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Foreign Direct Investment and Income Inequality in Southeast Asia: A Panel Unit Root and Panel Cointegration Analysis, 1990-2013

Hyungsun Chloe Cho and Miguel Ramirez
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Abstract
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J.E.L. Codes: C33; O10; O53
Keywords: Gini coefficient; Foreign direct investment (FDI); Fully modified ordinary least squares (FMOLS); Panel unit roots; Panel cointegration test; Southeast Asian countries

FOREIGN DIRECT INVESTMENT AND INCOME INEQUALITY IN SOUTHEAST ASIA: A PANEL UNIT ROOT AND PANEL COINTEGRATION ANALYSIS, 1990-2013.

By HYUNGSUN CHLOE CHO AND MIGUEL D. RAMIREZ*

This paper examines the relationship between foreign direct investment (FDI) and income distribution in the host country as measured by the Gini coefficient. After providing some background and reviewing the extant literature, it undertakes a panel unit root and cointegration analysis that tests whether FDI has a non-linear impact on income inequality in seven selected Southeast Asian countries over the period 1990 to 2013. The paper finds strong evidence for panel cointegration using the Pedroni Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) tests; thus, it proceeds to utilize the group-mean fully modified ordinary least squares (FMOLS) procedure to generate long-run estimates that are unbiased and consistent. The FMOLS estimator is also extremely accurate even in panels with very heterogeneous serial correlation dynamics, fixed effects, and endogenous regressors. The results confirm the hypothesis that FDI inflows tend to raise income inequality in the short run but reduce it in the long run. In this study, the Gini index starts decreasing after FDI inflows as a percentage of GDP reaches 0.56. The fact that the Gini coefficient reaches its maximum at a relatively low level of FDI inflows suggests that sample countries are endowed with substantial absorptive capacity. In other words, they will shift into the new technological paradigm quickly, thus supporting pro-globalization claims that, on balance, FDI is more beneficial than harmful. **Keywords:** Gini coefficient; Foreign direct investment (FDI); Fully modified ordinary least squares (FMOLS); Panel unit roots; Panel cointegration test; Southeast Asian countries. **JEL:** C33; O10; O53

* Department of Economics, Trinity College, 300 Summit Street, Hartford, CT 06106.

Introduction

FDI and Economic Growth in Southeast Asia

For several decades, Southeast Asian countries have exhibited remarkable annual growth rates second only to those of China. The average per-capita income growth rate in Southeast Asia has been sustained at around 4 percent since the 1970s, which is exceptional in comparison to those in other regions, ranging from 0.55 to 3 percent (Coxhead, 2014). Needless to say, economic globalization has been a vital factor in shaping and enlarging Southeast Asian economies. With its abundant labor and natural resources, Southeast Asia has not only become an important base for multinational corporation (MNC) operations and international trade, but also a popular destination of FDI flows throughout the past decades. The presence of FDI in Southeast Asia was especially significant in its manufacturing sector. According to the OECD (2014) report, out of the total US-owned affiliate employment in 2014, one half was in manufacturing. The report further explains that the largest share of employment within the manufacturing sector was involved in the production of high value-added computers and electronic goods.

Many experts argue that the increased flows of FDI into these sectors have contributed to industrialization and rapid economic growth in Southeast Asia. Several empirical studies, including those in the edited volume by Urata et al. (2012), confirm the positive relationship between FDI and economic growth in the region. Sjöholm (2014) contends that FDI generates job creation, market share reallocation, increased competition, and more importantly, access to foreign markets and new technologies. Similarly, Coxhead (2014) identifies liberalization of both trade and capital flows as a possible facilitator of the region's economic success. The role of regional trade agreements in Japan, China, Korea, and Taiwan have also been important sources of FDI flows to the region in recent years.

Yet, the popular notion that liberalization of trade and capital translates into broad-based economic growth and development has been questioned by critics such as Chang (2003), Cypher and Dietz (2004), and Wade (1990). They argue that neoliberal policies "have spectacularly failed" in generating faster growth and that the remarkable growth experience of states like South Korea, praised as an exemplary case of liberalization-led growth, has actually involved significant government intervention. Moreover, they contend that it is likely that the causality runs in the opposite way: often, economic growth can build "prior conditions" for increased volumes of trade and FDI, thus generating pressure for further liberalization. Supporters of the notion of growth-led exports believe that growth accumulates capital and builds up technological capacity, which are necessary for the export boom to take place (Agosin, 1999 and Wade, 1990). Similarly for FDI, Chang (2003) explains that MNCs often make their investment decisions based on factors like "large and/or growing markets, good infrastructure and good-quality labor force," which can be signaled by high growth rates.

Impact of FDI on Wage/Income Inequality

The extant literature has also addressed the contentious issue of whether FDI flows have contributed to greater or diminishing income and wage inequality in emerging nations. Although wage inequality is an incomplete proxy for income inequality (Lindert and Williamson, 2001), it is likely that high wage inequality will correlate with high income inequality, unless the government mitigates the wage differentials with appropriate welfare programs or a safety net system. This correspondence is especially likely to be present in countries where a large proportion of population makes a living through wages and salaries, which tends to be the case in most recipient countries of FDI. Hence, wage inequality and income inequality will be used interchangeably in this paper.

Bhandari (2006) hypothesizes that, in a host country where wage earners outnumber capital owner, the introduction of FDI will reduce income inequality. When capital is introduced in the form of FDI and added to domestic capital, the returns to capital are reduced, but the returns to labor are increased. Hence, income inequality within the economy decreases, ceteris paribus. However, his OLS results show little evidence for a negative relationship between FDI and income inequality, e.g., a one percentage point increase in FDI leads to a mere 0.01 percentage point decrease in the Gini coefficient. Regardless, Bhandari's hypothesis that FDI will reduce inequality in the host country has been supported by other prominent economists, including Obstfeld (1998) and Mundell (1957) who contend that the effects of FDI on income distribution are similar to those of trade as predicted by the Heckscher-Ohlin-Stolper-Samuelson (HOSS) model. The East Asian countries experienced an overall decrease in wage inequality after opening up their newly-industrialized economies, offering consistent historical evidence for the traditional HOSS prediction (Krueger, 1995; Obstfeld, 1998; and Wood, 1997).

This optimistic outcome has been challenged by the experience of other countries that underwent trade liberalization more recently, especially those in Latin America (Wood, 1997). Beyer et al. (1999) find a positive correlation between trade openness and wage disparity in Chile; Robbins and Gindling (1999) in Costa Rica; and Feenstra and Hanson (1995) in Mexico. In the case of Brazil, Arbache et al. (2004) report findings that trade liberalization introduced skill-biased technology to the country, hurting the low-skilled workers. Based on a similar logic, many dependency and Latin American structuralist theorists including Chase-Dunn (1975), Cypher and Dietz (2004), Kopinak (2003), and Rubinson (1976) contend that FDI increases income inequality. Like trade, FDI usually introduces new capital-intensive technology to which unskilled workers cannot readily adapt. Consequently, it becomes even less likely for low-wage workers to climb up the income ladder (Frank, 1969).

In this connection, Reuveny and Li (2003) discuss additional ways through which FDI may exacerbate income inequality within the host country. They argue that MNCs can hurt wage earners in the host country via several channels. First, they often enjoy sufficient political power and are able to pressure host governments to "curb labor unions" in order to guarantee cheap labor costs. Second, they can decrease the workers' bargaining power through the threat of leaving. Third, MNCs push domestic firms to also pay low wages to keep their costs down. Last, the authors note that MNCs may decrease welfare expenditures by paying a smaller tax than domestic firms are required to pay. Their empirical analysis of 69 selected countries from 1960 to 1996 finds a statistically significant and positive relationship between FDI inflows and income inequality, in support of their conjecture.

Other studies have also supported their proposition. For instance, Choi (2006) finds a positive relationship between FDI intensity and pooled Gini coefficients in 119 countries from 1993 to 2002. Basu and Guariglia (2007), Alderson and Nielsen (1999), Tsai (1995), and Mah (2002) have also found a positive relationship, respectively in 119 developing countries from 1970 to 1999; 88 countries from 1969 to 1994; 24 Asian countries from 1968 to 1981; and Korea from 1975 to 1995. Other economists have not found a significant relationship, despite the strong theoretical connection between FDI and income inequality. Sylwester (2005) finds a statistically significant, positive relationship between FDI and economic growth, but not between FDI and income inequality, in less developed countries during the period from 1970 to 1989. Franco and Gerussi (2013), who perform an empirical analysis on 18 transition countries for the period from 1990 to 2006, find trade to be relevant in affecting income inequality but not FDI. Barlow et al.

(2009) and Grimalda et al. (2010) also find FDI to be insignificant in explaining income inequality of transition economies.

In the relatively few studies for Southeast Asian economies, Mukaramah et al. (2014) find that FDI worsens wage disparity by increasing skill premium in Malaysia. In another recent study, Farhan et al. (2014) analyze the FDI-income inequality relationship in five ASEAN countries. The authors find a positive relationship in Singapore and Indonesia, but the opposite in Malaysia, Thailand, and the Philippines, using quantile regressions which include trade openness and life expectancy as control variables. They explain their findings by pointing out that FDI contributes to income inequality in the aforementioned two countries because it increases the skill premium, while in the other three it goes primarily into sectors with low-skilled workers, thus benefiting those at the bottom of the income distribution.

Purpose and Outline

In view of the growing importance and controversy surrounding the effects of trade and capital liberalization in emerging economies, this study explores the economic relationship between FDI and income inequality in a number of Southeast Asian nations which have attracted a substantial increase in inward FDI in recent decades. With the exception of relatively few studies, most of the extant literature on the FDI-income inequality relationship tends to focus on other regions than Southeast Asia; thus, this study represents a positive and significant contribution to the extant literature by providing new empirical evidence on this topic.

The paper is organized as follows. The next section presents the conceptual framework utilized in this study. Section III presents the empirical model and preliminary results, while Section IV reports the panel unit root and panel cointegration results. The last section is the conclusion.

Conceptual Background

Following the lead of Franco and Gerussi (2013) as well as Herzer and Nunnenkamp (2011), this paper builds its conceptual framework on the growth model constructed and refined by Aghion and Howitt (1992, 1999). Their original model is one of endogenous growth, which presents industrial innovations as a channel of knowledge accumulation (Aghion and Howitt, 1992). The authors later combine this model of creative destruction with the Helpman and Trajtenberg (1994) model of General Purpose Technologies (GPTs) to examine the effects of major technological change, which may be induced via FDI inflows. Their model is based on the following production function:

$$Y_t = \left\{ \int_0^1 {A_{it}}^{\alpha} {x_{it}}^{\alpha} d_i \right\}^{1/\alpha} \quad (1)$$

where *Y* is the final output; *x* denotes the intermediate inputs including labor *L*; and *A* is a productivity parameter which determines technological development. When *A=1*, old GPT is used; when *A>1*, new GPT is successfully adopted.

Aghion and Howitt (1999) suggest that this model can be extended to explain the effects of technological change on skill differentials and wage inequality. Suppose *L* is divided into skilled and unskilled labor, and that the new GPT requires the use of skilled labor. It is also assumed that the proportion of skilled labor is increasing over time, due to enhanced schooling and training. The authors explain that, under these assumptions, an economy would undergo different stages of technological development. During the very immediate stage, the number of sectors that adopt the new GPT will be small. Since these new sectors are unable to absorb the entire skilled labor force, a significant fraction of skilled workers will be hired at the same wage as unskilled workers and “the labor market will remain unsegmented.” As the technological transition continues and more firms adopt the new GPT, all skilled labor becomes employed by the new sectors, while all unskilled labor remains in the old sectors with relatively lower wages. The skill premium increases sharply during this stage of social learning, when there is high demand for skilled labor which is short in supply, and inequality rises. However, the authors note, real wages for skilled workers start “tapering off” in the long run, as virtually all sectors adopt the new GPT and the supply of skilled labor increases. Consequently, the relationship between wage inequality and new technology will show an inverted U shape.

In this connection, Arbache et al. (2004) argue that FDI inflows introduce new technologies to the host country, such as managerial know-how and new forms of work organization. These GPTs tend to be skill-biased because they are usually designed in skill-intensive, advanced countries (Berman et al., 1998; and Cypher and Dietz, 2004). Even GPTs that require less skilled labor from the perspective of the home country are likely to be skill-biased in the host countries which are less developed, since the definition of skill is relative. Another conjecture, proposed by Pissarides (1997), considers the possibility that it is not the technology but the process of transfer itself that requires skilled labor. In either case, FDI inflows will produce a non-linear effect on income distribution within the host country. In the short run, they lead to a rise in the skill premium and overall inequality. In the long run, however, inequality gradually declines, either because the economy as a whole evolves into a new technological paradigm and the supply of skilled labor increases, or because the benefits to labor become “derived entirely from the production technology,” assumed to be neutral.

Thus, the positive impact of FDI on inequality will diminish after the process of learning and skill upgrading. As Franco and Gerussi (2013) note, the speed of this transition depends on “the amount of absorptive capacity each country is endowed with.” The determinants of a country’s absorptive capacity are beyond the scope of this paper. Yet, it is encouraging to recognize that when this capacity is large, the technological shift will be fast and the initial rise in inequality will not be as detrimental, since it will be relatively short-lived.

Preliminary Analysis

Empirical Model and Methodology

The empirical model is in the line with the conceptual framework presented in the previous section. In order to account for the potential non-linear relationship between income inequality and FDI, the following equation will be estimated:

$$GINI_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 FDI_{it}^{\ 2} + \sum \beta_k X_{ikt} + e_{it} \quad (2)$$

where *GINI* is a measure of income inequality within the host country; *FDI* is a measure of inward FDI; and X_k is a vector of control variables. A more detailed description of each variable will be provided in the next section. It should be noted that *FDI squared* was added to the model in order to test for the variable's quadratic effects on inequality. The model also includes e_{it}, the traditional i.i.d. stochastic error term. *i* and *t* denote, respectively, each cross-sectional unit and time period. The sample consists of seven countries, namely Cambodia, Indonesia, Laos, Malaysia, Philippines, Thailand, and Vietnam. Four countries in the region, namely Singapore, Myanmar, Brunei, and East Timor, were excluded in this analysis due to the lack of data. The data span the time period 1990 to 2013. Since the number of time periods, 24, is greater than the number of countries, it is a long panel.

Panel data offer several advantages over pure cross-sectional or time series data such as more variability, less collinearity among variables, and more degrees of freedom as well as efficiency. On the other hand, they naturally require more complex econometric techniques, especially because heterogeneity is likely to be present across individual cross-sectional units. The increasing use of panel data in recent years has called for the development of relatively new methods, especially with regard to the issue of non-stationarity in panel variables. These tests will be formally presented in the next section.

Data and Variable Description

Income inequality is measured using the Gini coefficient, which will be the dependent variable, denoted by *GINI*. The Gini coefficient ranges from 0 to 100 index points, where 0 represents perfect equality and 100 represents perfect inequality. This index, as defined by the World Bank, "measures the extent to which the distribution of income … deviates from a perfectly equal distribution" using a Lorenz curve (World Bank, 2015). Data for the Gini come from the World Bank database.

There are two common measures of inward FDI utilized in the literature: flows and stocks. Generally, the latter is considered to be the better measurement for capturing long-run effects, as it shows the total amount of accumulated FDI within the host country. In contrast, annual FDI inflows fluctuate more easily and tend to be a short-run to medium-run measure. Still, this study will use both measures, following the conventional approach in the extant literature; this will allow us to compare and contrast the results from both models. Data on FDI inflows come from the World Bank (2015) and show net inflows, or investment less disinvestment, in the host country. Data on inward stocks of FDI come from the World Investment Report 2014 - Investing in the SDGs: An Action Plan (WIR14), prepared and edited by the UNCTAD (2014). Both FDI inflows and stocks are taken as a percentage of GDP in order to control for the varying sizes of the economies in the sample.

This study includes several control variables, one of which is the measure of overall trade. Represented by *TRADE*, this variable measures the sum of imports and exports of goods and services as a percentage of GDP. Since trade activity is another important aspect of economic globalization and a potential source of technology transfers, its effects on income inequality are expected to be similar to those of inward FDI. Hence, *TRADE squared* will be added to the regression equation. The second control variable is GDP per capita in current U.S. dollars, denoted by *GDPCAP*. According to the Kuznets hypothesis, this variable is also expected to have a quadratic relationship with the Gini index. Therefore, *GDPCAP squared* will also be included. Data for both trade and GDP per capita are obtained from the World Bank (2015).

The level of income inequality can be affected by other social and political factors. For instance, Alfonso et al. (2008) speculate that redistributive government spending, such as progressive taxation policy and family subsidies, has a strong negative impact on income inequality. The authors also contend that government spending, when invested in public education, access to free healthcare, and the likes, can reduce inequality indirectly through improving the poor's human capital endowment and competitiveness in the labor market. Based on their argument, this paper includes government expenditure as a percentage of GDP, obtained from the World Bank (2015) and denoted by *GOVEXP*, as a control variable. The variable measures government final consumption expenditures, excluding military spending.

Another control variable that is typically used in the literature is the level of education. Intuitively, a better educated country is expected to offer greater economic opportunities for its people to move up the income ladder. Figini and Görg (2006) also argue that an increase in overall education implies an increase in the supply of skilled labor, which should theoretically decrease wage inequality. This paper uses the gross enrollment ratio for tertiary education, represented as *EDUC*. Last control variable, *INFRAPHONE*, measures the number of telephone lines per 100 people and is included to measure the impact of economic infrastructure on inequality. Studies regarding the relationship between infrastructure and income distribution remain inconclusive, and are summarized effectively by Calderón and Servén (2004). On the one hand, it is assumed that better infrastructure will provide the poor with "access to productive opportunities" and help them integrate more effectively into the economy, thus alleviating inequality. On the other, most infrastructure services are not "pure public goods" and are in fact excludable. Many even require user fees - as is usually the case for power and telecommunications. In such cases, infrastructure development may marginalize the poor further and worsen income inequality.

Lastly, it should be noted that due to the lack of data for the Gini variable for some years, interpolation had to be used to generate missing values. In most cases, the average of the two consecutive preceding or succeeding values was calculated. In cases where the values of $GINI$ in the previous and subsequent years were given, their average was used to interpolate. Few, if any, data gaps for other variables were filled using the same method. Since most macroeconomic variables - the Gini index in particular - tend to stay relatively constant over a short period of time, such data interpolation is deemed acceptable in the extant literature.

FEM Results

Equation (2) was first estimated using the fixed effects least-squares dummy variable model (FEM).[1] The FEM estimator assumes that time-invariant differences across countries can be

[1] A Hausman test was implemented to determine whether the FEM or random effects model (REM) should be used. The null hypothesis is that the REM is appropriate; the alternative is that the FEM is appropriate. Since the Hausman statistics were highly significant in both cases, we rejected the null and concluded that the FEM was appropriate. The test results are available upon request.

captured in differences in the constant term. Formally, the FEM can be represented as:

(3) $$GINI_{it} = \beta_{0i} + \beta_1 FDI_{it} + \beta_2 FDI_{it}{}^2 + \sum \beta_k X_{ikt} + e_{it}$$

Note that the above equation is different from Equation (2) in that the intercept now has the subscript i, implying that it is country-specific.

The regression results, provided in Table 1, show that several coefficients are significant in the expected direction at the 5% level. Using inflows as the measure of FDI, we find that as *FDIINFLOWS* increase, income inequality also increases in the short run but then decreases in the long run. Among control variables, *TRADE squared*, *GDPCAP*, *INFRAPHONE,* and *EDUC* are significant. The FEM estimation using stock as the measure of FDI displays similar results: *FDISTOCK* is significant at the 10% level and *FDISTOCK squared* is significant at the 5% level. *GDPCAP*, *EDUC*, and *INFRAPHONE* are also significant at the 5% level. Interestingly, both outputs suggest a highly significant, positive relationship between *INFRAPHONE* and *GINI*. This finding supports the argument that infrastructure services, contrary to the popular belief, can be excludable and harmful for the poor.[2]

Although the FEM minimizes the possibility of misspecification by explicitly recognizing the inherent heterogeneity of the data, it can still produce biased and inconsistent estimates. First, as this study investigates the relationship among macroeconomic variables over time, non-stationarity or unit roots may be present in the panel data. Using the FEM on non-stationary

[2] This study relaxed the assumption that the disturbances across countries are unrelated, and estimated the model via the Seemingly Unrelated Regression (SUR) procedure. The rationale resides in the plausible hypothesis that events such as the 1997-98 Asian Crisis and the business cycle originating in the OECD countries are likely to affect all Southeast Asian economies to varying degrees. The estimated coefficients for the SUR model (available upon request) are consistent with the FEM estimates and, in the case of the FDI inflows and FDI stock variables, of greater statistical significance than those reported in Table 1; viz., t-ratios of 3.45 and 1.94, respectively, for the flow and stock variables.

variables can generate spurious regressions. Second, the direction of causality may simultaneously run from FDI to income inequality and from income inequality to FDI. In other words, the variables of interest, FDI and the Gini, may be endogenous. In the presence of cointegrated panels or endogeneity, the estimated coefficients in the FEM will not reflect the true population parameters.

TABLE 1 FEM Results[3]

Variables	Using FDI Inflows		Using FDI Stock	
	Coefficient	t-Statistic	Coefficient	t-Statistic
FDI	0.6501	3.31***	0.1104	1.81*
FDI^2	-0.0484	-2.64***	-0.0021	-2.20**
TRADE	0.0347	1.27	0.0186	0.57
TRADE^2	-0.0003	-2.52**	-0.0002	-1.58
GDPCAP	0.0012	2.28**	0.0012	2.20**
GDPCAP^2	-4.70E-08	-1.09	-4.40E-08	-1
GOVEXP	-0.0115	-0.08	0.0757	0.52
EDUC	-0.2045	-4.33***	-0.2036	-4.07***
INFRAPHONE	0.3983	5.73***	0.4036	5.67***
R-squared	0.8777		0.8724	
Adj R-squared	0.8647		0.8588	
SBC Value	4.5243		4.5669	
AIC Value	4.2128		4.2554	

Panel Unit Root and Cointegration Analysis

Panel Unit Root

Panel data, just like univariate time series data, tend to be non-stationary. Non-stationary data exhibit trends over time, either deterministic and/or stochastic; in other words, their variances and covariances are not time invariant. Stationarity is important in econometric analysis because the ordinary or generalized least squares regressions, when applied to non-stationary series, will

[3] In this table and others that follow, *** = significant at the 1% level; ** = significant at the 5% level; * = significant at the 10% level.

generate misspecified or spurious results. It is therefore crucial to test for the presence of panel unit roots and determine the order of integration. If the panel variables are found to have the same order of integration, it will be necessary to determine if a unique long-term relationship exists among them via panel cointegration test.

The relatively high R-squared values and t-statistics in Table 1 indicate that non-stationarity may be present and inflating the goodness-of-fit measures in this panel. Non-stationarity can be formally identified through testing for the presence of unit roots. This paper utilizes three panel-based unit root tests. The first test, proposed by Levin, Lin, and Chu (LLC, 2002), extends the Augmented Dickey-Fuller (ADF) test to panel data using the following model:

(4) $$\Delta Y_{it} = \gamma Y_{it-1} + \sum \theta_{ij} \Delta Y_{it-j} + \alpha_{mi} d_{mt} + u_{it}$$

Y_{it} refers to each pooled variable; u_{it} is the mutually independent error terms; and γ is equal to ρ-1. Heterogeneity is allowed through the component $\alpha_{mi} d_{mt}$, which represents exogenous variables of individual fixed effects and country-specific time effects. The lag order for the difference terms is also permitted to vary. γ, however, is assumed to be homogenous or the same across all cross section units.

As in the ADF test, the null hypothesis is that γ is equal to zero, or the variable is non-stationary. The alternative hypothesis is that γ is less than zero, or the variable is stationary. Since γ is same for all cross-sections, when the null hypothesis is rejected in the LLC test, we conclude that each time series is stationary for all seven countries. The LLC test hence fails to account for a case where the series is stationary in only some countries and not in others. The Im, Pesaran, and Shin (IPS, 1997) test addresses this drawback by allowing γ to vary across the cross-sectional units. The IPS test is thus less restrictive and tests the null of non-stationarity against the alternative that stationarity is present in at least one of the cross sections over time.

The LLC and IPS test results were confirmed using the Hadri test (2000). Unlike the other two tests, the Hadri test uses stationarity as its null hypothesis. The results are presented in Table 2. Most variables appear to contain a unit root in level form. For *TRADE*, *GDPCAP*, and *INFRAPHONE*, the Hadri test suggests that they are non-stationary even in differenced form. Yet, given that the presence of serial correlation can distort the Hadri z-statistic and lead to over-rejection of the null, we conclude that the three series are stationary in first difference.

TABLE 2 Summary of Unit Root Test Results

Variable	Levels			Differences		
	LLC	IPS	Hadri	LLC	IPS	Hadri
GINI	-0.04446	0.67327	5.18491***	-6.28572***	-6.21113***	-0.58338
FDIINFLOWS[4]	-1.11488	-2.00958*	1.32953*	-6.18893***	-5.88677***	-1.29429
FDISTOCK	1.33904	3.7501	6.47599***	-5.41104***	51.8704***	0.21324
TRADE	-1.14598	0.26838	6.68448***	-4.42615***	-5.63313***	3.38004***
GDPCAP	7.82571	8.44469	7.88870***	-2.92757***	-1.64794**	2.49444***
GOVEXP	1.25539	0.98029	5.60842**	-7.31902***	-6.36204***	1.03884
EDUC	0.26184	2.92314	8.90281***	-1.94259**	-2.76410***	1.00347
INFRAPHONE	-0.58141	11.9627	7.06235***	-4.17896***	41.2556***	1.87248**

Panel Cointegration

Given that all the series in the panel are integrated of order one, it discredits the use of the FEM (SUR) estimates reported earlier. To address the spurious regression problem, it is necessary to determine if a unique long-term relationship exists among the variables via panel

[4] Although the null is rejected at the 10% in the IPS test, we conclude that the series is non-stationary in level form since the conventional rule for conflicting results is to conclude in favor of a unit root, and since the IPS statistic is insignificant at the 5%.

cointegration test. This study utilizes the Pedroni methodology (1999) because it allows for considerable heterogeneity in the data. The test utilizes the following model:

(5) $$Y_{it} = a_i + \delta_t + \sum_{m=1}^{M} \beta_{mi} X_{mit} + u_{it}$$

allowing for multiple regressors, represented as m. The first two components represent individual-specific fixed effects and time trends. The methodology also allows the long-run cointegrating vectors and error terms to vary across cross-sectional units. The Pedroni test employs a total of seven statistics, four of which are panel statistics and the rest are group statistics. The panel statistics capture the within-dimension effects by pooling the AR coefficients across cross-sections to test for unit roots on the residuals. The group panel statistics capture the between-dimension effects by pooling the AR coefficients for each member.[5]

The null hypothesis is that of no cointegration. If it is rejected in the case of panel statistics, we can conclude that the variables in question are cointegrated for all countries. In the less restrictive group panel case, we conclude that the panel variables are cointegrated for at least one country. Reported in Table 3, both panel and group ADF and PP test statistics suggest strong evidence for the alternative hypothesis of cointegration or a long-term relationship.

TABLE 3 Summary of Pedroni Cointegration Test Results

	Using Inflows		Using Stock	
	Panel	Group	Panel	Group
v-statistic	-0.774154	-	-1.659706	-
rho-statistic	1.586944	2.506984	2.816463	3.597598
PP-statistic	-7.551448***	-8.775113***	-2.648340***	-5.404952***
ADF-statistic	-3.367586***	-1.848640**	-2.579604***	-2.581126***

[5] For the computation of the test statistics, please refer to Pedroni (1999).

FMOLS Results

Having established that the panel series are non-stationary but also cointegrated, we turn to generating long-run estimates for Equation (2). Following the lead of Pedroni (2000) and Ramirez (2007), this paper applies the group-mean panel fully modified OLS (FMOLS) technique to Equation (2) above. The FMOLS estimate of the β population parameter for country i is mathematically represented as:

$$(6) \qquad \hat{\beta}_i^* = (X_i'X_i)^{-1}(X_i'y_i^* - T\delta)$$

where y_i^* is the transformed variable; T is the number of time periods; and δ is the adjustment parameter for serial correlation. The bias induced by endogeneity is eliminated by applying a semi-parametric correction proposed by Phillips and Hansen (1990) into the model. Thus, as Pedroni contends, the FMOLS estimators are "extremely accurate even in panels with very heterogeneous serial correlation dynamics, fixed effects and endogenous regressors." Using Monte Carlo simulations, the author also shows that the FMOLS method generates consistent estimates even in relatively small samples.[6]

The results are presented in Table 4 and suggest that FDI does have a non-linear effect on income inequality. Using the stock variable, we find *FDISTOCK squared* to be of the expected sign and significant at the 5%, but not *FDISTOCK*. Using inflows, we find both coefficients for

[6] Franco and Gerussi (2013), whose model served as the basis for the conceptual framework in this thesis, utilize the one step SYS-GMM estimator to account for endogeneity. The GMM estimators, however, are usually employed when one has no knowledge of the underlying distribution. In a long panel, like the one utilized in this thesis, it is assumed that the errors are normally distributed, and the use of the FMOLS estimator is warranted. In fact, Pedroni (2002) has shown, via small sample Monte Carlo simulations, that the bias (and sampling variance) of the group mean FMOLS estimator (based on the "between" dimension of the panel) is very small, even in extreme cases when both the N and T dimensions are as small as N=10 and T=10 (and they become insignificant as the time dimension increases).

FDIINFLOWS and *FDIINFLOWS squared* to be significant. As *FDIINFLOWS* increase, the level of income inequality initially rises but falls after a certain point. In this specific case, ceteris paribus, the Gini index starts decreasing after FDI inflows as a percentage of GDP reaches 0.56.[7] The fact that *GINI* reaches its maximum at a relatively low level of *FDIINFLOWS* suggests that the sample countries are endowed with substantial absorptive capacity. In other words, they will shift into the new technological paradigm quickly.

Trade and GDP per capita also seem to have similar Kuznets-like effects on income inequality, although only *TRADE squared* is found to be significant in both regressions. *GOVEXP* is highly insignificant: this result is not surprising, since the variable captures not just redistributive or public expenditures, but *all* government spending including compensation of employees and some expenditure on national defense and security. The last two control variables, *EDUC* and *INFRAPHONE*, are highly significant in both regressions. *EDUC* has an expected negative impact on income inequality, whereas *INFRAPHONE* has a significant positive effect.

TABLE 4 FMOLS Results

Variables	Using FDI Inflows		Using FDI Stock	
	Coefficient	t-Statistic	Coefficient	t-Statistic
FDI	0.7874	2.83***	0.1257	1.42
FDI^2	-0.0652	-2.53**	-0.0026	-1.98**
TRADE	0.0510	1.24	0.0430	0.91
TRADE^2	-0.0004	-2.26**	-0.0003	-1.67*
GDPCAP	0.0010	1.37	0.0009	1.18
GDPCAP^2	-3.2E-08	-0.53	-2.1E-08	-0.34
GOVEXP	0.0814	0.36	0.1083	0.50
EDUC	-0.2271	-3.33***	-0.2071	-2.93***
INFRAPHONE	0.4809	4.93***	0.4967	5.07***
R-squared	0.8696		0.8615	
Adj R-squared	0.8549		0.8460	

[7] The value was calculated by setting the first derivative equal to zero.

Conclusion

In conclusion, this study estimated the impact of FDI on the level of income inequality in seven Southeast Asian countries during the 1990-2013 period. The conceptual model hypothesized that inward FDI introduces new technology and managerial knowhow, which initially raises the skill premium of relatively skilled factors of production but later becomes adopted by the entire economy. This hypothesis received strong support in the preliminary regressions generated using the fixed effects least-squares dummy variable model (FEM). To address the problem of spurious regression, the paper determined via panel unit root tests that all the variables were integrated of order one (non-stationary in level form but stationary in first differences). It then proceeded to test for panel cointegration among the variables in level form. The Pedroni ADF and PP tests found strong evidence for panel cointegration. Accordingly, new long-run estimates were generated using the fully modified OLS (FMOLS) methodology which corrects for both heterogeneous serial correlation and endogeneity of the included variables, even in a short panel which is certainly not the case in this study.

The FMOLS results were mostly in line with the FEM (SUR) estimates. The estimated coefficients for FDI inflows were significant and showed that a ceteris paribus increase in FDI inflows will be followed by an immediate increase in income inequality, which will start to gradually decrease when FDI inflows as a percentage of GDP approximates 0.56. In terms of the FDI stock specification, only the squared term was found to be significant. Still, both estimates had the expected signs. The paper also found that two of its control variables, the level of education and infrastructure development, were highly significant. The number of telephone lines had a strong positive impact on income inequality, while the tertiary school enrollment ratio had a strong negative impact. Furthermore, while the control variables for trade and GDP per capita were not as significant as the other two, the estimates suggested that both trade and economic growth have non-linear effects on income distribution, similarly to inward FDI.

This study has its limitations. First, the link between the conceptual framework and the empirical model used in this thesis relies on the implicit assumption that income inequality will reflect wage inequality. This assumption may not always hold. Still, such a connection seems to be a standard practice in the extant literature. Another drawback of this study is the use of interpolation to generate missing data for some of the GINI variable. Although the limited use of data interpolation is acceptable, we should still remain cognizant of potential measurement problems it may have caused. The study is also likely to suffer from the problem of omitted variables. Nevertheless, given that it is rather impossible to identify, let alone obtain for developing countries, all relevant variables that may affect income inequality, this shortcoming should not invalidate the important findings of this paper.

From a policy standpoint, the paper's findings suggest that host governments should make an effort to make proper adjustments and increase their domestic absorptive capacity to facilitate the technological shift, in turn minimizing the short-run detrimental effects of FDI on income distribution. In particular, this paper suggests that tertiary education had a very significant impact in reducing inequality in Southeast Asia. Investing in education, thus, may help mitigate the potential adverse effects of economic globalization. In addition, safety net programs for low-skilled workers and domestic firms which may be harmed by the entry of multinational corporations may help address some of the concerns that arise with a growth in FDI inflows. Other policy measures which governments may find useful include export performance and local content requirements, which may foster economic growth while also fulfilling development goals of a more equal distribution of income (see UNCTAD, 2004 and Mah, 2011).

References

Afonso, A., Schuknecht, L., & Tanzi, V. (2008). Income Distribution Determinants and Public Spending Efficiency. *European Central Bank Working Paper Series*, No. 861.

Aghion, P., & Howitt, P. (1992). A Model of Growth Through Creative Destruction. *Econometrica*, *60*(2), 323–351.

Aghion, P., & Howitt, P. (1999). On the Macroeconomic Effects of Major Technological Change. *Nordic Journal of Political Economy*, *25*, 15–32.

Agosin, M. R. (1999). Trade and growth in Chile. *Cepal Review*. Retrieved from http://repositorio.cepal.org/handle/11362/10688.

Alderson, A. S., & Nielsen, F. (1999). Income Inequality, Development, and Dependence: A Reconsideration. *American Sociological Review*, *64*(4), 606–631.

Arbache, J. S., Dickerson, A., & Green, F. (2004). Trade Liberalisation and Wages in Developing Countries. *The Economic Journal*, *114*(493), F73–F96.

Barlow, D., Grimalda, G., & Meschi, E. (2009). Globalisation vs Internal Reforms as Factors of Inequality in Transition Economies. *Intl Review of Applied Economics*, *23*(3), 265-287.

Basu, P., & Guariglia, A. (2007). Foreign Direct Investment, inequality, and growth. *Journal of Macroeconomics*, *29*(4), 824–839.

Berman, E., Bound, J., & Machin, S. (1998). Implications of Skill-Biased Technological Change: International Evidence. *The Quarterly Journal of Economics*, *113*(4), 1245–1279.

Beyer, H., Rojas, P., & Vergara, R. (1999). Trade Liberalization and Wage Inequality. *Journal of Development Economics*, *59*(1), 103–123.

Bhandari, B. (2007). Effect of Inward Foreign Direct Investment on Income Inequality in Transition Countries. *Journal of Economic Integration*, *22*(4), 888–928.

Calderón, C., & Servén, L. (2004). The Effects of Infrastructure Development on Growth and Income Distribution. *Central Bank of Chile Working Papers*, No. 270.

Chang, H. J. (2003). *Globalization, Economic Development and the Role of the State*. Zed.

Chase-Dunn, C. (1975). The Effects of International Economic Dependence on Development and Inequality: A Cross-National Study. *American Sociological Review*, *40*(6), 720–738.

Choi, C. (2006). Does Foreign Direct Investment Affect Domestic Income Inequality? *Applied Economics Letters*, *13*(12), 811–814.

Coxhead, I. (2014). *Routledge Handbook of Southeast Asian Economics*. Routledge.

Cypher, J. W. and Dietz, J. L. (2004). *The Process of Economic Development.* Routledge.

Farhan, M. Z. M., Azman-Saini, W. N. W., & Law, S. H. (2014). FDI and Income Inequality in ASEAN-5 Countries: A Quantile Regression Approach. *Prosidin Per KEM, 9,* 601–608.

Feenstra, R. C., & Hanson, G. H. (1995). Foreign Direct Investment and Relative Wages: Evidence from Mexico's Maquiladoras. *NBER Working Paper, No. 5122*.

Figini, P., & Görg, H. (2011). Does Foreign Direct Investment Affect Wage Inequality? An Empirical Investigation. *The World Economy*, *34*(9), 1455–1475.

Franco, C., & Gerussi, E. (2013). Trade, Foreign Direct Investments (FDI) and Income Inequality: Empirical Evidence from Transition Countries. *The Journal of International Trade & Economic Development*, *22*(8), 1131–1160.

Frank, A. (1969). *Latin America: Underdevelopment or Revolution*. Monthly Review Press.

Grimalda, G., Barlow, D., & Meschi, E. (2010). Varieties of Capitalisms and Varieties of Performances: Accounting for Inequality in post-Soviet Union Transition Economies. *International Review of Applied Economics*, *24*(3), 379–403.

Hadri, K. (2000). Testing for Stationarity in Heterogeneous Panel Data. *Econometrics Journal*, *3*(2), 148–161.

Helpman, E., & Trajtenberg, M. (1994). A Time to Sow and a Time to Reap: Growth Based on General Purpose Technologies. *NBER Working Paper, No. 4854*.

Herzer, D., & Nunnenkamp, P. (2011). FDI and Income Inequality: Evidence from Europe. *Kiel Working Paper, No. 1675*.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics*, *115*(1), 53–74.

Kopinak, K. (2003) Maquiladora Industrialization of the Baja California Peninsula: The Coexistence of Thick and Thin Globalization. *International Journal of Urban and Regional Studies, Vol.* 27, 319-336.

Krueger, A. O. (1995). East Asian Experience and Endogenous Growth Theory. In Ito, T. and Krueger, A. O. (Eds.) *Growth Theories in Light of the East Asian Experience.* NBER.

Levin, A., Lin, C.-F., & James Chu, C.-S. (2002). Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties. *Journal of Econometrics*, *108*(1), 1–24.

Lindert, P. H., & Williamson, J. G. (2001). Does Globalization Make the World More Unequal? *NBER Working Paper, No. 8228*.

Mah, J. S. (2002). The Impact of Globalization on Income Distribution: The Korean Experience. *Applied Economics Letters*, *9*(15), 1007–09.

Mah, J. S. (2011). Export Promotion Policies, Export Composition and Economic Development of Korea. *The Law and Development Review, 4*(2), Article 2.

Mukaramah, H., Siti, H. C. M., & Zalina, Z. (2014). Do FDI Deteriorate Income Distribution? Evidence from Malaysia. *AABSS Conference and Journals*.

Mundell, R. A. (1957). International Trade and Factor Mobility. *The American Economic Review*, *47*(3), 321–335.

Obstfeld, M. (1998). The Global Capital Market: Benefactor or Menace? *NBER Working Paper, No. 6559.*

OECD (2014). *Southeast Asia Investment Policy Perspectives*. OECD Publications, Paris.

Parker, S., Phan, V. Q., & Nguyen, N. A. (2005). Has the U.S.-Vietnam Bilateral Trade Agreement Led to Higher FDI into Vietnam? *MPRA Paper, No. 1384*.

Pedroni, P. (1999). Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors. *Oxford Bulletin of Economics and Statistics*, *61*(S1), 653–670.

Pedroni, P. (2000). Fully Modified OLS for Heterogeneous Cointegrated Panels. In: Advanced Econometrics, Vol. 15. *Nonstationary Panels, Cointegration in Panels and Dynamic Panels: A Survey.* Ed. by Baltagi, B.H. and C. Kao.

Pissarides, C. A. (1997). Learning by Trading and the Returns to Human Capital in Developing Countries. *World Bank Economic Review*, *11*(1), 17–32.

Ramirez, M. (2007). A Panel Unit Root and Panel Cointegration Test of the Complementarity Hypothesis in the Mexican Case, 1960-2001. *Atlantic Economic Journal*, *35*(3), 343-356.

Reuveny, R., & Li, Q. (2003). Economic Openness, Democracy, and Income Inequality An Empirical Analysis. *Comparative Political Studies*, *36*(5), 575–601.

Robbins, D., & Gindling, T. H. (1999). Trade Liberalization and the Relative Wages for More-Skilled Workers in Costa Rica. *Review of Development Economics*, *3*(2), 140–154.

Rubinson, R. (1976). The World-Economy and the Distribution of Income Within States: A Cross-National Study. *American Sociological Review*, *41*(4), 638–659.

Sjöholm, F. (2014). Foreign Direct Investments in Southeast Asia. *Social Science Research Network Scholarly Paper, No. 2475944.*

Sylwester, K. (2005). Foreign Direct Investment, Growth and Income Inequality in Less Developed Countries. *International Review of Applied Economics*, *19*(3), 289–300.

Tsai, P. L. (1995). Foreign Direct Investment and Income Inequality: Further evidence. *World Development*, *23*(3), 469–483.

UNCTAD (2004). *Foreign Direct Investment and Performance Requirements: New Evidence from Selected Countries*. United Nations Publications.

UNCTAD (2014). *World Investment Report 2014 - Investing in the SDGs: An Action Plan*. United Nations Publications.

Urata, S., Yue, C. S., & Kimura, F. (Eds.). (2012). *Multinationals and Economic Growth in East Asia: Foreign Direct Investment, Corporate Strategies and National Economic Development* (1st edition). Routledge.

Wade, R. (1990). *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization*. Princeton University Press.

Wood, A. (1997). Openness and Wage Inequality in Developing Countries: The Latin American Challenge to East Asian Conventional Wisdom. *World Bank Economic Review*, *11*(1), 33–57.

The World Bank (2015). *World Bank Database*.