Interdependence between banking earnings, banking security and growth achievement: case study in the ASEAN community

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Abstract

Purpose – The main purpose of this paper is to examine the existence of interdependence amongst banking earnings, banking security and growth performance across the Association of Southeast Asian Nations (ASEAN) region.

Design/methodology/approach – This paper utilizes a panel autoregressive distributed lag method with the annual data of nine ASEAN members over 1996–2017.

Findings – Only the short-run Granger causal impact of banking profitability on economic expansion is supported, while the long-run Granger causality between all the variables is strongly recognized. Increased banking well-being supports economic development, while higher banking security might have inverse impacts. However, increasing the banking profit without the corresponding better soundness can be detrimental to the economic growth in the short run and much more in the long run. Thus, improving banking profitability and stability simultaneously has positive net effects on the economic development.

Research limitations/implications – This research is restricted to unavailable data and limited measurements of both banking profitability and stability. Further inclusion of other macro-economic variables, other banking development aspects or even non-banking indicators should also be considered.

Practical implications – National governments should emphasize a convenient financial environment, which can strongly enhance the positive relationship between banking earnings, banking safeness and output growth. Also, the relevant policies on higher banking well-being and stricter security obligations have to be simultaneously maintained.

Originality/value – Few papers have inspected the interrelationship between banking stability, banking profitability and economic growth, particularly in the ASEAN region. This causes the banking literature shortage, as well as insufficient insights for the financial policymakers into their endogenous dynamics. Thus, the study is the first attempt to fulfil the research gap.

Keywords Banking earnings, Banking security, Economic achievement, Granger-causality

Paper type Research paper

1. Introduction

The banking sector development, especially the dynamics of banking profitability and stability, is closely associated with growth performance across countries. The empirical economic growth literature shows that an insufficiently supervised banking system might cause the financial crisis with potentially devastating effects. By contrast, an efficient and profitable one provides better financial services, allowing an economy to increase its potential growth (Pradhan *et al.*, 2014).

The Association of Southeast Asian Nations (ASEAN) region is no exception. The East Asia community has witnessed the homogeneous banking development for at least two

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reasons. Firstly, the commercial banks are predominant sources of financial assets, holding over 80% of the region's financial assets. Secondly, the banking sector enhancement has been supported by the national governments to ensure the banking industry security (Banna *et al.*, 2019). This entails the crucial position of the banking sector in the growth achievement, particularly across the ASEAN area. Consequently, such studies to ease the constraints of understanding co-integration and causality between banking safeness, banking earnings and economic improvement are necessary, especially from an economic policy perspective.

The causality determination between financial advancement and economic attainment has escalated recently. Economists and researchers have traced the fundamental theoretical discussion to Hammond (1991) and Schumpeter (1982) favouring the hypothesis that financial development pushes up economic expansion. On the contrary, Robinson (1952) and Hicks (1969) posit that, by and large, growth leads and finance follows. Furthermore, Lewis (1955) and Patrick (1966) postulate a feedback relationship between financial growth and economic development.

Following the theoretical discussion, the empirical analysis on the causality between banking development and economic growth has attracted attention in the banking literature. Particularly, Habibullah and Eng (2006) examined the interaction between financial development and economic growth in Asian developing countries. Recently, Jayakumar *et al.* (2018) and Nucu and Anton (2019) have continued contributing to the banking literature by investigating the interdependence between banking competitiveness, banking security and growth progress in the Central and Eastern European regions. In broad-spectrum, the empirical results have recognized the significant influence of banking improvement on growth expansion over different regions.

However, only a few researchers have investigated this relationship across the ASEAN region. Also, they have mainly emphasized the separate pairwise relationships and ignored the simultaneous causal interactions. First is the link between banking earnings and economic advancement (Kyophilavong *et al.*, 2016 in Lao PDR); second is between banking stability and economic development (Wulandari and Kusairi, 2017 in Indonesia); and finally between banking stability and banking profitability (Khan *et al.*, 2018 in ASEAN region and Oktaviyanti and Purnawan, 2019 in ASEAN-5). Although Pradhan *et al.* (2014) and Pradhan *et al.* (2017) have already started inspecting the causal interactions between banking performance and economic growth in the ASEAN region, they have only taken the banking depth into account. The interrelations between banking profitability, stability and output development remain unclear.

Thus, this paper aims to fill this literature gap. Furthermore, this study is also motivated with a practical perspective. One of the main targets of financial regulators is to ensure banking stability to support sustainable economic growth. Therefore, this study is supposed to provide credible evidence about various aspects in which one can rationalize the dynamic interactions between banking profitability, stability and economic improvement. This is necessary empirical evidence to build up the comprehensive financial policy systems.

The research question is relevant to the existence of an interrelationship between banking security, banking earnings and economic advancement. Therefore, the proposed hypotheses will include (1) banking earnings Granger – causes growth expansion and vice versa; (2) banking earnings Granger – causes banking security and vice versa (3) banking security Granger – causes growth expansion and vice versa.

Annual panel data of nine ASEAN countries are employed over 1996–2017. The panel vector-error correction framework is amongst the appropriate approaches to investigate the dynamic interaction amongst the variables. Accordingly, we can treat our variables as endogenous and then examine both short- and long-term Granger-causal impacts of one variable on others. However, the models are meaningful only if all the variables have the same order of integration and are co-integrated. Otherwise, the panel autoregressive distributed lag method is preferred, which can address the co-integration progress for a long-term

relationship, regardless the covariates are $I(0)$, $I(1)$ or a mix of both. Thus, the tests for panel unit root and panel co-integration are necessary to choose the appropriate method.

The empirical results only indicate the significant short-term Granger-causal effect of banking profitability on economic growth. However, we strongly support the long-run Granger-causality amongst the variables. Additionally, the increased banking profitability positively influence the economic growth, while the increased banking stability might deteriorate the economic expansion in some circumstances. However, boosting the banking well-being without the corresponding higher soundness can erode the economic development in the short term and much more in the long term because of the potential non-performing loans. Thus, the higher banking profitability and stricter banking safeness regulation have to be maintained simultaneously.

The remaining of the study will proceed as follows. Firstly, some previous empirical papers and rationale for the analysis are discussed in detail in Section 2. Detailed variables and data will be presented in Section 3. Subsequently, method and identification strategy are in Section 4, while the main outcomes are in Section 5. Lastly, the conclusion and policy recommendation are drawn out.

2. Literature review and the proposed hypotheses

The casual inter-correlation between banking development and economic spread has already been inspected quantitatively for different regions. The summaries of the studies are shown below.

Firstly, using panel vector autoregression, Habibullah and Eng (2006) inspected the causal relationship between financial development and economic growth across the 13 Asian developing countries including Bangladesh, India, Indonesia, South Korea, Lao PDR, Malaysia, Myanmar, Nepal, Pakistan, Philippine, Singapore, Sri Lanka and Thailand over 1990–1998. The economic growth was measured by the real gross domestic product (GDP) per capita, while the financial development was proxied by the ratio of domestic credit to GDP. The authors argued that financial development already promotes economic output. These results supported Patrick's supply-leading hypothesis.

Next, Jayakumar *et al.* (2018) also investigated the casual interdependence between banking competition, banking stability and economic growth across 32 European countries over 1996–2014. However, being different from Habibullah and Eng (2006), the authors instead employed a panel vector-error correction model. The economic growth was measured by the real GDP per capita. The banking competition was proxied by Lerner index, Boone index, H-statistic, bank concentration index and foreign ownership, while the stability is by bank capitalization, Z-score, non-performing loans, provision of non-performing loans, the ratio of private credit to deposit and a composite safeness index. They confirmed unidirectional or bidirectional, or eventually no short-run causal links between the variables in some cases. However, both banking competition and stability were the key drivers of economic growth in European nations in the long run.

Subsequently, Nucu and Anton (2019) also analysed the causal interdependence between banking competitiveness, banking safeness and growth development across the eleven Central and Eastern European nations over 2000–2015 using the panel vector-error correlation model. The economic advance was assessed by the real GDP per capita. The stability indicators included Z-score, non-performing loans, capitalization and private credit to deposit to GDP, while the competitiveness contained Lerner index, Boone indicator and bank concentration. Similar to Jayakumar *et al.* (2018), the authors strongly recognized the Granger-causal impact of economic performance on banking stability and vice versa. However, the Granger-causality between banking competitiveness and economic expansion was mixed and eventually, in some cases, no causality was proven.

The earlier studies support the Granger-causality between the banking and economic progress across European and Asian communities. However, as far as we know, few papers have inspected the interrelationship in the ASEAN, particularly between banking stability, banking profitability and economic growth. Only Pradhan *et al.* (2014) and Pradhan *et al.* (2017) already affirmed the Granger-connection between banking expansion and economic output in the ASEAN. However, the banking expansion was proxied by broad money supply, claims on private sectors or domestic credit provided by the banking sector, which might reflect the banking depth, but profitability or stability. Thus, the questions about the Granger – impacts of banking profit or stability on the economic output and vice versa remain unclear, especially in the ASEAN. The banking literature gap is, therefore, fulfilled in the study.

Subsequently, we will review the previous empirical research on the following relations: banking earnings and growth progress; banking stability and growth progress; and banking profitability and banking stability and then draw out the hypothesis examined in the paper. A quick recapitulation of three main flows of literature considered below is illustrated in Table 1. Generally, there are various outcomes for each particular country/region at different times.

The first strand of academic literature investigates the connection between banking profits and output growth. The results could be summarized under the following four hypotheses. Firstly, the demand-following hypothesis (DFH^A) recognizes the larger economic development, the larger firms' loans and deposits supplied and subsequently the greater banking profit. The hypothesis is supported by Bolt *et al.* (2012) and Acaravci and Çalim (2013). Secondly, the supply-leading hypothesis (SLH^A) represents increased banking earnings cause high output growth. This is because an efficient banking sector tends to use financial sources effectively, increasing the economy's productivity. The argument is supported in Anthony (2012) and Daly and Frikha (2016). Thirdly, the feedback hypothesis concludes banking earnings and growth explosion react to each other. The inference is confirmed by Miralles-Quiros *et al.* (2018). Finally, the neutrality hypothesis (NEH^A) suggests banking profitability and economic development are independent. The hypothesis is supported by Chang (2002).

The second strand inspects the link between banking stability and banking profitability and the results are also summarized in the following four hypotheses. Firstly, the demand-following hypothesis (DFH^B) indicates the banking profitability might cause stability. The more profitable, the higher efficiency in resource utilization, the more risks managed and subsequently the more secure the banks are. However, when a bank concentrates much on earnings, it is easier to ignore some financial security policies in providing credits and loans, leading to more risks. The arguments are encouraged in Ryoo (2013). Secondly, the supply-leading hypothesis (SLH^B) recognizes banking stability is likely to cause profitability. The more stable the banking sector, the less the cost to manage risks, and then the more fruitful it is. However, over-regulating can hinder banking sectors to make a profit. The hypothesis is supported by Abel and Le Roux (2016) and Knezevic and Dobromirov (2016). Thirdly, the feedback hypothesis (FBH^B) predicts banking safety and profitability enhance each other. The hypothesis is confirmed by Tagkalakis (2014) and I. Motelle and Biekpe (2014). Lastly, the neutrality hypothesis (NEH^B) illustrates banking profitability and stability are independent, which is proved by Tan (2016).

Finally, the relation between banking stability and economic enhancement are also studied. The results are summarized in the four hypotheses. Firstly, the demand-following hypothesis (DFH^C) postulates the increased economic prosperity will generate banking stability. Stricter security regulations of loans provided under economic explosion increase the banking sector operation for default risk. The conclusion is supported by Trabelsi and Trad (2017), Alshubiri (2017), and Pedro *et al.* (2018). Secondly, the supply-leading hypothesis (SLH^C) suggests the key entities are likely to control risks and default more effectively under a

Research	Research place	Period	Hypothesis confirmed
Strand 1: Relation between banking profit and output expansion			
Acaravci and Çalim (2013)	Turkish	1998–2011	DFH[A]
Bolt *et al.* (2012)	17 OECD nations	1979–2007	DFH[A]
Miralles-Quiros *et al.* (2018)	Brazil	2002–2013	FBH[A]
Anthony (2012)	Nigeria	1970–2006	SLH[A]
Daly and Frikha (2016)	10 countries	2005–2012	SLH[A]
Chang (2002)	Mainland China	1987–1999	NEH[A]
Strand 2: Relation between banking profit and banking security			
Ryoo (2013)	–	–	DFH[B]
Motelle and Biekpe (2014)	Southern Africa	1984–2010	FBH[B]
Tagkalakis (2014)	20 OECD nations	1997–2010	FBH[B]
Tan (2016)	China	2003–2011	NEH[B]
Abel and Le Roux (2016)	Zimbabwe	2009–2014	SLH[B]
Knezevic and Dobromirov (2016)	Serbia	2004–2011	SLH[B]
Strand 3: Relation between banking security and output expansion			
Alshubiri (2017)	Oman	2008–2014	DFH[C]
Pedro *et al.* (2018)	33 OECD nations	1991–2011	DFH[C]
Trabelsi and Trad (2017)	Gulf and Southeast Asia	2006–2013	DFH[C]
Dell'ariccia *et al.* (2008)	41 nations	1980–2000	FBH[C]
Fu *et al.* (2014)	14 Asia Pacific countries	2003–2010	NEH[C]
Hoggarth *et al.* (2002)	Developed and emerging-market nations	1977–1998	SLH[C]
Jayakumar *et al.* (2018)	32 European nations	1996–2014	SLH[C]
Jokipii and Monnin (2013)	18 OECD nations	1980–2007	SLH[C]

Source(s): Author's summary

Table 1.
Recap of literature review on pairwise interaction amongst banking security, banking profit and output growth

well-secured banking sector, which leads to more efficient resource utilization and subsequently greater economic productivity. By contrast, over-regulating the banking explosion probably deteriorates economic enhancement. The conclusion is encouraged by Hoggarth *et al.* (2002), Jokipii and Monnin (2013) and Jayakumar *et al.* (2018). Thirdly, the feedback hypothesis (FBH[C]) postulates banking security influences economic advancement and vice versa. The argument is promoted by Dell'ariccia *et al.* (2008). Finally, the neutrality hypothesis (NEH[C]) argues banking stability and economic growth are independent. Banking

security is strongly responsive to interest rate and investment, especially in the short-run. Hence, it might not identify its significant influence on economic development. The hypothesis is supported by Fu *et al.* (2014).

The main research gap in recent literature is an investigation of interdependence between all the variables of interest in the ASEAN region, especially given their dynamic integration over the years. This study plans to fulfil the research lack by examining their causal connections. Evidently, amongst other things, our study will meld the strands of the literature. We expect to test the three main hypotheses: Hypothesis A: Economic growth Granger – causes banking profit and vice versa; hypothesis B: banking profit Granger – causes banking security and vice versa and hypothesis C: economic growth Granger – causes banking security and vice versa. Figure 1 summarizes the proposed hypotheses, which demonstrates the direction of possible causality amongst these aforementioned variables.

Where H^A_1: Economic growth Granger – causes banking profitability, supporting the demand-following hypothesis (DFH^A); H^A_2: Banking profitability Granger – causes economic growth, supporting the supply-leading hypothesis (SLH^A); H^A_3: Banking profitability and economic growth boost each other, supporting the feedback hypothesis (FBH^A); H^A_4: Banking profitability and economic are independent, supporting the neutrality hypothesis (NEH^A); H^B_1: Banking profitability Granger – causes banking stability, supporting demand-following hypothesis (DFH^B); H^B_2: Banking stability Granger – causes banking profitability, supporting supply-leading hypothesis (SLH^B); H^B_3: Banking stability and banking profitability boost each other, supporting feedback hypothesis (FBH^B); H^B_4: Banking stability and banking profitability are independent, supporting the neutrality hypothesis (NEH^B); H^C_1: Economic growth Granger – causes banking security, supporting demand-following hypothesis (DFH^C); H^C_2: Banking security Granger – causes economic growth, supporting supply-leading hypothesis (SLH^C); H^C_3: Banking securities and growth explosion react to each other, supporting the feedback hypothesis (FBH^C); H^C_4: Banking security and output growth are independent, supporting the neutrality hypothesis (NEH^C).

3. Data and variables

Annual panel data are employed in the study over 1996–2017, which is mainly obtained from the World Bank. However, Laos PDR is excluded from the study because of much missing data over the period. Thus, the data only cover nine ASEAN members. Due to unavailable data from some ASEAN countries over the whole same duration, the panel data is unbalanced.

To gauge the interrelationship between the banking security (BSI), banking profitability (BPI) and economic expansion, we employ proxy variables for each dimension. All the variables are country level and expressed in percentage.

Firstly, the economic development (variable GRW) is evaluated by the growth of GDP per capita, consistently with Chang (2002), Habibullah and Eng (2006), Jayakumar *et al.* (2018)

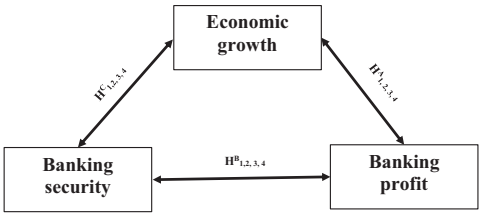

Figure 1.
Expected hypothesis on the causal link between growth performance, banking security and banking profit

and Nucu and Anton (2019). Next, the banking security is expressed via three measures, namely, banking system *z*-scores (variable ZSC); private credit by the domestic deposit (variable CRE) and bank liquid assets to deposits and short-term funding (variable LIQ). These measures rely on relevant literature (Abel and Le Roux, 2016; Knezevic and Dobromirov, 2016; Tan, 2016). Finally, the banking profitability is also represented by three indicators, including returns on average assets (variable ROA); returns on average equity (variable ROE) and net interest margin (variable NIM), consistently with Bolt *et al.* (2012), Acaravci and Çalim (2013), Tagkalakis (2014), and Daly and Frikha (2016).

There is no single measurement to completely express the banking profitability characteristic. Each of the three individual measurements (ROA, ROE or NIM) is to represent one specific dimension of banking profitability. Thus, a composite index of banking profit (variable PROFIT) is expected to reflect the general dynamic of banking earnings in a specific nation. This index combines all the three indicators (ROA, ROE, NIM) and is generated by using the principal component analysis (PCA). The same interpretation is applied to the banking stability composite index, which consists of ZSC, CRE and LIQ using PCA (variable STABILITY). The statistical description of PCA is shown in Table A1, while those of the measurements are in Table A2.

4. Method and identification strategy

This paper attempts to examine the dynamic relationship between banking stability, banking profitability and economic growth. Thus, the panel vector-error correction framework is an appropriate approach utilized in Jayakumar *et al.* (2018) and Nucu and Anton (2019). Accordingly, using the VEC methodology, we can treat the variables of interests as endogenous and therefore examine the short- and long-run effects of banking profitability on stability and economic growth, and respectively, the reverse effects. Our model can be written as:

$$\begin{bmatrix} \Delta \mathrm{GRW}_{it} \\ \Delta \mathrm{BPI}_{it} \\ \Delta \mathrm{BSI}_{it} \end{bmatrix} = \begin{bmatrix} \alpha_{1i} \\ \alpha_{2i} \\ \alpha_{3i} \end{bmatrix} + \sum_{k=1}^{n} \begin{bmatrix} \beta_{11ik} & \beta_{12ik} & \beta_{13ik} \\ \beta_{21ik} & \beta_{22ik} & \beta_{23ik} \\ \beta_{31ik} & \beta_{32ik} & \beta_{33ik} \end{bmatrix} * \begin{bmatrix} \Delta \mathrm{GRW}_{it-k} \\ \Delta \mathrm{BPI}_{it-k} \\ \Delta \mathrm{BSI}_{it-k} \end{bmatrix} + \begin{bmatrix} \delta_{1i} \mathrm{ECT}_{it-1} \\ \delta_{2i} \mathrm{ECT}_{it-1} \\ \delta_{3i} \mathrm{ECT}_{it-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1it} \\ \varepsilon_{2it} \\ \varepsilon_{3it} \end{bmatrix} \quad (1)$$

where i denotes individual ASEAN countries, t denotes years over 1996–2017; Δ is the first different filter, in which $\Delta \mathrm{GRW}_{it}$ captures economic growth; $\Delta \mathrm{BSI}_{it}$ captures one of the banking stability indicators (ZSC, CRE, LIQ or STABILITY); ΔBPI_{it} captures one of the banking profitability indicators (ROA, ROE, NIM or PROFIT); ε_{1it}, ε_{2it}, ε_{3it} are independently and identically distributed errors. The maximum lag order k of the right-hand variables can be determined with the Akaike Information Criterion. The coefficients of interest, β, are representing the short-run Granger-causality, while coefficients, δ, are examining the long-run Granger-causality between the variables. The long-run relationship can be estimated by panel fully modified ordinary least square or dynamic ordinary least square (Pedroni, 2000). However, Model 1 is meaningful only if all the variables, GRW, BSI, BPI, have the same order of integration and are co-integrated. Therefore, the tests for panel unit root and co-integration are necessary to proceed before the estimation of the model.

In the case of the mixed orders of integration, that is, the variables are both $I(0)$ and $I(1)$, panel autoregressive-distributed lag (PARDL) method is more appropriate. This approach can deal with the co-integration progress for a long-term connection, regardless of whether the covariates are $I(0)$, $I(1)$, or a mix of both (Nkoro and Uko, 2016). Our model can be written as:

$$\Delta y_{it} = \varnothing_i \left(y_{it-1} - \theta_i' X_{it} \right) + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{it-1} + \sum_{j=0}^{q-1} \delta_{ij}^{*\prime} \Delta X_{it-j} + \mu_i + \epsilon_{it} \quad (2)$$

where i denotes the individual ASEAN members, t denotes years over 1996–2017; Δ is the first different filter; y_{it} and X_{it} are the vectors which each includes three variables GRW (capturing economic growth), BSI (capturing one of the banking profitability indicators ROA, ROE, NIM or PROFIT), and BPI (capturing one of the banking stability indicators ZSC, CRE, LIQ or STABILITY); μ_i denotes individual fixed effects; ϵ_{it} is a vector of independently and identically distributed errors. The maximum lag order p and q of the right-hand variables are determined by the Akaike Information Criterion. The coefficient of interest is the vector $\varnothing_i$, representing the long-run Granger-causality or error-correcting speed of adjustment, while the vector δ_{ij}' captures the short-run Granger-causality. Another importance is the vector θ_i', which contains the long-term relationship between the underlying variables.

Regarding Pesaran *et al.* (1999), we allow for the heterogeneous short-term dynamics but the homogeneous long-term connection between the variables across the ASEAN area when employing the PARDL. In other words, vectors $\varnothing_i$ and θ_i' are homogeneous, while vector $\delta_{ij}'^*$ is heterogeneous across the countries. We assume that the ASEAN countries are homogeneous enough to have the same long-run interaction between banking and economic advancement. However, the short-run relationship should be different between the countries.

5. Empirical results and discussion

We will start by examining the panel cross-sectional independence. Under the Breusch and Pagan test, the panel cross-sectional dependence is confirmed. Thus, the second-generation test for panel unit root is utilized (Pesaran, 2007). For robustness, the test is done with various lags and different model specifications. The final interpretation is based on the majority of the results. At the level data, we have the combination of variables with different orders of integration in which ZSC, CRE, LIQ, STABILITY and NIM are $I(1)$, while the others are $I(0)$. Thus, the PARDL method should be employed. However, this model cannot run with $I(2)$ variables. In Table 2, at the first-difference level, all variables are $I(0)$, except for STABILITY. Thus, for the validity of estimations, variable STABILITY is excluded.

Table 3 represents the estimations of both short- and long-run Granger-causality between the variables from Model 2. The detailed results are interpreted as follows, while Table 4 recaps the confirmed hypotheses on the short-run Granger-causality.

For the short-run Granger-causality, we observe both unidirectional and non-directional causalities between banking profitability and economic development. However, in most cases, the unidirectional causal effect of banking profitability on the growth is affirmed (BPI → GRW), while the non-directional one is occasionally presented (BPI<≠>GRW). By contrast, the short-term Granger-causality between banking security and growth expansion is unclear. In Table 4, half of the cases demonstrate the non-directional causality (BSI<≠>GRW), while the others show the mixed unidirectional causalities. The same argument is also given to short-run Granger-causality between banking earnings and banking security. The results vary with different measures for banking profit or security.

However, the long-term Granger-causality between the variables is strongly confirmed when the estimations of ECTs are mostly significant and reflect the expected negative sign.

The empirical evidence provides us with more insights into the interconnection between the variables. Only the short-term Granger-causal link from banking earnings to output growth is significantly clear, while the other cases are non-uniform. However, we recognize the significant long-run Granger causalities between all the variables because of the general

Variable	Number of lags	PESARAN'S panel unit root test results Zt-bar statistical value Part 1: At level data Without trend	With trend	Inference	Part 2: At first difference Without trend	With trend	Inference
ZSC	1	−2.175**	−0.853	*I*(1)	−6.631***	−6.324***	*I*(0)
	2	−0.189	2.721		−2.105**	−2.329***	
	3	0.371	−0.850		1.523	2.330	
CRE	1	−6.525***	−3.200***	*I*(1)	−6.053***	−8.773***	*I*(0)
	2	−2.705***	0.216		−1.566*	−1.412*	
	3	0.252	1.458		−1.520*	−3.422***	
LIQ	1	−0.635	−0.865	*I*(1)	−5.103***	−3.943***	*I*(0)
	2	−0.079	1.360		−1.327*	−0.268	
	3	0.088	−0.871		−2.432***	0.866	
STABILITY	1	−0.400	1.119	*I*(1)	−4.486***	−4.412***	*I*(1)
	2	1.001	3.032		0.502	−1.100	
	3	0.972	2.198		4.172	1.657	
ROA	1	−4.005***	−2.710***	*I*(0)	–	–	
	2	−2.412***	−1.316*		–	–	
	3	−0.990	−3.047***		–	–	
ROE	1	−2.471***	−0.962	*I*(0)	–	–	
	2	−2.009**	−0.294		–	–	
	3	−1.851**	−3.169***		–	–	
NIM	1	−1.679**	−0.991	*I*(1)	−7.331***	−6.522***	I(0)
	2	−3.648***	−1.841**		−4.159***	−2.729***	
	3	2.257	2.906		−0.687	−0.793	
PROFIT	1	−4.354***	−3.486***	*I*(0)	–	–	
	2	−1.878**	−1.483*		–	–	
	3	−1.877**	−0.960		–	–	
GRW	1	−2.357***	−3.932***	*I*(0)	–	–	
	2	−1.859**	−2.533***		–	–	
	3	0.576	0.696		–	–	

Note(s) 1: The null hypothesis of all tests is of panel unit root. 2: *I*(0) stands for the integration of zero-order, while *I*(1) as the integration of order one. 3: ***, ** and * corresponding to 1, 5 and 10% significance levels, respectively

Source(s): Author's calculation

Table 2. Panel unit root test results under the second-generation test

significance of ECTs coefficients. In other words, in the ΔGRW equation, both banking stability and profit Granger – cause economic growth in the long run. The same conclusion is also drawn to banking earnings and banking security when they are dependent variables.

The negative sign of ECTs coefficients in the ΔGRW equations implies the change in the level of economic growth (ΔGRW), in fact, responds to any earlier short-run disequilibrium. In other words, the effect of shocks to BPI or BSI on GRW will be absolutely adjusted in the long run. The same argument is drawn when we consider ΔBPI and ΔBSI as dependent variables. However, in the case of ΔGRW as the dependent variable, the speed of adjustment is the largest, while it is the smallest when ΔBSI is the dependent variable. The empirical results indicate that the banking safeness will correct its previous period disequilibrium at a speed of convergence of about 20–30% per annum when ZSC and LIQ are proxies, while only 3–7% when CRE as the proxy. This implies that recovering the banking stability to its long-run equilibrium is more difficult and takes more time compared to the banking profit or economic development.

Another importance is the estimated coefficients of $\theta_i^{'}$, representing the long-run relationship between the variables. Table 5 strongly indicates the long-term impacts of

Table 3.
Results of panel Granger-causality estimations from Model 2

Dependent variable	Independent variables and error-correction terms (ECTs)											
	ZSC as proxy for BSI				CRE as proxy for BSI				LIQ as proxy for BSI			
	ΔGRW_{t-j}	ΔBSI_{t-j}	ΔBPI_{t-j}	ECT	ΔGRW_{t-j}	ΔBSI_{t-j}	ΔBPI_{t-j}	ECT	ΔGRW_{t-j}	ΔBSI_{t-j}	ΔBPI_{t-j}	ECT
ROE as proxy for BPI												
ΔGRW	–	−0.668	0.083**	−0.900***	–	0.044	0.079***	−0.984***	–	−0.069**	0.071***	−0.840***
ΔBSI	−0.123	–	0.018	−0.038	−0.547	–	0.218	−0.043***	1.252	–	0.103	−0.307***
ΔBPI	0.690	4.841*	–	−0.567***	0.104	0.975**	–	−0.768***	−0.814	0.467	–	−0.347**
ROA as proxy for BPI												
ΔGRW	–	0.206	0.140	−0.843***	–	0.017	0.874***	−0.855***	–	−0.088**	0.820**	−0.813***
ΔBSI	−0.117*	–	0.810***	−0.028	−0.209	–	3.610	−0.072***	0.670	–	−1.700	−0.233*
ΔBPI	0.124	0.142	–	−0.588***	0.164	0.014	–	−0.467***	0.156	0.012	–	−0.457***
NIM as proxy for BPI												
ΔGRW	–	−0.675	0.668	−0.875***	–	0.000	1.245***	−0.830***	–	−0.044	1.435**	−0.706***
ΔBSI	−0.019	–	0.659**	−0.268***	−0.607	–	2.660	−0.039*	1.148	–	−0.890	−0.326***
ΔBPI	−0.016	0.141	–	−0.618***	0.013	0.029**	–	−0.531***	−0.016	0.014	–	−0.634***
PROFIT as proxy for BPI												
ΔGRW	–	0.081	0.356	−0.843***	–	−0.008	0.977***	−0.974***	–	−0.079*	0.910***	−0.917***
ΔBSI	0.067*	–	0.424	−0.269***	−0.890***	–	6.745	−0.041**	0.943	–	−1.843	−0.254**
ΔBPI	0.062	0.191*	–	−0.577***	−0.012	0.054	–	−0.604***	0.032	0.016	–	−0.557***

Note(s) 1: The estimated coefficients of ΔGRW_{t-j}, ΔBSI_{t-j}, ΔBPI_{t-j} are equivalent to the parameters δ'_{ij} in Model 2, presenting short-run Granger-causality, while those of ECTs corresponds to the parameter $\varnothing_i$, implying long-run Granger-causality. 2: ***, ** and * corresponding to 1, 5 and 10% significance levels, respectively
Source(s): Author's calculation

	Banking profitability and output growth	Banking profitability and banking security	Banking stability and output growth
GRW, ZSC, BPI			
ROE	SLH[A]	SLH[B]	NEH[C]
ROA	NEH[A]	DHF[B]	DFH[C]
NIM	NEH[A]	DFH[B]	NEH[C]
Profit	NEH[A]	SLH[B]	DFH[C]
GRW, CRE, BPI			
ROE	SLH[A]	SLH[B]	NEH[C]
ROA	SLH[A]	NEH[B]	NEH[C]
NIM	SLH[A]	SLH[B]	NEH[C]
Profit	SLH[A]	NEH[B]	DFH[C]
GRW, LIQ, BPI			
ROE	SLH[A]	NEH[B]	SLH[C]
ROA	SLH[A]	NEH[B]	SLH[C]
NIM	SLH[A]	NEH[B]	NEH[C]
Profit	SLH[A]	NEH[B]	SLH[C]

Source(s): Author's summary

Table 4. Summary of the confirmed hypotheses on short-run Granger-causality results

Independent variable Dependent variable	Banking stability indicator (BSI)			Banking profitability indicator (BPI)			
	ZSC	CRE	LIQ	ROE	ROA	NIM	PROFIT
GRW	−0.111**	–	–	0.068***	–	–	–
GRW	−0.170***	–	–	–	1.029***	–	–
GRW	−0.188***	–	–	–	–	0.650***	–
GRW	−0.144***	–	–	–	–	–	1.586***
GRW	–	−0.002	–	0.0182	–	–	–
GRW	–	−0.001	–	–	0.387***	–	–
GRW	–	−0.001	–	–	–	−0.130	–
GRW	–	−0.002	–	–	–	–	1.088***
GRW	–	–	0.035**	0.043***	–	–	–
GRW	–	–	0.052***	–	0.491***	–	–
GRW	–	–	0.059***	–	–	−0.476***	–
GRW	–	–	0.032**	–	–	–	1.146***

Note(s): ***, **, * corresponding to 1%, 5 and 10% significance levels respectively
Source(s): Author's calculation

Table 5. The long-run relationship between the variables

banking security and earnings on economic enhancement. Increased banking profitability causes higher economic growth. The results are consistent with Miralles-Quiros *et al.* (2018). By contrast, increased banking security has no uniform impact, relying on specific banking security indicators.

Particularly, the improved ZSC decreases economic expansion, while higher LIQ has the reverse effect. This can be explained that the banking z-score can be partly increased by the higher ratio of shareholder's equity over total assets [1]. However, the improved capital capacity could be a very costly procedure and this can deteriorate the banking earnings (Van Dang, 2019). In some circumstances, improving regulated capital qualification might stimulate banks to get more involved in value-deteriorating activities (Jacques and Nigro, 1997).

6. Concluding remarks and policy implications

The research pursues to assess the interaction between banking earnings, banking safeness and output growth across the ASEAN region, employing panel annual data over 1996–2017. We expect to deploy four measures for each banking stability and banking profitability assessment. However, due to the validity of panel autoregression distributed lag analysis, we finally use three measurements for banking safeness, but four ones for banking profitability.

From our estimation, the long-term impacts of banking well-being and banking stability on economic growth are strongly affirmed. However, while the increased banking profitability, on average, leads to higher economic development, the increased banking stability may have reverse effects in some circumstances.

We proceed with further research by examining the short- and long-term Granger-causality amongst the variables. Generally, there is no evidence for the uniform short-run Granger relation between banking profitability and stability or banking stability and economic growth, except for banking profitability and economic growth. Nevertheless, we conclude the uniform long-run Granger causality between all the variables. This means that any variable is strongly Granger-caused by the other two variables in the long run. Additionally, the speed of adjustment of the banking stability to its short-run disequilibrium is comparably small to those of banking profit and economic development, implying the convergence of the banking stability to its long-run equilibrium takes more time and is more difficult.

Thus, the questions remain how one government should affect banking stability and profitability to achieve a higher economic achievement, given their significant long-run Granger causality. Although the increased banking stability might deteriorate the economic growth in some cases, its absolute margin impact magnitude is relatively much lower than that of the higher banking profitability (Table 5). Thus, improving the banking well-being and safeness capacity simultaneously might have net positive effects on the economic growth. Contrarily, higher banking earnings without the corresponding higher soundness can harm growth enhancement in the short-run and much more in the long run because of potential doubtful loans. This is because the severe impact of reduced banking soundness can last long due to its narrow speed of convergence to the long-run equilibrium. Hence, national governments should focus on creating a convenient banking market, which can continuously maintain the increased banking profitability and safeness obligations simultaneously.

This research is restricted to some unavailable data and limited measurements of both banking profitability and banking stability as well. This may cause us to draw a less convenient picture of the interaction within a tri-cycle analysis of banking profitability, banking stability and economic performance. Additionally, further inclusion of other macro-economic variables, or other banking development dimensions, or non-banking indicators can be further considered to obtain a better interaction amongst the variables.

Note

1. It is calculated as follows: $z_{it} = \frac{\mathrm{ROA}_{it} + (\mathrm{EQ/TA})_{it}}{\delta_{\mathrm{ROA}}}$, where ROA is the returns on assets; EQ/TA illustrates the ratio of equity to asset; δ_{ROA} represents the standard deviation of ROA. The higher the z-score, the more stable the banking sector.

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Appendix

We create composite indicators for banking profit (variable PROFIT) and banking safeness (variable STABILITY), employing principal component analysis (PCA). We follow three main steps: firstly, obtaining an input matrix for principal components, that are normalized using the min–max approach. Secondly, eigenvalues, factor loadings and principle components are gained. Lastly, the composite indexes are created for every nation each year. The approach is introduced and employed in various previous studies (Wang and Wang, 2015). The results are shown below.

For composite index of banking earnings (PROFIT)

Part A: Eigen analysis of correlation matrix

PCs	Eigen value	Proportion	Cumulative
1	1.637	0.546	0.546
2	0.923	0.308	0.854
3	0.439	0.146	1.000

Part B: Eigen vectors (Component loadings)

Variables	PC1	PC2	PC3
ROA	0.6795	−0.1254	−0.7229
ROE	0.6398	−0.3810	0.6674
NIM	0.3591	0.9160	0.1787

For composite index of banking safeness (STABILITY)

Part A: Eigen analysis of correlation matrix

PCs	Eigen value	Proportion	Cumulative
1	1.293	0.431	0.431
2	0.947	0.316	0.747
3	0.760	0.253	1.000

Part B: Eigen vectors (Component loadings)

Variables	PC1	PC2	PC3
CRE	0.4006	0.9084	0.1197
ZSC	0.6345	−0.3693	0.6790
LIQ	−0.6610	0.1960	0.7243

Note(s): PCs indicate principal components; ROA is the returns on assets; ROE is the returns on equity; NIM is net interest margin; ZSC is banking z-score; CRE is private credit by deposit money banks; LIQ is bank liquid assets to deposits and short-term funding

Source(s): Author's calculation

Table A1. Calculating the composite indexes of banking earnings and banking security

Variables	ZSC	CRE	LIQ	STABILITY	ROA	ROE	NIM	PROFIT	GRW
Observation	187	195	191	186	188	188	190	187	198
Minimum	0.109	37.939	6.036	−4.277	−29.117	−211.443	0.069	−9.184	−14.351
Mean	11.550	138.563	35.595	0.010	0.778	9.197	3.787	0.006	3.727
Median	11.509	88.127	30.959	0.040	1.088	11.849	3.376	0.066	4.296
Maximum	34.267	878.839	150	2.370	5.763	70.097	11.020	3.832	12.788
Standard dev	7.615	167.044	21.671	1.142	2.704	22.970	2.012	1.283	3.931
Skewness	0.546	2.789	1.885	−0.629	−8.062	−6.274	0.6015	−3.886	−0.776
Kurtosis	2.450	9.879	8.409	3.973	84.446	54.106	3.013	26.656	5.735

Table A2.
Descriptive statistics of variables

Note(s): ZSC is banking system z-scores; CRE is private credit by domestic deposit; LIQ is bank liquid assets to deposits and short-term funding; STABILITY is the composite index; ROA is return on assets; ROE is return on equity; NIM is net interest margin; PROFIT is composite indicator and GRW is per capita GDP growth
Source(s): Author's calculation

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