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Financial Environment and System Influence on Port Finance

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ABSTRACT

The development level of port finance has an important influence on the development of port economy. Under the background of the new economy and the construction of the 21st century Maritime Silk Road, the increasingly close economic and trade cooperation has put forward higher requirements for the financial development level of Shanghai Port. This paper takes Shanghai Port as the research object, analyzes the financial development level of Shanghai port by constructing Levin index, and takes the financial activity and financial scale of Shanghai Port as the dependent variable, selects the representative port container throughput and urban GDP of the financial environment factors and deposit and loan ratio of the financial system factors as independent variables. Then the VAR model is established to explore the influence of financial environment and financial system on the financial development level of Shanghai Port. The results show that the above-mentioned independent variables have positive effects on the financial activity and financial scale of Shanghai Port, and all have some lag. It shows that the level of financial development in Shanghai Port on the port of the financial environment and financial system has a certain dependence. Finally, according to the research results, some suggestions are put forward to improve the financial development level of Shanghai Port.

Keywords: port finance, financial environment, financial system, VAR model

INTRODUCTION

Port finance promotes the development of port economy. The development level of port finance affects the capital investment of port finance, which determines the contribution of port finance to the development of port economy. From the most basic port construction to the port logistics, and then to the development of related industries need a lot of money support. It can be said that port finance has an impact on all aspects of port development, and the higher the level of development of port finance, the more significant the role of port finance for the development of port economy, the closer the relationship between the development level of port finance and port economy. Shanghai is an important economic, technological, financial and shipping center in China (Hsueh & Su, 2016). It is necessary to seize the opportunity of "The Belt and Road" strategy to strengthen the construction of port facilities. While meeting the demand for more frequent cargo transit services, Shanghai should implement port finance projects, develop port financial business, enhance the level of port finance development, and give full play to the support role of finance for ports. This paper analyzes the financial development level of Shanghai port by constructing Levin index, and takes the financial activity and financial scale of Shanghai Port as the dependent variable, selects the representative port container throughput and urban GDP of the financial environment factors and deposit and loan ratio of the financial system factors as independent variables. Then the VAR model is established to explore the influence of financial environment and financial system on the financial development level of Shanghai Port, and some suggestions are put forward to promote the financial development level of Shanghai Port.

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Contribution of this paper to the literature

- The Steady growth of the economy is the guarantee of financial system reform and financial service innovation. Shanghai should be based on economic new normal rationality to delineate economic goals to avoid excessive growth in GDP.
- The Insurance institutions should innovate with the marine economy, port logistics-related insurance products, and enhance its adaptability to the development of the port.
- The focus of financial system innovation is to improve the degree of liberalization of port financial markets, reduce transaction costs, while giving foreign companies and financial institutions policy guarantees,

LITERATURE REVIEW

Foreign scholars for the port shipping and supporting financial support research began earlier. Early research on port finance focused on the financing channels and financing ways of port shipping (Richard Goss, 1987; Khan A, 2000). They found that the financing channels adopted by the port and shipping industry mainly rely on government direct investment. Then many scholars gradually realized the importance of port finance for the development of port and shipping industry (Kavussanos M G and Talley W K, 2004; Fraser K C, 2011). They pointed out that the development of ports and the support of financial capital are inseparable. With the deepening of the research of port finance, some scholars began to study the financing problems of port infrastructure (Haralambides H E et al., 2001; Meersman H et al., 2014). Based on the research of port infrastructure, some scholars presented a concept for differentiating public and private portions in financing port investments (Dekker S et al., 2003). The influence of policy, cost and return rate on port finance has also been studied (Goodman A C, 1984; Musso E et al., 2006; Talley W K, 2007; Tang O, 2014).

Although the domestic research on the port finance started late, but in recent years with the continuous development of the port economy, the domestic port finance research gradually increased. Some scholars have studied the development of port finance in the macro and proposed the suggestion of promoting the development of port finance from the aspects of financial system and financial innovation (Jin Y U and Zhang W, 2006; Chen X, 2013). With the deepening of the research of port finance theory, the research of port finance has been gradually applied to practice (Gui J et al., 2009; Wang, Lv and Zhao, 2016). Some scholars have studied the current situation of the financial development of specific ports, and put forward some effective suggestions to improve the development level of port finance from the micro aspects (Minfeng L U and Luan C K, 2012; Zhu Z X, 2016). On this basis, the use of port finance to promote the development of port logistics and other related industries has gradually been concerned (Yan H, 2013; Ruan Y, 2016). In addition, some scholars have noticed that the financial level of the port city has a significant impact on the development of port finance, and the financial innovation ability of the port city is studied (ZHOU Ai-min and SONG Xuan, 2016). Under the background of the close connection between ports and finance in the world, some scholars have done some research on the port financing mode of China, and found that the port financing mode of China is similar to that of many international ports (Zhang J, 2016).

From the above research and analysis, both domestic and foreign academic circles have been in the port finance has made some research results. However, most of the research mainly explores the status quo and problems of port finance development in a qualitative way and according to the actual situation puts forward some suggestions to develop port finance, strengthen the link between port finance and port economy, the quantitative research on port finance development is relatively lacking, especially for the further exploration of the influencing factors of the financial development level of port. Therefore, this paper takes Shanghai Port as the research object, analyzes the financial development level of Shanghai port by constructing Levin index, and takes the financial activity and financial scale of Shanghai Port as the dependent variable, selects the representative port container throughput and urban GDP of the financial environment factors and deposit and loan ratio of the financial system factors as independent variables. Then the VAR model is established to explore the influence of financial environment and financial system on the financial development level of Shanghai Port, so as to provide reasonable suggestions for the development of Shanghai Port finance.

CONSTRUCTION AND SELECTION OF INDEX

Construction of Port Financial Development Level Index

Ross Levine in 2002 built a series of indicators, including financial size and financial activity, the index is also used by scholars to analyze China's financial services industry. This paper applies this indicator to the analysis of the level of port finance development, the specific formula is:

$$Total\ transaction\ ratio = {Stock\ Market\ Volume}/{GDP} \tag{1}$$

$$Market\ capitalization\ ratio = \left\{0.5 \times \left[{M(t)}/{P_e(t)} + {M(t-1)}/{P_e(t-1)}\right]\right\} \Big/ \left[{GDP(t)}/{P_e(t)}\right] \tag{2}$$

$$Loan\ ratio = \left\{0.5 \times \left[{F(t-1)}/{P_e(t-1)}\right]\right\} \Big/ \left[{GDP(t)}/{P_e(t)}\right] \tag{3}$$

$$Financial\ activity = LN(total\ transaction\ ratio \times loan\ ratio) \tag{4}$$

$$Financial\ scale = LN(market\ capitalization\ ratio \times loan\ ratio) \tag{5}$$

Among them, $M(t)$ said the stock market capitalization of the SIPG at the end of the year t, and $P_e(t)$ represents the average consumer price index at the end of the year t. In this paper, the balance of loans of financial institutions is used to replace the balance of private loans in the proportion of the original loan, which is expressed by $F(t)$. The higher the financial activity, the larger the financial scale, the more developed the financial system, the higher the level of financial development.

Selection of Influencing Factors of Port Finance Development Level

The factors that affect the level of financial development are multifaceted. Some scholars have built a comprehensive system to evaluate the potential of China's six international financial centers. The results show that a good financial environment and a sound financial system can help promote the process of financial internationalization and enhance financial risk defense ability.

From the two angles of the financial environment and financial system, this paper selects the three indicators to explore the factors that affect the level of port finance development. Financial environment factors include gross domestic product and port total cargo throughput. GDP represents the overall economic development of the region. Port total cargo throughput reflects the intensity of the port expansion. The ratio of loans to deposits in the financial system is used as a measure of the degree of government credit intervention. The ratio of loans to deposits reflects the degree of tightness in the financial system and financial risk management. The higher the loan to deposit ratio, the smaller the local government's risk control efforts, the more relaxed credit; otherwise, more stringent control, credit tightening.

DATA SOURCE AND PROCESSING

In the process of calculating financial activity and financial scale, the gross domestic product, the balance of loans in domestic and foreign currencies and the average consumption price index used in this paper are derived from the 2000- 2016 Shanghai Statistical Bulletin. The total market capitalization and stock trading volume of SIPG from 2000 to 2016 are derived from the Wind information database and are compiled after the statistics. The financial activity and financial scale of Shanghai Port are calculated by the formula (3-1) - (3-5), respectively, as HYD and GM. Shanghai gross domestic product, port cargo throughput and loan-to-deposit ratio data were obtained by looking for the 2001-2016 Shanghai Statistical Yearbook, which were recorded as GDP, HTL, DCB. Specific data as shown in **Table 1**.

Table 1. The index of financial development level and its influencing factors in Shanghai Port in 2001-2016

Years	GDP (billion yuan)	HTL (Billion tons)	DCB	HYD	GM
2001	5210.12	2.2	0.76	-4.73	-5.57
2002	5741.03	2.6	0.75	-4.97	-5.33
2003	6694.23	3.2	0.76	-3.80	-5.19
2004	8072.83	3.8	0.75	-4.23	-5.04
2005	9247.66	4.4	0.72	-4.56	-5.25
2006	10572.24	5.4	0.70	-3.04	-4.78
2007	12494.01	5.6	0.72	-2.16	-3.60
2008	14069.86	5.8	0.68	-4.39	-3.56
2009	15046.45	5.9	0.67	-3.46	-3.25
2010	17165.98	6.5	0.65	-4.51	-2.87
2011	19195.69	7.3	0.64	-5.21	-3.41
2012	20181.72	7.4	0.64	-6.39	-3.75
2013	21818.15	7.8	0.64	-3.31	-3.34
2014	23567.7	7.6	0.65	-3.61	-2.96
2015	25123.45	7.2	0.51	-2.31	-2.88
2016	27466	7	0.54	-4.52	-3.08

MODEL ESTABLISHMENT

The VAR model is established by using Shanghai Port financial activity and financial scale as the dependent variable, using Shanghai GDP data, and port cargo throughput and loan-to-deposit ratio as independent variables. Then the dynamic analysis and research are carried out by means of impulse response and variance decomposition.

The underlying mathematical expression of the VAR model is:

$$y_t = v + A_1 y_{t-1} + \cdots + A_p y_{t-p} + B_1 x_t + \cdots + B_r x_{t-r} + u_t$$

where r and p are vector lag periods,

$y_t = (y_{1t}, y_{2t}, \ldots, y_{Kt})$ denotes a $K \times 1$ order random vector,

A_1 to A_p represent the parameter matrix of $K \times K$ order,

B_1 to B_r is the $K \times M$ order estimation coefficient matrix,

and assuming that u_t is a white noise sequence; that is,

$E(u_t) = 0$, $E(u_t u_t') = \sum_u$, and $E(u_t u_s') = 0, s \neq t$.

ADF Test

Steady conditions include covariance smooth and strong smooth. The first moment of a random process is non-time-varying with the second moment. That is, when

(1) For all t, $E(y_t) = \mu$;

(2) For all t, and $h = 0, 1, 2, \ldots, E[(y_t - \mu)(y_{t-h} - \mu)'] = \Gamma_y(h) = \Gamma_y(-h)'$

is satisfied, the process y_t is covariant smooth. The first condition means the same finite mean vector. The second condition implies that the covariance matrix of the process does not depend on time t and depends only on the time interval h. If the joint distribution of K variables is non-time-varying, the process is strong smooth.

In order to prevent the occurrence of pseudo-regression, the data must be tested for stability before establishing the VAR model. There are many kinds of data stability test, where the most commonly used ADF test. This article uses Eviews8.0 software to carry on the ADF test to all variable data. The test results are shown in **Table 2**:

Table 2. ADF test results for variables

Variable name	Inspection type (c,t,p)	ADF value	Critical value			Conclusion
			1%	5%	10%	
HYD	(c,t,0)	-2.6696	-4.7283	-3.7597	-3.3250	unstable
ΔHYD	(c,t,0)	-3.9895	-4.8001	-3.7912	-3.3423	stable
ΔΔHYD	(c,t,0)	-4.6063	-4.8864	-3.8290	-3.3630	stable
GM	(c,t,0)	0.47265	-4.7284	-3.7597	-3.3250	unstable
ΔGM	(c,t,0)	-3.0766	-4.8000	-3.7912	-3.3423	unstable
ΔΔGM	(c,t,0)	-4.7703	-4.8864	-3.8290	-3.3630	stable
GDP	(c,t,1)	-1.2561	-4.7284	-3.7597	-3.3250	unstable
ΔGDP	(c,t,1)	-3.8933	-4.8864	-3.8290	-3.3630	stable
ΔΔGDP	(c,t,1)	-4.3693	-4.9923	-3.8753	-3.3883	stable
HTL	(c,t,0)	-3.3046	-4.7284	-3.7597	-3.3250	unstable
ΔHTL	(c,t,0)	-5.6339	-4.8001	-3.7912	-3.3423	stable
ΔΔHTL	(c,t,1)	-6.8786	-4.8864	-3.8290	-3.3630	stable
DCB	(c,t,1)	-1.5309	-4.7284	-3.7597	-3.3250	unstable
ΔDCB	(c,t,1)	-3.2216	-4.8864	-3.8290	-3.3630	unstable
ΔΔDCB	(c,t,1)	-4.3183	-4.9923	-3.8753	-3.3883	stable

From **Table 2**, we can see that the ADF values of the second order differential sequences of all variables are less than the critical value of the significance level at 5%, i.e. all are stationary. Therefore, the above variables are second-order monotonic sequences, to meet the prerequisites for co-integration test.

The establishment of VAR model

From the results of ADF test, we can see that all variables are second order monotonic sequences, there may be co-integration relationship. Before performing a co-integration test, we need to create an unconstrained vector autoregressive model based on the variables. Two VAR models are established based on the financial activity and financial scale of Shanghai Port as the dependent variable, the data of Shanghai GDP, port cargo throughput and loan - to - deposit ratio as independent variables. They were named Model 1 and Model 2, respectively.

In the practical application process, since the lag phases p and r are sufficiently large, it can fully reflect the whole dynamic relation information of the constructed model. But there is a serious drawback is that if the lag period is longer, then the parameters to be estimated will become more, the degree of freedom will be reduced. So it is necessary to find a balance between the degree of freedom and the lag. The general criterion is to take the lag period when statistics of the SC and AIC are the smallest, and the statistics are derived from the following two formulas.

$$AIC = {}^{-21}/_{n} + {}^{2k}/_{n} \tag{6}$$

$$SC = {}^{-21}/_{n} + {}^{(k\log(n))}/_{n} \tag{7}$$

In the formulas 5-1 and 5-2, k represents the number of parameters to be estimated, n represents the number of observations, and l is the log likelihood

Based on the AIC and SC criteria, the study found that when the lag order to take 2, the test results are more reasonable. The equations are:

$$\begin{aligned} HYD = {} & 0.2594 * HYD(-1) - 0.0292 * HYD(-2) - 28.9753 * GDP(-1) + 20.5384 \\ & * GDP(-2) + 1.4821 * HTL(-1) + 1.8753 * HTL(-2) + 4.7452 \\ & * DCB(-1) + 51.4834 * DCB(-2) + 21.8864 \end{aligned}$$

$$\begin{aligned} GM = {} & 1.2042 * GM(-1) - 0.5558 * GM(-2) - 12.4630 * GDP(-1) + 10.8775 \\ & * GDP(-2) + 1.0512 * HTL(-1) - 0.1090 * HTL(-2) - 0.3662 \\ & * DCB(-1) + 18.7884 * DCB(-2) - 3.2946 \end{aligned}$$

Johansen Co-integration Test

In the time series, the co-integration test method is Engle-Granger two-step method and Johansen co-integration method. The former is suitable for covariance test of two-variable model, and the latter is suitable for covariance testing in multivariate VAR models. Therefore, this paper uses Johansen co-integration method for co-integration test; the results are shown in **Table 3**, **Table 4**. The results show that the characteristic traces test and the maximum eigenvalue test of the model 1 and model 2 are passed below the 5% level, i.e., there is a co-integration relationship between the VAR models 1 variable, and model 2 is the same.

Table 3. Model 1 of the Johansen covariance test results

Unrestricted Co-integration Rank Test	Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
Trace	None *	0.927266	68.27405	47.85613	0.0002
	At most 1 *	0.759865	31.58083	29.79707	0.0308
	At most 2 *	0.471769	11.60906	15.49471	0.1767
	At most 3	0.173865	2.673963	3.841466	0.1020
Maximum Eigenvalue	None *	0.927266	36.69322	27.58434	0.0026
	At most 1	0.759865	19.97176	21.13162	0.0720
	At most 2 *	0.471769	8.935101	14.26460	0.2916
	At most 3	0.173865	2.673963	3.841466	0.1020

Table 4. Model 2 of the Johansen covariance test results

Unrestricted Co-integration Rank Test	Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
Trace	None *	0.992831	102.0289	47.85613	0.0000
	At most 1 *	0.723482	32.89742	29.79707	0.0213
	At most 2 *	0.586620	14.90069	15.49471	0.0613
	At most 3	0.165521	2.533273	3.841466	0.1115
Maximum Eigenvalue	None *	0.992831	69.13151	27.58434	0.0000
	At most 1	0.723482	17.99673	21.13162	0.1300
	At most 2 *	0.586620	12.36742	14.26460	0.0976
	At most 3	0.165521	2.533273	3.841466	0.1115

This fully shows that there is a long-term stable relationship between the financial activity of Shanghai Port and Shanghai GDP, port cargo throughput and loan-to-deposit ratio. Similarly, there is also a long-term stable relationship between the financial scale of Shanghai Port and Shanghai GDP, port cargo throughput and loan-to-deposit ratio.

Impulse Response

For any VAR model can be expressed as an infinite order vector $MA(\infty)$ process.

$$y_{t+s} = U_{t+s} + \Psi_1 U_{t+s-1} + \Psi_2 U_{t+s-2} + \cdots \tag{8}$$

$$\Psi_s = \frac{\partial Y_{t+s}}{\partial U_t} \tag{9}$$

The element of column j in line i of Ψ_s indicates that the effect of the first i endogenous variable y_{jt} in the $t+s$ phase which is affected by the impact of the error item u_{jt} of the first j variable y_{jt} in the t phase when other error items are unchanged.

The element of column j in line i of Ψ_s is considered as a function of the lag period s

$$\frac{\partial y_{i,t+s}}{\partial u_{jt}}, s = 1,2,3, \ldots \tag{10}$$

Equation (5-5) is called the impulse response function. The impulse response function describes the effects of a perturbation term plus a one-time shock on the current and future values of the endogenous variables. According to the established VAR model, the impulse response functions of the two dependent variables are obtained by the impact of a unit size of each variable. As shown in **Figure 1** and **Figure 2**:

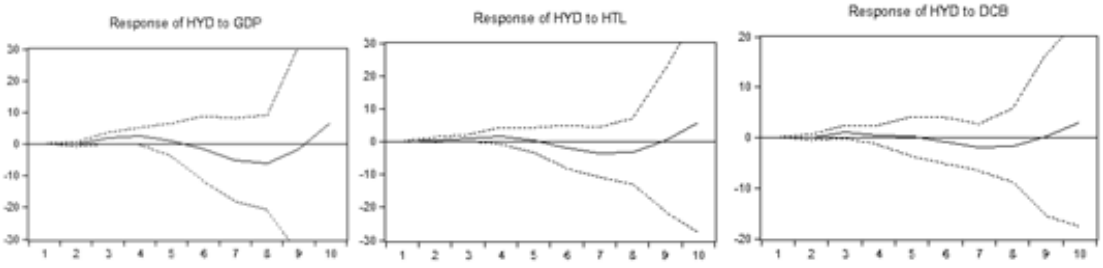

Figure 1. Response of HTD to each variable

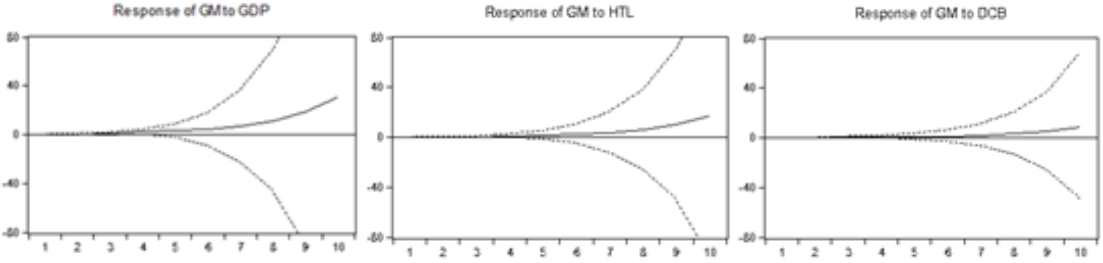

Figure 2. Response of GM to each variable

According to the impulse response function chart of Shanghai Port financial activity on Shanghai's GDP, we can see that in the current period to give GDP a positive impact, the financial activity is no obvious reaction in the first period. In the second period, the positive pulling effect begins to produce, in the fourth period the financial activity reaches the maximum of 2.4. Then the financial activity begins to decline, in the sixth period from positive to negative, and in the ninth period to form a positive role again.

According to the impulse response function chart of Shanghai Port financial activity on port cargo throughput, we can see that similar to Shanghai's GDP, there is no apparent reaction to the financial activity in the first period after a positive impact on the port's cargo throughput in the current period. In the second period, the positive pulling effect begins to produce, in the fourth period the financial activity reaches the maximum of 1.6. Then the financial activity begins to decline, in the fifth period from positive to negative, and in the ninth period to form a positive role again.

According to the impulse response function chart of Shanghai Port financial activity on loan-to-deposit ratio, we can see that in the current period to the loan to deposit ratio a positive impact, the financial activity in the first phase is still no change, and from the second phase begins to rise slowly, positive pull effect occurs. In the third period, the financial activity reaches a maximum of 1.1, and then begins to decline, in the fifth period from positive to negative, and in the ninth period again from negative to positive, resulting in positive effects.

According to the impulse response function chart of Shanghai Port financial scale on Shanghai's GDP, we can see that in this period to give the GDP a positive impact, the financial scale is no significant change in the first period and from the second period begins to rise steadily, starting from the seventh period, the rising rate gradually increases. On the whole, Shanghai's gross domestic product has a sustained effect on the financial scale of Shanghai port, which has a certain lag, and has maintained an upward trend.

According to the impulse response function chart of Shanghai Port financial scale on port cargo throughput, we can see that in the current period to give the port cargo throughput a positive impact, the financial scale in the first two periods has no obvious reaction, from the third period begins to rise steadily, and the rate of increase in the beginning of the seventh increases. On the whole, port cargo throughput has a sustained role in promoting the financial scale of Shanghai Port, and this promotion has been showing an upward trend. Only this promotion effect compared with Shanghai GDP, the beginning of the time later, the role of a slight reduction in strength.

According to the impulse response function chart of Shanghai Port financial scale on loan-to-deposit ratio, we can see that in the current period to give the loan-to-deposit ratio a positive impact, the financial size in the previous two also do not change, and in the third period, the pull effect begins to appear. Before the seventh period, this pulling effect remains basically unchanged and maintains at a low level, starting from the seventh period, this pull begins to show a clear upward trend. On the whole, the loan-to-deposit ratio has a sustained role in promoting the financial scale of Shanghai Port, and the role of promotion has increased over time. But compared with the Shanghai GDP and port cargo throughput, the promoting effect to the financial scale of Shanghai port is not obvious enough.

Table 5. Variance Decomposition of HYD

Period	S.E.	HYD	GDP	HTL	DCB
1	1.102304	100.0000	0.000000	0.000000	0.000000
2	1.204434	89.54870	0.952658	8.897299	0.601339
3	3.294683	50.17951	29.89299	8.842861	11.08464
4	4.620264	34.37647	43.16269	15.95370	6.507135
5	4.941660	37.08981	42.74020	14.43476	5.735229
6	5.667412	32.20866	40.70106	20.90431	6.185976
7	9.610402	31.35293	42.73071	19.66538	6.250987
8	12.79147	31.10186	46.51603	17.25780	5.124310
9	13.00554	31.44010	46.82904	16.72712	5.003742
10	16.70447	28.23879	43.99569	21.63201	6.133513

Variance Decomposition

Variance decomposition is another effective method to describe the dynamic effect, which can decompose the mean square error of the system into the contribution of each variable, and calculate the relative importance of each variable. At the same time, we can observe the important information according to the time variation in the variance decomposition diagram, so as to estimate the time delay effect of the change. The corresponding mean square expression for the future s period is:

$$MSE(\hat{Y}_{t+s\,t}) = E\left[(Y_{t+s} - \hat{Y}_{t+s\,t})(Y_{t+s} - \hat{Y}_{t+s\,t})'\right] = \Omega + \Psi_1\Omega\Psi_1' + \Psi_2\Omega\Psi_2' + \cdots + \Psi_{s-1}\Omega\Psi_{s-1}' \quad (11)$$

where $\Omega = E(u_t\, u_t{}')$

Then, the contribution of each orthogonal error term to $MSE(\hat{Y}_{t+s\,t})$ is investigated. The u_t is transformed into an orthogonal error term v_t.

$$u_t = Mv_t = m_1 v_{1t} + m_2 v_{2t} + \cdots + m_N v_{Nt} \quad (12)$$

$$\begin{aligned}\Omega = E(u_t\, u_t{}') &= (m_1 v_{1t} + m_2 v_{2t} + \cdots + m_N v_{Nt})(m_1 v_{1t} + m_2 v_{2t} + \cdots + m_N v_{Nt})' \\ &= m_1\, m_1' Var(v_{1t}) + m_2 m_2' Var(v_{2t}) + \cdots + m_N m_N' Var(v_{Nt})\end{aligned} \quad (13)$$

Substituting A in equation (5-6) and merging the same term.

$$MSE(\hat{Y}_{t+s\,t}) = \sum_{j=1}^{N} Var(v_{jt})(m_j\, m_j' + \Psi_1\, m_j\, m_j'\, \Psi_1' + \Psi_2\, m_j\, m_j'\, \Psi_2' + \cdots + \Psi_{s-1}\, m_j\, m_j'\, \Psi_{s-1}') \quad (14)$$

Then $\frac{\mathrm{Var}(\mathrm{v_{jt}})(\mathrm{m_j m'_j}+\Psi_1\mathrm{m_j m'_j}\Psi'_1+\Psi_2\mathrm{m_j m'_j}\Psi'_2+\cdots+\Psi_{s-1}\mathrm{m_j m'_j}\Psi'_{s-1})}{\sum_{j=1}^{N}\mathrm{Var}(\mathrm{v_{jt}})(\mathrm{m_j m'_j}+\Psi_1\mathrm{m_j m'_j}\Psi'_1+\Psi_2\mathrm{m_j m'_j}\Psi'_2+\cdots+\Psi_{s-1}\mathrm{m_j m'_j}\Psi'_{s-1})}$ represents the percentage contribution of the orthogonal j-th message to the pre-s prediction t variance.

Table 5 and **Table 6** are respectively the variance decomposition table of the financial activity and financial scale of Shanghai Port.

It can be seen from **Table 5** that the contribution of all variables is 100%. Affected by its inertia, the impact of Shanghai port's financial activity on its own reaches 100% in the period of first, and then gradually reduces. At the same time, the impact of Shanghai's GDP, port cargo throughput and loan-to-deposit ratio on financial activity has gradually increased. In the first four periods, the contribution rate of Shanghai GDP, port cargo throughput and loan-to-deposit ratio to Shanghai Port's financial activity continues to rise, but fluctuates within the next six periods. By the time of the tenth period, Shanghai's GDP has the greatest impact on the financial activity of Shanghai Port, with a contribution rate of 44%. In addition to Shanghai Port's financial activity itself, Shanghai's GDP has the greatest impact on financial activity, followed by port cargo throughput, and finally for loan-to-deposit ratio.

As can be seen from **Table 6**, similar to the financial activity, the financial scale of Shanghai Port is affected by its inertia, the influence on its own in the first period reaches 100%, then gradually becomes smaller, the difference is that the contribution rate of the financial scale on it own decline faster. In the first five periods, the contribution rate of Shanghai's GDP to Shanghai Port's financial scale has steadily increased. In the latter five periods, there has been a small fluctuation, but the contribution rate is basically maintained at 72%. In the first five periods, the port cargo throughput has a large fluctuation to the contribution rate of the Shanghai Port's financial scale. From the fifth period, the volatility decreases and finally stabilizes at the level of 21.3%. In the first four periods, the loan-to-deposit ratio has a greater volatility for the contribution rate of financial scale, and the volatility of the subsequent contribution rate decreases, and finally stabilizes at the level of 6.1%. Overall, Shanghai's GDP has the greatest impact on the financial scale of Shanghai Port, followed by port cargo throughput, and finally for loan-to-deposit ratio.

Table 6. Variance Decomposition of GM

Period	S.E.	GM	GDP	HTL	DCB
1	0.266257	100.0000	0.000000	0.000000	0.000000
2	0.432912	40.96197	28.69960	30.30069	0.037737
3	1.348402	6.054453	65.95444	12.50483	15.48628
4	2.869264	1.950607	71.61017	18.80286	7.636362
5	4.805500	0.953527	72.29414	21.11558	5.636759
6	7.091106	0.623603	72.24844	21.61940	5.508552
7	10.49776	0.444414	72.22469	21.22458	6.106316
8	16.53846	0.410763	72.05334	21.37261	6.163289
9	27.31393	0.481672	72.02495	21.30527	6.188109
10	45.36231	0.527224	72.05290	21.32322	6.096657

SUMMARY AND RECOMMENDATIONS

Summary

Based on the analysis of the VAR model, the improvement of the financial development level of Shanghai Port has a certain dependence on the financial environment and financial system of the port. The effects of Shanghai's GDP, port cargo throughput and loan-to-deposit ratio are positive for Shanghai Port's financial activity and financial scale, and all have a certain lag. The difference is that the positive effect on the financial scale is more obvious and the lag time is longer. Among them, according to the results of impulse response, the influence of Shanghai GDP, port cargo throughput and loan-to-deposit ratio on financial activity fluctuates with time, but maintains a positive effect on the whole. While Shanghai's GDP, port cargo throughput and loan-to-deposit ratio are able to generate sustained and stable effects on financial scale. According to the results of variance, the results show that Shanghai's GDP, port cargo throughput and loan-to-deposit ratio have a sustained and lagging effect on Shanghai Port's financial activity and financial scale. In the financial environment factors, relative to the port cargo throughput and loan-to-deposit ratio, the Shanghai GDP has a stronger role in promoting the financial activity and financial scale of Shanghai Port, and contributes more to the financial activity and financial scale of Shanghai Port.

The impact of Shanghai's GDP, port cargo throughput and loan to deposit ratio on the financial activity of Shanghai port is fluctuating, and the role of promoting the financial scale of Shanghai port is not significant enough. This shows that although the improvement of the financial development level of Shanghai Port has a certain dependence on the financial environment and financial system of the port, Shanghai Port's financial environment and financial system for its role in enhancing the level of financial development has to be strengthened.

Relative to the point of view, the increase in Shanghai's GDP will have a strong effect on the financial activity and financial scale of Shanghai Port, but it cannot make the financial development level of Shanghai Port a substantial leap. This is due to the added value of Shanghai port financial industry accounted for low proportion of Shanghai's GDP, at the same time, Shanghai Port's financial industry lacks innovation in financial instruments and cannot effectively meet the investment and financing requirements of Shanghai Port.

Although the increase in port cargo throughput will have a positive effect on the financial activity and financial scale of Shanghai Port, but not significant. It can be seen that the growth of the total port cargo cannot bring a significant improvement effect to the financial development level of Shanghai Port, which shows that the resource utilization efficiency of Shanghai Port is low. The increase of port cargo throughput is the embodiment of the expansion of Shanghai Port, and economic resources focus on the expansion of the scale rather than the innovation of port products and operational processes will reduce the efficiency of the allocation of financial resources, limiting the port financial level.

The loan to deposit ratio, as a financial system factor, also plays an important role in promoting the level of Shanghai Port's financial development. Therefore, to strengthen the reform of financial system can promote the development of Shanghai port finance to a great extent. With the "The Belt and Road" and other national strategies step by step to promote financial reform, the level of Shanghai Port's financial development will get more room for improvement.

Recommendations

(1) Achieving steady economic growth. The steady growth of the economy is the guarantee of financial system reform and financial service innovation. Shanghai should be based on economic new normal rationality to delineate economic goals to avoid excessive growth in GDP. At the same time, Shanghai should speed up

the establishment of a non-bank financial institution system that is complementary to the port finance, thus correctly guiding the development of the port economy.

(2) Innovating financial services products. In the insurance business, the insurance institutions should innovate with the marine economy, port logistics-related insurance products, and enhance its adaptability to the development of the port. In the port logistics and financial business, the bank should start a timely order financing, accounts receivable financing, warehouse receipts pledge, confirming warehouse, financing warehouse and other business, and constantly explore the risk of slow means of innovation.

(3) Implementing financial system innovation. The focus of financial system innovation is to improve the degree of liberalization of port financial markets, reduce transaction costs, while giving foreign companies and financial institutions policy guarantees, subsidies and other reasonable risk compensation. In addition, it can innovate in areas such as equity reform of maritime financial institutions, issuance and circulation of new port financial instruments.

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