An Empirical Analysis of the Impact of Urbanization on the Sharing Economy of 100 Cities in China

Lu Huang*, Yuan Li1, Huaping Zhang1, Jinjiang Yan1

1School of Business, Sichuan University, Chengdu, Sichuan, 610064, China.

*Corresponding author: huanglu@scu.edu.cn

Abstract: The sharing economy is an urban phenomenon. The process of urbanization promotes the development of sharing economy. Taking sharing travel as an example, this paper constructs an econometric model of the impact of urbanization on the development of sharing economy, and conducts an empirical study based on the relevant data of 100 large, medium and small cities in China. The empirical analyses reveal that the level of urbanization, urban trust, urban Internet technology and urban innovation have significant positive correlations with the development of sharing economy. After controlling the influence of other factors in the model, for every 1% increase in urbanization level, the development level of urban sharing economy increases by 0.31%; for every 1% increase in the level of urban trust, the development level of urban sharing economy increases by 4.54%. Therefore, in order to promote the development of urban sharing economy, it is necessary for the government to strengthen the urbanization construction and improve the level of urbanization. In addition, increasing the level of urban social trust also provides new ideas for the development of sharing economy.

1. Introduction
In recent years, sharing economy has developed rapidly. The State Information Center released the China's annual report on Sharing economic development in 2019[1], which shows that the scale of China's sharing economy reached 294.2 billion yuan in 2018, and the number of participants sharing economy was about 760 million. The sharing economy includes many fields such as shared production capacity, shared office, shared knowledge and skills, shared medical care, shared accommodation, shared transportation, shared life service and many other fields, which has an increasingly important impact on people's life and urban development.

The term sharing economy was first proposed by Marcus Felson and Joe Spaeth [2]when studying car sharing and leasing. Since then, Rachel Bostman and Roo Rogers [3] has proposed the theory of collaborative consumption, and the sharing economy has begun to receive widespread attention from the academic community. Bostman[3] pointed out that the driving forces of sharing economy come from four aspects: first, the development of information technology and network society; second, the rapid growth of population and the increasing urbanization; third, the widening income gap brought by sharing economy; Fourth, the impact of the financial crisis. Among them, Bostman believed that the increasing urbanization creates demand for services of the sharing economy and creates corresponding hardware and software conditions, which greatly promotes the development of the sharing economy. It can be seen that the sharing economy is not only a new economic form, but also an urban phenomenon. The urban economic development and urbanization level are closely linked to the sharing economy.
2. Literature Review

2.1. Urbanization and its economic growth effect
Urbanization is often defined as the transformation process from rural population to urban population. Sun Yongzheng [4] put forward that urbanization includes the transformation from rural population to urban population, as well as the upgrading of industrial structure, improvement of urban construction and enhancement of urban management. It was believed that the quality of urbanization includes: the quality of urban development, the efficiency of urbanization and the degree of urban-rural integration [5].

Scholars have done a lot of research on the relationship between urbanization and economic growth. Quigley [6] argued that urbanization is an important driver of economic growth, productivity growth and income growth. Krey [7] put forward that urbanization is critical to economic development, especially in developing countries. Through the empirical analysis of provincial panel data of China from 2000 to 2012, Kang Jijun and Wu Peng [8] found that urbanization has a significant promoting effect on economic growth, while the impact of economic growth on urbanization is shown the inverted u-shape curve relationship.

2.2. Sharing economy and urbanization
Urbanization has obvious economic growth effect, and it is no exception to the sharing economy. Sharing economy is also called "collaborative consumption" [9], "point-to-point economy", "collaborative economy" and "access consumption" [10]. At present, the definition generally accepted by the academic circles is that the sharing economy is a new culture and new economic form based on the Internet and social network platform to share goods, knowledge, time or services through sharing, barter, group buying, trading, leasing and so on.

Urbanization is highly compatible and consistent with the sharing economy in terms of goals, drivers, process and requirements of development, and is an important carrier and way to build a sharing economy with Chinese characteristics [11]. It can be seen that urbanization is the basis of the development of the sharing economy. Specifically, the high-density population brought by urbanization brings more opportunities to the transactions of the sharing economy, that is, population urbanization provides the basic impetus for sharing economy; economical urbanization provides material basis for sharing economy. [12][13]. To sum up, scholars generally agree that urbanization is the basis of the development of sharing economy. However, in the existing researches on urbanization and sharing economy, there is a lack of empirical research and the mechanism analysis of how urbanization affects the development of sharing economy. Therefore, it is of certain theoretical and practical significance to study the influence mechanism and to discuss how to promote the development of sharing economy through urbanization.

3. Data and model

3.1. Definition of variables and data sources

3.1.1. Explained variable -- the urban sharing economy level
The explained variable of this study is the urban sharing travel level. Considering the availability of data, this study draws on Ma Zhongxin's [14] expression method of sharing economic performance, and takes the ride-sharing industry as the object to study the correlation between urbanization level and sharing economy by using the data of 2017 China "Internet + traffic" city index research report released by Amap [15] (hereinafter referred to as "Amap report"). The "intelligent travel" index in the report is used to represent the development level of urban sharing economy. Amap report surveyed 100 large, medium and small cities in China, and constructed the city index of "Internet + traffic" with the three indicators of smart travel, smart transportation and political influence and 27 classified indexes. The data of the report is objective and credible. Therefore, it is reasonable to select indicator "smart travel" as the proxy variable of the sharing travel. The city with a score of 100 represent the best-performing
city.

3.1.2. Explanatory variable - urbanization level
The core explanatory variable of this study is urbanization level. It is common to measure the level of urbanization with single index method and comprehensive index method. Single index method uses the proportion of urban population in the total population to represent the urbanization level. The comprehensive index method can better reflect the urbanization level. There is a consensus that the basic connotation of urbanization should include four aspects: population, economy, society and space [16] [17]. Therefore, this study also adopts this kind of division, taking into account the availability and integrity of data, and constructs the urbanization level measurement index composed of 12 secondary indexes in four categories: population urbanization, economic urbanization, social urbanization and spatial urbanization.

The urbanization evaluation index system constructed in this study is shown in the following table:

Table 1. Evaluation index system of urbanization.

| Target Layer | First Grade Indexes               | Second Index                                      |
|--------------|----------------------------------|--------------------------------------------------|
| population urbanization | the proportion of urban population (%)         | urban population scale (person)                   |
|                |                                   | Per Capita GDP (10000 yuan)                       |
| economic urbanization | The proportion of secondary and tertiary industries in GDP (%) | Regional GDP (10000 yuan)                         |
|                |                                   | per capita disposable income of urban residents (yuan) |
| Urbanization   | social urbanization               | Total Retail Sales of Consumer Goods (100 million yuan) |
| level          |                                   | Hospital beds per 10,000 people (10000 beds)      |
|                |                                   | Green Coverage rate of built-up area (%)          |
|                | spatial urbanization              | Built-up Area (km²)                              |
|                |                                   | Road surface area per capita (km²)                |
|                |                                   | Waste-water Treatment Rate (%)                    |

3.1.3. Controlled variables
The drivers of the sharing economy, such as technology, economy and culture[18][19], mobile Internet technology[12] are often discussed. Based on the data of 45 large and medium-sized cities in the sharing economy, Ma Zhongxin[14] found that there are significant positive correlations between the institutional-cultural factors such as marketization, integrity, innovation, and tolerance, and the performance of the sharing economy. In this study, economic and social variables have been included in the urbanization level. Considering the influence of social trust on the development of sharing economy, this study takes it as a cultural factor. At the same time, the level of urban innovation and urban Internet technology are taken as technical factors. Therefore, three control variables are finally introduced: urban trust level, urban innovation level and urban Internet technology level.

3.1.3.1 urban trust level
As mentioned above, being different from the traditional economic form, the sharing economy is essentially the sharing of resource between strangers based on the Internet. In this process, social trust is a key influencing variable. Therefore, trust is considered as one of the basic determinants of the development of sharing economy and the guarantee of sharing satisfaction[20], which is an important key to support the development of sharing economy[21]. In this study, the 2017 Chinese city business
credit environment index (CEI) [22] compiled by the Integrity Evaluation Research Center was selected as an alternative indicator to represent the level of urban trust. The index ranges from 0 to 100, and the higher the value, the higher the level of urban trust.

3.1.3.2 urban innovation level
On the one hand, innovation ability provides impetus for the sustainable development of sharing economy[23]; On the other hand, improving the regulatory system with innovative thinking and creating a fair market environment for competition are important measures to healthily promote the development of the sharing economy[24]. This study uses the amount of urban patent authorization as the proxy variable of urban innovation level[25].

3.1.3.3 urban Internet technology level
Internet technology is the technical basis of sharing economy [20]. The development of the Internet technology level promotes the efficient and high-quality match between the suppliers and the demanders in the sharing economy, and thus to improve the development of the sharing economy[26]. The development of urban Internet technology contributes to the development of urban sharing economy. In this study, mobile phone penetration rate was used as an proxy variable of urban Internet technology level.

3.2. Model and Method
Based on relevant cross-sectional data such as Amap report, statistical yearbook and research reports, this study proposes an econometric model:

\[ \ln y = \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 \]  

(1)

Among them, \( y \) represents the urban sharing economy level, \( x_1 \) represents the urbanization level, \( x_2 \) represents the urban trust level, \( x_3 \) represents the urban Internet technology level, and \( x_4 \) represents the urban innovation level. \( \beta_1, \beta_2, \beta_3, \beta_4 \) respectively represent the regression coefficients of urbanization level, urban trust level, urban Internet technology level and urban innovation level. Among them, urban trust level, urban Internet technology level and urban innovation level are single variables, while urbanization level is a compound variable. Therefore, it is necessary to factor analyze the urbanization data first, then get a single evaluation value of urbanization level, and then conduct data analysis.

4. Measurement of urbanization level

4.1. factor analysis
The collected data were firstly analyzed in SPSS for Windows version 24.0. In this study, 100 cities investigated by "Amap report" were selected as samples, and the urbanization level of each city in China was comprehensively measured by factor analysis method. Firstly, factor analysis was carried out on the statistical data of the second-level indicators of the evaluation system of urbanization indicators. The KMO value was 0.826, and the Bartlett test significance was 0.000, indicating that it was suitable for factor analysis.

The table of eigenvalues and variance contribution rate is as follows:

| component | Initial eigenvalue | Sum of squares of rotating loads |
|-----------|-------------------|---------------------------------|
| total     | Percentage of variance | Cumulative % | total | Percentage of variance | Cumulative % |
| 1         | 5.655             | 47.125                          | 47.125 | 4.305  | 35.876               | 35.876 |
| 2         | 2.18              | 18.163                          | 65.288 | 3.461  | 28.845               | 64.721 |
| 3         | 1.173             | 9.773                           | 75.061 | 1.241  | 10.34                | 75.061 |

Extraction method: principal component analysis.

According to the principle that the eigenvalue is greater than 1, three common factors are extracted.
The first common characteristic value is 5.655, the second characteristic value is 2.180, the third characteristic value is 1.173, and the cumulative interpretation rate of variance is 75.06%.

The comprehensive score of urbanization level of each city is calculated by taking the ratio of variance contribution rate of each common factor as weight. The calculation formula is:
\[ x_i = 0.35876 \times f_1 + 0.28845 \times f_2 + 0.10340 \times f_3 \]  

(2)

4.2. Comprehensive value of urbanization level
This study converted the factor score of urbanization level into an index between 1-100 by referring to data processing method of Wu Yufeng. Among them, the city with a score of 100 represents the city with the highest urbanization level among 100 cities. The ranking of urbanization level obtained is shown in the following table:

Table 3. Comprehensive score ranking table of urbanization level.

| Rank | City    | Value | Rank | City    | Value | Rank | City    | Value | Rank | City    | Value |
|------|---------|-------|------|---------|-------|------|---------|-------|------|---------|-------|
| 1    | Beijing | 100   | 26   | Shijiazhuang | 42.08 | 51   | Luoyang | 32.22 | 76   | Lishui  | 20.31 |
| 2    | Shanghai| 95.89 | 27   | Zibo    | 41.26 | 52   | Taian   | 31.81 | 77   | Shantou | 19.9  |
| 3    | Guangzhou| 82.34| 28   | Wenzhou | 40.44 | 53   | Nanning | 31.4  | 78   | Lianyungang | 19.49 |
| 4    | Chongqing| 81.51| 29   | Xiamen | 40.02 | 54   | Huizhou | 31.4  | 79   | Ganzhou | 19.49 |
| 5    | Shenzhen| 73.71 | 30   | Weifang | 39.61 | 55   | Fuzhou  | 30.99 | 80   | Hengyang | 19.49 |
| 6    | Suzhou  | 72.07 | 31   | Quanzhou| 39.61 | 56   | Lanzhou | 30.17 | 81   | Yinchuan | 19.07 |
| 7    | Tianjin | 70.42 | 32   | Shaoxing| 38.38 | 57   | Huhehot | 30.17 | 82   | Zhangzhou | 17.84 |
| 8    | Nanjing | 67.14 | 33   | Zhumai | 38.38 | 58   | Taiyuan  | 29.76 | 83   | Ganzhou | 17.84 |
| 9    | Wuhan   | 66.73 | 34   | Zhongshan| 38.38 | 59   | Jiaxing  | 29.34 | 84   | Haikou  | 17.02 |
| 10   | Chengdu | 66.32 | 35   | Tangshan| 38.38 | 60   | Yancheng | 28.93 | 85   | Xinxian | 17.02 |
| 11   | Hangzhou| 60.98 | 36   | Taizhou | 37.56 | 61   | Wuhu    | 28.11 | 86   | Zhaoqing | 15.38 |
| 12   | Qingdao | 57.28 | 37   | Zhenjiang| 37.15 | 62   | Baoding | 28.11 | 87   | Zhangjiakou | 14.97 |
| 13   | Changsha| 56.46 | 38   | Changchun| 37.15 | 63   | Changzhou| 27.7  | 88   | Xianyang | 14.15 |
| 14   | Wuxi    | 56.05 | 39   | Kunming | 37.15 | 64   | Zoushan | 27.29 | 89   | Zigong  | 13.73 |
| 15   | Dongguan| 53.99 | 40   | Jinhua | 37.15 | 65   | Huaian  | 26.06 | 90   | Guilin  | 13.32 |
| 16   | Jinan   | 52.35 | 41   | Xuzhou | 36.74 | 66   | Langfang | 26.06 | 91   | Deyang  | 13.32 |
| 17   | Foshan  | 51.94 | 42   | Jining | 35.51 | 67   | Urumqi | 25.65 | 92   | Maoming | 12.91 |
| 18   | Zhengzhou| 51.94| 43   | Nanchang| 35.51 | 68   | Liuzhou | 24.41 | 93   | Jingzhou | 12.91 |
| 19   | Ningbo  | 49.88 | 44   | Dalian | 35.51 | 69   | Handan  | 24.91 | 94   | Sanya    | 12.5 |
| 20   | Changzhou| 47.42| 45   | Harbin | 35.51 | 70   | Jiangmen| 23.59 | 95   | Shaoguan | 11.68 |
| 21   | Hefei   | 47.42 | 46   | Taizhou| 34.68 | 71   | Nanyang | 23.59 | 96   | Bengbu   | 11.27 |
| 22   | Xi'an   | 47.01 | 47   | Linyi  | 34.27 | 72   | Dezhou  | 23.59 | 97   | Zhanjiang | 11.27 |
| 23   | Yantai  | 45.37 | 48   | Yangzhou| 33.45 | 73   | Chuzhou | 22.77 | 98   | Leshan  | 7.98 |
| 24   | Nantong | 44.95 | 49   | Huzhou | 33.45 | 74   | Suqian | 21.54 | 99   | Nanchong | 2.64 |
| 25   | Shenyang| 44.95 | 50   | Guiyang| 32.22 | 75   | Mianyang| 21.54 | 100  | Xining   | 1 |

5. Empirical research

5.1. Discrete point analysis
For these 100 cities, we use the level of urban sharing economy level as the abscissa and the level of
urbanization as the ordinate to make a scatter diagram. It can be preliminarily judged that the level of sharing economy has a positive relationship with the level of urbanization in Fig.1. Meanwhile, it can be seen that the three cities deviating from other cities in the figure -- Chongqing, Shanghai and Sanya -- are abnormal points. Therefore, the data of Chongqing, Shanghai and Sanya are deleted in this study, and subsequent data analysis is conducted based on the remaining 97 cities.

![Figure 1. Scatter diagram](image)

### 5.2. Econometric Model

#### 5.2.1. Model results

In this study, Eviews analysis tool was used and all data were log-processed. Table 4 shows the regression results of urbanization level and sharing economy level. In regression model 1, the explained variable is the level of urban Sharing travel, and the explanatory variable is the urbanization level. It is found that the urbanization level has a significant positive effect on the development of sharing economy. Regression models 2, 3 and 4 add control variables to regression model 1 in turn, including urban trust level, urban Internet technology level and urban innovation level. The regression analysis results show that the four variables of urbanization level, urban trust level, urban Internet technology level and urban innovation level are all significantly positive, while the regression coefficient of urbanization level decreases gradually with the addition of new variables. Finally, model 4 showed that the fitting degree of the model was good and passed F test.

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|----------|-------------|------------|-------------|-------|
| model 1  | C           | -0.191813  | 0.369913    | -0.518535 | 0.6053 |
|          | LNX1        | 0.906754   | 0.107761    | 8.414476 | 0.0000 |
|          |             | LNY = -0.19 + 0.91*LNX1 |
| model 2  | C           | -30.90964  | 5.739444    | -5.385476 | 0.0000 |
|          | LNX1        | 0.598914   | 0.110842    | 5.40328  | 0.0000 |
|          | LNX2        | 7.456230   | 1.390911    | 5.360681 | 0.0000 |
|          |             | LNY = -30.91 + 0.60*LNX1 + 7.46*LNX2 |
| model 3  | C           | -26.68998  | 5.319057    | -5.017803 | 0.0000 |
|          | LNX1        | 0.495117   | 0.103724    | 4.773404 | 0.0000 |
|          | LNX2        | 5.536180   | 1.339270    | 4.133731 | 0.0001 |
|          | LNX3        | 0.895580   | 0.200252    | 4.472267 | 0.0000 |
|          |             | LNY = -26.69 + 0.50*LNX1 + 5.54*LNX2 + 0.90*LNX3 |
| model 4  | C           | -21.04561  | 5.230940    | -4.023295 | 0.0001 |
5.2.2. Model test

In this study, the data are cross-sectional data, which may have heteroscedasticity, so the White test is used to test the model.

Table 5. White test result.

| Variable   | Coefficient | Std. Error | t-Statistic | Prob.  |
|------------|-------------|------------|-------------|--------|
| C          | -17.31282   | 5.101013   | -3.393997   | 0.0010 |
| LNX5       | 1.492745    | 0.344240   | 4.336555    | 0.0000 |
| LNX2       | 4.229549    | 1.215326   | 3.480177    | 0.0008 |
| LNX3       | 0.608044    | 0.187212   | 3.247887    | 0.0016 |
| LNX4       | 0.205321    | 0.055097   | 3.726566    | 0.0003 |

Obs* R-squared has a probability value of 0.5722, which is higher than the conventional test level of 0.05. Therefore, heteroscedasticity is not considered to exist. The final model is as follows:

\[ \ln y = -21.05 + 0.31\ln x_1 + 4.54\ln x_2 + 0.76\ln x_3 + 0.22\ln x_4 \]  \hspace{1cm} (3)

The final fitting regression equation shows that:

- For every 1% increase in urbanization level, the development level of urban sharing economy increases by 0.31%.
- For every 1% increase in the level of urban trust, the development level of urban sharing economy increases by 4.54%.
- For every 1% increase in urban Internet technology level, the development level of urban sharing economy increases by 0.76%.
- For every 1% increase in the level of urban innovation, the level of urban sharing economy will increase by 0.22%.

5.2.2.1 Robustness test of single index

This study constructs an index evaluation system of urbanization, and measures the urbanization level of each city with a composite index. This study further uses a single index, namely urbanization rate (represented by X5) to test the index robustness of the model. The regression results show that urbanization rate, city trust level, city innovation level, and city Internet technology level still have significant positive effects on the sharing economy, so the regression model is considered to be credible.

Table 6. Robustness test results of a single index.

| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
|----------|-------------|------------|-------------|--------|
| C        | -86.43361   | 26.53244   | -3.257658   | 0.0016 |
| X1       | 0.332850    | 0.106922   | 3.113013    | 0.0025 |

5.2.2.2 The model robustness test

Based on Eviews software, the original data are logarithmically processed and then regressed, so the model is tested. Therefore, the robustness test of the model is carried out by using raw data that has not been processed. According to the test results, urbanization level, urban trust level, urban innovation level, and urban Internet technology level still have significant positive effects on the sharing economy (Prob.<0.05), so it is considered that the regression model has credibility.

Table 7. Model robustness test results.

| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
|----------|-------------|------------|-------------|--------|
| C        | -86.43361   | 26.53244   | -3.257658   | 0.0016 |
| X1       | 0.332850    | 0.106922   | 3.113013    | 0.0025 |
6. Conclusions and suggestions

6.1. Conclusions
The conclusions include: firstly, the level of urbanization, the level of urban trust, the level of urban Internet technology and the level of urban innovation have a significant impact on the development of sharing economy. After controlling the influence of other factors in the model, for every 1% increase in urbanization level, the development level of urban sharing economy increases by 0.31%. Secondly, as scholars pointed out, the construction and improvement of trust mechanism is the core infrastructure for sustainable development of sharing economy. This study found that the level of urban trust has the greatest impact on the development of sharing economy, for every 1% increase in the level of urban trust, the development level of urban sharing economy increases by 4.54%.

6.2. Suggestion
Accelerating the urbanization process and promoting the coordinated development of population, economy, society and space urbanization can effectively promote urban sharing economy. Secondly, it is very important to promote the development of sharing economy by improving the credit system of online transaction subjects and strengthening the information security and privacy protection of online transactions. At present, the areas with unbalanced distribution of resources such as education and transportation have developed through the sharing economy. In the future, the sharing economy will penetrate into all aspects of people's life. Cities, especially those in central and western regions, should grasp the development opportunities of the sharing economy, and cultivate new economic growth points with the help of the development of sharing economy, so as to realize the leap forward economic development.

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