Research on Dynamic Co Integration of Urban Traffic Motorization Process and Economic Development

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Abstract: In recent years, China has gradually entered the era of motorized transportation. After the 21st century, the trend of urban traffic motorization in China is obviously accelerated. Motorized transportation has shortened the spatial distance of the city, which has changed the spatial structure of the city greatly, and the social activity radius of residents has greatly increased. Traffic motorization also further promotes the process of urbanization. Car traffic and public transport are the two main modes of urban traffic motorization. The number of small cars is increasing explosively. Urban traffic problems are increasing day by day, and traffic congestion is becoming more and more serious. What is the internal relationship between the motorized process of urban traffic and China's economic development. Based on the time series data of the number of private cars and macro-economic GDP, this paper studies the internal relationship between urban traffic motorization and macroeconomic development, and comprehensively uses ADF stationary test, VAR model, Granger causality test method and impulse response analysis function. The results show that the number of private cars and macroeconomic GDP data are non-stationary time series. The development of macro-economy is the Granger cause of the increase in the number of private cars, while the process of urban traffic motorization is not the Granger Cause of economic development. The results of VAR model show that there is a short-term interactive relationship between macroeconomic growth and urban traffic motorization. Generally speaking, the economic development has brought about the prosperity of automobile market and promoted the process of urban traffic motorization.

1. Introduction

1.1 Research Background

Urbanization is a worldwide phenomenon. More than half of the world's population lives in cities. Since the reform and opening up, China's social economy has developed rapidly, and the process of urbanization has been advancing continuously. At present, China is still in the stage of accelerated urbanization. With the continuous acceleration of urbanization, more and more people gather in the city, and the coverage of the city is becoming wider and wider, which requires more and more traffic in the urbanized areas, and makes the urban transportation system have a great development both in transportation mode and in technical means. Traffic motorization is accompanied by the continuous acceleration of the process of motorization, which directly promotes the development of urban transportation and industry, Social and economic activities have become more active. However, with the development of urbanization to a certain extent, the number and quality requirements of residents' travel increase, the city's motor traffic activities become more frequent, the urban traffic resources decrease, the urban traffic problems gradually increase, and the problems of traffic congestion, energy consumption and pollution become more and more serious. Car traffic and public transportation are two main modes of urban traffic motorization, which promote economic development. China has entered a stage of rapid development of modernization, urbanization and motorization. Profound changes have taken place in the quantity and quality of traffic demand. The contradiction between the rapid development of car traffic and the lagging public transport has become increasingly prominent, which leads to the unbalanced development of urban economy and traffic motorization. How to coordinate the relationship between car and public

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transport development, optimize the urban emergence structure, and promote the harmonious development of urban traffic motorization is the core part of the current urban traffic problems.

Based on the research results of urban traffic motorization and economic development at home and abroad, this paper introduces the co integration theory, and proposes to adopt the quantitative research method to analyze the urban traffic motorization developed by small cars. The empirical results show that there is a long-term co integration relationship between urban traffic motorization and economic development. Economic development is the Granger cause of urban traffic motorization, while urban traffic motorization is not the Granger cause of urban economic development. The results of VAR model show that urban traffic development has a significant two-way promoting effect on the progress of urban traffic motorization. The results of impulse response analysis show that urban traffic motorization has a positive impact on economic development in the short term. Combined with the urban social and economic development, the author hopes to find out the reasons for the transitional growth of car traffic from a quantitative perspective, and analyze the contribution of private transport development to urban economic development.

1.2 Research Purpose and Significance

This paper starts with the urban traffic theory, introduces the co integration theory, analyzes the urban traffic motorization and social and economic development, through data analysis, combined with the co integration idea, constructs the analysis model of urban traffic motorization and economic development, and carries out empirical analysis from two aspects of small cars and public transportation, hoping to find out the urban traffic mobility through specific quantitative analysis In the process of urbanization, the internal relationship between the development of car traffic and the development of social economy.

At present, the research on the relationship between urban traffic motorization and economic development is mainly qualitative, quantitative research is relatively less, and more simple mathematical statistical methods are used. In this paper, the co-integration theory, a more advanced and practical econometric method, is applied to the quantitative analysis of urban traffic motorization and economic development, and the idea of econometrics is applied to urban traffic problems. In the aspect of traffic research, it is conducive to quantitative, in-depth and meticulous research.

In this paper, the co integration theory is used to build a quantitative co integration analysis model of car traffic and public transport. The quantitative model can be used to diagnose the urban traffic problems in the process of motorization. It is helpful for the government to recognize the root causes of the transitional development of car traffic and find out the hindering factors of slow development of public transport, so as to formulate reasonable traffic policies and optimize the urban traffic structure To provide some theoretical support.

2. Urban Traffic and Co-Integration Test Theory

Urban traffic and urban economy are the basis of the study of urban problems. From the perspective of the interaction between traffic and economy, the analysis of the impact of urban traffic on urban economy and urban economy on urban traffic is conducive to the research and analysis of the mutual directivity of urban traffic and urban economy. Starting from the theory of the relationship between urban traffic and urban economy, the co-integration theory is introduced to lay the foundation for the follow-up quantitative research.

2.1 Definition of Related Concepts

2.1.1 Urban Economy

City is a kind of social and economic phenomenon, which exists objectively. The emergence of city has a history of more than 5000 years. From the point of view of population statistics, the city is a special form of settlement with a certain population size and mainly non-agricultural population;

from the function point of view, the city is the spatial structure system of human activities, with multiple functions and various forms; From the point of view of its essential characteristics, a city is the concentration of population, production tools, capital, enjoyment and demand; from the perspective of system and synthesis, the city is a large spatial and regional system with human beings as the main body, space and natural environment utilization as the specific, and the purpose of gathering economic and social benefits to concentrate population, economy, science, technology and culture.

Urban economy refers to the regional economy formed by various non-agricultural economic sectors such as industry and commerce. Urban economy is a regional economy with the city as the carrier and development space, the prosperity and development of the secondary and tertiary industries, the continuous optimization of economic structure, the high concentration of capital, technology, labor, information and other production factors. Urban economic development is an important material basis for urban functions.

2.1.2 Urban Traffic

City is a settlement form with a certain scale of population, while traffic refers to the transfer and flow of people and objects in the spatial position. Traffic is generated with people's social production and living activities. Urban traffic refers to a series of transportation activities, such as people flow and logistics, which are required by the residents in urban areas and suburbs for their normal work, life and study. Urban traffic is a whole composed of means of transportation, transportation routes, traffic management, service facilities and traffic participants. From the perspective of urban traffic and urban space, urban traffic is usually divided into urban internal traffic and urban external traffic; from the perspective of characteristics and functions, urban traffic can be divided into the following three types: transit traffic, inbound and outbound traffic and mixed traffic. Urban traffic is an important part of the whole city and an important subsystem of a large urban system.

2.1.3 Traffic Motorization

From the development history of cities and transportation, the development of cities needs the support of traffic motorization. It is undeniable that in the past quite a long time, minicars have been the most influential manifestation of traffic motorization, which has brought about the most profound and thorough changes in urban traffic. Therefore, it is a misunderstanding that some people regard the popularization of cars as motorization.

Motorization refers to the process of moving people and objects by replacing human and animal power by means of mobility. Traffic motorization refers to the motorization of means of transportation. With the development of society and the further improvement of living standards, people tend to choose a more comfortable and efficient way of appearance, which is a natural choice. The essence of traffic motorization is the mechanization of means of transportation. Mechanical transportation replaces human and animal power. Traffic motorization is the inevitable trend of the development of transportation means. In different countries, regions and cities, there are differences in the development stage and performance characteristics of motorization. This difference is mainly reflected in the difference of the mainstream motorized transportation modes. Motorcycles, cars, public transportation and rail transit are typical representatives of motorization.

2.1.4 Co-Integration Test

Co-integration represents a long-term stable equilibrium relationship, that is, for a group of non-stationary time series, there is a stable linear combination, which is the co-integration equation. Co-integration test was first proposed by Grange in 1978. It is the main method used to analyze non-stationary time. This method is analyzed through linear adjustment mechanism. It is a kind of linear co-integration. With the deepening of economic research, simple linear co-integration test is difficult to meet the requirements. In 1997, balk and Formby proposed a non-linear co-integration test method. From the perspective of the object of co-integration test, there are two types of co integration test: one is the test method with regression residual as the test object, mainly including

DF test, ADF test; the other is the test method with regression coefficient as the test object, such as Johansen test, this paper mainly uses Johansen test method.

2.2 Urban Traffic Theory

As the basic carrier of human, material and information displacement in space, urban traffic is the basic condition to ensure the basic operation of the city and realize the basic functions of the city. With the rapid development of social economy and the further advancement of urbanization, urban traffic demand and total traffic volume are are higher than before. With the development of urban traffic problems, the travel structure of urban transportation system presents a disordered development trend, and urban traffic investment is difficult to play its corresponding macro-control role.

Urban transportation system, also known as urban transportation system, is to use the means of transportation in urban area to connect the place where the traffic occurs and the traffic destination, so as to realize the spatial displacement of passengers and goods. At the same time, the city is a regional system integrating market, population, industry, land and other factors, and its corresponding radiation intensity is different in different spatial scales, so the urban transportation system has its corresponding characteristics.

(1) Social and economic functions of urban transportation system

As a basic part of a city, urban transportation system is closely related to urban development. Transportation plays an important role in urban development and urbanization process, and its direct and indirect benefits are obvious. Urban transportation system is an important part of urban spatial integration, and urban transportation network is the premise of urban activities. A perfect urban transportation network realizes the interoperability and accessibility of different spatial nodes in the city, which makes all kinds of urban activities possible. On the contrary, the serious lack of urban traffic network leads to traffic paralysis, which will directly lead to the suspension of urban production and living activities. It can be seen that the urban traffic system is an interdependent body of urban activities, providing traffic needs, meeting the traffic balance and ensuring the normal and efficient operation of the city. The rapid and large capacity transportation system can greatly improve the transportation capacity, expand the radius of social production and living activities, and accelerate the process of urbanization and the pace of urban development. A strong public transport system can optimize the mode of travel, save road resources and reduce traffic environmental pollution, which is conducive to the healthy and orderly development of urban traffic.

(2) Structural composition of urban traffic system

System structure refers to the stable contact way, aggregation state, sorting and spatial configuration among the interrelated factors in the system. Urban transportation system is a general term for urban transportation activities jointly carried out by means of transportation, transportation infrastructure, drivers, passengers or goods, as well as relevant traffic management departments and systems.

3. Empirical Results

Using the time series data of China's private cars and GDP from 1950 to 2018, this paper analyzes the dynamic relationship between China's urban traffic motorization and China's economic growth. The figure 1 and figure 2 shows the development process of the number of private cars in China and the development process of China's GDP since 1950. The results show that China's economic growth and the number of private cars maintain a high growth trend, so this paper makes a logarithmic treatment of the time series of China's economic growth and the number of private cars.

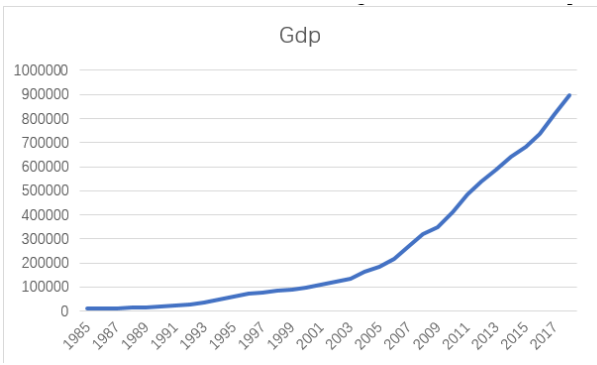

Fig.1 The Development Trend of China's Gdp

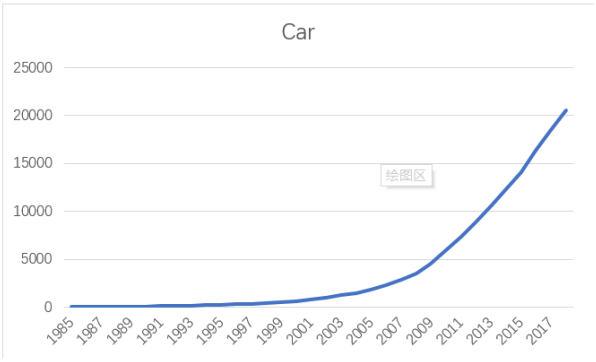

Fig.2 The Development Trend of the Number of Private Cars in China

3.1 Stationary Test

The table 1 shows the stationary test results of the number of private cars and the time series of urban economic development. The results show that lncar and lnGDP are both non-stationary time series, and the first-order difference sequence is stationary time series. Therefore, lncar and lnGDP are both time series of first-order integer.

Table 1 Stationary Test Of Lncar

Null Hypothesis: LNCAR has a unit root				
Exogenous: Constant				
Lag Length: 1 (Automatic - based on SIC, maxlag=8)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.623876	0.4591
Test critical values:	1% level		-3.653730	
	5% level		-2.957110	
	10% level		-2.617434	
*MacKinnon (1996) one-sided p-values.				

Table 2 Stationary Test Of d(Lncar)

Null Hypothesis: D(LNCAR) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=8)				

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.492680	0.0148
Test critical values:	1% level		-3.653730	
	5% level		-2.957110	
	10% level		-2.617434	
*MacKinnon (1996) one-sided p-values.				

Table 3 Stationary Test Of Lngdp

Null Hypothesis: LNGDP has a unit root				
Exogenous: Constant				
Lag Length: 4 (Automatic - based on SIC, maxlag=8)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.542607	0.1163
Test critical values:	1% level		-3.679322	
	5% level		-2.967767	
	10% level		-2.622989	
*MacKinnon (1996) one-sided p-values.				

Table 4 Stationary Test Of d(Lngdp)

Null Hypothesis: D(LNGDP) has a unit root				
Exogenous: Constant				
Lag Length: 3 (Automatic - based on SIC, maxlag=8)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.715059	0.0837
Test critical values:	1% level		-3.679322	
	5% level		-2.967767	
	10% level		-2.622989	
*MacKinnon (1996) one-sided p-values.				

3.2 Granger Test

The table 5 shows the Granger causality test results between the number of private cars and the development of domestic GDP. The results show that the development of urban economy is the Granger cause of the development of private cars.

Table 5 Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.

LNGDP does not Granger Cause LNCAR	33	2.60589	0.0124
LNCAR does not Granger Cause LNGDP		0.15962	0.6923

3.3 Var Model Estimation

Table 6 Shows the Optimal Lag Order Screening Results of Var Model Estimation Results. According to Lr, Fre, Aic, Sc and Hq Criteria, the Optimal Lag Order of Var Model is 2.

Table 6 Var Lag Order Selection Criteria

Endogenous variables: LNCAR LNGDP						
Exogenous variables: C						
Included observations: 26						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	29.47358	NA	0.000414	-2.113352	-2.016575	-2.085484
1	138.6508	193.1598	1.27e-07	-10.20391	-9.913580	-10.12031
2	156.2917	28.49685*	4.49e-08*	-11.25321*	-10.76933*	-11.11387*
3	157.0322	1.082258	5.87e-08	-11.00248	-10.32504	-10.80740
4	162.9189	7.697918	5.24e-08	-11.14761	-10.27662	-10.89679
5	167.0517	4.768683	5.48e-08	-11.15783	-10.09328	-10.85128
6	171.3469	4.295149	5.82e-08	-11.18053	-9.922433	-10.81824
7	173.0451	1.436913	7.89e-08	-11.00347	-9.551816	-10.58544
8	178.7611	3.957230	8.35e-08	-11.13547	-9.490263	-10.66171
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

The results of VAR model between the number of private cars and China's economic growth are shown in the table 7. The results show that the increase in the number of cars has a significant positive effect on economic growth, and the development of economic growth also has a significant role in promoting the increase in the number of cars. There is a two-way promoting process between the motorized process of urban transportation and urban economy.

Table 7 Vector Autoregression Estimates

Vector Autoregression Estimates		
Included observations: 32 after adjustments		
Standard errors in ( ) & t-statistics in [ ]		
	LNCAR	LNGDP
LNCAR(-1)	1.221560	0.107616
	(0.21897)	(0.18624)
	[5.57858]	[0.57782]
LNCAR(-2)	-0.252973	-0.031824
	(0.21494)	(0.18282)
	[-1.17693]	[-0.17408]

LNGDP(-1)	0.107949	1.520550
	(0.19227)	(0.16353)
	[0.56145]	[9.29830]
LNGDP(-2)	-0.072467	-0.640101
	(0.19138)	(0.16278)
	[-0.37865]	[-3.93241]
C	-0.026751	0.399735
	(0.21901)	(0.18627)
	[-0.12214]	[2.14596]
R-squared	0.999391	0.999052
Adj. R-squared	0.999301	0.998912
Sum sq. resids	0.013213	0.009559
S.E. equation	0.022122	0.018815
F-statistic	11084.95	7114.535
Log likelihood	79.27017	84.45083
Akaike AIC	-4.641886	-4.965677
Schwarz SC	-4.412865	-4.736655
Mean dependent	3.043028	5.122469
S.D. dependent	0.836899	0.570352
Determinant resid covariance (dof adj.)		1.28E-07
Determinant resid covariance		9.15E-08
Log likelihood		168.5042
Akaike information criterion		-9.906513
Schwarz criterion		-9.448470
Number of coefficients		10

Fig.3 Shows the Test Results of Var Model Stability. the Results Show That the Characteristic Roots Are All in the Unit Circle, Indicating That the Var Model Constructed in This Paper is Stable.

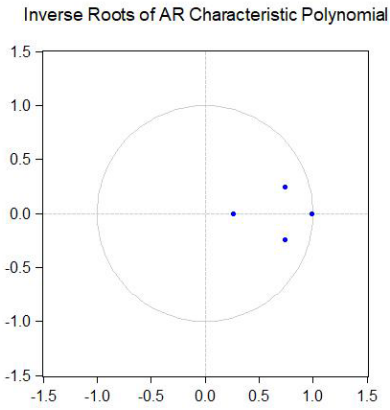

Fig.3 Ar Root

The figure shows the impulse response analysis results of VAR model. The results show that the increase of the number of cars has a positive pulse effect on economic growth. At the same time, the development of economic growth has a significant positive pulse effect on the increase of the number of cars. The shock effect will gradually decrease with time.

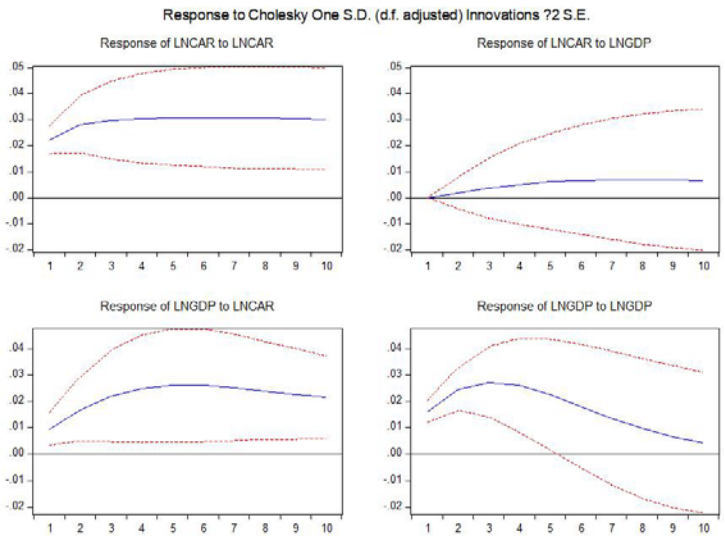

Fig.4 Impulse Response

4. Conclusions and Prospect

With the rapid development of urbanization, many urban problems emerge one by one. Urban transportation has become a hot issue in global research, and other issues are the key problems that need to be solved urgently. In this paper, in the analysis of the process of urban traffic motorization, social economy and macro-control factors are introduced. With the help of co-integration analysis theory, the influence and internal relationship between urban traffic motorization and social and economic growth are explored.

In conclusion, there is a co-integration relationship between car traffic and urban economic development. The rapid development of economy has further promoted the explosive growth of car traffic. On the other hand, the rapid growth of public transport investment will inevitably increase the construction of urban roads and further improve the urban transport infrastructure. The results of Granger causality test show that economic growth has a one-way Granger leading relationship to the motorization of urban traffic. The results of VAR model show that from a short-term perspective, there is a two-way promoting effect between urban economic growth and urban traffic motorization.

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