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New Financial Kinetic Energy Boosts the Conversion of Old and New Kinetic Energy in Shandong

Existing Dilemma and Path Breakthrough

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***Abstract*—This paper constructs the new financial kinetic energy index and the multi-level and multi-dimensional new and old kinetic energy conversion indicators represented by inclusive finance and technology finance. Using vector autoregressive model quantitatively analyzes the correlation between the two aspects. The research finds: the current stage the new financial kinetic energy has a certain boosting effect on the conversion of old and new kinetic energy, but the impact mechanism is complicated. Based on this, this paper proposes an effective breakthrough path to foster financial kinetic energy and promote the transformation of old and new kinetic energy: improve financial service capability and the technology capital market, focus on cultivating multi-level and multi-dimensional financial kinetic energy.**

Keywords—new financial kinetic energy; new and old kinetic energy conversion; VAR model

I. INTRODUCTION

Whether in historical experience or in previous studies, it can be intuitively discovered that there is a natural relationship between finance and economic development. As early as 19th century, the famous economist Schumpeter proposed in the article that the service function of the banking system can effectively promote technological progress to achieve efficient production, thereby promoting economic growth. Half a century later, Goldsmith concludes that the stronger the penetration of financial activities into the economy, the more the economy can achieve rapid development under the influence of financial instruments. Since then, the high-quality development of the economy should in any case be served as the ultimate destination of the financial system. In the new and old kinetic energy conversion work, the financial system should give better play to its function of arranging financial resources and guide it to return to the origin of the service economy.

However, in light of the actual situation, there is still room for improvement in the coverage of existing financial resources in Shandong. The availability of financial services in townships and villages is low. The shortage of funds for scientific and technological innovation projects will constrain the financial kinetic energy in the conversion of old and new kinetic energy. Most of the existing researches focus on how to promote the transformation of old and new kinetic energy through financial innovation, and the synergy effect of technology finance and inclusive finance on economic growth. However, few literatures combine the status quo of the region to analyze the dilemma and the breakthrough of new financial kinetic energy in the service of new and old kinetic energy conversion. In view of the structural problems existing in the current Shandong financial system, this paper will use the old and new kinetic energy conversion and financial kinetic energy index to study the influence mechanism between financial kinetic energy and old and new kinetic energy conversion in Shandong Province, and find the existing problems when financial kinetic energy is boosting the conversion of old and new kinetic energy. Based on this, propose relative policy recommendations and breakthrough paths.

II. LITERATURE REVIEW AND THEORETICAL ASSUMPTIONS

A. Inclusive Finance Boosts Old and New Kinetic Energy Conversion

Fu Sha (2018) used the provincial panel data to construct the inclusive financial index and found that the development of inclusive finance can effectively promote the growth of per capita income and the development of small and medium-sized enterprises. Zheng Xiufeng (2019) used the county sample to discover the intermediary of inclusive finance through macroeconomics. The effect can effectively regulate the income of poor groups and has a good effect of reducing poverty and income in poor areas. Based on the data of Yunnan County, Huang Qian (2019) empirically analyzed that Inclusive Finance helps to narrow the income gap between the rich and the poor in Yunnan. In recent years, China's inclusive financial system is better than most BRICS countries, but there is still a certain gap compared with developed countries in Europe and America (Yin Zhichao, 2019). It is necessary to increase the penetration of inclusive finance from the policy level and optimize the inclusiveness. The financial system structure will improve the efficiency of precision poverty alleviation and better serve the transformation of old and new kinetic energy.

B. *Technology Finance Boosts Old and New Kinetic Energy Conversion*

Ang (2014) uses time series data to find that finance is conducive to the development of science and technology innovation in the process of technology integration. Doh S (2014) finds that government funding support from government level helps high-tech enterprises to promote technological innovation. The domestic research direction has shifted from economic growth to qualitative improvement. Domestically, Zhang Mingxi (2018) constructed a theoretical system of science and technology finance and interpreted the nature of technology finance. Han Junhua (2018) analyzed that the synergy between finance and technology can make the macro economy run more smoothly and efficiently, and optimize the allocation of financial resources from the micro. Based on the spatial econometric model, Zou Jianguo (2018) found that technology finance can significantly promote the upgrading of industrial structure, and promotes the upgrading of industrial institutions in neighboring regions through spatial spillover effects.

Most scholars' research focuses on the promotion of financial kinetic energy to high-quality economic development and industrial structure upgrading, but the economic impact of the two kinds of financial kinetic energy has not yet formed a comprehensive answer in the academic world. Li Tao (2016) found through in cross-section data that inclusive finance will bring different degrees of negative impacts in different economies. Then Zhou Bin (2017) added inclusive finance, Internet and economic growth in various regions of China to PVAR. The model shows that due to the development of inclusive finance, the financial system may be less liquid due to excessive dependence on the bank structure. Inclusive finance has a certain negative impact on economic growth and Internet development in the long run. Li Junxia (2019) found that the allocation of science and technology financial resources in China has not reached the optimal state. Enterprise innovation and financial support need to be further coordinated. Financial support for technological development will bring high uncertainty in technology while bringing high uncertainty, lack of innovation and talent. Problems such as a single financing model will limit the function of technology finance in the high-quality development of the economy.

Therefore, this paper proposes the following assumptions:

Hypothesis 1: In general, inclusive finance has a certain boosting effect in the conversion of new and old kinetic energy, but there may be a negative effect in the environment where the supply and demand of financial resources are not balanced and the financial institutions are not balanced.

Hypothesis 2: technology finance plays a role in the transformation of old and new kinetic energy, but in the context of slow economic growth and few breakthroughs in technology research and development, the financing mechanism of technology finance may be complicated.

III. THE INDICATOR CONSTRUCTION AND DATA SELECTION

A. *Indicator Construction*

Since the selection of the proxy variables of the old and new kinetic energy conversion indicators is not strictly supported by the theory, it can only be simply understood as cultivating new kinetic energy and transforming and optimizing the old kinetic energy. The core of the new and old kinetic energy conversion is the rational allocation of economic factors, the optimization and upgrading of industrial structure, and the quality of life has steadily improved. In general terms, It's high-quality, high-level development of the economy. Based on the comprehensiveness and availability of data, select economic structure, market mechanism, innovation drive, resource allocation, economic stability, regional coordination, product quality, ecological civilization constitute a new high-quality development index of Shandong economy. On the new kinetic level of finance, according to the research done by the predecessors, Inclusive Finance selects the average number of financial institutions per 10,000 people in the province and the number of employees in the average financial industry per 10,000 people. The technology finance variables select the R&D investment of enterprises in the province and proportion of financial science and technology investment. The selected data spans from 2005 to 2017, both from the Wind macro database and the Shandong Statistical Yearbook.

B. *Data Processing*

In the first step, because there are many indicators selected in this paper, there are large differences in units and values, and the weights cannot be directly calculated. Therefore, in order to eliminate the inconsistency of different measurement indicators. This paper selects the maximum and minimum values to standardize the three variables.

$$Y_{ij}=\begin{cases}\dfrac{\max(x_{ij})-x_{ij}}{\max(x_{ij})-\min(x_{ij})}, u_{ij}\text{ is negative indicator}\\ \dfrac{x_{ij}-\min(x_{ij})}{\max(x_{ij})-\min(x_{ij})}, u_{ij}\text{is positive indicator}\end{cases} \quad (1)$$

u_i represents the three system variables of new and old kinetic energy conversion, technology finance, and inclusive finance, and $u_{ij}(0 \le u_{ij} \le 1)$the represent j-th subsystem in the i-th system variable. Therefore, the old and new kinetic energy conversion system variables can be obtained by linear weighting, that is:

$$Y_i=\sum_{j=1}^{m}\lambda_{ij}u_{ij};$$
$$\sum_{j=1}^{m}\lambda_{ij}=1 \quad (2)$$

Where λ_{ij} is the weight.

In the second step, the entropy method is used to determine the weight of each subsystem in the system.

Entropy is the brightness of the disorder of the system in thermodynamics. The higher the value, the greater the disorder of the system, and the less effective information is carried. Information entropy draws on the concept of thermodynamics as the representative of the average information of each source in the indicator system.

$$E = E\left[\log \frac{1}{p(Y_i)}\right] = -\sum_{i=1}^{n} P(Y_i)\log P(Y_i) \quad (3)$$

The smaller the information entropy, the more orderly the system is.

The third step is to calculate the weight of the indicator occupied by the i-th subsystem.

$$e_j = -k\sum_{j=1}^{m} p_{ij}\ln(p_{ij}) \quad (4)$$

Calculate the entropy redundancy of the j-th term.

$$d_{ij} = 1 - e_{ij} \quad (5)$$

Calculate the weight of each subsystem

$$w_{ij} = \frac{d_{ij}}{\sum_{j=1}^{m} d_{ij}} \quad (6)$$

Time-series data of new and old kinetic energy conversion and financial kinetic energy can be obtained by weighted calculation combined with standardized data. The obtained indicators are shown in "Fig. 1".

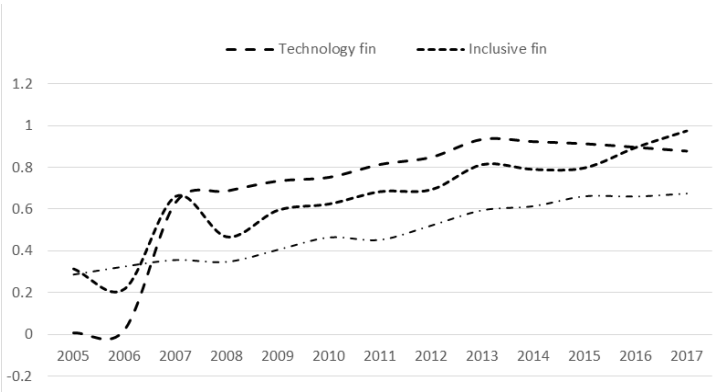

Fig. 1. The trend of new and old kinetic energy conversion and financial kinetic energy indicators.

IV. EMPIRICAL TEST

Based on the traditional regression analysis, the correlation between new and old kinetic energy conversion and financial kinetic energy is studied. It is necessary to identify endogenous variables and exogenous variables. The bias in the process of variable identification will make the prediction and estimation results deviate. In order to make the prediction result more accurate, the relevant variables need to be placed in the same system, namely Vector Autoregression. Take the two-variable system as an example. The basic structure is

$$\begin{cases} y_{1,t} = \beta_{10} + \beta_{11}y_{1,t-1} + \beta_{1p}y_{1,t-p} + \gamma_{11}y_{2,t-1} + \gamma_{1p}y_{2,t-p} + \varepsilon_{1t} \\ y_{2,t} = \beta_{20} + \beta_{21}y_{1,t-1} + \beta_{2p}y_{1,t-p} + \gamma_{21}y_{2,t-1} + \gamma_{2p}y_{2,t-p} + \varepsilon_{2t} \end{cases} \quad (7)$$

Based on this method, the technology finance (sf), inclusive finance (if) and old and new kinetic energy conversion (noc) variables are placed in a system to study its correlation and its impact mechanism to obtain a more accurate estimation result.

A. ADF Test

When constructing the VAR model of sf, if, and noc variables, since the model has certain requirements for the stability of the variables, in order to avoid the pseudo-regression problem, the ADF test should be performed on the three.

TABLE I. UNIT ROOT TEST RESULTS

Variable	Statistics	1% threshold	5% threshold	10% threshold	P-value	result
sf	-3.8820	-4.1705	-3.5107	-3.1855	0.0208	unstable
dsf	-4.1811	-4.1705	-3.5107	-3.1855	0.0097	stable
if	-1.2197	-3.5966	-2.9331	-2.6048	0.6571	unstable
dif	-1.3707	-3.5966	-2.9331	-2.6048	0.5874	unstable
ddif	-5.3679	-3.5966	-2.9331	-2.6048	0.0001	stable
noc	-2.2917	-4.1923	-3.5207	-3.1912	0.4290	unstable
dnoc	-1.9548	-4.1923	-3.5207	-3.1912	0.6082	unstable
ddnoc	-4.2588	-4.1923	-3.5207	-3.1912	0.0086	stable

[a.] Note: d represents the first-order difference of the sequence, and dd represents the second-order difference of the sequence.

It can be seen from "Table I" that at the 1% significance level, the original sequences of if, sf, and noc are non-stationary sequences, and sf is stable after first-order difference, which is I(1) integer, The if and noc sequences need a second-order difference to be a stationary sequence. A differential VAR model can be constructed by using the sequence after the difference.

B. Optimal Lag Period and Model Stability Test

The Eviews statistical software generally determines the optimal lag order of the VAR model by AIC, SC, and HQ information values. The results are shown in "Table II".

TABLE II. OPTIMAL LAG ORDER TEST

Lag	LogL	LR	FPE	AIC	SC	HQ
1	307.9585	NA	7.82e-11*	-12.4566*	-12.1057*	-12.32402*
2	308.6451	1.201544	1.11e-09	-12.11021	-11.40851	-11.84504

The results show that when the lag order is 1, the four information quantities are all significant at 5% significant level. Therefore, after weighing the trade, this paper thinks that the vector autoregressive model with lag 1 order should be established, and after determining the lag order, it should also be the model as a whole is tested for stationarity

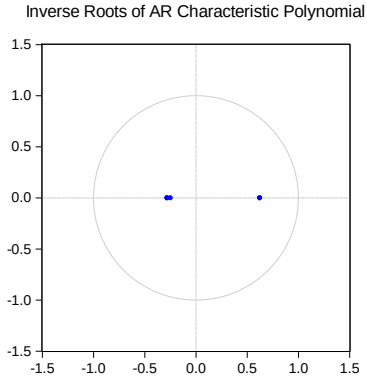

Fig. 2. Unit circle test.

As shown in "Fig. 2", the lag 1st-order VAR model is stable and consistent with the previous conclusions.

C. Establishment of VAR Model

According to the result determined by the optimal lag order, the VAR (1) model is established.

$$noc = -0.02438*sf(-1) + 0.00033*if(-1) - 0.26884*noc(-1) \quad (8)$$

$$sf = 0.61484*sf(-1) + 0.00575*if(-1) - 0.29762*noc(-1) \quad (9)$$

$$if = 0.14428*sf(-1) - 0.25169*if(-1) + 0.18083*noc(-1) \quad (10)$$

This paper believes that when analyzing the VAR model, the focus should be on the positive and negative of the coefficients of the variables in (8) (9) (10). It can be obtained from (8), and the sf variable coefficient of the lag phase is negative, indicating that Shandong's financial input in enterprise R&D and science and technology failed to produce the expected utility. Moreover, the noc coefficient of (9) is negative, it can be seen that the advancement of the new and old kinetic energy conversion process has not played a corresponding feedback role for science and technology finance. (8) The coefficient of if variable is positive, indicating that the in-depth development of inclusive finance in Shandong has a certain promotion effect on the conversion of old and new kinetic energy. The noc coefficient in (10) is positive, indicating that the conversion of new and old kinetic energy in Shandong helps to optimize finance. Industry layout, improve the inclusive financial mechanism.

D. Impulse Response Analysis

After determining the VAR model and the correlation between the variables, the impulse response analysis was used to observe how the new and old kinetic energy conversions will respond when technology finance and inclusive finance are subjected to a positive impact. The result is shown in "Fig. 3".

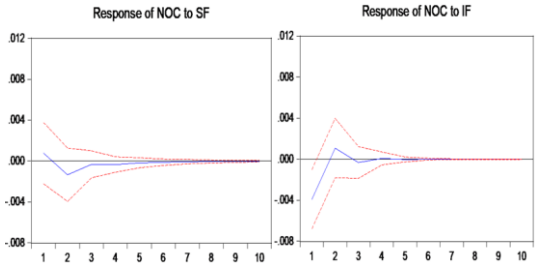

Fig. 3. New and old kinetic energy conversion impulse response diagram.

As can be seen from the figure, when a positive impact is imposed on technology finance, it will have a positive impact in the first period. This impact will be turned negative in the second period and then stabilized. The results show that Shandong scientific research financial investment will promote the conversion of old and new kinetic energy for a period of time, but the impact is limited and the time limit is short. Since the current scale of Shandong science and technology finance is not effective, this contribution will gradually become a certain degree of inhibition. The reasons are as follows: First, there is a certain gap between the output value of high-tech industries in Shandong and developed provinces, lacking the guidance of core technology; second, the training mechanism and introduction mechanism of Shandong talents are not yet mature, and the lack of high-quality talents limits the birth of a new batch of high-tech industries. Third, there is still a certain gap between the process of organically combining technology and finance and the main goal of improving the core competitiveness of science and technology, which limits the ability of service to conversion of old and new kinetic energy.

When applying a positive impact to inclusive finance, it will have a large negative impact on the conversion of old and new kinetic energy in the first phase, and then the impact will gradually become 0 after the second phase turns into a smaller positive impact. The "time lag" of the contribution of inclusive finance to the transformation of old and new kinetic energy is reflected in the following aspects: First, Shandong has a large population, and it is difficult for inclusive finance to realize the efficient allocation of financial resources to various key areas of economic development. The institutional layout has not reached the optimal scale, and the new rural cooperative financial function is lacking. Second, the input-output ratio of inclusive finance is not high. From "Fig. 3", the input is much larger than the output.

TABLE III. NEW AND OLD KINETIC ENERGY CONVERSION VARIANCE DECOMPOSITION TABLE

Period	S.E.	IF	SF	NOC
1	0.046590	13.95580	0.540502	85.50370
2	0.054514	13.77709	2.011952	84.21096
3	0.057370	13.77455	2.084668	84.14078
4	0.058436	13.76117	2.182083	84.05674
5	0.058847	13.75782	2.206924	84.03526
6	0.059006	13.75615	2.218818	84.02504
7	0.059068	13.75556	2.223049	84.02139
8	0.059092	13.75532	2.224765	84.01992

E. Variance Decomposition

Finally, the variance decomposition of the old and new kinetic energy conversion variables can obtain the degree of interpretation of the new and old kinetic energy conversion mean square error of the new financial kinetic energy, so as to deeply investigate the mutual influence degree of each variable. The results in the table are consistent with the results of the impulse response: At the beginning of the third period, the explanatory power of the financial new kinetic energy variable tends to be stable. If and sf explain the 13.77% and 2.08% of noc in turn, and noc explains 84.14% of its own, and then the two explain the strength in the eighth period. At 13.75% and 2.22%, similar to the impulse response analysis results, the advancement of the new and old kinetic energy conversion process is mainly driven by its own internal force. The low explanatory power of science and technology finance reflects that Shandong has not been able to transform the new production capacity generated by the organic integration of technology and finance into new kinetic energy under the influence of the official standard. The incubation of technological productivity may take a long period. Inclusive finance constitutes the main driving force in the new financial kinetics. However, combined with the results of impulse response analysis, the positive impact in the boosting effect is limited and tends to be stable at an early stage, failing to produce long-term stable positive effects.

Therefore, combined with the above VAR model, impulse response analysis and variance decomposition results, it can be seen that Shandong's inclusive finance and technology finance have a positive effect on the conversion of old and new kinetic energy, but this effect is limited, even accompanied by short-term negative effects., and hypothesis 1 and 2 are confirmed.

V. CONCLUSION

A. Summary

Based on the economic structure and market mechanism of Shandong Province in 2005-2017, this paper constructs the Shandong New and Old Kinetic Energy Conversion Index, and builds a new financial kinetic energy index based on relevant indicators of inclusive finance and technology finance. Using impulse response analysis and variance decomposition to quantitatively analyze the dynamic impact of new financial kinetic energy on the conversion of old and new kinetic energy, and draw the following conclusions:

Shandong new and old kinetic energy conversion index showed an overall upward trend during the sample period, and two sub-stage consolidation appeared in 2008 and 2011. Then entering the low-speed development model after 2015.

In addition to the sharp decline in 2008, the inclusive financial indicators showed an overall upward trend, and accelerated growth at a specific time when the country called for inclusive finance.

The technology financial index showed a rapid growth, and then slowing down, and finally a steady decline.

Showing that Shandong enterprises lacked scientific and technological innovation, and technology finance did not achieve good development.

Through impulse response analysis and variance decomposition, it is concluded that inclusive finance and technology finance have certain positive effects on the conversion of old and new kinetic energy, but the impact mechanism is complicated. In order to promote the new financial dynamism to better serve the transformation of old and new kinetic energy, this paper proposes the following breakthroughs in the development of Shandong's future financial new kinetic energy.

B. Breakthrough Path

First: Promote the construction of inclusive finance and improve financial service capabilities: The Shandong provincial government should focus on implementing the financial supply side reform requirements, scientifically define the inclusive financial concept that meets the requirements of Shandong's new and old kinetic energy conversion, strengthen supervision, and improve the overall level of inclusive finance from the depth.

Second: Deepening the integration of financial technology and improving the technology capital market: We must improve the technology capital market and establish an effective financial system such as technology credit and insurance. Implement the differential allocation of financial assets, implement step-by-step financing services for mature technology innovation enterprises, and improve the direct financing ability of technology enterprises.

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