	-3.3537 (0) *	-5.2287 (0) ***	-3.3488 [7] *	-5.7228[13] ***
lgdp_cap	-2.6395 (0)	-4.6472 (0) ***	-2.6395 [0]	-4.6472 [0] ***
education	-1.2431 (0)	-2.1848 (2)	-1.4131 [3]	-4.5581 [3] ***
		Germany		
Gini	-4.6240 (0) ***	-6.5710 (0) ***	-8.1871 [29] ***	-15.8186 [18] ***
FDI	-4.0196 (0) ***	-7.6264 (0) ***	-4.0196 [1] ***	-10.8158 [7] ***
openness	-2.4740 (0)	-5.1198 (0) ***	-2.4064 [11]	-6.0056 [20] ***
lgdp_cap	-4.0695 (1) ***	-4.3853 (2) ***	-6.4221 [6] ***	-22.7311 [15] ***
education	-2.4013 (0)	-3.8150 (0) **	-2.6126 [11]	-3.7829 [1] **
		Italy		
Gini	-3.6537 (1) **	-4.6435 (1) ***	-6.9338 [0] ***	-15.0596 [3] ***
FDI	-1.4944 (3)	-7.4385 (0) ***	-3.6469 [4] **	-14.3473 [16] ***
openness	-3.6319 (0) **	-5.5565 (0) ***	-5.1487 [26] ***	-8.5112 [28] ***
lgdp_cap	-2.5506 (0)	-4.3927 (0) ***	-2.5568 [3]	-4.4062 [3] ***
education	0.2464 (4)	-4.7099 (0) ***	0.4147 [8]	-5.6969 [16] ***
		Japan		
Gini	-0.1734 (6)	-5.6691 (0) ***	-3.0524 [2]	-7.5302 [9] ***
FDI	-0.7504 (4)	-6.0197 (0) ***	-3.4317 [3] **	-13.3379 [28] ***
openness	-2.6954 (0)	-5.2672 (0) ***	-2.6666 [4]	-5.7287 [6] ***
lgdp_cap	-2.8006 (0)	-4.0632 (0) ***	-5.8770 [29] ***	-4.0147 [6] ***
education	-1.2208 (0)	-2.4796 (2)	-1.2478 [2]	-5.3365 [2] ***

(continued…)

Table 1. Unit Root Tests (Concluded)

[Null Hypothesis: Unit Root; Alternative Hypothesis: No Unit Root

Variable	Augmented Dickey-Fuller Test ADF- statistics (k)		Phillips-Perron Test PP- statistics [BW]	
	Level	**First difference**	**Level**	**First difference**
		UK		
Gini	-2.0655 (2)	-15.2310 (0) ***	-7.1878 [2] ***	-14.4610 [1] ***
FDI	-0.3810 (5)	-7.8490 (0) ***	-3.1735 [2] *	-8.8384 [4] ***
openness	-1.7727 (4)	-5.6857 (0) ***	-2.9940 [6]	-6.2198 [9] ***
lgdp_cap	-2.2653 (0)	-4.2531 (0) ***	-2.2815 [3]	-4.2575 [2] ***
education	-1.9563 (0)	-4.9283 (0) ***	-2.1093 [2]	-4.9082 [3] ***
		US		
Gini	-1.0760 (2)	-4.0541 (0) ***	-2.8448 [1]	-3.6236 [1] **
FDI	-2.6687 (0)	-5.0664 (0) ***	-2.3316 [6]	-9.3816 [28] ***
openness	-3.9464 (0) **	-6.5354 (0) ***	-3.8642 [4] **	-16.5964 [28] ***
lgdp_cap	-1.0373 (0)	-3.5705 (0) **	-1.0061 [5]	-3.8546 [16] **
education	-2.5121 (0)	-3.7841 (0) **	-1.9594 [11]	-5.1338 [27] ***

Notes: (1) Figures in round parentheses are the k number of lags. Figures in the square brackets (BW) are the bandwidths. (2) *, ** and *** indicate the statistical significance at 10%, 5% and 1% levels, respectively. (3) The autoregressive lags in the ADF test are selected using the Modified Akaike Information Criterion with maximum lag set at 7. (4) The bandwidths for PP test are the Newey–West Bandwidths using the spectral estimation method of Bartlett kernel.

4.2 Estimates of the Long-run Coefficients

The optimal number of lags needs to be determined before estimating the ARDL model. Pesaran and Shin (1998) suggest that the optimal number of lags for the annual data set should be 2. Given the sample size, a larger number of lags will reduce the sample by one period, thus reducing the degree of freedom of the model. Therefore, based on those recommendations, the optimal lag length chosen for the ARDL model is 2. The long-run coefficients of the regressors, as well as the F-statistics calculated from the bounds test, are reported in Table 2. The F-statistics are compared against the critical values for the ARDL model with the constant and trend provided by Pesaran *et al*. (2001).

The results suggest that the F-statistics calculated for each individual country indicate that there is a long-relationship (cointegration) between variables in equation (2), except in France. The F-statistics calculated for France's ARDL model fall below the lower bound of critical value, implying that there is no long-run relationship between income inequality and FDI inflows and trade openness. The R-squared from each country's regressions suggest a relatively good fit of the model for all of the countries. There seems to be consensus in the sign of the FDI coefficient for all of the countries in the sample. The sign of the coefficient is negative, suggesting that the FDI inflows in those countries have a negative relationship with income inequality. Yet the results are statistically significant only for Germany (at a 10% level of

significance) and for the US (at a 1% level of significance). The theoretical prediction on the distributional effects of inward FDI in host countries regarding "transition to a new technological paradigm" (Aghion and Howitt 1998, p. 262) states that absorption of new technologies may increase inequality. This study results show that in advanced economies those FDI-induced spillovers may increase income inequality in a short-run, they will, however, reduce it in a long-run, thus fortifying the Kuznets inverted-U hypothesis of rising and falling inequality (Aghion et al., 2002; Acemoglu and Autor, 2011; Figini and Görg, 2011).

The fact that advanced countries attract mainly market orientated horizontal FDI (see Herzer and Nunnenkamp, 2013) could fuel this study results. Advanced countries are typically both host to foreign multinational enterprises (MNEs) and home to the domestic MNEs. The establishment of foreign plant may reduce the relative demand for skilled labour in the host country, especially where foreign plant operations are considerably less skill intensive than the headquarter services that are supplied from the domestic MNEs (Herzer and Nunnenkamp, 2013). The best examples of this phenomenon, in this study, is the case of US and Germany. Similar results can be found in the studies of Blonigen and Slaughter (2001), Figini and Görg (2011), Chintrakarn *et al*. (2012) and Herzer and Nunnenkamp (2013).

The sign for the second independent variable, trade openness, varies among countries. Half of the countries in the sample (France, Germany, Japan, the UK) seem to gain from the increased openness, as the increase in trade reduces their income inequality, but these results are significant for Japan and the UK only. This would suggest that the trade theory, which states that an increase in trade openness in developed countries will increase income inequality, does not hold here. Tsai (1995) and Jaumotte *et al*. (2013) reported similar findings, that an increase in trade openness will reduce income inequality in developed countries. The coefficient of the trade openness for Australia, Canada, Italy and the US is positive, thus in turn supporting the trade theory for the developed countries. However, Australia and the US are the only countries in that group for which the results are statistically significant. The significance of the trade openness variable would suggest that, in the last 3 decades, trade has played a dynamic role in the evolvement of the income inequality in those countries. Therefore, policy makers who seek a more equal income distribution within their country should promote international trade, with attached forms of compensation for those disadvantaged by the trade openness. Numerous researchers (e.g. Reuveny and Li, 2003; Celik and Basdas, 2010; Herzer and Nunnenkamp, 2013; Roser and Cuaresma, 2016) have recorded parallel conclusions showing how increasing trade openness advances income inequality.

The majority of the results from analysing the control variables' effects suggest that an increase in the level of development (lgdp_cap) will result in an increase in income inequality (Australia, France, Germany, the UK, the US). Basu and Guariglia (2007), Jensen and Rosas (2007) and Herzer and Nunnenkamp (2013) also report a positive relationship between the level of development and the income inequality. On the contrary, the increase in the level of development in Canada, Italy and Japan shows a decrease in their income inequality. Choi (2006), who finds similar results, argues

that an increase in the level of development would decrease the income inequality regardless of whether that country is a developed or a developing economy.

The literature suggests that an increase in education reduces the 'skill and wages gap' between high- and low-skilled labour. Results from the study indicate that this theory is true for Australia, Canada, Germany, Japan and the UK, and particularly for Canada and the UK, with results statistically significant at a 1% and a 5% level of significance, respectively. Researchers such as Wu and Hsu (2012), Herzer and Nunnenkamp (2013) and Roser and Cuaresma (2016) have also found similar results in their studies, confirming that theory. Yet this theory seems not to hold true for every country. The coefficient of education for France, Italy and the US is positive, which suggests that improving the education in the country would further increase the income inequality, not reduce it. The US is the only country for which the positive coefficient of the education variable is significant at a 1% level of significance. This could result from the fact that the tuition fees for higher education in the US have been increasing steadily over the years affecting affordability of the higher education to some low-income families (Mulhern *et al*., 2015).

Table 2. Long-run Estimates of the ARDL Models

Country (ARDL)	FDI	Openness	lgdp_cap	Education	R^2	LM test	Breusch-Pagan-Godfrey test	Bounds test F-Statistic
Australia	-0.0171	0.6930 ***	2.6717 **	-0.0107	0.9210	0.8142	0.7025	6.4742 **
(2,0,2,0,0)	(0.7796)	(0.0001)	(0.0174)	(0.5183)				
Canada	-0.0595	0.0639	-1.8927	- 0.1715 *	0.9790	0.6003	0.6004	8.0838***
(1,2,2,0,2)	(0.4924)	(0.1127)	(0.4119)	(0.0668)				
France	-0.5151	-0.2387	1.7746	0.0434	0.6727	0.1704	0.1152	2.5590
(2,0,0,0,0)	(0.4662)	(0.5125)	(0.7778)	(0.7623)				
Germany	-0.2434 *	-0.0632	5.8870 ***	-0.0822	0.7387	0.9209	0.7611	8.6660***
(2,0,0,2,0)	(0.0884)	(0.4607)	(0.0024)	(0.6985)				
Italy	-0.0443	0.0236	-5.7862 ***	0.1809	0.5001	0.1149	0.0220	15.1572 ***
(1,0,1,0,1)	(0.8449)	(0.7968)	(0.0066)	(0.1300)				
Japan	-0.2355	-0.2475***	-2.1864 ***	-0.0317	0.9003	0.2041	0.8589	10.1094 ***
(2,0,2,0,2)	(0.7504)	(0.0030)	(0.0085)	(0.8167)				
UK	-0.0112	-0.4170 ***	1.5394	-0.1020 **	0.8614	0.1398	0.8334	28.1319 ***
(1,2,2,2,2)	(0.9170)	(0.0039)	(0.5554)	(0.0164)				
US	-0.6140***	0.1606 ***	4.8544 ***	0.1471 ***	0.9513	0.9685	0.6401	11.9105 ***
(2,1,0,1,1)	(0.0000)	(0.0008)	(0.0018)	(0.0025)				

Notes: (1) All models are estimated using constant and trend, however those values are not reported here to conserve space but are available from the author on request. (2) Figures in parentheses are p-values. (3) *, **, *** indicate 10%, 5%, 1% level of significance, respectively. (4) Models selected on the basis of Akaike Information Criterion. (5) Figures for LM and Breusch-Pagan-Godfrey tests are probability values. (7) The LM test figures are based on 2 lags, with the exemption of the UK model, which is based on 1 lag; the probability for the LM test for the UK in lag 2 is 0.0421.

4.3 Short-run Estimates

The results for the short-run models are presented in Table 3. Note that, in the short run, FDI and trade openness affect more countries than in the long run; the same applies for the control variables. Furthermore, the results also indicate that current income inequality in a short run is affected by the previous year's income inequality, in the case of some countries. The coefficients of $CointEqt_{-1}$, for the corresponding country models, display the correct signs and are also statistically significant. Furthermore, they are fairly large for most of the countries; for example, the $CointEq_{t-1}$ coefficient of the UK is 0.9496. This implies that nearly 94% of the disequilibria of the income inequality of the previous year's shock adjusts back to the long-run equilibrium in the current year.

Table 3. Short-run Estimates of the ARDL Models

Variable	Australia ARDL (2,0,2,0,0)	Canada ARDL (1,2,2,0,2)	France ARDL (2,0,0,0,0)	Germany ARDL (2,0,0,2,0)	Italy ARDL (1,0,1,0,1)	Japan ARDL (2,0,2,0,2)	UK ARDL (1,2,2,2,2)	US ARDL (2,1,0,1,1)
Δ(Gini(-1))	0.2937		-0.3260 *	0.3978 **		0.4738***		0.6891 ***
	(0.1035)		(0.0544)	(0.0107)		(0.0064)		(0.0001)
Δ(FDI)		-0.0401					-0.0673	-0.6939 ***
		(0.1938)					(0.3631)	(0.0001)
Δ(FDI(-1))		0.0761 **					-0.2547 ***	
		(0.0125)					(0.0028)	
Δ(openness)	0.4643 ***	-0.0095			0.1356	-0.1758 **	0.0324	
	(0.0001)	(0.6195)			(0.1557)	(0.0005)	(0.6699)	
Δ(openness(-1))	-0.4270 ***	-0.0663 **				0.1505 ***	0.2794 ***	
	(0.0033)	(0.0017)				(0.0070)	(0.0029)	
Δ(lgdp_cap)				2.8832 ***			1.6318	-0.8995
				(0.0017)			(0.3715)	(0.8675)
Δ(lgdp_cap (-1))				-3.0383 **			5.8830 **	
				(0.0176)			(0.0202)	
Δ(education)		0.1220 *			-0.4894	0.2632 *	-0.0213	0.1183
		(0.0521)			(0.1790)	(0.0689)	(0.3353)	(0.1116)
Δ(education(-1))		0.1103 *				0.3065 **	0.1014 ***	
		(0.0990)				(0.0358)	(0.0002)	
CointEq(-1)	-1.7460 ***	-0.6471 ***	-0.3453 ***	-1.8604 ***	-1.2616 ***	-1.6172 ***	-0.9496 ***	-1.8090 ***
	(0.0000)	(0.0000)	(0.0008)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

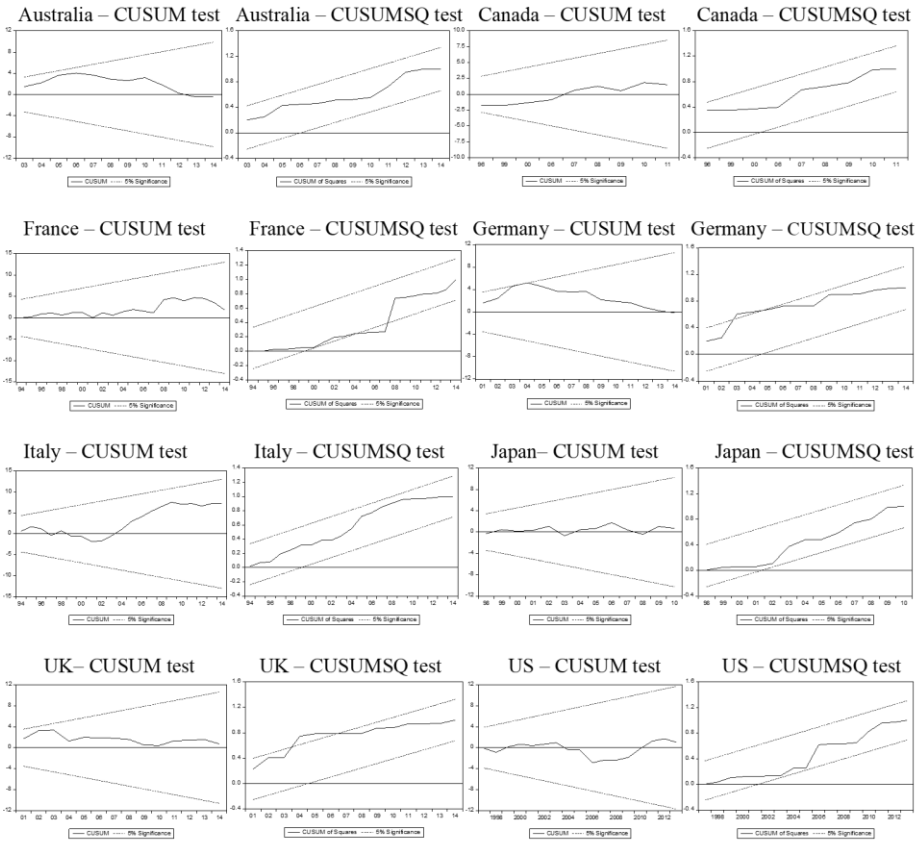
Notes: (1) All models are estimated using constant and trend; however. those values are not reported here to conserve space but are available from the author on request. (2) Figures in parentheses are p-values. (3) *, **, *** indicate 10%, 5%, 1% level of significance, respectively. (4) Models selected based on Akaike Information Criterion.

4.4 Robustness Check and Tests for Model Stability

To ensure the goodness of fit of the selected model, several diagnostic tests were conducted. These include the LM test for serial correlation (Breusch and Godfrey, 1978) and the Breusch-Pagan-Godfrey test for heteroskedasticity (Godfrey, 1978; Breusch and Pagan, 1979). After examination, the results of the diagnostic tests suggest that most models do not suffer from heteroskedasticity or serial correlation; the exception is Italy's model, which exhibits some heteroskedasticity. The cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) of the

recursive residuals tests are performed to test the stability of the estimated models (see Brown *et al*., 1975). Both the CUSUM and the CUSUMSQ tests are updated recursively and are plotted against the critical bounds representing the 5% level of significance. The null hypothesis of these tests states that all coefficient estimates in the regression are stable. When the plots of both the CUSUM and the CUSUMSQ test stay within the critical bounds, that hypothesis cannot be rejected. The plots of both those tests for the individual countries are presented below. Note that the plots of the CUSUM and CUSUMSQ statistics stay within the critical bounds of a 5% level of significance for most of the countries, which in turn indicates that the parameter estimates in the models are stable.

Figure 1. CUSUM and CUSUMSQ Tests for Model Stability



5. Conclusions

This study has examined the long-run relationship between FDI inflows, trade openness and income inequality in Australia and the G7 countries for the period 1984–2014 (Canada: 1981–2011). The model is estimated using the autoregressive distributed lag bounds test for cointegration. The findings indicate that there is a long-run relationship of these variables in seven of the countries examined, but not in France.

The results of the study also show that, in Australia and G7 countries, the FDI-induced spillovers may increase income inequality in a short-run, however, the FDI inflows have a decreasing long-term influence on income inequality in all of those countries (although the results are most prominent statistically for Germany and the US). Therefore, the results are fortifying the Kuznets inverted-U hypothesis of rising and falling income inequality.

The trade openness coefficient was found to have varied effects on the income inequality in the sample countries. Four of the sample countries (France, Germany, Japan and the UK) gain from the increase of openness of the trade, as it reduces their income inequality. Conversely, the remaining four countries in the sample experience an increase in income inequality as the trade becomes more open. Australia, Japan, the UK and the US are the only countries in the sample that seem to have statistically significant results for the effects of trade openness on income inequality.

The results from this study suggest that policymakers trying to expand the flow of their foreign investment need to realise that the access to new technologies and knowledge may come at the cost of initial increase in income gaps in the country and should not be ignored. However, this study draws an overall conclusion that policymakers in Australia and G7 countries attracting inward FDI need not to be concerned that productivity and growth-promoting access to superior technology will expand the income divide of the workforce in the long run. Nevertheless, it is vital to choose institutions and financial markets with a good, efficient investment environment, which will help not only to increase the benefits from the foreign investment, but also to stimulate economic growth in the host country.

References

Acemoglu, D. (2002), "Technical Change, Inequality, and the Labor Market," *Journal of Economic Literature*, 40, 7–72.

Acemoglu, D., and D. Autor, (2011), "Skills, Tasks and Technologies: Implications for Employment and Earnings," *Handbook of Labor Economics*, 12, 1043–1171.

Aghion, P., and P. Howitt, (1998), *Endogenous growth theory*, Cambridge, MIT Press.

Aghion, P., P. Howitt, and G. L. Violante, (2002), "General Purpose Technology and Wage Inequality," *Journal of Economic Growth*, 7, 315–45.

Alesina, A., and R. Perotti, (1996), "Income distribution, political instability, and investment," *European Economic Review*, 81, 1170–1189.

Barro, R. J. (2000), "Inequality and Growth in a Panel of Countries," *Journal of Economic Growth*, 5, 5–32.

Basu, P., and A. Guariglia, (2007), "Foreign Direct Investment, inequality and growth," *Journal of Macroeconomics*, 29, 824–839.

Blonigen, B., and M. Slaughter, (2001), "Foreign-affiliate Activity and U.S. Skill Upgrading," *Review Economics and Statistics*, 83, 362–376

Breusch, T. S. (1978), "Testing for Autocorrelation in Dynamic Linear Models," *Australian Economic Papers*, 17, 334–355.

Breusch, T. S., and A. R. Pagan, (1979), "A Simple Test for Heteroscedasticity and Random Coefficient Variation," *Econometrica*, 47, 1287–1294.

Brown, R. L., J. Durbin, and J. M. Evans, (1975), "Techniques for Testing the Constancy of Regression Relations Over Time," *Journal of the Royal Statistical Society*, Series B (Methodological), 37, 149–192.

Calderon, C., and A. Chong, (2001), "External Sector and Income Inequality in Interdependent Economies Using A Dynamic Panel Data Approach," *Economic Letters*, 71, 225-231.

Celik, S., and U. Basdas, (2010), "How Does Globalization Affects Income Inequality? A Panel Data Analysis," *International Advances in Economic Research*, 16, 358–370.

Chintrakarn, P., D. Herzer, and P. Nunnenkamp, (2012), "FDI and Income Inequality: Evidence from a Panel of U.S. States," *Economic Inequality*, 50, 788–801.

Choi, C. (2006), "Does Foreign Direct Investment Affect Domestic Income Inequality?" *Applied Economics Letters*, 13, 811–814.

Dickey, D. A., and W. A. Fuller, (1979), "Distribution of the Estimators for Autoregressive Time Series with a Unit Root," *Journal of the American Statistical Association*, 74, 427–431.

Feenstra, R., and G. Hanson, (1997), "Foreign Direct Investment and Relative Wages: Evidence from Mexico's Maquiladoras," *Journal of International Economics*, 42, 371–393.

Figini, P., and H. Görg, (2011), "Does Foreign Direct Investment Affect Wage Inequality? An Empirical Investigation," *The World Economy,* 34, 1455–1475.

Godfrey, L. G. (1978), "Testing Against General Autoregressive and Moving Average Error Models when the Regressors Include Lagged Dependent Variables," *Econometrica*, 46, 1293–1301.

Godfrey, L. G. (1978), "Testing for Multiplicative Heteroscedasticity," *Journal of Econometrics*, 8, 227–236.

Herzer, D., and P. Nunnenkamp, (2013), "Inward and Outward FDI and income inequality: evidence from Europe," *Review World Economics*, 149, 395–422.

Herzer, D., P. Hühne, and P. Nunnenkamp, (2014), "FDI and Income Inequality – Evidence from Latin American Economies," *Review of Development Economics*, 18, 778–793.

International Labour Organisation, (2019), "Labour Income Share and Distribution: Just 10 Per Cent Of Workers Receive Nearly Half of Global Pay," ILO: https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_712234/lang--en/index.htm

Jaumotte, F., S. Lall, and C. Papageorgiou, (2013), "Rising Income Inequality: Technology, or Trade and Financial Globalization?" *IMF Economic Review*, 61, 271–309.

Jensen, N. M., and G. Rosas, (2007), "Foreign Investment and Income Inequality in Mexico, 1990–2000," *International Organization*, 61, 467–487.

Krugman, P. (2000), "Technology, Trade and Factor Prices," *Journal of International Economics*, 50, 51–71.

Kanbur, R., C. M. Calvo, M. Das. Gupta, C. Grootaert, V. Kwakwa, and N. Lustig, (2001), *World Development Report 2000/2001: Attacking Poverty*, 22684, World Bank.

Kuznets, S. (1955), "Economic Growth and Income Inequality," *American Economic Review*, 45, 1–28.

Laudicina, P. A., and E. R. Peterson, (2017), "The 2017 A. T. Kearney Foreign Direct Investment Confidence Index: Glass Half Full," A. T. Kearney: https://www.kearney.com/foreign-direct-investment-confidence-index/article?/a/glass-half-full-2017-foreign-direct-investment-confidence-index-article

Mulhern, C., R. Spies, and D. Wu, (2015), "The Effects of Rising Student Costs in Higher Education: Evidence from Public Institutions in Virginia," *ITHAKA S+R.*

OECD, (2015), "In It Together: Why Less Inequality Benefits All," OECD Publishing: http://dx.doi.org/10.1787/9789264235120-en.

OECD, (2017a), "FDI restrictiveness (indicator)," DOI: 10.1787/c176b7fa-en.

OECD, (2017b), "Fiscal Approach for Inclusive Growth in G7 Countries", OECD publishing: https://www.oecd.org/tax/tax-policy/a-fiscal-approach-for-inclusive-growth-in-g7-countries.pdf

OECD, (2017c), "Income Distribution," OECD database, DOI:10.1787/data-00654-en.

Pesaran, M. H., and Y. Shin, (1998), "An Autoregressive Distributed-Lag Modelling Approach to Cointegration Analysis," *Econometric Society Monographs*, 31, 371–413.

Pesaran, M., Y. Shin, and R. Smith, (2001), "Bounds Testing Approaches to The Analysis of Level Relationships," *Journal of Applied Econometrics*, 16, 289–326.

Phillips, P. C. B., and P. Perron, (1988), "Testing for a Unit Root in Time Series Regression," *Biometrika*, 75, 335–346.

Reuveny, R., and Q. Li, (2003), "Economic Openness, Democracy and Income Inequality," *Comparative Political Studies*, 36, 575–601.

Roser, M., and J. C. Cuaresma, (2016), "Why Is Income Inequality Increasing in The Developed World?" *Review of Income and Wealth*, 62, 1–27.

Singh, T. (2017), "Are Current Account Deficits in the OECD Countries Sustainable? Robust Evidence from Time-Series Estimators," *The International Trade Journal*, 31, 29–64.

Stamatel, J. P. (2009), "Correlates of National-Level Homicide Variation in Post-Communist East-Central Europe," *Social Forces*, 87, 1423–1448.

Stolper, F. W., and P. A. Samuelson, (1941), "Protection and Real Wages," *Review of Economic Studies*, 9, 58–73.

Solt, F., and V. Ritakallio, (2008), "Economic Inequality and Democratic Political Engagement," *American Journal of Political Science*, 52, 48–60.

Sylwester, K. (2005), "Foreign Direct Investment, Growth and Income Inequality in Less Developed Countries," *International Review of Applied Economics*, 19, 289–300.

The World Bank, (2018a), "Economy and Growth Indicators," World Bank Open Data: https://data.worldbank.org/indicator

The World Bank, (2018b), "Education Indicators," World Bank Open Data: https://data.worldbank.org/indicator

Tsai, P. L. (1995), "Foreign Direct Investment and Income Inequality: Further Evidence," World *Development*, 23, 469–83.

UNU-WIDER, (2018), "World Income Inequality Database – WIID 3.4," United Nations University World Institute, Helsinki, Finland.

Wood, A. (1994), *North-South Trade, Employment, and Inequality: Changing Fortunes in a Skill-Driven World*, Oxford University Press, New York.

Wu, J., and C. Hsu, (2012), "Foreign Direct Investment and Income Inequality: Does the Relationship Vary with Absorptive Capacity?" *Economic Modelling*, 29, 2183–2189.