Econometric Analysis of Network Consumption and Economic Growth in China

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Abstract — With the rapid development of Internet technology, and prosperous progress of e-commerce, network consumption has become a new economic growth point to improve the quality of our national economy and to realize the development of economy. As both economy and society develop rapidly, people are increasingly aware of the importance of network consumption. Meanwhile, the rapid development and popularization of mobile Internet technology makes the network consumption more and more popular and convenient. This thesis is based on the actual data, which is related to the network consumption and economic growth from 2001 to 2013. Simultaneously, this paper makes use of Co integration test and VAR model to explore the relationship between network consumption and the development of economy. Furthermore, impulse response function is adopted to analyse the impacts of network consumption on economic growth.

Keywords - Economic growth; Impulse response function; Network consumption; VAR model

I. INTRODUCTION

A. The Background of the Research

In order to promote the further development of the domestic economy, China government formulated the new economic strategy, which recognized the transformation of the economic growth pattern as the core. According to this strategy, enlargement of interior need is the essential standpoint of the transformation of the economic growth pattern. At the same time, information consumption, as an important starting point for the expansion of domestic demand and change the mode of development of economy, is important to promote the rapid development of the national economy. Because the network consumption is also an important part of information consumption, it would play a vital role to promote the economic growth. In 2013, Chinese central government issued some opinions of the State Council on promoting information consumption to expand domestic demand. In the document, China government proposed the main goal in the future development of information consumption: by 2015, information consumption scale should reach at more than 3.2 trillion Yuan, and ensure the annual growth rate maintained at above 20%, including the new model of information consumption based on Internet should also achieve 2.4 trillion Yuan, requiring that an average annual growth should reach and keep at over 30%.

B. Basic Economic Theories

Network consumption as a way of consumption in recent years is novel. Although some improvement and innovation in the traditional consumption mode, it still retains its essential characteristics of consumption. Therefore, in order to research the relationship between the network consumption and economic growth, we can analysis on this problem according to the traditional macroeconomic theory of consumption.

1) The Multiplier Model Analysis

Keynes in 1936 published "employment, interest and money" (referred to as "the general"). According to Keynes's theory, he initially described the related concepts of the multiplier, and gives the relevant explanation of Economics. Keynes stressed that the short-term effect of multiplier effects. The multiplier model is a short-term output decision model and is to explain the impact on the national economy caused by each variable output in the short term. In the theoretical framework of the macro economy, consumption function can be assumed to be \( \frac{\partial C}{\partial Y} = c \), as the marginal propensity to consume. \( c \) shows each 1 unit increase in income how increase in consumption at the same time. So, \( 0 < c < 1 \), according to his national income equilibrium theory, \( Y = (C + I + G)/(1-c) \), \( I \) is investment and \( G \) is government spending. The multiplier is \( \frac{\partial Y}{\partial I} = 1+c+c^2+...... \). According to the related theorem of infinite series, the multiplier is \( \frac{1}{1-c} \). This shows that the marginal propensity to consume effect on short-term economic growth and the consumption function as an important part of the national economy to the economic growth.

2) Analysis on Economic Growth Model

Solow and swan put forward the new classical economic growth model on 1956 at the basic of Harold and Thomas research, known as the Solow economic growth model or Solow SWAN model of economic growth. By introducing Cobb Douglas production function, this model emphasizes the substitutability of capital and labour. \( Y = K^a L^{1-a} \). \( K \) is capital and \( L \) is labour and \( Y \) is output level. In order to
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affect the progress of further research on technology to economic growth, economists introduced the production function with Hicks technology neutral: \( Y = AK^aL^{1-a} = e^{\alpha K^aL^{1-a}} \), \( A \) is technological progress. According to the equilibrium conditions under the steady state conditions, we can get the growth rate: \( n + g/(1-\alpha) \). \( n \) is the growth rate of population. The formula shows that technical progress (\( g \)) play the important function in economic growth. Network consumption as a new consumption mode technology combined with the Internet and mobile Internet close. Its constantly development and expand reflect the progress and development of internet technology and mobile Internet technology. So the development of network consumption would promote the further growth of the national economy. Above, the relationship between the network consumption and national economic growth are expounded from the macro classic economics, thus creating conditions for the next empirical analysis.

II. DATA COLLECTION AND COLLATION

A. Per Capita Annual Consumption in Network

Per capita annual consumption in network means that the average annual consumption amount of Internet consumers on the Internet, including that network consumer information acquisition, online entertainment and Internet online shopping consumer costs generated by network. According to the statistical report on the development situation of the Internet and the status of China Mobile since 2010 China Internet development report (2010.7, 2011.7, 2012.7 and 2014.1), these data from 2001 to 2013 was classified.

![Figure (1). Per capita annual consumption in network.](image1)

According to this line graph, we can see immediately that there was an upward trend in the annual per capita consumption in network generally, though the figure went down from 2008 to 2009 because that the global economic crisis led to the economic situation of Chinese interference. But this downward trend could not influence the whole growth trend.

B. Per Capita Gross National Product

Per capita gross national product means that the average annual GDP of a country, which could reflect that a country’s annual development of the economy and the future direction of development, which directly affects people’s daily life, especially in the consumer life. According to Bulletin of statistics of the National Bureau of Statistics (2001-2013), these data was classified and arranged.

![Fig.(2). Per capita gross national product](image2)

From the chart, we can see clearly that China's per capita GDP always showed a rising trend. However, the growth rate obviously slowed down from 2008 to 2009, which was responding with the trend of the per capita net consumption. But, in general, this trend still would not affect its macro development trend.

According to the comparison of above two pieces of line graph, we can find that the annual per capita net consumption and annual per capita GDP exists a fit positive correlation. By comparing the actual data, we can find the accuracy of classical economic theory. Height fit of data resources is another important basis for next step regression analysis.

III. THE ESTABLISHMENT OF MATHEMATICAL MODEL AND MEASUREMENT MODEL

A. Variable description and pre-processing

According to the second part of the given data, we need to do some processing regression test. In order to eliminate the index trend exists two time series variables and heteroscedasticity, while satisfying the premise condition of least square estimation; we need to make log processing for the all variables. \( LN_{rjGDP} \) shows the per capita GDP logarithmic results and \( LN_{wlxf} \) illustrates Per capita consumption of logarithmic results network.

We can set up the corresponding econometrics model: \( LN_{rjGDP} = \beta_0 + \beta_1 LN_{wlxf} + \epsilon_i \) \( i = 1,2,...,13 \) (1)

Through further changes, we can get regression model: \( LN_{rjGDP} = \tilde{\beta}_0 + \tilde{\beta}_1 LN_{wlxf} + \epsilon_i \) \( i = 1,2,...,13 \) (2)
B. The least Squares Estimation and the Conventional Hypothesis Testing

By the application of Eviews7.0 to the least squares regression analysis, the regression equation was obtained:

$$\text{LNrjGDP} = -1.678 + 1.53*\text{LNdwlxf}$$  \hspace{1cm} (3)

Several hypotheses test routine is listed in the following table:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard deviation</th>
<th>t-Statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-1.677897</td>
<td>1.024171</td>
<td>-1.638298</td>
<td>0.1296</td>
</tr>
<tr>
<td>LNRJWLF</td>
<td>1.525184</td>
<td>0.135165</td>
<td>11.28389</td>
<td>0</td>
</tr>
<tr>
<td>R2</td>
<td>0.92</td>
<td>127.3261</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

We can find the goodness of fit reaches at 0.92, which shows that the quality of the samples is high and the fitting is also good. But we found significant test for independent variables ($\beta_0$ and $\beta_1$) could not pass. The T value of $\beta_0$ is -1.638 and Probability is only 0.1296. At the same time, the value of $\beta_1$ is 11.28389, while probability about parameters fall in the range of standard value is almost 0. We found that only using the method of least square estimation methods could not make the conventional regression test effectively.

C. Stability Test

If you want to make a series of changes in the time series data, the data in the system must be stable. At the same time, in order to ensure that the next step of the co integration test and Granger causality test, the stationary test of data needs to be processed.

Firstly, according to the data of the line graph of two variables to the analysis, we can find that the two variables are not stationary time series, but have a rising trend.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adf Statistic</th>
<th>1% Level</th>
<th>5% Level</th>
<th>10% Level</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNrgDGP</td>
<td>-0.484</td>
<td>8.12</td>
<td>3.41</td>
<td>2.71</td>
<td>instability</td>
</tr>
<tr>
<td>LNrgDGP (-1)</td>
<td>0.011</td>
<td>0.42</td>
<td>0.42</td>
<td>0.42</td>
<td>stability</td>
</tr>
<tr>
<td>LNWLxf</td>
<td>-0.973</td>
<td>3.96</td>
<td>3.96</td>
<td>3.96</td>
<td>instability</td>
</tr>
<tr>
<td>LNWLxf (-1)</td>
<td>-0.011</td>
<td>0.42</td>
<td>0.42</td>
<td>0.42</td>
<td>stability</td>
</tr>
</tbody>
</table>

Thus, we need to conduct ADF test further. Simultaneously, through the test, we can determine whether a variable with a smooth, and confirm the integration order. ADF test is performed on the two variable and the results are listed in the following table.

D. JJ Co Integration Test

Some sequence of variables may itself be a no stationary. But once these variables and other variables are combined, these variables may appear smooth result. This phenomenon is called the co integration relationship. In other words, we can use the co integration test to explain the equilibrium relationship between some of the variables, and this is a long-term stable equilibrium relationship.

<table>
<thead>
<tr>
<th>Hypothesized</th>
<th>Max-Eigen Value</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0.552680</td>
<td>0.05</td>
<td>0.30</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.161726</td>
<td>0.05</td>
<td>0.16</td>
</tr>
</tbody>
</table>

We found the maximum Eigen value statistics fall under 5% significant level, which means that there is a co-integration relation between the two variables and they have a long-term equilibrium relationship. According to the
maximum Eigen value test results, we revise the regression equation based on the least squares estimate. Regression equations are obtained long-term equilibrium condition system.

\[ \ln r_j \ln GDP = -0.07 + 0.61 \times \ln w_{xf} \]  \hspace{1cm} (4)

We can draw the following conclusions that each of the 1 percentage point increase in per capita consumption in network, which leads to the GDP per capital, will correspondingly increase nearly 0.61 percentage points. This means that economic growth on the network consumption elasticity is 0.61 and this idea is consistent with the view of economic theory.

IV. CONCLUSIONS

ACKNOWLEDGMENT

A. VAR Model

According to Grainger’s law, if there is a co integration relationship between the non-stationary time series variables, we can establish a corresponding error correction model to make Regression analysis and test.

<table>
<thead>
<tr>
<th>TABLE IV VAR MODEL AND RELATED DATA RESULTS</th>
</tr>
</thead>
</table>
| \( \begin{array}{c|c|c}
| & LNRJGDP & LNRJWLXF \\
| LNRJGDP(-1) & 1.101900 & 1.721630 \\
| & (0.43221) & (1.29802) \\
| LNRJGDP(-2) & -0.18971 & -1.14766 \\
| & (0.39532) & (1.18721) \\
| LNWLXF(-1) & 0.013593 & 0.105168 \\
| & (0.14724) & (0.44219) \\
| C & 0.293430 & 2.065933 \\
| & (0.09232) & (0.23783) \\
| \end{array} \) |

The model tells us that when explanatory variables contain the constraints of co integration relationship, especially there is a large range fluctuation; vector error correction model will make a convergence about interior variables in the long-run co integrating relationship. At the same time, the short part of the adjustment can also lead to the optimization of the co integrating relationship. We need to select the explanatory variables without changing trend. Simultaneously, we can establish the VAR model in which the co integration equation with intercept and co integration relation number is 1, and the differential hysteresis number is 1.

Error correction model is obtained:

\[ \ln r_j \ln GDP = 1.10 \times \ln r_j \ln GDP(-1) - 0.19 \times \ln r_j \ln GDP(-2) + 0.01 \times \ln w_{xf}(-1) + 0.08 \times \ln w_{xf}(-2) + 0.29 \]  \hspace{1cm} (5)

We can see, through the VAR model, the early network consumption is closely related to the current growth in GDP per person, which means that in the long-term, the per capita GDP and network consumption has to relevance, and this association is permanent. At the same time, the intercept is increased from -0.0718 to 0.293, and passes the significant test. This change indicates that long-term, Internet consumption is a lasting influence on economic growth.

B. Impulse Response Function and Variance Decomposition

Impulse function is based on the VAR model, and further analysis of the independent variables on the dependent variables impact degree. Not only reflect how much impact the amount of shock, but also indicate how long the reaction time. According to this method, the dynamic change between the variables and the delay effect can be found.

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Figure (5). Outcome of Impulse function.

From the figure, we found that the per capita GDP itself is a kind of lasting impact on its own, and is always above 0 line. This form illustrates the delay effect of per capita GDP is strong. At the same time, compared to the effect and delay effect on per capita GDP, delay action on the network...
consumption on its own is not obvious. Curve of network consumption will return to 0 lines in third years. The influence of network consumption of per capita GDP is significant, while there is some volatility. The influence is great in the previous three years, and then gradually decreases. But the line of response of network consumption to per capita GDP is still above the 0 line, which reflects this effect is permanent but the correlation coefficient decreases gradually.

Variance decomposition results:

**TABLE V THE RESULTS OF VARIANCE DECOMPOSITION**

<table>
<thead>
<tr>
<th>Period</th>
<th>S.E.</th>
<th>LNRJGDP</th>
<th>LNRJWLXF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.04488</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0.067001</td>
<td>99.9514</td>
<td>0.048601</td>
</tr>
<tr>
<td>3</td>
<td>0.086602</td>
<td>98.58388</td>
<td>1.416124</td>
</tr>
<tr>
<td>4</td>
<td>0.104295</td>
<td>97.7668</td>
<td>2.233197</td>
</tr>
<tr>
<td>5</td>
<td>0.118568</td>
<td>97.52279</td>
<td>2.477212</td>
</tr>
<tr>
<td>6</td>
<td>0.130234</td>
<td>97.32581</td>
<td>2.674193</td>
</tr>
<tr>
<td>7</td>
<td>0.140181</td>
<td>97.15321</td>
<td>2.84679</td>
</tr>
<tr>
<td>8</td>
<td>0.148703</td>
<td>97.04152</td>
<td>2.958483</td>
</tr>
<tr>
<td>9</td>
<td>0.156022</td>
<td>96.96318</td>
<td>3.036818</td>
</tr>
<tr>
<td>10</td>
<td>0.162379</td>
<td>96.89978</td>
<td>3.100216</td>
</tr>
</tbody>
</table>

Through the table, we can get the first stage fluctuations of the per capita GDP only relate to its own factors and the impact on economic growth coming from the network consumption would not appear until the second period. Although at the beginning, this influence is weaker, with the passage of time, its influence gradually expands. The impact of its GDP per capita has been maintained at more than 96%, showing its lag effect of more powerful. In the first stage, the influence of network consumption was mainly from its own and the figure reaches at about 66%, then the effect gradually declines. On the other hand, the influence coming from per capita GDP gradually rises, exceeding 60%. This means that the effect of GDP on the network consumption per capita is obviously higher than that of the influence of network consumption of per capita GDP, which means that economic growth would play an important role in the development of the network consumption.

V. CONCLUSIONS AND SUGGESTIONS

Through the above analysis, we can know there is close relationship between per capita GDP and per capita net consumption. Through the integration test, we realized there is a long-term equilibrium relationship between these two variables. And find out the quantitative relationship between the two factors, which means that for every 1 percentage point increase in per capita net consumption, GDP per capita will be a corresponding increase in 0.61 percentage points. This shows that there is a long-term dynamic equilibrium relationship between the two variables.

According to the classic economics, there is mutual interaction closely between per capita GDP and network consumption per capita. The growth of GDP per capita will generate positive effect on per capita consumption in network and a further rise of network consumption will have a more significant effect on economic growth, mutual influence and promote each other, forming a good mutual circulation.

Simultaneously, through the analysis of the per capita GDP of VAR model and the network consumption per capita, we further found that the lag of the variable itself, as well as the lag between two variable. Through the further improve of co integration test, we found the relationship between the two factors had some volatility in the short term. Through the function of revision coefficient (0.293), so the relationship between them returned to normal level. What is more important is the impulse response function and variance decomposition. We further found that a strong pull the relationship between the two variables, and determine the reaction time between the impact, strengthens the relationship between two variables.

By econometric analysis, we find that the relationship between these two variables. We need to pay attention to the new consumption mode especially the network consumption. Network consumption and economic growth are closely linked and it is also the important way to expand domestic demand. At the same time, network consumption is the important channel for further optimization and upgrading of the industrial. The government and enterprises should make full use of the favourable opportunity of rapid development of the Internet and e-commerce channels to further expand the domestic market of the network consumption, making it as one of the power source to further promote the development of economy. On the basis of the network consumption, government in china should also vigorously promote the transformation of the economic growth mode, which deeply depends on government spending and investment. And the government of China needs to fully stimulate domestic demand especially the great consumer potential demand.

CONFLICT OF INTEREST

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