Capital Markets Review Vol. 27, No. 1, pp. 1-18 (2019)

Financial Openness and Trade Openness Nexus: Empirical Evidence from Global Data

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Abstract: Over the past decades of globalization, most of the countries in the world is eventually opening up their financial markets which is believed to be an engine in fostering economic growth and development. Perhaps, it is not an exemption for their real market (goods and services), in particular market integration with other countries via trade liberalization. Indeed, the 'interconnectedness' between these two markets remains unclear from the empiric perspective. The objective of this study is to offer a fresh empirical evidence of financial openness and trade openness nexus. Both *de jure* (KAOPEN) and *de facto* (foreign direct investment inflow, FDII and outflow, FDIO) of financial openness are employed to link with trade openness (ratio of total trade, exports and imports to GDP) with an unbalanced panel data of 115 countries spanning between 1970 and 2014. The results of Granger non-causality tests show a two-way causality between *de facto* financial openness (FDII and FDIO) and trade openness, but it is not the case for *de jure* measure, in general (full panel data). Also, a two-way causality is observed for high, upper-middle, and low income groups, except for lower-middle income group, in which trade openness causes financial openness. This study does also support the interdependent hypothesis between real sector and financial sector, and this insight has important policy implication.

Keywords: Causality, financial openness, foreign direct investment, trade openness.
JEL classification: F3, F15

1. Introduction

In an era of financial globalization, in particularly capital markets liberalization (i.e. stock market and bond market), their correlation with the goods and services market (real sector) has been accepted the most contentious aspect of open economy macroeconomics (and financial economics). Generally speaking, a crucial role that capital markets play is to finance strategic sectors such as infrastructure, corporate, SMEs (small and medium enterprises), and so on. Their [capital markets] contributions to economic growth are increasingly being highlighted in the G20 (Group of Twenty) agenda.[1] That is capital markets connect monetary sector with real sector via. several fundamental transmissions channels, in which they enhance efficient of financial intermediation that increases mobilization of savings, and therefore improves efficiency and volume of investments, economic growth, and development.[2]

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Received 27 April 2019; Accepted 20 August 2019; Available online 24 September 2019.

[1] Capital Markets. http://www.worldbank.org/en/topic/financialsector/brief/capital-markets
[2] The Role of the Capital Market in the Economy. https://www.proshareng.com/news/Capital%20Market/The-Role-of-the-Capital-Market-in-the-Economy/28259

According to Akyüz (1993), financial openness can be broadly described as based on its three respective transactions, namely i) inward transactions - residents are permitted to borrow freely in foreign markets and foreigners are allowed to invest without restriction in domestic markets; ii), outward transaction - residents can transfer fund and hold foreign financial assets and meanwhile, non-residents can issue bond and finance in domestic markets; and iii) domestic transaction in other countries' currencies - bank deposits and lending in foreign currencies can be done among residents. Meanwhile, trade openness or trade liberalization[3] is more generally about reduction in tariffs[4] including non-tariff measures, and/or removing barriers to trade such as quotas - it is a 'reversed' process of protectionism. India, for example, a developing country which has undergone a significant depreciation of her real exchange rate, to which it increases export incentives and cushions the impact of lower import barriers on domestic industry before starting to liberalize trade in the early 1990s that trade liberalization preceded the opening of the capital account.[5] In fact, as highlighted by Rajan and Zingales (2003), financial development is not attainable without the combination of financial openness and trade openness. Eventually, financial development is a desirable outcome of financial openness or liberalization (Terrones, 2008). On the other hand, if a country's financial system becomes more advanced and comprehensive, she tends to have higher degree of financial openness - it is to say that a country relaxes the regulation on foreign capital and connects intensively with foreign financial system. Undoubtedly, financial openness is the consequences of communication between market forces and the enforcement of existing regulations (Aizenman and Noy, 2009).

It is important to note that, in order to pursue further financial development, financial openness and trade openness are inseparable. Rajan and Zingales (2003) have explained in their study that trade not only brings new opportunity into local market but also competition as it will create urgency forcing incumbents to increase their investment. When competing with foreign market, industrial incumbents can request for government loan subsidies - this sort of intervention can decrease the transparency of the financial structure. But, trade openness alone is unlikely to reach financial development. As they (Rajan and Zingales, 2003) have explained, when a country liberalizes its capital account with foreign countries - it enables the well-known local company to access for foreign funds. Yet, if there is no rival in the goods markets, those local companies may not have the need for foreign funds. Industrial firms will against financial development and repress the new entrants. Hence, the return of local financial institution from doing the finance services with leading industrial company reduces. Financial institution will need to overcome the objection of local industrial firms if they attempt to open financial market. Financial openness solely is unlikely to induce both financial and industrial incumbents to achieve for financial development.

Akyüz (1993) acknowledges that despite widespread claims for efficiency of financial markets, financial liberalization in many countries in recent years has generated more costs than benefits. Among them the costs include the persistent misalignment of prices of financial assets, inefficiencies in the allocation of resources, increased financial fragility and reduced household savings, and loss of autonomy in pursuing interest-rate and exchange-rate policies in accordance with the needs of trade and industry. By the same token, Ito (2004) finds higher financial openness reduces the likelihood of a currency crisis for industrialized countries and less developed countries, but it is not the case for emerging market countries. According to

[3] Trade openness is generally defined as elimination or lessening of trade barriers between countries in term of goods exchange (Lee, 2005). It evaluates level of a country's economic policies when connecting to foreign countries in terms of import and export. More technically, it is the sum of exports and imports as ratio to GDP.

[4] Trade Liberalization and Economic Development, https://research.stlouisfed.org/publications/economic-synopses/2018/04/20/trade-liberalization-and-economic-development

[5] Chapter 5 Trade Liberalization: Why So Much Controversy? http://www1.worldbank.org/prem/lessons1990s/chaps/05-Ch05_kl.pdf

Schmukler (2004), however, financial globalization (openness) is important for upper-middle income group or developing countries as it led to a more financially interconnected world and a deeper degree of financial integration with international financial markets. While a better-functioning financial system with more credit is key because it fosters economic growth. Besides, developing countries can benefit from financial globalization and should take advantage of it, and financial liberalization tends to develop the financial system. Meanwhile, trade liberalization in developing countries has had some modest benefits, but the simultaneous current and capital market liberalization have been associated with strong exchange rates and high interest rates, creating problems with productivity growth and income distribution and development.[6]

This study sheds light on the existing literature by offering a fresh empirical evidence of financial openness and trade openness nexus, in a sense of Granger panel non-causality, from a richer panel data of 115 countries (1970-2014). A seminal work by Aizenman (2008) has examined the effects of change in trade openness, and fluctuation in GDP (Gross Domestic Product) per capita on change in financial openness by using panel regression(s) for all available countries worldwide (1969-1998). The study (Aizenman, 2008) suggests further study to examine the possible reverse linkages between financial openness and trade openness. Aizenman and Noy (2009)'s study re-looks at the impact of lagged trade openness as well as other control variables on financial openness for 83 countries for the sample period 1982-1998. They also consider causality tests between these variables, and suggest a possible reversed linkage i.e. the influence of financial openness on trade openness. Other studies on the topic about the underlying relationships between financial openness and trade openness are Hanh (2010) for 29 Asian developing countries, Asongu (2010) for 29 African countries, and Zhang *et al*. (2015) for 30 Chinese provinces. Clearly, the existing theoretical and empirical literatures on financial openness (financial sector) and trade openness (real sector) nexus have not been examined extensively, and they offer negligible evidence. Their findings are based on regional data, instead of to consider a global evidence with all countries worldwide as well as their income levels given their data availability as this study with an unbalanced panel data of 115 countries.

Therefore, the objective of this study is to investigate the causation between financial openness and trade openness by considering *de facto* financial openness measures of foreign direct investment inflows (FDII), and outflows (FDIO) with worldwide data as well as different income groups, namely high, upper-middle, lower-middle, and low income groups as classified by the World Bank Country and Lending Groups[7]. This study complements previous studies by documenting that a two-way causality occurs between *de facto* financial openness (FDII and FDIO) and trade openness, but no evidence of using *de jure* financial openness. Also, a two-way causality occurs for high, upper-middle, lower-middle, and low income groups, except for lower-middle income group that causation is from trade openness to financial openness.

The structure of this study is organized as follows. Relevant studies have been reviewed in the Section 2. Section 3 briefly introduces the conceptual framework that has been backed up by the 'connectedness' or 'interdependent' between financial market, and real market, the variables (unbalanced panel data) used - financial openness (*de jure* and *de facto* measures), and trade openness, and testing method - Granger panel non-causality test. This section also reports their summary statistics, correlation matrix, as well as the results of panel unit root tests. Section 4 reports the core empirical results as obtained from the Granger panel non-causality tests. The last section concludes this study.

[6] Negative Effects of Trade and Capital Market Liberalization: https://www.twn.my/title/negat-cn.htm
[7] World Bank Country and Lending Groups, https://datahelpdesk.worldbank.org/knowledgebase/articles /906519-world-bank-country-and-lending-groups

2. Literature Review

Of the literature search, only two studies are the most related to this topic by examining the association [the effect] between financial openness and trade openness. A seminal work by Aizenman (2008) has explored the impact of trade openness on financial openness. This topic has been followed up by Aizenman and Noy (2009) by looking at the possible causations between these variables, Aizenman (2008) has offered an insight on the effect (impact) of trade openness on financial openness with *de facto* measure by sum of gross private capital inflows and outflows as a ratio to GDP. In the study, an *ad hoc* equation outlines financial openness as a function of trade openness, and GDP per capita. The results from a panel data of developing countries and OECD (Organization for Economic Co-operation and Development) countries over the period 1969-1998, show that trade openness has a positive effect on financial openness, in which a 10% rise in trade openness is associated with 2.6% increase in financial openness for the case of developing countries. But, deterring for the OECD countries that a 10% opening up the trade market, the financial openness is increased by about 2%. It is technically to note on the idea that the *cause* occurs before the *effect*, which is the basis of most, but not all, causality definitions (see, Granger, 1969; 2003). This concern has been taken into accounted by Aizenman and Noy (2009). The study (Aizenman, 2008) forwards that "… *The public finance linkage between trade and financial openness is only one of the possible channels explaining the association between the two*" (p. 381). Aizenman recommends further research to look into the impact of financial on trade openness.

Using panel data of 83 countries (1982-1998), a catch up work by Aizenman and Noy (2009) have extended Aizenman's (2008) equation to which financial openness (proxied by *de facto* measure) is assumed to be explained by the lagged trade openness, a set of macroeconomic variables (i.e. GDP per capita, government's budget surplus, inflation, world interest rate), and political-economic variables (i.e. democracy index, government fractionalization, corruption level - Herfindahl index). Their core finding is that trade openness has positive implication on future financial openness. More precisely, the decomposition of causality shows that 53% for financial openness causes trade openness, 34% for trade openness causes financial openness, and only 13% for their two-way causality.

On the other hand, Hanh (2010), in a report entitled "*Financial development, financial openness and trade openness: new evidence*" looks at some relationships among financial development, financial openness, and trade openness for 29 Asian countries for the period 1994-2008. It shows the existence of a long-run (cointegration) relation between these variables, and other control variables, namely GDP growth, GDP per capita, International Country Risk Guide (ICRG), and real exchange rate. Hanh concludes that trade liberalization of emerging countries is being considered as a threshold for financial development and financial openness. Both financial development and financial openness do improve trade openness in developing countries. A recent research published by Zhang *et al.* (2015) is aimed to examine the effect of liberalization in financial market and trade market on financial development for 30 China's provinces over the sample period between 2000 and 2009. A set of control variables are included, namely real per capita GDP, government spending, the share of industrial production of state-owned enterprises, and the gross enrollment rate. In contrary to early studies, the results from dynamic panel estimation techniques show that for the case of China, opening up the both trade and financial markets has a negative impact on the size of financial development. But, openness of both markets has positive impact on the financial and competition for the most open provinces, while negative for the least open regions.

Study also considers both the financial openness and trade openness as explanators to other behavior variable(s), especially financial development. For instance, Law (2007) examines the influence of trade openness and financial openness (i.e. private capital inflow) on financial development (proxied by private sector credit and stock market capitalization) for panel data

of 68 countries between 1980 and 2001. Other variables included are real GDP per capita, and five institutional variables (corruption, rule of law, bureaucratic quality, government repudiation of contracts and risk of expropriation). He finds that both financial and trade openness encourage financial development, however, the impact is relatively large for middle income groups by comparing to high income, and low income groups. Also, the positive effect of the interaction terms between financial openness and trade openness are greater than their individual impact. Similarly, Baltagi *et al.* (2009) have employed GDP per capital, trade openness, financial openness, financial liberalization, institutional quality, average trade openness of nearby countries as key determinants of financial development for the datasets of between 21 and 42 (industrialized and developing) countries during the sample period 1980-2003. Their study documents that trade openness is negatively related to the level of financial openness, while financial openness is associated negatively with trade openness. The study recommends the relatively 'closed' countries those can maximize their gain by further liberalizing both trade and financial markets together.

Other group of studies test the relationships between financial openness and other macroeconomic variables. Among them are economic growth (Estrada *et al.*, 2015), productivity (Bekaert *et al.*, 2011), economic integration (Carmignani and Chowdhury, 2006), and so on. Meanwhile, another bunch of relevant studies look at the relationships between trade openness and other variables i.e. economics growth (Yanikkaya, 2003; Gries and Redlin, 2012; Huchet-Bourdon *et al.*, 2018), financial development (Rajan and Zingales, 2003), and foreign direct investment (Liargovas and Skandalis, 2012).

3. Conceptual Framework, Data, and Methods

3.1 Conceptual Framework

Figure 1 represents the "*Three Type of International Transaction*" from Krugman *et al.*'s (2012) which explains the inter-relationships between financial market (assets) and real market (goods and services). It offers a conceptual framework to backup this study. According to Krugman *et al.* (2012, p. 588), *"...If Home has a current account deficit with Foreign, for example, it is a net exporter of assets to Foreign and a net importer of goods and services from Foreign"*. An 'older' hypothesis as similar to above is from Fausten (1989-90) on the 'interdependence' of between the two component accounts of balance of payments (BoP), namely current account (real market), and financial account (financial market). It exhibits the responses between both the capital and current accounts to economic disturbance, and their interaction throughout the adjustment process. In an open economy, the process of adjustment results concurrent changes in the real market and financial market to which must be mutually consistent. As documented that *"...Any residual imbalances between the component accounts precipitate further exchange rate changes, or, in a fixed rate system, official exchange market intervention. Unless perfectly sterilized, these changes feed back into the complex of structural relationships that determine real and financial behavior and the balances on current and on capital accounts"* (Fausten, 1989-90, p. 290).[8] It is true that as Beck (2003) in his study finds that countries with more developed financial system are tended to have higher export shares and trade balances in the industries with higher dependence in external finance.

On the other hand, Aizenman (2008) has depicted that higher degree of trade liberalization has raised the efficiency of financial liberalization via creating the incentive for capital flight

[8] Tang and Fausten's (2012) study offers a limited evidence of supporting this 'interdependent' hypothesis with only by the data of five developing countries and G-5 economies. The findings from BoP constraint specifications support all of the underlying countries, except for France. The U.S., the U.K., and Japan are supported by only two specifications. But, only the U.K., Germany, and Japan are supported by the open economics macro equilibrium specifications.

- Higher trade openness shrinks the degree of financial control selected by developing economies as it raises the financial control implementing cost, and decreases the effectiveness of financial repression - restructuring in financial system may be the by-product of trade openness. Eventually, it can be considered as a *necessary* condition for this mechanism [interdependent between financial market and real market] to take place, is to ensure these markets are *sufficiently* opened up. To test this intuition (hypothesis), this study considers Granger panel non-causality method which is widely applied in order to ascertain inter-relationships between two (or more) endogenous variables.

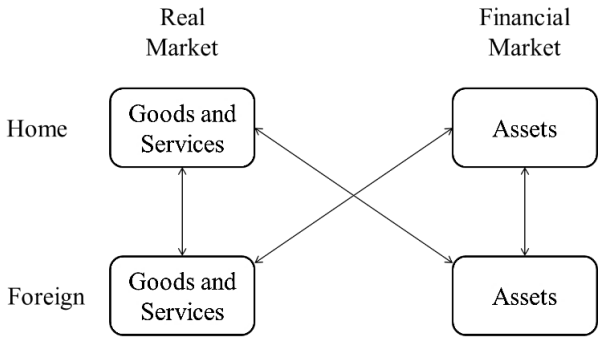

Figure 1: Krugman's framework of "The Three Type of International Transaction"
Source: Krugman *et al*. (Figure 21-1, 2012, p. 588)

3.2 Variables, Data, and Statistical Properties

This study employs an unbalanced panel data of 115 countries (see, Appendix A) for at least 30 annual observations between 1970 and 2014.[9] The variables are i) *de jure* measure of financial openness (KAOPEN) provided by Chinn and Ito (2006),[10] ii) *de facto* measures of financial openness (Zhang *et al.*, 2015), net foreign direct investment inflows (FDII) and outflows (FDIO),[11] and iii) trade openness (TO) that is the sum of exports and imports of goods and services measured as a share of gross domestic product, which is from the same data source as ii).

Table 1 is about the summary statistics of the underlying variables as described above. In general, the world (that is all countries) has the lowest financial openness (KAOPEN) with a negative value of -0.03 (mean). More interestingly, financial openness and trade openness are observed to be positively correlated, i.e. the highest financial openness is associated with the highest trade openness in high income countries, and *vice versa* for low income group. Meanwhile, the highest (averaged) score of KAOPEN, 1.10 is from high income group, and

[9] It is due to the data availability for *de jure* KAOPEN provided by Chinn and Ito (2006). Countries with at least 5 consecutive observations of missing values are excluded. Otherwise, the missing values (less than 5 observations) are estimated by an average between the two available data.

[10] That is from the hyperlink http://web.pdx.edu/~ito/Chinn-Ito_website.htm. It aims to measure the intensity of restriction on capital account transaction. KAOPEN is binary dummy variable constructed based on the tabulation of restrictions on cross-border financial transactions reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER).* The index includes four variables that informing the degree of control on external account in following aspects: the existence of multiple exchange rates, restrictions on current and capital account transactions and the requirement of the surrender of export proceeds, ranges from -1.89 (least financially open) to 2.39 (most financially open).

[11] Both FDII and FDIO data are collected from the World Development Indicators, World Bank (https://databank.worldbank.org/data/) as reported as percentage of GDP. Hanh (2010) considers foreign direct investment (total FDI inflows to GDP ratio), and gross private capital (percentage of Gross private capital flows to GDP) as *de facto* measure of financial openness. It can be measured by total capital flows as a ratio to GDP, such as (Lane and Milesi-Ferretti, 2006).

the lowest is from low income group (-0.86). Similar observation occurs for the *de facto* measures both FDII and FDIO that high income group has the highest FDII (0.04) and FDIO (0.03), while low income group experiences the lowest FDII (0.02) and FDIO (0.001), respectively. And, trade openness variable shows the highest average of 0.89 for high income group, and the lowest mean is from low income group with 0.53.

Table 2 reaffirms the correlations between the underlying variables. A positive correlation exists between financial openness and trade openness, except for the case between KAOPEN and TO for lower-middle income group with a negative correlation of -0.009 (eventually insignificant). The largest correlation is observed for upper-middle income group (0.508) with financial openness measure of FDII.

Table 1: Summary statistics

Variables	Income Group	Mean	Median	Maximum	Minimum	Std. Deviation
$KAOPEN_{i,t}$	All	-0.027	-0.573	2.389	-1.895	1.523
	High	1.103	1.870	2.389	-1.895	1.470
	Upper-middle	-0.364	-1.116	2.389	-1.895	1.344
	Lower-middle	-0.618	-1.189	2.389	-1.895	1.218
	Low	-0.861	-1.189	2.389	-1.895	0.868
$FDII_{i,t}$	All	0.030	0.012	4.517	-0.552	0.122
	High	0.043	0.013	4.517	-0.435	0.200
	Upper-middle	0.033	0.019	1.618	-0.552	0.076
	Lower-middle	0.020	0.011	0.372	-0.258	0.034
	Low	0.016	0.007	0.465	-0.286	0.036
$FDIO_{i,t}$	All	0.014	0.002	2.198	-0.897	0.090
	High	0.032	0.008	2.198	-0.897	0.143
	Upper-middle	0.004	0.001	0.069	-0.082	0.010
	Lower-middle	0.003	0.000	0.198	-0.249	0.020
	Low	0.001	0.000	0.337	-0.065	0.018
$TO_{i,t}$	All	0.752	0.626	5.317	0.049	0.526
	High	0.887	0.697	4.426	0.107	0.682
	Upper Middle	0.810	0.761	5.317	0.049	0.544
	Lower Middle	0.668	0.611	1.886	0.063	0.325
	Low	0.530	0.500	1.409	0.132	0.199

Table 2: Correlation matrix

	All	High	Upper-middle	Lower-middle	Low
			$KAOPEN_{i,t}$		
	0.211	0.018	0.125	-0.009	0.039
			$FDII_{i,t}$		
$TO_{i,t}$	0.330	0.300	0.508	0.386	0.345
			$FDIO_{i,t}$		
	0.200	0.214	0.133	0.191	0.186

Notes: Covariance analysis method: Ordinary Pearson Correlation. Based on the result of panel unit root tests, $\Delta KAOPEN_{i,t}$ is applicable to high income, while $\Delta TO_{i,t}$ is used for high and lower-middle income groups.

3.3 Panel Unit Root Tests

Three panel unit root tests namely Im, Pesaran, and Shin (IPS) (Im *et al.*, 2003), the Fisher-ADF, and PP tests (Maddala and Wu, 1999; Choi, 2001) are employed in order to test the stationarity of the underlying variables. If an OLS (ordinary least squares) regression consists non-stationary variables, it could exhibit *spurious* relationship(s) in which, the OLS estimates and *t* statistics indicate that a relationship exists when, in reality, there is no such relationship. A remedy is to transform the non-stationary $I(1)$ variables, for example into stationary $I(0)$ by differencing them once. Similarly, it implies that OLS estimator including for panel [VAR] (vector autoregression) Granger panel non-causality test, is feasible for only stationary

variables. Their results (test statistics) are reported in Appendix B. In short, for KAOPEN, all three tests reject the null hypothesis of a unit root – they are stationary at levels, except for high income group which is in *I*(1) process. The foreign direct investment inflow (FDII) and foreign direct investment outflow (FDIO) both are found to be stationary at levels, *I*(0) as suggested by the three tests. Trade openness is found to be stationary at level for all, upper-middle, and low income groups. For high, and lower-middle income groups, the results are inconclusive i.e. IPS and ADF-Fisher test suggest *I*(0), but PP-Fisher test suggest *I*(1). Hence, this study handles them as *I*(1). The *I*(1) variables of the respective groups are then differenced once to achieve stationary, *I*(0) for the panel VAR equations for non-causality tests.

3.4 Testing Method – Granger (2003) Panel Non-Causality Tests

In brief, with the rapid development of panel causality tests that started with the GMM (generalized method of moments) estimator by restricting the lagged of the independent variable, Hurlin and Venet (2001), and Hurlin (2004) have proposed alternative approaches for Granger panel causality tests those take into account the heterogeneity that has been ignored in the literature. In line with this concern, this study also considers a recent panel non-causlity testing method proposed by Dumitrescu and Hurlin (2012). Detailed methodology of this test is not documented here, but available from their study. In general, it is an extended test of Granger (1969) panel non-causality method as above, which accounts for heterogeneous panel data models, and their standardized panel statistics have very good small sample properties, even in the presence of cross-sectional dependence. However, a reservation of this method holds since this method requires that the panel must be balanced. In order to follow this requirement, this study makes the unbalanced panel data i.e. for the Granger (1969) panel non-causality tests, into balance panel with observations deleted due to missing and discontinues. As a result, some computations are infeasible, and their results may be interpreted with caution. For comprehensiveness, their findings are briefly reported in the next section after the Granger non-causality tests.

This study considers the Granger (2003) panel causality method by ordinary least squares (OLS) estimator, the simplest one but sufficient given the nature of unbalanced panel data. Granger (2003, p. 70) has noted that "*Various causality definitions have been used with panel data, which could be considered as a vector of time series, at least theoretically. When using G-causality, the test usually asks if some variable, say* X_t*, causes another variable, say* Y_t*, everywhere in the panel, in notation* $X_{jt} \Rightarrow Y_{j,t-1}$, for every j ["country" in the panel]." The details of this testing method not reported here since it has been widely employed in applied economics. It can be further referred to Granger (2003). The causal linkages among the underlying endogenous variables i.e. financial openness (FO), and trade openness (TO) in this study can be written with the following pairwise regressions (1) and (2).

$$FO_{i,t} = \alpha_{0,i} + \alpha_{1,i}FO_{i,t-1} + \cdots + \alpha_{k,i}FO_{i,t-k} + \beta_{1,i}TO_{i,t-1} + \cdots + \beta_{k,i}TO_{i,t-k} + \varepsilon_{i,t} \quad (1)$$

$$TO_{i,t} = \alpha_{0,i} + \alpha_{1,i}TO_{i,t-1} + \cdots + \alpha_{k,i}TO_{i,t-k} + \beta_{1,i}FO_{i,t-1} + \cdots + \beta_{k,i}FO_{i,t-k} + \varepsilon_{i,t} \quad (2)$$

where t is the time period dimension of the panel and i is the cross-sectional dimension i.e. countries. It treats the panel data as one large stacked set of data, and then perform the Granger panel non-causality test in the standard way, with an exception of not letting data from one cross-section enter the lagged values of data from the next cross-section. It is assumed all coefficients are same across all cross-sections that is $\alpha_{0,i} = \alpha_{0,j}, \alpha_{1,i} =$

$\alpha_{1,j}, \ldots, \alpha_{k,i} = \alpha_{k,j}, \forall i, j$ and $\beta_{1,i} = \beta_{1,j}, \ldots, \beta_{k,i} = \beta_{kj} \forall i, j$. A [standard] *Wald*-test procedure is to test the null hypothesis of "*TO* does not Granger-cause *FO"* for *FO* regression (i.e. $H_0 : \beta_{1,i} = \cdots = \beta_{k,i} = 0$, against $H_1 : \beta_{1,i} \neq \cdots \neq \beta_{k,i} \neq 0$) while "*FO* does not Granger-cause *TO*" for *TO* regression (i.e. $H_0 : \beta_{1,i} = \cdots = \beta_{k,i} = 0$, against $H_1 : \beta_{1,i} \neq \cdots \neq \beta_{k,i} \neq 0$). If the null hypothesis of *FO* regression is rejected at least, at 0.10 level, a causality is said from *TO* to *FO* can be inferenced, and *vice versa* for *TO* regression. The variables included into the VAR framework are stationary or *I*(0) including those first-differenced *I*(1) variables as suggested by the panel unit root tests.

4. Empirical Results

The empirical results of [pairwise] Granger panel non-causality test are reported in Appendix C1. The causalities happen throughout between 1 and 6 lags. For convenience purpose, these results are illustrated in Figure 2 on the direction(s) of causation between financial development in connection with all countries, and their four income groups (i.e. high, upper-middle, lower-middle, and low). This study takes into account a set of lag length between 1 and 6 in order to capture the possible causations between financial openness and financial openness as some may require a shorter (or longer) transmission lag, which is empirical matter.

Given at least 10% level of significance, a two-way causality is found between both *de facto* financial openness measures and trade openness for all countries panel[12] regardless of their lag orders (i.e. between 1 and 6), while *de jure* financial openness fails to support this finding. *De facto* financial openness (either FDII or FDIO) is capable to support this causality, instead of *de jure* financial openness. It is consistent with Quinn *et al*. (2011) that "*De jure* indices of financial globalization do not reflect the extent to which actual capital flows evolve in response to legal restrictions… therefore, do not necessarily reflect a country's actual degree of financial integration, highlighted by the fact that even countries with relatively closed capital accounts became substantially more financially integrated over the past decades" (p. 493-4).[13] To the extent that this 'generalized' finding of two-way causality between financial openness and trade openness, *partly* supports the "current and capital account interdependence" hypothesis (Fausten, 1989-90) i.e. interconnectedness between financial sector, and real sector, at least from their openness.

As expected, different income groups (i.e. high income, upper-middle income, lower-middle income, and low income) offer different findings due to the nature [characteristics] of countries' under their respective income group. It is relevant for policy implications. For the high income group, two-way causality only happens between FDIO and trade openness growth, but no for FDII (as for all countries panel). And, both right-hand side lagged KAOPEN growth, and FDII of the TO growth equations are statistically significant (at least 10%), informing a one-way causality from financial openness to trade openness. The KAOPEN has a shorter transmission period of between 1 and 2 lags to cause trade openness than of *de facto* measure FDII and FDIO with 1-6 lags. Upper-middle income group has slightly similar findings with all countries panel that no causality between KAOPEN and trade openness, which is the only income group with such finding. A two-way causality occurs between FDII and trade openness, while a one-way causation is found from trade openness to FDIO only with a year lag.

[12] A two-way causality result is found to be consistent with Aizenman and Noy (2009).

[13] For example, China can also experience financial development while maintaining a relatively closed financial system Estrada (2015, p. 1).

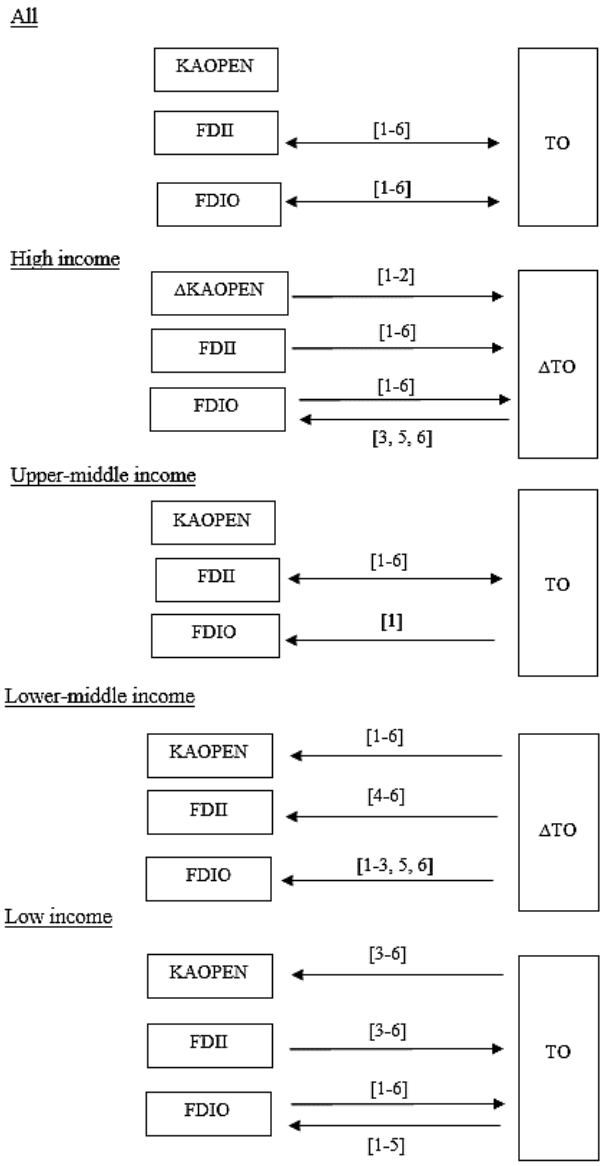

Figure 2: Diagram for the Granger panel non-causality findings

Of the four income groups, it is interesting to find that for lower-middle income group only one-way causality from trade openness growth to financial openness regardless of their financial openness measures either de jure (KAOPEN) or de facto (FDII and FDIO), but with different lag length. This finding is contrary with Hanh (2010) that financial development and financial openness help to lead trade openness in developing countries (i.e. 29 Asian countries). It informs that trade liberalization eventually a priority policy to be implemented by lower-middle income countries in order to open up their financial market, in particularly capital markets for fostering economic growth and development.

Lastly, low income group has mixture findings. A two-way causality is found between FDIO and trade openness, but a one-way causality from FDII to trade openness. As similar to

lower-middle income growth, trade openness does Granger cause KAOPEN, a de jure measure, but no reversed causality. This section also considers here the findings of Dumitrescu and Hurlin (2012) panel non-causality tests for comprehensiveness. The computed test statistics are reported in Appendix C2. As highlighted early, however, some test statistics may be incomputable because of insufficient observations after converting into balanced panel, for example the de jure financial openness, KAOPEN, except for, low income group. It is also the case for de facto measure that high income group is incomputable for higher lag order of 4-6; and for lower-middle income group with causation between FDIO and TO, as well as 3-6 lags for low income group. For convenience, their empirical findings are illustrated as in Figure 3.

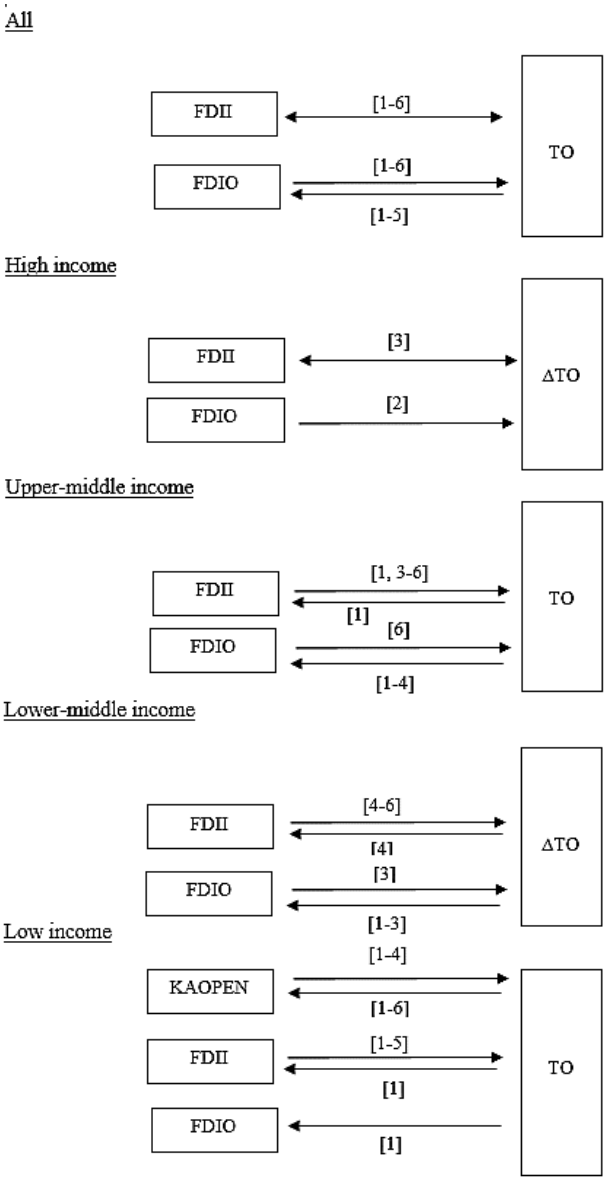

Figure 3: Diagram for the Dumitrescu and Hurlin, (2012) Granger panel non-causality findings

Generally speaking, the findings are observed to be inconsistent with the Granger panel non-causality tests, except for all countries that a two-way causality is found between both FDII and FDIO, and TO. Let say, Dumitrescu and Hurlin tests show high income growth for two-way causality between FDII and ΔTO, but Granger panel non-causality tests show one-way causality from FDII to ΔTO, while only one-way causality from FDIO to ΔTO, but two-way causality is found in the previous tests. As the clarification of the potential 'caution' of implementing this 'recent' non-causality tests as mentioned early, this study delivers the findings those based on the Granger panel non-causality tests, instead of Dumitrescu and Hurlin (2012).

5. Conclusion

In this study, an empirical evidence has been offered on the causation between financial sector (including capital markets) openness and trade (real sector) openness from an unbalanced panel data of 115 countries spanning between 1970 and 2014. There is a two-way causality between *de facto* financial openness (FDII and FDIO) and trade openness, but no causation when *de jure* financial openness (KAOPEN) is being tested in general, that is the full panel of all countries. It reveals that real sector, and financial sector are interdependent. The *de facto* financial openness – both FDII and FDIO offer richer finding than of the *de facto* financial openness (KAOPEN) on the causality between financial openness and trade openness with regard to their lag structures. Of the different income groups, a two-way causality is also found between financial openness (either *de jure* or *de facto* measure), and trade openness, except for the lower-middle income group that only one-way causality from trade openness (growth) to financial openness.

These findings are relevant for policy implications. Given a two-way causality between both sectors, policies to liberalize both financial market, and goods and services market (trade) are essential to be implemented simultaneously since opening up either market helps to further liberalization of other market, except for the lower-middle income countries. Perhaps, its relevant has been implemented globally, but further improvements and implementations are required in order to ensure a success story. Let say, the International Monetary Fund (IMF) that policies those make an economy open to trade, and investment with the rest of the world are needed for sustained economic growth given a stylized fact that no country in recent decades has achieved economic success (i.e. substantial increases in living standards) without being open to the rest of the world.[14] Furthermore, as reported by the World Bank, an estimated $4 trillion annual investment is required for developing countries to achieve the Sustainable Development Goals (SDGs) by 2030, and the investment requirement and the Maximizing Financing for Development (MFD) strategy is in helping countries maximize their development resources by drawing on private sector financing to which there is a greater need to develop and strengthen capital markets in order to mobilize commercial financing; and well-functioning capital markets require incentive structures to *crowd in* commercial investors, an enabling policy and regulatory framework, and synchronization of robust regulatory framework with institutional capacity.[15] Policy makers are advised to further liberalize a country's financial market, more importantly the capital market that helps in fostering trade openness, except for the lower-middle income group. The countries from the lower-middle income should open up their trade *a prior* to liberalize the financial market, for instance trade policies on, at least reducing trade barriers i.e. tariffs (including non-tariff measures), quotas, and so on will improve the degree of financial openness. Also, IMF has forwarded a need for both industrial and developing countries to

[14] Global Trade Liberalization and the Developing Countries. https://www.imf.org/external/np/exr/ib/2001/110801.htm#i

[15] As footnote 1.

further liberalization that aims to realize trade's potential as a driving force for economic growth and development.[16]

No study is free from limitations. Some of them are found to be insufficiently taken into accounted in this study, but to suggest remedies for further research. The first is about the measure of trade openness used in this study, the sum of imports and exports per GDP which has been employed the hundreds of studies published to date as noted by Squalli and Wilson (2011). It is believing that this 'conventional' measure still sufficient to capture the trade openness for a country (see, for example Kotcherlakota and Sack-Rittenhouse, 2000). Squalli and Wilson (2011) have proposed a composite trade share measure that more completely reflects reality by combining trade share, and the relative importance of a country's trade level to total world trade. Other new measure of trade openness is from Waugh and Ravikumar (2016) by introducing trade potential index that quantifies potential gains from trade as a simple function of data. This study does not implement both 'alternative' measures due to complication in their construction (i.e. raw data availability, and time-consuming by manual calculation), but for further study in a purpose of robustness check. Among other limitations face are that, this study only considers the influence of income levels in a bivariate framework with different income panels. Other factors are eventually omitted such as history, geographical and political background, institutional quality and economics, those may offer different findings. Hence, further study is to incorporate these potential variables as above in a multivariate framework. Lastly, the use of panel data may bias the findings in the case that some counties exhibit strong support of financial openness and trade openness nexus, which dominates the finding of the entire panel. In fact, some of the countries or a country has no causality between the variables. Time series method of non-causality (correlation) tests can be applied for all the 115 countries individually for further study, so that it may add to more comprehensive to the findings yet the policy with country's wise can be proposed.

References

Aizenman, J. (2008). On the hidden links between financial and trade opening. *Journal of International Money and Finance, 27*(3), 372-386.

Aizenman, J., & Noy, I. (2009). Endogenous financial and trade openness. *Review of Development Economics*, *13*(2), 175–189.

Akyüz, Y. (1993). *Financial liberalization: The key issues* (UNCTAD Discussion Paper No. 56). Retrieved from United Nations Conference on Trade and Development website: https://www.southcentre.int/wp-content/uploads/2013/08/REP1_FInancial-Liberalization_EN.pdf

Asongu, S. A. (2010). *Linkages between financial development and openness: Panel evidence from developing countries* (MPRA Paper 26926). Retrieved from Munich Personal RePEc Archive website: https://mpra.ub.uni-muenchen.de/26926/

Baltagi, B., Demetriades, P., & Law, S-H. (2009). Financial development and openness: Evidence from panel data. *Journal of Development Economics*, *89*(2), 285–296.

Beck, T. (2003). Financial dependence and international trade. *Review of International Economics*, *11*(2), 296-316.

Bekaert, G., Harvey, C. R., & Lundblad, C. (2011). Financial openness and productivity. *World Development*, *39*(1), 1-19.

Carmignani, F., & Chowdhury, A. (2006). The impact of financial openness on economic integration: Evidence from the Europe and the CIS. In L. Vinhas de Souza, O. Havrylyshyn (Eds), *Return to growth in CIS countries* (pp.281-299). Berlin, HD: Springer.

Chinn, M., & Ito, H. (2006). What matters for financial development? Capital controls, institutions, and interactions. *Journal of Development Economics, 81*(1), 163-192.

[16] As footnote 14.

Choi, I. (2001). Unit root tests for panel data. *Journal of International Money and Finance, 20*(2), 249–272.

Dumitrescu, E.-I., & Hurlin, C. (2012). Testing for Granger non-causality in heterogeneous panels. *Economic Modelling, 29*(4), 1450-1460.

Estrada, G., Park, D., & Ramayandi, A. (2015). *Financial development, financial openness, and economic growth* (ADB Economics Working Paper Series No. 442). Retrieved from Asian Development Bank website: https://www.adb.org/publications/financial-development-financial-openness-and-economic-growth

Fausten, D. K. (1989-90). Current and capital account interdependence. *Journal of Post Keynesian Economics, 12*(2), 273-292.

Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica, 37*(3), 424-438.

Granger, C. W. J. (2003). Some aspects of causal relationships. *Journal of Econometrics, 112*(1), 69-71.

Gries, T., & Redlin, M. (2012). Trade openness and economic growth: A panel causality analysis. Paper presented at *the International conferences of RCIE, KIET, and APEA*, Seattle, USA.

Hanh, P. T. H. (2010). *Financial development, financial openness and trade openness: New evidence* (FIW Working Paper Series 060). Retrieved from Semantic Scholar website: https://pdfs.semanticscholar.org/4ba5/46db53f278c8aed3de650bb229aa287c356d.pdf

Huchet‐Bourdon, M., Le Mouël, C., & Vijil, M. (2018). The relationship between trade openness and economic growth: Some new insights on the openness measurement issue. *The World Economy, 41*(1), 59-76.

Hurlin C., & Venet B. (2001). *Granger causality tests in panel data models with fixed coefficients.* (Working Paper Eurisco 2001-09). Retrieved from Researchgate website: https://www.researchgate.net/publication/229050746

Hurlin, C. (2004). Testing Granger causality in heterogeneous panel data model with fixed coefficients. *Document de recherche LEO, 5*, 1-31.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics, 115*(1), 53-74.

Ito, H. (2004). *Is financial openness a bad thing? An analysis on the correlation between financial liberalization and the output performance of crisis-hit economies* (UC Santa Cruz International Economics Working Paper No. 04-23). Retrieved from Social Science Research Network website: https://ssrn.com/abstract=621801

Kotcherlakota, V., & Sack-Rittenhouse, M. (2000). Index of openness: Measurement and analysis. *The Social Science Journal, 37*(1), 125-130.

Krugman, P. R., Obstfeld, M., & Melitz, M. (2012). *International Economic: Theory and Policy* (9th ed.). Boston, MA: Pearson Education.

Lane, P. R., & Milesi-Ferretti, G. M. (2006). *The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities 1970–2004* (IMF Working Paper 06/69). Retrieved from International Monetary Fund website: https://www.imf.org/external/pubs/ft/wp/2006/wp0669.pdf

Law, S-H. (2007). Openness and financial development: Panel data evidence from various stages of economic development. *Journal of Emerging Market Finance, 6*(2), 145-165.

Lee, Eddy. (2005). *Trade liberalization and employment* (Working Paper No. 5). Retrieved from Department of Economics and Social Affair website: https://www.un-ilibrary.org/economic-and-social-development/trade-liberalization-and-employment_b9794079-en

Liargovas, P. G., & Skandalis, K. S. (2012). Foreign direct investment and trade openness: The case of developing economies. *Social Indicators Research, 106*(2), 323–331.

Maddala, G. S., & Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and Statistics, 61*(S1), 631-652.

Quinn, D., Schindler, M., & Toyoda, A. (2011). Assessing measures of financial openness and integration. *IMF Economic Review, 59*(3), 488–522.

Rajan, R. G., & Zingales, L. (2003). The great reversals: The politics of financial development in the twentieth century. *Journal of Financial Economics, 69*(1), 5-50.

Schmukler, S. L. (2004). Financial globalization: Gain and pain for developing countries. *Economic Review - Federal Reserve Bank of Atlanta, 89*(2), 39-66.

Squalli, J., & Wilson, K. (2011). A new measure of trade openness. *The World Economy, 34*(10), 1745-1770.

Tang, T-C., & Fausten, D. K. (2012). Current account and capital account interdependence: An empirical test. *International Journal of Business and Society, 13*(3), 229 - 244.

Terrones, G. D. (2008). *Reaping the Benefits of Financial Globalization* (IMF Occasional Paper No. 264). Retrieved from International Monetary Fund website: https://www.imf.org/external/np/res/docs/2007/0607.pdf

Waugh, M. E., & Ravikumar, B. (2016). *Measuring openess to trade* (NBER Working Paper No. 22147). Retrieved from National Bureau of Economic Research website: https://www.nber.org/papers/w22147

Yanikkaya, H. (2003). Trade openness and economic growth: A cross-country empirical investigation. *Journal of Development Economics*, 72(1), 57-89.

Zhang, C., Zhu, Y., & Lu, Z. (2015). Trade openness, financial openness, and financial development in China. *Journal of International Money and Finance, 59*, 287–309.

Appendix A: List of countries (115)

By income group:			
High (37)	Upper-middle (30)	Lower-middle (29)	Low (19)
Australia	Algeria	Bangladesh	Benin
Austria	Argentina	Bhutan	Burundi
Bahamas	Belize	Bolivia	Central African Rep.
Bahrain	Botswana	Cameroon	Chad
Barbados	Brazil	Cape Verde	Comoros
Belgium	China	Congo, Rep.	Congo, Dem. Rep.
Canada	Colombia	Cote d'Ivoire	Gambia, The
Chile	Costa Rica	Egypt, Arab Rep.	Guinea-Bissau
Cyprus	Dominica	El Salvador	Madagascar
Denmark	Dominican Republic	Ghana	Malawi
Finland	Ecuador	Guatemala	Mali
France	Equatorial Guinea	Honduras	Nepal
Germany	Fiji	India	Niger
Greece	Gabon	Indonesia	Rwanda
Hong Kong, China	Grenada	Jordan	Senegal
Iceland	Guyana	Kenya	Sierra Leone
Ireland	Iran, Islamic Rep.	Lao PDR	Togo
Israel	Jamaica	Mauritania	Uganda
Italy	Malaysia	Morocco	Zimbabwe
Japan	Mauritius	Nicaragua	
Korea, Rep.	Mexico	Nigeria	
Kuwait	Panama	Pakistan	
Malta	Peru	Philippines	
Netherlands	South Africa	Solomon Islands	
New Zealand	St. Lucia	Sri Lanka	
Norway	St. Vincent & Grenadines	Sudan	
Oman	Suriname	Swaziland	
Portugal	Thailand	Syrian Arab Rep.	
Saudi Arabia	Turkey	Tunisia	
Seychelles [1]	Venezuela, RB		
Singapore			
Spain			
Sweden			
Trinidad and Tobago			
United Kingdom			
United States			
Uruguay			

Notes: [1] FDII and FDIO data are not available.

Appendix B: Results of panel unit root tests (test statistics)

Income Group		$KAOPEN_{i,t}$	$\Delta KAOPEN_{i,t}$	*I*(d)	$FDII_{i,t}$	$\Delta FDII_{i,t}$	*I*(d)	$FDIO_{i,t}$	$\Delta FDIO_{i,t}$	*I*(d)	$TO_{i,t}$	$\Delta TO_{i,t}$	*I*(d)
All	Im *et al.*	-3.94***	-	*I*(0)	-15.388***	-	*I*(0)	-14.377***	-	*I*(0)	-6.402***	-	*I*(0)
	ADF-Fisher	313.813***	-	*I*(0)	783.183***	-	*I*(0)	850.245***	-	*I*(0)	385.996***	-	*I*(0)
	PP-Fisher	315.845***	-	*I*(0)	974.705***	-	*I*(0)	1623.84***	-	*I*(0)	342.215***	-	*I*(0)
High	Im *et al.*	0.886	-24.427***	*I*(1)	-9.055***	-	*I*(0)	-8.491***	-	*I*(0)	-2.717***	-	*I*(0)
	ADF-Fisher	60.525	592.567***	*I*(1)	275.502***	-	*I*(0)	288.292***	-	*I*(0)	102.383**	-	*I*(0)
	PP-Fisher	62.507	598.685***	*I*(1)	422.138***	-	*I*(0)	467.776***	-	*I*(0)	88.787	1074.09***	*I*(1)
Upper-middle	Im *et al.*	-2.207**	-	*I*(0)	-9.545***	-	*I*(0)	-8.880***	-	*I*(0)	-3.486***	-	*I*(0)
	ADF-Fisher	74.414*	-	*I*(0)	204.493***	-	*I*(0)	250.553***	-	*I*(0)	103.043***	-	*I*(0)
	PP-Fisher	74.025*	-	*I*(0)	204.354***	-	*I*(0)	764.428***	-	*I*(0)	86.036**	-	*I*(0)
Lower-middle	Im *et al.*	-3.096***	-	*I*(0)	-7.146***	-	*I*(0)	-7.545***	-	*I*(0)	-2.095**	-	*I*(0)
	ADF-Fisher	94.559***	-	*I*(0)	185.712***	-	*I*(0)	207.153***	-	*I*(0)	83.966**	-	*I*(0)
	PP-Fisher	98.944***	-	*I*(0)	196.173***	-	*I*(0)	267.275***	-	*I*(0)	65.826	805.968***	*I*(1)
Low	Im *et al.*	-4.302***	-	*I*(0)	-4.479***	-	*I*(0)	-4.156***	-	*I*(0)	-5.004***	-	*I*(0)
	ADF-Fisher	84.316***	-	*I*(0)	117.476***	-	*I*(0)	104.247***	-	*I*(0)	96.604***	-	*I*(0)
	PP-Fisher	80.369***	-	*I*(0)	152.040***	-	*I*(0)	124.359***	-	*I*(0)	101.566***	-	*I*(0)

Notes: The symbol ***, **, and * denote significant level at 1%, 5%, and 10%, respectively. The optimal lag length is selected by Hannan-Quinn Criterion (not reported here). Individual constant and trend are assumed for unit root equation of level variable, while only individual intercept for first-differenced variable. The null hypothesis is a unit root of the underlying variable.

Appendix C1: Panel Granger non-causality tests

Lag length:	1	2	3	4	5	6
All						
$KAOPEN_{i,t}$ =/=> $TO_{i,t}$	2.573	1.214	0.901	1.388	1.167	1.218
$TO_{i,t}$=/=>$KAOPEN_{i,t}$	2.238	1.389	1.332	1.496	1.721	1.597
$FDII_{i,t}$=/=>$TO_{i,t}$	11.424***	14.191***	9.780***	7.617***	9.623***	16.407***
$TO_{i,t}$ =/=> $FDII_{i,t}$	52.496***	25.218***	28.053***	19.302***	12.226***	12.430***
$FDIO_{i,t}$=/=>$TO_{i,t}$	29.372***	18.737***	12.945***	10.784***	9.700***	7.807***
$TO_{i,t}$ =/=> $FDIO_{i,t}$	25.777***	6.417***	8.971***	13.118***	11.118***	8.497***
High Income						
$\Delta KAOPEN_{i,t}$=/=>$\Delta TO_{i,t}$	4.107**	2.651*	1.843	1.582	1.254	1.156
$\Delta TO_{i,t}$=/=>$\Delta KAOPEN_{i,t}$	0.000	0.195	0.680	0.515	0.732	0.790
$FDII_{i,t}$=/=>$\Delta TO_{i,t}$	36.071***	19.620***	14.037***	11.607***	8.958***	10.739***
$\Delta TO_{i,t}$ =/=> $FDII_{i,t}$	0.050	0.253	1.356	1.318	1.029	0.841
$FDIO_{i,t}$=/=>$\Delta TO_{i,t}$	30.383***	17.951***	12.596***	12.994***	9.844***	8.621***
$\Delta TO_{i,t}$ =/=> $FDIO_{i,t}$	0.093	0.872	3.228**	1.924	1.984*	2.125**
Upper-middle Income						
$KAOPEN_{i,t}$ =/=> $TO_{i,t}$	0.034	0.050	0.161	0.475	0.349	0.515
$TO_{i,t}$ =/=> $KAOPEN_{i,t}$	1.351	0.678	0.518	0.446	0.650	0.592
$FDII_{i,t}$=/=>$TO_{i,t}$	14.347***	33.082***	29.839***	32.414***	19.965***	30.150***
$TO_{i,t}$ =/=> $FDII_{i,t}$	42.925***	11.870***	9.166***	7.277***	5.086***	5.534***
$FDIO_{i,t}$=/=>$TO_{i,t}$	0.105	0.155	0.208	0.198	0.294	0.219
$TO_{i,t}$ =/=> $FDIO_{i,t}$	3.732*	1.355	0.943	0.640	0.569	0.648
Lower-middle Income						
$KAOPEN_{i,t}$ =/=> $\Delta TO_{i,t}$	0.064	0.246	0.170	1.069	0.978	0.954
$\Delta TO_{i,t}$ =/=> $KAOPEN_{i,t}$	9.378***	4.620**	2.93**	2.636**	2.292**	1.900*
$FDII_{i,t}$=/=>$\Delta TO_{i,t}$	0.425	0.098	0.156	0.143	1.544	1.354
$\Delta TO_{i,t}$ =/=> $FDII_{i,t}$	0.414	0.520	0.815	2.118*	3.171***	4.867***
$FDIO_{i,t}$=/=>$\Delta TO_{i,t}$	0.558	0.729	0.817	1.715	1.419	1.272
$\Delta TO_{i,t}$ =/=> $FDIO_{i,t}$	7.439***	4.573**	2.671**	1.799	6.225***	5.454***
Low Income						
$KAOPEN_{i,t}$ =/=> $TO_{i,t}$	0.008	0.111	0.097	0.220	0.239	0.538
$TO_{i,t}$ =/=> $KAOPEN_{i,t}$	0.483	0.258	4.814***	3.914***	2.994**	2.549**
$FDII_{i,t}$=/=>$TO_{i,t}$	0.702	1.503	2.423*	2.327*	2.477**	1.912*
$TO_{i,t}$ =/=> $FDII_{i,t}$	1.452	0.945	0.581	0.405	1.127	0.653
$FDIO_{i,t}$=/=>$TO_{i,t}$	4.820**	4.453**	4.106***	3.165**	2.524**	2.161**
$TO_{i,t}$ =/=> $FDIO_{i,t}$	10.843***	5.116***	2.878**	2.500**	1.986*	1.774

Notes: =/=> stands for "does not Granger cause". The symbol ***, **, and * represent significant at 1%, 5%, and 10%, respectively. The reported value is F-statistics.

Appendix C2: Dumitrescu and Hurlin, (2012) panel Granger non-causality tests

Lag length:	1	2	3	4	5	6
All						
$KAOPEN_{i,t}$ =/=>$TO_{i,t}$	-	-	-	-	-	-
$TO_{i,t}$=/=>$KAOPEN_{i,t}$	-	-	-	-	-	-
$FDII_{i,t}$=/=>$TO_{i,t}$	4.652***	3.107***	6.685***	6.896***	9.876***	9.823***
$TO_{i,t}$ =/=> $FDII_{i,t}$	10.462***	4.658***	3.657***	2.483**	2.264**	1.677*
$FDIO_{i,t}$=/=>$TO_{i,t}$	3.845***	4.155***	2.760***	3.947***	6.862***	6.851***
$TO_{i,t}$ =/=> $FDIO_{i,t}$	12.427***	6.916***	4.076***	3.20***	3.223***	1.579
High Income						
$\Delta KAOPEN_{i,t}$=/=>$\Delta TO_{i,t}$	-	-	-	-	-	-
$\Delta TO_{i,t}$=/=>$\Delta KAOPEN_{i,t}$	-	-	-	-	-	-
$FDII_{i,t}$=/=>$\Delta TO_{i,t}$	0.360	1.059	2.196**	-	-	-
$\Delta TO_{i,t}$ =/=> $FDII_{i,t}$	0.533	1.462	1.666*	-	-	-
$FDIO_{i,t}$=/=>$\Delta TO_{i,t}$	0.499	3.069***	1.574	-	-	-
$\Delta TO_{i,t}$ =/=> $FDIO_{i,t}$	-0.131	0.779	0.338	-	-	-
Upper-middle Income						
$KAOPEN_{i,t}$ =/=> $TO_{i,t}$	-	-	-	-	-	-
$TO_{i,t}$ =/=> $KAOPEN_{i,t}$	-	-	-	-	-	-
$FDII_{i,t}$=/=>$TO_{i,t}$	2.254**	0.978	8.417***	5.868***	8.166***	9.489***
$TO_{i,t}$ =/=> $FDII_{i,t}$	3.408***	0.634	-0.456	-0.516	-1.217	-0.984
$FDIO_{i,t}$=/=>$TO_{i,t}$	0.376	-0.357	-0.573	0.276	0.725	1.858*
$TO_{i,t}$ =/=> $FDIO_{i,t}$	3.760***	4.169***	1.938*	1.672*	0.299	-0.498
Lower-middle Income						
$KAOPEN_{i,t}$ =/=> $\Delta TO_{i,t}$	-	-	-	-	-	-
$\Delta TO_{i,t}$ =/=> $KAOPEN_{i,t}$	-	-	-	-	-	-
$FDII_{i,t}$=/=>$\Delta TO_{i,t}$	-1.027	0.687	1.302	2.812***	2.478**	3.442***
$\Delta TO_{i,t}$ =/=> $FDII_{i,t}$	0.152	0.208	1.538	1.790*	0.305	0.687
$FDIO_{i,t}$=/=>$\Delta TO_{i,t}$	0.622	1.562	3.146***	-	-	-
$\Delta TO_{i,t}$ =/=> $FDIO_{i,t}$	2.077**	2.804***	2.533**	-	-	-
Low Income						
$KAOPEN_{i,t}$ =/=> $TO_{i,t}$	1.997**	2.166**	1.964**	2.210**	1.215	0.752
$TO_{i,t}$ =/=> $KAOPEN_{i,t}$	4.542***	5.416***	6.216***	5.845***	5.447***	2.875***
$FDII_{i,t}$=/=>$TO_{i,t}$	3.06***	1.745*	2.383**	2.906***	2.841***	1.399
$TO_{i,t}$ =/=> $FDII_{i,t}$	2.349**	0.438	1.241	1.064	1.003	0.138
$FDIO_{i,t}$=/=>$TO_{i,t}$	-0.176	-0.078	-	-	-	-
$TO_{i,t}$ =/=> $FDIO_{i,t}$	2.795***	1.592	-	-	-	-

Notes: =/=> stands for "does not Granger cause". The null hypothesis is H_0: x does not Granger-cause y, against the alternative hypothesis H_1: *x* does Granger-cause *y* for at least one country. The symbol ***, **, and * represent significant at 1%, 5%, and 10%, respectively. The reported values is Z-bar tilde statistics. The symbol " – " stands for non-computable by Stata due to insufficient observations after making unbalanced panel to balanced panel. For example, the full panel has lost 294 observations (deleted) due to missing data, and 1,326 observations (deleted) due to discontinues. Also, the *de jure* measure is constant over the sample period for the countries such as the U.S. with 2.389 for all years, 1970-2014.