Econometric Model of Underground Economy Scale Estimation

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Abstract: As a special economic mode under market economy, underground economy exists in every country all over the world, China included for sure. Underground economy destroys badly normal market order and reasonable distribution of social resources, and makes national macro-control more difficult. This article establishes an econometric model to measure the underground economy scale in China in recent 5 years.

Keywords: underground economy; scale; econometric model

1 Introduction

Underground economy, with other names as shadow economy or hidden economy or informal economy, is the aggregation of all kinds of economic activities in one country out of its official GDP statistics due to the characteristics of evading tax, labor market supervision and other factors relating to market friction. Considering its negative impact caused by underground economy on national macro-control effect, economic statistics accuracy and labor market operation, many literatures discussed a lot on its cause, impact, scale and limitation method. Here, we introduce ways of measurement of underground economy scale.

2 Ways of Underground Economy Scale Estimation

There are two ways to estimate underground economy: direct and indirect ways.

2.1 Direct Ways

2.1.1 Investigation

To obtain details on the structure of underground economy by investigating both transaction sides, including supplier and demander. But normally, the practitioners do not willing to be interviewed, since most of the activities are illegal. Some researches at present shows that in the activity of underground economy, there are more men than women, more young people than old people, more unemployed people than employed people. The most active fields of underground economy are construction and other service industries. Comparatively speaking, higher capital concentration the industry owns, less underground economy it has.

2.1.2 Tax Audit

It is implemented strictly by the tax department on auditing to-be-paid tax term, so as to get detailed information of tax. Generally speaking, individual practitioners are more likely to evade tax and capital income is

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more likely to do so than labor income does. This way is only applied to the activity of tax-paying. However, most of the tax loss happens during the period of redistribution.

The advantage of direct ways is to supply abundant information on underground economy, including its structure and practitioner composing. The disadvantage is that it is hard to get the whole information on underground economy, which allows only a rough estimation about its scale.

2.2 Indirect ways

2.2.1 Underground Economy Appears In Different Markets

1) Consumer market. Practitioners’ expenditure usually exceeds their open file income. The difference can be obtained by observation of family income and nation income. The shortcoming of this way is that the gap between income and expenditure may be caused by the error of different measures or by other factors which has nothing to do with underground economy.

2) Labor market. The decline of employment in public economic departments may suggest the rising opportunity in underground jobs. Its disadvantage is that it is hard to identity the people who work in both public and underground economic department. As the same, the decline of employment in public economic department may relate with other factors.

3) Currency market. This is on the basis of hypothesis: underground economic activity is done by cash, which can easily escape from the government supervision. The scale of underground economy can be reflected by the currency in circulation, not including public transaction, which is easy to control. But the results of present research show that about 20%-30% of underground economic activities are completed by goods or payment through banks. The ratio of cash payment will change according to different countries and time, and some of them are paid by cash in foreign countries. The usage of credit card and different currency in circulation rates between underground and public economic department will bring measure errors when taking this way. However, recent researches have solved these problems successfully, especially by the way of econometrics, which takes many factors into account, such as change of interest rate. Its scale can be calculated by comparison between the tax in different years and the strictness of government laws & rules. This way considering cash demand is widely used, especially by OECD. The consumption of electricity is also included when estimating underground economic scale. The consumption beyond normal demand is regarded as the result of underground economy. The advantage of this way is that it is easy to get data, which is especially applicable to developing countries and countries modifying economic structures. While the disadvantage is that many underground economic activities have nothing to do with power consumption. With the development of science & technology and usage of substitute energy, relationship between production and power consumption is changing.

The biggest difficulty for indirect ways is to choose a datum year, in which no underground economic activity happened, to estimate the underground economic scale in other years.

2.2.2 Models

To choose a dependent variable and build a model by analyzing the cause of underground economy. Main factors influencing underground economy are as follows:

1) Higher tax payment, heavier social security burden and stricter government regulation will stimulate the development of underground economy. For example, illegal activities like drug production and sale, the activities by the people with less than eight-hour working time or having holiday or of early retirement or unemployment.

2) An anticipation of criminal engagement or economic punishment by underground economic activities, as well as the abidance of social ethics, will restrain its development.

This way is comprehensive and more applicable, based on a lot of datum. Thus, it is difficult for the developing countries and countries modifying economic structures because of their insufficient statistics.
3 Econometric Model of Estimating Underground Economy

It is not an easy job to estimate the scale of underground economy, because no activities are declared, which makes direct observation difficult. With its characteristic of tax-avoidance, we can suppose that its transaction is done by cash which makes it much shadier. We can estimate its scale by observing currency in circulation. According to our real situation, the factors influencing currency in circulation are: valid tax rate, deposit annual average interest rate, national per capita net income and national per capita consumption level. Now, we establish one currency in circulation equation with these independent variables:

\[ LM_{0t} - LM_{2t} = \beta_0 + \beta_1 LT_t + \beta_2 LR_t + \beta_3 Y_{1t} + \beta_4 Y_{2t} + \varepsilon_t \] (1)

where \( L \) is logarithm, \( M_0 \) is currency in circulation, \( M_2 \) is money supply, \( T \) is valid tax rate, \( R \) is deposit annual average interest rate, \( Y_1 \) is national per capita net income, \( Y_2 \) is national per capita consumption level, \( \varepsilon \) is error, \( t \) is the year.

In Eq.(1), valid tax rate is positive to cash demand, while deposit annual average interest rate, national per capita net income and national per capita consumption level is negative. Increasing of valid tax rate will stimulate tax evasion and underground economic activities become active, which increase cash demand. Increasing of interest rate will enhance opportunity cost of cash-holding, while cash demand decrease. Increasing of national per capita net income and national per capita consumption level will lead to payment modernization, which decrease the cash-holdings.

<table>
<thead>
<tr>
<th>Item Year</th>
<th>Currency in circulation (( M_0 ), RMB 100 million)</th>
<th>Money supply (( M_2 ), RMB 100 million)</th>
<th>Valid tax rate (( T ), %)</th>
<th>Deposit annual average interest rate (( R ), One Year, %)</th>
<th>National per capita net income (( Y_1 ), RMB)</th>
<th>National per capita consumption level (( Y_2 ), RMB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>17278.0</td>
<td>185007.0</td>
<td>14.66</td>
<td>2.03</td>
<td>4518.90</td>
<td>4106</td>
</tr>
<tr>
<td>2003</td>
<td>19746.0</td>
<td>221222.8</td>
<td>14.74</td>
<td>1.98</td>
<td>4993.22</td>
<td>4411</td>
</tr>
<tr>
<td>2004</td>
<td>21468.3</td>
<td>254107.0</td>
<td>15.12</td>
<td>2.03</td>
<td>5644.62</td>
<td>4925</td>
</tr>
<tr>
<td>2005</td>
<td>24031.7</td>
<td>298755.7</td>
<td>15.65</td>
<td>2.25</td>
<td>6366.56</td>
<td>5463</td>
</tr>
<tr>
<td>2006</td>
<td>27072.6</td>
<td>345603.6</td>
<td>16.51</td>
<td>2.34</td>
<td>7174.75</td>
<td>6111</td>
</tr>
</tbody>
</table>

Note: Valid tax rate is the ratio between the total revenue of national all kinds of tax and GDP. Considering the interest rate adjustment in some years and to make the calculation rational, we take the average annual interest rate of one year as interest rate variable. National per capita net income is the weighted average value of average per capital net income of rural residents and that of urban residents.

Making regression analysis of Eq.(1), we can get regression equation for cash demand as:

\[ LM_0 - LM_2 = 5.3188 + 1.1018LT - 0.1073LR - 0.085LY_1 - 0.6342LY_2 \] (2)

4 Calculation of Underground Economy Scale

As mentioned above, underground economy is mainly caused by the increase of effective tax. Recent years, China has strengthened the tax levy. Valid tax rate is increasing continuously, which makes underground economy scale is expanding also. For the lack of datum, we make the valid tax rate in 2001 a reference to calculate underground economy scale from the year 2002 to 2006. However, it doesn’t mean that there were no underground economic activities in China in 2001.

Take 13.95%, the valid tax rate in 2001, into Eq.(2) as a benchmark rate, to calculate the currency in circulation \( M_0 \) from 2002 to 2006. The margin between \( M_0 \) and \( M_0' \) is underground currency in circulation.
Table 2 Underground Economy Scale in China

<table>
<thead>
<tr>
<th>Item Year</th>
<th>Currency in circulation ($M_0$, RMB 100 million)</th>
<th>Currency in circulation under benchmark rate ($M'_0$, RMB 100 million)</th>
<th>Currency in circulation of underground economy ($M_0-M'_0$, RMB 100 million)</th>
<th>Ratio between underground economy scale and GDP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>17278.0</td>
<td>16364.51</td>
<td>913.49</td>
<td>0.76</td>
</tr>
<tr>
<td>2003</td>
<td>19746.0</td>
<td>18590.34</td>
<td>1155.66</td>
<td>0.85</td>
</tr>
<tr>
<td>2004</td>
<td>21468.3</td>
<td>19652.90</td>
<td>1815.40</td>
<td>1.14</td>
</tr>
<tr>
<td>2005</td>
<td>24031.7</td>
<td>21180.37</td>
<td>2851.33</td>
<td>1.55</td>
</tr>
<tr>
<td>2006</td>
<td>27072.6</td>
<td>22394.83</td>
<td>4577.77</td>
<td>2.17</td>
</tr>
</tbody>
</table>

The result shows that the ratio between the underground economy scale and GDP rose from 0.76% to 2.17% with the increase of valid tax rates from 2002 to 2006.

5 Conclusion

Generally speaking, the existence and increase of underground economy may arouse problems in three aspects. The first one is that it may cause error when estimating economic and social development of individual, family and nation according to official statistics, which will result in over expansion of micro economic policy and over application of social policy, because the official unemployment figure will exceed a lot of real figure. The second one is that it leads to tax lost directly. The third one is that the activeness of underground economy is considered as a symbol of unhealthy economy. Because of its high benefit and low cost, some public economic department may be stimulated to engage in underground economy.

Fighting against underground economic activities is a common task in every country. A general way is to strengthen the power of supervision and punishment, which can not solve the problem fundamentally and thoroughly, especially when dealing with illegal trades like drug transaction and prostitution which are more hidden, well organized and more brutal. To solve these problems, in a long run way, we should do as follows: (1) to improve efficiency of public service department and create one streamlined and efficient civil servant team. (2) to build a reasonable tax system and a relatively safe social security system. (3) to improve national moral standards. (4) to build a fair and democratic society.

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References


