Further discussion on the relationship between financial development and economic growth under the background of digital economy

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Abstract. In the past decade, the rapid development of digital economy has brought innovative development to finance. This change will not only affect the financial system, but also affect economic growth. In this context, it is of great theoretical and practical significance to re explore the relationship between financial development and economic growth. This paper first makes a theoretical discussion on the relationship between existing financial development and economic growth, then studies the deep-seated relationship between financial development and economic growth under the background of digital economy, and finally constructs an econometric model for empirical analysis by using the quarterly data of GDP, financial asset ratio m2 and total loans to total deposits of financial institutions from 2014 to 2021. The results show that under the background of digital economy, The support of digital technology improves financial efficiency, and financial development can well promote economic growth, but at the same time, disorderly financial development will also hinder economic growth; Financial development and economic growth promote each other. In this relationship, economic growth plays a leading role, that is, financial development comes from the needs of economic growth.

Keywords: Digital economy, financial development, economic growth.

1. Introduction

Over the past decade, the digital economy has experienced rapid growth, characterized by its reliance on the internet as a carrier and informatization as a defining feature, permeating all aspects of the economy through industrial digitization. Many industries have optimized their operational models and efficiency while expanding their scale under the influence of the internet. As the digital economy transforms numerous sectors in China, finance, as a crucial component of the economy, is also undergoing significant changes.

Finance should serve the real economy. With the development of the digital economy, internet and big data technologies are becoming increasingly integrated with industries, leading to new developments in the financial sector, such as internet finance. The intrinsic development of finance is not the ultimate goal; rather, financial development should enhance the welfare of every Homo sapiens, which, from a macroeconomic perspective, translates to promoting economic growth. Against the backdrop of new transformations in the financial sector, exploring the mechanisms through which finance impacts the real economy and the relationship between financial development and economic growth holds significant importance.

In recent years, China has prioritized high-quality economic development, driving supply-side reforms and transforming its economic growth model. As the primary source of investment capital, finance plays a crucial role in optimizing resource allocation and ensuring efficient capital distribution. Against the backdrop of rapid digital economy expansion and proactive financial sector reforms, discussions on financial development and economic growth hold significant implications for advancing China's high-quality economic development and advancing financial sector reforms.

2. Literature Review

Li Miaomiao and Xiao Hongjun et al. (2015) conducted a panel data analysis revealing that financial development drives economic growth [1]. Tian Jing (2017) demonstrated through provincial-level panel data that financial development is a crucial factor in economic growth, with more pronounced effects in underdeveloped regions [2]. Lu Wenxiang and Xu Jiakai et al. (2018) analyzed panel data from Chongzuo City, showing that financial development stimulates local economic growth and efficiency improvements [3]. Zhao Xue (2019) established a positive correlation between financial development and economic growth in the Yangtze River Delta region, highlighting its significant role in economic advancement [4]. Xing Qin (2022) empirically examined financial mechanisms affecting real economic growth, concluding that financial development promotes real economy development through industrial structure optimization, increased household consumption, and enhanced corporate investment [5].

Huang Zhilin and Dong Zhiyong (2013) analyzed panel data from cities in our province, concluding that the relationship between financial development and economic growth is significantly influenced by inflation. Financial development's effectiveness in promoting economic growth becomes particularly evident under low inflation conditions [6]. Zhan Peng and Li Xinrui (2020) empirically demonstrated that both the scale and efficiency of financial development tend to restrain economic growth [7]. Gao Yang and Li Yunhai (2020) found through research that excessive investment in financial markets leads to risk concentration, which in turn restricts the development of the real economy [8]. Zhang Xuefang and Dai Wei (2020) proposed that financial development exhibits a threshold effect on economic growth, with an optimal scale that, when exceeded, may limit economic expansion [9].

3. Introduction to variable and Its Modeling Design

3.1. Variable Selection

This study utilizes quarterly time series data from 2014 to 2024, incorporating currency issuance (M2), gross domestic product (GDP), stock market capitalization, bond balance, and financial institutions' RMB loan and deposit figures. While GDP is measured as a flow variable, all other indicators are stock variables.

This paper primarily utilizes three indicators: GDP, Financial Indicators Ratio (FIR), and Financial Efficiency (FE). GDP reflects economic growth, while FIR and FE measure financial development.

GDP data effectively measures the monetary value generated by economic activities over a period, serving as a flow concept that accurately reflects economic growth. This study utilizes quarterly GDP data.

The Financial Inclusion Ratio (FIR) measures the scale of financial development through the ratio of financial assets to GDP. Financial assets comprise M2 plus securities assets, which this study approximates by summing M2 with the total stock market value and bond balance at the end of the period.

FE is used to measure the development of financial development efficiency. In this paper, it is expressed as the total loan/total deposit of financial institutions dominated by banks. The higher the ratio of this index, the more capital flows into the real economy and the higher the financial development efficiency.

3.2. model specification

This study employs a Vector Autoregression (VAR) model, a multivariate framework designed for analyzing data with delayed relationships between variables. In standard VAR models, all variables are endogenous (dependent variables), while their lagged values are exogenous (independent variables). Financial development and economic growth interact through time lags,

making VAR the optimal choice for examining their relationship. For clarity, we present three model formulations in this paper.

(1) Vector representation of the VAR model.

$$X_t=B_0+B_1*X_{t-1}+B_2*X_{t-2}+\cdots\cdots+B_{t-k}*X_{t-k}+e_t$$

In the aforementioned model, all variables are represented as vectors: Xt denotes the current variable sequence, Xt-k the lagged sequence, Bt-k the parameter sequence, and et the residual sequence.

(2) The VAR(1) model employed in this study features a compact number of variables and a low-order structure, which is better understood when expressed in equation form.

$$gdp=\beta_0+\beta_1*gdp(-1)+\beta_2*fe(-1)+\beta_3*fir(-1)+e$$

$$fir=\beta_0+\beta_1*gdp(-1)+\beta_2*fe(-1)+\beta_3*fir(-1)+e$$

$$fe=\beta_0+\beta_1*gdp(-1)+\beta_2*fe(-1)+\beta_3*fir(-1)+e$$

GDP indicates economic growth, with its lagged value (-1) representing historical data. Similarly, FIR (financial development scale) and its lagged value (-1) represent historical data, while FE (financial development efficiency) and its lagged value (-1) also represent historical data. The model captures how historical information of variables influences current performance.

(3) The actual VAR (1) model with differencing applied in this study

$$dgdp=\beta_0+\beta_1*dgdp(-1)+\beta_2*dfe(-1)+\beta_3*dfir(-1)+e$$

$$dfir=\beta_0+\beta_1*dgdp(-1)+\beta_2*dfe(-1)+\beta_3*dfir(-1)+e$$

$$dfe=\beta_0+\beta_1*dgdp(-1)+\beta_2*dfe(-1)+\beta_3*dfir(-1)+e$$

The meaning of the model variables is consistent with (2). The original sequence data in this paper is not stationary, so the difference-stationary data is used for modeling.

4. Empirical analysis

4.1. Determining the optimal lag

A Vector Autoregression (VAR) model incorporates lagged variables. When constructing a specific VAR model, the optimal lag order must be determined using information criteria. A lag order of zero renders the data unsuitable for VAR modeling, while excessive lags significantly reduce the model's degrees of freedom, ultimately compromising its performance. Given the limited number of observations, this study adopts a maximum lag order of 6. Under various information criteria, the optimal lag is consistently identified as 1.

Table 1. Determination of optimal lag

Lag	LogL	LR	FPE	AIC	SC	HQ
0	144.2644	NA	3.83e-09	-10.86650	-10.72133*	-10.82469*
1	154.4440	17.22692*	3.52e-09*	-10.95723*	-10.37657	-10.79002
2	157.3463	4.241790	5.83e-09	-10.48817	-9.472019	-10.19556
3	163.2843	7.308409	8.02e-09	-10.25264	-8.800992	-9.834619
4	170.6671	7.382728	1.08e-08	-10.12824	-8.241091	-9.584807
5	173.1001	1.871534	2.45e-08	-9.623082	-7.300442	-8.954246

4.2. Give a shock to economic growth

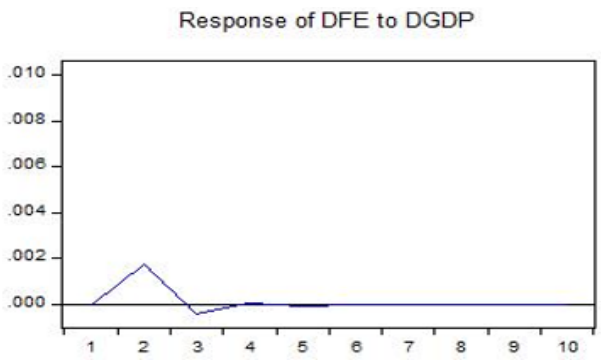

Figure 1. Financial efficiency response to GDP

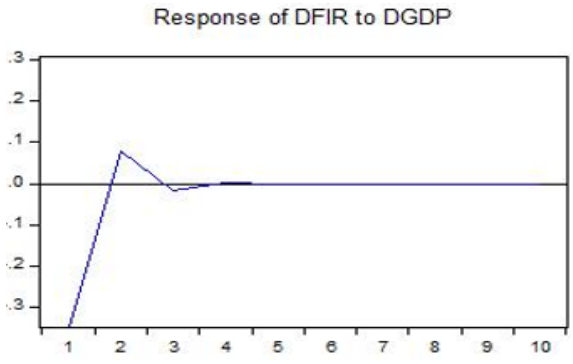

Figure 2. Financial-related rate response to GDP

When GDP is subjected to a shock, financial development efficiency (FE) generally shows a positive response. After the first period, the response increases linearly, reaching its peak in the second period, then gradually declines. By the fourth period, FE shows minimal responsiveness to GDP. From the perspective of response transmission, GDP exerts influence on financial development efficiency. When GDP improves, the economy tends to flourish, leading to increased investment demand. Financial institutions extend more loans to enterprises, thereby enhancing financial development efficiency. This effect is short-term, peaking in the next two quarters, with medium-to-long-term impacts gradually diminishing.

The response of Financial Development Index (FIR) to GDP initially shows a negative correlation, but the intensity of this response gradually increases, peaking in the second phase. After the third phase, the impact becomes negligible as GDP's influence diminishes. In terms of transmission mechanisms, both FIR and financial development efficiency exhibit similar patterns: they produce immediate effects that fade over medium to long-term periods. The initial negative response primarily stems from the short-term inverse relationship between FIR and GDP. From an economic perspective, rising GDP signals improved economic conditions, increased investment demand, and reduced deposits from enterprises and households flowing into the real economy (leading to a decrease in M2). This short-term contraction of financial development scale may occur, but as economic growth progresses, the income generated from investments will be converted into deposits due to subsequent economic uncertainties, thereby expanding M2 and ultimately increasing the scale of financial development.

4.3. Give a shock to financial development

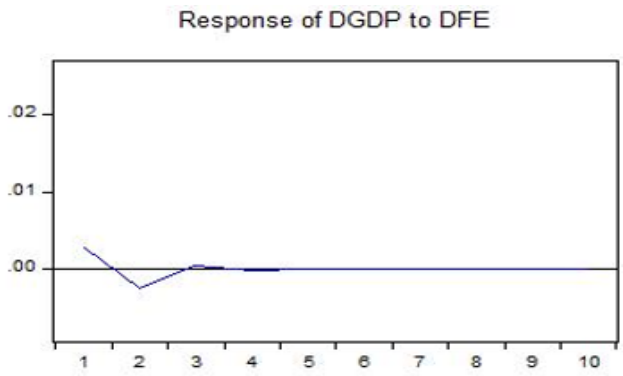

Figure 2. The GDP's reaction to financial efficiency

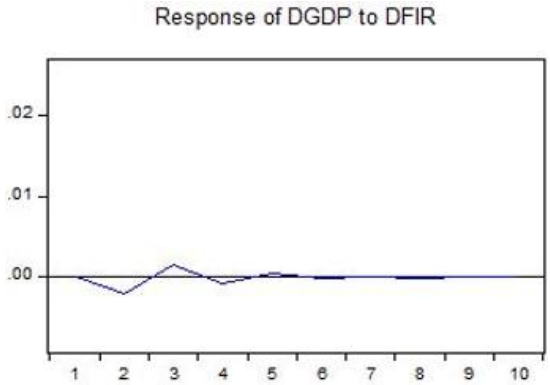

Figure 3. The GDP's reaction to financial correlation

The GDP's response to Financial Indicators Ratio (FIR) exhibits a complex trajectory: it shows negative correlation in the first quarter, peaks at negative levels in the second quarter, reaches maximum positive response in the third quarter, and gradually diminishes after the fifth quarter. As FIR is calculated as the ratio of financial assets to GDP, its negative correlation with GDP explains

why GDP's short-term response to FIR remains negative when financial assets remain stable. Over the long term, the growth of FIR reflects capital market prosperity and increased savings, which ultimately contributes positively to GDP expansion.

As shown in the figure, a shock to financial inclusion (FE) triggers a positive response in economic growth (GDP) during the first period, followed by a gradual negative response thereafter. The response converges to zero after three periods. From the perspective of transmission path, the improvement in financial development efficiency has a positive effect on economic growth in the first period, but this efficiency does not last long.

5. Summary

In the context of digital economy, the support of digital technology improves financial efficiency, and financial development promotes economic growth. However, disordered financial development will hinder economic growth. But in general and reality, financial development promotes economic growth.

Financial development and economic growth reinforce each other, with economic growth taking the lead in this relationship, meaning that financial development originates from the needs of economic growth. China's GDP grew rapidly from 2014 to 2024, and the expansion of investors' investment demands and enterprises' financing needs objectively required the development of finance.

Therefore, we maintain that financial development should be anchored to economic growth. We must prevent uncontrolled expansion of financial sectors that operate in isolation from the real economy, where excessive capital circulates without productive use. The rapid growth of credit and rising leverage ratios in financial institutions do not necessarily boost economic growth—they may instead amplify financial risks. The subprime mortgage crisis exemplifies this: the real estate boom fueled by low interest rates created unrealistic loan demand, while financial institutions continuously issued housing loans far exceeding economic capacity, inflating the property bubble. Governments should strengthen oversight of unregulated financial expansion, stabilize leverage ratios, and encourage financial innovations that align with current economic growth needs.

In addition, in the context of the vigorous development of digital economy, finance can make use of digital technology to carry out financial innovation, develop inclusive finance, tap the potential of rural finance, and promote the development of consumer finance and stimulate domestic demand with the help of Internet platform economy.

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