3-2022

Bank, Stock Market Efficiency and Economic Growth: Panel Data Evidence from ASEAN-5, Asia-5 and OECD-7 Countries

Swee Liang TAN
Singapore Management University, sltan@smu.edu.sg

Bank, Stock Market Efficiency and Economic Growth: Panel Data Evidence from ASEAN-5, Asia-5 and OECD-7 Countries

Swee Liang TAN, Singapore Management University[1]

Abstract

This paper estimates bank and stock market efficiency associations with real per capita GDP growth by examining panel-data across three different regions using Beck-Katz Panel-Corrected Standard Errors (PCSE) regression. It allows heteroskedastic and/or contemporaneously correlated disturbances across panels, with to specify a common first-order autocorrelation within the panel. The results suggest efficiency effects on growth is not unambiguous. The results suggest a threshold beyond which increase in bank overhead cost hurts economic growth, for developing countries. Likewise, there is a threshold beyond which increase in stock market turnover ratio hurts economic growth, for developed countries. One policy implication of the findings is that bank leaders and policy makers should take precautionary measures on overhead costs and stock market liberalisation policies so that savings are efficiently allocated through the financial system between financial and real sectors.

Keywords: financial development, efficiency, economic growth, panel corrected standard error

JEL Codes: C23, G10, G22, 016

[1] Email contact: sltan@smu.edu.sg

This paper is first presented at the 2022 Advances in Empirical Macroeconomics (5-6 May 2022), and subsequent revisions for the Singapore Economic Review Conference (1–3 August 2022). The author is grateful to participants and organizers for suggestions, especially Tomoki Fuji and Thuy Phan.

1. Introduction

There are competing perspectives on the effects of financial development on economic growth.
Following the Schumpeterian view [25] in the 1930's that entrepreneurs need credit to finance their innovations, banks and financial markets are considered important facilitators of economic development. Studies have shown that development of financial system induces a better allocation of resources, mobilises savings, reduces risks and facilitates transactions. The financial sector acts as a lubricant for the economy, ensuring a smoother allocation of resources and the emergence of innovative firms. Some empirical studies (drawing on cross-country, time series and panel studies) in contrast have found mixed results with respect to the association of financial development and growth. These studies found the negative role of finance (e.g., that the stock markets have destabilising effects, or that financial liberalisation can lead to financial crises). Instead of being facilitators of economic growth, financial institutions favour their own growth and become "too big to fail", enabling them to take excessive risk since they know it will most certainly be mutualized by the intervention of the public authorities. There is also divergence in views on causality, which is finance appears to respond to economic growth. Some even argue that the link is tenuous or even non-existent in developed countries, because once a certain economic wealth level has been reached, the financial sector makes only a marginal contribution to the efficiency of investment.

The financial development and economic development nexus are widely studied in the literature, with banks and stock markets typically examined to be important sources of economic growth. Intuitively, firms raise fundings through borrowing from financial institutions or issuing equities in the financial markets to finance their investment activities, which in turn promotes economic growth. The purpose of this paper is to critically examine whether well-developed banks and stock markets (size to GDP, relative structure, and efficiency) are essential parts of the financial development of countries. Overall, the existing literature is inconclusive regarding the association between financial development and economic growth (outcomes vary depending on researchers' choice of countries, time-period, explanatory variables, methodology, etc). Most of the existing studies are found in the case of developed economies, and very few studies have compared the finance and growth relationship across different economic blocs or country-level groupings. To this end, the purpose of this paper is to provide consistent comparison of the link across three different country-level groupings: ASEAN-5 (Singapore, Malaysia, Thailand, Philippines, and

Indonesia), Asia-5 (Japan, China, Hong Kong SAR, South Korea, and India) and OECD-7 (Australia, Canada, Denmark, Norway, Sweden, U.K., and U.S.) - over the period 1996 to 2017, by using panel regression with fixed effects model (to account for country-heterogeneity), and allowing for *various types of* error assumption violations (namely, the Prais-Winsten estimates of the Beck-Katz [5] Panel-Corrected Standard Errors (PCSE) model which assumes that the disturbances are, by default, heteroskedastic and/or contemporaneously correlated across panels, with the option corr(ar1) included to specify a common first-order autocorrelation within the panel). The countries (and region) were chosen to reflect the efficiency-growth nexus among developed and developing economies. Following IMF (2016) classification, this paper uses bank size (proportion of liquid liabilities to GDP), activities (proportion of domestic private credit to GDP), and efficiency (bank overhead cost to total assets, and net interest margin) for banking sector development indicators. For stock market development indicators, this paper uses stock market size (proportion of stock market capitalization to GDP), activities (proportion value of shares traded to GDP), and efficiency (proportion of value of shares traded to stock market capitalization, or the turnover ratio). Stock market return is included to account for stock prices' effects on GDP per capita growth. Control variables such as government expenditure to GDP. exports to GDP, and inflation are included.

The remainder of the paper is set out as follows. Some prominent literature pertaining to financial development-growth nexus are discussed in Section 2. The financial development indicators and macroeconomic variables are examined in Section 3. Panel data estimation methodology is briefly explained in Section 4. Model evaluation and empirical findings are shown in Section 5. Lastly, summary and conclusions are drawn in Section 6.

2. Literature review

Our work builds on an extensive body of research, especially the empirical literature relating economic growth to finance[2]. After the early debate on the relationship between financial development and economic growth, many subsequent empirical studies (drawing on cross-country, time series and panel studies) have found mixed results with respect to the association of financial development and growth. Following the Schumpeterian view [25] that entrepreneurs need credit to finance their innovations, banks and financial markets are considered important facilitators of economic development. Development of financial system

[2] Notable contributions on this topic include [3, 10, 13, 15,16, 19]. Comprehensive surveys can be found [17, 18].

induces a better allocation of resources, mobilises savings, reduces risks and facilitates transactions. The financial sector acts as a lubricant for the economy, ensuring a smoother allocation of resources and the emergence of innovative firms. In contrast, some researchers highlight the negative role of finance (e.g., that the stock markets have destabilising effects, or that financial liberalisation can lead to financial crises). Instead of being facilitators of economic growth, financial institutions favour their own growth and become “too big to fail”, enabling them to take excessive risk since they know it will most certainly be mutualized by the intervention of the public authorities. There is also divergence in views on causality, which is finance appears to respond to economic growth. Some even argue that the link is tenuous or even non-existent in developed countries, because once a certain economic wealth level has been reached, the financial sector makes only a marginal contribution to the efficiency of investment.

Reference [25] opines those financial services (e.g., reallocating capital to the highest value use without substantial risk of loss through moral hazard, adverse selection, or transaction costs) are essential catalyst of economic growth. Reference [11] uses data for 77 countries from 1960 to 1989 and finds a statistically significant positive relationship between financial indicators (ratio of broad money to GDP, ratio of private sector credit to GDP) with real per capita GDP growth, per capita physical capital accumulations, and capital allocation efficiency improvements (residual of real per capita GDP growth after accounting for the rate of physical capital accumulations), as well as their future rates respectively. Their findings are consistent with Schumpeter’s [25] view that the services provided by financial intermediaries stimulate long-run growth, by increasing capital accumulation rate and capital allocation efficiency. They support the view that developed financial intermediaries boost technological innovation through rewards to the entrepreneurs [12].

Reference [13] empirically assesses the relationship between growth and both stock markets and banks. To measure bank development, they use bank credit to the private sector as a share of GDP. To measure stock market development, e.g., for overall size of the market, they use market capitalization relative to GDP; for stock market activity, they use the value of trades relative to GDP; and for stock market liquidity, they use the value of trades relative to market capitalization. They find that initial measures of stock market liquidity and banking sector development are both strong predictors of economic growth over the next 18 years. Their study however has been criticized for econometric weaknesses – namely, the ordinary least squares (OLS) approach does not account formally for potential simultaneity bias, nor does it control explicitly for country fixed effects or the routine use of lagged dependent variables in growth regressions.

Reference [6] uses the generalized method of moments (GMM) techniques and constructs a panel-data set for 40 countries with data averaged over five-year intervals from 1976 to 1998, to abstract from business cycle relationships. It is found that bank and stock market development positively influenced economic growth. This is after controlling for simultaneity bias, omitted variable bias, the routine inclusion of lagged dependent variables in growth regressions, and assessing the robustness using several variants of the system estimator [7].

Reference [23] criticises earlier work on the grounds that first, both financial development and growth could be driven by a common omitted variable such as the propensity of households in the economy to save. Since endogenous savings (in certain models of growth) affects the long-run growth rate of the economy, one may expect growth and initial financial development to be correlated. Second, financial development (typically measured using bank credit level, and stock market size) may predict economic growth simply because the stock's price in the present value of future growth opportunities, while banks lend to growing sectors. Thus, financial development may simply be a leading indicator rather than a causal factor; or according to [24] ‘where enterprises lead, finance follows’ - economic development creates demands for types of financial arrangements, and the financial system responds automatically to these demands. To determine whether financial development facilitates economic growth, [23] examine one rationale for such a relationship: that financial development reduces the costs of external finance to firms. They find industrial sectors that are relatively more in need of external finance develop disproportionately faster in countries with more-developed financial markets, in a large sample of countries over the 1980's, after considering omitted variables, outliers, or reverse causality

Reference [4] uses a unique database for 74 countries and firms of small, medium, and large size; it finds that bank concentration increases obstacles to obtaining finance for firms of all sizes, but only in countries with low levels of economic and institutional development. For policy makers interested in alleviating financing obstacles, there are negative effects of bank market power on firms’ access to credit, especially for developing countries. The effect of concentration on financing obstacles is exacerbated by more restrictions on banks' activities, more government interference in the banking sector, and a larger share of government-owned banks. On the contrary, the effect is dampened by a larger share of foreign-owned banks and an efficient credit registry.

References [1, 6] use cross-sectional data on 71 countries over the period 1960 to 1995 and find that a country's convergence rate to the frontier growth rate depends on its level of financial development, though having vanishing effects. They analyse the effects of financial constraints that prevent poor countries from taking full advantage of technology transfer thus leading to an ever-increasing technology gap and cause some of them to diverge from the growth rate of the world frontier. Specifically, they find a significant and sizable effect of an interaction term between initial per-capita GDP (relative to the United States) and some financial intermediation measures (such as value of credits by financial intermediaries to the private sector, divided by GDP).

Reference [11] uses Arellano-Bond GMM estimator [2] to determine the relationship between economic performance and financial stability in the European Union. They test how different measures of financial instability (an institutional index, microeconomic indicators, and author's computed statistical index derived from a principal component analysis) affect economic performance (or components of aggregate dynamics like consumption, investment, and disposable income), and find that financial instability has a negative effect on economic growth.

On the other hand, there are economists who have different perceptions toward the association between financial development and economic growth. As [24] opined, "finance plays a minor role in economic growth; rather it is driven by growth", while [20] insists that finance is an "overstressed" determinant of economic growth. Therefore, any strategies aimed at promoting financial system development would be a waste of resources, as it diverts attention from more relevant policies such as labour and productivity improvement programs, implementation of pro-investment tax reforms, encouragement of exports, amongst others.

References [9, 31] focus on the curb market, which are informal (sometimes illegal) credit markets where loans suppliers and demanders can transact freely at uncontrolled interest rates, in financially repressed economies. Reference [31] argues that financial development in least developing countries LDC in the form of interest rates reform (i.e., higher time deposit rates) leads to portfolio reallocation from the informal sector to the formal sector which in turn reduces the total supply of credit, thereby stifling economic growth of the concerned economy. Reference [31] disagrees with [14, 21] proposal that higher time-deposit rates (coupled with tight money growth rule) increases the savings rate - higher time deposit rates lead to an influx of deposits into commercial banks, raises the real size of the banking system and hence the net flow of real bank credit to finance investment. These

authors assume that the portfolio shift into time deposits is coming out of an 'unproductive' asset like gold, cash, commodity stocks, etc. Realistically, in most LDCs there are flourishing Unorganized Money Markets, UMM, where the public can lend directly to firms or farmers. These alternative assets provide more, rather than less intermediation, than the banking system. Hence, an increase in time deposit rates may raise the real curb market rate and slow down the growth rate instead.

Reference [26] opines that Asian economic crisis of 1997 has cast doubt on the hypothesis that financial development "leads" economic growth, as financial markets have failed to allocate the large inflow of funds into profitable ventures and are largely responsible for the meltdown. It is argued that cross-sectional studies have failed to address the possibility of reverse causality from economic growth to financial development [26]. Using a Vector Autoregression (VAR) technique of innovation accounting or variance decomposition and impulse response function analysis to examine the various interrelationships between financial development, and economic growth, investment, and productivity, the author found little evidence that financial development 'leads' economic growth in the eleven countries in the sample. For example, one would find support for the hypothesis that financial development 'leads' economic growth if the response of economic growth to a 'shock' in total credit exhibits a larger and longer effect than the response of total credit to a 'shock' in economic growth. Reference [26] shows the responses of economic growth to 'shocks' in total credit and the responses of total credit to 'shocks' in economic growth are small and die out over a six-year time horizon. This suggests weak causality patterns in all countries in the sample.

Considering these conflicting views, this paper hopes to advance the line of research on a much-debated question on the finance-growth nexus and the extent to which financial sector development helps or hinders ASEAN-5 economic growth, using panel data analysis. This paper, an extension of author's earlier [27], examines banking sector and stock market efficiency as key drivers of real per capita GDP growth.

3. Overview of the Data Set

Our dataset is composed of country variables from five economies in ASEAN (Singapore, Malaysia, Thailand, Philippines, and Indonesia), five economies in Asia (Japan, China, Hong Kong SAR, South Korea, and India) and seven economies in OECD (Australia, Canada, Denmark, Norway, Sweden, U.K., and U.S.). Annual data between 1990 and 2017 is used.

The dependent variable is measured as real per capita GDP growth rate, and the explanatory variables comprise a broad array of financial indicators on banks and stock markets to maximise the information on financial development. See Box 1 for details about the financial development indicators. These indicators follow the IMF (2016) classification of financial development indices on depth (or size) and efficiency. The banking sector development indicators include bank *size* (ratio of liquid liabilities in GDP), bank *activities* (ratio of credits by banks to the private sector in GDP - this excludes credit granted to the public sector and credit granted by the central bank), and bank *efficiency* (ratio of bank overhead cost in total assets, and net interest margin). The stock market development indicators are stock market *size* (ratio of stock market capitalization in GDP), *activity* (ratio of stock market total value traded in GDP), and *efficiency* (ratio of stock market total value traded in stock market capitalization, or the turnover ratio). Stock market return is also included to account for stock prices' effects on GDP per capita growth.

Lastly in line with existing research, control variables known to influence real per capita GDP, namely the ratio of liquid liabilities in GDP, the ratio of government expenditure in GDP, the ratio of exports in GDP, and CPI inflation, are included. Data for these variables are obtained from the World Bank's World Development Indicators database.

Box 1: Financial Development Indicators

The following indicators are used as proxies to measure banking sector and stock market development.

1. To measure bank size relative to the size of the economy, the ratio of ***liquid liabilities of bank and nonbank financial intermediaries*** in GDP is used. It is frequently used as an overall measure of financial sector development [15,16].

2. To measure bank activity in the private sector the ratio of ***claims of deposit money banks on private sector*** in GDP is used. This measure excludes credits to the public sector (central and local governments and public enterprises). Due to lack of data for some countries, claims of other financial institutions on private sector as a share in GDP, which focus on insurance companies, finance companies, pooled investment schemes (mutual funds), savings banks, private pension funds, and development banks, are not used, although it provides a broader measure of nonbank activity in the private sector.

3. To measure bank efficiency, a variety of indicators are used:
   (a) The ratio of bank overhead costs in total assets - In general, a company strives to achieve the lowest operating expenses possible without sacrificing the quality or competitiveness of its goods or services. If the banks' operating cost to asset ratio is consistently declining, it indicates its operational efficiency in managing costs against increased assets. Excessive overhead expenditures may reflect not only waste, but a lack of competition. It should also be recognized, however, that overhead cost is not an unambiguously clear measure of efficiency. Competitive banks may undertake substantial investments to provide high-quality financial services, and these productivity-enhancing investments may boost overhead costs. Put differently, very low overhead costs may reflect insufficient competition and insufficient investment in providing superior banking services[3].

   (b) Bank net interest margins equals the bank interest income minus interest expense, then divided by total assets. Since the interest earned on such assets is a primary source of revenue for a bank, this metric is a good indicator of a bank's overall profitability, and higher margins generally indicate a more profitable bank.
   Factors that can significantly impact net interest margin includes interest rates charged by the bank and the source of the bank's assets. On the one hand, tighter interest margins are frequently viewed as representing greater competition and efficiency. On the other hand, it reveals a lower bank's net profit on interest-earning assets, such as loans or investment securities.
   - From a macro (welfare and monetary policy) perspective, low net interest margins (NIM) can be a sign of a relatively competitive banking sector and of lower funding costs for the non-financial private sector. Banks' individual interest rate-setting abilities in highly competitive markets should be limited, potentially resulting in a more complete interest rate pass-through [30].
   - However, from a financial stability perspective lower margin imply, ceteris paribus, a weaker ability of banks to build up capital through retained earnings, decreasing their shock absorbing capacity. Most of the related literature regarding the impact of the interest rate level is on bank profitability.

- To measure stock market size, the ratio of market capitalization (the value of domestic equities) in GDP, is used.

[3] Notably, Singapore and Japan have the lowest overhead costs to total assets ratio, and it would be interesting for future research to estimate the association of this variable with economic performance.

- To measure stock market activity, the ratio of stock market total value traded in GDP is used. It is used to gauge market liquidity because it measures the value of stock transactions relative economic activity [19].
- To measure stock market efficiency, turnover ratio (defined as the total value of shares traded during the period divided by the average market capitalization for the period) is used.

Source: World Bank's World Development Indicators

Descriptive statistics are presented in Table 1. See the columns labelled *xtsdw* and *xtsdb* - the within and between standard deviation of the data, respectively – and note the considerable differences within and among the selected economies – the latter, represents the heterogeneity among the countries, in the different groups.

Table 1. Descriptive Statistics

(a) ASEAN-5

Summary statistics: ASEAN-5

VarName	mean	min	max	sd	xtsdw	xtsdb	obs
GDPpc_gr	0.0	-0.0	0.1	0	0	0	90
PrivateCredit_gdp	78.0	15.8	164.2	43	14	45	90
MarketCap_gdp	97.8	14.0	259.0	66	24	69	90
Overheadcost_TotalAssets	2.0	0.2	6.0	1	1	1	90
NIM	3.3	0.1	6.8	2	1	2	90
SMTOR	42.9	10.8	125.8	26	12	25	90
SMTVT_gdp	41.9	2.7	173.8	37	16	36	90
SM_return	8.8	-27.0	56.2	19	18	5	90
LL_gdp	86.7	29.0	135.1	35	9	38	90
ExportGS_gdp	84.2	19.1	229.0	63	12	69	90
Inflation	3.4	-0.9	13.1	3	2	2	90
GovCon_gdp	11.3	6.5	17.1	2	1	2	90

(b) Asia-5

Summary statistics: Asia-5

VarName	mean	min	max	sd	xtsdw	xtsdb	obs
GDPpc_gr	0.0	-0.1	0.1	0	0	0	90
PrivateCredit_gdp	117.9	25.6	218.9	52	19	54	90
MarketCap_gdp	209.8	18.7	1,098.9	320	135	323	90
Overheadcost_TotalAssets	1.5	0.2	3.3	1	1	1	90
NIM	2.3	0.2	5.0	1	1	1	90
SMTOR	124.1	36.8	556.9	78	62	53	90
SMTVT_gdp	153.0	2.3	822.3	172	100	155	90
SM_return	8.0	-28.6	160.0	26	25	4	90
LL_gdp	160.1	50.4	368.9	89	28	94	90
ExportGS_gdp	56.6	10.2	221.6	65	14	70	90
Inflation	2.5	-3.7	12.0	3	2	2	90
GovCon_gdp	13.7	8.4	20.3	4	1	4	90

(c) OECD-7

Summary statistics: OECD-7

VarName	mean	min	max	sd	xtsdw	xtsdb	obs
GDPpc_gr	0.0	-0.1	0.1	0	0	0	126
PrivateCredit_gdp	137.8	64.1	211.9	36	23	29	117
MarketCap_gdp	97.3	35.8	161.7	31	15	29	111
Overheadcost_TotalAssets	1.7	0.3	4.4	1	1	1	126
NIM	1.9	0.3	4.1	1	0	1	126
SMTOR	95.7	38.1	292.6	48	28	40	111
SMTVT_gdp	95.7	19.1	313.7	64	26	61	113
SM_return	6.5	-32.8	54.9	17	17	3	126
LL_gdp	78.5	37.8	164.4	31	14	30	117
ExportGS_gdp	32.7	9.0	55.4	13	3	14	126
Inflation	2.0	-0.5	4.5	1	1	0	126
GovCon_gdp	20.6	14.0	27.9	4	1	4	126

Note:

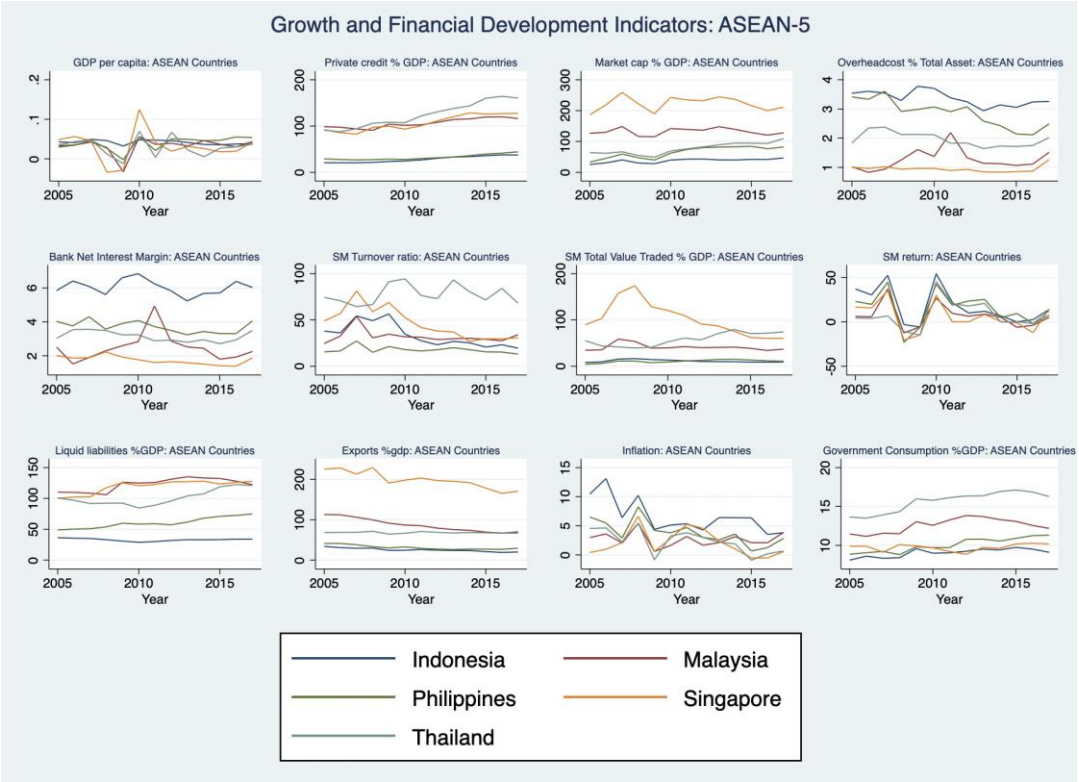
- *"xtsdw" is the within standard deviation of a variable (i.e., the standard deviation from each country's mean in the sample period)*
- *"xtsdb" is the, between standard deviation" of a variable (i.e., the standard deviation among the sub-group variable data).*

Time series financial development indicators and macroeconomic variables over the period 2005 to 2017 again show there are considerable differences between and / or among the selected economies in ASEAN-5, Asia-5 and OECD-7 (Figure 1). This paper seeks to address the association between bank sector and stock market development and economic

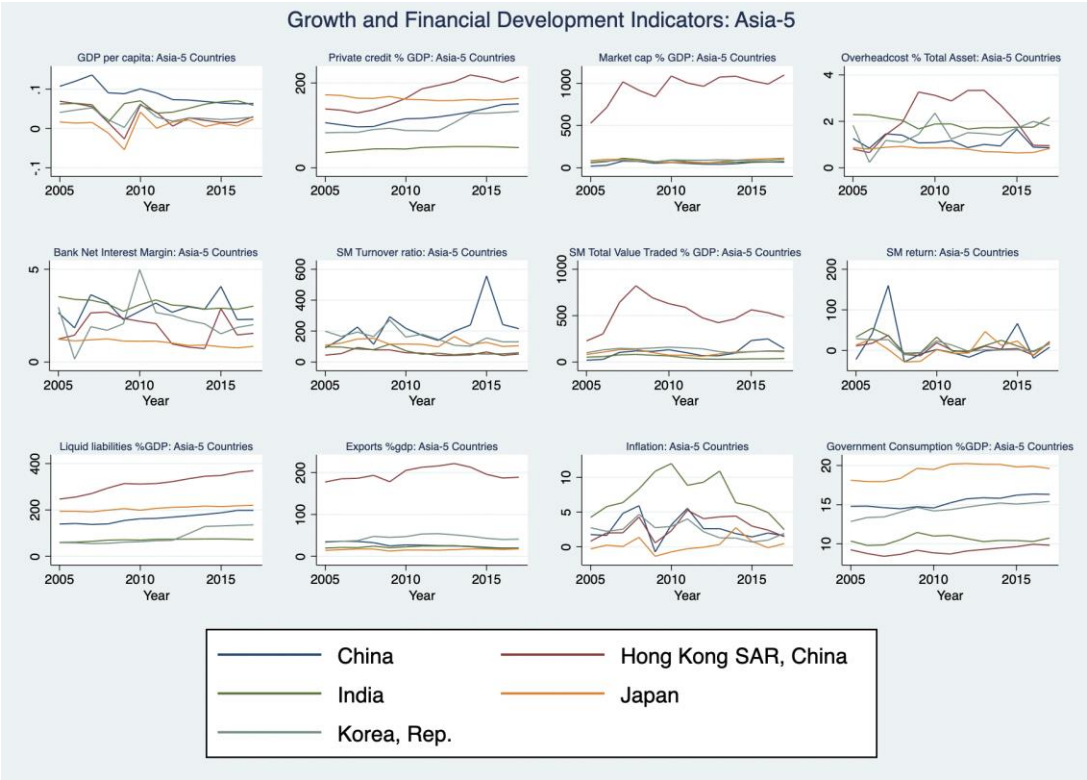
growth, and it is found that interpretation of efficiency indicators, in particular, are not unambiguous.

Figure 1: Financial development and Macroeconomic variables

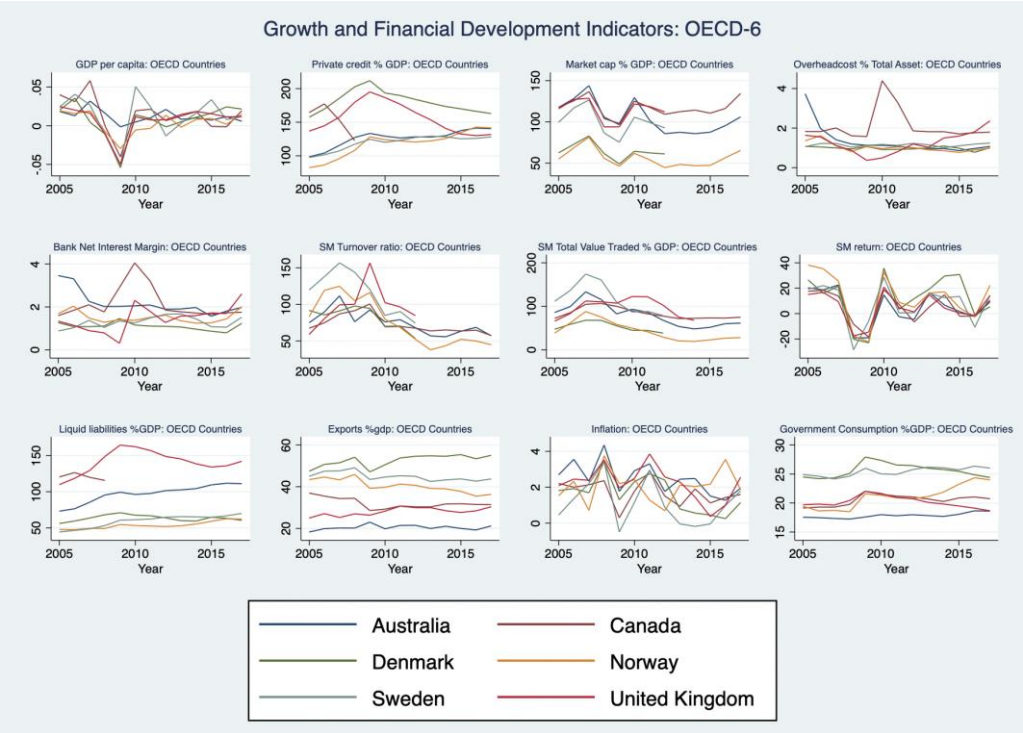
(a) ASEAN-5



(b) Asia-5



(c) OECD-7



Note:

1) In ASEAN-5, the average growth rate of real per capita GDP of the selected economies ranged between 2.4% (Philippines) and 3.7% (Malaysia) during the study period (1990-2017). In the case of Asia-5, the range

is wider - average growth rate of real per capita GDP ranged between 1% (Japan) and 8.7% (China). In OECD-7 the range for developed economies is narrower - between 1.1% (Canada) and 1.7% (Australia), respectively.

2) The bank size has been increasing overtime since 1990 for the ASEAN-5 and some Asia-5 economies. The average share of banks' private credit as a proportion to GDP is lowest for Indonesia, at about 30%, and this is followed by Philippines (33%), Singapore (103%), Malaysia (105%) and Thailand (highest on average at 116%). In Asia-5, the average share is lowest for India (34%), followed by South Korea (81%), China (105%), Hong Kong (160%) and Japan (highest average at 171%). In OECD-7, bank size has trended up for Norway, Sweden, Australia, and otherwise for Denmark and UK.
3) In ASEAN-5, the average value of overhead cost as share of total assets is lowest for Singapore (0.9%), followed by Malaysia (1.2%), Thailand (1.9%), Philippines (3.2%), and Indonesia (highest at 3.3%). In the case of Asia-5 and OECD-7, the average value ranged between 0.9% (Japan) and 2.2% (India), and between 1.1% (Denmark) and 3.1% (United States) respectively during the study period. In ASEAN-5, the average value of net interest margin is lowest for Singapore (1.7%), and highest for Indonesia (5.3%). In Asia-5 for Japan (1.1%) is lowest and for India (3.2%) is highest, while in OECD-7 for Denmark (1.3%) is lowest and for US (3.6%) is highest.
4) Next, the examination of the stock market development indicators shows that the mean of stock market capitalization to GDP is lowest for Indonesia (28%) followed by Philippines (54%), Thailand (61%), Malaysia (147%) and Singapore is highest (178%). In Asia-5 and OECD-7, the average value range between 37% (China) and 578% (Hong Kong), and between 42% (Norway) and 113% (UK and US), respectively. Further, the value of shares traded as share of stock market capitalization (or, turnover ratio), a proxy for the stock market efficiency, indicates that the average value in ASEAN-5 ranges from 21% for Philippines to 77% for Thailand; in Asia-5, the average value ranges from 53% for Hong Kong, to 185% for China; and for OECD-7 the average value ranges from 30% for Belgium, and 145% for United States The mean value of shares traded a proportion to GDP – as measure of activities - in ASEAN-5 is found to in be lowest for Indonesia (9%) and highest in Singapore (89%); in Asia-5 lowest in India (30%) and highest in Hong Kong (309%).
5) Lastly, among the selected control variables, inflation was high for Indonesia and India, which smoothed out in subsequent years. The mean value of exports expressed as a ratio of GDP, an indicator of the relative importance of international trade in the economy, is highest for Singapore (188%) and Hong Kong (159%), and lowest for Japan (13%) and US (11%).

Figure 2a illustrates that ASEAN-5 has comparable bank size to OECD *(80.2% vs 74.9%)*, but a larger stock market size *(93.6% vs 73.5%)*; yet its bank and stock market activities are much smaller *(77.7% vs 102%; and 38.2% vs 61%) respectively*. Compared to Asia-5, ASEAN-5 has smaller bank & stock market *size*, and smaller bank and stock market *activities***.** Figure 2b illustrates that ASEAN-5 when compared to Asia-5 and OECD-7 countries, has on average highest bank net interest margin *(3.3% vs 2.3% vs 1.6%),* and highest bank overhead cost to total assets *(2.1% vs 1.6% vs 1.5%)*, respectively. Figure 2c illustrates that ASEAN-5 compared to Asia-5 and OECD-7 countries, has the lowest ***stock market turnover ratio*** - the value of shares traded in proportion to stock market capitalization - *(43.6% vs 116% vs 81.2%),* respectively*.* This paper seeks to address the association between bank sector and stock market development (size, activities and

efficiency) and economic growth, and in particular it raises question whether countries should be cautious if excessive bank lending or highly liquid stock markets (i.e. large values of stock traded traded) dampen economic growth.

Figure 2a: Bank and Stock Market (Size, Activity)
(Average 1990 - 2017)

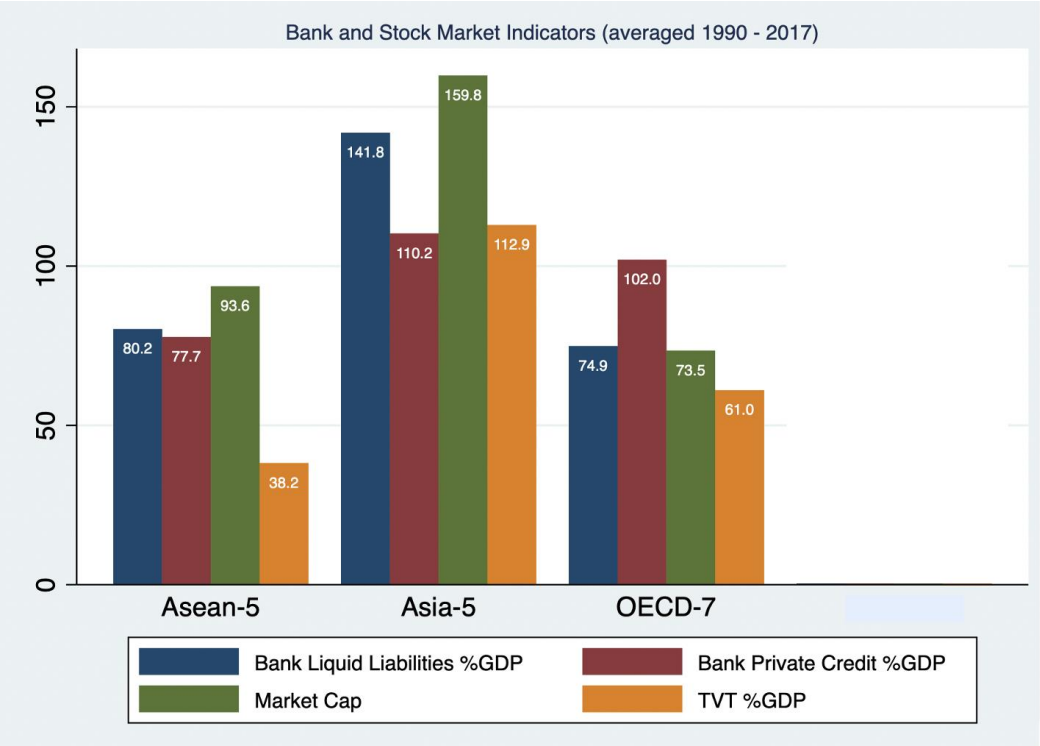
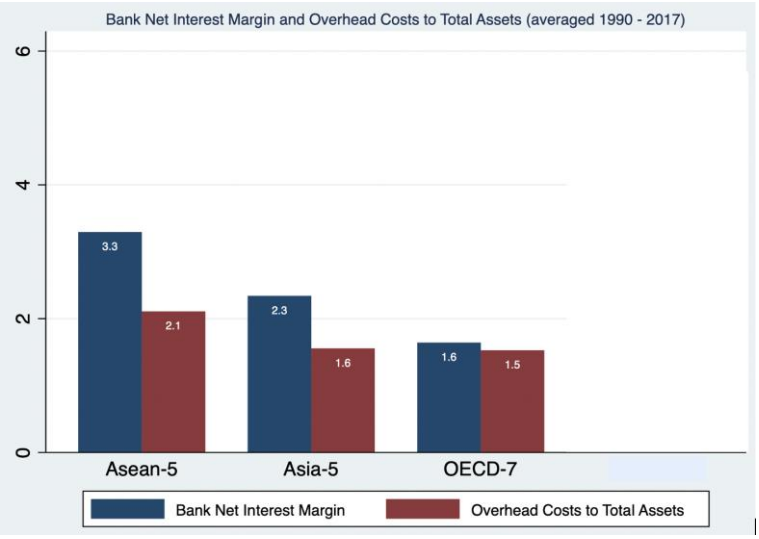
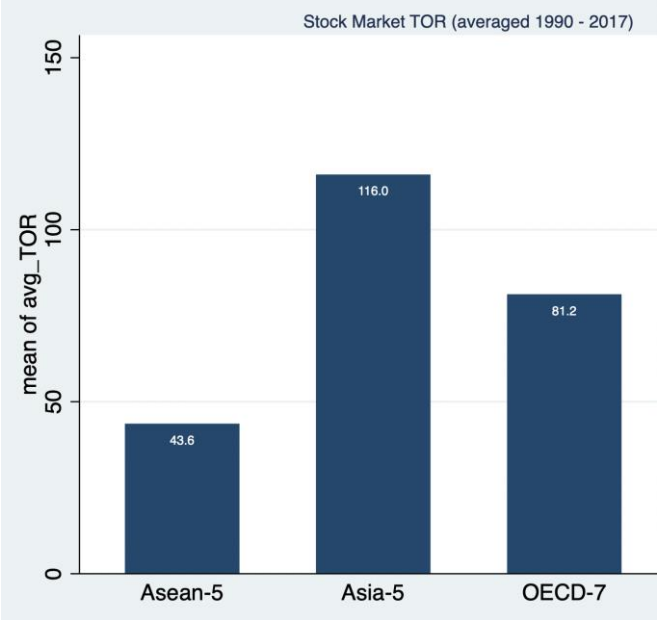


Figure 2b: Bank Net Interest Margin and Bank Overhead Costs to Total Assets (Average 1990 - 2017)



Note: OECD-7 higher income countries tend to have lowest average bank net interest margin, and lowest average bank overhead cost to total assets.

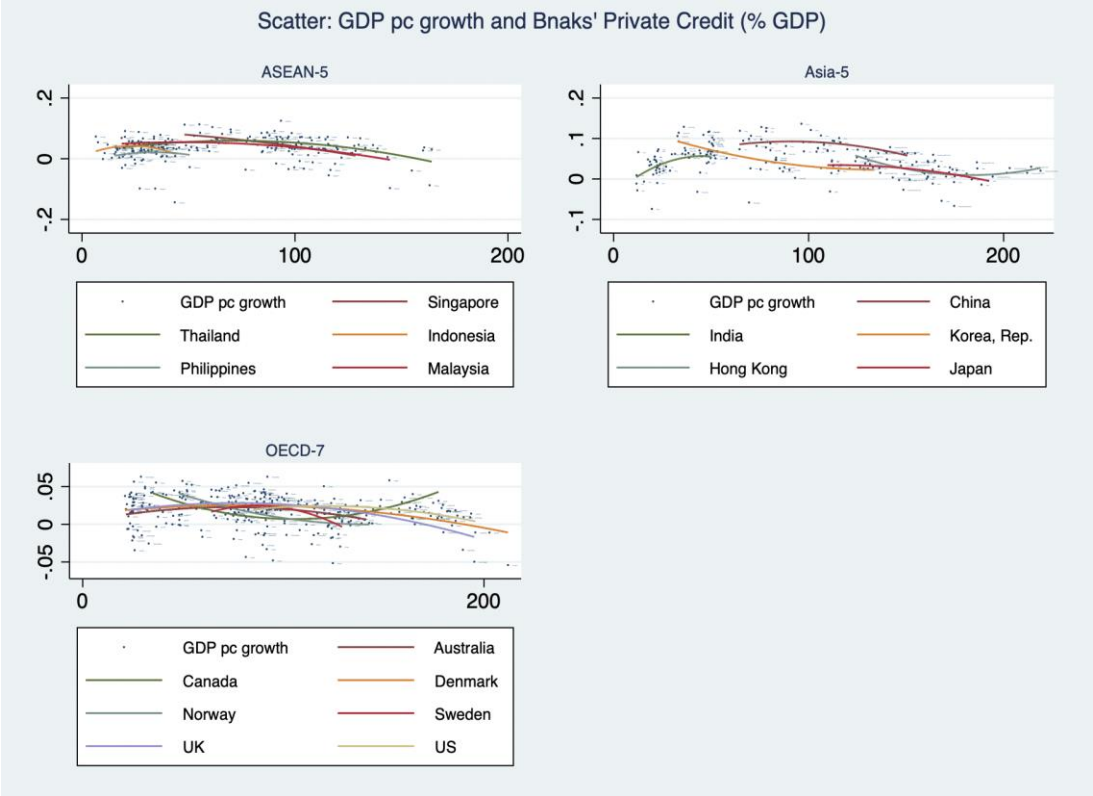
Figure 2c: Stock Market Turnover (Average 1990 - 2017)



The scatter diagram (Figure 3a) of financial intermediation (using private credit by deposit money banks proportion to GDP) and real per capita GDP growth in ASEAN-5, Asia-5 and OECD-7 appears consistent with the literature findings of a positive effect of financial

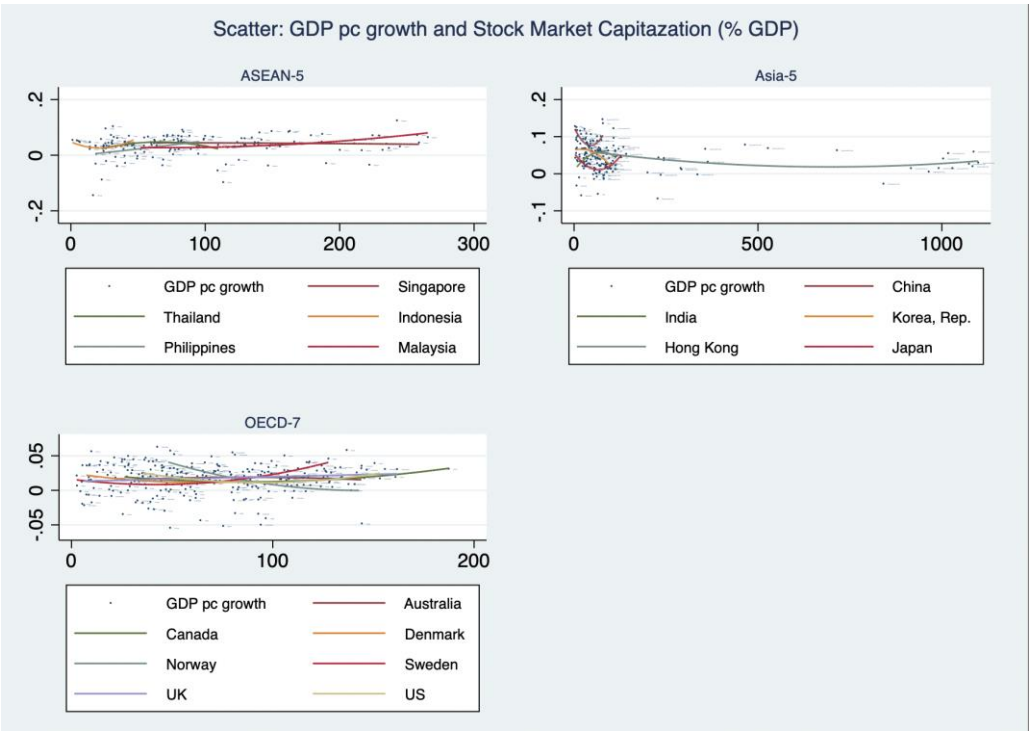
intermediation on growth which vanishes once financial intermediation has reached some critical value (except for South Korea, India, and Canada). The scatter diagram (Figure 3b) of stock market size (using stock market capitalization proportion to GDP) and real per capita GDP growth in ASEAN-5, Asia-5, and OECD-7 shows diminishing effects in some countries (particularly in ASEAN-5 and China) and otherwise in a few countries (China, Japan, and Hong Kong; Sweden, Canada, and US, namely).

Figure 3a: Bank size (% GDP) and real per capita GDP growth



Note: Figure 3a shows quadratic fit of financial intermediation (using private credit by deposit money banks proportion to GDP) and real per capita GDP growth in ASEAN-5, Asia-5, and OECD-7. It appears consistent with the literature findings of a positive effect of financial intermediation on growth which vanishes once financial intermediation has reached some critical value (except for South Korea, India, and Canada).

Figure 3b: Stock market size (% GDP) and real per capita GDP growth



Note: Figure 3b shows diminishing effects in some countries (particularly in ASEAN-5, China) and otherwise in a few countries (China, Japan, and Hong Kong; Sweden, Canada, and US, namely).

Figures 3 do not control for the effects of any other possible influences on growth, nor do they deal with the problem of possible endogeneity of financial intermediation. For these we turn to regression analysis.

4. Methodology of Panel Data Estimation

First, the fixed effects model (with varying coefficients and/or slopes), and likely considerations for a random effects model are discussed. This is followed by time-effect checks using time dummies or linear time trends, and robustness checks for heteroscedasticity, serial-correlation and cross-sectional dependencies. Lastly, the reason for using the Prais–Winsten Panel-Corrected Standard Errors (PCSE) model to account for the problem of panel heteroscedasticity, serial correlation and cross-sectional dependencies in the residuals is explained.

4.1 Estimation Techniques

Panel data, also known as longitudinal or cross-section time series, is a dataset with two dimensions in which the panel behaviours (i.e., country units) are observed across time. A panel data regression differs from a regular time-series or cross-section regression in that it has a double subscript on its variables (*i* subscript denotes the cross-section unit dimension, and *t* denotes the time-series dimension). To fix ideas and notation, Equation (1) shows a panel model to estimate the association between financial development and real per capita GDP growth.

$$y_{it} = \alpha + x_{it}\beta + v_i + \mathcal{E}_{it} \quad .....(1)$$

for i = 1, …, n number of panels or countries and *t = 1, …, T number of year periods in panel i;* where y_{it} is the dependent variable (annual real per capita GDP growth), x_{it} represents the set of observed k independent variables: bank and stock market development indicators (size, activity and efficiency) and control variables known to influence aggregate growth (openness to trade measured by the ratio of imports and exports in GDP, the share of government consumption in GDP, and CPI inflation). α is the constant term, and βs are the slope coefficients[4] for the independent variables x. The term $\mathcal{E}_{it}$ is the idiosyncratic error, for now assumed to have zero mean, equal variance, uncorrelated with itself, *x* and v_i; of which these assumptions to be relaxed. The term v_i varies for each country *i*, it represents all country-specific characteristics (such as societal attitude to risk, culture, institutional, and social factors) that are unobservable and time-invariant, which means that the effect of a country's social or political factors on its GDP per capita at time 1, is the same as the effect of social factors at time 5[5]. The effects are the same, or "fixed" regardless of the time (hence the name fixed effect model). If these country-specific heterogeneous characteristics are omitted (i.e., absent when estimating the model and hence subsumed under $\mathcal{E}_{it}$), then panel data estimation suffers from omitted variable bias problem[6]. This problem is addressed

[4] In a level-level regression, β interpretation is "in a given country, as x varies across time by one unit, y increases or decreases by β units". Since the outcome variable GDP per capita is natural-log transformed given data skewness, the coefficient interpretation requires exponentiation.

[5] For unobserved heterogeneities that are not time-invariant, these will be still present in $\mathcal{E}_{it}$, hence there is a limitation of panel data regression.

[6] The term v_i represents the joint impact of variables that are responsible for the unobservable or unmeasurable country-heterogeneity. If omitted, these variables can cause the exogeneity assumption (between the explanatory variables and the idiosyncratic error terms $\mathcal{E}_{it}$) to break down. To fix definitions, ***unobserved heterogeneity*** is

depending on whether the regressors (x_{it}) are assumed to be correlated with the unobserved heterogeneity component v_i, or otherwise:

- If x_{it} are uncorrelated with v_i (i.e. $E[v_i|x_{i1}, \ldots, x_{iT}]=0$), then the random effects framework applies, and equation (1) is estimated by Generalized Least Squares GLS. If v_i is not correlated with x_{it}, the equation allows for time-invariant variables to play a role as explanatory variables. v_i is treated as a component of a composite error term.
- If x_{it} are correlated with v_i (i.e. $E[v_i|x_{i1}, \ldots, x_{iT}] \neq 0$, there is an endogeneity problem), then the fixed effects framework applies. Equation (1) can be estimated by several methods such as using Least Squares with Dummy Variables (LSDV)[7]; or within-estimation technique (differencing by subtracting the country-level average over time); or by using the first-difference technique. The LSDV has an advantage over the within-estimation and first-difference techniques because it gives sample estimates of fixed effects. The within-estimation and first-difference techniques, on the other hand, remove the fixed effects v_i from the model during data transformations; in itself, this is not limitation for this research as it is not on entity-effects comparison.

There are two main approaches to fitting models using panel data: fixed effects and random effects regressions. The key difference between these two approaches is how the unobservable characteristics (or, the individual effects) v_i, are modelled. The **random-effects model** considers the unobserved variable v_i has one value for each *i* and it is being drawn *randomly* from a given probability distribution (with mean $\bar{v}$), hence the name of the model. The **fixed-effects model**, on the other hand, considers v_i as a fixed set of constants that differ across *i*. One critical assumption of the random effects model is that the unit-specific error term v_i is independent of the included regressors. This assumption is tested using the Hausman test [12] (or the Mundlak test [22] if the difference in parameter variance is not positive semi-definite) to decide whether the random effects or fixed effects model applies. If the fixed-effects model is chosen as the appropriate model over the random

where correlation between observables and unobservables may be expected. ***Endogeneity*** is where there is correlation between the independent variable(s) and the error term (i.e., the unobserved independent variables).

[7] There is another way to write the fixed effects model as *n-1* binary variables. Equation (1) then becomes: $y_{it} = \alpha + x_{it}\beta + \gamma_i E_i + \varepsilon_{it}$; also known as Least Squares Dummy Variables LSDV model since it is equivalent to adding (*n-1* dummy variables in the OLS regression of *y* on *x*. E_i is the unit country *i*, and since they are binary (dummies), there are *n-1* units included in the model and the term γ_i is the coefficient for the binary regressors. In effect, it means each country has its own intercept.

effects model, the next step is to decide between the LSDV estimator or the within-estimator to estimate equation (1). Since the research focus in this paper is not about deducing fixed effects estimates v_i, the within-estimator is used instead of the LSDV estimator. The paper's research primary focus is only on analysing the impact of variables that vary over time on economic performance; namely to explain potential financial efficiency association with real per capita GDP growth in the ASEAN-5, Asia-5, and OECD-7 economies.

The **fixed effects model**, equation (1) has different intercepts and constant slope for each country *i*. One variation of the fixed effects model is for each k^{th} independent variable, the slope coefficients β_i vary for each country *i*. Equation (1) becomes

$$y_{it} = \alpha + x_{it}\beta_i + v_i + \varepsilon_{it} \quad .....(2)$$

This requires estimating equation (2) separately for each country which makes this panel model type impractical for large panels *n.* Aside from time-invariant unit country-specific effects, (v_i) there is another variation of the fixed effects model; the time-effects $\boldsymbol{\lambda}_t$ account that time may induce omitted variable bias (e.g., global crisis that affects all panel regardless, and evolves over time). Equation (1) becomes

$$y_{it} = x_{it}\beta + v_i + \boldsymbol{\lambda}_t + \varepsilon_{it} \quad .....(3a)$$

where $\boldsymbol{\lambda}_t$ is the time-fixed effects that do not vary across countries for each t (e.g., at t = 2008 to control for macroeconomic global financial crisis shocks common to all countries in 2008). $\boldsymbol{\lambda}_t$ is a series of time-dummies but unlike the v_i set of country-dummies, $\boldsymbol{\lambda}_t$s are not eliminated during the fixed effects (within-transformation) estimation and has coefficient estimates for the year *t* effects[8]. Alternatively, the time effects can be constructed as a single time trend variable to capture general trend effects without specific time restrictions; this reduces computational burden when estimating time dummies for large T. Equation (1) becomes

$$y_{it} = x_{it}\beta + v_i + \boldsymbol{\lambda}t + \varepsilon_{it} \quad .....(3b)$$

[8] The constant term is omitted if all T dummies are used to avoid collinearity; alternatively, the dummy for one time period is omitted. Like equation (1), equation (3a) can be estimated using LSDV (with both unit and time dummies), or within-estimator (demeaning the data both with respect to time and with respect to units). Equation 3a excludes the effects of changes that are strictly over time (taken out with time dummies or demeaning), as well as the effects of changes that are strictly across units (taken out with unit dummies or demeaning). This leaves only differences across units in how the variables change over time to estimate β.

i.e., increasing *t* by one year, yields an effect of λ on the outcome variable, to inform how the outcome variable changes over time, all else equal. In this paper, the differences between the individual effects are not of interest, only β is interesting, which is estimated using the within-groups estimation. This eliminates all between-individuals variability (which may be contaminated by omitted variable bias) and leaves only the within-subject variability to analyse. Time dummies for 1997 for ASEAN-7 region to represent Asian financial crisis event, and 2008 for all regions to represent the global financial crisis event, can be included in LSDV estimation.

4.2 Tests

First, we test if pooled OLS is preferred over fixed effects. The F-test that all country effects are equal to 0 (v_i ***= 0)*** is strongly rejected for all ASEAN-5, Asia-5 and OECD-7 models, suggesting there are panel effects; hence poolability is rejected and the fixed effects model is opted. The next question was the choice of estimation technique based on the standard error component model of panel data: random effects (RE) or fixed effects (FE). Tests to gauge the presence of serial correlation, cross sectional dependence and heteroskedasticity are run.

The standard procedure for deciding between RE and FE is the Hausman test [12]. However, since the Hausman test in some of our country-level groupings was undefined[9], the Mundlak test [22] is used instead. The test suggests there is significant correlation between the time-invariant unobservables and the regressors, hence, the fixed-effects model is more suitable. Regardless of the nature of how v_i is modelled, FE is almost always much more convincing than RE for policy analysis using aggregated data.

Next, the Wooldridge ***first order serial correlation*** test [32] of the idiosyncratic errors (using the Stata ***xtserial*** command) has p-values < 0.05 (for ASEAN-5 and Asia-5), hence the null hypothesis of zero correlation in errors is rejected at the 5% level. The presence of cross-sectional dependence and groupwise heteroskedasticity is also tested; a priori, there are reasons to expect cross-sectional dependence, especially during the last few decades of ever-increasing economic and financial integration of countries and financial entities, which implies strong interdependencies between cross-sectional units. There is also a priori reason to expect groupwise heteroskedasticity, given the heterogeneous nature of the panel (see

[9] Hausman's test [12] is based on estimating the variance of the difference of the estimators [var(b-B)] by the difference of the variances [var(b)-var(B)]. Var(b)-Var(B) is a consistent estimator of var(b-B), but it is not necessarily positive definite. In that case, the Hausman test is undefined.

Table 1).

Following the fixed effects regression, the Breusch-Pagan LM test [8][10] is used to test for ***cross-sectional independence*** in the residuals of a fixed effect regression model for ASEAN-5, Asia-5, and OECD-7 (see Stata ***xttest2*** command). The p-value is < 0.01, hence the null hypothesis of cross-sectional independence is rejected[11]. Lastly, following the fixed effects regression, the modified Wald test is used to test for ***groupwise heteroskedasticity*** in the fixed effect model using the Stata ***xttest3*** command. The p-value is < 0.01, hence the null hypothesis of homoscedasticity is rejected for ASEAN-5 and OECD-7.

Table 2 summarises the tests' outcomes - the results of the Wooldridge test, the modified Wald test, and the Breusch-Pagan LM test indicate the presence of serial correlation, groupwise heteroskedasticity, and cross-sectional independence in the residuals of our fixed-effect regressions for the ASEAN-5, Asia-5, and OECD-7 groupings. Intuitively, the economies are largely *heterogeneous* with respect to their geographical region and size, culture, political and financial structures, and economic development stage, hence significant country-effect variation can be expected. Moreover, the period between 1990 to 2017 covers an era of liberalisation, rapid economic growth, and volatile world markets. Recessions, economic or financial crises, and oil price shocks, even though they might start from one or two countries, potentially affect all countries. Hence, these contagions are expected to introduce cross-sectional interdependencies among regressors and error terms across countries; and when ignored can lead to seriously misleading inferences.

The tests confirm when fitting linear cross-sectional time-series models the disturbances are not assumed to be independent and identically distributed (i.i.d.). To ensure validity of the statistical results, the Panel-Corrected Standard Errors (PCSE) model (which assumes that the disturbances are by default, heteroskedastic across panels *i=1,…n*; or heteroskedastic and contemporaneously correlated across panels *i=1,…n*) is used. The Stata command

[10] In the context of large T and small N (N=5 for ASEAN-5 and Asia-5 grouping, and N=7 for OECD-7 grouping, with T in the range of x-y years), the Breusch-Pagan LM test statistic can be used to test for cross-sectional dependence (*xttest2*).

[11] The new Stata command *xtcsd* tests for the presence of cross-sectional dependence in FE and RE panel-data models. The command is suitable for cases where T is small as N → ∞. It therefore complements the existing Breusch–Pagan LM test written by Baum, ***xttest2***, which is valid for small N as T → ∞. By making available a series of tests for cross-sectional dependence for cases where N is large and T is small, *xtcsd* closes an important gap in applied research.

xtpcse is used for the main estimations[12]. It produces OLS estimates of the parameters when no autocorrelation is specified, or Prais–Winsten estimates when autocorrelation is specified.

Table 2: Summary of tests for iid violation

	ASEAN-5	**Asia-5**	**OECD-7**
Serial correlation (*xtserlal*)	Yes**	Yes**	No
Groupwise heteroscedasticity (*xttest3*)	Yes***	No	Yes***
Cross-sectional dependency (*xttest2*)	Yes***	Yes***	Yes*

*Note: *** 1%; ** 5%; * 10% significance*

There is concern about the autocorrelation of the disturbances for ASEAN-5 and Asia-5, hence the option corr(ar1) is included to specify a common first-order autocorrelation along t=1,.. T within the panel

5. Empirical findings and discussion

We now report the panel regression estimation results of the relationship between banks and stock market development and real per capita GDP growth in the ASEAN-5, Asia-5 and OECD-7 groups, using annual data from 1990 to 2017. Table 3 presents results for the Prais-Winsten estimates of the Panel-Corrected Standard Errors (PCSE) model corrected for first order autocorrelation, groupwise heteroskedasticity and contemporaneous correlation across panels for ASEAN-5 and Asia-5; and the OLS estimates of the PCSE model corrected for groupwise heteroskedasticity and contemporaneous correlation across panels for OECD-7.

Table 3: Panel Regression Estimation Results

[12] All three datasets show cross sectional dependence in fixed-effect residuals; hence this ruled out standard estimators such as *xtreg* (which is a Stata command to fit panel data using fixed / random effects model) and *xtregar* (which is a Stata command to fit panel data using fixed / random effects model when the disturbance term is first- order autoregressive).

using panel corrected standard errors (PCSE)

VARIABLES	(1) ASEAN-5: PCSE	(2) Asia-5: PCSE	(3) OECD-7: PCSE
PrivateCredit_gdp	0.0005	0.0015***	0.0000
PrivateCredit_gdp2	-0.0000**	-0.0000***	-0.0000
MarketCap_gdp	0.0002*	0.0002***	0.0001
Overheadcost_TotalAssets	-0.0077***	-0.0082	0.0084***
NIM	0.0021	0.0082**	-0.0042
SMTOR	0.0001	0.0001*	-0.0002***
SMTVT_gdp	-0.0001	-0.0002***	0.0001
SM_return	0.0008***	0.0003***	0.0005***
LL_gdp	-0.0003	0.0003**	-0.0000
ExportGS_gdp	-0.0001	-0.0007***	-0.0000
Inflation	-0.0023***	0.0002	0.0018
GovCon_gdp	-0.0001	-0.0026	0.0001
Constant	0.0489***	0.0112	0.0073
Observations	106	110	129
R-squared	0.6433	0.5754	0.4747
Number of country	5	5	7
rho	-0.0568	0.134	0.134

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table reports the results for the Prais–Winsten Panel-Corrected Standard Errors (PCSE) model that estimates the effect of banking sector and stock market development on real per capita GDP growth in three economic regions (ASEAN-5, Asia-5, and OECD-7)

In all 3 regions, the overall models are "statistically significant" (F test statistic has p value < 0.01 hence the null hypothesis that all coefficients are zero is rejected). In the ASEAN-5 and Asia-5 region, the explanatory variables explain almost 64% and 58% of the variation in real per capita GDP growth, respectively; and 47% in the OECD-7 region. For example, the fitted ASEAN-5 model for the period under study (1990 to 2017) is:

GDPpc_gr = 0.0489 + 0.005**PrivateCredit(%GDP) + 0.000*PrivateCredit(%GDP)*
*+ 0.002*MarketCap(%GDP) - 0.008*Overheadcost(%Total Assets) + 0.002*NIM*
*+ 0.000*SMTOR - 0.0001*TVT(%GDP) + 0.0008*(SM_return) + control variables*

According to the ASEAN-5 estimated model, the results show there is a statistically significant and positive correlation between real per capita GDP growth, and stock market capitalization to GDP; and stock market return; as well as a statistically significant and negative correlation between real per capita GDP growth and private credit to GDP squared,

and bank overhead costs to total assets, at the 10% significance level. Interpretation of the latter (bank overhead costs) is ambiguous. In general, a company strives to achieve the lowest operating expenses possible without sacrificing the quality or competitiveness of its goods or services. If the banks' operating cost to asset ratio is consistently declining, it indicates its operational efficiency in managing costs against increased assets. Excessive overhead expenditures may reflect not only waste, but a lack of competition. However, it should also be recognized that overhead cost is not an unambiguously clear measure of efficiency - competitive banks may undertake substantial investments to provide high-quality financial services, and these productivity-enhancing investments may boost overhead costs. Put differently, very low overhead costs may reflect insufficient competition and insufficient investment in providing superior banking services. In ASEAN-5 context, the coefficient of bank overhead costs to total assets is negative, hence it is inferred that countries with high bank overhead cost ratio reflect waste and lack of competition, may have lower economic growth[13].

Next, is the overall comparison study of the fitted ASEAN-5, Asia-5 and OECD-7 regression, and our findings are as follows:

- One, bank *activities* (proxied by the ratio of the amount of credit provided to the private sector by banks and other financial institutions, in GDP) is not a statistically significant determinant of economic performance in ASEAN-5 and OECD-7; that means there is no improvement in economic performance expected from an increase in allocated credit. For future research, alternative channels of funding (data from bond market, or fintech) will be used to assess impact.
- Two, the coefficients of the squared ratio of credit to GDP for ASEAN-5 and Asia-5 are statistically significant and have negative signs, evidence of potential non-linear effects of banking sector development on economic performance, that is, the effects of bank size become less important at higher levels of bank development.
- Three, bank *efficiency* (measured using ratio of overhead costs in total assets, or net interest margin) matter statistically in all three country-level groupings, but notably the effects are not consistent for different group.
    - For example, the ratio of overhead costs in total assets coefficient for Asean-5 is statistically significant has a negative sign (as discussed earlier); but for OECD-7 is statistically significant and it has a positive sign which means countries with weak banking competition *(hence <u>little</u> investment initiatives to*

[13] Notably, Singapore and Japan have the lowest overhead costs to total assets ratio. It is beyond the scope of the paper to analyse the effects of the ratio of bank overhead costs to total assets on real capita GDP growth. Future research on estimating the effects using a random coefficient model with panel data is warranted.

provide superior banking services) may experience low economic growth. Overhead cost is not an unambiguously clear measure of efficiency! The results suggest threshold below which increasing overhead costs to total asset to provide superior banking services positively impacts growth, but above which increasing overhead costs to total asset leads to excessive waste which drags down economic growth (See Figure 2(b), OECD-7 higher income countries tend to have lowest average bank net interest margin, and lowest average bank overhead cost to total assets)

- The net interest margins (NIM) coefficient for Asia-5 is statistically significant and has a positive sign. An interpretation, from a macro (welfare and monetary policy) perspective is that low NIM can be a sign of a relatively competitive banking sector and of lower funding costs for the non-financial private sector. Banks' individual interest rate-setting abilities in highly competitive markets should be limited, potentially resulting in a more complete interest rate pass-through [30]. Another interpretation from a financial stability perspective, suggests that lower margins imply, ceteris paribus, a weaker ability of banks to build up capital through retained earnings, hence decreasing their shock absorbing capacity. Most of the related literature regarding the impact of the interest rate level is on bank profitability. It is inferred, given the positive NIM coefficient sign for Asia-5, that countries with large NIM have greater bank profitability, may experience stronger economic growth.

Turning to stock market development, the empirical results show that stock market *size* (ratio of market capitalization in GDP) is statistically significant and has positive signs for the ASEAN-5 and Asia-7 groups, which means a bigger stock market size to GDP affects real per capita GDP growth positively. In contrast, our results show no statistically reliable relationship between stock market size and real GDP per capita growth in OECD-7. As for stock market *activity* (ratio of market total value traded in GDP), it is shown to be statistically significant and has positive sign for the Asia-7 groups. Stock market *efficiency* (stock market turnover ratio coefficient) is statistically significant and positive in Asia-5 but surprisingly it has a negative sign for OECD-7. The latter OECD-7 findings put doubt whether developing countries should seek to develop liquid stock markets as a means of advancing economic growth[14]. Future research on effects of omitted variable – alternative financing in the form of

[14] Reference [19] presents cross-country econometric evidence showing that, in a sample of 47 countries, stock market liquidity (measured using the stock market turnover ratio) contributed a significant positive influence on

fintech lending is warranted [29]. Lastly, stock market return is statistically significant in explaining real per capita GDP growth and has positive signs in all three country groupings.

In summary, our results show that various dimensions of financial sector development (size, activities, and efficiency) have distinctive impacts on ASEAN-5, Asia-5, and OECD-7 groups.

6. Conclusions

This paper, an extension of author's work [28], presents results of a panel data analysis of the impact of bank and stock market efficiencies on real per capita GDP growth in three country-level groupings; ASEAN-5 economies (Singapore, Malaysia, Thailand, Philippines, Indonesia), Asia-5 (Japan, China, Hong Kong SAR, South Korea and India) and OECD-7 countries (Australia, Canada, Denmark, Norway, Sweden, U.K., and U.S.) covering the period from 1990 to 2017. The Prais–Winsten Panel-Corrected Standard Errors (PCSE) model to account for the problem of panel heteroskedastic, cross-sectional dependencies and autocorrelated errors, is used as the main estimation technique in the paper.

Does bank and stock market efficiency spur economic growth? The results suggest bank and stock market efficiency effects on growth is not unambiguous. For ASEAN-5 which shows a negative relationship, a high bank overhead costs (as a share of total assets) may suggest expenses have not been channelled efficiently to income generating activities; unlike for OECD-7 data which shows a positive relationship, a high overhead costs may reflect strong competition and strong investment in providing superior banking services, hence boosting economic growth. The results suggest a threshold beyond which increase in bank overhead cost hurts economic growth, for developing countries. Two, stock market turnover ratio has a positive association with Asia-5, but a negative association with OECD-7 economic growth, which also suggest the relationship between stock market efficiency and growth is ambiguous. For Asia-5, high stock market turnover ratio reflects market efficiency; and in contrast for OECD-7, excessive stock market turnover ratio cause business

GDP growth between 1976-93. Their study suffers from an assortment of econometric weaknesses. The ordinary least squares (OLS) approach does not account formally for potential simultaneity bias, nor does it control explicitly for country fixed effects or the routine use of lagged dependent variables in growth regressions. In addition, [33] have disputed [19] finding that the results are not robust to alternative specifications because of the incomplete way they control for outliers in their data. They showed that when one properly controls for outliers, stock market liquidity no longer exerts any statistically observable influence on GDP growth.

uncertainty and dampen growth. One policy implication of these findings is that while policymakers should take necessary measures toward financial liberalisation policies that boost growth through the efficiency channel (so that savings are efficiently allocated through the financial system between financial and real sectors), there are thresholds beyond which excessive bank overhead costs and stock market turnover ratio can hurt growth for developing and developed economies, respectively.

Our panel data evidence from ASEAN-5, Asia-5 and OECD-7 shows that the association of banks and stock market (size and activities) vary for different country groupings; and efficiency indicators are important drivers; particularly bank net interest margin, overhead costs to total assets, and stock market turnover ratio. Specifically for Asia-5, banking sector and stock market development (size, activities, and efficiency) matters more, while in OECD-7 what matters more is banking sector and stock market efficiency.

What lessons can ASEAN-5 policy makers learn from Asia-5 and OECD-7 financial development histories? One, for the Asia-5 economies, bank size and stock market size are statistically significant and have positive effects on real per capita GDP growth, but the effects of bank size become less important at higher levels of bank development. Bank and stock market efficiency matters as well. Two, for the OECD-7 economies, both bank size and stock market size are not statistically significant in explaining real per capita GDP growth; instead bank overhead costs as a ratio to GDP (and stock market turnover ratio) are statistically significant and have a positive (and negative, respectively) association in explaining real per capita GDP growth. The Asia-5 results highlight the importance of the financial sector's role to shift away from simply mobilising savings toward improving the efficiency of investment, and thereby contributing to higher economy-wide standard of living [10. The OECD-7 results prompt question of financial system efficiency impact on economic performance; has omitted variable bias from alternative financing model, such as fintech lending caused the sign for stock market efficiency to be negative? Further research is warranted [29].

Three for ASEAN-5, stock market size matters for now, but as these economies develop, banking sector and stock market efficiency will likely matter more. Namely, the coefficient of bank overhead costs to total assets is significant and has a negative sign; one infers those excessive overhead expenditures reflect waste and a lack of competition dampens the region’s real capita GDP growth. In cases of rising bank overhead costs to total assets, banks should review whether expenses on overhead costs have been channelled efficiently to income generating activities.

It is beyond the scope of the paper to analyse the country-specific effects of the ratio of bank overhead costs in GDP, and bank net interest margins on real capita GDP growth (especially for Singapore and Japan). Future research on estimating the effects of banking sector efficiency using a random coefficient model with panel data, together with robustness study using feasible generalized least squares estimation. Another future research is to compare traditional finance (financing institutions and capital markets) with alternative finance (fintech) on SMEs loans accessibility.

References

[1] P. Aghion, P.W. Howitt, and D. Mayer-Foulkes, “The effects of financial development on convergence: theory and evidence,” *Quarterly Journal of Economics, 120*, 2005, pp. 173-222.

[2] M. Arellano, and S. Bond, “Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations,” *Review of Economic Studies, 58,* 1991, pp. 277–297.

[3] T. Beck, A. Demirguc-Kunt, and R. Levine, “A new database on financial development and structure,” *World Bank Economic Review*, *14*(3), 2000, pp. 597-605.

[4] T. Beck, A. Demirguc-Kunt, and V. Maksimovic, “Bank competition and access to finance: International evidence,” *Journal of Money, Credit, and Banking, 36* (3), 2004, pp. 627-648.

[5] N. Beck and J.N. Katz, “What To Do (and Not To Do) with Times-Series–Cross-Section Data in Comparative Politics,” *American Political Science Review, 89*(3), 1995, pp. 634–647.

[6] T. Beck, and R. Levine, “Stock markets, banks, and growth: Panel evidence,” *Journal of Banking and Finance, 28*(3), 2004, pp. 423-442.

[7] R. Blundell, and S. Bond, “Initial conditions and moment restrictions in dynamic panel data models,” *Journal of Econometrics, 87*(1), 1998, pp. 115-143.

[8] T. Breusch, and A. Pagan, “The Lagrange multiplier test and its application to model specification in econometrics,” *Review of Economic Studies, 47*, 1980, pp. 239–253.

[9] E. Buffie, E, “Financial repression, the new structuralists, and stabilization policy in semi-industrialized economies,” *Journal of Development Economics, 14*(3), 1984, pp. 305-322.

[10] S. Cecchetti, and E. Kharroubi, “Reassessing the impact of finance on growth,” *BIS Working Papers, No 381, 2012.*

[11] J. Creel, P. Hubert, and F. Labondance, “Financial stability and economic performance,” *Economic Modelling*, *48*(C), 2015.

[12] J. A. Hausman, “Specification tests in econometrics,” *Econometrica, 46*, 1978, pp. 1251-1271.

[13] N. Islam, “Growth empirics: a panel data approach,” *Quarterly Journal of Economics, 110, 1995, pp.* 1127–70.

[14] B.K. Kapur, “Alternative Stabilization Policies For Less Developed Economies,” *Journal of Political Economy, 84*, 1976, pp. 777-795.

[15] R.G. King, and R. Levine, “Finance and growth: Schumpeter might be right,” *The Quarterly Journal of Economics, 108* (3), 1993a, pp. 717-737.

[16] R.G. King, and R. Levine, “Finance, entrepreneurship, and growth: theory and evidence,” *Journal of Monetary Economics, 32*(3), 1993b, pp. 513-542.

[17] R. Levine, “Financial development and economic growth: views and agenda,” *Journal of Economic Literature, 35*, 1997, pp. 688–726.

[18] R. Levine, “Finance and growth: theory and evidence,” Handbook of Economic Growth, 1, Elsevier, 2005, pp. 865–934.

[19] R. Levine, and S. Zervos, “Stock markets, banks, and economic growth,” *The American Economic Review, 88*(3), 1998, pp. 537-558.

[20] R.E. Lucas, “On the mechanics of economic development,” *Journal of Monetary Economics, 22*(1), 1998, pp. 3-42.

[21] R. McKinnon, “Money and Capital in Economic Development,” Washington, D.C.: The Brookings Institution, 1973.

[22] Y. Mundlak, “On the pooling of time series and cross section data,” *Econometrica*, (46), 1978, pp. 69-85.

[23] R. Rajan, and L. Zingales, “Financial dependence and growth,” *American Economic Review, 88,* 1998, pp. 559–86.

[24] J. Robinson, “The generalization of the general theory,” *The Rate of Interest and Other Essays*, Macmillan, London, 1952.

[25] J.A. Schumpeter, “A Theory of Economic Development: An Inquiry into Profits, capital, credit, interest, and the Business Cycle,” Harvard University Press, Cambridge, MA., 1934.

[26] J. Shan. “Does financial development ‘lead’ economic growth? A vector autoregression appraisal,” *Applied Economics,* 37(12), 2005, pp. 1353-1367.

[27] S.L. Tan, Y.W. Tok, and T. Chansriniyom, “Financing Singapore’s SMEs and the crowdfunding industry in Singapore,” In *The Singapore economy: Dynamism and inclusion* Singapore, H.T. HOON, Ed. Taylor Francis and Group, 2021, pp. 26-57.

[28] S.L. Tan, “What, Why and How Financial Development Matters,” *Economics and Finance Readings - Selected Papers from Asia-Pacific Conference on Economics & Finance,* 2022, Springer.

[29] S.L. Tan, “Fintech credit, bank and stock market: Panel Study of Growth Effects,” unpublished.

[30] M. van Leuvensteijn, C. Kok Sørensen, J.A. Bikker, and A.R.J.M. van Rixtel, “Impact of bank competition on the interest rate pass-through in the euro area,” *Applied Economics, Taylor & Francis Journals, 5*(11), 2013, pp. 1359-1380.

[31] S.V. Wijnberg, “Interest rate management in LDCs,” *Journal of Monetary Economics, 12*(3), 1983, pp. 433-452.

[32] J. M. Wooldridge, “Econometric Analysis of Cross Section and Panel Data,” Cambridge, MA: MIT Press, 2002.

[33] A. Zhu, M. Ash, and R. Pollin, “Stock market liquidity and economic growth: A critical appraisal of the Levine/Zervos Model,” *International Review of Applied Economics, 18*(1), 2002, pp. 63-71.