THE IMPACT OF FOREIGN DIRECT INVESTMENT ON INCOME INEQUALITY: A PANEL AUTOGRESSIVE DISTRIBUTED LAG APPROACH FOR THE ASIA-PACIFIC ECONOMIC COOPERATION DEVELOPING ECONOMIES

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In the present paper, the effect of foreign direct investment (FDI) inflows on income inequality in Asia-Pacific Economic Cooperation (APEC) economies is investigated by using annual data for the period 1990–2015. The variables used are the Gini coefficient, FDI inflows, gross domestic product (GDP) per capita, trade openness and human capital. Also, panel Autoregressive Distributed Lag (ARDL) and panel heterogeneous non-causality tests are used in this study. The panel ARDL results suggest that, in the long run, FDI inflows decrease income inequality. This supports the argument that encouraging FDI inflows does not harm the distribution of income in APEC economies. The results also confirm that GDP per capita and trade openness help reduce income inequality while human capital widens income inequality. The results from this study suggest that APEC authorities could implement sound policies to attract more FDI, as evidence indicates that those inflows would narrow income inequality in APEC economies.

JEL classification: C23, D30, F21

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I. INTRODUCTION

The effect of foreign direct investment (FDI) has been one of the most widely debated issues among economists and policymakers in developed and developing countries in recent years. The debate has been greatly reinforced because of the rapid increase in FDI flowing to least developed countries. It is estimated that total FDI inflows to least developed countries reached $35 billion in 2015, a 133 per cent increase since 2005.[1] (UNCTAD, 2016). Economist and policymakers believe that FDI could contribute to the growth and development of the host least developed countries through such channels as transfer of modern technology and management skills, human capital development and exporting market access. While the potential role of FDI in the least developed countries development process is once again the focus of attention, some fundamental issues remain unresolved. Among those issues, the impact of FDI on the host country's income inequality is perhaps the most complicated and controversial. While least developed countries have been experiencing an increase in inequality in recent decades, it is also experiencing rapid globalization of economic activities through the means of international trade and international investment, particularly in the form of FDI.

Since 1995, special attention has been devoted to examining the impact of FDI on income inequality, including by, among others, Tsai (1995), Choi (2006), Wu and Hsu (2012), and Bogliaccini and Egan (2017). However, the theoretical and empirical studies have explored the diverse arguments on the association between FDI inflows and income inequality. While the first group reveals that increasing FDI inflows have contributed to greater income inequality, the second group claims that FDI inflows have helped to reduce income inequality; and the third group indicates that no significant relationship exists between FDI inflows and income inequality. The association between FDI inflows and income inequality remains an area of unresolved controversy in open economy macroeconomics. Accordingly, the objective of the present paper is to investigate whether the FDI inflows are associated with greater income inequality for a sample of 13 Asia-Pacific Economic Cooperation (APEC) developing economies over the period 1990-2015.

Achieving equitable and balanced growth is important for people, society, and government. Increasing inequality leads to social unrest and political instability, which, in turn, undermine economic growth and sustainable development. The relationship between sustainable development and income inequality has been one of the most interesting research areas among academics and policymakers. It is

[1] The average of FDI net inflows into APEC developing economies for the selected period is given in the figure in the appendix.

expected that sustainable development cannot be achieved if extreme inequalities are not addressed. The degree to which inequality has been included in the 2030 Agenda for Sustainable Development has been debated. According to the *World Inequality Report 2018*, income inequality has increased in almost all parts of the world since 1980, but at different speeds (Alvaredo and others, 2017); and hence, the 2030 Agenda has included the issue of inequality. Those factors have motivated the selection of this topic.

The present paper contributes to the FDI and income inequality literature in the following ways. First, though there are some single country studies available on the APEC region, this may be the first study to investigate the impact of FDI on income inequality in APEC developing economies as a group. Second, various recently developed econometric techniques are used: (a) the cross-sectional dependence (CD) test (Pesaran, 2004) and the cross-sectionally augmented Im-Pesaran-Shin (CIPS) unit root test (Pesaran, 2007), in which, the former is based on the assumption of cross-section independence and in the latter, cross-section dependence is considered; (b) the panel Autoregressive Distributed Lag (ARDL) approach developed by Pesaran, Shin, and Smith (2001); (c) the more recently developed panel heterogeneous non-causality test (Dumitrescu and Hurlin, 2012) to examine the causal relationship among the variables.

The empirical investigation of this paper yields several results, which show that FDI inflows reduce income inequality in APEC developing economies in the long-run. They also reveal that an increase in gross domestic product (GDP) per capita and trade openness leads to a reduction in income inequality. Furthermore, the heterogeneous panel non-causality test shows that, in the short-run, there is no causality run from FDI inflows to income inequality.

The rest of the paper is structured as follows. Section II includes a review of relevant theoretical and empirical literature on FDI and income inequality. Section III provides data and the preliminary analysis on APEC developing economies. In section IV, the empirical results and analysis are presented, followed by the conclusion and policy implications.

II. REVIEW OF THE LITERATURE

Theoretical literature

The impact of FDI inflows on income inequality has received only limited coverage in theoretical literature. However, theoretical predictions on the impact of FDI inflows on income inequality have become more ambiguous. In this section, the arguments of the modernization, dependency theories and North–South models with respect to the impact of FDI on income inequality are briefly touched upon.

Modernization theorists argue that FDI is an ideal mechanism for the diffusion of capital, markets and knowledge, which leads to development for newly independent economies (King and Váradi, 2002). They treat foreign and domestic capital as homogeneous goods, so the capital fosters economic growth and its benefits ultimately spread throughout the whole economy. The theorists address the Kuznets effect wherein income inequality increases at first as per capita income grows, but declines later once a certain level of development is reached. Even though FDI initially stimulates growth in some leading sectors and regions, and provides benefits to some skilled elites, growth in the leading sectors and regions facilitate more equal income distribution within a country in the long-run (Tsai, 995). Several researchers have drawn conclusions in line with the modernization theory (Hanad and Harrison, 1993; Coe, Helpman and Hoffmaister, 1994; Blomstrom and Kokko, 1996; Batra and Tan, 1997; Markusen and Venables, 1999). Their results indicate that because of the increased levels of technology and capital within a country, the overall level of efficiency and labour productivity increased.

Contrary to the modernization theory, dependency scholars argue that FDI increases income inequality. The theory qualifies the existing income inequality as a result of historical events. Furthermore, the theory states that the influence of institutional factors and the strength of the government are very important for the distribution of income. Tsai (1995) argues that the inequality problem is based on the world economy and historical perspective. The influence of where a country fits into the world economy and its relative position determines its income distribution. It demonstrates that as FDI increases, a country's foreign control increases; and the degree of income equality also increases (Bornschier and Chase-Dunn, 1985). According to the theory, the most common argument is that FDI raises relative wages of skilled labour in a host country by bringing in skill-biased technology. In addition, the capital-intensive techniques used by foreign investors promote unemployment among unskilled workers and distort income distribution by creating an economy with a small advanced sector and a large backward sector (Lall, 1985; Jenkins, 1996; Reuveny and Li, 2003).

Both theories identify the influence of FDI inflows on the rising levels of inequality within countries and make a clear distinction between the consequences for developed and developing countries. The modernization theory views the increased income inequality during the development stage of a country as a necessary stage that eventually leads to more equal income distribution. The dependency theory argues that because of initial differences between countries in terms of government strength, internal market control and foreign market dependency, countries develop in different ways, resulting in differences in the level of income inequality within countries. Based on those theories, it is not possible to state if FDI inflows are increasing or decreasing the income distribution. The modernization theory clearly states the negative side effect in the development stage, but it also points out that once a country is past that stage, FDI inflows in other sectors eventually improve the overall income inequality. The dependency theory acknowledges that FDI inflows are an evident factor for worsening the income inequality.

The impact of FDI inflows on income inequality is also dealt with in the North-South models. Those models, which were introduced by Feenstra and Hanson (1996), explain that an increase in the Southern capital stock relative to that of the North can increase the relative wage of skilled labour in both regions. Accordingly, the availability of relatively cheap labour in the poorer host countries may encourage firms based in the richer source countries to undertake cost-oriented, vertical FDI by offshoring labour-intensive parts of the production process. This type of FDI may increase the skill premium not only in the richer source country, but also in the poorer host country. Several empirical studies (Aitken and others, 1996; Feenstra and Hanson, 1997; Mah, 2002; Hanson, 2003; Lipsey and Sjöholm, 2004) support the hypothesis derived from endowment-driven North-South models, according to which FDI is associated with greater inequality by raising the skill premium in poorer host countries.

Empirical literature

A summary of the empirical literature review is available in table in the appendix. From that table, a few important studies are reviewed.

Focusing on income inequality in least developed countries using cross-country data, Tsai (1995) examines the relationship between FDI and income inequality in 33 least developed countries (in Latin America and South-East Asia), and finds that FDI rises to more unequal income distribution in the host least developed countries, particularly in countries in South-East Asia. The findings of Tsai (1995) are generally consistent with the argument of the dependency theorists. Along similar lines, Te Velde (2003) investigates the effects of FDI on income inequality in four Latin American countries

for the period 1978–2000. The findings of the study show that FDI does not reduce inequality, with the exception of Colombia. Moreover, FDI raises wage inequality by boosting the wages of skilled workers more than the wages of less-skilled workers. On average, the results indicate that not all types of workers necessarily gain from FDI to the same extent. Furthermore, Choi (2006) uses pooled data for the time period 1993–2002 for 119 countries to determine the relationship between FDI and income inequality. The results show that there is a highly significant and positive relationship between FDI and income inequality in those selected countries.

The finding of Tsai (1995) is supported by Basu and Guariglia (2007), who examine the interactions between FDI, inequality, and economic growth in 119 developing countries, over the period 1970–1999. The study indicates that FDI and inequality are positively correlated and that FDI fosters growth. The study concludes that FDI could increase inequality, particularly in an environment where the poor are unable to access the modern FDI-based technology because of low initial human capital. In particular, human capital inequality increases as FDI drives the modern sector's growth. This suggests a positive relationship between FDI and inequality. Furthermore, Herzer, Huhne and Nunnenkamp (2014) investigate the long-run impact of FDI on income inequality in five Latin American countries (Bolivia, Chile, Colombia, Mexico and Uruguay) for the period 1980–2000. The findings reveal that FDI has a significant and positive effect on income inequality. That implies that FDI leads to wide income gaps in Latin America and hence supports the previous study. In a country-specific analysis, FDI also increases inequality in all the individual countries, except for Uruguay.

In contrast to there being a positive relationship, other studies argue that FDI has a negative impact on income distribution. Among them, Wu and Hsu (2012) assess the impact of FDI on income inequality, using a cross-sectional dataset for 54 countries (33 developing countries and 21 developed countries) over the period 1980–2005. The findings show that FDI reduces the income inequality for countries with well-developed absorptive capacity more than for those countries whose absorptive capacity is less developed. That is, FDI could be harmful to the income distribution of those host countries that have low levels of absorptive capacity.

Furthermore, in contrast to positive and negative effects, using 29 least developed countries, Sylwester (2005) examines how FDI is associated with income inequality for the period 1970–1989. The findings of that study provide no evidence to suggest that there is a significant association between FDI and changes in income inequality within this group of least developed countries. Im and McLaren (2015) investigate the effects of FDI on income distribution and poverty in 127 developing countries for the period 1977–2012 and find that FDI does not influence income inequality.

III. DATA AND PRELIMINARY ANALYSIS

Data sources and description of the variable

For this study, a balanced panel data for 13 APEC economies, namely, Chile; China; Hong Kong, China; Indonesia; Malaysia; Mexico; Republic of Korea; Peru; Philippines; Singapore; Taiwan Province of China; Thailand; and Viet Nam, from 1990 to 2015 are used. Even though there are 21 economies in the APEC region, this study considers only developing economies. Among the fifteen developing economies,[2] the noted 13 economies are chosen for the analysis, as reliable and consistent series of data on them for the above period are available. The two developing countries not covered in the study are Brunei Darussalam and Papua New Guinea.

After reviewing the literature, the important variables for the study were selected: annual time series data on Gini coefficient, FDI inflows, GDP per capita, trade openness and human capital. The Gini coefficient[3] is used as a dependent variable. The Gini coefficient, as an indicator of income inequality, is denoted by *LGINI*. The Gini coefficient data are obtained from the Standardized World Income Inequality Database (Solt, 2009; 2016). FDI is defined as FDI inflows ($ million), denoted by *LFDI*. GDP per capita (constant 2005 $), as an indicator of economic growth, is denoted by *LGDPPC*. Human capital (*LHC*) is measured as index of human capital per person. Trade openness (*LTO*),[4] which is total exports and imports, is measured as a percentage of GDP. The data for FDI inflows, GDP per capita, and trade openness are collected from World Bank (2017) and United Nations Conference on Trade and Development Statistics (UNCTADstat, 2017) online database. The Index of human capital per person is gathered from Penn World Table 9.0 (Feenstra, Inklaar and Timmer, 2015).

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[2] The country classification is based on United Nations (2014).

[3] One of the tools for measuring inequality of a distribution is the Gini coefficient. Inequality on the Gini scale is measured between 0, where everybody is equal, and 1, where all the country's income is earned by a single person. The Gini coefficient has been the most popular method for operationalizing income inequality in the economic literature. However, a number of alternative methods exist (Atkinson index, Coefficient of variation, Decile ratios, Generalised entropy index, Kakwani progressivity index, proportion of total income earned, Robin Hood index and Sen Poverty measure); they offer researchers the means to develop a more nuanced understanding of the distribution of income.

[4] It is a measure of how a country is liberalized to the rest of the world. Reviewing the existing literature on trade openness shows that there is not a clear proxy of trade openness. Many different measures of trade openness (openness index by Leamer, 1988; price distortion and variability index by Dollar, 1992; and openness index of Sachs and Warner, 1995) have been proposed and used in empirical analyses, but for this paper, the simplest ones, which are based on actual trade flows, such as the sum of exports and imports as percentage of GDP, are used.

Preliminary analysis and discussion

Before starting the investigation, a preliminary analysis check is conducted to determine whether FDI inflows and income inequality are an issue in APEC developing economies. Average annual growth rates on the considered variables are provided in this study for the period 1990–2015. Those growth rates are shown in table 1 (column ***a***). The results show that, out of 13 APEC developing economies, eight economies have average positive growth rates for income inequality. The highest positive average growth rates for income inequality are attained by China (1.50 per cent), Indonesia (1.46 per cent) and Hong Kong, China (0.98 per cent). The highest negative average growth rates for income inequality are attained by Malaysia (-0.57 per cent) followed by Thailand (-0.51 per cent). A positive growth of income inequality is a concern as it indicates the widening of income inequality in those economies while negative growth rates suggest a reduction in income inequality in those economies.

Table 1. Average annual growth rates and mean statistics for individual economies, 1990–2015

Country	GINI		FDI		GDPPC		TO		HC	
	a	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*
Chile	-0.37	49.07	21.87	8 775.19	3.79	7 127.19	-0.12	63.75	0.58	2.84
China	1.50	44.66	0.22	66 333.5	9.21	1774.86	2.52	43.59	1.12	2.20
Hong Kong, China	0.98	43.87	44.73	41 347.69	2.91	25 447.12	2.07	336.10	0.74	3.03
Indonesia	1.46	34.89	5.77	10 728.74	3.51	1360.04	0.50	56.37	1.20	0.82
Republic of Korea	0.06	29.91	13.74	7 290.35	4.49	16 836.54	2.37	73.06	0.92	3.37
Malaysia	-0.57	39.18	43.72	6 190.26	3.58	5 298.96	-0.18	177.81	0.91	3.24
Mexico	-0.05	46.56	18.19	19 220.73	1.17	7 634.04	3.38	51.76	0.81	2.55
Peru	-0.37	49.68	14.89	3 916.37	3.29	2 822.65	1.97	40.46	0.88	2.58
Philippines	0.06	42.56	46.94	1 860.28	2.20	1 195.31	0.48	81.69	0.69	2.47
Singapore	0.39	39.98	31.32	25 733.13	3.55	27 436.69	0.00	359.29	2.13	2.84
Taiwan Province of China	0.43	29.46	8.50	4 036.73	4.11	15 263.15	1.63	92.43	1.21	2.82
Thailand	-0.51	38.23	23.36	6 457.64	3.51	2 722.54	2.34	112.23	1.03	2.34
Viet Nam	0.38	35.16	25.33	4 109.13	5.60	631.19	3.57	118.41	1.73	2.12

Source: Authors' calculations on data from Penn World Table 9.0, Solt (2016); World Bank (2017); UNCTADstat (2017).

Note: Columns ***a*** and ***b*** represent average growth rates and mean statistics on individual economies, respectively. Average growth rates and mean statistics are calculated using original data.

Similarly, the average growth rates on FDI inflows indicate that all the economies had significant positive growth rates during the study period, with the exception of China, for which the lowest growth rate (0.22 per cent) was recorded. Regarding GDP per capita, the highest rates were achieved by China (9.21 per cent), Viet Nam (5.60 per cent), Republic of Korea (4.49 per cent) and Taiwan Province of China (4.11 per cent), while the lowest GDP per capita was attained by Mexico (1.17 per cent). Considering trade openness, 11 economies recorded positive growth in trade openness, while only two economies (Chile and Malaysia) had negative growth rates during the sample period. Finally, the considered 13 economies showed remarkable positive average growth rates in human capital, with the highest growth rates obtained by Singapore (2.13 per cent) and Viet Nam (1.73 per cent).

Table 1 (column ***b***) also presents the mean statistics on individual economies for the 1990–2015 period. The results suggest that income inequality among the economies differs significantly. The income inequality was highest in Peru (49.68), Chile (49.07), and Mexico (46.56) while some other economies had relatively low income inequality, such as Taiwan Province of China (29.46) and the Republic of Korea (29.91). Similarly, FDI inflows were significantly higher for China ($66.3 billion), Hong Kong, China ($41.4 billion) and Singapore ($25.7 billion) while it was considerably lower in the case of the Philippines ($1.86 billion), and Peru ($3.92 billion).

Among the 13 sample economies, four of them (Hong Kong; China, Republic of Korea, Singapore and Taiwan Province of China) recorded a GDP per capita that exceeded $15,000 while for six economies (China, Indonesia, Peru, the Philippines, Thailand and Viet Nam) it was less than $5,000. For the same period (1990–2015), the average GDP per capita for APEC countries was $9,071.67. This indicates that only four economies, out of 13, had a higher GDP per capita than that of average for APEC countries. The trade openness was higher in Singapore (359.29) and Hong Kong; China (336.10), while some other economies had relatively low trade openness, such as Peru (40.46) and China (43.59). Finally, human capital was higher for the Republic of Korea (3.37), Malaysia (3.24) and Hong Kong, China (3.03) while it was lower for Indonesia (0.82).

For the same sample period (1990–2015), the world's average GDP per capita was $7,234.19. This indicates that only five out of the 13 APEC developing economies had a higher GDP per capita than that of world average. The results on summary statistics on individual economies indicate that a majority of the APEC economies were suffering from higher income inequality. As a result of the preliminary analysis, there was sufficient evidence for research to be conducted on the impact of FDI inflows on income inequality in APEC economies. Accordingly, the empirical analysis is presented in the following sections.

Table 2 displays the descriptive statistics and correlation matrix on panel data set. The results show that the average income inequality among the APEC economies is about 40.25 per cent. This implies that those economies had significantly higher income inequality during the sample period. The average FDI inflows are $15.82 billion while GDP per capita is $8,888.46. However, the average trade openness is substantially higher at 119.29 per cent. Finally, human capital per person is 2.47. In addition, to avoid the problems associated with their distributional properties, the variables are transformed into the natural logarithm form, as variables considered in this study are measured differently. GINI and human capital are measured as indexes, FDI inflows and GDP per capita are measured in monetary units and trade openness is measured in percentage. Then, the correlation coefficients between them are calculated. The correlation matrix for the five selected variables confirms that none of the variables are highly correlated, in table 2.

Table 2. Preliminary statistics

Variables	Summary statistics				Correlation matrix				
	Mean	Std.Dev	Min.	Max.	LGINI	LFDI	LGDPPC	LTO	LHC
GINI	40.25	0.38	27.02	53.19	1				
FDI	15 818.00	1 373.25	0.37	174 892.49	0.19	1			
GDPPC	8 888.46	518.44	286.00	38 701.00	-0.05	0.30	1		
TO	119.29	5.98	1.03	455.42	0.03	0.16	0.43	1	
HC	2.47	0.03	0.64	3.60	0.15	0.09	0.42	0.37	1

Source: Authors' calculations on data from Penn World Table 9.0; Solt (2016); World Bank (2017); UNCTADstat (2017).
Note: Summary statistics and correlations are calculated using original data and log data, respectively.

IV. EMPIRICAL RESULTS AND ANALYSIS

Model specification

Panel econometric models are used for this analysis, as they provide more information and also control individual heterogeneity. Accordingly, this raises the efficiency of the econometric estimation. Income inequality is expressed as a function of FDI, GDP per capita (GDPPC), human capital (HC) and trade openness (TO).

$$GINI_{it} = f(FDI_{it}, GDPPC_{it}, HC_{it}, TO_{it}) \quad (1)$$

Equation (1) can be rewritten in a linear regression framework as follows:

$$LGINI_{it} = \delta_{0i} + \delta_{1i}LFDI_{it} + \delta_{2i}LGDPPC_{it} + \delta_{3i}LHC_{it} + \delta_{4i}LTO_{it} + \varepsilon_{it} \quad (2)$$

In equation (2), all variables are in natural logarithms. Cross nations are denoted by i (i = 1, 2,…,N) and t denotes time (t = 1,2,….T). ε is a random error term.

Empirical results and analysis

Cross-sectional Dependence (CD) test

To adopt the type of panel unit root test suitable for this study, an investigation is made to determine whether the sample data have cross-sectional dependence. Accordingly, a cross-sectional dependence test (Pesaran, 2004) is used to examine the cross-sectional dependency of the series. The null hypothesis of the CD test is that the given series is cross-sectionally independent. Table 3 presents the CD test results. As can be seen, the null hypothesis of cross-sectional independence should be rejected at the 5 per cent and 1 per cent significance levels for the considered variables: LGINI, LFDI, LGDPPC, LHC and LTO. Hence, it can be proved through evidence that all the selected variables have cross-sectional dependence. Based on the CD test, it is inappropriate to use a conventional panel unit root test, such as Im, Pesaran, and Shin (2003), which work under the assumption of cross-sectional independence.

Table 3. Cross-sectional Dependence test results

Variable	Statistic	P-value
LGINI	1.99*	0.05
LFDI	28.01**	0.00
LGDPPC	43.44**	0.00
LHC	43.37**	0.00
LTO	25.46**	0.00

Source: Authors' calculations on data from Penn World Table 9.0; Solt (2016); World Bank (2017); UNCTADstat (2017).

Note: *, ** denotes the rejection of null hypothesis of cross-sectional independence (CD test) at 5 per cent and 1 per cent significance levels.

Cross-sectionally augmented Im-Pesaran-Shin unit root test

The cross-sectionally augmented Im-Pesaran-Shin (CIPS) unit root test (Pesaran, 2007) is applied to investigate the order of integration of the variables. That test was developed on the assumption of cross-sectional dependence. Table 4 presents the CIPS panel unit root test results.

Table 4. Cross-sectionally augmented Im-Pesaran-Shin panel unit root test results

Variables	Levels		First differences		Order of integration
	Statistic	P-value	Statistic	P-value	
LGINI	-2.35	0.00**	-	-	I(0)
LFDI	-2.37	0.00**	-11.45	0.00 **	I(I)
LGDPPC	1.87	0.96	-7.29	0.00 **	I(1)
LHC	-3.08	0.00**	-	-	I(0)
LTO	0.81	0.79	-6.51	0.00 **	I(1)

Source: Authors' calculations on data from Penn World Table 9.0; Solt (2016); World Bank (2017); UNCTADstat (2017).
Note: ** Indicates the rejection of null hypothesis of unit root at 1 per cent significance level. The CIPS test is estimated using constant and trend variables in the model.

It can be seen that the null hypothesis of panel unit root cannot be rejected for the three variables, FDI inflows, GDP per capita and trade openness, in their level form, while the unit root test can be rejected for the two variables, GINI and human capital. However, at the first difference, the null hypothesis of the panel unit root can be rejected for those three variables, FDI inflows, GDPP per capita and trade openness. Hence, the results confirm that income inequality and human capital are integrated of order zero, I(0), and the other three variables are integrated of order one, I(1).

Panel Autoregressive Distributed Lag approach

The ARDL (Pesaran, Shin and Smith, 2001) approach has several desired properties, including whether the regressors are purely of I(0) or purely I(1) in the model, and can be used to estimate short-run and long-run relationships of the model simultaneously. Accordingly, the panel ARDL is applied to this study to examine the relationship among the variables. The unrestricted error correction model for the panel ARDL can be represented as follows:

$$\Delta LGINI_{it} = \beta_{0i} + \beta_{1i} LGINI_{i,t-1} + \beta_{2i} LFDI_{i,t-1} + \beta_{3i} LGDPPC_{i,t-1} + \beta_{4i} LHC_{i,t-1} + \beta_{5i} LTO_{i,t-1} + \sum_{j=1}^{f} \alpha_{1i} \Delta LGINI_{i,t-j} + \sum_{j=0}^{g} \alpha_{2i} \Delta LFDI_{i,t-j} + \sum_{j=0}^{h} \alpha_{3i} \Delta LGDPPC_{i,t-j} + \sum_{j=0}^{i} \alpha_{4i} \Delta LHC_{i,t-j} + \sum_{j=0}^{j} \alpha_{5i} \Delta LTO_{i,t-j} + \varepsilon_{it} \quad (3)$$

where Δ is the first difference operator, $\hat{\beta}_{0i}$ are the fixed effect components, and ε_{it} are the standard normal residuals. The coefficients ($\hat{\beta}_1$, $\hat{\beta}_2$,...$\hat{\beta}_5$) represent the long-run relationship whereas the remaining coefficients with summation sign (α_1, α_2,... α_5) represent the short-run dynamics of the model. The optimal lags (*f, g, h, i and j*) are determined by using the Akaike Information Criterion (The estimated coefficients for the long-run model are given in table 5).

Table 5. Estimated long-run coefficients of the panel Autoregressive Distributed Lag model

Regressor	Parameter	Coefficient	Standard error	P-value
LFDI	δ1	-0.08	0.01	0.00**
LGDPPC	δ2	-0.11	0.01	0.00**
LHC	δ3	0.43	0.08	0.00**
LTO	δ4	-0.17	0.02	0.00**

Source: Authors' calculations on data from Penn World Table 9.0; Solt (2016); World Bank (2017); UNCTADstat (2017).
Note: ** Indicates statistical significance at the 1 per cent level.

As can be seen, in the long-run, the coefficient of FDI on the Gini coefficient is negative and significant at the 1 per cent level. This supports a positive view that encouraging FDI inflows causes a reduction in income inequality. This result is consistent with previous studies of Jensen and Rosas (2007), Figini and Gorg (2011), Wu and Hsu (2012), Herzer and Nunnenkamp (2013) and Im and McLaren (2015), which are group country studies, Mexican states, developing and developed economies, European economies and developing economies, respectively.

GDP per capita contributes negatively to income inequality and is statistically significant at the 1 per cent level, confirming that GDP per capita plays a significant role in reducing income inequality. This result is in line with the results reported in Tsai (1995) and Choi (2006). It may be because higher GDP per capita is associated with higher investments and higher employment generating processes, which consequently, provide increased access to jobs and income. In addition, to illustrate the Kuznets (1955) inverted U-shaped curve hypothesis (nonlinear relationship

between the GDP per capita and income inequality), GDP per capita squared is also included as an additional variable in the analysis. The result (sign and significant) is not any different from the estimated coefficient of GDP per capita reported in table 5, indicating that there is no non-linear effect of income on income inequality in APEC economies. Accordingly, GDP per capita squared is excluded. The result, which is not reported but available upon request, implies that the hypothesis of Kuznets is not supported by APEC economies' data. This could be possibly because the economies, considered in this study are classified in different income groups (for example, five high, five upper middle and three lower middle income economies).

Human capital positively affects income inequality and is statistically significant at the 1 per cent level, implying an investment in human capital tends to increase income inequality. The index of human capital that is used in this study is based on years of schooling (Barro and Lee, 2012) and returns to education (Psacharopoulos, 1994). Accordingly, the impact of human capital on income inequality depends not only in the years of schooling but also on the rate of return of those investments. According to Colclough, Kingdon and Patrinos (2010) and Montenegro and Patrinos (2014), the returns to education in the 1990s and 2000s are larger for higher education than for primary or secondary schooling in many economies. Hence, the improvements in education, in general, do not benefit all people (with different education levels) equally. As a result, human capital increases income inequality, which implies that an increase in human capital (skills and knowledge of workers) is the fundamental source of labour productivity growth. Increasing labour productivity is likely to cause a rise in labour demand. This, in turn, increases the wage rate and results in greater income inequality.

The trade openness coefficient is significant at the 1 per cent level and has a negative impact on inequality, which confirms that international trade leads to a narrowing in the income inequality. The result in relation to trade openness is consistent with the previous studies by Tsai (1995), Reuveny and Li (2003), and Wu and Hsu (2012). It may reflect that trade openness is associated with more equitable income distribution within APEC economies. This indicates that an increase in trade openness leads to a reduction in income inequality, which may be because APEC economies are able to reap the benefits of international trade as those economies have enough competition power in international markets. Accordingly, economies with more openness have more equal income distribution.

Robustness checks

In addition, robustness checks are carried out. For this purpose, first, FDI net inflows are used instead of FDI inflows. The result shows that FDI net inflows have a negative effect (-0.04) and are statistically significant at the 1 per cent level. This result also suggests that FDI inflows narrow income inequality in APEC developing economies. Subsequently, the findings are robust and provide consistent results in terms of using FDI inflows or FDI net inflows on income inequality in APEC developing economies. Second, a dummy variable is used to capture the effect of the financial crises on income inequality. The "financial crises" variable takes the value 1 for the years 2007 and 2008 and 0 otherwise. However, the financial crises variable is not significant. This implies that financial crises do not affect income distribution in the APEC developing countries.

To estimate the short-run dynamic parameters, the following error correction model is used:

$$\Delta LGINI_{it} = \alpha_{0i} + \sum_{j=1}^{f} \alpha_{1i} \Delta LGINI_{i,t-j} + \sum_{j=0}^{g} \alpha_{2i} \Delta LFDI_{i,t-j} + \sum_{j=0}^{h} \alpha_{3i} \Delta LGDPPC_{i,t-j} + \sum_{j=0}^{i} \alpha_{4i} \Delta LHC_{i,t-j} + \sum_{j=0}^{j} \alpha_{5i} \Delta LTO_{i,t-j} + \lambda_i ECT_{i,t-1} + \varepsilon_{it} \quad (4)$$

where α_1, α_2,... α_5 are the short-run coefficients, λ is the speed of the adjustment parameter and ECT is the Error Correction Term. The ARDL (3, 3, 3, 3, 3) is selected based on Akaike Information Criterion, and the results of the short-run dynamic coefficients associated with the long-run relationships are shown in table 6.

The equilibrium ECT is -0.31, which has the expected negative sign and is significant at the 5 per cent level. The absolute value of the coefficient of error correction term (i.e. 0.31) implies that about 31 per cent of the disequilibrium of the previous year's shock adjusts back to the long-run equilibrium in the current year. Consequently, the adjustment process is not quick.

Table 6. Estimates of the error correction model

Regressor	Parameter	Coefficient	Standard Error	P-value
ECM (-1)	λ	-0.310	0.065	0.02 *
ΔLGINI (-1)	α_{11}	0.189	0.139	0.17
ΔLGINI (-2)	α_{12}	0.247	0.132	0.04
ΔLFDI	α_{20}	0.008	0.006	0.19
ΔLFDI (-1)	α_{21}	0.007	0.005	0.14
ΔLFDI (-2)	α_{22}	0.010	0.007	0.18
ΔLGDPPC	α_{30}	-0.141	0.116	0.22
ΔLGDPPC (-1)	α_{31}	0.133	0.231	0.56
ΔLGDPPC (-2)	α_{32}	0.009	0.086	0.91
ΔLHC	α_{40}	0.542	0.817	0.33
ΔLHC (-1)	α_{41}	-0.016	0.771	0.36
ΔLHC (-2)	α_{42}	0.204	0.533	0.08
ΔLTO	α_{50}	-0.205	0.258	0.32
ΔLTO (-1)	α_{51}	0.579	0.532	0.31
ΔLTO (-2)	α_{52}	-0.840	0.828	0.31
C	α_{0}	0.615	0.339	0.05

Mean dependent variable	0.001	S.D dependent variable	0.024
S.E. of regression	0.013	Akaike information criterion	-5.120
Sum squared residuals	0.023	Schwarz criterion	-2.722
Log likelihood	1077.353	Hannan-Quinn criterion	-4.164

Source: Authors' calculations on data from Penn World Table 9.0; Solt (2016); World Bank (2017); UNCTADstat (2017).
Note: * Indicates statistical significance at the 5 per cent level.

Heterogeneous panel causality test

This section presents the short-run causal bivariate panel causalities among LGINI, LFDI, LGDPPC, LHC, and LTO in APEC economies by using a model that deals with a specification of the heterogeneity between the cross nations. Dumitrescu and Hurlin (2012) developed this approach to investigate the null hypothesis of homogeneous non-causality hypothesis against an alternative of heterogeneous non-causality. For this approach, variables need to be stationary so that the first differences of the data series are employed. The causality test results are reported in table 7.

Table 7. Results of heterogeneous panel non-causality test

Null Hypothesis	Zbar- Stat	P-value	Causal direction
LFDI does not homogeneously cause LGINI	1.561	0.118	No
LGINI does not homogeneously cause LFDI	1.327	0.184	No
LGDPPC does not homogeneously cause LGINI	4.351 **	0.002	LGDPPC → LGINI
LGINI does not homogeneously cause LGDPPC	0.940	0.113	No
LHC does not homogeneously cause LGINI	6.601 **	0.000	LHC → LGINI
LGINI does not homogeneously cause LHC	1.076	0.152	No
LTO does not homogeneously cause LGINI	5.554 **	0.000	LTO → LGINI
LGINI does not homogeneously cause LTO	1.059	0.289	No
LGDPPC does not homogeneously cause LFDI	11.047 **	0.000	LGDPPC → LFDI
LFDI does not homogeneously cause LGDPPC	1.414	0.157	No
LHC does not homogeneously cause LGDPPC	5.671 **	0.000	LHC → LGDPPC
LGDPPC does not homogeneously cause LHC	-0.967	0.333	No
LTO does not homogeneously cause LGDPPC	3.454 **	0.000	LTO→ LGDPPC
LGDPPC does not homogeneously cause LTO	0.664	0.785	No
LHC does not homogeneously cause LFDI	6.002 **	0.000	LHC → LFDI
LFDI does not homogeneously cause LHC	0.297	0.765	No
LTO does not homogeneously cause LFDI	1.600	0.098	No
LFDI does not homogeneously cause LTO	-0.249	0.803	No
LTO does not homogeneously cause LHC	0.153	0.877	No
LHC does not homogeneously cause LTO	5.774 **	0.000	LHC → LTO

Source: Authors' calculations on data from Penn World Table 9.0; Solt (2016); World Bank (2017); UNCTADstat (2017).
Note: ** Indicates rejection of the null hypothesis of no causality at the 1 per cent significance levels.

The results of heterogeneous panel non-causality test show that, in the short run, the results reveal that the evidence of unidirectional causality runs from GDP per capita to GINI and FDI; human capital to GINI, GDP per capita, FDI and trade openness; and trade openness to GINI and GDP per capita. This means that economic growth increases income inequality and FDI inflows; human capital increases income inequality, economic growth, FDI inflows and international trade; and trade openness increases income inequality and economic growth. In the analysis, there is no short-run causal relationship between FDI inflows and income inequality (FDI inflows do not increase income inequality), but a long-run relationship exists. From the causality test, it can be concluded, that in the short run, the benefits that are accumulated from GDP per capita, human capital and trade openness cannot be distributed equally in APEC economies.

V. CONCLUSIONS AND POLICY IMPLICATIONS

The objective of this paper is to investigate the effect of FDI inflows on income inequality in APEC economies by using panel data for the period 1990–2015. The panel long-run estimation suggests that FDI reduces income inequality. This supports the argument that encouraging FDI inflows does not harm the distribution of income and also result in more equal income distribution in APEC developing economies in the long-run.

The findings of this paper confirm that FDI inflows narrow the level of income inequality in APEC economies. Currently, a 1 per cent increase in FDI inflows reduces income inequality by 8 per cent. This enables domestic firms to compete with multinational enterprises and many of them merge their businesses, which will eventually lead to an equal income distribution. Policymakers and government authorities in those economies should initiate appropriate policies and provide various types of financial and non-financial support to help domestic firms continue to reap benefits from multinational enterprises. Furthermore, increasing FDI inflows are important to keep up the momentum in reducing income inequality. Frequent economic policy changes relevant to FDI inflows in host APEC economies can foster an unstable environment for attracting more FDI into the region. Accordingly, policymakers and government authorities should be aware of the effects of such changes. Some evidence indicates that FDI inflows decrease income inequality in this region. Based on that, FDI inflows should be considered as a best strategy for income inequality reduction. A policy implication of the paper is that to reduce income inequality, APEC economies should define appropriate strategies and policies to attract more FDI. Because of the unavailability of disaggregate data, the scope of this study was limited to the aggregate level of FDI. However, a firm-level study can provide better results than the aggregate study if data become available for a reasonable period of time.

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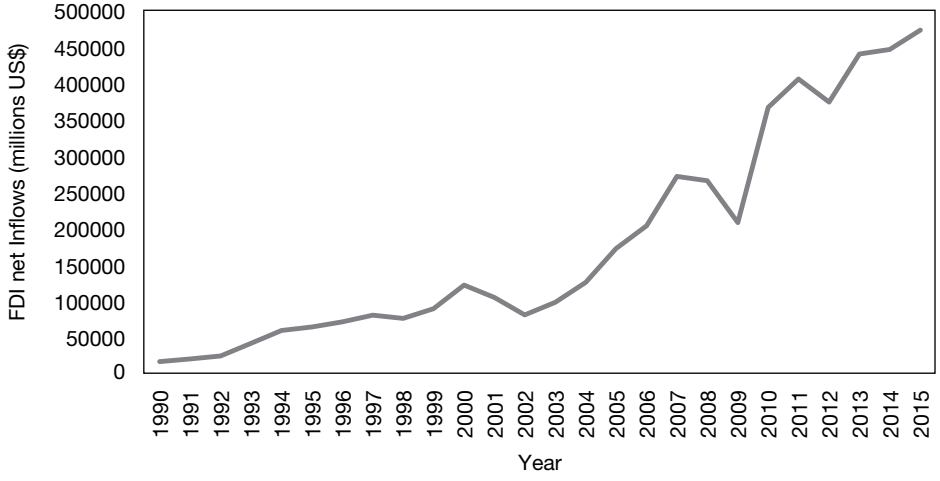
APPENDIX

Average FDI net inflows into Asia-Pacific Economic Cooperation Developing Economies, 1990-2015



Source: Authors, based on World Bank (2017); UNCTADstat (2017).

A summary of findings on foreign direct investment and income inequality

Author(s), Year	Period	Country	Technique	Variables	Findings
Tsai (1995)	1970s	33 developing economies	Ordinary Least Squares (OLS)	Gini coefficient, real GDP per capita, FDI stock to GDP ratio, share of government services in real GDP, agricultural labour force to total labour force ratio, trade to GDP ratio, economic growth and human capital	FDI increases income inequality.
Feenstra and Hanson (1997)	1975–1988	Mexico	OLS	Wage, FDI stock, domestic capital and real value added in manufacturing	FDI leads to increased wages of skilled workers relative to unskilled workers and thus probably increases income inequality.
Te Velde and Morrissey (2002)	1985–1998	East Asia – Republic of Korea, Singapore and Hong Kong, China Philippines and Thailand	OLS	Wages, FDI stock to GDP ratio and employment	FDI does not reduce wage inequality.
Te Velde (2003)	1978–2000	4 Latin American countries	OLS	Wages, FDI stock to GDP ratio and employment	FDI does not reduce inequality.
Sylwester (2005)	1970–1989	29 Less developed economies	OLS	Gini coefficient, FDI inflows to GDP ratio and GDP per capita growth	FDI does not lead to more income inequality.
Choi (2006)	1993–2002	119 economies	OLS	Gini coefficient, inward FDI stock to GDP ratio, outward FDI stock to GDP ratio, total FDI stock to GDP ratio, GDP, GDP per capita, GDP Per capita growth and dummy (Asia, Latin America)	The positive effect of FDI on income inequality is greater in the case of outward FDI than in the case of inward FDI.

Author(s), Year	Period	Country	Technique	Variables	Findings
Basu and Guariglia (2007)	1970–1999	119 developing economies	OLS	Gini coefficient, FDI net inflows, economic growth, share of agriculture to GDP and human capital	FDI and inequality are positively correlated.
Bhandari (2007)	1990–2002	19 transitional economies in Eastern Europe and Central Asia	OLS	Gini coefficient, Inward FDI stock to GDP ratio, GDP per capita, Square of GDP per capita, unemployment rate, domestic investment to GDP ratio and rate of inflation	FDI does not affect overall income inequality.
Jensen and Rosas (2007)	1990–2000	32 Mexican states	OLS, Two-stage least squares (TSLS)	Gini coefficient, FDI inflows GDP per capita, distance to border and education	Increased FDI inflows are associated with a decrease in income inequality.
Figini and Gorg (2011)	1980–2002	103 developing and developed economies	OLS and Generalized method of moments (GMM)	Gini coefficient, FDI stock to GDP ratio, GDP per capita, Openness to trade and education	Wage inequality decreases with FDI in developed economies, for developing economies, wage inequality increases with FDI.
Chintrakarn, Herzer and Nunnenkamp (2012)	1977–2001	United States.	OLS	Top decile income earners and FDI stock to gross state product ratio	The short-run effects of FDI on income inequality are insignificant and negative; in the long-run, FDI has a significant negative effect on income inequality.
Tang, Eliyathamby and Selvanathan (2012)	1978–2004	China	OLS	Gini coefficient, FDI inflows to total investment ratio, trade, real GDP per capita, agriculture labour force to total labour force ratio, human capital and total government expenditure to GDP ratio	FDI increases regional income inequality at the national level, as well as in rural and urban regions.

Author(s), Year	Period	Country	Technique	Variables	Findings
Wu and Hsu (2012)	1980–2005	54 economies (33 developing economies and 21 developed economies)	OLS	Gini coefficient, initial Gini, initial GDP, FDI inflows to GDP ratio, schooling, inflation and trade	FDI reduces the income inequality for economies with well-developed absorptive capacity than less absorptive capacity.
Deng and Lin (2013)	1970–2007	102 economies	Generalized likelihood ratio test	FDI flows to GDP ratio, FDI stocks to GDP ratio, human capital, trade and private credit	FDI inflows increase inequality in low-income economies where human capital is scarce.
Franco and Gerussi (2013)	1990–2006	17 transition economies	GMM	Gini coefficient, FDI stock, GDP per capita, trade and inflation rate	FDI does not have significant effect on income inequality.
Herzer and Nunnenkamp (2013)	1980–2000	8 European economies	Cointegration and Dynamic OLS	Gini coefficient, FDI stock to GDP ratio, GDP per capita, trade to GDP ratio and human capital	Both inward FDI and outward FDI have, on average, a negative long-run effect on income inequality; bidirectional causality between FDI and income inequality.
Ucal and Bilgin (2013)	1990–2006	Turkey	Autoregressive distributed lag approach (ARDL)	Gini coefficient, FDI inflows growth, GDP growth, population growth, inflation and literacy rate	FDI positively affects income inequality in the short-run but not in the long-run.
Im and McLaren (2015)	1977–2012	127 developing economies	OLS and TSLS	Gini coefficient, FDI stock to GDP ratio, trade to GDP ratio, GDP per capita, GDP growth, gross capital formation and total population	FDI decreases inequality.

Author(s), Year	Period	Country	Technique	Variables	Findings
Ucal, Haug and Bilgin (2016)	1970–2008	Turkey	Non-ARDL	Gini coefficient, FDI inflows, GDP growth rate, gross domestic fixed capital formation, inflation rate, political stability index, population growth rate, literacy rate and trade	FDI negatively affects income inequality in the short-run and long-run.
Bogliaccini and Egan (2017)	1989–2010	60 middle-income economies	Error Correction Model	GINI, FDI stock in primary, secondary and tertiary sectors; FDI stock in utilities and communications and wholesale, hotels, restaurants and construction, employment in primary, secondary and tertiary sectors; employment in utilities and communications and wholesale, hotels, restaurants and construction, trade openness, GDP per capita, unemployment and democratic record	FDI in services is more likely to be associated with inequality than FDI in other sectors.