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Flow Space is a New Kind of Power Space —— An Empirical Study Based on the Flow of Technology Factors

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Abstract— *To accelerate the improvement of socialist market economy system and promote high-quality economic development, we must deepen the reform of factor market allocation. This paper will select the technology factor flow among many factor flows as an entry point to verify that the flow space is a new type of power space. The research results show that: (1) the current technology factor flow is influenced by market power, and government power intervention should be reduced to give full play to the role of the market; (2) the more market power and government power, the greater the fluctuation of technology factor flow; (3) it confirms that the flow space is a new type of power space. Finally, targeted policy recommendations are proposed.*

Keywords— *Flow Space, Power Space, Technology Factor Flow.*

I. INTRODUCTION

In 2020, in the face of the continued global economic slowdown, the continued evolution of trade friction between China and the United States, and the sudden outbreak of the new crown epidemic, the Chinese government continued to issue major structural reform documents, of which the direction of reform represented by factor mobility, regional integration, metropolitan areas and city clusters occupied an important space. 2020, the "Opinions on Building a More Perfect Institutional Mechanism for Market-based Allocation of Factors" issued in April proposed to improve the market-oriented allocation of factors, accelerate the free flow of factors, and actively build metropolitan areas and city clusters; the Opinions on Accelerating the Improvement of the Socialist Market Economy System in the New Era, issued in May, intends to make coordinated regional development one of the most important national strategies; the Proposal of the CPC Central Committee on Formulating the 14th Five-Year Plan and the 2035 Visionary Goals, adopted in October, points out the need to promote coordinated regional development and create At the same time, the construction of a new development pattern of "double cycle" is also inseparable from the promotion of regional integration. The main contradiction of Chinese society in the new era has prompted us to focus on regional economy, and how to alleviate regional development disparity and promote coordinated regional development has become the concern of scholars and policy makers, and the concepts of Guangdong-Hong Kong-Macao Greater Bay Area, Yangtze River Economic Zone and Xiongan New Area have been proposed, which are precisely the efforts to this end.

The development of China's market economy has been accompanied by the decentralization and reshaping of the government's power over the market, but government intervention has never stopped. How to choose the boundary of governmental power? The question of whether the flow of factors prefers market power or governmental power has become a problem for scholars and policy makers, and how to better balance the two types of power under the joint action of the "invisible hand" of the market and the "visible hand" of the government is also a concern for regional development. The content of concern. In order to further understand regional development, this article intends to take a new perspective by placing factor flows in the structure of power space and using data to verify that the flow space is a new type of power space, so as to explore the issue of regional development. The article is structured as follows: firstly, the literature on flow space and power space is sorted out to get the connection between them, secondly, the view that flow space is a new type of power space is verified through data, and finally, effective policies to balance regional economic development and improve factor mobility are proposed based on the results of empirical research.

II. THEORETICAL FOUNDATION AND ANALYSIS

A. Overview of flow space theory

The cross-regional flow of production factors was restricted under the planned economy and began to flow freely after the reform and opening up, with the development of information and communication technologies(ICTs), various factors such as labor, capital, technology and data flowed more smoothly, further breaking through the restrictions of geographic space in the traditional sense, forming the cross-regional flow of labor and cross-regional diffusion of knowledge and technology, etc, and also bringing a change in research perspective, and since the sociologist Castells M (Manuel Castell) proposed the flow space theory, scholars at home and abroad have conducted systematic research from different perspectives.

Foreign studies were initiated by Manuel Castor, who made the initial explanation and description of flow space, Peca Hermannen, who further emphasized the importance of material support, Felix Stender, who incorporated flowing information into the system, Hanley, who specified flowing information as people, logistics, information, value, culture,

capital, technology and knowledge flows, and Thrift, who predicted that the spatial structure of the global economy will show a networked pattern, and Sasson, who pointed out that agglomeration and diffusion are the manifestations of networkedness.

Domestic research is also rich, including the exploration of the theory of flow space itself, which finds that the flow space in the information age has dual properties of virtual space and physical space, with regional development effects such as association, agglomeration, diffusion and divergence, and the flow of factors guided by information flow has formed new regional advantages, and in view of the characteristics of China's economic and social development, the scale of the flow space should not be too large. In view of the characteristics of China's economic and social development, the scale of the study should not be too large, and the government and the market are the main rulers of the development of the flow space, and at the same time, we should pay attention to the measurement of relevant "flows", and combine with big data for more detailed data collection. The collected "flow" data have been applied to the study of urban and regional spatial structure, and capital flow has been used as an important basis for classifying urban nodes, and information flow, traffic flow, human flow, and capital flow have been used to study the spatial network structure of urban clusters. The intensity of urban flows is used to reflect the degree of external connection and radiation of a city, and the evolutionary characteristics of urban association networks are studied in conjunction with gravity models. The flow of factors needs to be accomplished by modern infrastructure, and modern transportation modes such as railroads and passenger transport accelerate the flow and integration of factors between regions, which in turn leads to an increasing exchange of heterogeneous knowledge, thus bringing about knowledge innovation, increasing output, and promoting regional development. Extended research combining flow space theory has also made corresponding developments, such as studying industrial transfer, regional governance, urban cluster deformation structure identification, integrated urban-rural development, geo-economics, and regional cultural forces.

B. Overview of power space theory

Power is a dominant force, such as governmental authority determines the policy direction or the power delegated to other groups, the amount of power resources determines the social status and unequal relationship of power subjects, and the diversity of power resources in turn makes it necessary to negotiate, negotiate and exchange between different power subjects to achieve the final purpose. And space is the core concept of human geography research and has developed its connotation and extension in the era of globalization. The theoretical perspectives of Western scholars on the study of power space include Lefebvre's theory of spatial production, Foucault's theory of power space and David Harvey's critical theory of capital, with research themes focusing on the material imagination of power space, the construction and reconstruction of power space, the relationship between power space and discourse, identity and politics and the power space of special groups.

In contrast, domestic research on power space has diversified and is often related to urban planning, power changes, and regional economy. The earlier spatial configuration pattern of provincial government power formed based on geographic space has been continuously improved, the construction of special economic zones has extended local power and formed special economic space, the new urban space and regional economic system formed across administrative boundaries has become a new engine of economic growth, the construction of geographic infrastructure under government-led and market participation has continuously prompted multiple elements to circulate and stay within the government-managed space, the government plays a more active role in economic activities, and the formation of a new governance network continues to improve the healthy development of the regional economy. At the same time, the main body of power has shifted from the monolithic dominance of government to the joint role of multiple forces of government, market and citizens, and power shifts continue to influence the formation of new urban spaces, with the dominant role of the will of local governors being particularly important. In addition, government and business-based growth alliances and farmer-based anti-growth alliances likewise influence regional economic development, and the construction of smart cities is imminent.

C. The inner logic of flow space and power space

Flow space and power space are both important concepts in sociology and geography, and both studies involve cities, regions, factors, governments, and markets. The theory of flow space provides a research perspective on the interaction between information networks and geographic space, and although ICTs can weaken to a certain extent the restrictions of factor flow brought by geographic space, they cannot completely ignore their influence, and geographic space is inevitably influenced by the division of administrative and economic zones. The internal logic between "flow space" and "power space" is self-evident, and the "flow space" dominated by both government and market power will eventually be a new type of "power space".

This paper aims to introduce the power factor into the study of flow space from the perspective of economics and the development characteristics of the times, to link flow space and power space, and to prove that flow space is a new type of power space, so this paper will conduct a first theoretical investigation.

III. Variable Selection, Model Setting and Empirical Analysis

A. Variable Selection

Selection of explanatory variables. The explanatory variable in the model is the flow of technology factors, which must depend on a specific material factor to play its role, either in the form of an increase in human capital or in the productivity of material capital such as machinery. In order to ensure data availability and reliability, the change in the number of people employed in urban units of scientific research and technical services in each province engaged in and possessing technology

is selected here as the explanatory variable and is taken as a positive number.

Selection of explanatory variables. In this paper, two explanatory variables and four control variables will be mainly selected. Among the explanatory variables are market power and government power, and since there is no better literature available on the measurement of market power and government power, this paper combines Zhu Heping's measurement of market power with the concentration ratio of industries in 1998, Jia Junxue's representation of market power with the degree of imperfect competition in 2010 and Lu Pingyue's representation of market power with money in 2013, the and the conclusion that technology marketization policies can promote technology transfer proposed by Jinhong Mi in 2020, the proportion of technology market turnover to regional GDP that can express the results of technology transfer will be selected to represent market power, and its larger proportion indicates greater market power; for government power, refer to the article of Rui Wen in 2011 and the proposal of Jinhong Mi in 2020 that when the government engages in basic R&D In terms of government power, referring to Wen Rui's article in 2011 and Mi Jinhong's conclusion in 2020 that when the government engages in basic R&D, both private sector innovation and technology transfer will accelerate, the share of local fiscal science and technology expenditure in regional GDP that can express government investment in basic R&D will be selected to represent government power, and again, a larger share indicates greater government power.

There are many factors affecting the flow of technology factors, and in addition to the two key explanatory variables, the following variables will be selected as control variables. Wage level, regions with high average wage levels are likely to attract talent clusters and drive the flow of technology factors. Transportation level, railroads, as an important cross-province transportation mode, are the main way for the flow of people carrying technology factors, and railroad mileage is an important indicator reflecting the level of development of railroad transportation industry. Education level, the level of social culture also plays an important role in attracting the concentration of technology factors. Medical level, the level of medical care provides health protection for people carrying technology factors and attracts the inflow of technology factors.

The above data were selected from relevant data of 31 provinces (except Hong Kong, Macao and Taiwan) for a total of 11 years from 2009 to 2019, and the data sources were taken from the website of the National Bureau of Statistics, and the missing data were made up according to the actual distribution of the data, and the setting of relevant variables and their descriptive definitions are shown in Table 1, where the calculation of technology factor flow is explained, such as in Beijing in 2019 Technology factor flow is calculated as the absolute value of the difference between the number of employed persons in urban units of scientific research and technology service industry in Beijing in 2019 and the number of employed persons in urban units of scientific research and technology service industry in Beijing in 2018. All other variables are calculated as the ratio of the corresponding values in that year.

TABLE I. Variable settings and their descriptions.

Variables	Variable Symbols	Variable Description
Technology factor flow	FL	FL=Change in the number of persons employed in urban units of the regional scientific research and technical service industry
Market Power	MP	MP=Regional Technology Market Turnover / Regional Gross Domestic Product
Government Power	GP	GP=Regional financial science and technology expenditure / Regional Gross Domestic Product
Wage level	WL	WL=Average wage of urban unit employees in scientific research, technical services and geological exploration in the region / National average salary of employed persons in urban units of scientific research, technical services and geological exploration
Transportation Level	TL	TL=Regional railroad mileage / National railroad mileage
Medical level	ML	ML=Number of regional hospitals / Number of hospitals nationwide
Education Level	EL	EL=Regional average of higher education schools per 100,000 population / National Average number of students in higher education per 100,000 population

B. *Model Setting*

Synthesizing the above analysis, we construct the following basic panel data econometric model.

$$FL_{i,t} = \alpha_0 + \alpha_1 MP_{i,t} + \alpha_2 GP_{i,t} + \alpha_3 WL_{i,t} + \alpha_4 TL_{i,t} + \alpha_5 EL_{i,t} + \alpha_6 ML_{i,t} + \mu_t + \gamma_i + \varepsilon_{i,t}$$

where the subscripts i and t denote sample and time (expressed as year in this paper), respectively, μ_t denote time fixed effects, and γ_i denote area fixed effects, $\varepsilon_{i,t}$ for the random error term.

C. *Empirical analysis*

Descriptive statistics. All data were imported into Stata software for empirical evidence and the panel data type was determined to be a balanced panel. The descriptive statistics for all variables are shown in Table 2, and the number of valid observations for each variable in each province is 341.

TABLE II. Descriptive statistics of each variable.

	Median	SD	Min	Max	Obs
FL	0.9577713	1.5163150	0.0000000	10.8000000	341
MP	0.0129264	0.0246248	0.0000000	0.1606789	341
GP	0.0045070	0.0025727	0.0015534	0.0136771	341
WL	0.8565183	0.2660566	0.5227250	1.8724240	341
TL	0.0322676	0.0188420	0.0035088	0.1000000	341
EL	1.0269270	0.3572536	0.4802486	3.0122180	341
ML	0.0322581	0.0179534	0.0042899	0.0789219	341

From Figure 1, we can see that the flow of technology factors over time fluctuates greatly in four provinces: 1, 9, 10 and 19, representing Beijing, Shanghai, Jiangsu and Guangdong provinces respectively. Shanghai is the financial center of China, and the absolute amount of local financial expenditure on science and technology is in the top; Jiangsu Province and Guangdong Province are the major economic provinces in China, and the absolute amount of regional GDP and local financial expenditure on science and technology are always in the top two, and the technology market turnover is also very high (the corresponding graphs are not shown here for space reasons). Thus, it can be seen that the flow of technology

factors is closely related to government power and market power in both theoretical and practical data, which in practice also supports the theoretical and practical significance of this paper's research.

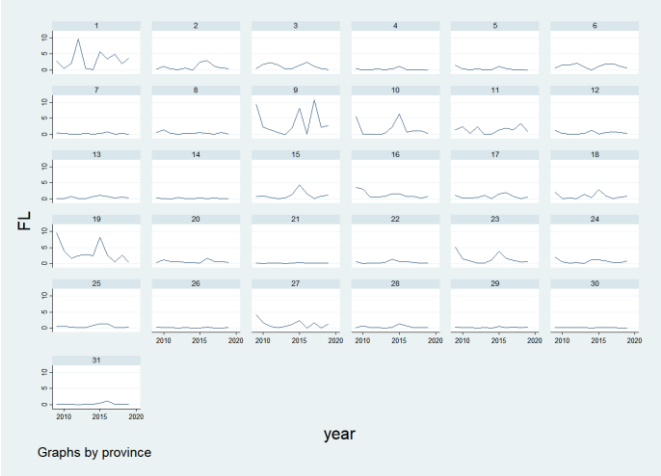

Figure I. Time trend of the explanatory variable FL in 31 provinces.

Panel unit root test. Before estimating the above model, a panel unit root test is performed, here HT test is used and the test results are presented in Table III, from the results in Table III. It can be seen that $\hat{\rho}$ = -0.1114, while z = -18.9030 and the corresponding p-value is 0.0000, so the original hypothesis of panel unit root is strongly rejected and the panel is considered as a smooth process.

Model test. After the conclusion that the panel is smooth the model is selected and the test results are shown in Table IV. According to the results of Stata program operation, the two-way fixed effects model should be used.

TABLE III. Panel unit root test results.

	statistic	z	p-value
rho	-0.1114	-18.9030	0.0000

TABLE IV. Model test results.

	P-value	Select results
Mixed regression or fixed effects model?	0.0092	The original hypothesis is strongly rejected and a fixed effects model should be used
Fixed effects or random effects models?	0.0000	The original hypothesis is strongly rejected and a fixed effects model should be used
Is there a two-way fixed effect?	0.0000	The original hypothesis is strongly rejected, so there is a two-way fixed effect

Analysis of baseline regression results. Table V shows the results of the benchmark regressions of mixed OLS, fixed effects (FE_robust), fixed effects (FE), random effects (RE_robust), random effects (RE) and two-way fixed effects (FE_TW) obtained using the panel data econometric model, from the results it can be seen that the effects of both market power and government power under two-way fixed effects are not significant, probably due to Due to the complexity of the time effect (i.e., technological progress independent of province, etc.), the market power under the fixed effect considering only regional differences is significant at the 5% level, while the market power has no significant effect, indicating that the market power plays a more important role and the market is the key factor to promote the flow of technological factors. Therefore, administrative intervention should be reduced and the main position of the market should be brought into play.

TABLE V. Baseline regression results.

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	FE_robust	FE	RE_robust	RE	FE_TW
MP	7.104**	23.60**	23.60*	8.069**	8.069	15.91
	(3.247)	(10.88)	(13.50)	(3.144)	(5.071)	(10.46)
GP	101.9	7.589	7.589	94.30	94.30*	-12.51
	(75.86)	(93.27)	(69.03)	(81.57)	(50.36)	(97.24)
WL	1.826***	-1.619	-1.619	1.642***	1.642***	-1.202
	(0.493)	(1.307)	(1.134)	(0.516)	(0.505)	(1.252)
TL	2.899	27.38	27.38	1.785	1.785	20.27
	(3.173)	(35.88)	(32.57)	(3.251)	(5.757)	(31.82)
EL	-0.100	1.056*	1.056	-0.0419	-0.0419	1.023**
	(0.281)	(0.622)	(0.861)	(0.248)	(0.354)	(0.490)
ML	21.87***	-0.147	-0.147	21.68***	21.68***	-0.621
	(4.830)	(15.29)	(25.98)	(4.837)	(5.443)	(14.92)
_cons	-1.853***	0.0419	0.0419	-1.692***	-1.692***	0.920
	(0.444)	(0.971)	(1.495)	(0.417)	(0.463)	(0.862)
Regional fixed effects	Y	Y	Y	Y	Y	Y
Time fixed effects	Y	Y	N	Y	Y	Y
Sample size	341	341	341	341	341	341
R2	0.276	0.022	0.022			0.179

Note: Standard errors are in parentheses, *, **, *** indicate significant at the 10%, 5% and 1% levels, respectively.

IV. POLICY RECOMMENDATIONS

Firstly, strengthen the construction of basic technology investment. In the data and information era, it is especially important to focus on the wide application of information and communication technologies such as 5G, big data and cloud computing, so that information technology can drive the free flow of various factors in the networked spatial pattern and strengthen the connection with the extra-regional market with

the intra-regional market as the main body, and thus achieve good time-economic benefits.

Secondly, strengthen regional internal and external linkage. In the process of developing regional economy, attention should be paid to internal and external linkage, coordinating the flow of multiple factors in the region and building a regional development consortium. On the one hand, it is necessary to strengthen the timely processing and feedback of information by the region itself, and make reasonable use of market behavior and government planning for regional structure optimization; on the other hand, it is necessary to actively establish links with other regions to form good cooperative and competitive relations to achieve the goal of coordinated regional development and economic growth. Accurately locate the center and node position of the region in the networked spatial pattern to realize the role of factor agglomeration and diffusion.

Finally, coordinate the distribution of market and government power. Coordinate the distribution of market and government power, let the government do a good job of macro planning, central cities strengthen their functions, and do a good job of introducing elements while also appropriately exporting them to ensure the balanced development of each central city and node city in the region. Appropriately decentralize government power to further strengthen government efficiency, while giving full play to the role of market mechanisms. In fact, the development of China's flow space is more obviously controlled by administrative forces, and it is difficult to bring into play the full strength of the flow space in the information age in the short term, and it is necessary to strengthen the construction of a dominant system based on technological innovation and market orientation in the future.

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