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"An Inch in A Miss Is As Good As An Ell" – Selecting The Right Financial Openness Indicators: Precision Matters in Modelling Financial Development

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ABSTRACT

Empirical studies often employ financial openness indicators randomly without clear justification. This study re-estimates the association between financial openness and financial development (measured by financial depth, efficiency, and stability) using panel data of 87 countries spanning 1995 to 2019. Six financial openness indicators are considered, including both *de facto* and two *de jure* measures. Additional determinants of financial development include economic growth, trade openness, inflation, and institutional quality. Although the six indicators are strongly correlated, but the principal component analysis rejects the construction of a single composite indicator. This study offers that the KOF Globalization Index is a suitable proxy for modelling financial development. For researchers, analysts and policymakers, a systematic evaluation to selecting a financial openness indicator is required for robust analysis of the topic under study. Financial development has growth-promoting effect. contributing to social welfare gains.

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INTRODUCTION

Financial markets are a place that allow traders (buyers and sellers) to transact financial instruments such as bonds, equities, international currencies, and derivatives.[1] These markets are typically categorized into four major types, namely capital markets, money markets, derivative markets, and currency (foreign exchange) markets. Quinn and Inclán (1997) construct indicators of financial openness available from 1950 through 1988 by systematically coding the laws governing capital (financial) and current account transactions for 21 Organization for Economic Cooperation and Development (OECD) member countries. The literature in financial economics generally informs that financial openness[2] acts a catalyst for financial development (Baltagi et al., 2019; Tongurai and Vithessonthi, 2023; Nam et al., 2024; Ghossoub et al., 2024; Liang and Yan, 2025; Nam et al., 2025). Open capital markets may enable economic agents to circumvent capital and wealth taxation policies. (Quinn and Inclán, 1997, p.773). Several empirical studies confirm the positive contributions of financial openness to economic growth (Bussière and Fratzscher, 2008; Gaies and Nabi, 2019; Kennedy, 2013), while another body of research focuses on the impact of financial development on economic growth (Khan and Senhadji, 2000; Dawson, 2008; Law and Singh, 2014). Crucially, for the financial markets to develop, a country must liberalize her financial system *a priori.* Financial openness and financial markets development are positively associated and bidirectionally related (Tongurai and Vithessonthi, 2023).

This study is motivated by the ongoing debate in the existing literature that the most appropriate indicator of financial openness either *de jure* or *de facto* measure in estimating its relationship with financial development. This ambiguity is due to the complexity and continuous evolution of global financial systems, which has led to inconsistent empirical findings and weakens the reliability of policies, particularly for policymakers seeing to foster financial development through openness. In general, the *de jure* measure assesses rule-based barriers to international financial transactions such as controls on capital movements, the acquisition of domestic and foreign assets, and foreign exchange arrangements (Gnangnon, 2018). In contrast, the *de facto* measure captures actual cross-border financial flows such as foreign direct investment (FDI), international debts and liabilities, portfolio investment, and international income payments (Gygli et al. 2019). Despite the imposition of defensive *de jure* capital controls, high volumes of financial transactions may still occur due to political and/or environmental factors (Aizenman, 2008; Aizenman and Noy, 2009; Grabner et al., 2021). Commonly, *de facto* measure is often considered more appropriate for assessing the effectiveness of legal barriers enforcement to capital flows. Both *de jure* and *de facto* measures are randomly employed in related research topics without prejudice, largely due to their public availability through reputable databases from the well-recognized databases (i.e. capital account openness index by International Monetary Fund, IMF), the precedent set by previous studies such as Chinn-Ito index (KAOPEN), which offers longer time periods for broad country coverage. Perhaps, inappropriate selection of financial openness indicators can degrade the robustness of empirical findings. Indeed, theoretical advantages and limitations of *de jure* and *de facto* measures are difficult to resolve in the absence of a comprehensive theoretical justification(s) (see, footnote 12 of Baltagi et al., 2019, p.288). Quinn et al. (2011) note that these two measures *de jure* and *de facto* yield systematically different growth outcomes. For *de jure* measure, much of the variation in growth results can be explained to sample differences, with weaker effects found in more recent data and among advanced economies. Schindler (2009) recommends that *de jure* based indicators of financial openness are more suitable for policy-oriented studies, while *de facto* based indicators are more applicable for empirical or practical studies.

A number of studies (Quinn and Toyota, 2008; Grabner et al., 2021) offers that financial openness indicators within the same measures either *de jure* or *de facto* from various sources are highly correlated. However, little or no correlation is observed between indicators from different measures *de jure* vis-à-vis *de*

[1] Financial Markets. https://www.occ.treas.gov/topics/supervision-and-examination/capital-markets/financial-markets/index-financial-markets.html

[2] This study considers the same implication of financial globalization, liberalization, and integration, interchangeably. Indeed, they are relatively varying in some aspects. This study focuses on financial openness.

facto. This informs that each measure *de jure* and *de facto* captures different dimensions of financial openness, hence complementing each another. Bush (2015) documents a weak correlation between legal openness and realized capital flows, while a strong relationship is witnessed in countries with well-developed financial markets. Given the need for a more comprehensiveness assessment, many empirical studies have employed both *de jure* and *de facto* based indicators simultaneously to estimate the impact of financial openness on various dependent variables, for examples, financial development (Karimu and Marbuah, 2017; Asongu and Minkoua, 2018) and bank loan pricing (Ashraf et al., 2021). By the same token, hybrid indicators have emerged that combine both relevant regulatory elements and realized capital flows statistics to provide a more integrated alternative indicator of financial openness.[3] Indeed, such hybrid indicators must be interpreted with caution because they may *overload* information of *de jure* and *de facto* financial openness indicators, and introduce potential correlation bias. Let say, the FORU indicator has limited sample size and focuses on equity market liberalization, while the eGlobe-KOF index is broad in coverage and may be too generalized for for some financial globalization applications with about 50% trade related data and exhibits persistent serial correlation (Quinn et al., 2011, p.515).

This study adds a new contribution to the literature and empirical evidence by comparing six widely used financial openness indicators in the context of financial development using different methods such as principal component analysis (PCA) and generalized method of moments (GMM). The existing studies typically rely on a single indicator or a few, without a comprehensive, side-by-side evaluation. This results different empirical findings, deteriorating the effectiveness of policies and reforms aimed at liberalizing financial markets. This study offers a more nuanced understanding of how to select the most appropriate indicator(s) improve the robustness and comparability of research on financial markets development. Notably, constructing a composite index from available indicators using PCA finds to be an undesirable approach for examining the relationship between financial openness and financial development. This systematic approach to selecting financial openness indicators can also be applied by researchers as well as policymakers to other topics.

The research problem arises from the lack of consensus in in past studies regarding which financial openness indicators is most suitable for explaining financial development. This uncertainty is largely due to the absence of a systematic comparative assessment of the available indicators employed in empirical studies. Hence, their empirical findings may be inconsistent and biased. Two studies (Quinn et al., 2011; Grabner et al., 2021) evaluates the appropriateness of available financial openness indicators within the topic of finance led growth framework. Using data from 189 countries spanning 1950 to 2009, Quinn et al. (2011) find that *de jure* and *de facto* based indicators yield systematically different growth results in relation to economic growth. A similar observation occurred in the study by Grabner et al. (2021), which considers 216 countries between 1965 and 2019. In contrary, Le (2000) argues that financial openness should be viewed as a necessary condition for accelerating financial development. Kose et al. (2009) and Ersoy (2011) argue that the impact of financial openness on financial development may be more significant than its effect on economic growth. Unfortunately, in the absence of a systematic assessment of financial openness indicators, neither the conventional *de jure* and *de facto* measures, nor hybrid indicators have generated consistent finding across different research topics (Ahmed, 2013; Karimu and Marbuah, 2017; Ashraf, 2018; Selcuk, 2018; Umutlu et al., 2020; Wai et al, 2024). Taghizadeh-Hesary et al. (2019) find an inverted U-shaped relationship between external debt (as a proxy for financial openness) and financial development. Different financial openness indicators offer different results either overestimated or underestimated the relationship when assessing its impact on financial development beyond their underlying countries, sample period, historical and political contexts, and estimation techniques employed.

[3] Examples include the correlation of between saving and investment (Feldstein and Horioka, 1980), the ratio of market capitalizations of Investable (IFCI) to Global (IFCG) indexes (Edison and Warnock, 2003) including KOF Globalization Index, which is based on several sub-indices reflect various aspects of financial openness. Available at: https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html. A hybrid measure is FORU (Edison and Warnock, 2003), a monthly measure of capital account openness based on the share of domestic equities available for foreign purchase.

The key research gap identified from the literature review is the extensive employment of available financial openness indicators with no consensus on which indicator is most appropriate for explaining financial development. This has contributed to mixed findings, and this variation is rarely addressed, especially in the context of determining financial development. Hence, the main research questions raised by this study are, first "*Which available financial openness indicators best explain their impact on the development of financial markets?"* Second is, "*Are there significant differences in the findings across countries with different income levels?"* This study does not aim to re-examine the impact of financial openness on financial development. Rather, it systematically assesses six commonly used financial openness indicators, namely KAOPEN index, Lane and Milesi-Ferreti (LMF) indicator, *de jure* and *de facto* KOF financial globalization, net inflows, and outflows of FDI and to select them with financial development, to assess their relevance in explaining financial development. The assessment covers pairwise correlation analysis, PCA, and panel data regression modelling by ordinary least square (OLS), as well as the two-step system and first-differenced GMM (Blundell and Bond, 1998)[4] estimators. This study complements previous studies (Quinn et al., 2011; Grabner et al., 2021), and offers additional insights into the ongoing debate regarding the appropriateness of which financial openness indicator in explaining their relationship with financial development. This study also examines the findings by categorizing the sample countries to their income levels, namely high, upper-middle, lower-middle, and low income.

This study is beneficial to key stakeholders involved directly or indirectly in financial markets. Academics and researchers focused on financial development can benefit from a clearer understanding of which financial openness indicators are most appropriate for determining financial development. Policymakers, particularly those in government, can consider this study to design second-best policies that strategically open financial markets to promote financial development. Scholars including those from international organizations involved in constructing financial openness datasets, may also find this study useful for improving the comprehensiveness and consistency of their data. Graduate students can build upon this study by exploring more systematic approach to further examine the nexus between financial openness and financial development.

The organization of this study is as follows: The next section reviews the selected studies of financial openness indicators and their relationship with financial development. Section 3 describes the selection procedure for financial openness indicators, model specifications, and data. The empirical results are documented in Section 4. The final section concludes the study.

LITERATURE REVIEW

This section reviews the use of common financial openness indicators and considers selected empirical studies that estimate their impact on financial development. In many cases, the choice of financial openness indicators is either arbitrary or based on precedent, without by a systematic selection procedure (see, Khan and Senhadji, 2000; Dawson, 2008; Law and Singh, 2014; Nam et al., 2024; Ghossoub et al., 2024; Liang and Yan, 2025; Nam et al., 2025). These indicators include both *de jure* and *de facto* measures including hybrid measures that capture multiple dimensions of financial openness (Quinn, et al., 2011; Grabner et al., 2021). For example, at the banking sector level, the deregulation of financial activities is generally expected to stimulate market competition, enhance efficiency gains, and promote financial development. From a narrow perspective (the banking sector), financial openness indictors encompass a range of dimensions such as interest rates liberalization, removal of entry barriers, supervisory reforms, privatization initiatives, and the adoption of pro-competitive measures (Abiad and Mody, 2005; Ahmed, 2013; Mukherjee et al., 2021). Using a panel dataset of 35 emerging markets from 1976 to 2003, Huang (2006) considers a set of financial openness indicators (including for financial development) from banking sector, stock market, and national capital accounts. The

[4] It is a more efficient than of conventional technique because it mitigates a few technical issues related to weak instruments, persistent series, and endogeneity (Blundell and Bond, 2023).

study finds that financial openness significantly influences cross-country differences in financial system development. The banking sector does promote financial market development, but this relationship varies depending on the different openness measures (and model specifications). Strong evidence is found in the context of stock markets. In the banking sector, this relationship is not robust to different indicators of financial openness (and model specification). Openness in stock market does not always offer a desirable outcome for financial development (Tongurai and Vithessonthi, 2023). Indeed, there is no universal rule for selecting the most 'fit' financial openness indicator to model financial development, making it essential for empirical studies to adopt a careful and context-specific approach to indicator selection.[5]

Liberalizing capital market (i.e. removing capital controls) is theoretically beneficial for resource reallocation, such as enhancing domestic capital accumulation that increasing international capital flows and investment activities stimulating financial market and economic development (Ersoy, 2011). Ersoy (2011) confirms a long run relation among financial development, growth and output volatility based on Turkish data covering the period 1980 - 2008. A unidirectional causality is confirmed from financial development to financial openness. The realized capital flows, FDI is used as indicate of the effectiveness of financial openness (Huang, 2006; Ozkok, 2015). The net inflows and outflows of FDI from the World Development Indicators (WDI, World Bank, 2007) comprise equity capital, earnings from reinvestment, and other short-and long-term capital. However, skepticism remains for FDI as a proxy for financial openness. Taghizadeh-Hesary et al. (2019) assesses the impact of financial integration on financial development for 34 East Asian and Pacific countries (1996 – 2017) using threshold dynamics models. They find that different types of financial inflows have different effects. A robust inverted U-shaped relationship between financial openness and financial development is observed when external debt is used as proxy for financial openness. Although FDI is country-specific in terms of definition, data collection method, and statistical standards vary significantly across countries (Bajpai and Dasgupta, 2004; Quinn et al., 2011), but it is conventionally employed due to its public availability (Zhang et al., 2015; Luo et al., 2016, Ziaei, 2017).

Another study by Ozkok (2015), which analyzes panel data from 61 advanced and developing countries (1996 – 2007), finds that financial openness explains most variation in financial development alongside institutional and educational factors. The study also finds that different indexing strategies provide better measures of financial openness (and financial development) compared to individual indicators. The financial openness index constructed by PCA has a positive effect on financial development, regardless of the lag structure or model specifications. Similarly, KAOPEN index *de jure* measure of financial openness offers broader country coverage and longer time span, improving the robustness and comparability of the results.

This index is constructed by PCA based on four financial binary measures, namely restriction of the current account, restriction on the capital account, repatriation and surrenders of trading proceeds, and the absence or presence of multiple exchange rates (Chinn and Ito, 2006; 2008). Braun and Raddatz (2007) find that international economic integration changes the real effect of domestic financial institutions considering a country as always open if its KAOPEN index is persistently above zero, and closed it is below zero. Nevertheless, this index has faced criticism for being relatively time-invariant and for reflecting a country's policy stance or openness intent rather than actual financial flows (Quinn et al, 2011).

Recent studies such as Nam et al. (2024) confirm nonlinear effects of financial openness (*de facto,* sum of foreign assets and liabilities) on financial development in five ASEAN countries (2002 - 2020) that low levels of financial openness (below the threshold) boosts equity market capitalization and financial development, institution, and market indices. However, the effect becomes insignificant beyond the threshold. Eduboah (2024) finds a long-run relation between financial openness and development in Ghana (1990Q1 – 2020Q4). Using data from 136 countries (1997 – 2017), Ghossoub et al. (2024) show that capital account

[5] Huang (2006) measure stock market openness by using the ration of market capitalization and number of firms in the of International Finance Corporation (IFC) Investible index to IFC Global index. Law and Habibullah (2009) use the Kaminsky and Schmukler (2003) financial liberalization indices. Umutlu et al. (2020) employ capital flow-based - ratio of foreign equity liabilities to the market capitalization of the stock exchange, and valuation-based - the degree of segmentation of a stock market, for stock market openness. Wai et al. (2024) find that exchange rates explain negatively the correlations between financial openness (*de jure* or *de facto* measures) and trade openness while, interest rates explain their bidirectional causality.

openness promotes banking sector development, depending on income levels. High income countries' financial openness is associated with higher credit market activity in concentrated banking system, while such concentration does not hold for developing countries. Nam, et al. (2025) further confirm that financial openness (total of foreign assets and foreign liabilities) promotes financial development in Eastern European countries (1992 - 2021) with strong institutional quality, though trade openness may weaken this association. Liang and Yan (2025) finds a positive impact of both *de jure* and *de facto* measures of financial openness and trade openness on financial development in 44 emerging market countries for the period 1996 - 2020.

Another commonly used indicator for financial openness is the KOF Financial Globalization Index (Dreher, 2006; Gygli et al., 2019). This indicator alternates other financial openness indicators by combining both *de jure* and *de facto* dimensions. That is, *de jure* measure accounts for investment restrictions, capital account openness, and international investment agreement, whereas *de facto* measure encompasses FDI, portfolio investment, international debt, reserves, and income payments. Aluko and Opoku (2022) use such index to investigate its impacts on financial development for OECD countries from 1996 to 2017 incorporating a set of control variables, namely institutional quality, government size, inflation, and income. They find that financial globalization positively influences financial development. Their findings are robust across KOF *de facto* and *de jure* measures including alternative measure of financial globalization-financial openness index.

The Heritage Foundation's Financial Freedom index (HFFF, hereafter) is relatively limited in use, which incorporates both financial freedom and investment freedom. Mukherjee et al. (2021) find that openness in financial sector promotes financial development in nine emerging countries (BRICS and South-East Asian economies - Malaysia, Philippines, Indonesia and Thailand) during the period 1995 - 2016. The HFFF index covers both gradual and continuous financial openness processes based on the official country publications and data from *The Economist* and U.S. government agencies. Its scale (coding rubric) changes over time reducing its appeal for measuring financial openness (Quinn et al., 2011). Similarly, the financial liberalization index by Kaminsky and Schmukler (2003) compiles the monthly financial liberalization status viz. fully, partially, and repressed of advanced and emerging economies (Quinn, 2011). Law and Habibullah (2009) consider a sample of 27 economies from the G-7, Europe, East Asia and Latin America for the period 1980 - 2001, find through dynamic panel data analysis that domestic financial sector reforms promote banking sector development, while stock market liberalisation significantly enhances stock market development. The financial liberalisation programmes tend to be more responsive in developed economies.

Lane and Milesi-Ferreti (2007) employ LMF financial openness indicator, which encompasses portfolio equity and debt, FDI, financial derivatives, aggregate foreign assets and liabilities, net international investment position, capital account balance, and other investment assets and liabilities. Some studies use the sum of foreign assets and liabilities as percentage of GDP, to measure financial openness because of its time-varying in nature, suitability for semi-parametric estimation, and so on. For example, using data from 78 economies between 1981 and 2006, Herwartz and Walle (2014) find that very high levels of financial openness can undermine the growth-promoting role of financial development, while high trade openness strengthens them. Similar findings hold for subsamples of Sub-Saharan African, Latin American and OECD economies. Notable exceptions include the invariance of the finance-growth nexus to trade openness in OECD economies, and a positive effect of financial openness on the finance-growth nexus in Latin American economies.

The main issues observed in the prior studies that need to be addressed are two-fold. First, the past studies rely on precedent-based indicator selection that employing publicly available financial openness indicators without prejudice for estimating their impact on financial development. This issue can be addressed by technically selecting an indicator from others based on high correlation, theoretical sign and magnitude, or PCA to construct composite indices. This approach ensures consistency, comparability, and robustness of empirical findings. Second, mixed results have been observed across difference financial openness indictors (*de jure* and *de facto*) in the past studies. Other reasons include model specifications, control variables, and testing methods exits, but they are not the focus of this study. To address this, this study follow the solution proposed for the first issue and conduct robustness checks using multiple indictors, various model types

(estimators), and grouping the countries by income level, among others. These approaches improve the generalizability of the findings.

This section concludes that existing (selected) studies employ a mix of financial openness measure (i.e. *de jure*, *de facto* and hybrid) randomly each with its strengths and limitations. There is no universal indicator of financial openness that is both context-specific and theoretically justified for influencing financial development. The impact of financial openness on financial development is mixed across countries, time periods, and financial sectors. This study benefits from the literature review by addressing key literature gaps such as in the selection of financial openness indicators and the inconsistencies in empirical findings. It highlights the need for a systematic approach to select financial openness indicators for modelling financial development. By selecting the most appropriate indicators based on the country context, time period, and financial sector, this study improves the accuracy and relevance of financial openness indicators employed in determining financial development. The literature acknowledges that financial markets are complex and continuously evolving, which makes selecting the 'fit' financial openness indicator(s) more challenging and critical due to its significant policy implications.

SELECTION PROCEDURE, MODEL SPECIFICATIONS, AND DATA

This section briefly outlines the selection procedure for the financial openness indicator used in modelling financial development. It covers methods such as pairwise correlation analysis, PCA, GMM, and so on. It also presents the empirical rationales linking financial openness to financial development, along with a description of the variables and data collected.

Pairwise correlation tests are employed to estimate the correlation coefficients of among six financial openness indicators. A positive correlation shows the pair of indicators tend to move in a same direction either increasing or decreasing concurrently, and *vice versa*. A preferred indicator of financial openness is expected to exhibit a close to one positive correlation coefficient signifying strong alignment with other indicators. Conversely, a weak correlation may reflect the multidimensional nature of the financial openness, as different indictors may capture different aspects of the financial openness (Quinn et al., 2011).

The PCA is employed to evaluate the relative importance (weight) of a single indicator over others. Identifying principal components allows the maximum variance in the data, PCA effectively reduces dimensionality while preserving essential information. This procedure has been applied by Quinn (2011) to measure the weightage(s) of financial openness indicators in order to construct a composite index. PCA generates a set of summary indices, each representing a linear combination of the original variables, with associated loadings that reflect their contribution. A *varimax* rotation is utilized to facilitate the estimation of indicator weights within each principal component. Indicators (or a group) with high loadings on a given component are considered to have a significant influence on the composite index construction, thereby improving its explanatory power in subsequent econometric analysis. The Kaiser–Meyer–Olkin (KMO) tests are employed as a robustness check to assess sampling accuracy and appropriateness of the data for factor analysis or PCA. According to Kaiser (1974), a value of KMO above 0.6 is generally considered acceptable for factor analysis. Value at least 0.8 (to 1.0) informs meritorious to excellent sampling adequacy, while values between 0.5 and 0.59 is miserable, and value between 0 and 0.49 is unacceptable. In this study, both correlation coefficients and PCA loadings are considered to assess the significance and coherence among financial development indicators.

Consistent with prior studies (Tongurai and Vithessonthi, 2023; Nam et al., 2024; Ghossoub et al., 2024; Liang and Yan, 2025; Nam et al., 2025), financial development is modelled using the panel data specification as presented in equation (1).

$$FD_{i,t} = \alpha_0 + \beta_1 FO_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $FD_{i,t}$ denotes financial development in country i for period t, $FO_{i,t}$ is financial openness indicator measured using variables such as KAOPEN, LMF, net inflows and outflows of FDI, *de jure* and *de facto* KOF financial globalization. $X_{i,t}$ represents a vector of control variables, namely economic growth, trade openness, inflation rate, and institutional quality (see, Taghizadeh-Hesary et al., 2019). The term $\varepsilon_{i,t}$ is the stochastic term. Several statistical criteria such as the estimated coefficient, adjusted R-square, and root mean square errors (RMSE) are used to evaluate the 'fitness' of the financial openness indicators. A single indicator is chosen based on its high adjusted R-square (i.e. stronger explanatory power) and low RMSE (i.e. greater predictive accuracy), and *vice versa*.

Three proxies of financial development are used in equation (1), namely financial depth (*lndepth*), financial efficiency (*lndepth*), and financial stability (*lnlnstability*). Financial competition is excluded from the analysis because of limited data available. Firstly, financial depth captures the extent to which a country's financial system allocates resources to the private sector. A higher ratio of private credit to GDP indicates greater financial depth. Secondly, financial efficiency reflects the effectiveness of financial institutions in transforming savings into productive investment. It is typically the difference between the costs and benefits by investments that higher returns of interest-bearing assets, greater operational efficiency among banks and financial intermediaries. Lastly, financial stability captures the resilience of the financial system to economic dynamics (shocks). High level of bank credit provided to the private sector reveals more stable financial markets.

Both *de jure* and *de facto* measures are employed to measure financial openness, namely KAOPEN, LMF, *de jure* and *de facto* KOF financial globalization, and net inflows and outflows of FDI.[6] These indicators capture distinct dimensions of financial openness. The normalized KAOPEN index, *ka_open* (ranging from 0 to 1) reflects the degree of capital account openness, where higher values indicate fewer controls on cross-border capital transactions, and *vice versa*. Similarly, KOF, *kofdj* (from 1 to 100) captures legal and institutional aspects of financial openness such as investment restrictions, capital account openness, and international investment agreements. A higher *kofdj* score informs a more open financial environment. The LMF, *totalla* is the ration of a country's total foreign financial claims and liabilities to GDP encompassing a broad range of cross-border financial transactions such as FDI, portfolio investment, financial derivatives, foreign exchange reserves and other investments. The net inflows and outflows of FDI both expressed by a country's direct investment equity flows relative to GDP, where the foreign ownership stakes account of at least 10%. A positive net inflows (outflows) informs that inwards (outward) FDI exceeds outward (inward) FDI. Lastly, KOF financial globalization index, *kofdf* (ranging from 1 to 100, full financial openness) captures the actual international financial transactions which is based on the sum of capital flows and the stock of foreign assets and liabilities relative to GDP. A high value indicates greater financial openness.

Four control variables are included in this study, namely economic growth (Law and Habibullah, 2009; Ozkok, 2015; Selcuk, 2018), trade openness (Rajan and Zingales, 2003; Hauner et al., 2013; Ashraf, 2018; Tongurai and Vithessonthi, 2023), inflation (Huybens and Smith, 1999; Mishkin, 2009), and institutional quality (Law and Habibullah, 2009; Karimu and Marbuah, 2017). The right-hand side variables may exhibit persistence over time, either due to regulatory (policy) changes with permanent effects, or because they are endogenous regressors, or both. To handel these technical issues, this study employs both system GMM and first-differenced GMM with appropriate moment restrictions (see, Arellano and and Bover, 1995; Arellano and Bond, 1991; Blundell and Bond, 1998).[7] The system GMM estimator combines moment conditions for

[6] Measures of bond and stock markets openness are excluded as they merely capture only a specific dimension of the financial markets. The KOF hybrid indicator melts both *de jure* and *de facto* aspects of a broader financial openness. The Heritage Foundation index is less appropriate due to its unclear scaling and construction.

[7] Lagged one period is considered based on the estimated coefficients of lagged dependent variable(s). If the first-differenced GMM estimate is below the fixed-effects estimator (lower bound), it suggests downward bias of weak instruments, hence GMM is suitable. The first-differenced GMM estimator is chosen if the estimated coefficient of lagged dependent variable is close to OLS estimate (upper bound). The first-differenced GMM estimate is biased upwards (Blundell et al.,2001; Bond et al., 2001). In this study, system GMM is appropriate for financial depth since the estimated one lag financial depth ($lndepth_{t-1}$) by first-differenced GMM estimator across all six financial openness indicators are lower than fixed-effects estimates. The first-differenced GMM estimator is suitable financial efficiency and financial stability because of upward bias. Their estimates are tabulated in Appendix 2.

equations in levels and first-differences with a set of instrumental variables (IVs). The former is expressed as follows:

$$FD_{i,t} = \beta_1 FD_{i,t-1} + \beta_2 FO_{i,t} + \beta_3 X_{i,t} + \mu_{i,t} + \tau_{i,t} \quad (2)$$

where, $\mu_{i,t}$ and $\tau_{i,t}$ capture the unobserved country fixed effect and other factors affect the dependent variable, respectively. Equation (2) is specified in first-differences.

$$\Delta FD_{i,t} = \beta_1 \Delta FD_{i,t-1} + \beta_2 \Delta FO_{i,t} + \beta_3 \Delta X_{i,t} + \Delta\mu_{i,t} + \Delta\tau_{i,t} \quad (3)$$

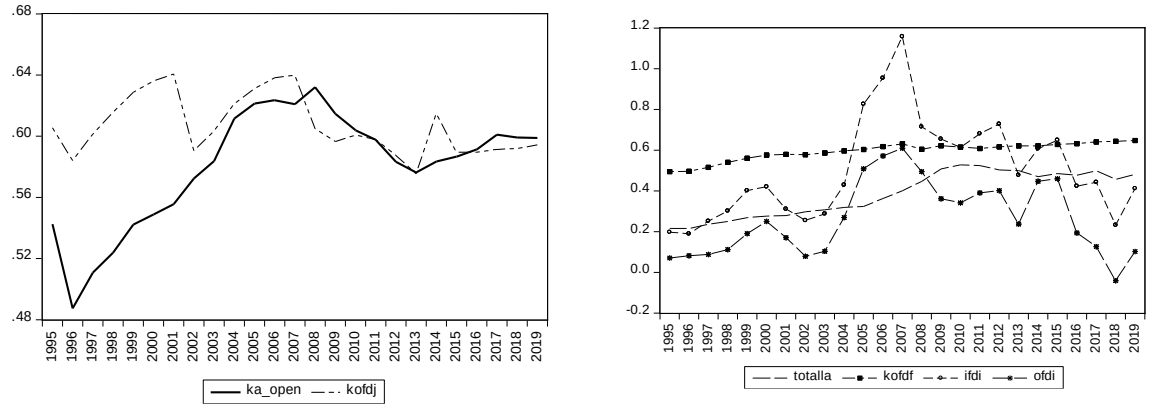
where, Δ represents first-differenced operator. The instrumental variables are the lagged dependent and regressors.[8] This study employs the system GMM estimator given its efficiency and robustness to both heteroscedasdicity and autocorrelation (Roodman, 2009). To assess serial correlation, both AR(1) and AR(2) tests (Arellano and Bond, 1991) are carried out at preliminary diagnostics. The Hansen tests are used to check the possible over-identifying restrictions, ensuring the appropriateness of the instrumental variables. Table 1 presents the description and data sources of the variables used in this study. Variables that have been transformed using the natural logarithm are denoted with the prefix *ln*.[9]

Table 1 The variables

Variable		Description	Source
Financial development, *FD*			
lndepth		Private credit by domestic deposit money banks and other financial institutions to private sector as a percentage of GDP.	[1] Global Financial Development (GFD), World Bank.
lnefficiency		The ratio of bank's net interest revenue to average interest-bearing assets.	[1]
lnlnstability		Bank credit provided by domestic money banks to private sector as a share of total bank deposits.	[1]
Financial openness, *FO*			
de facto	*lntotalla*	A *de facto* measure that is the sum of total assets and liabilities as a share of GDP.	Lane and Milesi-Ferretti (2018).
	lnkofdf	The sub-dimension of KOF financial globalization basses on foreign direct investment portfolio investment, international debt, international reserves (Lane and Milesi-Ferretti, 2018 and IMF International Investment Position (IIP), 2022) and international income payments (World Bank WDI).	[2] KOF Globalisation Index.
	ifdi	The net inflows (new investment inflows less disinvestment) as a share of GDP.	[3] World Development Indicator (WDI), World Bank.
	ofdi	The net outflows of direct investment equity as a share of GDP.	[3]
de jure	*ka_open*	A *de jure measure by KAOPEN* index (Chinn and Ito, 2006; 2008) based on 4 assigned binary indicators – restriction of current account, restriction on capital account, repatriation and surrenders of trading proceeds and absence or presence of multiple exchange rates – using the first PCA.	Chinn and Ito (2006, 2008).
	lnkofdj	The sub-dimension of KOF financial globalization basses on investment restrictions (Gwartney et al., 2022), capita account openness (Chinn and Ito, 2006; 2008) and international investment agreements (UNCTAD, 2022).	[2]
Control variables, X			
Economic growth, *lny*		Real GDP per capita of each country i.e., nominal GDP per capita divided by GDP deflator.	[3]
Trade openness, *lnto*		The sum of exports and imports of goods and services measured as a share of GDP.	[3]
Inflation, *inf*		Annual percentage change in the cost to the average consumer of acquiring a basket of goods and services (consumer price index).	[3]
Institutional quality, *lniq*		A single index of the quality of government measures by the mean value of corruption, law of order and bureaucracy quality.	International Country Risk Guide (ICRG), PRS Group

[8] Determining the optimal set of external instrumental variables (IVs) remains ambiguous to theory(ies), and "too many" relevant independent variables as IVs. External IVs must satisfy exogeneity and relevancy for the regressors. Therefore, using a simple approach of either internal IV or lagged dependent variable and regressors, are sufficient in practice (see, Blundell and Bond; 1998).

[9] Multicollinearity exists when two (or more) independent variables in a regression model are highly 'correlated' deteriorating their individual effects on the dependent variable, for instance, GDP and its components. In panel data, multicollinearity occurs from time-invariant variables; variables that trend similarly across entities over time; lagged independent variables in dynamic panel models. However, this issue does not appear for equations (2) and (3) in this study.



(a) *de jure* measures (b) *de facto* measures

Figure 1 Financial openness indicators, 1995 – 2019

Panel (a) in Figure 1 illustrates that both *de jure* indicators are relatively moving together over time. The *ka_open* diverges widely (below) from *kofdj* until 2007 with two surpasses in 2008 - 2010, and 2016 - 2019. The *kofdj* experiences a sharp increase in 2013 and 2014, overtaking *ka_open* with an opposite observation in 2015. Panel (b) depicts the trends of four *de facto* financial openness indicators that *totalla* is below *kofdf* but moving together with a gradual upward trend. Also, *ifdi* is above *ofdi* peaking at 1.16 in 2007, and moving together with an upward trend prior to the subprime mortgage crisis, but a moderate downward trend then.

A balanced panel dataset comparing 87 countries, based on data availability from 1995 to 2019, is compiled for analysis. The countries are then grouped into different income groups viz. high (33 countries), upper-middle (20 countries), lower-middle (25 countries), and low (9 countries) as classified by the World Bank (see, Appendix 1). To note that, most econometric tests and estimates cannot be computed on unbalanced panel dataset due to missing data and insufficient observations. Based on data from 87 countries, Table 2 presents the summary statistics of the key variables. Among three financial development proxies, *lnstability* is the highest than of *lndepth* and *lnefficiency* and with the smallest dispersion. Looking at the financial openness indicators, they are varying on average between -0.58 and 0.54 for *de facto* indicators, and *de jure* indicators pose the same observation that *ka_open* and *lnkofdf* are in the same magnitude (0.58), but in contrast sign. The averaged financial openness indicators even within their categories either *de facto* or *de jure*, are varying justifying the fundamental concern of the most appropriate indicator to be chosen in studying a particular economic topic, such as financial openness and financial development link. The summary statistics of the four control variables are also reported for further reference. All control variables have a positive average, except for intuitional quality, *lniq* which is negative.

Table 2 Descriptive statistics

	Mean	Standard deviation	Minimum	Maximum	NxT
Financial development:					
lndepth	3.615	1.013	-1.718	5.719	2200
lnefficiency	1.587	0.880	-2.813	4.067	1305
lnstability	4.568	0.469	2.768	6.800	2175
Financial openness:					
de facto - lntotalla	0.537	1.001	-2.700	4.915	2200
lnkofdf	-0.582	0.372	-2.187	-0.020	2200
ifdi	0.050	0.195	-0.395	4.491	2200
ofdi	0.026	0.166	-0.872	3.012	2200
de jure - ka_open	0.581	0.368	0.000	1.00	2200
lnkofdj	-0.557	0.358	-2.175	-0.071	2200
Control variables: *lny*	4.160	1.586	-1.967	7.716	2200
lnto	4.201	0.514	2.693	6.081	2200
inf	6.326	14.443	-4.478	376.746	2200
lniq	-0.633	0.405	-2.197	0.000	2200

Notes: N stands for cross-sectional dimension (no. of countries), and T is time series dimension. NxT is the total of observations.

ESTIMATED RESULTS

This section is about the empirical results. Table 3 presents the estimated coefficients of pairwise correlation matrix among the six financial openness indicators. A positive correlation is observed for all possible pair of financial indicators ranging between 0.109 (*ka_open* and *ifdi*) and 0.847 (*ka_open* and *lnkofdi*). However, *ka_open* shows a weak correlation between *ofdi* and *ifdi*, that is about 0.1, respectively. Such a low correlation (0.1) is also found for the cases between *lnkofdf* (*lnkofdj*) and *ifdi*, and *ofdi*, respectively. Such low correlation suggests their complementary relationships in capturing various aspects of financial openness. These observations are aligned with Quinn et al. (2011) and Grabner et al. (2021), which found strong correlations within the same group of indicators either *de jure* or *de facto*.

Table 3 Estimated coefficients of Pairwise correlation between financial openness indicators

Variables	*ka_open*	*lntotalla*	*lnkofdf*	*lnkofdj*	*ifdi*
lntotalla	0.440***				
lnkofdf	0.534***	0.790***			
lnkofdj	0.847***	0.347***	0.511***		
ifdi	0.109***	0.296***	0.191***	0.113***	
ofdi	0.116***	0.268***	0.181***	0.123***	0.835***

Note: *** denotes statistically significant at 1% level.

The PCA summarizes the six financial openness indicators separately, while retaining their essential information within a few components. The corresponding loadings represent the weight (inter-correlation) of financial openness indicators for those derived principal component. Table 4 reports three principal components those are ranked from most (PC1) to least (PC3) preference. Among the indicators, the loading of *lnkofdf* in PC1 has the highest frequency by its mean (0.55), minimum (0.43), and maximum (0.71). It informs that *lnkofdf* contributes significantly to PC1 among the 71 countries as showed by frequency. The frequencies of *lntotalla*, *lnkofdj* and *ka_open* indicators have their loadings in individual PC1 range from 44 to 64 countries. Notably, the frequencies of *de facto* indicators' loadings surpass those *de jure* indicators. Indeed, the frequencies of loadings for *ifdi* and *ofdi* in individual PC1 are relatively low (approximately, 20 countries) that they are considerably limited in PC1.

For PC2 that ranks the second-high frequency, the loadings of *ifdi* and *ofdi* are 54 and 46 countries, respectively. Other indicators *ka_open*, *lnkofdj*, *lntotalla*, and *lnkofdf* are sporadically observed between 15 and 24 countries. The results show that *ifdi* and o*fdi* are most preference in providing information in PC2 (54 and 46, respectively). The loadings of *ifdi* and *ofdi* are exceed 80% from few countries viz. Iran, the Islamic Rep, Korea, Rep., Romania, Sri Lanka, and Vietnam. PC3 is the least concern principal components given its low frequency of loadings between 2 and 6 countries, and their average (mean, 0.67 - 0.84), minimum (0.41 - 0.69) and maximum (0.77 - 1) are considerably high.

The KMO statistic is less than 0.8 informing that each individual indicator is preferred than of an aggregated composite index. The latter may be unsuitable due to inadequate sampling adequacy and limited predictive accuracy. Quinn (2011, p.512) contends that "…*in employing 1st PCA when other available indicators are precisely measured, some identifying variance will be lost, so using a well-measured indicator, or multiple ones if the investigator is interested in multiple facets of financial globalization, would be preferable*". The comprehensive country-level statistics on the loadings of financial openness indicators for each derived principal component including KMO statistics are presented in Appendix 3.

Table 4 Loadings of financial openness indicators in each principal component

Principle components	Indicators	Frequency	Mean	Minimum	Maximum
Component 1 (PC1)	*ka_open*	44	0.522	0.408	0.677
	lntotalla	64	0.556	0.401	0.789
	lnkofdf	71	0.548	0.434	0.705
	lnkofdj	56	0.517	0.403	0.681
	ifdi	19	0.513	0.402	0.702
	ofdi	21	0.494	0.408	0.694
Component 2 (PC2)	*ka_open*	24	0.618	0.431	0.731
	lntotalla	16	0.604	0.421	0.739
	lnkofdf	15	0.589	0.446	0.695
	lnkofdj	24	0.632	0.435	0.837
	ifdi	54	0.665	0.411	0.931
	ofdi	46	0.647	0.438	0.920
Component 3 (PC3)	*ka_open*	5	0.669	0.409	0.902
	lntotalla	3	0.691	0.437	0.874
	lnkofdf	2	0.734	0.694	0.774
	lnkofdj	3	0.696	0.444	0.823
	ifdi	5	0.679	0.582	0.949
	ofdi	6	0.841	0.591	0.997

Notes: The principle components are selected based on the PCA's eigenvalue exceeds one. *Varimax* rotation is used to compute the component loadings of each financial indicator. The component loadings (absolute values) are above 0.4.

Table 5 report the six estimates of financial openness indicators on financial development by three dimensions (financial depth, financial efficiency, and financial stability). The most financial openness indicators are statistically significant at least at 5% level, having a positive impact on financial depth, except for the *ifdi* and *ofdi*. Meanwhile, *lnkofdf* and *lnkofdj* are the most influential indicators, with estimated coefficients of 0.43 and 0.5, respectively. These findings suggest that greater openness in financial markets enhances financial depth. The of *ka_open* falls short of KOF indictors those are more influential than of other *de facto* indicators (*lntotalla*, *ifdi*, and *ofdi*). The OLS regression estimates of (3) - (4) exhibit relatively high adjusted R-squared and low RMSE, indicating strong model performance. The *ka_open* indicator in estimates (1) outperforms those in estimates (2), (5) and (6).

For the dimension of financial efficiency, the results are different from financial depth. Three indicators *ka_open*, *lnkofdf* and *lnkofdj* remains a positive sign, but *lntotalla* in estimate (2) appears to be statistically insignificant at 10% level with the lowest adjusted R-squared (0.35) and the highest RMSE (0.67). The estimates (4) and (5) that *ifdi* and *ofdi* indicators are statistically significant at 5% level with their estimated coefficients 6.69 and 2.24. The estimated regression (5) has the highest adjusted R-square, 0.42, with the lowest RMSE – it tells that *ifdi* indicator serves better in explaining the variation of financial efficiency. The *ofdi* indicator is not preferable given lower adjusted R-squared (0.35) and high RMSE.

Looking at the last dimension - financial stability, the estimates of six indicators are mixture between positive (i.e. *lnkofdf* and *lnkofdj*) and negative sign (i.e. *ka_open*, *lntotalla*, *ifdi* and *ofdi*). The former implies that greater openness in financial markets may lead to deteriorated financial market stability contradicting the famous financial openness and financial depth nexus. Other financial openness indicators, *ka_open* and *ofdi* are statistically insignificant at 10% level. As similar to the results of financial depth and efficiency, *lnkofdf* and *lnkofdj* have positive implication on financial stability, at least at 5%. Nevertheless, their estimated coefficients are small ranging between 0.03 and 0.14 (in absolute term). Their adjusted R-squared are close to each other around 0.16.[10] And, the RMSE is low, 0.43. Therefore, the selection of these six indicators of financial openness in the dimension of financial stability is infeasible. By and large, *ka_open* in (1), and *ofdi* in (6) are said to be unfavorable given their relatively low adjusted R-squared and high RMSEs.

[10] The low adjusted R-square values observed in dimensions 2 (financial efficiency) and 3 (financial stability) in Table 5 are common and do not reflect 'badness' in panel data estimates. The focus is typically placed on the significance and direction of estimated coefficients. Several factors can contribute to low adjusted R-squared values: high dependent variable is either highly volatile or influenced by unobserved factors; fixed effects model absorb much of the variation through entity-specific intercepts; multicollinearity or redundant independent variables can dilute explanatory power; independent variables are noisy or weakly related to the dependent variable; and in the case of either the unbalanced panel data or short time span, the model may not capture dynamics well.

Three key findings are drawn. Firstly, a high estimated coefficient of financial openness indicators is associated with a high adjusted R-squared and a low RMSE. This suggests that a single indicator with a high estimated coefficient improves the model's explanatory power and predictive accuracy, as by OLS estimator. Secondly, *lnkofdf* and *lnkofdj* indicators have a significant positive impact on financial development offering that *de facto* measure outweighs *de jure* measure. This finding is in line with existing studies that utilize *de facto* financial openness indicators. Lastly, all indicators yield a positive coefficient on financial depth and financial efficiency. That is, financial openness stimulates the development of financial markets. However, it is not the case for the dimension of financial stability. All indicators have a comparatively small impact on financial stability than of financial depth and financial efficiency.

Equation (1) are re-estimated by four income groups namely, high, upper-middle, lower-middle, and low. Their estimates are tabulated in Appendix 4. Most of the estimated financial openness indicators are statistically significantly at least at 5% level (with a positive sign) in respect to financial depth across all income groups, except for *ifdi*. The *de jure* measures of *ka_open* and *lnkofdj* exert a significant negative impact on financial depth at 1% level, for upper-middle income group. Indeed, *lnkofdf* and *lnkofdj* are more influential with a relatively high adjusted R-square and a low RMSE, see estimates (3) - (4). The *ofdi* is statistically significant with a positive sign for the upper-middle-and low-income groups. Looking at the financial efficiency, a relatively similar results are observed for financial depth, but mix results in terms of signs and coefficients for the indicators of *lntotalla* and *ofdi* among high, upper-middle, and lower-middle-income groups. The *de jure* financial openness indicators, *ka_open* and *lnkofdj* deteriorate financial efficiency in low-income group. The *lntotalla* does improve the 'fitness' of estimates of lower-middle-and low-income groups, while *ifdi* and *ofdi* financial openness indicators for high and upper-middle-income groups. Turning to the last dimension of financial development, financial stability - the estimates are inconsistent in sign and size across all indicators and income groups. For high income group, five financial openness indicators are negatively associated with financial stability, that *ifdi* is the most influential indicator. The more open the financial markets are, the more unstable they become. Most of the comparable results are observed within the upper-middle income group. The *ifdi* and *ofdi* indicators have a positive impact (1.36 and 3.12, respectively) on financial stability. For lower-middle-income group, the results are mixed between a negative (*lntotalla*, *lnkofdf* and *ofdi*) and positive signs (*lnkofdj*) those are statistically significant at 5% level. It is ambiguity to choice a fit financial openness indicator based on high explanatory power and prediction accuracy. For low-income group, only *lntotalla* and *lnkofdj* are significantly associated with financial stability with -0.36 and 0.15, respectively.

Table 6 shows the estimates of the system and first-differenced GMM estimator. For financial depth, their estimates are mixture, in which financial openness indicators i.e. *lntotalla* and *lnkofdf* are statistically significant with a negative sign of -0.03 and -0.05, respectively. Other indicators such as *lnkofdj*, *ifdi*, and *ofdi* are statistically insignificant at 10% level (i.e. have positive sign). The AR(1) and AR(2) tests support no autocorrelation across all estimates (1) - (6). The Hansen tests validate the instruments included. For financial efficiency, all of the financial openness indicators are statistically insignificant at 10% level. The diagnostic check signals that the estimates (1) – (6) are restricted by autocorrelation and invalid instruments. The both indicators *lntotalla* and *lnkofdf* have deteriorating impact on financial stability, -0.05 and -0.12, respectively. They are free from autocorrelation and instrumental problem. The financial efficiency and stability models are re-estimated by system GMM estimator. Their estimates are in line with those obtained from the first-differenced GMM estimator (see, Appendix 5).

Table 5 Ordinary least squares (OLS) regression results of financial development

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	**Dimension 1: Financial depth**					
ka_ open	0.277 (0.045)***					
lntotalla		0.074 (0.021)***				
lnkofdf			0.428 (0.057)***			
lnkofdj				0.500 (0.048)***		
ifdi					0.025 (0.092)	
ofdi						0.061 (0.135)
lny	0.127 (0.015)***	0.136 (0.015)***	0.107 (0.016)***	0.119 (0.015)***	0.153 (0.014)***	0.152 (0.014)***
lnto	0.253 (0.029)***	0.203 (0.033)***	0.131 (0.034)***	0.240 (0.029)***	0.256 (0.030)***	0.257 (0.030)***
inf	-0.011 (0.00101)***	-0.011 (0.00102)***	-0.010 (0.001)***	-0.011 (0.001)***	-0.012 (0.001)***	-0.012 (0.001)***
lniq	1.080 (0.057)***	1.108 (0.056)***	1.131 (0.055)***	1.005 (0.056)***	1.136 (0.056)***	1.135 (0.056)***
dummy_crisis	0.088 (0.044)**	0.100 (0.044)**	0.095 (0.044)**	0.095 (0.044)**	0.098 (0.045)**	0.097 (0.045)**
Constant	2.601 (0.142)***	2.914 (0.158)***	3.629 (0.190)***	3.081(0.145)***	2.680 (0.145)***	2.679 (0.143)***
N x T	2,175	2,175	2,175	2,175	2,175	2,175
Adjusted R-squared	0.559	0.556	0.565	0.574	0.553	0.553
F-Statistics (*p-value*)	461.100 (0.000)***	454.100 (0.000)***	470.700 (0.000)***	489.400 (0.000)***	449.600 (0.000)***	449.600 (0.000)***
RMSE	0.669	0.672	0.665	0.658	0.674	0.674
	Dimension 2: Financial efficiency					
ka_open	0.380 (0.064)***					
lntotalla		0.040 (0.031)				
lnkofdff			0.334 (0.088)***			
lnkofdj				0.397 (0.069)***		
ifdi					6.688 (0.601)***	
ofdi						2.240 (0.971)**
lny	-0.071 (0.021)***	-0.066 (0.021)***	-0.089 (0.022)***	-0.064 (0.020)***	-0.049 (0.019)**	-0.067 (0.021)***
lnto	-0.146 (0.038)***	-0.159 (0.044)***	-0.230 (0.046)***	-0.149 (0.039)***	-0.352 (0.042)***	-0.167 (0.042)***
inf	0.012 (0.001)***	0.011 (0.001)***	0.013 (0.001)***	0.012 (0.001)***	0.011 (0.001)***	0.011 (0.001)***
lniq	-1.330 (0.090)***	-1.290 (0.092)***	-1.281(0.090)***	-1.324 (0.090)***	-1.370 (0.086)***	-1.293 (0.091)***
dummy_crisis	-0.049 (0.063)	-0.019 (0.063)	-0.027 (0.063)	-0.039 (0.063)	-0.090 (0.060)	-0.028 (0.063)
Constant	1.420 (0.214)***	1.699 (0.233)***	2.315 (0.288)***	1.858 (0.218)***	2.172 (0.211)***	1.730 (0.225)***
N x T	1,050	1,050	1,050	1,050	1,050	1,049
Adjusted R-squared	0.370	0.349	0.357	0.368	0.418	0.352
F-Statistics (p-value)	103.600 (0.000)***	94.930 (0.000)***	98.230 (0.000)***	103.000 (0.000)***	126.400 (0.000)***	95.790 (0.000)***
RMSE	0.655	0.666	0.662	0.656	0.630	0.665
	Dimension 3: Financial stability					
ka_open	-0.030 (0.032)					
lntotalla		-0.045 (0.014)***				
lnkofdf			0.121 (0.037)***			
lnkofdj				0.073 (0.032)**		
ifdi					-0.141 (0.059)**	
ofdi						-0.047 (0.087)
lny	0.024 (0.010)**	0.031 (0.010)***	0.009 (0.010)	0.016 (0.010)*	0.021 (0.009)**	0.021 (0.009)**
lnto	0.102 (0.019)***	0.136 (0.022)***	0.065 (0.022)***	0.098 (0.019)***	0.113 (0.020)***	0.103 (0.019)***
inf	-0.005 (0.001)***	-0.005 (0.001)***	-0.005 (0.001)***	-0.005 (0.001)***	-0.005 (0.001)***	-0.005 (0.001)***
lniq	0.295 (0.037)***	0.305 (0.036)***	0.289 (0.036)***	0.270 (0.037)***	0.292 (0.036)***	0.291 (0.036)***
dummy_crisis	0.025 (0.029)	0.022 (0.029)	0.023 (0.029)	0.023 (0.029)	0.028 (0.029)	0.025 (0.029)
Constant	4.278 (0.092)***	4.122 (0.103)***	4.543 (0.124)***	4.331 (0.096)***	4.231 (0.093)***	4.267 (0.092)***
N x T	2,150	2,150	2,150	2,150	2,150	2,150
Adjusted R-squared	0.158	0.162	0.162	0.160	0.160	0.158
F-Statistics (p-value)	68.370 (0.000)***	70.270 (0.000)***	70.280 (0.000)***	69.220 (0.000)***	69.320 (0.000)***	68.250 (0.000)***
RMSE	0.433	0.432	0.432	0.432	0.432	0.433

Notes: Standard errors in parentheses, ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively. The *dummy_crisis* is zero-one based for the 2007-2008 subprime mortgage crisis.

Table 6 System and first-differenced GMM estimates

System GMM - financial depth						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
ka_open	-0.019 (0.025)					
lntotalla		-0.028 (0.011)**				
lnkofdf			-0.046 (0.028)*			
lnkofdj				0.033 (0.023)		
ifdi					0.003 (0.011)	
ofdi						0.024 (0.015)
$lndepth_{t-1}$	0.882 (0.032)***	0.894 (0.031)***	0.892 (0.031)***	0.883 (0.031)***	0.0879 (0.031)***	0.879 (0.031)***
lny	0.020 (0.011)*	0.024 (0.010)**	0.022 (0.010)**	0.015 (0.010)	0.019 (0.011)*	0.019 (0.011)*
lnto	0.025 (0.021)	0.042 (0.021)**	0.036 (0.021)*	0.022 (0.020)	0.024 (0.021)	0.024 (0.021)
inf	-.006 (0.002)***	-0.006 (0.002)***	0-.006 (0.002)***	-0.006 (0.002)***	-0.006 (0.002)***	-0.006 (0.002)***
lniq	0.099 (0.036)***	0.093 (0.033)***	0.087 (0.033)***	0.089 (0.034)**	0.098 (0.037)***	0.097 (0.037)***
dummy_crisis	0.039 (0.009)***	0.036 (0.009)***	0.038 (0.009)***	0.039 (0.009)***	0.039 (0.009)***	0.038 (0.010)***
Constant	0.368 (0.107)***	0.238 (0.109)**	0.234 (0.129)*	0.397 (0.114)***	0.374 (0.109)***	0.371 (0.108)***
Diagnostic test: AR(1)	-3.79***	-3.78***	-3.79***	-3.79***	-3.79***	-3.79***
AR(2)	1.17	1.18	1.15	1.18	1.17	1.17
Hansen test	60.30	57.73	58.67	60.37	60.55	60.49
N x T (N=87)	2088	2088	2088	2088	2088	2088
No. of instruments	54	54	54	54	54	54
F-statistics	1419.640***	1955.870***	1641.720***	1629.55***	1446.27***	1473.73***
First-differenced GMM - financial efficiency						
ka_open	-0.142 (0.130)					
lntotalla		-0.083 (0.079)				
lnkofdf			-0.151 (0.144)			
lnkofdj				-0.116 (0.127)		
ifdi					-0.319 (0.358)	
ofdi						0.228 (0.192)
$lnefficiency_{t-1}$	0.873 (0.063)***	0.855 (0.095)***	0.842 (0.076)***	0.899 (0.077)***	0.887 (0.074)***	0.894 (0.074)***
lny	-0.100 (0.085)	-0.129 (0.098)	-0.124 (0.075)	-0.098 (0.087)	-0.090 (0.088)	-0.096 (0.087)
lnto	-0.007 (0.073)	-0.047 (0.071)	-0.009 (0.073)	-0.014 (0.076)	-0.021 (0.069)	-0.035 (0.068)
inf	-0.001 (0.003)	0.000 (0.003)	0.000 (0.003)	-0.001 (0.003)	-0.001 (0.003)	-0.001 (0.003)
lniq	0.263 (0.176)	0.283 (0.168)*	0.280 (0.168)	0.279 (0.171)	0.277 (0.171)	0.281 (0.172)
dummy_crisis	0.082 (0.025)***	0.072 (0.023)***	0.075 (0.022)***	0.080 (0.024)***	0.079 (0.023)***	0.077 (0.023)***
Diagnostic test: AR(1)	-4.15***	-3.88***	-3.96***	-4.06***	-4.15***	-4.12***
AR(2)	-1.81*	-1.82*	-1.79*	-1.82*	-1.81*	-1.82*
Hansen test	23.16	24.40	24.55	24.57	23.79	23.62
N x T (N=42)	966	966	966	966	966	966
No. of instruments	29	29	29	29	29	29
F-statistics	124.687***	81.639***	89.803***	148.139***	127.694***	121.155***
First-differenced GMM- financial stability						
ka_open	-0.005 (0.047)					
lntotalla		-0.051 (0.018)***				
lnkofdf			-0.116 (0.047)**			
lnkofdj				0.042 (0.044)		
ifdi					0.010 (0.029)	
ofdi						0.041 (0.040)
$lnstability_{t-1}$	0.891 (0.069)***	0.892 (0.061)***	0.913 (0.057)***	0.897 (0.068)***	0.891 (0.069)***	0.892 (0.069)***
lny	0.044 (0.022)*	0.039 (0.024)	0.034 (0.025)	0.045 (0.022)**	0.044 (0.022)*	0.044 (0.022)**
lnto	0.076 (0.046)	0.115 (0.047)**	0.128 (0.054)**	0.073 (0.045)	0.074 (0.045)*	0.074 (0.045)
inf	-0.003 (0.001)***	-0.003 (0.001)***	-0.003 (0.001)***	-0.002 (0.001)***	-0.003 (0.001)***	-0.003 (0.001)***
lniq	0.079 (0.054)	0.027 (0.052)	0.037 (0.057)	0.079 (0.055)	0.080 (0.055)	0.080 (0.055)
dummy_crisis	-0.003 (0.008)	-0.005 (0.007)	-0.003 (0.007)	-0.004 (0.007)	-0.004 (0.007)	-0.004 (0.007)
Constant						
Diagnostic test: AR(1)	-3.14***	-3.13***	-3.16***	-3.15***	-3.14	-3.13***
AR(2)	0.39	0.42	0.39	0.39	0.39	0.39
Hansen test	65.00**	62.32**	1.45**	6.45**	64.82**	4.71**
N x T (N=86)	1978	1978	1978	1978	1978	1978
No. of instruments	51	51	51	51	51	51
F-statistics	49.677***	69.672***	65.778***	50.707***	48.625***	48.499***

Notes: Standard errors in parentheses, ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

CONCLUSION

This study assesses the 'fitness' of six financial openness indicators to estimate their impact on financial development (financial depth, efficiency, and instability) for 87 countries (1995 – 2019). This study confirms a strong correlation among the financial openness indicators within the measures (either *de jure* or *de facto*). The PCA shows that the aggregation of the six indicators can be detracted as some individual indicators (either *de jure* or *de facto*) contribute to the most important, while the net inflows and outflows direct investment are least important. This study finds an inferiority of aggregated financial openness indicators given its sampling inadequacy, and omission of relevant information. This study finds that the KOF Globalization Index (*de facto*) to be a fit 'stand-alone' financial openness indicator for modelling financial development, given its high estimated coefficients and integration of data from various authoritative sources such as the World Bank (2007), Lane and Milesi-Ferretti (2018), Gwartney et al. (2022), Chinn and Ito (2008), and UNCTAD (2022).

A practical implication for researchers, analysts, and policymakers is the necessity of systematically choosing the right financial openness indicator based on the topic focuses, rather than selecting randomly from publicly available sources. The KOF index is the most suitable for modelling financial development, while other topics require further evaluation. Given complexity of financial openness data, policymakers face a challenge in selecting the right indicator for formulating effective policies that align with institutional frameworks and support international coordination and cooperation. For investor, using the appropriate financial openness indicator helps better investment decision-making with risk mitigation and improved financial infrastructure. For society at large, is welfare gains through economic growth and job creation, knowledge transfer, and resilience to external economic shocks.

Several limitations should be acknowledged here. Firstly, the KOF index is systematically selected for modelling financial development, but it may not fit other macroeconomic topics (i.e. economic growth, exchange rates, inflation, interest rates and so on). Secondly, the data end in 2019, thereby failing to capture the recent economic issues such as the Covid-19 pandemic, escalating geopolitical tensions (e.g., conflict in Ukraine, trade war between US-China), and inflation those all have impacted the global financial markets and systems. Thirdly, the analysis is restricted to OLS and GMM estimators which may lack robustness in certain aspects. They include unobserved heterogeneity, serial correlation, heteroscedasticity, and dynamic bias in panel OLS estimations; while weak instruments, instrument proliferation, no second-order autocorrelation assumption are among possibilities for GMM estimations. Lastly, a few key macroeconomic determinants of financial development are omitted, for examples interest rates, exchange rates, fiscal policy, and political stability.

Future study should consider re-evaluating the choice of KOF financial openness indicator, either in the context of financial development or related topics. Incorporating updated data is crucial to offer better findings with recent information captured. A variety of methods are important to be applied for robustness such as difference-in-differences (DiD), quantile regression, Bayesian approach, and machine learning methods (i.e. Gradient boosting, neural networks, and so on).

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APPENDIXES

Appendix 1 List of sample (87) countries

Income group:	Countries:
High (33 countries)	Australia, Austria, Bahamas, Belgium, Chile, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Korea, Rep., Kuwait, Malta, Netherlands, New Zealand, Norway, Oman, Panama, Portugal, Romania, Saudi Arabia, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States and Uruguay.
Upper-middle (20 countries)	Argentina, Botswana, Brazil, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Gabon, Guatemala, Jamaica, Jordan, Malaysia, Mexico, Paraguay, Peru, Russian Federation, South Africa, Thailand, and Turkey.
Lower-middle (25 countries)	Algeria, Bangladesh, Bolivia, Cameroon, Congo, Rep., Côte d'Ivoire, Egypt, Arab Rep., El Salvador, Ghana, Honduras, India, Indonesia, Iran, Islamic Rep., Kenya, Morocco, Nicaragua, Nigeria, Pakistan, Philippines, Senegal, Sri Lanka, Tunisia, Ukraine, Vietnam and Zimbabwe.
Low (9 countries)	Burkina Faso, Guinea-Bissau, Madagascar, Malawi, Mali, Niger, Sudan, Togo and Uganda.

Appendix 2 Estimated coefficients of lagged one-period dependent variable

	(1) *ka_open*			(2) *lntotalla*			(3) *lnkofdf*		
	Fixed-Effect	First- Differenced GMM	OLS	Fixed-Effect	First- Differenced GMM	OLS	Fixed-Effect	First- Differenced GMM	OLS
$lndepth_{t-1}$	0.905	0.887	0.950	0.912	0.889	0.952	0.905	0.874	0.953
	(0.007)***	(0.033)***	(0.004)***	(0.007)***	(0.033)***	(0.004)***	(0.008)***	(0.038)***	(0.004)***
$lnefficiency_{t-1}$	0.767	0.873	0.922	0.755***	0.855	0.923	0.748***	0.842	0.922
	(0.019)***	(0.063)***	(0.011)***	(0.019)	(0.095)***	(0.010)***	(0.019)	(0.076)***	(0.011)***
$lnstability_{t-1}$	0.806	0.891	0.950	0.814	0.892	0.949	0.813	0.913	0.953
	(0.011)***	(0.069)***	(0.006)***	(0.011)***	(0.061)***	(0.006)***	(0.012)***	(0.057)***	(0.006)***
	(4) *lnkofdj*			(5) *ifdi*			(6) *ofdi*		
	Fixed-Effect	First- Differenced GMM	OLS	Fixed-Effect	First- Differenced GMM	OLS	Fixed-Effect	First- Differenced GMM	OLS
$lndepth_{t-1}$	0.903	0.890	0.949	0.905	0.886	0.949	0.905	0.886	0.949
	(0.007)***	(0.035)***	(0.004)***	(0.007)***	(0.033)***	(0.004)***	(0.007)***	(0.033)***	(0.004)***
$lnefficiency_{t-1}$	0.768	0.899	0.924	0.769	0.887	0.919	0.768	0.894	0.923
	(0.019)***	(0.077)***	(0.011)***	(0.019)***	(0.074)***	(0.011)***	(0.019)***	(0.074)***	(0.010)***
$lnstability_{t-1}$	0.803	0.897	0.950	0.808	0.891	0.950	0.808***	0.892	0.950
	(0.011)***	(0.068)***	(0.006)***	(0.011)***	(0.069)***	(0.006)***	(0.011)	(0.069)***	(0.006)***

Notes: Standard error is in parentheses, *** indicates 1% significance level. The full estimates are available upon request.

Appendix 3 Principle component loadings of financial openness indicators and Kaiser–Meyer–Olkin (KMO) returns values

Country	Component 1						Component 2						KMO
	ka_open	*lntotalla*	*lnkofdf*	*lnkofdj*	*ifdi*	*ofdi*	*ka_open*	*lntotalla*	*lnkofdf*	*lnkofdj*	*ifdi*	*ofdi*	
Algeria			0.649	0.506		0.461		0.498			0.738		0.413
Argentina	0.579			0.557	0.402	0.438		0.695	0.683				0.503
Australia		0.584	0.600	0.504							0.695	0.718	0.452
Austria		0.609	0.602	0.512							0.685	0.676	0.580
Bahamas, The		0.698			0.702			0.700		0.701			0.359
Bangladesh			0.544		0.618	0.429	0.584	0.552		0.505			0.500
Belgium					0.615	0.622		0.628	0.601				0.622
Bolivia	0.527	0.519	0.667							0.642	0.671		0.640
Botswana	0.626			0.656				0.550	0.613		0.552		0.518
Brazil		0.615	0.564		0.543		0.629			0.609			0.491
Burkina Faso		0.545	0.535		0.503		0.723			0.596			0.596
Cameroon		0.607	0.665				0.619			0.568	0.495		0.546
Chile	0.517	0.431	0.514	0.525							0.697	0.690	0.551
China		0.502	0.514	0.405		0.429							0.773
Colombia	0.440	0.401	0.465	0.427									0.692
Congo, Rep.			0.572		0.457	0.578	0.652			0.649			0.428
Costa Rica	0.563	0.535	0.502								0.743	0.642	0.609
Côte d'Ivoire	0.607	0.569		0.553					0.584		0.549	0.554	0.556
Cyprus	0.556		0.486	0.545							0.684	0.694	0.757
Denmark		0.621	0.640	0.447							0.658	0.693	0.568
Dominican Republic	0.493	0.503	0.482	0.521							0.712	0.695	0.634
Ecuador		0.668	0.705				0.710			0.474	0.518		0.564
Egypt, Arab Rep.		0.670	0.675				0.654			0.729			0.465
El Salvador	0.592			0.622				0.680	0.685				0.503
Finland		0.644	0.645								0.670	0.641	0.582
France		0.610	0.629	0.479							0.662	0.683	0.549
Gabon	0.664			0.644				0.460	0.583		0.462	0.484	0.337
Germany		0.612	0.569	0.547							0.696	0.672	0.416
Ghana	0.483			0.601	0.636			0.661	0.695				0.559
Greece		0.503	0.446	0.561	0.452		0.598					0.684	0.637
Guatemala	0.493	0.490	0.516	0.499							0.702	0.693	0.668
Guinea-Bissau	0.676			0.616				0.521	0.552			0.525	0.391
Honduras	0.677			0.623					0.460		0.595	0.608	0.558
Iceland	0.502	0.498	0.473	0.509							0.629	0.669	0.656
India		0.479	0.483		0.456	0.423							0.637
Indonesia		0.583	0.526		0.481		0.708			0.683			0.459
Iran, Islamic Rep.	0.459	0.429	0.464	0.515								0.920	0.593
Ireland	0.488	0.509	0.573	0.417							0.688	0.692	0.629
Israel	0.435	0.447	0.463										0.709
Italy		0.608	0.570	0.553							0.696	0.711	0.566
Jamaica	0.417	0.534	0.496	0.492			0.431				0.781		0.676
Japan	0.451	0.497	0.496			0.453	0.479			0.810			0.748
Jordan		0.563	0.434	0.534	0.456		0.731					0.598	0.560
Kenya	0.560		0.531	0.537							0.668	0.670	0.528
Korea, Rep.	0.408	0.482	0.494	0.436		0.408					0.931		0.677
Kuwait				0.541	0.586	0.470	0.565	0.648					0.573
Madagascar	0.537	0.534		0.543					0.468		0.651	0.535	0.525
Malawi	0.507	0.514	0.439	0.502							0.787	0.494	0.656
Malaysia	0.482	0.481	0.504	0.461							0.742	0.667	0.619
Mali			0.575		0.444	0.475	0.649	0.421		0.622			0.340
Malta	0.512	0.510	0.488	0.471							0.673	0.690	0.522
Mexico		0.627	0.621			0.432	0.573			0.797			0.506
Morocco		0.575	0.590			0.551	0.731			0.644			0.638

Notes: The loadings of financial openness indicators in each principle component are normalized by taking their absolute values. Component 3 is not reported in the above table in part because it is least important among the three components (the loading of financial openness indicators only observed in 15 out of 87 countries) and partly because of space constraints. The loadings of financial openness indicators in Component 3 are available upon request.

Appendix 3 Cont.

Country	Component 1						Component 2						KMO
	ka_open	*lntotalla*	*Lnkofdf*	*lnkofdj*	*ifdi*	*ofdi*	*ka_open*	*lntotalla*	*lnkofdf*	*lnkofdj*	*ifdi*	*ofdi*	
Netherlands		0.587	0.552	0.592							0.707	0.688	0.642
New Zealand		0.651	0.558							0.445	0.538	0.712	0.475
Nicaragua			0.661			0.557	0.467	0.723			0.415		0.423
Niger		0.567	0.512	0.548			0.538				0.638		0.438
Nigeria	0.536	0.702								0.739		0.590	0.456
Norway	0.477	0.527	0.544	0.430							0.699	0.692	0.577
Oman	0.416	0.405	0.472	0.427									0.594
Pakistan		0.441	0.559	0.447	0.520		0.723					0.649	0.411
Panama			0.624		0.608	0.477	0.722			0.541			0.578
Paraguay	0.563	0.551	0.590								0.650	0.759	0.478
Peru			0.462		0.421	0.694		0.512		0.793			0.419
Philippines			0.603	0.453		0.566	0.472				0.757		0.539
Portugal	0.433	0.561	0.545							0.435	0.432	0.753	0.588
Romania	0.495	0.522	0.479	0.458							0.823	0.487	0.604
Russian Federation		0.493	0.588		0.452	0.455	0.642			0.617			0.566
Saudi Arabia		0.502	0.485	0.468		0.468					0.777		0.603
Senegal		0.659	0.604				0.588			0.484		0.497	0.562
Singapore		0.608	0.604	0.403							0.528	0.759	0.667
South Africa	0.435	0.617	0.636								0.592	0.693	0.378
Spain	0.433	0.562	0.553	0.436							0.604	0.636	0.647
Sri Lanka	0.534		0.444	0.595					0.446		0.834		0.476
Sudan	0.657			0.618				0.682	0.571			0.438	0.637
Sweden	0.541	0.580	0.598							0.542	0.557	0.564	0.629
Switzerland		0.789	0.596	0.537							0.665	0.690	0.582
Thailand	0.483	0.460		0.443		0.469			0.580		0.753		0.631
Togo		0.584	0.511	0.597							0.710	0.653	0.637
Tunisia		0.622		0.471		0.516			0.618		0.718		0.414
Turkey		0.583	0.562		0.406		0.642			0.700			0.624
Uganda	0.561		0.542	0.535				0.739			0.549		0.473
Ukraine	0.565	0.508	0.460	0.428							0.753	0.558	0.610
United Kingdom		0.610	0.589	0.508							0.710	0.649	0.521
United States		0.595	0.572	0.558							0.752	0.622	0.521
Uruguay	0.451	0.518	0.537							0.837	0.412		0.591
Vietnam	0.482		0.483	0.480							0.898		0.721
Zimbabwe	0.658			0.681					0.695			0.660	0.433

Notes: The loadings of financial openness indicators in each principle component are normalized by taking their absolute values. Component 3 is not reported in the above table in part because it is least important among the three components (the loading of financial openness indicators only observed in 15 out of 87 countries) and partly because of space constraints. The loadings of financial openness indicators in Component 3 are available upon request.

Appendix 4 Ordinary Least Square (OLS) estimates of financial development by countries' income groups

Income group:	Variables	(1)	(2)	(3)	(4)	(5)	(6)
Dimension 1: Financial depth							
High income	*ka_open*	0.294 (0.057)***					
	lntotalla		0.069 (0.018)***				
	lnkofdf			0.827 (0.071)***			
	lnkofdj				0.200 (0.054)***		
	ifdi					0.052 (0.057)	
	ofdi						0.069 (0.083)
	lny	0.076 (0.034)**	0.051 (0.036)	0.022 (0.032)	0.105 (0.034)***	0.094 (0.034)***	0.092 (0.034)***
	lnto	0.103 (0.025)***	0.028 (0.032)	-0.075 (0.028)***	0.098 (0.025)***	0.093 (0.027)***	0.097 (0.026)***
	inf	-0.019 (0.002)***	-0.021 (0.002)***	-0.014 (0.002)***	-0.021 (0.002)***	-0.022 (0.002)***	-0.022 (0.002)***
	lniq	0.952 (0.093)***	0.964 (0.094)***	0.798 (0.089)***	0.867 (0.097)***	0.945 (0.095)***	0.943 (0.095)***
	dummy_crisis	0.165 (0.043)***	0.167 (0.043)***	0.117 (0.041)***	0.168 (0.043)***	0.170 (0.044)***	0.170 (0.044)***
	constant	3.512 (0.246)***	4.156 (0.274)***	5.058 (0.258)***	3.667 (0.246)***	3.713 (0.249)***	3.705 (0.248)***
	N x T	825	825	825	825	825	825
	Adjusted R-squared	0.441	0.433	0.505	0.432	0.424	0.423
	F-Statistics (*p-value*)	109.400 (0.000)***	105.800 (0.000)***	141.000 (0.000)***	105.600 (0.000)***	101.900 (0.000)***	101.900 (0.000)***
	RMSE	0.397	0.400	0.374	0.400	0.403	0.403
Upper-middle income	*ka_open*	-0.436 (0.096)***					
	lntotalla		0.346 (0.083)***				
	lnkofdf			0.049 (0.165)			
	lnkofdj				-0.426 (0.132)***		
	ifdi					1.372 (1.191)	
	ofdi						9.427 (2.405)***
	lny	-0.037 (0.050)	0.001 (0.050)	-0.020 (0.051)	-0.014 (0.050)	-0.020 (0.051)	-0.079 (0.052)
	lnto	0.316 (0.061)***	0.124 (0.071)*	0.263 (0.076)***	0.323 (0.063)***	0.265 (0.063)***	0.221 (0.063)***
	inf	-0.010 (0.002)***	-0.008 (0.002)***	-0.009 (0.002)***	-0.010 (0.002)***	-0.009 (0.002)***	-0.008 (0.002)***
	lniq	0.859 (0.143)***	0.819 (0.144)***	0.851 (0.146)***	0.917 (0.146)***	0.834 (0.146)***	0.835 (0.144)***
	dummy_crisis	0.004 (0.092)	-0.020 (0.092)	-0.029 (0.094)	-0.013 (0.093)	-0.044 (0.095)	-0.032 (0.093)
	constant	3.357 (0.370)***	3.659 (0.385)***	3.295 (0.468)***	2.810 (0.393)***	3.195 (0.376)***	3.580 (0.382)***
	N x T	500	500	500	500	500	500
	Adjusted R-squared	0.176	0.171	0.142	0.159	0.144	0.167
	F-Statistics (*p-value*)	18.730 (0.000)***	18.120 (0.000)***	14.710 (0.000)***	16.730 (0.000)***	14.950 (0.000)***	17.710 (0.000)***
	RMSE	0.665	0.667	0.679	0.672	0.678	0.668

Notes: Standard errors in parentheses, ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

Appendix 4 Cont.

Income group:	Variables	(1)	(2)	(3)	(4)	(5)	(6)
Dimension 1: Financial depth							
	ka_open	0.277 (0.050)***					
	lntotalla		0.074 (0.021)***				
	lnkofdf			0.428 (0.057)***			
	lnkofdj				0.500 (0.048)***		
	ifdi					0.025 (0.092)	
	ofdi						0.061 (0.135)
	lny	0.127 (0.015)***	0.136 (0.015)***	0.107 (0.016)***	0.119 (0.015)***	0.153 (0.014)***	0.152 (0.014)***
	lnto	0.253 (0.029)***	0.203 (0.033)***	0.131 (0.033)***	0.240 (0.029)***	0.256 (0.030)***	0.257 (0.030)***
Lower-middle income	*inf*	-0.011 (0.001)***	-0.011 (0.001)***	-0.010 (0.001)***	-0.011 (0.001)***	-0.012 (0.001)***	-0.012 (0.001)***
	lniq	1.080 (0.057)***	1.108 (0.056)***	1.131 (0.055)***	1.005 (0.056)***	1.136 (0.056)***	1.135 (0.056)***
	dummy_crisis	0.088 (0.044)**	0.100 (0.044)**	0.095 (0.044)**	0.095 (0.044)**	0.098 (0.045)**	0.097 (0.045)**
	constant	2.601 (0.142)***	2.914 (0.158)***	3.629 (0.190)***	3.081 (0.145)***	2.680 (0.145)***	2.679 (0.143)***
	N x T	2,175	2,175	2,175	2,175	2,175	2,175
	Adjusted R-squared	0.559	0.556	0.565	0.574	0.553	0.553
	F-Statistics (*p-value*)	461.100 (0.000)***	454.100 (0.000)***	470.700 (0.000)***	489.400 (0.000)***	449.600 (0.000)***	449.600 (0.000)***
	RMSE	0.669	0.672	0.665	0.658	0.674	0.674
	ka_open	0.438 (0.194)**					
	lntotalla		-0.360 (0.111)***				
	lnkofdf			0.490 (0.186)***			
	lnkofdj				0.636 (0.129)***		
	ifdi					0.316 (1.698)	
	ofdi						3.420 (1.689)**
	lny	-0.345 (0.069)***	-0.416 (0.071)***	-0.318 (0.070)***	-0.314 (0.067)***	-0.354 (0.072)***	-0.362 (0.069)***
Low income	*lnto*	1.133 (0.146)***	1.145 (0.142)***	0.755 (0.178)***	1.153 (0.137)***	1.039 (0.147)***	0.977 (0.145)***
	inf	-0.008 (0.003)***	-0.006 (0.003)**	-0.010 (0.003)***	-0.009 (0.003)***	-0.009 (0.003)***	-0.009 (0.003)***
	lniq	0.180 (0.229)	0.289 (0.210)	0.442 (0.210)**	0.011 (0.215)	0.380 (0.215)*	0.443 (0.212)**
	dummy_crisis	0.078 (0.132)	-0.044 (0.135)	0.123 (0.132)	0.118 (0.127)	0.069 (0.135)	0.097 (0.132)
	constant	-1.482 (0.613)**	-1.172 (0.535)**	0.766 (0.786)	-1.080 (0.509)**	-0.768 (0.534)	-0.453 (0.551)
	N x T	225	225	225	225	225	225
	Adjusted R-squared	0.296	0.313	0.302	0.352	0.280	0.293
	F-Statistics (*p-value*)	16.700 (0.000)***	17.980 (0.000)***	17.140 (0.000)***	21.250 (0.000)***	15.500 (0.000)***	16.470 (0.000)***
	RMSE	0.638	0.630	0.635	0.612	0.645	0.639

Notes: Standard errors in parentheses, ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

Appendix 4 Cont.

Income group:	Variables	(1)	(2)	(3)	(4)	(5)	(6)
Dimension 2: Financial efficiency							
High income	*ka_open*	0.365 (0.104)***					
	lntotalla		-0.016 (0.032)				
	lnkofdf			0.437 (0.145)***			
	lnkofdj				0.544 (0.093)***		
	ifdi					6.562 (0.770)***	
	ofdi						3.408 (1.035)***
	lny	0.072 (0.064)	0.070 (0.067)	0.048 (0.064)	0.132 (0.063)**	0.147 (0.059)**	0.032 (0.064)
	lnto	0.127 (0.052)**	0.149 (0.061)**	0.041 (0.061)	0.122 (0.050)**	-0.267 (0.067)***	0.014 (0.064)
	inf	0.027 (0.003)***	0.024 (0.003)***	0.027 (0.003)***	0.024 (0.003)***	0.022 (0.003)***	0.023 (0.003)***
	lniq	-1.460 (0.181)***	-1.479 (0.185)***	-1.546 (0.183)***	-1.632 (0.177)***	-1.885 (0.172)***	-1.578 (0.184)***
	dummy_crisis	-0.128 (0.101)	-0.111 (0.103)	-0.140 (0.102)	-0.142 (0.098)	-0.142 (0.093)	-0.130 (0.102)
	constant	-0.705 (0.465)	-0.489 (0.501)	0.232 (0.505)	-0.536 (0.442)	0.439 (0.429)	0.172 (0.490)
	N x T	300	300	300	300	300	300
	Adjusted R-squared	0.450	0.428	0.445	0.487	0.541	0.448
	F-Statistics (*p-value*)	41.820 (0.000)***	38.270 (0.000)***	40.890 (0.000)***	48.270 (0.000)***	59.780 (0.000)***	41.420 (0.000)***
	RMSE	0.568	0.580	0.571	0.549	0.519	0.569
Upper-middle income	*ka_open*	0.592 (0.105)***					
	lntotalla		0.096 (0.093)				
	lnkofdf			0.299 (0.185)			
	lnkofdj				0.781 (0.152)***		
	ifdi					1.320 (1.265)	
	ofdi						-14.730 (2.518)***
	lny	0.076 (0.056)	0.040 (0.058)	0.0245 (0.0580)	0.033 (0.056)	0.040 (0.058)	0.158 (0.059)***
	lnto	-0.682 (0.066)***	-0.673 (0.083)***	-0.712 (0.087)***	-0.744 (0.069)***	-0.627 (0.068)***	-0.548 (0.066)***
	inf	0.013 (0.003)***	0.012 (0.003)***	0.013 (0.003)***	0.014 (0.003)***	0.012 (0.003)***	0.009 (0.003)***
	lniq	-0.767 (0.149)***	-0.798 (0.155)***	-0.783 (0.155)***	-0.819 (0.150)***	-0.828 (0.156)***	-0.760 (0.148)***
	dummy_crisis	-0.048 (0.097)	0.002 (0.101)	-0.009 (0.101)	-0.031 (0.098)	-0.019 (0.102)	0.036 (0.097)
	constant	3.556 (0.421)***	3.979 (0.472)***	4.409 (0.578)***	4.692 (0.457)***	3.736 (0.440)***	3.150 (0.432)***
	N x T	375	375	375	375	375	375
	Adjusted R-squared	0.394	0.343	0.346	0.385	0.343	0.397
	F-Statistics (*p-value*)	41.530 (0.000)***	33.590 (0.000)***	33.980 (0.000)***	40.100 (0.000)***	33.590 (0.000)***	42.110 (0.000)***
	RMSE	0.605	0.630	0.629	0.610	0.630	0.604

Notes: Standard errors in parentheses, ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

Appendix 4 Cont.

Income group:	Variables	(1)	(2)	(3)	(4)	(5)	(6)
Dimension 2: Financial efficiency							
	ka_open	0.347 (0.111)***					
	lntotalla		0.383 (0.086)***				
	lnkofdf			0.055 (0.115)			
	lnkofdj				0.257 (0.104)**		
	ifdi					5.747 (1.426)***	
	ofdi						-5.713 (6.581)
	lny	-0.093 (0.037)**	-0.125 (0.036)***	-0.119 (0.038)***	-0.101 (0.037)***	-0.081 (0.037)**	-0.112 (0.037)***
Lower-middle income	*lnto*	0.233 (0.071)***	0.027 (0.082)	0.198 (0.088)**	0.243 (0.072)***	0.059 (0.081)	0.230 (0.072)***
	inf	0.0078 (0.001)***	0.0085 (0.001)***	0.008 (0.002)***	0.008 (0.001)***	0.008 (0.001)***	0.008 (0.001)***
	lniq	-1.017 (0.162)***	-0.943 (0.157)***	-0.927 (0.163)***	-0.983 (0.162)***	-0.954 (0.158)***	-0.935 (0.163)***
	dummy_crisis	-0.018 (0.094)	0.058 (0.093)	0.013 (0.095)	-0.002 (0.094)	-0.032 (0.093)	0.023 (0.096)
	constant	0.003 (0.390)	1.169 (0.416)***	0.491 (0.509)	0.331 (0.378)	0.741 (0.386)*	0.304 (0.383)
	N x T	325	325	325	325	325	324
	Adjusted R-squared	0.207	0.230	0.183	0.198	0.222	0.185
	F-Statistics (*p-value*)	15.100 (0.000)***	17.140 (0.000)***	13.110 (0.000)***	14.340 (0.000)***	16.430 (0.000)***	13.210 (0.000)***
	RMSE	0.545	0.537	0.553	0.548	0.540	0.554
	ka_open	-0.503 (0.197)**					
	lntotalla		1.228 (0.231)***				
	lnkofdf			0.201 (0.344)			
	lnkofdj				-0.986 (0.265)***		
	ifdi					5.906 (2.374)**	
	ofdi						22.790 (32.750)
	lny	-0.236 (0.207)	0.461 (0.234)*	-0.440 (0.205)**	-0.006 (0.214)	-0.532 (0.188)***	-0.427 (0.208)**
Low income	*lnto*	-0.124 (0.475)	1.456 (0.516)***	-0.350 (0.500)	0.105 (0.452)	-0.838 (0.510)	-0.427 (0.515)
	inf	-0.007 (0.007)	-0.016 (0.006)**	0.002 (0.007)	-0.015 (0.008)*	0.009 (0.007)	0.002 (0.007)
	lniq	-2.523 (0.645)***	-2.126 (0.545)***	-2.717 (0.687)***	-2.436 (0.601)***	-2.909 (0.642)***	-2.695 (0.689)***
	dummy_crisis	0.331 (0.206)	0.111 (0.178)	0.370 (0.219)*	0.250 (0.194)	0.223 (0.214)	0.376 (0.219)*
	constant	1.964 (1.974)	-5.048 (2.179)**	2.831 (2.120)	-0.100 (1.967)	4.270 (2.071)**	2.903 (2.124)
	N x T	50	50	50	50	50	50
	Adjusted R-squared	0.741	0.820	0.704	0.775	0.739	0.705
	F-Statistics (*p-value*)	24.370 (0.000)***	38.230 (0.000)***	20.450 (0.000)***	29.070 (0.000)***	24.180 (0.000)***	20.540 (0.000)***
	RMSE	0.293	0.244	0.313	0.274	0.294	0.313

Notes: Standard errors in parentheses, ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

Appendix 4 Cont.

Income group:	Variables	(1)	(2)	(3)	(4)	(5)	(6)
Dimension 3: Financial stability							
High income	*ka_open*	-0.013 (0.053)					
	lntotalla		-0.059 (0.017)***				
	lnkofdf			0.146 (0.071)**			
	lnkofdj				-0.021 (0.045)		
	ifdi					-0.156 (0.052)***	
	ofdi						-0.034 (0.075)
	lny	-0.042 (0.031)	-0.007 (0.033)	-0.055 (0.032)*	-0.044 (0.031)	-0.047 (0.031)	-0.042 (0.031)
	lnto	0.0132 (0.023)	0.076 (0.030)***	-0.019 (0.028)	0.014 (0.023)	0.036 (0.024)	0.015 (0.024)
	inf	-0.009 (0.002)***	-0.009 (0.002)***	-0.007 (0.002)***	-0.009 (0.002)***	-0.008 (0.002)***	-0.008 (0.002)***
	lniq	0.522 (0.086)***	0.505 (0.086)***	0.499 (0.087)***	0.531 (0.089)***	0.533 (0.086)***	0.525 (0.087)***
	dummy_crisis	0.115 (0.040)***	0.120 (0.040)***	0.104 (0.040)**	0.115 (0.040)***	0.125 (0.040)***	0.116 (0.040)***
	constant	5.091 (0.228)***	4.682 (0.253)***	5.331 (0.255)***	5.085 (0.226)***	5.023 (0.225)***	5.077 (0.226)***
	N x T	800	800	800	800	800	800
	Adjusted R-squared	0.114	0.127	0.118	0.114	0.124	0.114
	F-Statistics (*p-value*)	18.070 (0.000)***	20.300 (0.000)***	18.860 (0.000)***	18.090 (0.000)***	19.790 (0.000)***	18.100 (0.000)***
	RMSE	0.365	0.363	0.364	0.365	0.363	0.365
Upper-middle income	*ka_open*	-0.287 (0.058)***					
	lntotalla		-0.144 (0.051)***				
	lnkofdf			-0.360 (0.099)***			
	lnkofdj				-0.335 (0.080)***		
	ifdi					1.361 (0.722)*	
	ofdi						3.123 (1.476)**
	lny	-0.002 (0.030)	0.000 (0.031)	0.011 (0.031)	0.014 (0.030)	0.010 (0.031)	-0.010 (0.032)
	lnto	-0.117 (0.037)***	-0.081 (0.044)*	-0.051 (0.045)	-0.106 (0.038)***	-0.154 (0.038)***	-0.162 (0.039)***
	inf	-0.004 (0.001)***	-0.004 (0.001)***	-0.004 (0.001)***	-0.003 (0.001)**	-0.003 (0.001)**	-0.003 (0.001)*
	lniq	-0.029 (0.087)	-0.022 (0.088)	-0.040 (0.088)	0.018 (0.088)	-0.050 (0.089)	-0.040 (0.088)
	dummy_crisis	-0.023 (0.056)	-0.048 (0.057)	-0.036 (0.056)	-0.033 (0.056)	-0.060 (0.057)	-0.046 (0.057)
	constant	5.261 (0.224)***	4.979 (0.236)***	4.558 (0.281)***	4.849 (0.237)***	5.149 (0.228)***	5.287 (0.235)***
	N x T	500	500	500	500	500	500
	Adjusted R-squared	0.074	0.044	0.054	0.062	0.035	0.037
	F-Statistics (*p-value*)	7.649 (0.000)***	4.814 (0.000)***	5.716 (0.000)***	6.487 (0.000)***	4.034 (0.000)***	4.193 (0.000)***
	RMSE	0.402	0.409	0.407	0.405	0.411	0.410

Notes: Standard errors in parentheses, ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

Appendix 4 Cont.

Income group:	Variables	(1)	(2)	(3)	(4)	(5)	(6)
Dimension 3: Financial stability							
	ka_open	0.010 (0.067)					
	lntotalla		-0.172 (0.049)***				
	lnkofdf			-0.199 (0.067)***			
	lnkofdj				0.131 (0.057)**		
	ifdi					0.888 (0.541)	
	ofdi						-2.177 (1.212)*
	lny	-0.186 (0.023)***	-0.196 (0.023)***	-0.192 (0.023)***	-0.181 (0.023)***	-0.183 (0.023)***	-0.182 (0.023)***
	lnto	0.614 (0.043)***	0.731 (0.054)***	0.715 (0.054)***	0.607 (0.043)***	0.588 (0.04)***	0.608 (0.043)***
Lower-middle income	*inf*	-0.003 (0.001)***	-0.004 (0.001)***	-0.004 (0.001)***	-0.003 (0.001)***	-0.003 (0.001)***	-0.003 (0.001)***
	lniq	0.548 (0.055)***	0.522 (0.054)***	0.525 (0.054)***	0.528 (0.055)***	0.567 (0.055)***	0.551 (0.054)***
	dummy_crisis	-0.031 (0.055)	-0.047 (0.055)	-0.036 (0.055)	-0.034 (0.055)	-0.038 (0.055)	-0.023 (0.054)
	constant	2.925 (0.179)***	2.439 (0.224)***	2.347 (0.264)***	3.023 (0.182)***	3.020 (0.186)***	2.944 (0.176)***
	N x T	625	625	625	625	625	624
	Adjusted R-squared	0.317	0.331	0.327	0.323	0.320	0.319
	F-Statistics (*p-value*)	49.310 (0.000)***	52.400 (0.000)***	51.480 (0.000)***	50.610 (0.000)***	49.970 (0.000)***	49.680 (0.000)***
	RMSE	0.445	0.441	0.442	0.443	0.444	0.440
	ka_open	-0.000 (0.094)					
	lntotalla		-0.359 (0.049)***				
	lnkofdf			-0.097 (0.090)			
	lnkofdj				0.145 (0.065)**		
	ifdi					0.323 (0.813)	
	ofdi						-0.461 (0.816)
	lny	-0.068 (0.034)**	-0.127 (0.031)***	-0.0766 (0.034)**	-0.058 (0.033)*	-0.065 (0.034)*	-0.067 (0.034)**
	lnto	0.173 (0.071)**	0.272 (0.062)***	0.230 (0.087)***	0.197 (0.068)***	0.166 (0.070)**	0.182 (0.070)***
Low income	*inf*	-0.008 (0.001)***	-0.005 (0.001)***	-0.007 (0.001)***	-0.008 (0.001)***	-0.008 (0.001)***	-0.008 (0.001)***
	lniq	-0.177 (0.111)	-0.273 (0.092)***	-0.188 (0.102)*	-0.262 (0.108)**	-0.183 (0.103)*	-0.185 (0.103)*
	dummy_crisis	0.037 (0.064)	-0.080 (0.059)	0.028 (0.064)	0.048 (0.063)	0.034 (0.064)	0.034 (0.064)
	constant	3.576 (0.297)***	3.179 (0.235)***	3.273 (0.381)***	3.506 (0.254)***	3.583 (0.256)***	3.533 (0.266)***
	N x T	225	225	225	225	225	225
	Adjusted R-squared	0.209	0.366	0.213	0.227	0.210	0.210
	F-Statistics (*p-value*)	10.870 (0.000)***	22.560 (0.000)***	11.120 (0.000)***	11.960 (0.000)***	10.900 (0.000)***	10.940 (0.000)***
	RMSE	0.309	0.277	0.308	0.306	0.309	0.309

Notes: Standard errors in parentheses, ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

Appendix 5 System GMM estimates of financial efficiency and financial stability

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Dimension 2: Financial efficiency						
ka_open	0.068 (0.052)					
Lntotalla		0.020 (0.026)				
Lnkofdf			0.060 (0.066)			
Lnkofdj				0.054 (0.049)		
Ifdi					0.447 (0.528)	
Ofdi						0.229 (0.467)
$lndi01_{t-1}$	0.827 (0.059)***	0.821 (0.061)***	0.834 (0.062)***	0.816 (0.068)***	0.838 (0.058)***	0.828 (0.058)***
lny	-0.027 (0.014)*	-0.030 (0.014)**	-0.030 (0.014)**	-0.028 (0.015)*	-0.024 (0.013)	-0.027 (0.014)
lnto	-0.033 (0.057)	-0.039 (0.053)	-0.041 (0.059)	-.0038 (0.059)	-0.036 (0.053)	-0.031 (0.053)
inf	0.008 (0.005)*	0.008 (0.004)*	0.008 (0.005)	0.008 (0.005)*	0.006 (0.004)	0.007 (0.004)
lniq	-0.128 (0.080)	-0.131 (0.082)	-0.111 (0.079)	-0.137 (0.087)	-0.117 (0.079)	-0.120 (0.080)
dummy_crisis	0.01 (0.024)	0.017 (0.022)	0.016 (0.023)	0.014 (0.023)	0.016 (0.022)	0.016 (0.022)
Constant	0.355 (0.274)	0.430 (0.259)	0.479 (0.304)	0.465 (0.291)	0.376 (0.254)	0.393 (0.258)
Diagnostic test: AR(1)	-4.20***	-4.18***	-4.18***	-4.15***	-4.17***	-4.17***
AR(2)	-1.88	-1.89	-1.89	-1.88	-1.86	-1.88
Hansen test	24.43	24.21	24.92	24.67	24.33	24.01
N x T (N=87)	1008	1008	1008	1008	1008	1008
No. of instruments	30	30	30	30	30	30
F-statistics	193.250***	133.180***	134.230***	175.600***	207.810***	180.500***
Dimension 3: Financial stability						
ka_open	-0.010 (0.015)					
lntotalla		-0.023 (0.010)**				
lnkofdf			-0.042 (0.021)*			
lnkofdj				0.016 (0.014)		
ifdi					0.000 (0.012)	
ofdi						0.013 (0.019)
$lndi01_{t-1}$	0.871 (0.064)***	0.869 (0.059)***	0.895 (0.061)***	0.872 (0.064)***	0.872 (0.064)***	0.871 (0.064)***
lny	0.002 (0.007)	0.007 (0.007)	0.007 (0.007)	0.000 (0.007)	0.001 (0.007)	0.001 (0.007)
lnto	0.015 (0.020)	0.030 (0.022)	0.023 (0.019)	0.014 (0.020)	0.015 (0.020)	0.015 (0.020)
inf	-0.002 (0.001)**	-0.002 (0.001)**	-0.002 (0.001)**	-0.002 (0.001)*	-0.002 (0.001)*	-0.002 (0.001)*
lniq	0.046 (0.033)	0.048 (0.030)	0.032 (0.030)	0.040 (0.032)	0.044 (0.033)	0.044 (0.033)
dummy_crisis	0.008 (0.007)	0.007 (0.007)	0.007 (0.007)	0.008 (0.007)	0.008 (0.007)	0.008 (0.007)
Constant	0.564 (0.287)*	0.498 (0.268)*	0.368 (0.288)	0.570 (0.292)*	0.557 (0.286)*	0.563 (0.284)*
Diagnostic test: AR(1)	-3.29***	-3.30***	-3.31***	-3.29***	-3.29***	-3.29***
AR(2)	0.41	0.42	0.41	0.40	0.40	0.40
Hansen test	63.24	62.40	62.49	63.79	63.49	63.22
N x T (N=86)	2064	2064	2064	2064	2064	2064
No. of instruments	54	54	54	54	54	54
F-statistics	188.390***	166.870***	201.130***	164.960***	202.820***	208.260***