

# An Empirical Study on the Development of the Shadow Banking in Hubei Province Based on VAR Models

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## Abstract

Based on the integration of relevant conceptions of shadow banking, this paper sets out to make an empirical study on the scale of the shadow banks in Hubei province. Building the VAR model through series of test on the data and parameter identification of the model, it has revealed that the development of the Shadow banks will be influenced by the growth of the economy and the scale expansion of the social financing. The financial regulatory authorities in Hubei Province maintain an objective attitude towards the shadow banks. It is advisable that they take the “not blocking but dredging” philosophy rather than “prohibiting immediately”.

## Keywords

Shadow Banking, VAR Model, Empirical Study

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## 1. Introduction

Shadow banking is the result of strong financing demand, financial innovation and regulatory arbitrage, which has played an important role in the stabilizing growth of macroeconomic. In his article in 2011, Li [1] highly praised the Shadow Bank's function to economic system, regarding the shadow banking as one of the greatest achievements of financial innovation. However, as “Shadow bank” often appears in public alongside with the “financial crisis” news reports, such as the 2007 subprime mortgage crisis in United States and the debt crisis in Europe, people tend to have negative impression of the “Shadow bank” concept so that sometimes they become frightened when it is mentioned [2]. Nevertheless, under the impetus of profit-seeking and increasing demand, shadow bank-

ing business and its derivative financial products show explosive growth, which have nonnegligible impact on the stability of financial system and the development of society and economy. It has now been the hot issue and focus of academic and industry discussions and attracted the financial regulatory authorities' intimate attention [3].

## 2. Literature Review and Hypothesis

The shadow banking system generally refers to a collection of non-bank financial intermedia that provides services similar to traditional commercial banks but free of normal financial regulations. It's characterized by the nature of high leverage and maturity mismatch in different degrees. Unlike regulated banks, shadow banks can't get their last resort supported by the central bank [4] [5].

Wang and Guo (2012) [6] believe that there are main four types of pattern for shadow banks in our country: 1) non-bank financial intermedia approved by the banking supervision and management department, 2) quasi-financial institutions capable of investing and financing approved by local government, 3) legal financial intermedia approved by the relevant department, 4) underground financial activities including private lending and illegal private banks.

Ba (2009) [7], who introduces the business features, risk level and supervision of the foreign shadow banks, concludes four basic characteristics of this kind of banks: 1) choosing wholesale as their financial products retailing mode, quite different from traditional commercial banks; 2) developing such a sophisticated dealing transaction mode that they lead to many commercial secrets for the outsiders but only held by the issuers, which brings a situation of delayed and insufficient information disclosure; 3) getting higher leverage capital adequacy ration through operation on borrowings regarding commercial banks; 4) acquiring generally higher profitability than commercial banks.

Through their empirical study, Shen and Xie (2013) [8] proved the existence of Two-way causality and long-term stable and balanced relationship between economic growth and the development of shadow banking business. Wang and Shen (2014) [9] empirically analyzed the liquidity of shadow banking and its impact on the macro economy with the liquidity of shadow banking, bank credit amount and economic growth as major indicators. The two different ways of liquidity creation in credit has been compared and analyzed. The results showed that since 2007, the liquidity creation of shadow banking business had rather positive effect on China's economic growth. Zhang (2016) [10] claimed that in a highly efficient market environment, shadow banking enabled some enterprises to employ various financial instruments to attract more capital suppliers with higher returns at their affordable costs that not only satisfied financial needs but also achieved sustainable economic development. Where there is demand there is supply, which is the way how market works. It is the economic growth that expanded the space for shadow banking business to thrive.

Based on the all above, this paper defines the shadow banks as following: a

collection term of the financial intermediate activities providing liquidity, different from traditional commercial banks, to the enterprises, residents and other institutions beyond supervision or a little, which are characterized as maturity mismatch and high leverage. According to the definition, shadow banks include both the financial institutions except traditional banks and beyond supervision special services and markets conducted by commercial banks under supervision.

### 3. Data and Methodology

#### 3.1. Data Collection and Processing

Lack of effective supervision, shadow banks usually have a delayed and insufficient data exposure, which makes statistical work more difficult. As a result, a plenty of indirect methods have been applied to measure the scale of the shadow banks. Different measure calibers will lead to different measure results.

This paper holds that the total social loan can be divided into two parts: Loan that can be observed directly and the other can not. The unobservable loan is taken as the scale of the shadow banks, since the main character of the shadow banks is taking financial activities in the blind-spot of normal supervision. During every certain period, there is always a relatively stable relationship between finance and economy. According to this path in respect to the Li (2008) [11], the evaluation is as follows:

$$\text{Shadow Bank}/\text{NOE} = L/\text{GDP}$$

Since 1994, Hubei statistical office has stopped to publish GNP data but stationary GNP can still be found in China Statistic Year-Book. This paper assumes that Hubei GNP synchronises with the development of the stationary GNP.

From Hubei Statistic Year-Book and financial statistical Data Base Chinese Academy of Social Sciences, we can find the GNP, INC, LGDP (2001-2016).

According to the above, we get the result about measurement of the shadow banks in Hubei province displayed in **Table 1**.

It's not so hard to find that the shadow banks in Hubei province are yearly increasing in the scale, which break trillion in 2010 and multiple by 9 from 275.31 billion to 2558.34 billion during 16 years. This implies that the shadow banking has been a nonnegligible factor contributing to economic growth and financial stability in Hubei province.

#### 3.2. VAR Model Regarding the Developmentally Economic Growth of the Shadow Banks in Hubei Province and Social Financing Scale

##### 1) The Rationale of VAR Model

Introduced by Sims in 1980 as Vector Autoregressive Model, VAR model is applied to the empirical study of shadow banks in Hubei province. Here is the formula of this model:

$$Y_t = a_1 Y_{t-1} + a_2 Y_{t-2} + \dots + a_p Y_{t-p} + bX_t + \varepsilon_t$$

##### 2) The Selection of the Index and Data

**Table 1.** The scale of the shadow banks in Hubei Province (hundred million Yuan).

Year	GDP	The loan balance of financial institutions	GNP	Observable income	Unobservable income	the scale of the shadow banks
2001	466.23	378.72	459.48	120.56	338.92	275.31
2002	497.56	431.28	492.45	135.29	357.16	309.58
2003	539.59	499.96	536.23	146.81	389.42	360.81
2004	632.05	535.97	630.37	165.42	464.96	394.28
2005	648.45	564.97	643.83	181.89	461.93	402.46
2006	761.75	669.61	786.43	204.66	581.78	511.41
2007	933.34	777.09	1004.68	242.24	762.44	634.79
2008	1132.89	873.23	1211.2	281.55	929.65	716.57
2009	1296.11	1201.83	1331.88	309.0	1022.88	948.47
2010	1596.76	1413.66	1628.55	353.96	1274.59	1128.43
2011	1963.23	1566.25	2014.22	415.45	1598.77	1275.49
2012	2225.05	1800.45	2291.35	475.31	1816.04	1469.5
2013	2479.18	2079.69	2531.07	529.25	2001.82	1679.25
2014	2737.92	2423.99	2727.78	601.36	2126.42	1882.6
2015	2955.02	2833.89	2941.1	727.51	2213.59	2122.86
2016	3229.79	34531	3179.33	786.44	2392.89	2558.34

Data on developing scale of the shadow banks has been discussed in Part 2. Economic growth is defined as GDP. Local Social Financing Scale before 2012 derives from the loan direct financing growth and balance of financial institution while from the People's Bank of China after 2013 instead. In order to get the stable time series from the potential heteroscedasticity, we logarithm all the data (see **Table 2**).

## 4. Model Evaluation and Result Analysis

### 4.1. Unit-Root Test

An Augmented Dickey-Fuller Test is adopted under the Eviews 7.2. According to the data above, we take Sbank for shadow banks.

According to **Figure 1**, Sbank series shows an obvious increasing trend, which means that the series is not stable. So it needs to be stabilized.

The **Table 3** shows that lnSbank, lnFsize and lnHgdp have the same unit root implying they belong to be process. So they can be cointegrated to each other, which means we should run EG test on them to see if there is a long-term equilibrium between them.

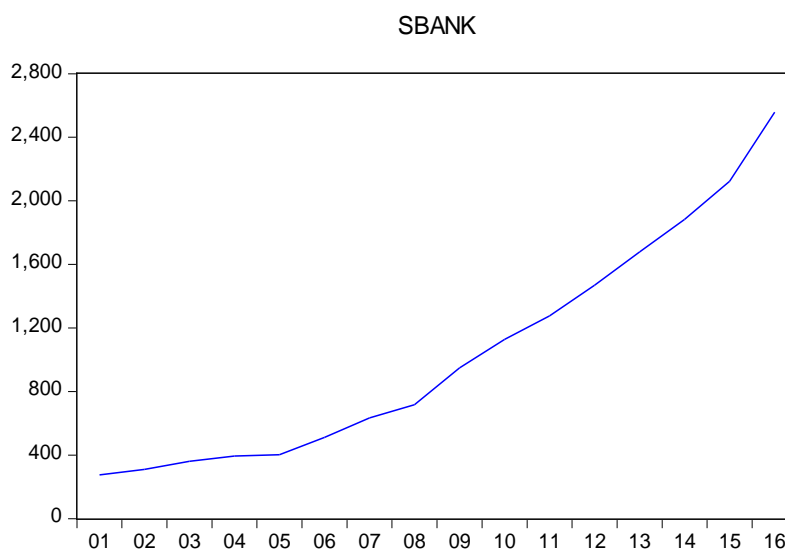
Firstly, cointegrated regression is used to get the long term equilibrium relationship between lnSbank, lnFsize and lnHgdp. Secondly, we test the stability of series run the ADF test on the residual series to get the t-value and compare it to the critical value from the cointegrated test under the 5% significant level. If the

**Table 2.** Definition of variance.

Variance	Definition	Variance	Definition	Variance	Definition
Sbank	scale of the shadow banks	lnSbank	using Log function on Sbank	dlnSbank	Variable difference method on lnSbank
Fsize	scale of the social financing	lnFsize	using Log function on Fsize	dlnFsize	Variable difference method on lnFsize
Hgdp	GDP of HuBei Province	lnHgdp	using Log function on Hgdp	dlnHgdp	Variable difference method on lnHgdp

**Table 3.** Process of unit-root test.

Series	Test type (c,t,k)	ADFvalue	5% significant level	10% significant level	Conclusion
lnSbank	(c,0,0)	0.211663	-3.081002	-2.681330	not significant
dlnSbank	(c,n,0)	-3.465510	-3.098896	-2.690439	significant
lnFsize	(c,0,0)	-1.956575	-3.759743	-3.324976	not significant
dlnFsize	(c,n,1)	-4.117487	-3.828975	-3.362984	significant
lnHgdp	(c,0,0)	-2.900658	-3.875302	-3.388330	not significant
dlnHgdp	(c,0,1)	-4.073264	-1.974028	-1.602922	significant

**Figure 1.** the Scale of Shadow Banking in Hubei Province (hundred million Yuan).

t-value is below the critical value, then it means there is a cointegrated relationship between the two variables, otherwise not.

From **Table 4**, we know that all the t-values are below the ADF critical value under the 5% significant level. So  $\varepsilon_{t1}$   $\varepsilon_{t2}$  are stable series, which implies there is a cointegrated relationship between lnSbank, lnFsize and lnHgdp. It proves the long term equilibrium relationship does exist and the unrestrained VAR model can be applied to the empirical study.

**Table 4.** EG cointegrated test.

residual serial	t-values	5% significant level	Cointegration (yes/no)
lnSbankand lnHgdg $\varepsilon_{t,1}$	-3.207869	-1.966270	yes
lnSbankand lnFsize $\varepsilon_{t,2}$	-2.946440	-1.970978	yes

## 4.2. Generated Impulse Response Analysis Based on VAR Model

1) Stability test on the VAR model. Based on the analysis above, we run the VAR evaluation on lnSbank, lnFsize and lnHgdg, and apply the AR root evaluation to the VAR results, to make a judgement whether they are stable. The AR root evaluation is based on such a principle: if all the inverse roots from VAR model are less than 1, then they are in the unit circle, so the model is stable; otherwise not.

We can tell from the **Figure 2** above that all the roots from AR are inside the unit circle. It's obvious that the VAR model is stable and the result is efficient. Therefore the generalised impulse response and analysis based on the VAR model is feasible. This VAR model could be used to analyze the impulse response between shadow banks in Hubei province, GDP in Hubei and social financing scale index, even to describe the dynamic relationship between the variables. This paper chooses the impulse response model 20 periods delay.

2) The impulse response analysis on the development of the shadow banks due to the GDP in Hubei and social financing scale index.

We can figure out that when a positive impulse is applied to the dlnSBank during two periods (**Figure 3**), the GDP and social financing scale decline a little in the last period, and go up then down during the second period all the way to the 10th period. This trend implies that there is an inverted U-shape curve, to some degrees, between the development of the shadow banks in Hubei province and GDP and social financing scale:

3) Variance decomposition analysis based on VAR model

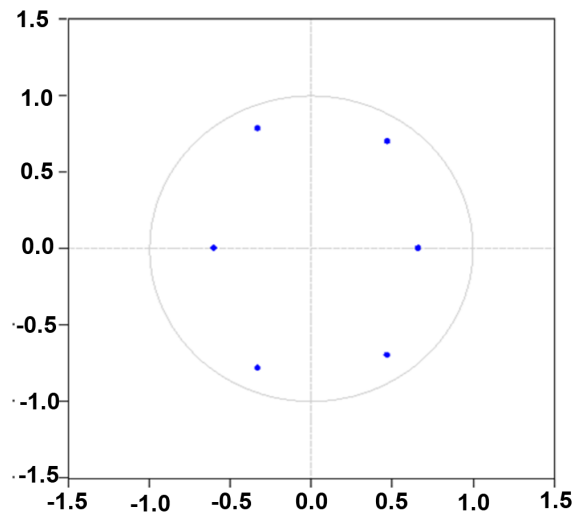
Variance decomposition analysis based on VAR model gives comment on the importance of different structure impulses through analysing the contribution every structure impulse makes on the every endogenous variable changes (which is valued by the variance) **Figure 4** shows the result of variance decomposition. Generally speaking, **Figure 4** implies that among the decomposition results, social financing scale makes the most contribution to the development of the shadow banks in Hubei province, followed by the GDP.

## 4.3. Analysis of Empirical Results

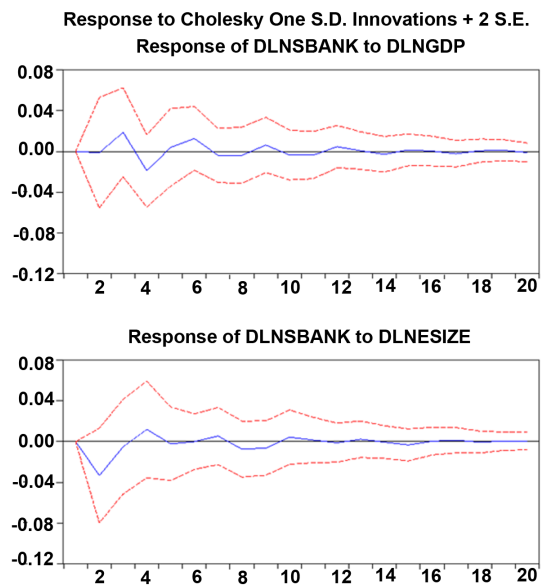
1) The size of social financing and the development of shadow banking are interdependent and mutually reinforced.

Under credit crunch conditions, the flexible and efficient shadow banking on the one hand meets the financing needs of private enterprises, alleviating the problems caused by insufficient coverage of commercial banks through

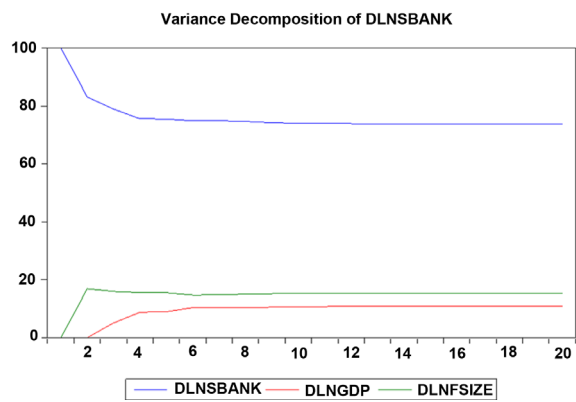
**Inverse Roots of AR Characteristic Polynomial**



**Figure 2.** Root of VAR model.



**Figure 3.** The impulse response analysis.



**Figure 4.** The result of variance decomposition.

increasing the scale of social financing. On the other hand, the development of economy, especially the rapid development of private economy, needs to be financed by more social funds, which in return promotes the development of shadow banking.

2) Economic growth has positive effect on the development of shadow banking.

The development of shadow banking can help ease the financing difficulties of small and medium-sized private-owned enterprises which will thus be promoted to a sound development. Under the macroeconomic situations of tight financial regulations and funds monopoly, shadow banking has satisfied the financing needs of enterprises and contributed to the economic growth to a certain extent.

Shadow banking is a product of fulfilling financing needs, encouraging financial innovation and implementing regulatory arbitrage. It has broken through the original fund price control, provided the social capital with higher efficient and diversified investment channels, as well as expanded the scale of social financing. The functions of the shadow bank, such as credit conversion, term conversion and liquidity conversion, can effectively improve the efficiency of social capital use, meet the investment and financing demands of the real economy, then motivate the macro economy to develop.

## 5. Theoretical and Practical Implications

With the rapid economic development in our country, shadow banking has also shown a geometric growth as for its scale in our country. In 2002, the scale of RMB loans in China was 2011.2 billion Yuan, accounting for 91.86% of the total social financing scale during the same period. In 2014, the scale of RMB loans was 9783.3 billion Yuan, accounting for 59.59% of the total social financing scale during the same period. The evident change in number in 2002 and 2014 shows that the social financing structure in our country has undergone tremendous changes [12].

Shadow banks in Hubei province has gone through a rapid growth in a close step with other parts in China dating from the dawn of the new century. Regarding the demand, Chinese economy has been developing in a boom for nearly 20 years due to the reform and opening up policy. Urban dweller has breached 10 thousands Yuan in terms of per capita disposable income (PCDI in 2005 was 10493). With an obvious gradually improved life, the financial management demand has been springing through the time. Along with the increase of CPI since 2005 (Domestic CPI increased from 1.26% Aug. 2005 to 8.74% Feb. 2008) [13] and the low interests rate (2.25% back in 2005) [14], the intensive crowding out effect on residential deposit caused by the long-term negative interests rate has greatly stimulated the demand for financial management as well.

So from the perspective of financial supervision in Hubei Province, how to supervise shadow banking scientifically and effectively has become an important issue for government, with the following urgent problems to be solved:



1) The current status of shadow banking in Hubei Province, what are the key factors affecting the development of shadow banking?

2) What kind of regulatory measures should be taken is based on the principle government tends to follow: “blocking”, limiting or even prohibiting its further development; combining “blocking” with “sparseness”, improving relevant laws and regulations on the basis of constantly accumulating regulatory experience through practices and indirectly enhance self-discipline level of financial industry?

Finding the feasible solutions to these problems above is of great significance to gear up the leapfrog development of Hubei province.

## 6. Conclusions and Countermeasures

This paper studies on the relationship between the scale of the shadow banks in Hubei province and GDP and the social financing scale. Based on VAR model, we use the general impulse response and variance decomposition in the study. Finally we come to the conclusion that economic growth, known as GDP growth, and expansion of social financing scale may influence the shadow banks' development scale and lead an inverted U-shape curve.

First, the scale of corporate financing needs in Hubei Province has contributed to the development of shadow banking.

Second, economic growth has a positive impact on the development of shadow banking, and the fluctuations in economic growth will influence the size of shadow banking.

From the conclusion, we can suggest that the financial regulatory authorities in Hubei Province maintain an objective attitude towards the shadow banks. It is advisable that they take the “not blocking but dredging” philosophy rather than “prohibiting immediately”.

All the factors that influence the shadow banking should be taken into consideration when Hubei Financial Supervision Department draws up their regulations. GDP growth and social financing scale expansion contribute to the development of the shadow banks, and exacerbate the risk of financial supervision as well. In the meanwhile, a moderately limited development of the shadow banks can be beneficial to the economy growth. When Financial Supervision Department strengthens the supervision, it should also enrich the financial services, optimize the allocation of funds and utilize the funds more efficiently to activate financial market and social economic development.

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