

The Study on the Relationship Between Shared Cars and Air Quality in Cities based on Changes in Private Car Ownership

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Abstract: With the rapid growth of the scale of shared cars in China, it has a great positive external effect on people's daily lives, and this result is especially reflected in the air quality index. Within cities, a very important factor affecting air quality is the emission of vehicle exhaust. The size of the displacement and the number of vehicles in transit directly affect the amount of exhaust emissions. This paper conducts research based on this principle, and finally concludes: 1. The increase in the scale of shared cars has solved the car purchase needs of some people. 2. The increase in the scale of shared cars, especially electric shared cars, can solve the problem of air pollution within the city to a certain extent. This study has important reference significance for the development and promotion of shared cars by governments and related enterprises, as well as the evaluation of the environmental protection efficiency of shared cars.

Keywords: Car Shared; Air Quality; Private Car Ownership

Introduction

With the continuous progress of economic development and society, the sharing economy has ushered in the spring in China, and China's sharing automobile industry has also come into being in this environment. In this context, this paper studies the impact of shared cars, especially the electric sharing car industry, on the social welfare of our country. This is reflected in whether there is a positive impact on air quality.

The rapid development of shared cars has effectively reduced the growth rate of private car ownership in society. Since private cars inevitably cause traffic congestion and emit more exhaust gases on the road, curbing the growth of private car ownership and some other initiatives can effectively improve the air quality in the city. The existing research is limited to these two types: the connection between shared cars and private cars, and the link between private cars and air quality. This paper breaks through the barrier between them and explores the connection between the two areas of sharing economy and social welfare through the connection between the size of shared cars and air quality.

Through the research in this paper, it provides a reference for the government and related enterprises to develop and promote shared cars in the future, and the government can measure the cost of introduction and the gain of urban social welfare. At the same time, through the research in this paper, it provides a basis for defining the carbon emission standards of the shared automobile industry.

1. Literature Review

With the continuous progress of economic development and society, the sharing economy has ushered in the spring in China, and China's sharing automobile industry has also come into being in this environment.

But, due to the rapid development of the economy, the increasing number of cars in motion has also caused many problems. The most significant of these is the excessive ownership of private cars that causes extremely serious air pollution in the city. But the shared care can give it a great solution.

The rapid development of shared cars has effectively reduced the number of private cars in society. Based on the theoretical support of evolutionary game theory and the principles of user bounded rationality, it is concluded that when the initial number of shared cars reaches a certain value, stable development can be achieved, and it can inhibit or even destroy the frequency of private car users choosing private cars when traveling. [1] Although this document provides a solid background for this paper's research, given the rapid development of China's car-sharing market, the initial scale of shared cars is in line with the requirements, but it is still not possible to directly express the relationship between shared cars and air quality.

A practical approach is proposed in this document: the control variable method. He designed a econometric model for reducing private car ownership under China's "carbon neutral" grand strategy, which includes several important factors. Examples include the Consumer Price Index (CPI), disposable income, length of rail transport routes and car production. And it has been concluded in the literature that the CPI factor can be excluded because it has less impact. [2] Inspired, I finally used three explanatory variables: disposable income per capita, total length of railway operation, and car-sharing size to explore the relationship with the explanatory variable private car ownership.

In addition, since most cars on the market are powered by burning gasoline and diesel, it is inevitable that pollutants such as PM10 will pollute the air in the city in the process.[3] The emergence of shared cars, on the one hand, reduces the number of travel vehicles, on the other hand, because most of the shared cars on the market have unified standards, using low-displacement cars and even electric vehicles, reducing the emission of pollutants such as PM10 in the city and solving the problem of air quality inside the city.

2. Methodology

This paper adopts the research methods used both qualitative and quantitative analysis. By first finding out the influencing factors affecting the ownership of private cars, the relationship between the scale of shared cars and the ownership of private cars is studied, and finally the relationship between the ownership of private cars and the air quality is compared, and the trend of air quality index changes with the scale of shared cars is explored. The advantages of this are: 1. the accuracy of the results is guaranteed to the greatest extent, so that the research is more rigorous. 2. qualitative analysis and quantitative analysis to test each other.

Considering the time and development of shared cars entering China, this paper collects relevant data between 2016 and 2020. At the same time, all the data used in this article come from authoritative institutions. In the treatment of the AQI, the air quality index over the years, the researchers made some small improvements. Due to China's vast territory and uneven development, there are the following problems: 1. Air quality in some places has been at an excellent level. 2. The introduction of shared cars in some places is not in place. In order to make the analysis more rigorous, the researchers selected four representative cities of Beijing, Shanghai, Guangzhou and Shenzhen, which are the areas with better development of the shared automobile industry and the key areas for air quality monitoring in China.

3. Results

Table 1. Metrological analysis results

Factors	Coefficient	Sid. Error	T-Statistic	Prob.
X1	-0.007889	0.000525	-15.02161	0.0423
X2	8005.226	184.3473	43.42469	0.0147
X3	1591.002	133.2007	11.94440	0.0532
C	-31707.88	1546.578	-20.50196	0.0310
R2	0.99997			

As can be seen from the table above, all three explanatory variables and the function pass the test. Thus, we can get the following equation:

$$Y = -0.007889X1 + 8005.226X2 + 1591.002X3 - 31707.88$$

Y is the number of private cars, the unit is 10,000 vehicles, X1 is the scale of shared cars, the unit is 10,000 yuan, X2 is per capita disposable income, the unit is 10,000 yuan, X3 is the total operating mileage of the railway, and the unit is 10,000 kilometers.

A line chart between the growth rate of private car ownership and the aqi average of the four major cities is made:

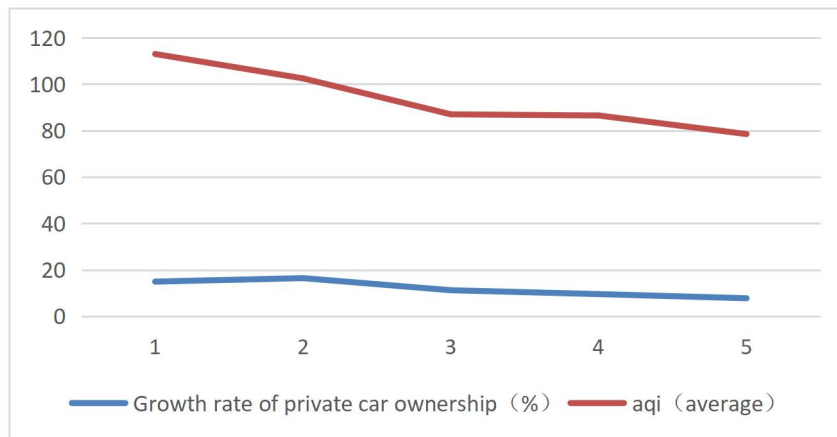


Figure 1. Growth rate of private car ownership and the aqi average

It can be seen that the growth rate of private car ownership has a similar trend with the average aqi of the four major cities, so, with the reduction of the growth rate of private car ownership, the air quality in the city will increase.

4. Discussion

The above results show that as the growth rate of private car ownership declines, so does the aqi index of the four major cities, indicating that air quality is constantly improving.

The study has achieved three main results:

First, The model shows that the number of private cars and the size of shared cars are negatively correlated, and for every 10,000 yuan increase in the size of shared cars, the number of private cars will decrease by about 79.

Second, through the line chart method: as the growth rate of private car ownership declines, the air quality inside the city will become better.

Third, combined with the above two results, we conclude that the growth of the scale of car sharing will improve the air quality inside cities.

After obtaining the model, we found that the individual parameters and functions as a whole passed the test.

The research in this article combines two different research directions, and provides a certain theoretical basis and prediction method for the future government or related enterprises to introduce or invest in shared cars in China's "carbon neutral" environment. It also provides a feasible solution for how to improve the air quality inside the city. At the same time, it provides a model for future generations to study the relationship between shared cars and private car ownership.

However, there are still many shortcomings in this article that need to be improved. First of all, the accuracy of the model can be further improved, and more control variables can be identified. Secondly, for the influencing factors of air quality in cities, some variables cannot be quantified and are difficult to quantify and analyze. In addition, due to the late rise of shared cars in China, the collected data is limited, and there may be certain data errors.

5. Conclusions & Recommendations

So far, this article has reached the following conclusions:

1. The ownership of shared cars has a significant impact on the ownership of private cars, the following functions are obtained:

$$Y = -0.007889X1 + 8005.226X2 + 1591.002X3 - 31707.88$$

2. The total mileage of railway operation and per capita disposable income were positively correlated with private car ownership.

3. As the growth rate of private car ownership decreases, the air quality inside the city will become better.

4. The growth of the scale of shared cars will improve the air quality inside the city.

References

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