

# *A comparison of relations between transportation and communication consumption of China's urban and rural residents and their income (An empirical analysis based on data between year 1994 and 2010)*

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**Abstract**—Transportation and communication consumption is an important manifestation of consumption structure upgrading. After conducting a statistical analysis and comparison of the relationship between transportation and communication consumption by urban and rural residents from 1994 to 2010 and their income, and based on Keynesian theory of absolute income and consumption, consumption models are built between per capita consumption expenditure of transportation and communication by urban (rural) residents and the per capita disposable income between the Gini coefficient of urban and rural residents' income and the average propensity to consume of transportation and communication. Through a comparative analysis, it is thought that the average income of China's urban and rural residents is still at a low level, that income constraints have an obvious role of restraining transportation and communication consumption by residents, especially rural residents; with the expansion of the internal income gap between urban and rural residents, both their average propensities to consume for transportation and communication go up, while that of rural residents rise much higher than that of urban residents, which is not consistent with the law described by Keynes that the larger the income gap, the smaller the average propensity to consume. This is the reason for a representation of the macroeconomic reality that there is a low level of per capita income of urban and rural residents and the situation is more serious in rural areas. Finally, some policy recommendations were put forward.

**Keywords**—transportation and communication consumption; income; average propensity to consume; income gap

## I. INTRODUCTION

Since reform and opening up more than 30 years ago, China's per capita income has shown a steady growth, but the growths of income levels respectively examined and weighed by urban and rural residents have not always been so stable.

During the years between 1978 and 1988, rural reform released the agricultural productivity, and the income of rural residents grew substantially. Since 1989, income of farmers had begun to grow slowly. Especially during the period between 1997 and 2005, the growth entered a stagnation phase. Since 2005, with the promulgation and implementation of a series of policies and measures of the country in respect of supporting agriculture, benefiting peasants, and reducing the burden of farmers and further development of urbanization, farmers' income has begun to grow, however, the income gap between urban and rural areas and the internal urban-rural income gap have not been seen to shrink, which has become one of the major factors resulting in the lack of effective domestic demand and the weak market in recent years.

Among the aggregate demand management theories advocated by Keynes where there is government intervention in the economy, consumption theory possesses a core position. Thus in nearly 60 years, consumption has become an important issue of macroeconomic research for scholars at home and abroad. The classic theories include Keynes' absolute income theory of consumption, Duesenberry's relative income theory of consumption, Franco Modigliani's life-cycle theory of consumption, Milton Friedman's permanent income theory of consumption and liquidity constraints hypothesis, etc., and theoretical studies have been more mature.

In China, there appear a number of recent literatures on the relationship between consumption and income. Most of their researches are empirical analysis for Chinese reality based on classical theory of consumption. Their object of study mainly includes the relationship between total consumption and income [1], relationship between consumption structure and income [2-3] as well as relationship between structure of income and consumption [4-

5] and others, and then compares the gap between urban and rural areas. There also appear research literatures on relationship between a certain item of consumption and income through subdivision of total consumption. Those that can be currently retrieved include researches on the relationship between tourism consumption and income [6-7], researches on the relationship between information consumption and income structure [8-9], researches on the relationship between sports consumption and income [10] and others. However, there are relatively rare research literatures on the relationship between transportation and communication consumption and income. Those that can currently be retrieved are the ones either analyzing the status of transportation and communication needs [11], or the ones taking it as one of the consumption categories to conduct an analysis in the study of aggregate consumption or consumption structure [12]. There are yet no search results in respect of the researches specifically aimed at relationship between transportation and communication consumption and income and that between transportation and communication consumption and income distribution.

Consumption of transportation and communication is the expenditure spending on transport and communications by China's urban and rural residents, including domestic transport and its maintenance, transportation expenses, telecommunication facilities, postage expenses and others. In recent years, with gradual improvement of urban-rural income levels, scientific and technological development, perfection of transportation and communications infrastructures and development of transportation and communication industries, transportation and communication consumption has gradually become an indispensable part of people's lives. It belongs to a high demand level of consumption. The income elasticity of the demand is greater than 1. With the characteristics of higher rate of growth that exceeds the income level, its growth is more stable and long-lasting compared to other consumption categories, so it is of great importance for sustained stimulation toward domestic demand. Therefore, single consumer item of transportation and communication consumption is selected to investigate its relationship with per capita income of urban and rural residents, at the same time, to investigate the influence of income distribution on urban and rural consumption of transportation and communication within the background of gradual expansion of the income gap between urban and rural areas and the internal urban-rural income gap, in the hope of grasping objectively the variation pattern and trend of transportation and communication consumption of China's urban and rural residents, mining the potential for consumption, and providing a useful reference for the formulation and implementation of relevant policies and measures by the departments and businesses concerned.

## II. KEYNES' ABSOLUTE INCOME THEORY OF CONSUMPTION

In his book "The General Theory of Employment, Interest and Money", Keynes put forward his consumption function [13]:  $C = f(Y) = \alpha + \beta Y$ , where  $C$  is consumption,  $Y$  is income, and  $\alpha$  is spontaneous consumption;  $\beta Y$  is the consumption caused by income, and  $\beta$  is marginal propensity to consume.

The key findings of Keynes' consumption function include the following:

First, he thinks the change in current income decides the current consumption. Thus the government can raise consumer spending by adjusting public revenue, thus changing the income level of the whole society.

Second, he thinks marginal propensity to consume (MPC) has a regular pattern of diminishing with the increase of income, resulting in a multiplier effect so that the effective demand is insufficient, which in turn lead to the fact that the position of balanced national income is below the level of national income under full employment, resulting in high unemployment.

Third, he thinks that average propensity to consume (APC) has a regular pattern of decreasing with the increase of income. As income increases, consumption will also increase, and at the same time, people will use more income for savings. Since consumption increases much less than the increase in income, the absolute proportion of consumption to income presents a decreasing state. Therefore, if there is a wide social income gap, APC will be reduced, resulting in lack of consumer demand, and if the government adopts a "Robin Hood" type of income distribution policy, the APC of the whole society will be improved.

In China, some scholars believe through their studies that in the long run, Keynesian theory of consumer spending has some explanatory power for China's household consumption, and with respect to the subdivision consumption item of transportation and communications, does the absolute income theory of consumption hold true? This is the question this article attempts to answer.

## III. AN EMPIRICAL ANALYSIS AND COMPARISON OF THE RELATIONSHIP BETWEEN URBAN AND RURAL TRANSPORTATION AND COMMUNICATION CONSUMPTION AND INCOME

### A. Model Building

According to Keynesian theory of absolute income and consumption, the linear consumption model [15] constructed in this paper of the relationship between incomes of urban and rural residents and their consumer spending in transportation and communication and that between the average propensity to consume and internal urban-rural income gap is as follows:

$$C_{it} = \alpha_i + \beta_i Y_{it} + \mu_i \quad (i=1,2,3) \quad (1)$$

In formula (1),  $C_{it}$  represents the consumer spending of urban and rural residents in the item of transportation and communication,  $Y_{it}$  represents the real income of the current period of urban and rural residents,  $\alpha_i$  and  $\beta_i$  are parameters to be estimated, among which  $\alpha_i$  is the spontaneous consumption, while  $\beta_i$  is the marginal propensity to consume of the consumption of transportation and communication,  $\alpha_i > 0$  and  $0 < \beta_i < 1$ ,  $\mu_i$  represents the random error term,  $i = 1, 2$ , where 1 represents urban residents, and 2 rural residents.

$$APC_{it} = \delta_i + \gamma_i G_{it} + \varepsilon_{it} \quad (i=1,2,3, \dots, n) \quad (2)$$

In formula (2), APC is the average propensity to consume of transportation and communication consumption of urban and rural residents, G is the Gini coefficient of urban and rural residents' per capita income, which is used to measure the interior income gap of urban and rural residents,  $\delta$  and  $\gamma$  are the parameters to be estimated,  $\varepsilon_i$  is the random error term,  $i = 1, 2$ , where 1 represents urban residents, and 2 rural residents.

### B. Model Estimation and Testing

In practical applications, most time series are non-stationary, and using the least square method to conduct regression toward non-stationary time series may produce a phenomenon of spurious regression. Time series transformed through differential method does not have direct economic implications, which is difficult to explain. Therefore, following the ideas of co integration, this article uses software Eviews 6.0 for empirical analysis.

#### 1) Relationship between Per Capital Disposable Income and Per Capital Expenditure of Transportation and Communication Consumption

Before the parameter estimation of the model, whether the time series is stationary shall first be determined. ADF approach is used to conduct unit root test respectively toward C1, C2, Y1 and Y2 sequences. It is found that there are unit roots in all the four sequences, which shall be non-stationary sequences. And the four sequences are all the second-order single whole ones, where co-integration analysis can be conducted.

Least square method is used to conduct regressions respectively toward models of transportation and communication consumption of urban and rural residents and their income, and at the same time, a co integration test is conducted toward the regression residuals sequences to determine whether there is co integration relationship between the sequences. The regression results are:

$$\hat{C}_1 = -326.79 + 0.119309 Y_1 \quad (3)$$

(30.664) (0.002981)

(-10.65692) (40.01737)

R2=0.990720 F=1601.390 DW=1.732136

$$\hat{C}_2 = -134.6749 + 0.105631 Y_2 \quad (4)$$

(15.97604) (0.004927)

(-8.429802) (21.44127)

R2=0.968403 F=459.7283 DW=0.463977

Conduct unit root tests respectively toward the residual sequences of equation (3) and (4), and the results show that the residual sequences are stationary series, and spurious regression phenomenon does not exist during the modeling process.

Select correlogram and measurement method of Q and manpower to conduct serial correlation test toward equations (3) and (4), and the result shows that serial correlation does not exist in the residual series of equation (3) and the various

statistics of the model are also significant; the correlogram and Q statistics test show that a first-order serial correlation exists in equation (4). Choose AR correction model to conduct amendment toward equation (4). Finally, after the amendment by model AR (3), serial correlation disappears, and the regression equation amended shows:

$$\hat{C}_2 = -146.3297 + 0.120155 Y_2 \quad (5)$$

(12.82587) (0.004177)

(-11.40895) (26.37181)

R2=0.980218 F=223.7086 DW=0.711747

Select white test method to conduct a white heteroskedasticity test toward equations (3) and (5), the result shows that heteroscedasticity does not exist in equations (3) and (5). Therefore, it can be determined that equation (5) should be the final equation to reflect relationship between the expenditure of transportation and communication consumption of rural residents and their income, and equation (3) should be final equation to reflect the relationship between the expenditure of transportation and communication consumption of urban residents and their income.

#### 2) Relations between Income Distribution Gap and Transportation and Communication Consumption

Conduct an ADF unit root test toward sequences APC1, G1, APC2 and G2, the results show that APC1 and G1 are integrated of order one, and APC2 and G2 are second-order single whole. Conduct the least squares regression respectively toward the average propensity to consume of transportation and communication spending of urban and rural residents and the Gini coefficient of their income, and at the same time conduct co integration test toward regression residuals sequences, and the regression results are as follows:

$$APC1 = -0.045841 + 0.419005 G1 \quad (7)$$

(0.006423) (0.022596)

(-7.137499) (18.54313)

R2=0.958200 F=343.8477 DW=1.184086

$$APC2 = -0.307503 + 1.0049 G2 \quad (8)$$

(0.029153) (0.081361)

(-10.54786) (12.35221)

R2=0.910489 F=152.5772 DW=1.618872

Conduct an ADF unit root test toward the regression residuals sequences of equations (7) and (8), and the results show that at the 1% level of significance, the hypothesis of unit root rejects to exist in the residuals of the regression equation, so spurious regression phenomenon does not exist in the modeling process.

Select correlogram and measurement method of Q and manpower to conduct serial correlation test toward equations (7) and (8), and the results show that there are no presence of serial correlation.

Use white test method to conduct white heteroskedasticity test toward equations (7) and (8), and the results show that at a significance level of  $\alpha = 5\%$ ,  $nR_2^1 = 2.119724$  and  $nR_2^2 = 0.666232$  both are smaller than  $\chi^2_{0.05}(2) = 5.99147$ , so heteroscedasticity does not exist in both the models. Therefore, it can be determined that equation (7) is the final equation to reflect the relationship between internal income distribution gap of urban residents and their average propensity to consume in transportation and communication consumption, while equation (8) is the final equation to reflect the relationship between the internal income distribution gap of rural residents and their average propensity to consume in transportation and communication consumption.

### C. Economic Analysis for the Empirical Results

The above empirical results show that there exists a long-term equilibrium relationship between the per capita disposable income of China's urban and rural residents and the per capita consumption expenditure of transportation and communication. Income is one of the main factors affecting transportation and communication consumption of urban and rural residents. There exists a significant positive correlation between transportation and communication spending and income. There exists a long-term equilibrium relationship between the internal distribution gap of income of urban and rural residents and the average propensity to consume of transportation and communication.

#### 1) Spontaneous Consumption of Transportation and Communication

The spontaneous consumption in Keynesian consumption function is the amount of consumption when the income is zero, and  $\alpha > 0$ . In this paper, the regression equations (3) and (5) show that the spontaneous consumer expenditure of urban residents in transportation and communications is -326.79 yuan, while that of the rural residents is -146.3297 yuan, indicating that under the constraints of low-income level, transportation and communication products and services have not become necessities of the consumption by China's urban and rural residents, and it further validates that currently, the urban and rural consumption is at the initial stage of the consumer upgrade process, and transportation and communication consumption is in the phase of rapid growth of demand. The conclusion of  $\alpha > 0$  in Keynesian consumption function is not applicable for the individual consumer item of the transportation and communication consumption of China's urban and rural residents.

#### 2) Marginal Propensity to Consume of Transportation and Communications

The  $\beta$  in the Keynesian consumption function is the marginal propensity to consume, and it is the increment of consumption brought about by the increase in per unit of income.  $0 < \beta < 1$ , and  $\beta$  has the regularity of decreasing with the increasing of income. In this paper, the regression equations (3) and (5) show that the marginal propensity to consume of transportation and communication consumption of urban residents is 0.119309, indicating that with every increase of 100 yuan of the disposable income of urban residents, there are 11.93 yuan spent for consumer spending of transportation and communications. The marginal propensity

to consume of transportation and communication consumption of rural residents is 0.120155, indicating that the marginal propensity to consume of rural residents is slightly higher than that of urban residents; Meanwhile, marginal propensity to consume of transportation and communications show a decreasing trend with the increase of income, and the increasing trend of rural areas is relatively more significant than that of the urban areas. This result is consistent with the conclusion described in the second part and revealed by the statistical analysis that the degree of reaction of the consumption of rural residents in transportation and communications toward the increase of income is slightly higher than that of the urban residents, that rural consumption of communications product is much higher than that of the urban areas and that consumer spending of rural residents in transportation and communications has the trend of breaking through the low-income constraints to catch up with that of the urban areas. Transportation and communication spending belongs to the item of high level consumption both in China's urban and rural areas. The law of diminishing marginal propensity to consume in Keynesian consumption theory is not reflected in the individual consumer item, and at least it has not yet been reflected.

#### 3) Average Propensity to Consume and Income Gap

Keynesian theory suggests that average propensity to consume (APC) has the law of diminishing with the increase of income. If there is a wide gap of social income, APC will reduce, resulting in lack of consumer demand, and if the government adopts a "Robin Hood" income distribution policy, the APC of the whole society will improve.

In this paper, the regression equations (7) and (8) show that with every increase of 1 percentage point of Gini coefficient of the average income of urban residents, its APC of transportation and communications spending will rise by 0.419005 percent, indicating that with the expansion of the gap of internal income level of urban residents, the APC of transportation and communications of urban residents will increase, and the rate of increase is relatively small; while with every one percentage point of increase of the Gini coefficient of average income of rural residents, the APC of transportation and communication spending will rise by 1.004990 percent, much higher than that of the urban residents. This shows that whether in urban or rural areas, transportation and communications are among the consumer items of high-income groups, and the more concentrated the income toward high-income groups, the higher the APC of transportation and communications will be. In rural areas, the situation is more serious. The more focused the income toward high-income groups in rural areas, the higher the APC of transportation and communication of rural residents, and its elasticity is greater than 1. It should be noted that the conclusion of the statistical analysis described in the second part that "the functioning directions of the both in the rural areas have been reversed since 2007, and the expansion of internal income distribution gap reduces the strength of consumer spending of transportation and communications of the residents, showing a weak negative correlation" is not consistent with the empirical results here. Given that the description of statistical analysis is usually simpler and more

superficial, the rural data between 2007 and 2010 can be viewed as an unstable random fluctuation. The empirical results that the average propensity to consume of transportation and communications increases with the expansion of the internal income gap of urban and rural areas further illustrate the macroeconomic reality that the income level of urban and rural residents in China is generally low, while in rural areas the situation is more serious. The law described by Keynes that “the greater the income gap, the smaller the APC” is not applicable for China’s individual consumer item of transportation and communications at the present stage.

#### IV. CONCLUSIONS AND POLICY RECOMMENDATIONS

##### A. Conclusions

There is huge room for the consumer demand of transportation and communication by China’s urban and rural residents, and the low level of per capita income has a very obvious inhibitory effect on transport and communications spending of residents, especially that of rural residents.

Generally, consumption of transportation and communications belongs to a consumer item of high demand levels of the higher-income resident groups of the urban and rural areas. At the same time when the internal income gap of urban and rural areas expands, the average propensity to consume of transportation and communications will rise. In rural areas, the elasticity of income gap of the average propensity to consume in transportation and communications is greater than 1. This is actually a representation of the low level of per capita income of the residents. Precisely because the level of per capita income is low, consumption of transportation and communications becomes a consumer item of high-income groups. The more focused the income toward high-income groups, the stronger the consumer demand for transportation and communications, indicating that the consumer demand for transportation and communications not only by low-income groups but also by high-income groups have not been fully met, thus further validates the conclusion that there is huge room for the consumer demand for China’s urban and rural residents in transportation and communications.

##### B. Policy Recommendations

*1) The government should take all effective measures to improve the income level of the residents, to narrow the gap between urban and rural areas, and to make the increase of transportation and communication consumption stable and lasting.*

Through analysis, it is believed that the strong demand for products and services of transportation and communications by urban and rural residents cannot be fully realized because it is subject to the low level of income, but the root cause of the increase of the average propensity to consume of transportation and communications with the widening income gap also lies in the low level of per capita income, and therefore to fundamentally solve the problem the income level of the residents must first be improved. Consumption is one of the “three carriages” to promote economic growth. The contribution of China’s domestic consumption to economic

growth is low in the long term, so at the same time when the government strives to develop the economy, it should appropriately tilt its income distribution system of social wealth to the residents’ income so as to improve the overall level of income of urban and rural residents. The empirical analysis of this paper argues that in the short term, the expansion of the internal income distribution gap of urban and rural areas will allow the propensity to consume of transportation and communication to rise, which, in the circumstances that other factors do not change, will help expand domestic consumption demand for transportation and communications. However, from the perspective of long-term and harmonious development, expansion of internal income disparities will inevitably affect the growth of final consumption demand [16]. Narrowing the income gap and tapping the consumption potential of transportation and communications of vast majority of residents, especially of rural residents, will make the huge consumption space of transportation and communications into effective demand. Therefore, the government should, in respect of urban and rural income distribution of social wealth, through a variety of paths and mechanisms, guide and perfect the system of agricultural subsidies, maintain a reasonable price level of agricultural products, open up income-generating channels for farmers, increase investment in poverty alleviation [17] and others, significantly increasing the income levels of rural residents, narrowing the income gap between urban and rural residents, and narrowing the internal income gap of urban and rural areas.

*2) Vigorously support the development of transportation and communication sector; and put more efforts in infrastructure construction of urban and rural transportation and communications, especially that of rural areas.*

Through analysis, it is believed that there is huge space of consumer demand for transportation and communications products and services of urban and rural areas, especially of rural areas. Transportation and communications sector and its infrastructure construction have a significant positive external economic effect on economic development. At the same time when it helps improve the quality of life of residents, it also plays a role of creating market opportunities, increasing market efficiency, reducing information asymmetry and saving transaction costs, which is of particular significance for the economic growth and farmers’ getting rid of poverty and becoming better off in backward and remote rural areas. Thus, whether in terms of stimulating consumption and economy or increasing farmers’ income, or seeking harmonious development between economy and society, the national policy should vigorously support the development of transportation and communications sectors, increase length and area of highway and railway construction, increase the number of public transport operators, popularize communications network coverage and other constructions of transportation and communication infrastructure.

*3) Relevant departments and enterprises of transportation and communications should increase investment in technology and market research, so as to provide multi-level, high-quality transportation and communication products and services.*

Through analysis, it is believed that subject to the income constraint, the major consumer groups of overall transportation and communication products and services at present stage are high-income strata in urban and rural areas. In order to fully exploit the potential of transportation and communication spending of the more overwhelming majority of residents, relevant departments and enterprises of transportation and communications should pay attention to the research and development of the technology and market of civilian transportation and communications, developing and designing multi-level products and services that meet different needs by aiming at different income levels of urban and rural populations, and at the same time, conducting pellucid product knowledge publicity and simple and easy-to-apply usage training toward the majority of rural residents through a variety of channels. Financial institutions should promote transportation and communication consumer credit in rural areas, simplifying credit procedures and reducing credit threshold so as to fully tap the potential of consumption of transportation and communications by rural and urban residents, stimulate domestic demand and promote sustained economic growth and to realize the harmonious development of economy and society.

#### V. NOTES

The data is from "China Statistical Yearbook" and "China Rural Statistical Yearbook" during the period between 1995 and 2011, and at the same time, it is assumed that there are no inflation factors.

The Gini coefficient reflects the distribution status of wealth in a country or a region. The real number of the Gini coefficient is between 0 and 1. The smaller the number, the more evenly the wealth is distributed among social members, while the larger the number, the larger the distribution gap of income is.

The calculation formula of Gini coefficient is  $G = \frac{PIL}{L}$ , where P is the row vector of the share of the population in each group, I is the square matrix when the diagonal element is 0, the top diagonal element is 1 and the bottom element is -1, and L is the column vector of the share of disposable income of each group. The product of the above three matrixes is the Gini coefficient, the result of which can be worked out by using the matrix multiplication function MMULT in excel.

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