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Supply-leading or demand-following financial sector and economic development nexus: evidence from data-rich Indonesia

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Abstract

Supply-leading theory predicts that the financial sector development precedes economic development while demand-following theory believes that the economy should develop, then the financial sector follows. This study exploits the financial sector and economic development relationship in a data-rich environment. Besides the depth, financial access and efficiency are also vital in the financial sector development. We employ a FAVAR model using 22 financial development indicators and 12 economic variables of the monthly Indonesian data series 2015M1-2023M6. Our empirical results reveal the bi-causal relationships between the financial sector and economic development. Then, whether the relationship is more demand-following or supply-leading depends on the measures used and the time trajectory. While an expansion in real GDP seems to have a more persistent impact on the development of financial institutions such as the banking and insurance sectors (demand-following relationship), the supply-leading relationship is influential in the short run. We also find that boosting access to credit and both stock and bond markets provokes economic activities. In addition, the increasing usage of electronic money encourages more consumption of imported goods than domestic goods.

Keywords: financial sector, economic activities, demand, supply, FAVAR

JEL Classification: C11 , C38 , C55 , E44 , G10 , G18 , G21 , G28

1 Introduction

The causal relationship between financial sector development and economic development remains inconclusive despite the longevity of the studies in this matter. In general, there are three hypotheses: (i) financial sector development induces economic development – "supply leading theory" (see e.g., Fase and Abma, 2003; Xu, 2000); (ii) economic development persuades financial sector development – "demand following theory" (see e.g., Masih and Masih, 1996); and (iii) bidirectional causation between both (see e.g., Furqani and Mulyany, 2009; Al-Yousif, 2002). Unlike those studies, Galindo and Micco (2004) and Harris (1997) find insignificant causal relationships between both.

This study examines the causal relationships between the financial sector and economic development in Indonesia using broader measures. Our contribution lies within the encyclopedic indicators of the financial sector development that we use and wide-ranging indicators of economic activities. To the best of our knowledge, this kind of research has not been done in the previous literature on the relationships between the financial sector and economic development. Existing literature on this research line associates the financial sector development with financial sector depth. This research adds two more dimensions of the financial sector development, i.e., financial access and financial efficiency, in addition to the financial depth. We also distinguish between financial institutions and the financial market.

Investigating whether the causal relationships follow supply-leading or demand-following theories is crucial before policymakers can formulate policies to support the financial sector development, particularly related to financial sector deepening. The depth of the financial sector is closely linked to economic development, and it

may inspire economic growth if it can transmit financial resources to the economy effectively. Nevertheless, we argue that not only is the financial depth crucial but the financial access and efficiency are also influential for the economic performance.

The supply-leading theory stresses that the financial sector development should precede economic development since the financial sector supplies the financing needed for economic development. In contrast, the demand following theory asserts that the economy should expand before the financial sector develops. This theory argues that financing or credit only exists if there are demands in the economy. One of the closest studies to ours is Malarvizhi et al (2019) studying ASEAN-5 countries. Compared to theirs, our study elaborates more dimensional financial sector indicators, covering financial sector depth, efficiency, and access. We utilize the financial sector development indicators used in Svirydzenka (2016) and Mansur and Nizar (2019). These indicators have covered both the financial institutions and financial markets, offering more comprehensive measures.

Other studies close to ours are Puatwoe and Piabuo (2017), studying the financial development and economic growth in Cameroon, and Qamruzzaman and Jianguo (2017), studying a similar notion in Bangladesh. While the latter considers financial depth as the indicator of financial development, the former covers two dimensions of financial development, i.e., financial depth and financial efficiency. Our study here enriches the measures of the financial sector development used in the previous literature.

Due to the large dimension of indicators that we use, we estimate a Factor-Augmented Vector Autoregressive (FAVAR) model as our methodological approach. We use monthly Indonesian data for 2015M1-2023M6, including 22 financial development indicators and 12 economic indicators. We apply the recursive Cholesky identification strategy to identify the structural shocks by utilizing the theoretical predictions of the supply-leading and demand-following theories.

Our empirical results reveal bi-causal relationships between the financial sector and economic development in Indonesia. Then, whether the relationship is more demand-following or supply-leading depends on the measures used and the time trajectory. The short-run relationship is more supply-leading as the real GDP always rises on impact in response to an increase in any measure of the financial development indicators. However, when we consider industrial production as an economic measure, the relationship is more demand-following as the industrial production's responses are either zero or negative after the financial development indicators expand. Whereas the financial indicators generally respond positively to an industrial expansion on impact.

In the long run, our results indicate that the demand-following is as strong as the supply-leading. We draw some policy implications based on our results as follows: (i) An expansion in real GDP seems to have a more persistent impact on the development of financial institutions such as the banking and insurance sector, so their depth will eventually improve when national income improves; (ii) The supply-leading relationship is influential in the short-run, so improvement in all areas including the depth, access, and efficiency both in financial institutions and financial markets, particularly the bond markets, will benefit the economy. We also find that boosting access to credit and both stock and bond markets encourages economic activities.

The rest of this paper is structured as follows. Section 2 summarizes the previous studies on the financial sector and economic development nexus, then Section 3 describes the data and methodology. Section 4 discusses the main findings, and finally, Section 5 concludes.

2 Related literature

There has been a long exhaustive list of studies on the financial sector and economic development nexus, and most agree on the positive correlation between both. Although the positive correlation does not guarantee a causal relationship, the financial sector

development is closely related to the income per capita growth (Rajan, 2001). Schumpeter (1911) emphasizes that the financial sector can relocate capital from capital-rich agents or individuals to other agents and individuals in the economy. Furthermore, financial services may lower the financing cost for firms, which eventually benefits the economy (Zingales and Rajan, 1998). Several other studies (e.g., Cameron, 1961, 1967; Gerschenkron, 1962; Goldsmith, 1969; McKinnon, 1973) also find similar results of the significant relationship between the financial sector and economic development.

Fast forward two decades later, Levine (1997) studies the causal relationship between the financial sector and economic development, and he finds a significantly positive relationship. He also finds that the current financial sector condition is useful to forecast economic growth in 10 to 30 years. Zingales and Rajan (1998) offer alternative reasons for the positive relationship between the financial sector and economic development. First, both the financial sector and economic development may have been affected by the same unobservable factor, i.e., the household's propensity to save. Second, financial sector development, conventionally proxied by credit and stock market capitalization, indeed precedes economic growth. Financial institutions offer more credits when they foresee that the economy will grow in the future, while the stock market capitalizes future growth opportunities to the present market values.

With the sample of 43 countries in their study, Zingales and Rajan (1998) find a positive correlation of as much as 27% between financial sector development and per capita income (significant at 10%). They identify the lower financing cost for firms as the main channel of how the financial sector affects economic growth. Other channels that may affect the positive correlation between both are the banking system's structure (Cetorelli and Gambera, 2001), financial institutions' efficiency (Al-Yousif, 2002), and size, activities' intensity and efficiency (Cooray, 2009), among other things.

Albeit the positive relationship between the financial sector and economic development, the causal relationship greatly varies from country to country or across a

sample of different times. With the sample of 30 developing countries of the 1970-1999, Al-Yousif (2002) finds a bidirectional causal relationship. They contend that we cannot generalize across countries as each country has different economic policies and structures. Similarly, Lawrence (2006) also reaches the same conjecture where the causal relationship also depends on whether the financing can encourage productive investment.

In another study, Sehrawat and Giri (2015) investigate the Indian economy from 1982 to 2012 using an Autoregressive Distributed Lags (ARDL) model. They use alternative measures of the financial sector development, including banking and financial market indicators, to study their causal relationships to economic growth. They find that those financial variables significantly and positively affect Indian economic growth. Therefore, their results support the hypothesis of the supply-leading theory.

Unlike the previously mentioned studies, Alexiou et al (2018) do not find a significant causal relationship between the financial sector and economic development. They argue that the positive relationship has deteriorated and even become negative. Their sample covers 34 European countries from 1998-2014 and considers several fundamental factors. They employ real per capita GDP growth as the dependent variables, and their control variables include the financial sector, macroeconomic, and institutional indicators. Their financial sector indicators consist of credit to GDP ratio, net interest rate margin between credit and deposit rates, real credit interest rate, money supply, M2 to GDP ratio, tradable stocks to GDP ratio, and market capitalization of stocks to GDP ratio. They note that using the market capitalization of stocks to GDP measure suits advanced economies better than developing economies. For the latter group, they suggest using the M2 to GDP ratio as a better measure of the financial sector depth. Meanwhile, their macroeconomic indicators contain investments, wages, unit labor cost, government consumption, inflation, and trade openness. Lastly, their institutional variables consist of voice and accountability, political stability and absence

of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption.

Several factors may significantly affect the relationship between the financial sector and economic development. Institutional factors such as regulations and the rule of law, as well as historical and geographical factors, are among the important factors that vary from country to country (Alexiou et al, 2018). Their results also reveal that macroeconomic volatility dampens the overall financial sector depth.

Specific to the ASEAN countries, Malarvizhi et al (2019), for example, study five ASEAN countries during the 1980-2011. They inspect whether the financial sector develops parallel with higher economic growth, accumulated physical investment, and better economic efficiency. They use the Solow 1956 growth model as the theoretical framework to answer the above questions. From the famous Cobb-Douglas equation, output (Y) depends on capital (K), labor (L), and technology (A). Malarvizhi et al (2019) then adds a variable of financial sector development into the Cobb-Douglas equation. The financial sector development variable consists of three measures: (i) the liquid liabilities ratio of the financial system to GDP, (ii) the ratio of claims of the non-banking private sector to the total domestic credit, and (iii) ratio of claims of the non-banking private sector to GDP. Their results suggest that the financial sector development positively affects economic growth, but investment and exports contribute more than the financial sector. Complementary to this study, our study here elaborates more dimensional financial sector indicators, covering financial sector depth, efficiency, and access, hence offering more comprehensive measures of the financial sector development.

Table 1: Indicators of financial development

Variables	Definition	Measure
fid1	Private-sector credit (Credit from bank & Credit from financial institution); ratio to GDP	FID
fid2	Pension fund assets; ratio to GDP	FID
fid3	Mutual fund assets; ratio to GDP	FID
fid4	Insurance premiums, life and non-life; ratio to GDP	FID
fia1	Number of bank's deposit accounts per 1,000 adults	FIA
fia2	Number of bank's credit accounts per 1,000 adults	FIA
fia3	Number of bank's credit accounts of small and medium enterprises per 1,000 adults	FIA
fia4	Number of electronic money per 1,000 adults	FIA
fie1	Bank's net interest margin	FIE
fie2	Bank's lending-deposits spread	FIE
fie3	Bank's non-interest income to total income ratio	FIE
fie4	Bank's overhead costs to total assets ratio	FIE
fie5	Bank's return on assets	FIE
fie6	Return on equity of financial enterprises listed on the Jakarta Stock Market (JAKFIN)	FIE
fmd1	Stock market capitalization to GDP ratio	FMD
fmd2	Stocks traded value to GDP ratio	FMD
fmd3	Tradable debt securities of government to GDP ratio	FMD
fmd4	Total debt securities of financial corporations to GDP ratio	FMD
fmd5	Total debt securities of nonfinancial corporations to GDP ratio	FMD
fma1	Percent of market capitalization outside of top 10 largest companies	FMA
fma2	Total number of issuers of debt (domestic and external, nonfinancial and financial corporations)	FMA
fme1	Stock market turnover ratio (stocks traded to market capitalization)	FIE

Notes: FID = Financial Institution Depth; FIA = Financial Institution Access; FIE = Financial Institution Efficiency; FMD = Financial Market Depth; FMA = Financial Market Access; FME = Financial Market Efficiency.

Sources: Bank of Indonesia; Indonesia's Financial Services Authority; Bloomberg.

3 Data and methodology

3.1 Data

We use the monthly Indonesian series of 2015M1-2023M6 (102 observations), including 22 financial development indicators and 12 economic indicators. Table 1 lists the financial development indicators, while Table 2 contains the details of the economic indicators. We report their descriptive statistics and correlation matrices in Section A.

Table 2: Indicators of economic activities

Variables	Definition
Monthly GDP	Constructed from quarterly GDP series (2010 constant price; logarithmic scale) using mixed frequency VAR model as explained in Section 3.2.
Industrial production	Industrial production index 2010=100; logarithmic scale
Retail	Retail sales; survey by Bank of Indonesia
Retail 3M	Expectation of retail sales for 3 months ahead; survey by Bank of Indonesia
Retail 6M	Expectation of retail sales for 6 months ahead; survey by Bank of Indonesia
Export	Exports FOB in USD million; logarithmic scale
Import	Imports CIF in USD million; logarithmic scale
CPI	Consumer price index 2015=100; logarithmic scale
JCI	Jakarta composite index of stock market; logarithmic scale
IDRUSD	Indonesian Rupiah per USD; logarithmic scale
PUAB1D	1 day interbank interest rates
SBN1YR	Yield of 1-year government's bond

Notes: All series are seasonally adjusted using X12.

Sources: Indonesia's Statistics Agency; Bank of Indonesia.

3.2 Construction of monthly GDP

One of the economic indicators used, i.e., the monthly GDP, is a generated series using a mixed frequency bi-variate Vector Autoregression (VAR) model, consisting of a monthly log of industrial production index of 2015M1-2023M6 and quarterly GDP series of 2015Q1-2023Q2. We apply the mixed frequency VAR model package of Ferroni and Canova (2022).[1] This setup, in a nutshell, suppose we have monthly and quarterly series $\{y_t^m, y_t^q\}$ with t corresponding to the month, we assume that there exists a mapping from the monthly series into the quarterly series. We have the quarterly aggregator as

$$y_t^q = \frac{1}{3}(x_t^m + x_{t-1}^m + x_{t-2}^m)$$

where y_t^q is the quarterly observable series and x_t^m is the monthly unobserved counterpart. We assume a VAR with six lags, and the system is assumed linear and Gaussian. The constructed monthly GDP series is displayed in Figure 1, together with the quarterly observable series.

[1]The model is estimated using the Bayesian method, and the detailed assumptions and estimation procedure can be seen in their paper.

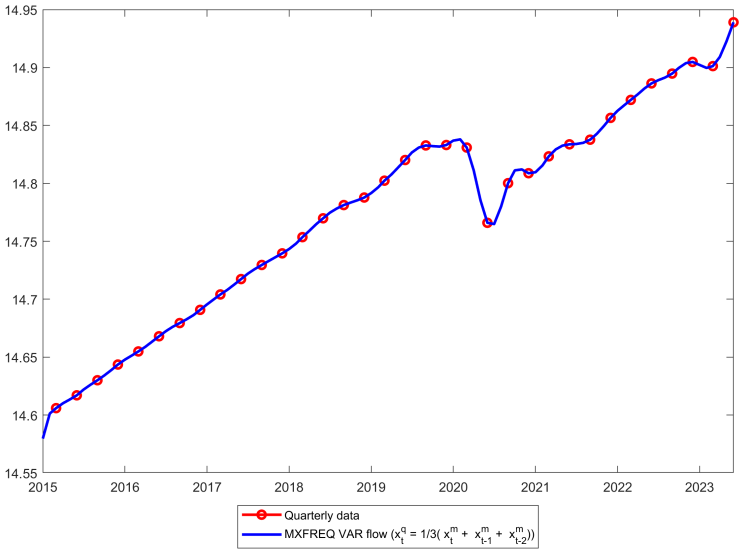


Fig. 1: Constructed monthly real GDP in logarithmic scale

3.3 The FAVAR model

In the first place, we argue that it is crucial to measure the development of the financial sector from multiple dimensions. Therefore, we incorporate many variables in our study. One model that can facilitate this large number of variables is the factor-augmented VAR (FAVAR) model (e.g., Bernanke et al, 2005).

Let us first consider the general setup of a VAR model with lags p as follows:

$$z_t = c + \Phi_1 z_{t-1} + ... + \Phi_p z_{t-p} + \mu_t \tag{1}$$

where c is a $n \times 1$ vector of constants, z_t is a $n \times 1$ vector of endogenous variables, and Φ_j, $j = 1, ..., p$ are $n \times n$ lag coefficient matrices. The error term μ_t is i.i.d. normally distributed with zero mean and covariance matrix Σ. Now, when n, the number of variables, is large and the period is short, estimating a VAR model is problematic

as the number of parameters increases enormously. The FAVAR model comes as a solution to the large-dimension problem.

We follow the procedure in Ferroni and Canova (2022) in estimating the FAVAR model as follows. Let $z_t = [z_{1t}, z_{2t}]$, where z_{2t} contains data excluded from the VAR system which is going to be used to construct factors w_t. Then, we can replace z_{2t} with w_t so that we entertain $\tilde{z}_t = [z_{1t}, w_t]$ as observable. By keeping the size of w_t small, our model dimension will be sufficiently small. We estimate $\tilde{z}_t$ using the Bayesian methods with standard Minnesota priors as in Ferroni and Canova (2022).[2] Once we have estimated $\tilde{z}_t$, we can then use the estimated loadings to transform the responses of the factors into responses of the variables in z_{2t}.

Our goal is to study the effects of an economic expansion on the financial development variables and the impact of financial development innovations on the economic variables. Motivated by the demand following and supply leading theoretical predictions, we lay out two FAVAR model specifications as follows:

$$z_t^{fd} = [z_{1t}^{e}, z_{2t}^{fd}] \tag{2}$$

where z_{1t}^{e} contains the monthly GDP series and z_{2t}^{fd} comprises the 22 financial development indicators listed in Table 1, and

$$z_t^{econ} = [z_{1t}^{fin}, z_{2t}^{econ}] \tag{3}$$

where z_{1t}^{fin} is the first principal component series of the 22 financial development indicators, and z_{2t}^{econ} contains the 12 economic activity indicators listed in Table 2. The first principal component series of the 22 financial development indicators may indicate the average measure of the financial sector development as it considers multiple

[2] See Ferroni and Canova (2022) for the technical details.

dimensions of the financial sector. We also entertain one of the 22 financial development indicators as z_{1t}^{econ} to see the impact of a specific financial innovation on economic activities.

As far as identification is concerned, we rely on the recursive Cholesky ordering to identify the structural shocks. We use the demand following and supply leading theoretical predictions to fix the ordering. The demand-following theory predicts that the economy must grow first, then the financial sector develops. Therefore, z_{1t}^{e} in equation (2) should be ordered first. In contrast, the supply-leading theory predicts that financial sector development precedes economic growth, suggesting z_{1t}^{fin} in equation (3) is ordered first. In the meantime, the ordering of the other variables is irrelevant since we are only interested in the impact of a positive shock to z_{1t}^{e} on the variables in z_{2t}^{fd}, and the effects of a positive shock to z_{1t}^{fin} on the variables in z_{2t}^{econ}.

4 Results and discussion

In both models in equations (2) and (3), we estimate FAVAR models with lags $p = 2$ or two months to preserve the degree of freedom. To make the units of the variables comparable and ensure stationarity, all variables entering the models are demeaned and standardized, as suggested by Ferroni and Canova (2022). Then, regarding the factors w_t, we extract six factors in model (2) and five factors in model (3), ensuring more than 90% variance in both models. The first principal component series of the 22 financial development indicators contained in z_{1t}^{fin} in equation (3) account for around 51% variance.

Having estimated the factors and the FAVAR models, we then compute the impulse responses of the factors to a positive shock to z_{1t}^{e} (for the model in equation (2)), and to z_{1t}^{fin} (for the model in equation (3)). After that, the impulse responses of the factors are mapped into the impulse responses of the variables, i.e., z_{2t}^{fd} in equation (2) and z_{2t}^{econ} in equation (3). Note that the variables entering the models are demeaned and

standardized, so when mapping into the impulse responses of the variables, they need to be scaled back into the uncompressed raw variables.

4.1 Responses of the financial development variables to an economic expansion

The demand-following theory predicts that an economic expansion will promote financial sector development. The impulse responses of the variables in z_{2t}^{fd} in equation (2) to a positive shock to z_{1t}^{e} correspond to the responses of the financial development variables to an economic expansion, indicated by a 1% increase in the real GDP. Figure 2 displays the results.

First, we analyze the responses of the financial depth indicators, both financial institutions and financial markets. The financial depth indicators are private credit, pension fund, mutual fund, and insurance. Meanwhile, the financial depth variables are the stock market, stocks traded, government bond market, corporate bond market, and non-financial bond market. Based on Figure 2, not all financial sectors expand after an economic expansion. Among those indicators, private credit and the stock market expand instantaneously after an economic expansion,[3] while insurance and non-financial corporate bonds scale up after delays. The responses of the other indicators are zero with a high probability or even negative. In short, from the financial depth aspects, only the development of the banking sector, stock market, insurance, and non-financial corporate bonds accord with the prediction of the demand-following theory.

Second, we examine the responses of the financial access indicators of both financial institutions and financial markets. Financial institution access increases as the economy expands, indicated by increases in the number of deposit and credit accounts. At the same time, the number of credit accounts for small and medium enterprises

[3]These results remain intact when we replace the monthly GDP series with industrial production (see Section B of the Appendix for the robustness analysis).

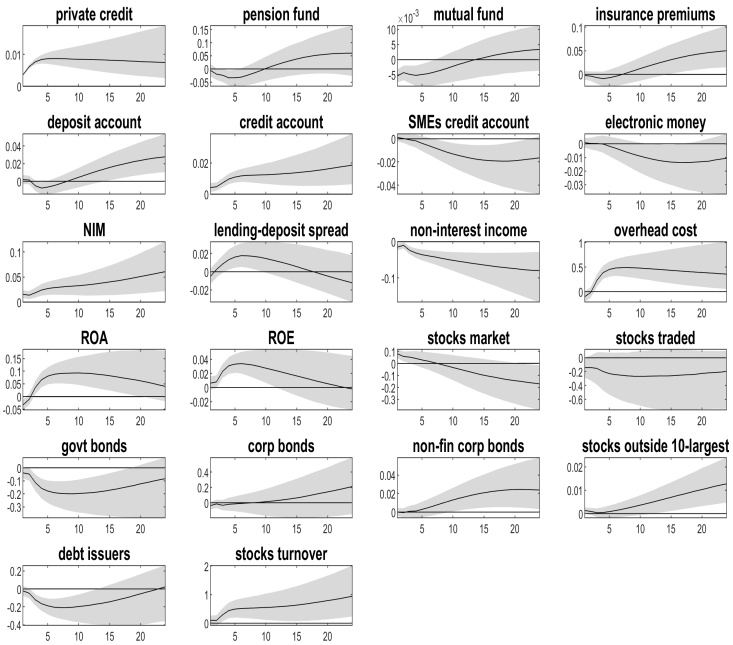


Fig. 2: Impulse responses to 1% increase in real GDP (monthly GDP ordered first – demand following theory). The shaded areas are 68% credible sets.

(SMEs) and the number of electronic money seems unaffected in the short run (see Figure 2). On the other hand, the financial market access indicators indicate different results depending on the markets. The financial access to the stock market, indicated by the market share of companies outside the 10-largest companies, improves after some delays. It suggests that small enterprises can access the stock market better as the economy expands. However, in the corporate bond market, the number of debt issuers decreases. It might suggest that funding through stock markets is preferable to funding via debt issuance.

Third, we assess the responses of the financial efficiency indicators. Figure 2 shows mixed results from the financial efficiency point of view. Decreasing non-interest income, higher return on asset (ROA) and return on equity (ROE), and increasing

stock turnover together indicate improving efficiency in the banking sector and the stock market, respectively. Nonetheless, increasing banking net interest margin (NIM), lending-deposit spread, and overhead cost signal deteriorating efficiency. On the other hand, it might also indicate that when the economy expands, banks tend to shift their primary income from non-interest to interest income. In the financial market, though limited to only the stock market, an economic expansion promotes more trading activities. More turnover volumes then encourage improving efficiency in the stock market.

4.2 Responses of the economic variables to the financial development

While the previous section inspects the predictions of the demand-following theory, this section examines the predictions of the supply-leading theory, i.e., a financial sector development should promote economic growth. In this study, we consider not only the real GDP growth as the economic indicator but also broader measures of economic activities. The impulse responses of the variables in z_{2t}^{econ} in equation (3) to a positive shock to z_{1t}^{fin} correspond to the responses of the economic activity variables to an expansion in financial sector development, indicated by a 1% increase in z_{1t}^{fin} or the first principal component of the 22 financial development indicators.[4] Figure 3 displays the results.

Based on Figure 3, the results indicate that most agree with the supply-leading theory that financial development encourages economic activities. After a 1% expansion in financial development, real GDP rises instantly by around 0.07%, while expected retail sales in the next six months and exports increase by around 0.005-0.01%. The financial sector's expansion also seems to promote more buying activities in the stock market and government bond market, indicated by rising stock prices (JCI) with some

[4] In the later section, we also assess the impact of a positive shock to alternative measures of the financial sector development on the economic activities.

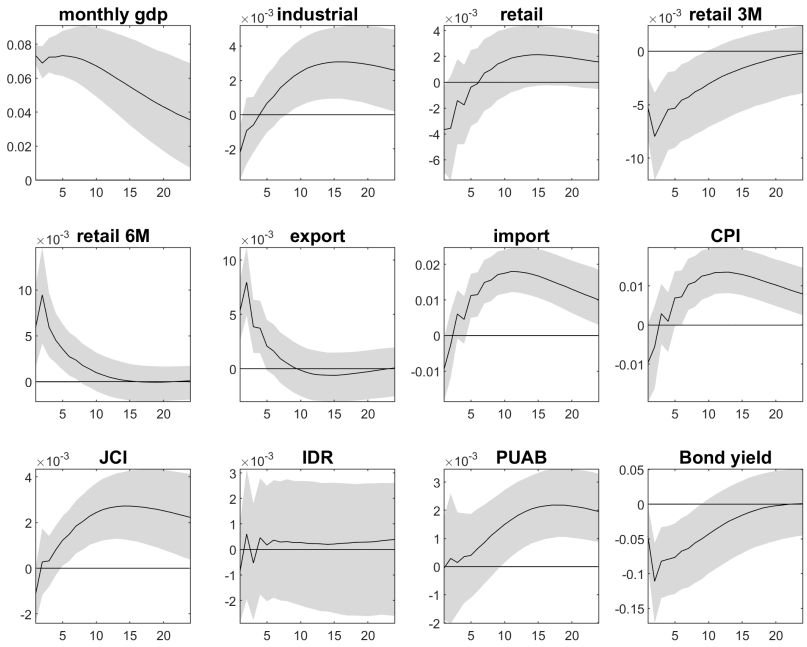


Fig. 3: Impulse responses of economic activities to 1% expansion in financial development (the financial development variable is the first principal component of 22 financial development indicators, accounted for around 51% variance, and it is ordered first – supply leading theory). The shaded areas are 68% credible sets.

delays and falling bond yield, respectively. On the other hand, exchange rates remain unaffected.

So far, we have found bi-causal relationships between the financial sector and economic development in Indonesia. The next question that one possibly asks is whether the relationship is more demand-following or supply-leading. To answer this question, we compare the magnitudes of the impulse responses, i.e., the responses of the real GDP and industrial production to a 1% increase in alternative measures of the financial sector development. We summarize the results in Table 3 and then compare them with the results from Figure 2.[5]

[5] To save space, we summarize the results in Table 3. We do not report all figures of the impulse responses, but they are available upon request.

Table 3: Comparison of responses

	1% increase in real GDP		1% increase in industrial production	
Panel A. Responses of:	On impact	After 24 months	On impact	After 24 months
Private credit	+0.004	+0.01	+0.04	0
Pension fund	0	0	0	0
Mutual fund	-0.005	0	-0.003	0
Insurance	0	+0.40	0	0
Deposit account	0	+0.30	0	0
Credit account	+0.01	+0.20	+0.004	0
SME's credit account	0	-0.02	0	0
Electronic money	0	0	0	0
NIM	+0.20	+0.60	+0.01	0
Lending-deposit spread	0	0	+0.01	0
Non-interest income	0	-0.70	0	0
Overhead cost	0	+0.35	+0.15	0
ROA	-0.03	0	+0.02	0
ROE	+0.01	0	+0.01	0
Stock market	+0.80	0	+0.40	0
Stocks traded	0	0	0	0
Govt bond	0	0	-0.05	0
Corp. bond	0	0	0	0
Non-fin corp. bond	0	+0.02	0	0
Stocks outside 10-largest	0	+0.01	0	0
Debt issuers	0	0	-0.08	0
Stocks turnover	0	+0.90	0	0
	Responses of real GDP		Responses of industrial production	
Panel B. 1% increase in:	On impact	After 24 months	On impact	After 24 months
Private credit	+0.60	0	0	0
Pension fund	+0.03	0	-0.003	+0.003
Mutual fund	+0.08	0	-0.002	0
Insurance	+0.07	0	0	0
Deposit account	+0.03	+0.01	0	+0.003
Credit account	+0.05	+0.02	0	+0.004
SME's credit account	+0.06	+0.02	0	+0.004
Electronic money	+0.07	0	-0.002	0
NIM	+0.12	0	-0.003	0
Lending-deposit spread	+0.10	0	0	0
Non-interest income	+1.50	+0.25	+0.002	+0.004
Overhead cost	+0.25	-0.05	0	+0.003
ROA	+0.15	0	0	0
ROE	+0.50	0	0	-0.003
Stock market	+1.60	0	-0.004	0
Stocks traded	+0.50	0	-0.002	0
Govt bond	+0.45	+0.20	0	0
Corp. bond	+0.04	+0.03	-0.004	0
Non-fin corp. bond	+0.04	+0.01	0	+0.002
Stocks outside 10-largest	+0.85	0	0	0
Debt issuers	+2.00	+0.40	0	0
Stocks turnover	+8.00	0	-0.003	0

Note: All responses above are median impulse responses; Zero values indicate either that the 68% credible sets include zero values or the corresponding figure is very small close to zero, suggesting zero effect; Units are in percentage.

Table 3 suggests that whether the relationship between the financial sector and economic development in Indonesia is more demand-following or supply-leading really depends on the measures used and time trajectory. First, let's look at the short-run relationships by focusing on the impact responses. When we consider the real GDP as the economic measure, the relationship is more supply-leading as the real GDP always rises on impact in response to an increase in any measure of the financial development indicators. On the contrary, when we consider industrial production as an economic measure, the relationship is more demand-following as the industrial production's responses are either zero or negative after the financial development indicators expand. Whereas the financial indicators generally respond positively to an industrial expansion on impact.

Second, let us look at the long-run relationship by inspecting the responses after 24 months. It seems that the demand-following is as strong as the supply-leading in the long run. When using the real GDP as the economic measure, only specific sectors feature the demand-following relationship stronger than the supply-leading one, i.e., the banking sector (private credit) and insurance sector. On the other hand, the bond markets, including government, corporate, and non-financial corporate bonds, signal more supply-leading relationships. When using industrial production as the economic measure, pension funds and non-financial corporate bonds characterize the supply-leading relationship.

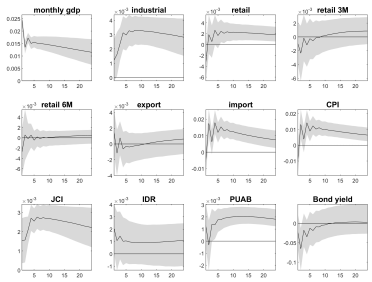
Based on the results above, we can draw some policy implications as follows: (i) An expansion in real GDP seems to have more persistent impact on the development of financial institutions such as banking and insurance sector, so their depth will eventually improve when national income improves; (ii) The supply-leading relationship is influential in the short-run, so improvement in all areas including the depth, access, and efficiency both in financial institutions and financial markets will benefit the economy, particularly the bond markets.

4.3 The role of digital banking

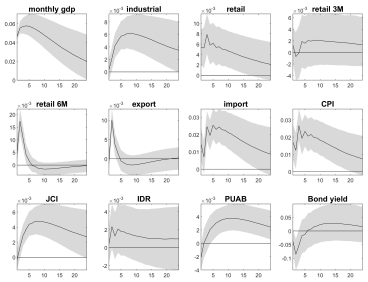
Digital financial services have improved dramatically in the last decades, so here we intend to highlight the impact of digital banking on economic activities. In our view, these digital practices affect financial access rather than the financial sector depth. Then, the next question is whether improving financial access promotes more economic activities. In our study here, we have indicators of financial institution access, i.e., the number of deposit accounts, the number of credit accounts, the number of credit accounts of the SMEs, and the number of electronic money. We also have two indicators of the financial market, i.e., the share of the stock market capitalization outside the ten largest companies in the stock market and the number of debt issuers. Increases in both indicate that the stock market and corporate bond market are easily accessible for companies so that they have access to alternative funding for their projects.

To investigate the above propositions, we re-estimate the model in equation (3) by replacing the variable in z_{1t}^{fin} with the corresponding financial access indicators one by one. We then draw the impulse responses of z_{2t}^{econ} to a positive shock to z_{1t}^{fin}. Figure 4 displays the impact of increases in financial institution access, while Figure 5 depicts the impact of increases in stock and bond market access.

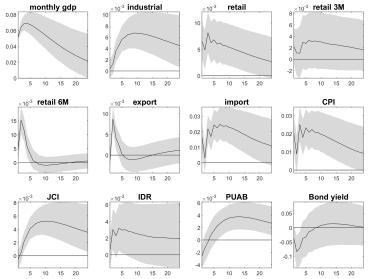
Based on Figures 4 and 5, promoting financial access induces economic activities with slightly different characteristics. Boosting access to credit seems to encourage expansions in real GDP and domestic consumption, indicated by increasing all retail sales variables. However, increasing the number of electronic money induces more consumption of imported goods than domestic consumption. Panel (d) of Figure 4 shows rising imports but lower all three retail sales variables. Finally, improving access to both stock and corporate bond markets promotes higher economic activities, including expanding real GDP, industrial production, and higher consumption (indicated by rising retail sales and imports). It also encourages higher buying activities in stock and bond markets as stock prices (JCI) rise while bond yield falls.



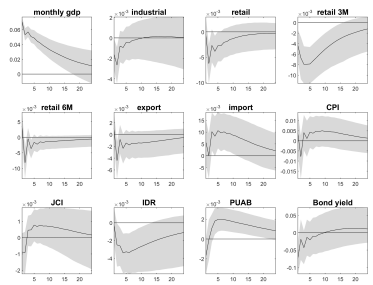
(a) Impact of 1% Δ in deposit account



(b) Impact of 1% Δ in credit account

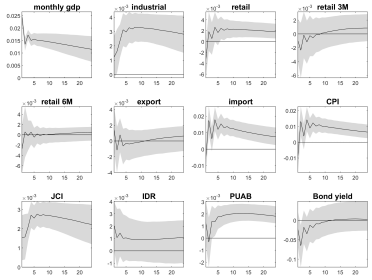


(c) Impact of 1% Δ in SME's credit account

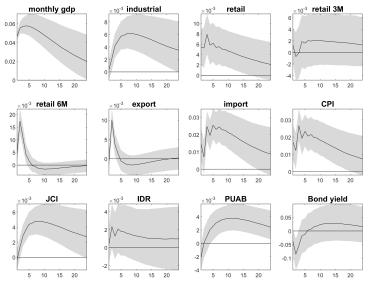


(d) Impact of 1% Δ in electronic money

Fig. 4: Impulse responses of the economic activity variables (pointwise median and 68% credible sets) to 1% increase in financial institution access indicators



(a) Impact of 1% Δ in stock market outside 10



(b) Impact of 1% Δ in debt issuers

Fig. 5: Impulse responses of the economic activity variables (pointwise median and 68% credible sets) to 1% increase in financial market access indicators

5 Conclusions

This study contributes to the literature studying the causal relationships between the financial sector and economic development in Indonesia in a data-rich environment. Not only do we use the conventional financial depth variables such as private credit and stock market capitalization, but we also incorporate the financial access and efficiency dimensions. Moreover, we distinguish between financial institutions and the financial market. We use the monthly Indonesian series of 2015M1-2023M6 (102 observations), including 22 financial development indicators and 12 economic indicators, to estimate FAVAR models.

Our results reveal bi-causal relationships between the financial sector and economic development in Indonesia. Then, whether the relationship is more demand-following or supply-leading depends on the measures used and the time trajectory. The short-run relationship is more supply-leading as the real GDP always rises on impact in response to an increase in any measure of the financial development indicators. However, when we consider industrial production as an economic measure, the relationship is more demand-following as the industrial production's responses are either zero or negative after the financial development indicators expand. Whereas the financial indicators generally respond positively to an industrial expansion on impact.

Then, our results indicate that the demand-following is as strong as the supply-leading in the long run. From our results, we draw some policy implications as follows: (i) An expansion in real GDP seems to have a more persistent impact on the development of financial institutions such as the banking and insurance sector, so their depth will eventually improve when national income improves; (ii) The supply-leading relationship is influential in the short-run, so improvement in all areas including the depth, access, and efficiency both in financial institutions and financial markets will benefit the economy, particularly the bond markets.

In this digital era, digital banking has developed tremendously, so access to financial services has never been easier than before. We also highlight the importance of this financial access development. We find that boosting access to credit encourages expansions in real GDP and domestic consumption, indicated by increasing all retail sales variables. However, increasing the number of electronic money induces more consumption of imported goods than domestic consumption. Besides, improving access to both stock and corporate bond markets promotes higher economic activities and buying activities in stock and bond markets. One aspect that this study has not covered is the financial stabilization aspect, so we leave it for further research.

Declarations

Availability of data and material:

Data are available upon request to the corresponding author.

Competing interests:

The authors declare that they have no competing interests.

Funding:

Not applicable.

Authors' contributions:

The first author contributes to the research design, coding, analysis, results interpretation, and writing. The second author contributes to the data collection, analysis, results interpretation, and writing. All authors read and approved the final manuscript.

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Appendix A Data statistics

In this section, we report some of the descriptive statistics of 22 financial development indicators and 12 economic indicators in Table A1. The financial institution depth indicators, i.e., fid1-fid4, indicate the structure of the Indonesian financial sector from the institution's point of view. The banking sector dominates the Indonesian financial sector, with the private credit to GDP ratio accounting for around 37% within the sample period (mean of fid1=37.04). Then, indicators fid2-fid4 measure the size of the pension fund, mutual fund, and insurance sectors, respectively.

In addition, we also report the correlation matrices among the indicators. Table A2 presents the correlation matrices among the financial development indicators, while Table A3 displays the corresponding figures of the economic indicators.

Table A1: Descriptive Statistics

Variables	Minimum	Maximum	Mean	Median	Std. Dev.
Financial development indicators					
fid1	33.27	38.81	37.04	37.44	1.35
fid2	1.70	2.02	1.84	1.82	0.08
fid3	2.23	3.74	3.02	3.10	0.44
fid4	1.99	3.29	2.85	2.89	0.26
fia1	6.73	7.89	7.33	7.36	0.35
fia2	5.38	6.50	5.61	5.44	0.35
fia3	4.09	5.42	4.47	4.33	0.38
fia4	5.22	8.56	6.81	6.92	1.09
fie1	4.06	5.65	4.97	4.90	0.39
fie2	6.57	9.20	7.51	7.17	0.70
fie3	32.53	52.61	43.16	43.35	5.32
fie4	9.38	12.33	10.86	10.84	0.68
fie5	1.59	3.02	2.35	2.43	0.28
fie6	7.37	16.36	11.88	12.3	2.20
fmd1	32.85	52.95	45.84	46.65	3.91
fmd2	10.8	19.68	14.67	14.05	2.38
fmd3	16.29	35.06	25.56	23.15	6.27
fmd4	0.92	1.83	1.51	1.56	0.24
fmd5	0.75	1.39	1.07	1.09	0.19
fma1	45.82	61.27	52.70	52.01	4.14
fma2	120	174	144.90	147	19.48
fme1	23.80	78.10	35.91	33.56	9.80
Economic indicators					
Monthly GDP (log)	14.58	14.94	14.77	14.79	0.09
Industrial production (log)	4.72	5.12	4.94	4.95	0.07
Retail (log)	5.15	5.45	5.32	5.33	0.07
Retail 3M (log)	4.79	5.10	4.95	4.96	0.07
Retail 6M (log)	4.79	5.13	4.97	4.99	0.07
Export (log)	9.20	10.22	9.65	9.57	0.25
Import (log)	9.01	10.02	9.56	9.56	0.21
CPI (log)	4.59	4.85	4.72	4.73	0.07
JCI (log)	8.35	8.69	8.63	8.66	0.08
IDRUSD (log)	9.46	9.70	9.55	9.56	0.05
PUAB1D	2.68	7.88	4.50	4.39	1.17
SBN1YR	5.24	8.68	6.27	6.11	0.66

Note: The variables' definition can be seen in Tables 1 and 2.

Appendix B Sensitivity analysis

Responses of the financial development variables to an industrial expansion

Here, we re-estimate the model in equation (2), replacing the real GDP series with the industrial production series. Then, compute the impulse responses of the 22 financial

Table A2: Correlation matrix of financial development variables

	fid1	fid2	fid3	fid4	fia1	fia2	fia3	fia4	fie1	fie2	fie3	fie4	fie5	fie6	fmd1	fmd2	fmd3	fmd4	fmd5	fma1	fma2	fme1
fid1	1																					
fid2	0.26	1																				
fid3	0.20	0.54	1																			
fid4	0.10	0.54	0.87	1																		
fia1	-0.65	-0.03	0.44	0.54	1																	
fia2	-0.86	-0.29	-0.08	0.03	0.77	1																
fia3	-0.82	-0.23	0.05	0.14	0.81	0.99	1															
fia4	-0.58	-0.04	0.44	0.56	0.98	0.73	0.78	1														
fie1	0.30	-0.01	-0.41	-0.48	-0.71	-0.46	-0.48	-0.79	1													
fie2	0.17	0.00	-0.69	-0.69	-0.80	-0.36	-0.44	-0.84	0.77	1												
fie3	-0.58	0.09	0.31	0.44	0.87	0.65	0.69	0.88	-0.63	-0.69	1											
fie4	0.49	0.38	-0.12	-0.12	-0.55	-0.67	-0.66	-0.52	0.45	0.38	-0.15	1										
fie5	-0.18	-0.62	-0.38	-0.54	-0.17	0.04	0.02	-0.24	0.36	0.20	-0.30	-0.14	1									
fie6	0.18	-0.66	-0.67	-0.79	-0.63	-0.25	-0.32	-0.64	0.53	0.58	-0.69	0.01	0.68	1								
fmd1	-0.40	0.11	0.08	-0.16	0.11	0.31	0.32	0.00	0.13	0.12	-0.06	-0.40	0.32	0.08	1							
fmd2	-0.66	0.14	0.26	0.30	0.71	0.75	0.76	0.69	-0.50	-0.38	0.62	-0.57	-0.19	-0.50	0.46	1						
fmd3	-0.64	0.16	0.38	0.54	0.94	0.74	0.77	0.94	-0.73	-0.69	0.90	-0.43	-0.40	-0.76	0.05	0.77	1					
fmd4	0.75	0.40	0.62	0.44	-0.33	-0.72	-0.62	-0.32	0.21	-0.12	-0.40	0.31	-0.06	-0.08	-0.11	-0.42	-0.43	1				
fmd5	-0.46	0.15	0.60	0.71	0.93	0.62	0.68	0.95	-0.77	-0.84	0.84	-0.45	-0.38	-0.76	-0.01	0.67	0.92	-0.15	1			
fma1	-0.56	0.09	0.33	0.45	0.82	0.71	0.72	0.87	-0.78	-0.63	0.82	-0.46	-0.42	-0.65	0.07	0.81	0.91	-0.46	0.84	1		
fma2	-0.59	-0.01	0.38	0.51	0.95	0.73	0.75	0.98	-0.80	-0.80	0.91	-0.46	-0.29	-0.65	-0.02	0.69	0.95	-0.40	0.92	0.90	1	
fme1	-0.08	0.46	0.34	0.40	0.33	0.22	0.25	0.36	-0.37	-0.27	0.39	-0.06	-0.52	-0.59	0.04	0.39	0.46	-0.04	0.43	0.47	0.39	1

Note: The variables' definition can be seen in Tables 1.

Table A3: Correlation matrix of economic variables

Variables	GDP	IP	Retail	Retail 3M	Retail 6M	Export	Import	CPI	JCI	IDR	PUAB	SBN
GDP	1											
IP	0.72	1										
Retail	0.50	0.61	1									
Retail 3M	0.57	0.47	0.28	1								
Retail 6M	0.63	0.39	0.25	0.65	1							
Export	0.78	0.65	0.21	0.43	0.35	1						
Import	0.73	0.77	0.34	0.45	0.33	0.91	1					
CPI	0.98	0.64	0.40	0.56	0.63	0.79	0.70	1				
JCI	0.79	0.57	0.44	0.58	0.71	0.57	0.56	0.77	1			
IDR	0.80	0.49	0.27	0.35	0.51	0.59	0.54	0.82	0.49	1		
PUAB	-0.41	-0.21	0.04	-0.43	-0.50	-0.46	-0.30	-0.45	-0.50	-0.17	1	
SBN	-0.68	-0.46	-0.28	-0.45	-0.49	-0.61	-0.52	-0.70	-0.80	-0.34	0.60	1

Note: The variables' definition can be seen in Tables 2.

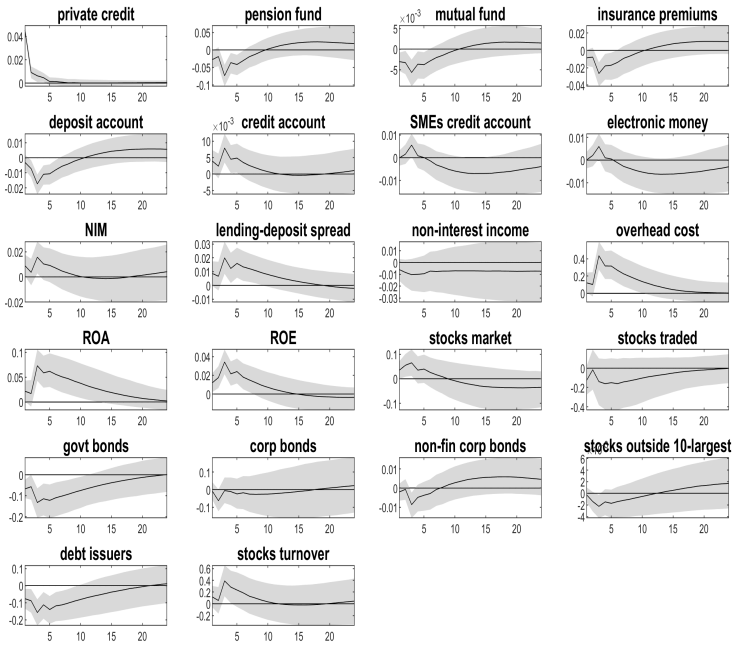

Fig. B1: Impulse responses to 1% increase in industrial production (industrial production variable ordered first – demand following theory). The shaded areas are 68% credible sets.

development variables to a positive shock to industrial production. We normalize the magnitude of the shock, corresponding to a 1% increase in industrial production.

Having compared Figures B1 with 2, the following results remain robust: (i) an economic expansion promotes more depth in the banking credit and stock market and credit access; (ii) banks tend to shift their primary income from non-interest to interest income when the economy expands; (iii) stock market's efficiency is likely to improve as the trading activities escalate.

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