



Research on the Impact of Digital Economy on Local Tax Revenue—PVAR Model Analysis Based on Chinese Provincial Panel Data

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Abstract. The digital economy has been clearly identified as an important means to promote China's economic development in the 14th Five-Year Plan. While promoting regional development, it also affects local tax revenues. Based on the provincial panel data of 30 provinces from 2011 to 2020, this paper constructs an index system to measure the development of provincial digital economy through Internet penetration rate, number of Internet practitioners, Internet-related output, number of mobile Internet users and digital inclusive financial index, and explores the dynamic interaction between digital economy and tax revenue by using PVAR model. The results show that the digital economy has a long-term positive impact on regional tax revenue, but the impact of tax revenue on the digital economy is not significant. It is suggested that local governments should seize the opportunity of the development of the digital economy, conserve tax sources and increase tax revenue on the one hand, and make good use of digital information technology to accelerate the construction of tax information on the other hand.

Keywords: Digital Economy · Tax Revenue · Economic Development

1 Introduction

The digital economy with the core content of 5G, industrial Internet, artificial intelligence, cloud computing, big data and other new generation of information technology research and development and application has gradually become the backbone of promoting high-quality economic growth. At present, China's economic development is in the growth rate shift period, structural adjustment pains period, the early policy digestion period three superimposed stage, emphasizing the steady economic growth, making local taxes subject to certain restrictive effects. At the same time, due to the unprecedented changes in the world and the global pandemic of the new coronavirus epidemic, China's economic and social development environment is more complicated. In this special environment, local taxation is facing tremendous pressure. In the current era of digital economy, digital economy creates growth momentum for local tax revenue by optimizing structure and improving production efficiency. This paper uses empirical methods to test the impact of digital economy on local tax revenue.

2 Variable Description and Data Sources

2.1 Digital Economy Evaluation System

The digital economic evaluation system includes two levels: the first level index and the second level index. The first level index is the digital economy index, which fully reflects the development level of China's digital economy. The secondary indicators include five indicators: Internet penetration rate, number of Internet practitioners, Internet-related output, number of mobile Internet users, and digital inclusive financial index, reflecting the five dimensions of digital economic development in various regions of China. Among them, the number of Internet practitioners with information transmission, software and information technology services in urban units employed persons accounted for the proportion of urban units employed persons. Internet-related output is expressed as the ratio of telecommunications business volume to the year-end resident population. All selected indicators are positive.

2.2 Calculation of Digital Economic Index

Through the principal component analysis method (PCA), the data of the above five indicators are standardized and processed in Dimensionality Reduction. Then we can get the digital economic index of each province, which is recorded as Z. Specifically, in the first step, the data of each index is dimensionless processed by means of averaging, the negative index is reciprocal first. The second step is to determine the weight of each index by PCA, and input with the covariance matrix of the basic index. The third step is to calculate the comprehensive index of the principal components according to the index weight.

The calculation results are shown in Table 1. According to the digital economy index of all provinces (autonomous regions and municipalities), the overall development level of digital economy from 2016 to 2020 is still low, and the regional development level is quite different. The digital economy development level of Beijing, Shanghai, Guangdong, Zhejiang, Jiangsu and other places is far ahead of other regions. However, the development level of digital economy is gradually improving.

Table 1. Digital economy index of 30 provinces in 2016–2020

Provinces	2016	2017	2018	2019	2020
Beijing	4.3670	4.8185	5.7985	6.6143	7.4159
Tianjin	0.8407	1.1953	1.8901	2.4202	3.0750
Hebei	0.4185	0.7310	1.2523	1.7732	2.1312
Shanxi	0.3984	0.6592	1.1112	1.5692	1.9806

(continued)

Table 1. (continued)

Provinces	2016	2017	2018	2019	2020
Neimenggu	0.5814	0.9883	1.5899	2.0612	2.4793
Liaoning	0.9990	1.3566	1.7539	2.1649	2.5003
Jilin	0.6343	0.9912	1.4711	1.8882	2.2185
Helongjiang	0.4322	0.8157	1.2021	1.7418	2.2448
Shanghai	2.3334	2.7997	3.6833	4.3915	5.1669
Jiangsu	0.8580	1.1812	1.9004	2.5059	2.7110
Zhejiang	1.3480	1.7514	2.3895	3.1035	3.3507
Anhui	0.0971	0.4350	0.9750	1.5241	1.9597
Fujian	0.9860	1.2887	1.8183	2.2677	2.4709
Jiangxi	-0.0301	0.3457	0.8796	1.4007	1.8246
Shandong	0.5178	0.7915	1.2507	1.6647	2.0156
Henan	0.0521	0.3981	0.9763	1.5385	1.9805
Hubei	0.3951	0.7629	1.3737	2.0549	2.3684
Hunan	0.0384	0.3305	0.8428	1.3871	1.8466
Guangdong	1.5851	1.9981	2.8593	3.3762	3.6290
Guangxi	0.0446	0.3677	1.0360	1.4842	2.0083
Hainan	0.6446	1.0685	1.7429	2.2060	2.5167
Chongqing	0.3927	0.7780	1.3876	1.8934	2.2477
Sichuan	0.5218	0.8583	1.4427	1.9031	2.3951
Guizhou	0.1089	0.5707	1.2740	2.0206	2.5295
Yunnan	0.0592	0.4180	0.9392	1.6011	2.1209
Shanxi	0.7977	1.1694	1.9370	2.4257	2.7851
Gansu	0.0263	0.4388	1.0420	1.6262	2.0404
Qinghai	0.4403	0.8571	1.6173	2.0713	2.5309
Ningxia	0.4966	0.9083	1.5723	2.0238	2.3671
Xinjiang	0.2659	0.4365	1.0197	1.7146	2.3621

2.3 Data Sources

The purpose of this paper is to study the relationship between the digital economy and local tax revenue. Therefore, the tax revenue (tax) and the digital economy index (t) of 30 provinces from 2011 to 2020 are selected as the research samples. Among them, the data of tax revenue are all from the provincial statistical yearbooks. The data used by the provincial digital economy index are from the official website of the National Bureau of Statistics, the China Statistical Yearbook, the China Financial Yearbook, and the China

Urban Statistical Yearbook. For individual missing data, the interpolation method and the trend extension method are used to supplement the integrity.

3 Empirical Analysis

3.1 Model Design

PVAR model is an innovative method of vector auto regression of panel data proposed by Holtz-Eakin in 1988, which has been widely used and optimized in practice. It is a mature method that can truly reflect the dynamic interaction between panel data. The advantage of this method is that it does not need to explore the internal relationship logic between variables in advance, nor does it need to consider the endogenous, exogenous and causal relationship of variables. Instead, all variables are regarded as endogenous variables and put into the model for analysis.

3.2 Stationarity Test of Variables

In order to ensure the robustness of the regression results and avoid the occurrence of “pseudo regression”, it is necessary to conduct a stationarity test on the variables before using the PVAR model. LLC test and IPS test are selected. LLC test is for common unit root, while IPS test is for individual unit root. Table 2 shows the results of stationarity test. The test results show that the digital economy (z) and tax revenue (tax) show stable characteristics, and the PVAR model can be established.

Table 2. Variable stationarity test

Variable	LLC Statistic	Prob	IPS Statistic	Prob
Tax	-3.2145	0.0007	7.6921	0.0000
T	-8.2633	0.0000	9.0788	0.0000

Table 3. Determination of Lag Order

Lag	AIC	BIC	HQIC
1	13.918*	14.853*	14.2944
2	15.0732	16.1635	15.5136
3	15.1998	16.4832	15.7199
4	15.7846	17.3161	16.4067
5	14.1311	15.9961	14.8887

Table 4. Variance Decomposition

Periods	Tax	t
1	1	0
2	0.966	0.034
3	0.918	0.082
4	0.878	0.122
5	0.85	0.15
6	0.832	0.168
7	0.822	0.178
8	0.817	0.183

3.3 Determination of Lag Order

In order to perform PVAR estimation, the required optimal lag order needs to be tested. According to AIC, BIC and HQIC information criteria, the optimal lag order of this model is order 1. The results are as follows (Table 3).

3.4 Impulse Response Analysis

1 and 2 in Fig. 1 respectively show the reaction of tax revenue after being impacted by tax revenue and digital economy. It can be seen from the figure that when the tax revenue is impacted by itself, it will form a positive response in the short term, reach the maximum value in the current period, and then decrease rapidly. After the lag of 4 periods, the response value will be stable and tend to zero. When the tax revenue is impacted by the digital economy, it shows the characteristics of rising first and then falling. It reaches the maximum value in the third period, then gradually decreases, always positive, and tends to zero in the long term, indicating that the role of the digital economy on local tax revenue is always positive. With the development of digital economy, the impact on local tax revenue is increased first and then decreased.

3 and 4 in Fig. 1 respectively show the reactions of the digital economy after being impacted by the digital economy and tax revenue. When the digital economy is impacted by itself, it will form a positive response in the short term, and reach the maximum value in the current period, and then rapidly decrease. After it becomes negative, the response value will be stable and tend to zero. This shows that the increase of local tax revenue can bring a positive impact on the digital economy in the short term, but it will soon have a restraining effect.

3.5 Variance Decomposition

As the complementary analysis of impulse response, variance decomposition describes the contribution of impact variables to the changes of variables in the system. As shown in Table 4. Since the decomposition results have not changed much since the 9th period, and

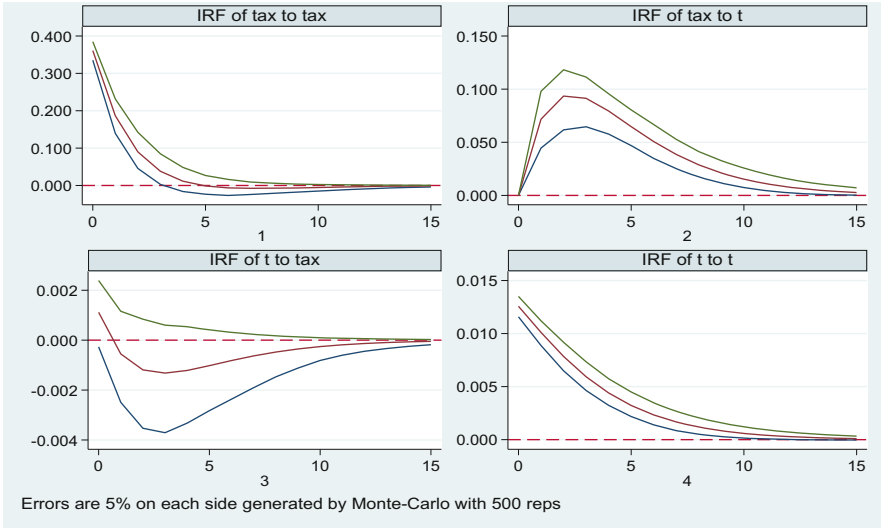


Fig. 1. Impulse response diagram

the variable fluctuation tends to be stable, Table 4 only shows the variance decomposition results of the first 8 periods.

In the variance decomposition of tax revenue, the contribution of digital economy to tax revenue is increasing, and the influence is significant. The contribution of digital economy to tax revenue is 8.2% in the second lag period and 18.3% in the eighth lag period, which indicates that digital economy is an important factor affecting tax revenue.

4 Conclusions and Suggestions

4.1 Conclusion

Based on the provincial-level panel data and using the digital economy index of 30 provinces (autonomous regions and municipalities directly under the Central government) from 2011 to 2020, this paper empirically analyzes the impact of digital economy on local government tax revenue and draws the following conclusions: Digital economy plays a significant role in supporting local tax revenue. This kind of influence effect presents the parabola form which rises first and then decreases; The increase of local tax revenue has a weak effect on the development of local digital economy.

4.2 Suggest

First, the government should make good use of the development of the digital economy to increase local tax revenue. Enhance big data, cloud computing, chain blocks, artificial intelligence and other digital economy core plate support, enhance the level of regional digital economy, it is advantageous to the growth of residents' income and consumption, but also to entrepreneurship and employment market, and let more people

benefit from the development of the digital economy, so as to realize the digital economic development lead to the growth of tax revenue. It is necessary to pay attention to the economic characteristics of the region and formulate development policies according to local conditions. Regions with poor regional economic foundation can vigorously develop digital economy and seize development opportunities, while regions with good regional economic foundation can enable digital to empower traditional industries and achieve high-efficiency economic growth.

Second, the government should make good use of the opportunity of the development of digital economy to strengthen the construction of tax information. To make good use of digital information technology, specifically, one is artificial intelligence technology. This technology aims to simulate and expand human intelligence, which can effectively facilitate the collection, analysis and management of tax-related information data, and improve the efficiency of intelligent management of tax data. The second is blockchain technology. It is a distributed shared database, which has the advantages of decentralization, trace, traceability, non-tampering, openness and transparency. It can effectively solve the problems of information closure, forgery and tampering, and can establish a reliable tax coordination mechanism based on it. The third is big data technology. Big data applications can facilitate tax compliance and optimize tax payment services. Through the analysis, mining and application of data information obtained from big data, tax non-compliance behaviors can be effectively identified and tax management risks can be reduced.

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