The Impact of Shadow Banking Scale on China's Macro Economy

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Abstract: Based on the annual data of 14 provinces in seven regions of China from 2006 to 2017, this paper constructs a panel vector autoregression (PVAR) model to analyze the dynamic relationship among China's shadow banking scale, price stability and economic development. The results show that when the size of shadow banking is under a positive impact, GDP per capita and CPI will decline. This paper explains that the expansion of shadow banking leads to excessive concentration of capital in the financial sector, which inhibits the development of the real economy. Through variance decomposition, it can be seen that, in each forecast period, the change of shadow banking scale is mainly affected by its own impact, while the change of macroeconomic variables such as per capita GDP and CPI is largely affected by shadow banking scale impact.

Key words: shadow banking; macro economy; PVAR

1.Introduction

With the rapid development of China's shadow banking, shadow banking and China's economy have become two topics of widespread concern. Moody's quarterly monitoring report on China's shadow banking (2016) shows that by the end of 2015, shadow banking assets accounted for 58% and 28% of bank loans and assets respectively. In recent years, the rise of China's shadow banking has greatly changed China's financial structure and exerted great influence on China's economic development. Kinda (2018) argues that China's shadow banking is no different from the traditional definition of shadow banking, that is, a mismatch in the term structure that avoids regulation. According to FENG L and WANG D (2011), shadow banking expands the channels for corporate financing and personal debt borrowing, so that corporate financing and residential debt demand are met and capital flow is accelerated, thus promoting GDP growth. Guofeng Sun (2019) highlighted the role of shadow banking in the transmission of China's monetary policy. According to him, shadow banking weakens the ability of monetary policy to create money and take risks, not only by accumulating systemic risks, but also by undermining China's economic development. Based on the influence of shadow banking on monetary policy transmission, shadow banking may also have an influence on price stability. However, the current research on this field is mostly based on a specific region in China and cannot fully reflect the relationship among them. In addition, this relationship is mostly dynamic and interactive rather than simple one-way and static relationship. Previous research has limitations in this field.

Based on the above problems, this paper uses the annual data of 14 provinces in seven regions of China from 2006 to 2017 to build a panel vector autoregressive (PVAR) model to study the dynamic interaction between China's shadow banking scale, price stability and economic development. The advantage of using this model is that combining the advantages of the VAR model with the panel data model no longer has the limitation that there is only one-way

influence between the assumed variables of the generic panel data model. The results show that GDP per capita and CPI fall when shadow banking is hit in a positive direction. This paper explains this result that social resources are increasingly concentrated in the financial sector as shadow banking expands. The concentration of social resources in the financial field may have two effects: one is that the expansion of shadow banking can to a certain extent broaden the financing channels of SMEs, promote the production and operation of SMEs, thus creating more wealth for the society; the other is that the expansion of shadow banking may lead to the excessive concentration of capital in the financial field, and the high profit of the financial sector inhibits the production enthusiasm of the real economic sector, thus reducing production and investing more capital in the financial field. The results show that the second effect is stronger than the first. In addition, the results of variance decomposition show that, in each forecast period, the change of shadow banking scale is mainly affected by its own impact, while the change of macroeconomic variables such as per capita GDP and CPI is largely affected by shadow banking scale impact.

2.Literature Review

China Banking Regulatory Commission (CBRC) defines shadow banking (Shadow Banking) as a credit intermediary that is free from the regulatory system and may trigger systemic risks and regulatory arbitrage. Some scholars have argued that the development of shadow banking will bring about the development of the local economy. FENGL and WANGD (2011) believe that shadow banking expands the channels for corporate financing and personal debt borrowing, so that corporate financing and residential debt demand are met and capital flow is accelerated, thus boosting GDP growth. At the same time, they believe that shadow banking overdevelopment was one of the most important causes of the financial crisis of 2008, but it is undeniable that shadow banking did promote the growth of the global economy before the crisis. Jian Chen and Xiaolong Zhang (2012) believe that shadow banking will increase money supply, thus promoting economic growth, but will not affect the consumer index (CPI).At the same time, the growth of the economy and the reduction of money supply will lead to the growth of shadow banking. Jianjun Li and Ying Xue(2014) believe that various products of shadow banking products can meet people's daily needs faster and more conveniently than other lending methods, so as to reflect the money supply and money demand more truly.The shadow banking system can improve the circulation of money and the level of market activity, so that the financial system can play a more powerful pricing function.

But most scholars believe that although the development of shadow banking will increase the level of economic activity, but there are many problems, such as regulatory difficulties, easy to trigger the financial system risk, even financial crisis. Kenc and Dibooglu (2010) believe that since shadow banking is outside the national regulatory system, the government has many difficulties in supervising shadow banking, which is prone to regulatory loopholes and systemic risks. The direct consequence of inadequate government supervision is that shadow banking is prone to business with high leverage, thus accelerating the spread of systemic risks in the financial system. As a result, the shadow banking system over-expanded and, if it collapsed, led directly to a global financial crisis. Rui Li (2015) explained this phenomenon from the perspective of demand side and supply side: from the perspective of demand side, the market interest rate is lower than the financial demand of the entity sector, so shadow banking appears as a substitute for traditional financial instruments; from the perspective of supply side, banks are monitored by the government financial system, but shadow banking can inject a large amount of capital through trust companies, so shadow banking also has a large amount of capital supply. According to Adrian and Ashcraft (2012), the "shadow banking" system consists of a network of specialized financial institutions engaged in credit, maturity and liquidity conversion, but the network does not have direct and transparent access to public liquidity and credit resources, resulting in the endogenous vulnerability of the "shadow banking" system. Some scholars argue that shadow banking, together with government debt and real estate bubbles, is considered to be the three major financial pressures affecting China's economic growth.

However, there are few theoretical models for shadow banking in academia. Gennaioli et al.(2013) established a "shadow banking" model through theoretical analysis, in which banks act as intermediaries, packaging and selling

shadow banking products to investors, and issuing bonds to finance. The finance of foreign investors in this model generates the demand for risk-free bonds, thus indirectly generating the demand for securitization. The combination of bank assets and leverage allows banks to be interconnected across markets, doubling the systemic risk in the financial system. Under the hypothesis of economic man," shadow banking "is relatively stable in the financial system, but the financial system is vulnerable to liquidity crisis when the participants in the market take risks lightly. Based on the Christiano et al.(2010) model, Verona (2011) improved a shadow banking system to help low-risk businesses broaden their access to finance. Moreira and Savov (2013) developed a shadow banking model for financial intermediation that can issue shares without resistance. Through research, the model shows that this financial intermediary can maximize liquidity in a highly leveraged way, which is now called shadow banking. When uncertainty increases and the market shakes, this financial intermediary can only deleverage, not shadow banking. Verona et al. (2013) used a DSGE model of bond financing through the "shadow banking" system to simulate the effects of expected and unexpected monetary policy. Lu Wang(2020), through the establishment of shadow banking size, economic growth, consumer price index, registered urban unemployment rate and financial institutions RMB loan balance growth rate VAR model to study the shadow banking and GDP growth rate. The research shows that, on the one hand, the increase of shadow banking scale will accelerate the growth of GDP and reduce the unemployment rate, but it will also bring about the continuous increase of prices; on the other hand, the increase of GDP will bring about the continuous development of shadow banking, but the change of unemployment rate and CPI will not affect the development of shadow banking.

Many scholars have also studied the economic effect of shadow banking. Junhui Xu (2013) thinks that the excessive expansion of shadow banking will occupy the normal financing channels of SMEs, which is not conducive to the development of SMEs. Xiang Qiu and Qianglong Zhou (2014) believed that shadow banking, on the one hand, expanded the financing channels of commercial banks, and on the other hand, blocked the transmission channels of monetary policy, monetary policy ineffective. According to Sixian Feng et al. (2014), social financing cost, monetary policy and bank stability are three indicators, and shadow banking mainly influences the financial system through influencing the indicators. Wenxia Cai (2015) believes that shadow banking weakens the role of traditional commercial banks in monetary policy and weakens the transmission of interest rates to the real economy.

Although many literatures are concerned with the relationship between shadow banking and economic development, shadow banking and inflation, there is a relationship between shadow banking, economic development and inflation. Second, most of the existing literatures use static models to analyze the relationship between the three, but the whole economic system is always in change, not out of the static state, so it is difficult to observe the change of the studied variables, and cannot describe the dynamic relationship between them. Third, the current discussion of shadow banking is largely national in nature and lacks analysis of provincial data.

In this paper, the dynamic panel model (PVAR) is used to analyze three economic variables, which are shadow banking, GDP per capita representing the level of economic development and CPI representing the degree of inflation in each province. The contributions of this paper are as follows:1. The previous research is mostly based on the time series data of a certain country or a certain province in China. Using the annual data of 14 representative provinces in China, this paper establishes the panel vector autoregression (PVAR) model, which not only studies the dynamic relationship between shadow banking scale, price stability and economic development, but also increases the reliability of the research results.2. This paper breaks through the limitation of the previous literatures, puts the three problems of shadow banking scale, price stability and economic growth into the same system, analyzes the dynamic coupling relationship between the three, and provides reference for the development of shadow banking and the formulation of financial supervision policy.

3.Model Design and Data Source

3.1 Model design

According to the existing literature, there is a long-term relationship between shadow banking scale, economic

development and monetary stability. This paper aims to study the relationship between the three. Considering that there may be endogenous and autocorrelation problems caused by lag effect, and there may be non-observation effects such as time effect and individual effect in panel data, the lag term of variables is introduced into the model to eliminate endogenous; meanwhile, time effect and individual effect are added into the model to avoid omission of important explanatory variables. Based on the above analysis, this paper uses panel vector autoregressive model (PVAR) to analyze the dynamic relationship between shadow banking scale, economic development and monetary stability. The PVAR model established in this paper is as follows:

$$Y_{i,t} = \sum_{i}^{n} \alpha_j Y_{i,t-j} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

In this model, Yi, t is a vector of order 1×3, which contains endogenous variables: size of local shadow bank (shabank), level of economic development (GDP), currency stability (CPI).μi represents individual effects that cannot be observed and can reflect regional differences, such as local policy, financial environment, etc.λt refers to the time effect that is difficult to observe, which can reflect the influence of factors that change with time, such as the improvement of technical level, the influence of economic cycle, etc., so as to eliminate the influence on the time level.are random error terms.The selected cross-section units in this paper are based on seven geographical regions (North China, Northeast China, East China, Central China, South China, Southwest China, Northwest China).The specific selection method is to select two provinces (excluding municipalities directly under the Central Government) from each region. The purpose of this selection is to make the selected provinces as representative as possible, so that they can eliminate regional differences and reflect the dynamic relationship between the overall size of shadow banking, economic development and monetary stability in China. t,j are time subscripts and lag periods respectively. Due to the availability of data related to the size of shadow banking, this paper uses the annual data of 14 provinces in China from 2006 to 2017.One of the advantages of the PVAR model over the common VAR model is that the length of the time series is reduced due to the addition of data at the individual level, which provides convenience for the study of this paper. The selection of the number of lag periods and the estimation of model coefficients by the system GMM method are based on STATA packages and procedures from Lian Yujun, Love and Abrigo (2016), respectively.

3.2 Variable Selection and Data

Since the PVAR model has taken into account the possible impacts on the individual and time levels, there is no need to introduce other control variables into the model, which are endogenous variables. The variables studied in this paper are measured as follows, and the required data are from Guotai'an database and National Bureau of Statistics.

Shadow bank size. At present, there is no index to estimate the size of shadow bank directly in China, so we can only measure it according to its concept. According to the study of Fengmin Xie et al.(2014) and the improvement of their indicators, the total investment of fixed assets in the region less the funds in the national budget, domestic loans, the scale of foreign capital utilization and the remaining funds raised by themselves have been used as indicators to measure the scale of shadow banks in the region. Because of the great difference of other funds in each region, this paper chooses its proportion in the regional GDP to measure the scale of shadow banks in each province. The specific formula is as follows. Where, fi, fb, dl, fi and fo respectively refer to the total fixed asset investment, funds in the national budget, domestic loans, total foreign capital utilization and self-raised funds.

$$shabank = \frac{fi - fb - dl - fi - fo}{GDP}$$

Inflation (CPI). This paper uses cpi to measure the change of regional price level. Based on the base period of 2005, the consumer price index (CPI) of each province in 2005 is recorded as 100, and the CPI of each province in 2006-2017 is calculated on this basis. As the data is not stable, it is subsequently subjected to logarithmic difference processing (deltacpi).

The level of economic development (PGDP).The level of economic development is inextricably related to the scale of shadow banking and inflation, so this paper introduces it into the model to observe the dynamic relationship among

the three, and at the same time, it can exclude the influence brought by the different degree of economic development between regions. This paper uses the regional GDP per capita to measure the regional economic development level, because the data is not stable, so the subsequent logarithmic difference processing.

3.3 Descriptive Statistics

The descriptive statistical results of the variables in Table 1 are as follows: there is a great difference in the development scale of shadow banking in each province in China. The largest one accounts for 17.8% of the local GDP in the in which statistics are made, and the smallest accounting for only 4.7% of the local GDP. Likewise, there is a significant disparity in the level of economic development among the provinces, with the annual per capita GDP reaching a minimum of 5.79 million yuan and a maximum of 107.15 million yuan. The increase of consumer price index over the base period indicates that the price level of each province from 2006 to 2017 is higher than that of 2005.

Table 1 Descriptive statistics of data

Statistic	Shadow banking scale shabank	Inflation CPI	Level of economic development PGDP (10,000 yuan)
Average	0.095	124.829	3.680
Standard deviation	0.033	12.197	1.964
Minimum	0.047	101.414	0.579
Max.	0.178	147.896	10.715

4.Empirical Analysis

Through the above analysis, this paper thinks that the size of shadow banking will influence the macroeconomic variables such as GDP per capita and CPI. In order to analyze the direction and degree of influence among these variables, this paper selects the annual data of 14 provinces from 2006 to 2017 for empirical analysis. Because the data used in this paper is panel data, and this paper hopes to get the response of other variables to the impact when the shadow bank size, GDP per capita and other variables are affected by the external impact, so I chose the panel VAR (PVAR) model for subsequent empirical analysis.

4.1 Unit root test (LLC)

In order to prevent the pseudo-regression phenomenon caused by the data instability from causing the untrustworthiness of the empirical analysis results, this paper first carries out the unit root test on the data stability. First of all, I use the method of LLC test to check the unit root of the horizontal value of the selected variables, and find that each sequence is large enough to have a unit root. In this paper, the logarithmic difference of each original variable is carried out, and then the stability of panel data is tested by LLC test. The final inspection results are shown in the following table.

Table 2 Unit Root Inspection

Variable	Sequence symbol	Inspection method	T-statistics	P value
Shadow banking scale	Shakank	LLC	-4.60	0***
GDP per capita	DPGDP	LLC	-9.39	0***
Consumer price index	DeltaCPI	LLC	-4.55	0***

Note:* means significant at 10% confidence;** means significant at 5% confidence;*** means significant at 1% confidence.

It can be seen from the above table that each data series after logarithmic difference is significantly stable at 1% confidence level. Therefore, the following empirical analysis is based on the differential data series.

4.2 Optimal lagging order

When the hysteresis order is too long, the number of parameters needed to be estimated will rise, which will result in the loss of more degrees of freedom, thus reducing the fitting accuracy. However, when the hysteresis order is too low, the dynamic characteristics of the model cannot be described completely. Therefore, in the process of constructing PVAR model, it is very important to select the appropriate lag order of variables to fit the model. Therefore, in order to determine the lag order in the PVAR model, this paper synthesizes AIC, BIC and HQIC criteria to select the optimal lag order in the PVAR model. See the following table for the specific results.

Table 3 Determination of lagging order

Lag	AIC	BIC	HQIC
1	-13.50*	-12.43*	-13.06*
2	-13.78	-12.43	-13.23
3	-13.98	-12.30	-13.30
4	-15.54	-13.48	-14.71
5	-16.07	-13.55	-15.06
6	-16.61	-13.52	-15.38

According to the above table, the optimal hysteresis order of the PVAR model set this time is 1.

4.3 GMM Estimate

After the above steps, GMM estimation is carried out for the PVAR model established by formula (1), and the regression estimation results are shown in the following table.

Table 4 GMM estimation coefficient of PVAR model

Response variable	Shock variable								
	Shabank			DeltaCPI			DPGDP		
	B_GMM	Se_GMM	T_GMM	B_GMM	Se_GMM	T_GMM	B_GMM	Se_GMM	T_GMM
Shabank	0.95	0.19	4.93	0.19	0.1	1.87	-0.02	0.03	-0.56
DeltaCPI	-0.59	0.17	-3.57	-0.58	0.13	-4.28	0.15	0.04	3.86
DPGDP	-1.78	0.68	-2.64	-2.18	0.37	-5.87	0.79	0.13	5.98

4.4 Pulse response

Because this paper is very interested in the dynamic relationship between the several variables involved in this paper, especially the desire to observe the response of other variables in the model to an exogenous impact on shadow banking scale. For example, when the policy is suddenly strictly regulated and causes an exogenous shock to the shadow bank, how does the macroeconomic variables such as GDP and CPI change? The impulse response graph of PVAR shows this dynamic relationship intuitively, so I'm going to do the impulse response analysis next.
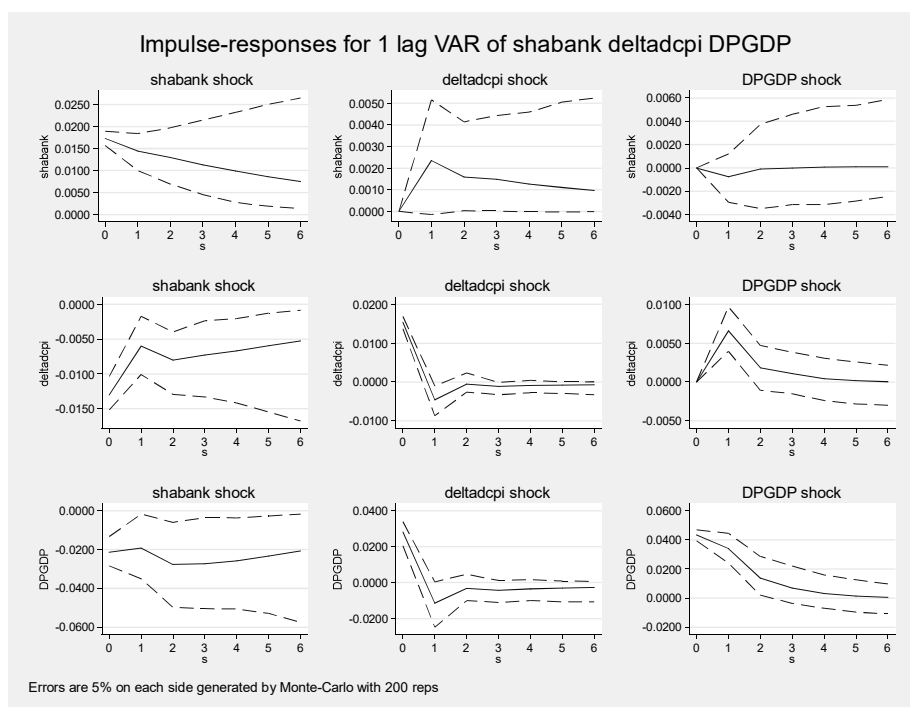
Impulse-responses for 1 lag VAR of shabank deltadcpi DPGDP

Errors are 5% on each side generated by Monte-Carlo with 200 reps

Figure 1 Pulse response diagram

As you can see from the figure above, when shadow banking is hit in the positive direction, per capita GDP and CPI will decline. This paper explains this result that social resources are increasingly concentrated in the financial sector as shadow banking expands. The concentration of social resources in the financial field may result in two opposite situations: one is the expansion of the scale of shadow banking, which can widen the financing channels of small, medium and micro enterprises to a certain extent, and can promote the production and operation of small, medium and micro enterprises, thus creating more wealth for the society; the other is that the expansion of shadow banking may lead to excessive concentration of capital in the financial field, and the high profits of the financial sector restrain the production enthusiasm of the real economic sector, thus reducing the production to invest more capital in the financial field. The real social wealth is the products produced by the real economic sector through the input of capital, labor and other production factors, and the excessive financial prosperity will reduce the social wealth. It can be seen from the figure above that when the scale of shadow banking is expanded, China's per capita GDP is reduced, so it can be preliminarily determined that the second impact is higher than the first.

4.5 Variance decomposition

By means of variance decomposition analysis, we can get the explanation degree of each variable in the model system to a variable quantitatively. The results of variance decomposition of PVAR are shown in Table 5 below.

Table 5 Decomposition of Variance

Variable	Forecast Period	Shabank	DeltaCPI	DPGDP
Shabank	10	0.9858	0.1367	0.0006
DeltaCPI	10	0.6072	0.3315	0.0613
DPGDP	10	0.5268	0.1098	0.3634
Shabank	20	0.9856	0.0138	0.0005
DeltaCPI	20	0.6237	0.3176	0.0587
DPGDP	20	0.5543	0.1042	0.3415
Shabank	30	0.9856	0.0138	0.0005
DeltaCPI	30	0.6247	0.3168	0.0585
DPGDP	30	0.5559	0.1038	0.3402

It can be seen from the above figure that, in each forecast period, the scale of shadow banking is mainly affected by its own impact, less affected by macro-economic variables such as GPD and CPI, while GDP and CPI are largely affected by the scale of shadow banking.

5.Conclusion

Based on the above analysis, the following conclusions can be drawn:

1. According to the impulse response analysis, when the shadow bank scale is impacted in a positive direction, the per capita GDP and CPI will decrease. This paper explains this result that social resources are increasingly concentrated in the financial sector as shadow banking expands. The concentration of social resources in the financial field may result in two opposite situations: one is the expansion of the scale of shadow banking, which can widen the financing channels of small, medium and micro enterprises to a certain extent, and can promote the production and operation of small, medium and micro enterprises, thus creating more wealth for the society; the other is that the expansion of shadow banking may lead to excessive concentration of capital in the financial field, and the high profits of the financial sector restrain the production enthusiasm of the real economic sector, thus reducing the production to invest more capital in the financial field. The real social wealth is the products produced by the real economic sector through the input of capital, labor and other production factors, and the excessive financial prosperity will reduce the social wealth. It can be seen from the figure above that when the scale of shadow banking is expanded, China's per capita GDP is reduced, so it can be preliminarily determined that the second impact is higher than the first.

2. Through the analysis of variance, it can be seen that the change of shadow banking scale is mainly affected by its own impact, while the change of macroeconomic variables such as per capita GDP and CPI is largely affected by shadow banking scale impact. And the influence mechanism needs further research and discussion.

In view of the above conclusions, this paper thinks: First of all, shadow banking as a invisible member of the financial sector, although its transparency, standardization, security and legitimacy need to be further improved and improved, but the financial regulatory authorities can not completely resist the existence of shadow banking. Although the existence of shadow banking may weaken the effective implementation of central bank's monetary policy and fiscal policy to a certain extent, disrupt the social financial order and trigger systematic financial risks, shadow banking is also an important part of social financing, which can make up for the deficiencies of financial institutions in some aspects and thus bring wealth to society. In addition, the interaction mechanism between shadow banking size and GDP and macroeconomic variables such as CPI needs to be analyzed by other more appropriate models or other more reasonable analysis methods. For example, the two possible impacts of the shadow banking expansion mentioned above need more detailed analysis to determine which one is dominant.

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