Research on the Relationship Between Economic Growth and Road Traffic Infrastructure in Inner Mongolia

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Abstract. To characterize the relationship between economic growth and road traffic infrastructure, the PVAR model was established using the GDP and road transport infrastructure density of 12 cities in Inner Mongolia from 2000 to 2016. Economic growth and road traffic infrastructure are mutually reinforcing, but there are two years of lag. Through impulse response analysis, it is found that the promotion of road traffic infrastructure to economic growth is permanent, which is also in line with common sense. The impact of road traffic infrastructure on economic growth reached its maximum in the fifth period and gradually weakened.

1. Introduction

Transportation infrastructure is the carrier of economic activities. The inherent network characteristics of the transportation infrastructure are connected to various economies, ensuring the normal operation of economic activities. The development of transportation determines the mobility of products and elements in geographical space by reducing transportation costs, which determines the accessibility of the market. As Weibo’s industrial location selection theory and new economic geography theory put forward, transportation cost and market accessibility not only affect the location choice of individual enterprises, but also affect the layout of the entire industry in geographical space. Therefore, the degree of perfection of the transportation infrastructure determines the efficiency of the entire social resource allocation on a certain basis.

Since the reform and opening up, China’s economic growth rate has attracted the attention of the whole world. Although China is a developing country, the economic aggregate is already the second largest in the world. China's economic growth not only benefits from various factors such as reform and opening up policies, demographic dividends, capital accumulation, and rising human capital, but also thanks to China's traffic-first policy. The transportation system is a support for inter-industry trade and inter-regional trade. The transportation network promotes regional integration through two mechanisms: First, transportation costs can be considered as a transaction cost, and the improvement of the transportation network will reduce the space movement cost of products and services, thereby reducing transaction costs and promoting regional trade. Second, improve market accessibility, accelerate knowledge spillovers and industrial gradients, and promote economic growth in underdeveloped regions. Therefore, the improvement of the level of transportation infrastructure will help the regions with higher economic growth in the eastern coastal areas to exert their “dropping effect” and promote the economic development of the central and western regions.
2. Literature review
In the late 1960s and early 1970s, infrastructure investment and productivity in the United States began to decline. Aschauer recognized this problem, in order to explore the relationship between them, he began to use time series data for relevant empirical research. He selected the United States 1945-1988 years of time series data, and the results show that transportation infrastructure has a significant impact on economic growth, and the output elasticity of transportation infrastructure is 0.39[1]. Zong Gang et al. and Binglian Liu et al. discussed transportation infrastructure investment and economic growth, transportation infrastructure density and economic growth, respectively, and believed that there is only one-way causal relationship between economic growth and transportation infrastructure [2-3]. The Granger causality test has certain limitations. It can only test the linear relationship between two variables, and can not test the complex nonlinear relationship. The mechanism of interaction between economic growth and transportation infrastructure is more complicated, and it is not only simple linear relationship. Shoufeng Huang et al. used Diks and Panchenko nonlinear Granger causality test to test the causality of GDP and transportation infrastructure, and found that there is a two-way causal relationship between the two, and the transportation infrastructure has a significant role in promoting economic growth [4]. Using Vector Error Correction Model, Pradhan and Bagchi finds bidirectional causality between road transportation and economic growth over the period 1970-2010 in India. For India, transport infrastructure not only influences economic growth but also gross capital formation. It is therefore suggested that increasing transport facility along with gross capital formation will lead to more pervasive economic growth in India. The achievement of higher economic growth through transport infrastructure would be due to its various direct and indirect benefits imparted to the economy [5]. To overcome the limitations of time series data, Agbelie, using the panel data, studied the impact of the transport infrastructures on economic growth separately under the three framework the traditional Ordinary least square model, random-effects model and random-parameters model, using the 40 countries data for theyear2010. And he found out that transport infrastructure has differences in elasticity, at the international level [6].

First, Shenglong Liu and Angang Hu, through the growth and decomposition of the Barrow model, found that Inner Mongolia, as a typical western province, has higher human capital than other western regions [7]. Therefore, the relationship between transportation infrastructure and economic growth derived from macroeconomic research from the perspective of regional economic growth cannot be adapted to each region. Second, Inner Mongolia, as a typical inland area, the most important transportation infrastructure is railways and highways. The construction of the railway is generally decided by the central government and institutions, and the local government basically has no right to speak. The local government has certain power to decide on the construction of road traffic infrastructure. Therefore, if it is necessary to test whether the local government's policies are effective, it is more reasonable to select the road traffic infrastructure. Third, most of the research mainly measures the transportation infrastructure from the value form. The transportation infrastructure measured by the perpetual inventory method cannot accurately estimate the capital stock of the existing transportation infrastructure because the depreciation rate and the service life are not the same. So in this paper we will use highway traffic network density for road traffic infrastructure.

3. Data and Methodology
The variables used in this study are highway traffic network density for road traffic infrastructure, and real GDP for economic growth. We have logarithm of two variables, and represented by lntrans and lngdp respectively.

This study aims to reveal the relationship between road traffic infrastructure and economic growth in Inner Mongolia via panel vector auto regressive model (PVAR). VAR models constructed with time series data are more prone to problems such as multicollinearity, and the use of panel data to build VAR models can overcome such problems. Therefore, Holtz Eakin proposed a panel vector auto regressive model (PVAR) in 1988. The PVAR model solves the shortcomings of multicollinearity and insufficient sample size of the VAR model, and can also perform dynamic analysis.
4. Empirical Analysis

4.1. Stationarity test of variables

In order to ensure the stationarity of the data, the variable lngdp and lntrans was tested by LLC, IPS, AD, and PP-Fisher. The result show as table 1. After the first-order difference, LLC, IPS, ADF, and PP-Fisher test of lntrans and lngdp almost all pass the 1% significance level test, so lntrans and lngdp are first order single sequence.

|                | Intrans | lngdp | Intrans | lngdp |
|----------------|---------|-------|---------|-------|
| LLC            | -1.62** | 8.41  | -1.25   | -6.95*** |
| IPS            | 1.49    | 10.51 | -3.53***| -3.89***|
| ADF            | 9.16    | 0.96  | 50.40***| 55.49***|
| PP-Fisher      | 21.97   | 1.75  | 124.05***| 63.99***|

*** indicates significant at 1% significance level.
** indicates significant at 5% significance level.
* indicates significant at 10% significance level.

4.2. PVAR

According to the AIC and SC, the lag length used in the model is 2, and the result of PVAR show as table 2. The effect of the road traffic infrastructure with the lag phase 1 and the lag phase II on economic growth can be tested by the 5% significance level, with impact coefficients of 0.15 and -0.14, respectively. The effect of the economic growth of the first phase and the second phase of the lag on the road traffic infrastructure is also significant at the 5% significance level, with the impact coefficients of 0.08 and -0.08, respectively.

|                | Intrans | lngdp | Intrans | lngdp |
|----------------|---------|-------|---------|-------|
| lngdp(-1)      | 1.56**  | 26.92 | 0.08**  | 1.93  |
| lngdp(-2)      | -0.59** | -10.40| -0.08** | -2.01 |
| Intrans(-1)    | 0.15*   | 1.75  | 0.96*   | 14.99 |
| Intrans(-2)    | -0.14*  | -1.65 | 0.03*   | 0.46  |
| c              | 0.25**  | 5.10  | 0.01**  | 0.31  |

*** indicates significant at 1% significance level.
** indicates significant at 5% significance level.
* indicates significant at 10% significance level.

According to the PVAR model, the interaction between economic growth and road traffic infrastructure is significant, and the impact of road traffic infrastructure on economic growth is greater. From the interaction between the two, the independent variables of the previous period have a positive influence on the dependent variables, while the last two periods have a negative influence. The PVAR estimated equation show as (1) and (2).

\[
\begin{align*}
\text{lngdp} &= 1.56\text{lngdp}(-1) - 0.59\text{lngdp}(-2) + 0.155\text{lntrans}(-1) - 0.14\text{lntrans}(-2) + 0.25 \\
\text{lntrans} &= 0.08\text{lngdp}(-1) - 0.08\text{lngdp}(-2) + 0.96\text{lntrans}(-1) + 0.03\text{lntrans}(-2) + 0.01 \\
\end{align*}
\]

4.3. Impulse responses

To further analyze the dynamic relationship between road traffic infrastructure and economic growth, the impulse responses of them was analyzed. The result of impulse responses showed in figure 1. The impact of road traffic infrastructure on economic growth reached its maximum at t+7 and continued. The impact of economic growth on road traffic infrastructure reached its maximum at t+5 and gradually declined.
5. Conclusion
This paper establishes a panel VAR model based on the data of road traffic infrastructure and economic growth in 12 cities in Inner Mongolia from 2000 to 2016, and observes the impulse response to characterize the relationship between economic growth in Inner Mongolia and road traffic infrastructure. And the following conclusions are drawn:

- Road traffic infrastructure and economic growth promote each other.
- There is a two-year lag period for the impact of Inner Mongolia's road traffic infrastructure and economic growth on each other.
- The impact of road transport infrastructure on economic growth is permanent, and the impact of economic growth on road traffic infrastructure has reached its maximum in the fifth phase and has gradually weakened.

From the study of the interaction between economic growth in Inner Mongolia and road traffic infrastructure, the two are closely linked. Investing in road traffic infrastructure can promote economic growth in Inner Mongolia which is delayed by two years, but the promotion of the economy is permanent. The same economic growth will also improve the Inner Mongolia road transport infrastructure, but it takes two years of conversion time, which can be understood as the construction time of the road traffic infrastructure because the variable in this paper is the density of existing road traffic.

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