The linkage between international financial integration and income inequality: New evidence on threshold effects

Abstract

Following the trend of financial globalization since the 1980s, more and more tropical economies have embraced financial openness as one of the drivers of economic growth, allowing foreign investments to pour into their countries. While FDI capital flows are often associated with higher economic growth, fickle non-FDI flows are blamed for exposing developing economies to the risk of 'Sudden Stop' and economic instability. Financial openness associated with different types of foreign investment is likely to make differential impacts across different income groups within an economy, which has implications for a nation's income inequality. Since most of the tropical economies are in a relatively early phase of financial openness compared to their developed counterparts, it would be meaningful to investigate the relationship between financial openness and income inequality, allowing for possible nonlinear linkage dependent on stages of financial openness.

Keywords: International Financial Integration, Financial Openness, Income Inequality, Panel Threshold Regression **JEL Codes:** O15, F30, F62.

1 Introduction

Since the 1980s, the world has embarked on a wave of financial globalization, characterized by a surge in international capital flows and asset holdings. Advancement in information technology and digital finance has broken the geographical boundaries for cross-border investments between nations, enabling more and more developing nations to join the bandwagon of financial liberalization by allowing foreign investments to pour into their countries. At first glance, financial globalization may seem like a straightforward solution to tropical underdevelopment, an economic puzzle where a majority of countries located in the tropics are falling behind in economic performance (Sachs, 2001). However, history has shown that financial globalization can be a double-edged sword, as untamed capital flows

may invite macroeconomic instability and accentuate the host country's income inequality (Eichengreen et al., 2021).

Indeed, while countries receiving greater capital flows often also enjoyed higher economic growth, the fickleness of foreign inflows and lack of regulation in the financial opening process was blamed for exposing the recipient economies to the risk of Sudden Stop of capital inflows and led to a series of financial crises in emerging market economies during the late 20th century, including the notable Latin American debt crisis in the 1980s and Asian financial crisis in the 1990s (Prasad et al., 2005; Calvo, 1998). Such widespread financial turmoil had undoubtedly caused a devastating blow to the emerging market economies, many of which are also situated in tropical areas[1]. Economic growth in the crisis-stricken countries was impeded, and poverty rose sharply as a result[2]. While the linkage between cross-border capital flows and income inequality is less clear ex-ante, some empirical studies find evidence that capital account liberalization tends to increase income inequality. For instance, Furceri & Loungani (2018) discover that the impact of financial liberalization on inequality is more substantial when liberalization is followed by a financial crisis. The finding of Das & Mohapatra (2003) suggests the top quintile of the income distribution benefits from capital account openness at the expense of the middle class, while the lowest income share group is least affected in the event of liberalization.

Moreover, financial openness associated with different types of foreign investment flows are likely to exhibit different behaviors and have heterogeneous economic effects. According to International Monetary Fund's capital flows classification, the types of capital flows can be broadly categorized as direct investment, portfolio investment, and other investment flows. Foreign direct investment (FDI) involves an investment by a foreign investor with an

[1] Such as most Latin American countries hit by the 1980s debt crisis, and Southeast Asian countries affected by the Asian financial crisis.

[2] According to Cline (2002), around 40 to 60 million people were forced into poverty by the financial crises originated in the eight emerging economies (Mexico, Thailand, Indonesia, Korea, Russia, Brazil, Argentina and Turkey), which was a stark figure comparing to the 800 million total population of these countries combined

ownership of more than 10 percent of a local business. Portfolio investment refers to investments made in securities and other financial assets such as shares and bonds. Other investment, sometimes also known as credit flows in the capital flow literature, is mainly related to banks' deposit and lending transactions. Due to their different characteristics, these capital flow components differ vastly in their dynamic patterns and impact on the domestic financial and economic systems. Ample evidence in the existing literature indicates that FDI is usually a source of stable long-term capital flows conducive to the country's development and able to reduce extreme poverty through facilitating economic growth and creating jobs in the host countries. In contrast, portfolio and other flows are shorter-term capital flows that are very sensitive to external financial conditions and thus are deemed more volatile and likely to be the main contributor to the Sudden Stop phenomenon (See, Sula & Willett, 2009; Ahlquist, 2006). Therefore, it is imperative to consider the composition within the capital flows when analyzing the economic impact of international financial integration.

Clearly, financial globalization comes with both benefits and costs that may be shared unevenly among different income groups within an economy, which has implications for a nation's income inequality. This adds an essential aspect to the debate of whether the tropical economies should adopt a more conservative stance when embracing financial openness as one of the drivers of economic growth. Understanding the income inequality effects of capital flows may help policymakers in these economies design policy measures that allow growth gains from financial liberalization to be more equally distributed among different segments of society and achieve greater social welfare. However, much of the existing research focuses on the impact of financial openness on economic growth (See for instances, Sahoo & Sethi, 2020; Selvarajan & Ab-Rahim, 2020; Yakubu et al., 2020; Estrada et al., 2015; Kim et al., 2012; Bekaert et al., 2011), whereas the studies on the nexus between international financial integration and income inequality remain relatively thin. Among this strand of literature, Lim & McNelis (2016) build a small open economy heterogeneous agent model and conduct

simulation exercises which show both trade and financial openness improve income growth and equality once an economy crosses a critical threshold in capital intensity and the use of imported intermediate goods in the production process. This implies that the relationship between economic globalization and income inequality is nonlinear. Erauskin & Turnovsky (2019) employ a stochastic growth model to study the impact of international financial integration on income inequality based on the premise that financial liberalization will reduce costs of investing and borrowing abroad while these activities favor the wealthy and thus tend to increase inequality. The simulations suggest that financial liberalization during 1970–2015 contributed significantly to the increase in income inequality experienced over that period. In terms of empirical evidence, Jaumotte et al. (2013) find that financial globalization (particularly FDI) tends to exacerbate inequality as opposed to the equalizing effect of trade openness. Asteriou et al. (2014) find similar results in that financial globalization through FDI, capital account openness, and stock market capitalization has been driving up inequality in the EU-27 countries over 1995-2009. Heimberger (2020) conducts a meta-analysis based on 123 existing studies and concludes that while the effect of trade globalization is small, financial globalization shows a more substantial inequality-increasing impact. In terms of evidence of nonlinear FDI-inequality nexus, Lin et al. (2015) use a smooth transition regression model to a panel of developing and advanced countries from 1976 to 2005. They find that FDI increases income inequality, and the effect becomes more assertive with greater financial sophistication. Jung & Kim (2021) find that financial market integration and financial depth interact to influence income inequality, in which financial openness worsens income inequality in the countries with underdeveloped financial markets, but the effect is statistically insignificant in the countries with developed financial markets.

Building on the above extant literature, our study aims to reexamine the relationship of a country's degree of international financial integration (IFI) - a proxy for financial openness - with the country's income inequality in the context of tropical economics. In particular, we

attempt to contribute to the empirical research on the income distributional effect of financial openness in three respects. First, we explore whether there exists a threshold level of financial openness in the IFI-inequality linkage, i.e., whether the impact of IFI on income inequality varies across different regimes contingent on the country's magnitude of IFI. This is motivated by the pioneering theoretical model on the finance-inequality nexus as developed by Greenwood & Jovanovic (1990), which hypothesizes an inverted U-shaped relationship between income inequality and financial development. According to this hypothesis, financial factors tend to worsen income inequality during the early stage of economic development since only the rich can afford to access the financial market and make gains from financial investments. As the economy develops, stable income distribution across people is attainable under a maturely developed financial structure, allowing less endowed people to participate in financial markets. While the theoretical framework mainly focuses on domestic financial factors, we assume such hump-shaped behavior may also be present for the international financial market due to the same rationale. This hypothesis also has important implications for the tropical economies, given that most tropical economies are still in the early phase of financial openness relative to their developed counterparts. If this hypothesis is true, the nations may experience rising income inequality when they first integrate into global financial markets, but such a situation may only be transitory.

Second, we employ dynamic panel threshold regression (PTR) as developed by Kremer et al. (2013), which has not been used before in exploring the nonlinear relationship between IFI and income inequality. One of the main appeals of PTR methodology, compared to the ad hoc methods of sample-splitting or linear interaction specification, is that it provides an endogenous estimation of threshold levels. Furthermore, dynamic PTR is a combination of the original static PTR model (Hansen, 1999) with the instrumental variable estimation of the cross-sectional threshold model (Caner & Hansen, 2004). This method allows for the inclusion of instrumented initial values for income inequality as one of our control variables,

hence enable us to capture the dynamic adjustment and persistence of income inequality without running into endogeneity issues.

Third, de facto IFI indicators constructed from different types of capital flows (including FDI vs. non-FDI inflows) are employed in our analysis to capture differences between FDI and non-FDI investments. It is argued that de jure indicators, i.e., capital account restrictions, do not adequately represent the amount of external financing received in developing countries due to the poor enforcement of capital control policies (See for examples, Edison et al., 2004; Prasad et al., 2005; Edwards, 2007). Our study analyzes how financial openness influences income inequality; what matters most is the actual integration level between the country's economy and the international capital market. As such, de facto instead of de jure financial openness is what we should consider.

We find evidence of a nonlinear relationship between IFI and income inequality, in which IFI indicators significantly increase inequality in the low financial openness regime, but the impact diminishes in the high financial openness regime. The qualitative outcome of the nonlinear IFI-inequality nexus holds for several robustness checks. Our results also corroborate heterogeneity across various types of capital flows, as different IFI indicators yield different results for the estimated regime-dependent parameter values. Out of four IFI indicators, FDI inflows seem to associate with a more significant increase in income inequality at the early phase of liberalization, but such correlation becomes insignificant when the ratio of FDI over GDP reaches a certain threshold. These findings provide insights into the financial liberalization process and its accompanying inequality effect on the tropics. Since most of the tropical economies within our sample have passed the FDI openness threshold, this implies that while FDI inflows have a more substantial worsening effect on income distribution than the non-FDI inflows, such effect only prevails at the early stage of financial integration and will not persist as the country further opens to receiving more FDI investments.

This chapter is organized as follows. Section 2 gives a brief context about the distinct economic characteristics of the tropics. Section 3 presents the data and empirical methodology. Section 4 discusses the empirical findings. Section 5 concludes.

2 Tropical Economies

In the field of development economics, many economists have observed a geographical pattern of wealth and poverty. Influential work by Gallup et al. (1999) that set foot in this field uncovered the empirical fact that tropical and landlocked areas are systematically more impoverished and less developed than the other regions. In fact, according to the United Nation's country classifications from the World Economic Situation and Prospects (WESP) report published in 2020 (United Nations, 2020), out of 52 high-income economies (by per capita GNI in June 2019), only 8 are tropical[3]; and none of the 33 developed economies is from the tropical area.

No doubt, determinants of tropical poverty are incredibly complex, and even within the economic profession, a consensus has yet to be reached. Some of the leading hypotheses aimed to explain tropical poverty include the historical reason (such as colonization) and tropical disease prevalence (Gallup et al., 1999), institutional factor (Easterly & Levine, 2003), agricultural productivity (Gallup & Sachs, 2000) as well as environment and latitude which determine the frequency of natural catastrophe and climatic condition of the regions (Hsiang & Jina, 2014; Hsiang & Meng, 2015).

Comparing to the literature on tropical underdevelopment, few studies have examined the tropical income inequality issue. A seminal study by Engerman & Sokoloff (1994) propose the famous factor endowment hypothesis to explain the association between tropical ecology and income inequality. Under this hypothesis, the production of tropical crops such as tobacco and sugar had significant economies of scale as compared to the production of non-

[3] They are Bahamas, Barbados, Brunei Darussalam, Hong Kong SAR, Panama, Singapore, Taiwan Province of China, and Trinidad and Tobago.

tropical crops such as wheat and barley, hence giving rise to wealth concentration in the hands of a few elites, who had incentives to monopolize human capital resources to entrench their political power. Gavin & Hausmann (1998) adopt this explanation for their empirical finding of Latin America, where countries located near the equator and with large natural resource endowments tend to encounter slower growth and higher income inequality than less resource-intensive economies located in non-tropical climates. Easterly's (2007) empirical exercise further corroborates this hypothesis. Using cross-country data, he confirms that agricultural endowments can predict inequality, and inequality in turn predicts development.

We have briefly discussed the economic traits of the tropics, but what is meant by tropical region? As noted by Gallup et al. (1999), the tropics can be defined on the basis of geography or ecology. The geographical tropics refer to regions of Earth that lie between the latitude lines of the Tropic of Cancer (23.5° N) and the Tropic of Capricorn (23.5° S). However, there lacks of a fundamental explanation of why physical geography can have economic implications since countries located in the same latitude can be affected by very different climates depending on factors other than latitude.[4] Instead, most of the theories outlined above suggest that the more meaningful definition of the tropics in an economic sense should be based on ecological or climatic attributes which will influence the country's economic activities, especially those heavily reliant on nature. Therefore, we will follow country classification by Hsiang & Meng (2015), who identify tropical countries based on the country's susceptibility to El Niño-Southern Oscillation (ENSO) climate[5]. Specifically, tropical

[4] Other climatic factors such as ocean current, topography, wind and air masses, and so on, can also determine the regional climate condition.

[5] In short, ENSO is a climatic phenomenon periodically fluctuating between three phases which affect the climate of much of the tropics and subtropics. The three phases are El Niño (warming of the ocean surface), La Niña (cooling of the ocean surface) and Neutral (neither El Niño or La Niña).

countries are defined as countries whose local temperatures are strongly related to ENSO, whereas temperate countries are those with local temperatures weakly linked to ENSO.

3 Data and empirical methodology

3.1 Data

The data employed in this study comprises a balanced panel of observations from 43 countries covering the 1980-2014 period. To reduce the possible effects of short-term fluctuations and measurement errors, the data are averaged over five-year intervals resulting in seven distinct periods per country (1980-1984, 1985-1989, ..., 2005-2009, and 2010-2014). The selection of countries is restricted by the availability of data on inequality and balance of payment statistics. Following Hsiang & Meng's (2015) country assignment, our sample consists of 20 tropical and 23 temperate countries (See Table A1 in the Appendix).

The dependent variable is (log of) Gini coefficient, a standard measure for within-country income inequality. Specifically, we collect Gini indices from the Standardized World Income Inequality Database (SWIID) created by Solt (2009), which provides comparable data of market-income and disposable-income-based Gini coefficients across an extensive set of countries. Market income Gini coefficient measures inequality of gross income so that this indicator proxies inequality exclusive of fiscal policy effect. On the other hand, the net income Gini coefficient is calculated based on the after-tax income inclusive of taxation and transfer payment effects and may complicate our purpose of studying the IFI-inequality linkage. Hence, we use market income Gini coefficient (*gini_mkt*) as our preferred income distributional measure and dependent variable in our primary analysis, whereas disposable income Gini coefficient (*gini_disp*) is included in the section of robustness check. Figure 1a and 1b in the Appendix plot the world map of Gini coefficients by country based on the average values of market income Gini coefficient and disposable income Gini coefficient during the period 2010-2014, respectively. As can be seen from the figure, the top 3 countries

with the highest *gini_mkt* are concentrated in the southern area of Africa, including South Africa (72.3), Namibia (69.8), and Botswana (63.7), all of which belong to the tropical zone. Meanwhile, quite several temperate countries also have the value of *gini_mkt* greater than 50. For instance, *gini_mkt* of the United States is 51.9. However, if we consider the disposable income Gini coefficient, due to a more progressive tax system adopted in many developed and temperate nations, the net income in these countries actually results in lower Gini coefficient values in the temperate zone. For example, *gini_disp* of the United States is 37.3, much lower than its *gini_mkt*. This is further substantiated by the mean and median of the Gini coefficients between tropical and temperate economies as presented in Table 1, in which the tropical-temperate difference is more apparent for *gini_disp*.

To indicate the country's degree of financial openness, we construct four de facto international financial integration (IFI) measures used as regime-dependent and threshold variables in the PTR regressions. Following Kose et al. (2011) and Chen & Quang (2014), total flows of capital are measured by summing the absolute inflows (external liabilities) and outflows (external assets) of capital, divided by the country's nominal GDP. As the extant capital flows studies have pointed out, the financial stability of emerging market economies is prone to the Sudden Stop phenomenon mainly caused by foreign inflows, particularly non-FDI inflows, which are more speculative and erratic. Therefore, we also construct IFI indicators based on only the inward component of capital flows and IFI indicators that distinguish between FDI and non-FDI (defined as the sum of portfolio and other investments) inflows. As shown in Table 1, generally, temperate countries have higher financial openness than tropical countries, especially in terms of non-FDI inflows. This is unsurprising given that the temperate economies are usually more developed economies with deeper markets for trading in financial securities that can efficiently facilitate cross-border portfolio flows. In terms of direct investment, developed nations are also more likely to be net capital investors than investees when the local enterprises seek a blue ocean market or lower labor costs in less developed markets.

Table 1: Mean, standard deviation, and quantiles of Gini coefficients and IFI indicators for tropical and temperate economies

Tropical Economies

Variable	n	Mean	S.D.	Min	0.25	Mdn	0.75	Max
gini_mkt	140	47.49	7.24	35.66	41.94	46.44	52.08	68.22
gini_disp	140	45.14	5.68	31.7	41.08	45.27	49.02	58.5
Inflows	140	9.71	13	0.08	3.75	6.18	9.58	85.18
FDI Inflows	140	2.91	3.68	0	0.55	1.57	3.51	21.19
Non FDI Inflows	140	6.8	11.08	0.08	2.2	3.83	6.9	81.56
Total Flows	140	15.39	26.95	0.08	4.89	7.87	11.43	172.76

Temperate Economies

Variable	n	Mean	S.D.	Min	0.25	Mdn	0.75	Max
gini_mkt	161	45.7	7.24	30.12	42.78	46.76	49.46	59.96
gini_disp	161	32.12	5.68	20.66	26.62	31.46	34.9	51
Inflows	161	10.65	13	0.7	4.76	7.5	12.76	73
FDI Inflows	161	2.85	3.68	0	0.77	1.79	3.44	40.41
Non FDI Inflows	161	7.8	11.08	0.48	3.37	5.58	9.22	45.19
Total Flows	161	19.91	26.95	1.5	7.32	13.16	25.89	144.53

To strengthen our empirical results, control variables are selected similar to previous studies on the linkage between financial openness and income inequality. First, growth of GDP per capita is included to capture the income effect on distribution. Following Kuznets (1955), inequality is expected to follow a hump-shaped curve with economic growth over levels of income. Second, (log of) average years of secondary level schooling compiled by

Barro & Lee (2013)[6] is used as a proxy for the impact of human capital on income inequality. Third, (log of) age dependency ratio controls for income distributional effect of demographic change through population age distribution. Age dependency ratio is defined as youth and old population as a fraction of the working population. Forth, initial Gini coefficient (given by the first annual observation within each five-year interval) enters the dynamic model specification to capture the persistence in income inequality. The persistence of high and, in many economies, rising income inequality over the recent period is a growing concern for policymakers and economists worldwide (Clements et al., 2015; Dabla-Norris et al., 2015). Income inequality is persistent in the long run since low-income families are unable to catch up with the rest of the population due to various reasons such as imperfect financial market (Mookherjee & Ray, 2003) or the choice of high fertility rate over child educational investment rate (Moav, 2005).

Moreover, we test the sensitivity of our results by including the (log of) level of trade share, given by the sum of exports and imports as a percentage of nominal GDP, to capture the impact of trade openness on income inequality. Finally, inflation measured by percentage changes in the GDP deflator is also included as a robustness test.

Table 2 summarizes the descriptive statistics of all the variables used in this paper.

3.2 Panel Threshold Regression

To study the potential nonlinear relationship between IFI and income inequality, we adopt panel threshold regression which allows for endogenous identification of threshold levels. First proposed by Hansen (1999) in a static setup, the panel threshold regression model for a two-regime case in our study can be represented by the following equation:

[6] The data version we use is 2016 updated version.

Table 2: Summary of statistics

Variable	Mean	Std. Dev.	Min	Max
gini mkt	3.8303	0.1404	3.4052	4.2227
gini disp	3.6115	0.2519	3.0282	4.0690
IFI variables				
Inflows	10.2153	11.2905	0.0783	85.1808
FDI Inflows	2.8771	4.1191	0.0000	40.4090
Non FDI Inflows	7.3382	9.0803	0.0783	81.5577
Total flows	17.8092	23.5334	0.0783	172.7622
Control variables				
Initial gini mkt	3.8266	0.1421	3.4078	4.2268
Initial gini disp	3.6090	0.2552	3.0301	4.0673
Growth	1.9652	2.7382	-20.9885	10.8843
Secondary education	0.7837	0.7039	-1.9661	1.9228
Age dependency ratio	4.0572	0.2301	3.5865	4.6017
Trade Openness	4.0347	0.5668	2.5936	6.0157
Inflation	0.2967	1.4425	-0.0135	16.7741

$$INEQ_{it} = \mu_i + \beta_1 IFI_{it} I(IFI_{it} \leq \lambda) + \alpha_1 I(IFI_{it} \leq \lambda) + \beta_2 IFI_{it} I(IFI_{it} > \lambda) + \gamma' Z_{it} + \epsilon_{it} \quad (1)$$

where *INEQ* is an income inequality indicator, *IFI* is the international financial integration indicator used to split the sample into low or high openness regime, $I(\cdot)$ is the indicator function equals 0 when *IFI* is less than or equal to the threshold parameter λ and 1 otherwise. Z_{it} contains the control variables in which the slope coefficients are constrained to be regime-

independent. β_1 is slope terms of IFI under low openness regime. α_1 captures differences in the regime intercept following Bick (2010). β_2 is the slope coefficient of IFI under high openness regime, γ indicates slope coefficients for control variables, μ_i is the country-specific fixed effect. The error term ϵ_{it} is assumed *i.i.d.* of mean 0 and variance σ^2.

Given the dynamic nature of most macroeconomic indicators, we employ dynamic panel threshold regression approach of Kremer et al. (2013), which is an extension based on Hansen's static panel threshold regression model and Caner & Hansen's (2004) cross-sectional threshold regression, where generalized methods of moments (GMM) type estimators are used to deal with possible endogeneity induced by initial values of income inequality as one of the controls. Under such dynamic setting, Z_{it} in Equation 1 is partitioned into a subset $Z_{1,it}$ of exogenous variables uncorrelated with ϵ_{it}, and a subset of endogenous variables $Z_{2,it}$ (initial Gini coefficient in our case) that is correlated with ϵ_{it}.

Prior to the estimation procedure, one must first eliminate the fixed effects, μ_i, through variable transformation. As suggested by Kremer et al., the endogenous regressor (initial Gini index) in the dynamic model will be correlated with the transformed errors resulted from the within transformation or first differencing methods and thus lead to inconsistent estimates. As such, the forward orthogonal deviations transformation proposed by Arellano & Bover (1995) is used to eliminate individual effects. This method subtracts the average of all available future observations from the contemporaneous one, hence avoids serial correlation of transformed disturbance terms. The error term after the forward orthogonal deviation transformation is as shown below:

$$\epsilon_{it}^{*} = \sqrt{\frac{T-t}{T-t+1}}\left[\epsilon_{it} - \frac{1}{T-t}\left(\epsilon_{i,t+1} + \cdots + \epsilon_{iT}\right)\right] \qquad (2)$$

And the uncorrelatedness of the error terms remains:

$$Var(\epsilon_i) = \sigma^2 I_T \Longrightarrow Var(\epsilon_i^{*}) = \sigma^2 I_{T-1}$$

Thus, we can proceed to apply the estimation procedure developed by Caner & Hansen to Equation 1.

The estimation of threshold indicator following Caner & Hansen consists of three steps. First, reduced form regression of the endogenous variables, $Z_{2,it}$, is conducted on the set of instruments, X_{it}, together with exogenous variables, $Z_{1,it}$, to obtain the fitted values, $\hat{Z}_{2,it}$. After replacing $Z_{2,it}$ by their predicted values $\hat{Z}_{2,it}$, the sequential least square regressions based on Equation 1 are carried out for a strict subset of the support of the threshold variable *IFI*. Finally, the estimator of the threshold parameter λ is selected as the one that corresponded with the smallest sum of squared residuals (SSR) obtained in the previous step, i.e. $\hat{\lambda}=\underset{\lambda}{argmin} SSR_n(\lambda)$.

As in Hansen and Caner & Hansen, the critical values for determining the 95% confidence interval of the threshold value are given by:

$$\Gamma = \{\lambda : LR(\lambda) \leq C(\alpha)\}$$

where $C(a)$ is the 95% percentile of the asymptotic distribution of the likelihood ratio $LR(\gamma)$ that has been adjusted to account for the time dimension for each cross-section unit. Once the threshold parameter $\hat{\lambda}$ is determined, the slope coefficients can be estimated by the GMM for the previously used instruments. In line with Kremer et al., we use lags of the endogenous regressor, i.e., lags of initial Gini coefficient, as its own instruments.

4 Estimation results

As a preliminary inspection before proceeding to PTR analysis, we first run a simple panel regression by including a dummy variable for tropical countries and assuming all slope coefficients are regime-invariant. Table 3 reports the regression results for random-effects models (1a to 1d) corresponding to each IFI measure. We find that tropical dummy is significantly associated with higher *gini_mkt*, suggesting tropical economies in our sample

tend to have higher income inequality than their temperate counterparts. Regarding the financial openness indicators, only total flows openness has a significant positive coefficient. Per capita GDP growth is negative across all four specifications, implying an upper Kuznets curve effect where income inequality is lower with higher economic growth. The result also suggests a positive linkage between average secondary schooling and income inequality, consistent with Coady & Dizioli's (2018) finding. This may be attributed to inequality in educational attainment has further worsened income inequality within the country.

To investigate the potential inverted U-shaped relationship of IFI and inequality, we estimate Equation 1, considering IFI as a threshold variable. Table 4 reports the dynamic PTR results. The results suggest evidence of heterogeneity of different capital flows components since the regime-dependent slope coefficients vary significantly across the four indicators of IFI. Our findings highlight the existence of a nonlinear relationship between IFI and income inequality. However, aside from FDI-inflows, we do not find evidence of a clear inverted U-shaped IFI-inequality nexus for the other IFI indicators. Based on the results, a country would experience rising income inequality during the early phase of financial openness, but the positive effect either diminishes or turn insignificant as the extent of financial openness passes a certain threshold.

Referring to Model 2a, where the IFI measure is inflows of capital, the point estimate of the threshold value is 4.2966 (% of GDP). In our data set, 225 out of 301 observations have inflows to GDP ratio exceeding this threshold value. We then examine the statistical significance of its regime-dependent coefficients and find that the inflows indicator is a positive and statistically significant regressor for income inequality if it is less than the threshold value, but its impact on income inequality turns insignificant beyond the threshold. Model 2b and 2c compare between FDI and non-FDI components of inflows. In our sample, 246 out of 301 observations lie in the high FDI openness regime, while 62 out of 301 observations lie in the high non-FDI openness regime. FDI has the largest positive impact on

Table 3: Random-effects panel regression with tropical dummy

	Model 1a	Model 1b	Model 1c	Model 1d
Constant	3.8870***	3.8440***	3.8872***	3.8971***
	(0.1618)	(0.1598)	(0.1627)	(0.1611)
Growth	-0.0047***	-0.0052***	-0.0047***	-0.0046***
	(0.0014)	(0.0014)	(0.0015)	(0.0014)
Secondary education	0.0524***	0.0557***	0.0547***	0.0504***
	(0.0134)	(0.0134)	(0.0131)	(0.0133)
Age dependency ratio	-0.0325	-0.0213	-0.0328	-0.0349
	(0.0378)	(0.0372)	(0.0380)	(0.0376)
Inflows	0.0007			
	(0.0004)			
FDI inflows		0.0011		
		(0.0010)		
Non-FDI inflows			0.0007	
			(0.0004)	
Total flows				0.0004**
				(0.0002)
Tropical dummy	0.0788*	0.0780*	0.0806**	0.0791*
	(0.0404)	(0.0405)	(0.0404)	(0.0405)
R-squared:				
within	0.1694	0.1635	0.1678	0.1754
between	0.0581	0.0617	0.0571	0.0528
overall	0.0730	0.0754	0.0717	0.0688
Observation	301	301	301	301
N	43	43	43	43

Standard errors in parentheses. Significance at 10%, 5% and 1% are denoted by *, **, and ***, respectively.

Table 4: Results of dynamic panel threshold estimations

	Model 2a	Model 2b	Model 2c	Model 2d
	Inflows	FDI inflows	Non-FDI inflows	Total flows
$\hat{\alpha}_1$	-0.0751***	-0.0647***	-0.0145***	-0.0728***
	(0.0137)	(0.0056)	(0.0046)	(0.0083)
Initial Gini	0.8171***	0.9219***	0.8793***	0.8328***
	(0.0496)	(0.0454)	(0.0484)	(0.0509)
Growth	-0.0013**	-0.0025***	-0.0005	-0.0011*
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Secondary education	-0.0033	-0.0148***	0.0018	-0.0024
	(0.0042)	(0.0044)	(0.0043)	(0.0043)
Age dependency ratio	0.0019	-0.0022	-0.0091	0.0224*
	(0.0121)	(0.0118)	(0.0127)	(0.0117)
Financial Openness				
Low Regime	0.0122***	0.1976***	0.0061***	0.0102***
	(0.0038)	(0.0156)	(0.0007)	(0.0012)
High Regime	0.0000	-0.0004*	0.0005***	0.0001***
	(0.0001)	(0.0002)	(0.0001)	(0.0000)
Threshold estimate	4.2966	0.4626	9.2314	9.0468
95% confidence interval	[3.572-12.375]	[0.147-3.269]	[7.965-9.256]	[3.073-22.616]
Observations	301	301	301	301
N	43	43	43	43

Notes:

1. Low (high) regime refers to low (high) financial openness state.
2. Standard errors in parentheses. Significance at 10%, 5% and 1% are denoted by *, **, and ***, respectively.

income inequality out of four IFI indicators during the low openness state, but its correlation with income inequality becomes negative with a 10% significance level in the high openness state. On the other hand, non-FDI inflows (comprises portfolio and other investments) have positive and significant effects on inequality in both low and high regimes even though the coefficient value in the latter regime becomes much smaller. This finding confirms the composition effect of capital flows widely recognized in the previous literature, that the distinct behaviors and effects existed between FDI and non-FDI flows (See for examples, Smith & Valderrama, 2009; Aizenman et al., 2013; Kirabaeva & Razin, 2010). Finally, looking at the aggregate IFI variable as indicated by total flows, 169 out of 301 observations are in the high regime in which the threshold is estimated to be 9.0468 (% of GDP). Similar to non-FDI inflows, the magnitude of positive coefficient for IFI reduces in the high openness regime.

4.1 Implications of nonlinear IFI-inequality to the tropics

To further shed light on the impact of financial liberalization on income inequality in the context of tropical and temperate economies, Table 5 shows the number of countries with IFI exceeding the threshold levels as provided in Table 4. Focusing on FDI inflows, by comparing the average value of the country's FDI inflows to GDP ratio across time with the estimated threshold level of 0.4625, we find that most of the tropical countries (18 out of 20) and temperate countries (all 23 countries) have already achieved the high FDI inflows regime. This is not the case if we look at non-FDI inflows when only a few countries (2 out of 20 for the tropical countries and 7 out of 23 for the temperate countries) have fulfilled the threshold as a high non-FDI inflows regime. The outcomes based on median instead of average values are similar, except that fewer temperate countries are detected as high openness regimes in terms of FDI and non-FDI inflows (the numbers are 22 and 4 countries, respectively).

The implications of our research findings are twofold. First, even though our results align with the existing finding on the inequality-increasing effect of financial globalization, such

effect only prevails during the stage of low financial openness. This means the inequality effect of financial integration may not seem as intimidating as the existing literature has suggested. Second, FDI inflows have a more substantial worsening effect on income inequality than non-FDI inflows at the low financial openness regime, but the effect only exists at a very low threshold level of FDI openness. Once the threshold is crossed, FDI inflows will have a negative association (albeit weakly significant) with the nation's *gini_mkt*. This result, together with the above finding that the degrees of FDI openness of most tropical economies in our sample has reached the threshold level, implies FDI flows have a more benign impact than non-FDI flows on income inequality in the long run. This suggests that a multifaceted approach to financial liberalization is necessary to deal with heterogeneous impacts across different types of capital inflows. In particular, developing nations should treat non-FDI inflows with extra caution, and a more mature income distribution mechanism should be in place as they further develop their portfolio and credit markets to accept more financial inflows.

Table 5: High-financial-openness countries identified by comparing mean or median of IFI to the estimated threshold

	By mean		By median	
	Tropic (20)	Temperate (23)	Tropic (20)	Temperate (23)
Inflows	16	21	16	21
FDI inflows	18	23	18	22
Non-FDI inflows	2	7	2	4
Total flows	9	18	8	18

4.2 Robustness checks

In this section, we conduct several robustness checks to examine the sensitivity of the PTR results to using an alternative measure of Gini coefficient as the dependent variable, adding additional control variables, and using trade openness instead of financial openness as a threshold variable. The results of nonlinear IFI-inequality nexus are consistent throughout all sensitivity tests.

4.2.1 Alternative Gini measure as the dependent variable

Models 3a-3d in Table 6 show results using disposable income Gini coefficient (*gini_disp*) as a dependent variable. As aforementioned, *gini_disp* is calculated using disposable income, which is income after redistribution policies. This may explain why the findings differ from baseline results which use gross income Gini coefficient as the dependent variable.

Nonetheless, even with *gini_disp*, we find some evidence of nonlinear linkage between financial openness and inequality after controlling for the same set of control variables. The coefficients are positive across four IFI measures, but the magnitude significantly reduces the high financial openness regime.

4.2.2 Inclusion of further explanatory variables

We also conduct a robustness check concerning how results are affected by adding additional covariates such as trade openness and price inflation to our baseline model. To save space, we only display regression results for inflows and total flows indicators. As suggested by Hecksher-Ohlin-Samuelson (HOS) model, trade openness of a nation is linked to the nation's income distribution, and the distributional effect of international trade, in turn, depends on the relative factor abundance and the extent to which individuals obtain income from labor or capital endowment (Easterly, 2005). Previous empirical studies which focus on the impact of economic openness on income inequality have found that trade openness exerts an equalizing effect as opposed to that of financial openness (Asteriou et al., 2014). Our results

Table 6: Results of dynamic panel threshold estimations with alternative Gini coefficient

	Model 3a Inflows	Model 3b FDI inflows	Model 3c Non-FDI inflows	Model 3d Total flows
$\hat{\alpha}_1$	-0.0288***	0.0856***	0.0079*	-0.0660***
	(0.0067)	(0.0087)	(0.0046)	(0.0111)
Initial Gini	0.8944***	1.0390***	0.8638***	0.9792***
	(0.1162)	(0.0988)	(0.1254)	(0.1074)
Growth	-0.0005	-0.0025***	-0.0004	-0.00002
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Secondary education	-0.0067	-0.0321***	0.0000	-0.0156***
	(0.0049)	(0.0047)	(0.0052)	(0.0049)
Age dependency ratio	0.0076	0.0094	-0.0051	0.0253
	(0.0169)	(0.0155)	(0.0187)	(0.0154)
Financial Openness				
Low Regime	0.0078***	0.2615***	0.0038***	0.0101***
	(0.0011)	(0.0251)	(0.0008)	(0.0015)
High Regime	0.0007***	0.0010***	0.0009***	0.0004***
	(0.0001)	(0.0004)	(0.0001)	(0.0001)
Threshold estimate	10.0154	0.4626	9.2314	9.2204
95% confidence interval	[3.596-12.639]	[0.147-2.550]	[1.3441-9.2563]	[2.968-22.616]
Observations	301	301	301	301
N	43	43	43	43

Notes:

1. Low (high) regime refers to low (high) financial openness state.
2. Standard errors in parentheses. Significance at 10%, 5% and 1% are denoted by *, **, and ***, respectively.

Table 7: Results of dynamic panel threshold estimations with additional control variable

	Model 4a	Model 4b	Model 4c	Model 4d
	Inflows	Total flows	Inflows	Total flows
$\hat{\alpha}_1$	-0.0228***	-0.0533***	-0.0758***	-0.0724***
	(0.0056)	(0.0076)	(0.0135)	(0.0082)
Initial Gini	0.8836***	0.9239***	0.8231***	0.8314***
	(0.0561)	(0.0532)	(0.0482)	(0.0495)
Growth	-0.0013**	-0.0007	-0.0012**	-0.0011*
	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Secondary education	0.0066	-0.0006	-0.0031	-0.0020
	(0.0044)	(0.0042)	(0.0042)	(0.0043)
Age dependency ratio	0.0200*	0.0166	0.0011	0.02136*
	(0.0105)	(0.0104)	(0.0122)	(0.0118)
Trade Openness	-0.0012	-0.0125**	-	-
	(0.0068)	(0.0064)	-	-
Inflation	-	-	0.0010***	0.0009***
	-	-	(0.0003)	(0.0003)
Financial Openness				
Low Regime	0.0059***	0.0078***	0.0125***	0.0100***
	(0.0007)	(0.0011)	(0.0037)	(0.0011)
High Regime	0.0001	0.0001***	-0.0001	0.0001***
	(0.0001)	(0.0000)	(0.0001)	(0.0000)
Threshold estimate	10.3637	9.0468	4.2966	9.0468
95% confidence interval	[3.587-12.779]	[3.073-22.568]	[3.571-12.375]	[3.073-22.568]
Observations	301	301	301	301
N	43	43	43	43

Notes:

1. Low (high) regime refers to low (high) financial openness state.
2. Standard errors in parentheses. Significance at 10%, 5% and 1% are denoted by *, **, and ***, respectively.

Table 8: Results of dynamic panel threshold estimations with trade openness as threshold variable

	Model 5a	Model 5b	Model 5c	Model 5d
	Inflows	FDI inflows	Non-FDI inflows	Total flows
$\hat{\alpha}_1$	-0.1138***	-0.0757***	-0.1073***	-0.1038***
	(0.0083)	(0.0070)	(0.0064)	(0.0078)
Initial Gini	0.8972***	0.9550***	0.9179***	0.8610***
	(0.0475)	(0.0463)	(0.0454)	(0.0497)
Growth	-0.0022***	-0.0021***	-0.0017***	-0.0024***
	(0.0006)	(0.0005)	(0.0006)	(0.0006)
Secondary education	-0.0015	-0.0013	-0.0007	-0.0023
	(0.0042)	(0.0043)	(0.0041)	(0.0041)
Age dependency ratio	0.0469***	0.0434***	0.0408***	0.0406***
	(0.0110)	(0.0105)	(0.0110)	(0.0109)
Financial Openness Low Regime (Trade ≤ γ)	0.0096***	0.0032	0.0118***	0.0060***
	(0.0013)	(0.0039)	(0.0012)	(0.0008)
High Regime (Trade > γ)	0.0000	-0.0004	0.0001	0.0001***
	(0.0000)	(0.0003)	(0.0001)	(0.0000)
Threshold estimate	3.6177	3.4520	3.6177	3.6177
95% confidence interval	[3.452-3.727]	[3.238-3.702]	[3.238-3.641]	[3.238-3.702]
Observations	301	301	301	301
N	43	43	43	43

Notes:

1. Low (high) regime refers to low (high) trade openness state.
2. Standard errors in parentheses. Significance at 10%, 5% and 1% are denoted by *, **, and ***, respectively.

partially support the previous findings in which trade openness has a significant and negative correlation with the Gini coefficient in Model 4b.

The finding from robustness checks may also suggest that high trade openness might moderate the positive impact of financial openness on inequality in the low regime. Jaumotte et al. (2013) investigate the impacts of globalization in trade and finance on income inequality and find the effect insignificant. The authors explain that this is because the inequality-dampening effect of trade liberalization and the inequality-widening effect of financial openness have offset each other.

Inflation is regarded as a cruel tax that hurts the poor more than the rich, given that the rich are likely to have better access to financial instruments that hedge against inflation (Easterly & Fischer, 2001). Our findings in Model 4c and 4d confirm this view with a significant and positive coefficient found for the inflation variable.

In a nutshell, the qualitative results of the nonlinear IFI-inequality relationship still hold across Models 4a to 4d in Table 7 with additional control variables.

4.2.3 Trade openness as threshold variable

Previous empirical studies find a complementary effect between trade and financial liberalization. Notably, Aizenman & Noy (2003) discover that de facto financial openness depends positively on trade openness. Thus, to further shed light on the nonlinear linkage between IFI and income distribution, we also inspect such linkage conditional on different trade openness regimes.

Table 8 reports PTR results with trade openness acts as threshold variable. Interestingly, there exists evidence of nonlinear IFI-inequality nexus (except under FDI inflows where the low-regime coefficient is insignificant) even the regime considered is based on trade openness.

The majority of the countries in our sample, both tropical and temperate, have trade openness surpassing the estimated threshold values [7]. This implies that the income inequality effect induced by the financial opening process is weakening as the host economy becomes further globalized, both in cross-border financial flows and international trade.

5 Conclusion

Following the volatile capital flows and contagious financial market crashes witnessed from the emerging market crises during the end of the last century, the recent disastrous Global Financial Crisis, and the current ongoing COVID-19 pandemic, there had been controversy on whether the current economic liberalization is too excessive. While more comprehensive and in-depth research is needed to deal with such a broad topic, this chapter attempts to contribute to the debate by looking at the linkage between financial openness and income inequality.

Our results provide new evidence on the nonlinear relationship between IFI and income inequality using data from 43 countries covering the period from 1980 through 2014. The empirical results indicate that there exists a significant IFI threshold effect in the IFI-inequality linkage. For financial openness below the threshold, IFI indicators exert a positive impact on income inequality. However, once the degree of financial openness exceeds the threshold level, the effect of IFI on inequality will diminish. The qualitative results hold across four measures of IFI indicators and various robustness checks, such as when alternative Gini coefficient is used as the dependent variable when additional controls variables are included and when trade openness replaces financial openness as the threshold indicator.

[7] 16 tropical and 23 temperate economies are classified as high trade openness regime if we consider the threshold value at 3.6177. And the numbers change to 17 tropical and 21 temperate economies at threshold of 3.4520.

Previous empirical studies have suggested that while trade openness improves income distribution, financial openness worsens it. Our result confirms the positive effect of financial openness on income inequality, but the good news is that such an effect is weaker as the economic globalization process continues. The financial openness threshold, especially the FDI inflows based IFI is not hard to attain, as the majority of the tropical countries within our sample are identified as high FDI inflows regime. FDI inflows can therefore be seen as an important source of capital inflows that can help solve the structural poverty issue facing the tropics without creating too much burden on the country's income gap. As for non-FDI inflows, the tropical countries will need a more sophisticated income distribution policy as their financial market further opens up to accept more non-FDI investment flows.

Our study only establishes the first step of identifying a nonlinear IFI-inequality nexus. Other questions such as which factors lead to such nonlinearity or whether the effect of IFI on growth is permanent or transitory remain further explored in the future.

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Appendix

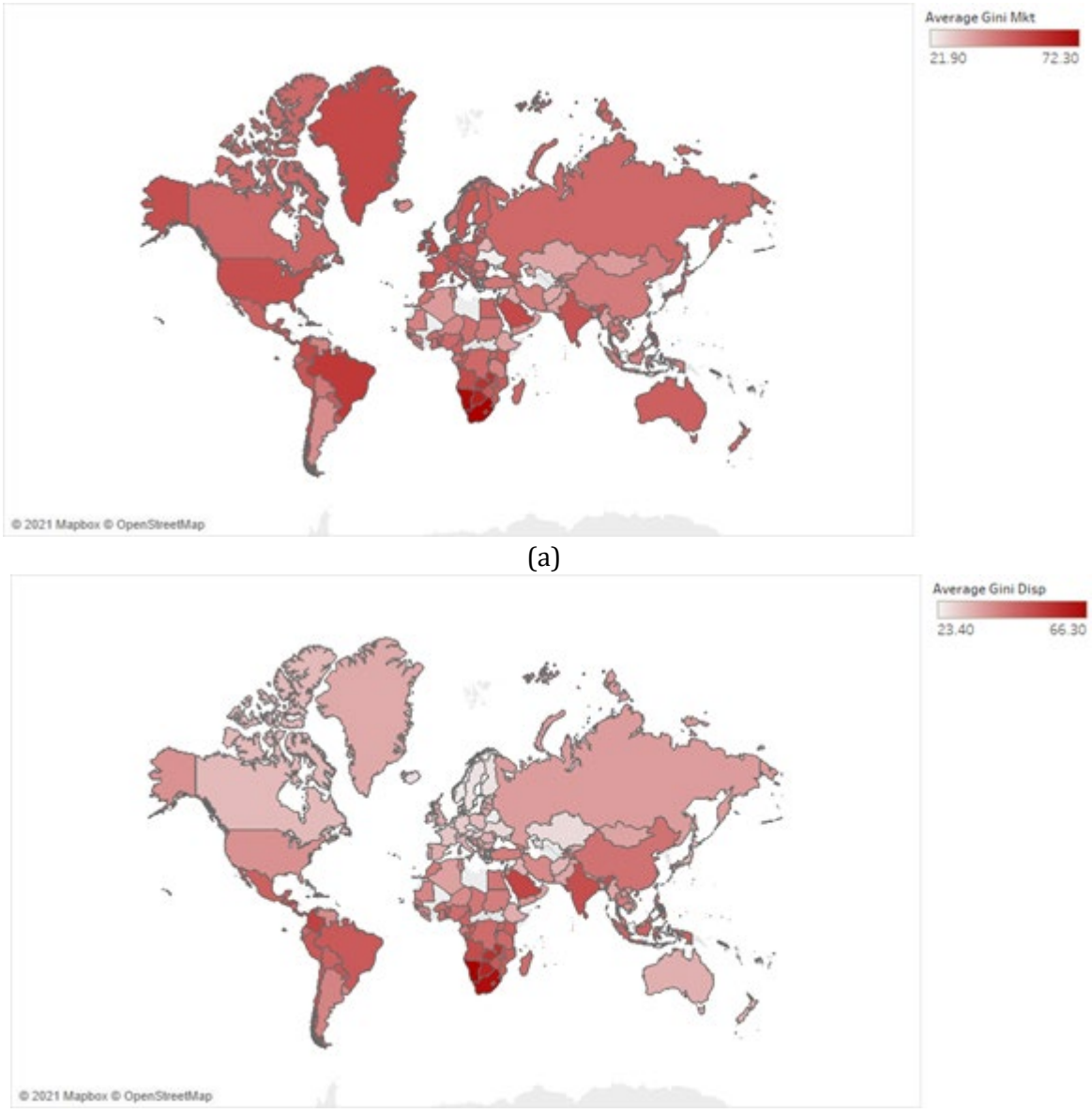

Figure 1: World map of the Gini coefficients by country based on (a) average Gini Market value and (b) average Gini Disposable value for the period 2010-2014.

Table A1: List of Countries

Tropical (20)		Temperate (23)	
Bangladesh	Philippines	Argentina	Italy
Barbados	Sierra Leone	Canada	Korea, Rep.
Brazil	Singapore	Chile	Netherlands
Colombia	South Africa	China	Norway
Costa Rica	Sri Lanka	Denmark	Pakistan
Fiji	Tanzania	Egypt, Arab Rep.	Portugal
India	Thailand	Finland	Spain
Indonesia	Venezuela, RB	France	Sweden
Malawi		Germany	Switzerland
Mexico		Greece	United Kingdom
Panama		Hungary	United States
Peru		Israel	

Table A2: List of Countries

Variable	Definition	Sources
gini_mkt	Logarithm of Gini index calculated from household market (pre-tax, pre-transfer) income	Solt (2009)
gini_disp	Logarithm of Gini index calculated from household disposable (post-tax, post-transfer) income	Solt (2009)
IFI variables		
Inflows	Absolute inflows of capital, divided by GDP	IFS
FDI Inflows	Absolute inflows of FDI investments, divided by GDP	IFS
Non-FDI Inflows	Absolute inflows of portfolio and other investments, divided by GDP	IFS
Total flows	Sum of absolute inflows and outflows of capital, divided by GDP	IFS
Control variables		
Initial gini_mkt	First observation of every five-year interval for gini_mkt	Solt (2009)
Initial gini_disp	First observation of every five-year interval for gini_disp	Solt (2009)
Growth	GDP per capita growth (annual %)	WDI
Secondary education	Logarithm of average years of secondary school education	Barro and Lee (2013)
Age dependency ratio	Logarithm of the ratio of people younger than 15 or older than 64 to people ages 15-64.	WDI
Trade Openness	Logarithm of the sum of exports and imports to GDP	WDI
Inflation	GDP deflator (annual %)	WDI