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Study on the Relationship Between Regional Financial Efficiency and Economic Growth in China*

Haizhi Zhang
Hubei University of Education
Wuhan, China

Xia Wang
Hubei Business College
Wuhan, China

***Abstract*—Based on the panel data of 31 provinces in China from 2003 to 2015, this paper uses VAR model and PVAR model to contrastive analysis of the relationship between regional financial scale, financial efficiency and economic growth in China, and compares the differences between the impact of regional financial development on economic growth in eastern, central and western regions. The results show that the improvement of financial efficiency can promote economic growth both from the national and the regional perspective, but the effects are different. On the other hand, economic growth is also a major contributor to the expansion of regional finance scale and the improvement of financial efficiency.**

Keywords—regional financial scale; financial efficiency; economic growth; PVAR

I. INTRODUCTION

Financial development is one of the core contents of economic development, as well as an important driving force for economic growth. Many scholars have studied the relationship between the two factors from both theoretical and empirical aspects, which shows that financial development has a great effect on economic growth. As China's investment in finance increases, the level of regional financial development gradually changes from the extreme imbalance in the past to the relative balance currently. The standard of financial level has also been shifted from the pursuit of scale effect in the past to the structural optimization and the improvement of financial efficiency. In recent years, China has begun to pay attention to the improvement of financial efficiency, and stressed that it should speed up the reform of the financial system, enhance the efficiency of the financial industry and play the financial industry's role in the real economy.

Many scholars have done a lot of researches on the relationship between financial scale, financial efficiency and economic growth. First, from the national perspective to study the relationship between financial efficiency and economic growth. Second, from the inter-regional perspective to study the relationship between financial efficiency and economic growth in the region. The research methods mainly include co-integration test based on time series, causality test and VAR model, as well as static panel analysis based on panel data and dynamic analysis. From the regional perspective, there are relatively less researches on the relationship between regional financial scale, financial efficiency and economic growth of provincial panel data.

This paper will compare the dynamic relationship between financial scale, financial efficiency and economic growth considering and regardless of regional differences, and compare the differences in eastern, central and western regions to establish VAR model and PVAR model respectively, so there is a difference between variable data. VAR model variable data is the time series data of financial scale, financial efficiency and economic growth in China from 2003 to 2015. PVAR model variables are panel data of financial scale, financial efficiency and economic growth for the 31 provinces and municipalities in China and the eastern, central and western provinces and cities in the 2003-2015.

II. VAR MODEL, PVAR MODEL AND VARIABLE DESCRIPTION

The Vector Autoregressive Model (VAR) was proposed and applied to the field of economics by the Nobel Prize winner SIMS (1980). The model does not depend on economic theory, instead, it constructs the autoregressive model regarding lag phase as independent variable to study the dynamic relation between the variables. Therefore, if the variables are not discriminated by the intrinsic and exogenous properties, they are all treated as endogenous variables. The panel vector autoregressive model (PVAR) is an extension of the vector autoregressive model (VAR). The VAR model can only be used to estimate the time series of variables, rather than estimating the panel data variables. Later, Holtz-Eakin, Newey and Rosen (1988) combined the VAR model with the panel data to form the Panel VAR model. Unlike the VAR model, the PVAR model introduces individual effects to reflect the individual differences in the variables. In addition, the PVAR model does not require longer spans like the VAR model, and it can be used for analysis of wide panel data with shorter pans. The PVAR model has been widely used after the improvement and perfection by Pesaran and Smith (1995), Binder and Hsiao (2010), Love and Zicchino (2006, 2015) and other scholars.

The basic form of the PVAR model is as follows:

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$$Y_{i,t} = \alpha_0 + \beta_i + \gamma_t + \Phi_1 Y_{i,t-1} + \Phi_2 Y_{i,t-2} + \cdots \Phi_p Y_{i,t-p} + BX_{it} + \varepsilon_{i,t}$$
$$\forall \mathrm{i}=1, 2, \cdots, \mathrm{n} \quad \forall t=1, 2, \cdots, \mathrm{T}$$
$$\varepsilon_{i,t} \sim i.i.d(0, \Omega)$$
$$E[\mathrm{Y}_{i,t}\varepsilon_{i,t}] = E[\mathrm{X}_{i,t}\varepsilon_{i,t}] = E[\beta_i\varepsilon_{i,t}] = 0$$

Y_{it} represents endogenous variable vector, X_{it} represents exogenous variable vector, α_0 represents intercept term vector, p represents lag order, γ_t represents time effect, β_i represents the individual effect of the variable, $\Phi_1, \Phi_2 \cdots, \Phi_p$ and B are vectors to be estimated, and ε_{it} represents random error term.

This paper mainly studies the relationship between regional financial efficiency and economic growth. In order to reflect the influence of financial development, the financial scale index is also introduced into the model as an endogenous variable. It studies the impact and the dynamic relationship of financial development on economic growth from the aspects of quality and quantity. Research objects are regional financial scale, financial efficiency and economic growth, which are selected as follows:

- Regional Economic Growth Indicators (GDP). As the dependent variable, economic growth indicators represent the average level of China's regional economic growth. Due to the uneven regional development, we will exclude the impact of population factors in order to reflect the real economic growth in each region. This paper uses the per capita GDP of provinces to measure economic growth, and carries out price deflator for GDP via 2000 constant price.
- Regional Financial Development Scale Indicator (FIR). The normal indicator to measure regional financial development is financial interrelations ratio (FIR), which is defined as the ratio of the value of all financial assets and economic aggregate (GDP). In view of the availability and applicability of the data, this paper uses the balance of local and foreign currency deposits and loans of local financial institutions to replace the value of all financial assets.
- Regional Financial Efficiency Indicators (FE). This paper takes China's regional financial input-output efficiency, which is measured through the stochastic nonparametric envelope method, as an independent variable to reflect the regional financial efficiency.

III. MODEL DESIGN

To establish VAR model based on the time series data of China's overall financial scale, financial efficiency and economic growth and establish PVAR model based on the panel data of regional financial scale, financial efficiency and economic growth considering regional differences, so as to compare the connection and differences of the dynamic relationship between the two variables in two cases. At the same time, to establish PVAR model in the eastern, central and western regions of China, and compare the effect of regional differences on this dynamic relationship. The model is as follows:

A. *VAR Model Regardless of Regional Differences*

$$Y_t = A + \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2} + \cdots \Phi_p Y_{t-p} + E_t$$
$$\forall t=1,2,\cdots,\mathrm{T}$$
$$E_t \sim i.i.d(0,\Omega)$$

In the model, Y_t represents endogenous variable vector $(\ln GDP_t, \ln FIR_t, \ln FE_t)$, A represents intercept term vector, p represents lag order, $\Phi_1, \Phi_2 \ldots, \Phi_p$ and B represent coefficient vectors to be estimated, and E_t represents random error term.

B. *PVAR Model Considering Regional Differences*

$$Y_{i,t} = \alpha_0 + \beta_i + \gamma_t + \Phi_1 Y_{i,t-1} + \Phi_2 Y_{i,t-2} + \cdots \Phi_p Y_{i,t-p} + \varepsilon_{i,t}$$
$$\forall \mathrm{i}=1, 2, \cdots, \mathrm{n} \quad \forall t=1, 2, \cdots, \mathrm{T}$$
$$\varepsilon_{i,t} \sim i.i.d(0, \Omega)$$
$$E[y_{i,t}\varepsilon_{i,t}] = E[x_{i,t}\varepsilon_{i,t}] = E[\beta_i\varepsilon_{i,t}] = 0$$

In the model, $Y_{i,t}$ represents endogenous variable vector $(\ln GDP_{it}, \ln FIR_{it}, \ln FE_{it})$, α_0 represents intercept term vector, p represents lag order, γ_t represents time effect, β_i represents individual effect of variables, $\Phi_1, \Phi_2 \ldots, \Phi_p$ represents coefficient vectors to be estimated, and ε_{it} represents random error term.

IV. EMPIRICAL ANALYSIS

A. *Variable Test of Models*

1) The stability test of variables: The unit root test of variable data is the first step in estimating VAR model and PVAR model. The test is carried out on time series data and panel data. The results show that the variables LnGDP, LnFIR and LnFE are stationary that can be used to construct the vector autoregressive model.

2) Covariance test of variables: All variables are stationary variables integrated of order one. In order to understand the long-term relationship between variables, we use the Johansen covariance test for the variables LnGDP, LnFIR and LnFE in this paper. Co-integration test results show that there are at least two co-integration relationships between three endogenous variables, indicating a long-term equilibrium relationship between LnGDP, LnFIR and LnFE.

B. Construction and Estimation of Models

For the establishment of VAR model and PVAR model, first, we should determine the lag order of endogenous variables, and then regard the lag value of endogenous variables as tool variables to estimate.

1) Establishment and estimation of VAR model regardless of regional differences: First, to determine the optimal lag order of VAR model. According to AIC criteria, SC criteria and HQ criteria, the order that makes the minimum value of each criterion is the optimal lag order. It has been calculated that the minimum value of each criterion is the second order value. Therefore, the second order is chosen as the optimal lag order to construct the VAR model. Regardless of regional differences, VAR model of China's financial scale, efficiency and economic growth is as follows:

$$Y_t = A + \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2} + E_t$$
$$\forall t = 1,2,\cdots,T$$
$$E_t \sim i.i.d(0,\Omega) \quad (1)$$

In the model, Y_t represents endogenous variable vector $(\ln GDP_t, \ln FIR_t, \ln FE_t)$, A represents intercept term vector, p represents lag order, Φ_1, Φ_2 and B represents coefficient vectors to be estimated, and E_t represents random error term.

VAR estimation is carried out on Model 1 and the results are shown in "Table I".

TABLE I. VAR MODEL ESTIMATION RESULTS

Dependent variable / independent variable	LnGDP	LnFIR	LnFE
	Coef. (Std.E) [t-stat]	Coef. (Std.E) [t-stat]	Coef. (Std.E) [t-stat]
L1.LnGDP	0.975616	-3.003414	1.332935
	(0.22886)	(0.51579)	(0.55007)
	[4.26296]***	[-5.82297]***	[2.42320]**
L1.LnFIR	0.156794	-0.044446	-0.003920
	(0.05110)	(0.11517)	(0.12282)
	[3.06831]**	[-0.38592]	[-0.03192]
L1.LnFE	-0.245015	0.411857	-0.007405
	(0.07877)	(0.17753)	(0.18933)
	[-3.11048]**	[2.31995]**	[-0.03911]
L2.LnGDP	0.019297	2.997654	-1.008819
	(0.23484)	(0.52926)	(0.56444)
	[0.08217]	[5.66389]***	[-1.78730]*
L2.LnFIR	-0.059508	-0.141013	-0.262498
	(0.04256)	(0.09592)	(0.10229)
	[-1.39823]*	[-1.47013]*	[-2.56610]**
L2.LnFE	-0.109689	0.242767	0.034939
	(0.04508)	(0.10160)	(0.10836)
	[-2.43307]**	[2.38935]**	[0.32244]

[a.] Note: *, **, *** represent significant statistics at the level of 10%, 5% and 1% respectively.

2) Establishment and estimation of PVAR model considering regional differences: The establishment and estimation of PVAR model in this paper is completed in the STATA21.0 software, which use programs written by Michael R.M. Abrigo and Inessa Love (2015) for reference.

First, determine the optimal lag order of PVAR model. In Love's STATA program, it uses the MMSC criteria proposed by Andrews and Lu (2001) based on Hansen's J test (1982), which is similar to AIC, BIC, and HQIC. The order that minimizes the above criteria is recognized as the optimal lag order. The results show that first-order values are the smallest among all the statistical values of the criteria. Therefore, the first-order value is chosen as the optimal lag order to construct the PVAR model. PVAR model of China's regional economic growth, financial scale and financial efficiency is as follows:

$$y_{i,t} = \alpha_0 + \beta_i + \gamma_t + \varphi_i y_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

$y_{i,t}$ represents column vectors composed of LnGDP, LnFIR and LnFE, while $y_{i,t-1}$ represents column vectors composed of the lagging period of LnGDP, LnFIR and LnFE.

Before estimating, the time effect γ_t is removed by using the sectional mean method, and the individual effect β_i is removed by using Helmert transformation. At the same time, in order to eliminate the endogeneity of variables, the lag phase of endogenous variables is chosen as a tool variable. In order to ensure that the number of tool variables is appropriate, Hansen's J test is used to estimate whether the model is over-identified to ensure the validity of estimation results.

GMM estimation is carried out for Model 2 and the estimation results are shown in "Table II".

TABLE II. GMM ESTIMATION RESULTS FOR PVAR MODEL

dependent variable / independent variable	LnGDP		LnFIR		LnFE	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
L1.LnGDP	0.62167	0.02825***	0.30832	0.03952***	0.00193	0.00615
L1.LnFIR	-0.11698	0.04387***	0.15890	0.06928**	-0.04993	0.00855***
L1.LnFE	0.25261	0.12073**	0.38925	0.10009***	0.72065	0.02941***
Hansen's J chi2=23.99151 (p = 0.1551)						

[a.] Note: *, **, *** represent significant statistics at the level of 10%, 5% and 1% respectively.

3) Establishment and estimation of sub-regional PVAR model: Before modeling, to select the order that minimizes the MMSC criterion value as the optimal lag order as in the previous case. The results show that first order is the optimal lag order among the three regions, so the Panel Vector Autoregression of lagging first order is established. After time effect and individual effect of panel data were removed, the lagged value of endogenous variables is chosen as the tool variable for GMM estimation. At the same time, Hansen's J test is carried out on the endogeneity of tool variables. The estimation results are shown in "Table III".

TABLE III. GMM ESTIMATION RESULTS FOR REGIONAL PVAR MODELS

Region	Dependent variable / Independent variable	LnGDP		LnFIR		LnFE	
		Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Eastern	L1.LnGDP	0.50604	0.02875***	0.82152	0.08414***	0.00637	0.00315**
	L1.LnFIR	0.01611	0.04458	**0.05531**	0.11933	-0.01817	0.00661***
	L1.LnFE	1.11225	0.07434***	-3.01060	0.20356***	0.61225	0.01279***
	Hansen's J chi2=34.46533 (p = 0.153)						
Central	L1.LnGDP	0.39219	0.03129***	0.30056	0.04476***	0.02849	0.00343***
	L1.LnFIR	-0.13859	0.05478***	0.62932	0.08164***	-0.07437	0.01075***
	L1.LnFE	1.02045	0.04214***	-0.63690	0.05429***	0.79146	0.00559***
	Hansen's J chi2=33.941024 (p = 0.168)						
Western	L1.LnGDP	0.87097	0.02124***	0.08698	0.02551***	0.0042	0.01240
	L1.LnFIR	-0.32980	0.06841***	0.62252	0.07217***	-0.06216	0.04100*
	L1.LnFE	0.17936	0.06102***	-0.04476	0.07256	0.77428	0.03233***
	Hansen's J chi2 = 33.580299 (p = 0.179)						

[a.] Note: *, **, *** represent significant statistics at the level of 10%, 5% and 1% respectively.

4) Comparative analysis of model estimation results: First, from the estimation results of model 1 and model 2, the statistical results are basically significant. P value of Hansen's J test is 0.1551, indicating that the selected tool variable is reasonable. As the lag orders of the two models are different, this paper only carries out comparative analysis on first-order lag variables. Regardless of regional differences or not, there is a positive correlation between the economic growth of lagging period and its current value in the estimation results of VAR model PVAR model. Compared with other factors, the larger the coefficient is, the greater the impact is, which illustrates the inertia of economic growth. And the relationship between financial scale, financial efficiency and economic growth in the lagging period present opposite results in the two models. In the results of VAR model that does not consider regional differences, the coefficient of the financial scale of the lagging period for the current GDP is 0.156794, while the coefficient of the financial efficiency of the lagging period for the current GDP is -0.245015, which indicates that China's financial scale growth has a positive effect on GDP regardless of regional differences, but the effect of financial efficiency is the opposite. After considering regional differences, the financial scale of the lagging period is negatively related to the current GDP, with a coefficient of -0.11698, which indicates that the growth of regional financial scale in China not only fails to promote the growth of regional economy, but also has a certain resistance. And the financial efficiency of the lagging period is positively related to the current GDP, with a coefficient of 0.25261, which indicates that the improvement of regional financial efficiency is more conducive to the promotion of regional economic growth. The above analysis shows that regional differences have a significant impact on the relationship between financial efficiency and economic growth in China.

Secondly, from the estimation results of the sub-regional PVAR model, most of the statistical results are significant, and all the P values of Hansen's J are greater than 0.1, but less than 0.25. The selected tool variables of GMM estimation are exogenous and reasonable. There are significant differences in the relationship between financial scale, efficiency and economic growth of eastern, central and western regions. The coefficient of GDP of the lagging period is positive to the current GDP in the eastern, central and western regions. From the coefficient point of view, the

contribution rate of the western region is the largest one, which is 0.87097, followed by the eastern region, 0.50604, and the central region, 0.39219. In the previous conclusion, the coefficient of the financial scale of the lagging period is positive for the current GDP and the coefficient of the financial efficiency is negative for the current GDP regardless of regional differences. However, after considering regional differences, the results are absolutely different. It can be explained from the estimation results of each region. The financial scale and efficiency of the lagging period in the eastern region are both positive for the current GDP, while the financial scale in the central and western regions is negatively related to GDP. The financial efficiency in the lagging period is positive for GDP, which is consistent with the results of the national panel data. In terms of coefficient, for the contribution rate of LnFE to LnGDP of the lagging period, the eastern region has the largest rate of 1.11225, followed by the central, 1.02045, and the western is only 0.17936. From the above analysis we can see that the contribution differences of financial scale and financial efficiency to economic growth are mainly due to the out-dated financial development in the central and western regions. The financial scale and financial efficiency of the eastern region have a significant effect on the regional economic growth. The financial efficiency of the central region has promoted the regional economic growth effectively. And the western region has no significant effect on the economic growth, whether it is financial scale or financial efficiency. This result is consistent with the actual economic development of China's regions. The financial scales in the central and western regions are significantly lower than that in the eastern region, and the growth rate of financial scale in the regions is much lower than the rate of economic growth. Therefore, the expansion of the financial scale in the central and western regions has little effect on the promotion of economic growth. But the financial efficiency is significant positive for regional economic growth. Therefore, in order to better serve economic growth, China's financial development should pay attention to improve the level of financial efficiency while increasing the quantity.

C. Model Inspection and Reconstruction

1) Granger test: According to the analysis of VAR model and PVAR model, the overall or regional early economic growth, financial scale and financial efficiency can explain some of the current economic growth, financial scale and financial efficiency, assuming that all three variables are endogenous variables. But are the three variables all endogenous variables, whether there is a causal relationship between the three variables? In this paper, Wald-granger Test Method is used to test the causal relationship between the three variables to determine the endogeneity of the variables.

The results of the Granger Test were statistically significant regardless of regional differences. The three variables were causally related to each other, and the variables were non-exogenous variables; considering regional differences, there is a causal relationship between financial size, financial efficiency and economic growth, but there is only one-way causal relationship between financial efficiency and economic growth, namely, financial efficiency leads to economic growth.

From the sub-regional perspective, there are causal relationship between financial scale, efficiency and economic growth in the eastern and central regions. The three variables are all endogenous variables, but there is no causal relationship between the financial efficiency, financial scale and economic growth in the western region, whose financial efficiency should be exogenous variables. Therefore, we should reconstruct PVAR model for the western region. To take the financial scale and economic growth as the endogenous variables, and the financial efficiency as the exogenous variable, the reconstructed PVAR model is as follows:

$$y_{i,t} = \alpha_0 + \beta_i + \gamma_t + \varphi_i y_{i,t-1} + Bx_{i,t} + \varepsilon_{i,t} \quad (3)$$

$y_{i,t}$ represents column vector composed of LnGDP and LnFIR, $x_{i,t}$ represents exogenous variable LnFE, $y_{i,t-1}$ represents column vector composed of LnGDP and LnFIR of the lagging period.

GMM Estimation is carried out for the reconstituted PVAR model 3 in the western region, and the results are shown in "Table IV".

TABLE IV. GMM ESTIMATION RESULTS FOR RECONSTRUCTING PVAR MODEL IN WESTERN CHINA

	LnGDP		**LnFIR**	
	Coef.	Std. Err.	Coef.	Std. Err.
L1.LnGDP	0.84815	0.02464***	0.03363	0.18221*
L1.LnFIR	-0.43453	0.12814***	0.76522	0.07665**
LnFE	0.39988	0.1341***	0.07347	0.08947
Hansen's J chi2 =11.634557 (p = 0.168)				

From the estimation results of the readjusted PVAR model in the western region, the coefficients between the variables are not changed greatly. After the financial efficiency changes from the endogenous variable to the exogenous variable, its contribution to the economic growth is still positive while the coefficient becomes larger, and the coefficient to financial scale is negative. It shows that the current financial efficiency contributes to the growth of financial scale in the western region, which is different from the negative effect of the lagging period.

2) Model stability test: Stability test is carried out on the VAR model and the PVAR model. All the characteristic roots of the two models fall within the unit circle, and the models are stable.

D. Impulse Response and Variance Decomposition

On the basis of the existence of Granger causality and the stability of the model, the impulse response and variance decomposition analysis of the impact of financial scale and financial efficiency on economic growth are carried out regardless of regional differences or not. The standard

deviation and confidence interval of the confidence interval and the variance decomposition of the prediction error of the impulse response equation are simulated by 500 Monte Carlo simulations to obtain the results of the variance analysis and the impulse response function diagram, as shown in "Table V", "Table VI" and "Table VII", as well as "Fig. 1", "Fig. 2" and "Fig. 3". Since this paper mainly analyzes the effect of financial scale and financial efficiency on economic growth, the variance decomposition and impulse response function have intercepted the corresponding parts.

TABLE V. VARIANCE DECOMPOSITION RESULTS REGARDLESS OF REGIONAL DIFFERENCES

		LnGDP			**LnFIR**			**LnFE**	
	LnGDP	LnFIR	LnFE	LnGDP	LnFIR	LnFE	LnGDP	LnFIR	LnFE
1	1	0	0	0.34192	0.65808	0	0.99370	0.00011	0.00620
2	0.93908	0.05943	0.00149	0.64287	0.35648	0.00065	0.99513	0.00009	0.00478
3	0.92695	0.06997	0.00308	0.70187	0.29567	0.00246	0.99384	0.00114	0.00503
4	0.92693	0.06985	0.00322	0.81711	0.18141	0.00148	0.99356	0.00134	0.00510
5	0.92776	0.06961	0.00263	0.83652	0.16132	0.00215	0.99074	0.00415	0.00511
6	0.91114	0.08591	0.00295	0.85241	0.14573	0.00186	0.98949	0.00541	0.00510
7	0.91008	0.08868	0.00314	0.86341	0.13474	0.00185	0.98922	0.00566	0.00512
8	0.91368	0.08330	0.00302	0.85934	0.13883	0.00182	0.98942	0.00556	0.00503
9	0.90600	0.09087	0.00313	0.86400	0.13423	0.00177	0.98900	0.00595	0.00505
10	0.90212	0.09454	0.00334	0.86222	0.13599	0.00179	0.98903	0.00592	0.00505

TABLE VI. VARIANCE DECOMPOSITION RESULTS CONSIDERING REGIONAL DIFFERENCES

		LnGDP			**LnFIR**			**LnFE**	
	LnGDP	LnFIR	LnFE	LnGDP	LnFIR	LnFE	LnGDP	LnFIR	LnFE
1	1	0	0	0.21180	0.78820	0	0.11525	0.01532	0.86943
2	0.97114	0.02201	0.00685	0.22259	0.76852	0.00889	0.13978	0.04962	0.81060
3	0.95181	0.03440	0.01379	0.24719	0.73445	0.01836	0.14193	0.06434	0.79373
4	0.94102	0.04005	0.01893	0.25801	0.71739	0.02460	0.13980	0.07010	0.79010
5	0.93536	0.04245	0.02219	0.26141	0.71043	0.02816	0.13785	0.07227	0.78988
6	0.93253	0.04342	0.02405	0.26225	0.70789	0.03006	0.13671	0.07305	0.79024
7	0.93116	0.04381	0.02503	0.26238	0.70662	0.03100	0.13614	0.07333	0.79053
8	0.93052	0.04396	0.02552	0.26235	0.70619	0.03146	0.13588	0.07342	0.79070
9	0.93022	0.04402	0.02576	0.26232	0.70601	0.03167	0.13577	0.07345	0.79078
10	0.93009	0.04404	0.02587	0.26229	0.70594	0.03177	0.13573	0.07346	0.79081

TABLE VII. VARIANCE DECOMPOSITION RESULTS OF DIFFERENT REGIONS

	Eastern LnGDP			**Central LnGDP**			**Western LnGDP**		
	LnGDP	LnFIR	LnFE	LnGDP	LnFIR	LnFE	LnGDP	LnFIR	LnFE
1	1	0	0	1	0	0	1	0	0
2	0.94634	0.01295	0.04071	0.97353	0.00275	0.02372	0.93750	0.05628	0.00622
3	0.89736	0.01967	0.08297	0.93717	0.00522	0.05761	0.86147	0.12203	0.01650
4	0.86260	0.02336	0.11404	0.90625	0.00650	0.08725	0.79744	0.17470	0.02786
5	0.84229	0.02511	0.13260	0.88493	0.00695	0.10812	0.74872	0.21234	0.03894
6	0.83161	0.02587	0.14252	0.87195	0.00704	0.12101	0.71305	0.23790	0.04905
7	0.82638	0.02618	0.14744	0.86475	0.00701	0.12824	0.68746	0.25464	0.05790
8	0.82396	0.02630	0.14974	0.86107	0.00698	0.13195	0.66943	0.26522	0.06535
9	0.82290	0.02635	0.15075	0.85936	0.00695	0.13369	0.65695	0.27164	0.07141
10	0.82246	0.02636	0.15118	0.85863	0.00695	0.13442	0.64851	0.27533	0.07616

In terms of variance decomposition results, the contribution rate of economic growth, financial correlation and financial efficiency to economic growth is not very different, regardless of regional differences or not. The impact of GDP growth comes mainly from the impact of GDP itself, whose contribution rate is as high as 90% or more, while financial correlation and financial efficiency contribute relatively little to economic growth. Although this effect is increasing, the contribution rate is low. Comparatively, considering regional differences, the contribution from its own contribution is larger, the contribution from the financial correlation rate is relatively small, and the contribution from the financial efficiency is relatively large. The impact of economic growth, financial correlation and financial efficiency on financial correlation and financial efficiency has significant differences regardless of regional differences or not. Regardless of regional differences, the contribution of financial correlation and financial efficiency comes mainly from economic growth, with contribution rates of 80% and 90% respectively. After considering regional differences, the contribution of financial correlation and financial efficiency mainly comes from its contribution, with the contribution rate of more than 70%, followed by the contribution from economic growth, while the contribution rate between financial correlation and financial efficiency is relatively low.

From the results of regional variance decomposition, the impact of per capita GDP growth is mainly due to the impact of GDP itself, with the contribution of more than 90%, while the impact of financial correlation and financial efficiency is relatively small, which is gradually increasing. The

contribution rates of financial correlation and financial efficiency to GDP in the eastern, central and western regions are slightly different. The contribution rate of financial efficiency to GDP in the eastern and central regions is much greater than the contribution rate of financial correlation rate, while the contribution rate of financial correlation rate to GDP in the western region is significantly large. Regardless of its own influence, economic growth GDP has the largest contribution to financial scale and financial efficiency, with the contribution rate of 26% and 13% respectively, reflecting the fundamental function of economic growth on financial development.

From the impulse response function graph, the impact of economic growth on standard deviation innovation from its own, financial scale and financial efficiency is not stable regardless of regional differences. Considering regional differences, economic growth has a markedly positive effect on the impact of standard deviation innovation from itself, but this effect is gradually reduced and stabilized. The impact of economic growth on the standard deviation innovation from the financial efficiency is also positive, which gradually increases and then stabilizes, indicating that financial efficiency plays a certain role in promoting regional economic growth; while the impact of economic growth on standard deviation innovation from financial scale is negative, but the impact is gradually reduced and stabilized, indicating that financial growth may hamper regional economic growth.

From the sub-regional perspective, the regional economic growth has a significant positive effect on the impact of standard deviation innovation from itself, and the effect is gradually reduced and stabilized. The eastern region has the fastest decay rate, while the rates in central and western regions appear more stable; the impact of economic growth on the standard deviation innovation from financial efficiency is positive and gradually increases, but the cumulative response is not large, indicating that financial efficiency has a little positive effect on economic growth; the impact of economic growth on the standard deviation innovation from financial scale LnFIR is negative, except for the eastern region, but the impact is gradually reduced and stabilized, indicating that the growth of the financial scale in the eastern region is favorable to economic growth, while the central and western regions are the opposite.

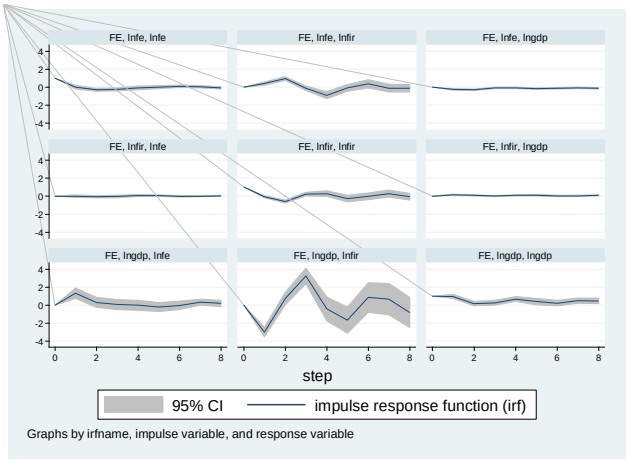

Fig. 1. Impulse response graph regardless of regional differences.

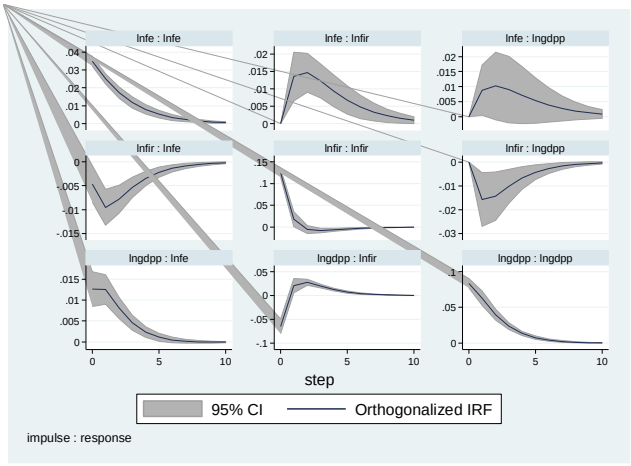

Fig. 2. Impulse response graph considering regional differences.

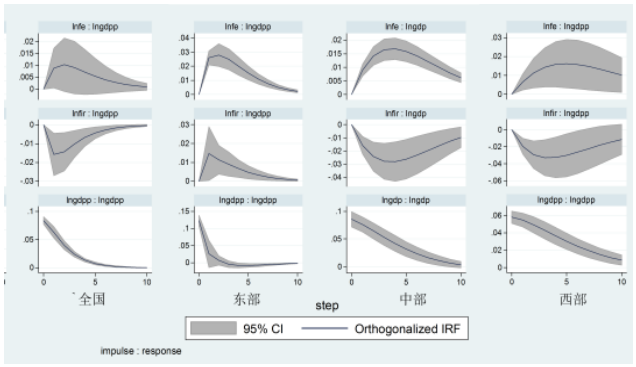

Fig. 3. Impulse response function graph.

V. CONCLUSION

This paper studies the relationship between regional financial efficiency and economic growth from a macro perspective. It carries out comparative analysis on the dynamic relationship between regional financial efficiency and economic growth considering or regardless of regional differences by using VAR and PVAR method, and finds out the reasons for the differences through regional comparison with the following conclusions: there is a significant

dynamic relationship between financial efficiency and economic growth in China, which is different in different regions. Different contributions of financial size and financial efficiency on economic growth are mainly due to the outdated financial development of the central and western regions. The financial scale and financial efficiency of the eastern region have a significant effect on regional economic growth. The financial efficiency of the central region has promoted the regional economic growth effectively. But both financial scale and financial efficiency have no significant effect on the economic growth in the western region.

In view of the above conclusions, the following recommendations are made for the promotion of regional financial scale, financial efficiency and economic growth in China:

First, the improvement of financial efficiency is based on the increase of financial scale, but the excessive expansion of financial scale will hinder the improvement of financial efficiency. According to the conclusion, the growth of China's financial scale may show an excessive trend, and the regional development is imbalanced, resulting in the overall inefficiency of financial efficiency. Therefore, we should moderately control the overall growth of China's financial scale, and control financial investment scale and coordinate financial resources allocation according to different regions.

Second, the growth of financial scale in the eastern region has played a role in promoting economic growth, while the financial development in central and western regions is still relatively backward. Therefore, the eastern region should maintain a moderate growth rate in financial resources investment, reduce repeated construction, and improve the utilization efficiency of financial resources. Unlike the eastern region, the financial development in the central and western regions is still lagging behind, so they need continuous investment in financial resources. However, we should learn from the experiences and lessons of the financial development in the eastern region and combine the regional characteristics to rationalize financial investment elements.

Third, while financial development serves the real economy, real economic growth can also promote financial development, both of which are causal. Real economic growth is the foundation of financial development. Therefore, China should focus on the development of real economy and guide the financial resources to flow to the real economy in order to effectively allocate financial resources and improve the economic efficiency of financial services entities. Specifically, the economic base of the central and western regions is relatively weak, and the quality of real economy is poor. They lack not only funds, but also financial attraction. Therefore, we must adhere to the introduction of advanced technology and industry, play a geographical advantage and vigorously develop physical industry. At the same time, the rural development in the central and western regions is more lagging behind. It will contribute to the free flow of financial resources in the central and western regions and improve the financial efficiency to accelerate the process of rural industrialization and urban-rural economic integration.

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