A Measurement of "Gray Income"
- A Case of China

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< Preliminary>

Abstract

Based on a Wang's (2012) method of analysis, this paper uses the CHIP data in 2007, and is verifying about the existence and its measurement method of Chinese "gray income" or "hiding income."

Unlike Wang (2012), in this paper, it analyzed using the CHIP data which is the random family-income-and-expenditure-survey data performed on a scale of the whole country.

We obtained the following conclusions.

1. Although "a hidden income" can be measured using CHIP2007 data and the same method as Wang (2012), our result has arbitrariness nature and it is not accepted as an estimation income according to income class.

2. Adding change in a Wang's (2012) measurement method based on Engel's low, we estimate "hidden income" as 5 decile and 10decile. A measurement result is similar to a Wang's (2012) result, and the estimation income has far exceeded the official announcement income in order of the class exception. The greatest magnification to the official announcement income of an estimation income is 161.9%.

On the other hand, the percentage of bottom of income class to average income proceeds is 2.2%-3.4%, and the percentage of highest income class to average income 39.6% - 45.4%. This result has suggested that the inequality in China is very serious.

3. As an estimation result of a "hiding income" of this paper, the Chinese "hidden income" scale in 2007 to GDP is 17.6-25.4 %, 4,680 billion yuan 6,730 billion yuan. (about 78,900 billion yen 104,800 billion yen). It is too much to ignore it.

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1 Introduction

According to the trial calculation using CHIP in 2007 and 2008 (Chinese Household Income Project) , the Gini coefficient of the urban and rural areas of China is 0.372 and 0.398, respectively. [1]
Generally speaking, when we see income difference among 5 quantile, Gini coefficient over 0.4 means 20% people in the 5th quantile gorpe has more than 50% income and inequality of income difference is serious. If the above result is accepted, the situation of the income differential in the urban areas of China is very serious.

There are a lot of literature on the reason for income difference on China, for example, the Kuznets hypothesis about Chinese income differential or the Kuznets turning point. (李, 1993; 李, 趙 and tension, a 1999; Wang and 樊, 2005; 蔡, 2006). However, inequality from income difference in China may be not from the stage of economic developing but institution and structure as Wang[2] pointed out. Wang(2007) and Wang(2010) shows “ Gray income” which does not appear in official statics. A "gray income" means the income which is not the formal remuneration which cannot judge easily whether it is lawful or illegal.

According to the Wang's (2010) measurement, the "hiding income" of China in 2008 is 9,300 billion yuan equivalent to 29.5% of GDP of China of the year, and increased no less than 24.1% compared with 2005. The income especially considered to be a "gray income" among the "hiding incomes" of China in 2008 is 5,400 billion yuan, and it occupies it no less than 17.2% of GDP in 2008. Wang (2007) has pointed out the source of such income is based on "decomposition of finance" (commission more than needed, etc.), "administrative power abuse and a bribe", monopolistic firms and the rent seeking dealings in real estate", etc.

The argument about Chinese "gray income" has had big issue not only on an area of research but on politics. In the government activity report by Prime Minister Wen Jiabao to whom it was carried out at the 3rd time of 11th term National People's Congress (National People's Congress) meeting, he says "gray income" for the first time, and he emphasizes correcting it. [3] The measurement for gray income will play a role when reforming Chinese tax system and income redistribution policy. However, now, the measurement is on the way of developing and the Statistics Bureau of China is against it. [4]

The argument about a "gray income" seems to be focused on the method to measure it rather than the existence of the existence of a "gray income" . Many of questions to a Wang (2007, 2010, 2012) are in the measurement method (Engel's coefficient method) and collecting method of data.

Although 羅・岳・ 李 (2011) says that there are big errors in a Wang's (2007, 2010) method of analysis, they do not tell the counterargument about existence of a "gray income".
It is a future subject to improve a Wang's (2007, 2010, 2012) method of analysis, and to develop a more exact measuring method.

This paper examines the validity of the measurement method which checks existence of Chinese "gray income" and measures it using the CHIP data in 2007. A Wang's (2012) examination method is based on an interview, and is generating data by the memory of people.
Therefore, it is indicated that the method has the arbitrary side.
On the other hand, since the CHIP data using in this paper is the random family-income-and-expenditure-survey data performed on an economywide, it has universality, and it is thought that a Wang's (2012) problem is overcomed.

This paper is as follows. Section 2 shows theoretically the methodology of the "gray income" measurement by a Wang's (2012) Engel's coefficient method. Section 3 explains the Chinese family-income-and-expenditure-survey data (CHIP) using in this paper, and it summarizes a measuring result and an implication in Section 4. In Section 5, we put conclusions and talk about our future reserch.

2 Method of Analysis

2-1 Measuring Method (1) of "Gray Income" by Engel's Coefficient : Theoretical Aspect

Wang (2012) are the consumption activities which do not balance with the average proceeds performed in China now (For example, many luxury cars were purchased, so that it did not balance with the average income level.). Asset accumulation activities (unusual real estate investment etc.) were raised as a problem, and it is indicated that this is what is depended on existence of the "gray income" which is not reflected in the official announcement data of the Statistics Bureau.

Probably, it is a fact without doubt that the "gray income" exists. However, many questions are still left behind measuring it correctly.

Wang (2012) thinks that a true income including a "gray income" can be measured, even if a "gray income" exists. This is a measuring method of the true income by an Engel's coefficient method.
An Engel's coefficient method is the method of computing average income based on assumption which Engel's coefficient also has strong relationship between Engel’s law and income. The average income measured by this method is true income without false.[5]

Wang (2012) defines the difference between the average income (it is called an "estimation income" below) of each class measured by the Engel's coefficient method and a household income (below, an "official announcement income" is called) the Statistics Bureau released as a "hiding income" or a "gray income."

Wang (2012) focuses on two kinds of the statistical data (a "castle Satoie income" 「城郷家庭人均収入」and the "aggregate household disposable incomes") China Statistics Bureau has released[6], and defines " hidden income" and "gray income" according to each data. That is, the difference of an estimation income and a "castle Satoie income" was defined as being "a hidden income", and the difference of an estimation income and the "aggregate household disposable incomes" is defined as

"gray income."

Although these definitions are almost same and Wang (2010) does not always explain the reason to be distinguished, "a hidden income" corresponds to the concept of 1st order distribution, and it seems that a "gray income" is secondary one.

Let us see Wang's (2012) view using a simple model[7]. A household income in case there is "no gray income", consumer spending, and storage are denoted by y_i、C_i、S_i, and a household income (a true income = estimation income) in case there is "gray income", consumer spending, and storage are denoted by y_i'、C_i'、S_i'.

If G_i made into a "hiding income" or a "gray income", the relation between an estimation income and a "gray income" can be defined like $y_i' \equiv y_i + G_i$.

In this case, y_i expresses the official announcement income which the Statistics Bureau released.

The relation of variables in case there is "gray income" can be expressed as follows.

$$y_i' \equiv y_i + G_i = C_i + S_i + G_i = C_i' + S_i' \neq y_i \quad (G_i \neq 0\ ) \tag{1}$$

He defines "gray income" G_i on not statistically appeared income. There is a possibility that GDP ($\sum_i y_i$) which the Statistics Bureau released has become less than true GDP ($\sum_i y_i'$) by existence of a "gray income." Therefore, GDP may be evaluated too little. In this meaning, existence of a "gray income" is also a problem of the reappraisal to the economic magnitude or economic strength of not only the problem of mere income hiding but its country.

(1) The relationship among the variables is considered as follows.

$$\begin{aligned} & y_i' \equiv y_i + G_i = C_i + S_i + G_i = C_i' + S_i' \geq y_i \qquad (G_i \geq 0\ ) \\ & \Rightarrow \quad C_i = y_i - S_i = y_i' - G_i - S_i = C_{a,i} + C_{b,i} \\ or \quad & \Rightarrow \quad C_i' = y_i + G_i - S_i' = y_i' - S_i' = C_{a,i}' + C_{b,i}' \end{aligned} \tag{2}$$

However, C_a and C_b express the consumer spending of wining and dining expenses and others, respectively, and $C_{a,i}'$ and $C_{b,i}'$ express wining and dining expenses in case there is "gray income", and other consumer spending. Therefore, Engel's coefficient can be defined as follows.

$$\beta_i = \frac{C_{a,i}}{y_i - S_i} = \frac{C_{a,i}}{y_i' - G_i - S_i} = C_{a,i} \times exp\big(-ln(y_i' - G_i - S_i)\big) \tag{3}$$

Rewriting (3), true family income (estimation income) in the case of being "gray income", and Engel's coefficient can be expressed as follows.

$$y_i'(G_i,\beta_i) \equiv y_i + G_i = \frac{1}{\beta_i} \times\ C_{a,i} + S_i + G_i = C_{a,i} \times exp(-ln\beta_i)\ + S_i + G_i \tag{4}$$

Hnece, the relationship between estimated income and Engel's coefficient becomes as:

$$\begin{aligned} \frac{\partial \beta_i}{\partial y_{i\,i}'(G_i,\beta_i)} &= -\ C_{a,i} \times exp\big(-2ln(y_i' - G_i - S_i)\big) < 0 \\ \frac{\partial y_i'(G_i,\beta_i)}{\partial \beta_i} &= -\ C_{a,i} \times exp(-2ln\beta_i) < 0 \end{aligned} \tag{5}$$

(5) It turns out that it has negative correlation between β_i and y_i'. Based on this relationship, Wang(2010) thinks that Engel's coefficient has something to do with real income of each income class (estimated income of each class) . On the other hand, it is defined the difference $y_i' - y_i$ as "gray income" or a "hiding income, where y_i' (estimation income) and y_i (official announcement income) like (4). Wang (2012) uses survey data and measures a true income (estimation income) and "gray income", using survey data, comparing with the official announcement income of the Statistics Bureau.

2-2 Measuring Method (2) of "Gray Income" by "Engel's Coefficient Method" : Positive Side

More generally (2) and (4) can be expressed as follows.
However, J= 1, 2, ・・・ j are the number of groups (class), and N= 1, 2,・・・n express the number of samples in a group (class).

$$\begin{array}{rl} y'_{1,1} = & C_{a,1,1} \times exp\left(-ln\beta_{1,1}\right) + S_{1,1} + G_{1,1} \\ \vdots & \vdots \\ y'_{1,n} = & C_{a,1,n} \times exp\left(-ln\beta_{1,n}\right) + S_{1,n} + G_{1,n} \\ \vdots & \vdots \\ \vdots & \vdots \\ y'_{j,1} = & C_{a,j,1} \times exp\left(-ln\beta_{j,1}\right) + S_{j,1} + G_{j,1} \\ \vdots & \vdots \\ y'_{j,n} = & C_{a,j,n} \times exp\left(-ln\beta_{j,n}\right) + S_{j,n} + G_{j,n} \end{array} \qquad (6a)$$

or

$$\begin{array}{rl} \beta_{1,1} = & C_{a,1,1} \times exp\left(-ln\left(y'_{1,1} - G_{1,1} - S_{1,1}\right)\right) \\ \vdots & \vdots \\ \beta_{1,n} = & C_{a,1,n} \times exp\left(-ln\left(y'_{1,n} - G_{1,n} - S_{1,n}\right)\right) \\ \vdots & \vdots \\ \vdots & \vdots \\ \beta_{j,1} = & C_{a,j,1} \times exp\left(-ln\left(y'_{j,1} - G_{j,1} - S_{j,1}\right)\right) \\ \vdots & \vdots \\ \beta_{j,n} = & C_{a,j,n} \times exp\left(-ln\left(y'_{j,n} - G_{j,n} - S_{j,n}\right)\right) \end{array} \qquad (6b)$$

Using a Wang's (2012) "Engel's coefficient method", since existence of a "gray income" is proved, it can compare with the official announcement income of the Statistics Bureau . For this, Wang(2012) considers many methods of the measurement of estimation income every group(calss) by survey data.

In this case, we have to care how a group with a true income is divided from with "gray income". Like (6a), if caritas paribus and the standard of most reliable grouping is Engel's coefficient in case Engel's law is materialized, it is thought that the group (class) divided on the basis of Engel's coefficient will be what is formed from comrades with true income $y'_{i,j}$without false.

Therefore, it is thought like (4) types like a formula (6a) or (6b) a formula using average Engel's coefficient $(\overline{\beta}_1, \cdots, \overline{\beta}_j)$ and average proceeds $(\overline{y'_1}, \cdots, \overline{y'_j})$ which were deduced from each group

(class) that a "gray income" can be measured. So that it may compare with the "official announcement income" of the Statistics Bureau considered that the Wang (2012) is not taking the "gray income" into consideration according to the Engel's coefficient level according to income bracket of the Statistics Bureau official announcement, average Engel's coefficient and average proceeds of the group of survey data were deduced, and measurement of the "gray income" (= "estimation income" "official announcement income") was tried.

As mentioned above, if a relation like Engel's law is materialized between Engel's coefficient and a true income, it should become a group (class) of the high (low) income as the low (high) Engel's coefficient group (class) ((6)). Therefore, in a Wang (2012), first the Engel's coefficient level according to income bracket of the "城鎮居 private house yard basic situation" (city residents' household economy basic situation) of the Statistics Bureau official announcement (seven classifications which united about 5 minutes with about 10 minutes) to a standard, Engel's coefficient $(\overline{\beta}_1 = \tilde{\beta}_1, \cdots, \overline{\beta}_7 = \tilde{\beta}_7)$ of seven classes which suit them from survey data is deduced.

Next, deduced average-proceeds $y_i'$of Engel's coefficient of survey data and the class is measured, and let this be a true income ("estimation income").

At the end, it compares to $y_i$which is an official announcement income of the China Statistics Bureau of the same class, and measures the difference of estimation income y_i' and official announcement income y_i as a "hiding income" or a "gray income."

Below, referring to a Wang's (2010) method, using the data (CHIP data) of the China family income investigation 2007, Chinese "hiding income" or "gray income" is measured, and it verifies about the ability of a Wang's (2012) method to detect a gray income.

As mentioned above, it seems that the CHIP data in this paper is the random family-income-and-expenditure-survey data performed on a scale of the whole country, and has universality as data which verifies existence of a "gray income" compared with Wang (2012).

3 About Data (CHIP)

3-1 CHIP Data

The data used for this paper is private data(個票) called CHIP.

CHIP is the abbreviation for Chinese Household Income Project (the China family income investigation), it is the family income and expenditure survey (a farm village and a city) of China which it aged and the researcher (for example, Keith Griffin, Carl Riskin, John Knight) of the China social-studies institute and an overseas performed together 1988.

We use the CHIP data in 2007. Although there are two kinds of CHIP data in 2007, urban (city) and rural (farm village), this paper uses the data of urban (city).

About the CHIP data in 2007

In this paper, we use three kinds of data in the CHIP data in 2007. That is, they are an income (below, it abbreviates to an income per person), household consumer spending, and the wining and dining expenses in the consumer spending per annual one of city residents. Engel's coefficient is calculated by household consumer spending and wining and dining expenses. Those amounts of key statistics are as in Table 1. The number of effective samples is 4995.

＜table1 here＞

4 Measuring Result and Interpretation

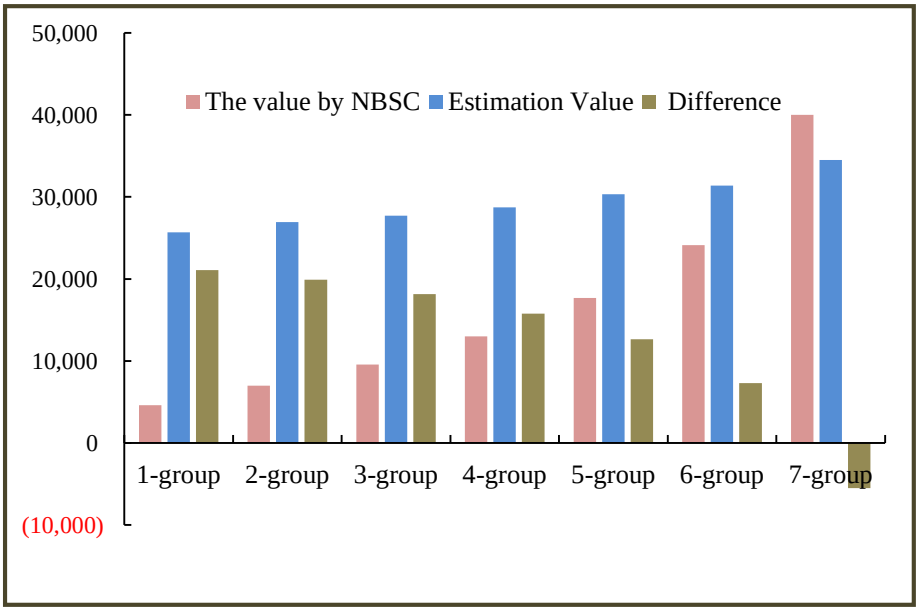
4-1 Measurement (1) : Estimation of Each "Class" Average Income United with Engel's Coefficient Level of Statistics Bureau

We summarize the measurement result of the estimation income obtained by the same method as a Wang (2012) in Table 2 and Table 3. The measuring method is as follows. First, Engel's coefficients of seven classes are deduced which fit conformity CHIP(2007) data at them according to the Engel's coefficient level according to income bracket in the " Urban-areas resident home fundamental situation " in CHIP (2007) which is published by the National Bureau of Statistics of China(here after, NBSC)[8]. Then, we estimate the average per capita income in each class of Engel's coefficient levels in CHIP(2007) data. Finally, we define a “gray income” by the differences between estimated per capita income and the official data “per capita income in urban area and rural area” which is also published by NBSC[9].

(table2&3 here)

Fig. 1 is illustrating the result of Table 2.

Figure 1 Per capita income estimated by the method of Engel’s coefficient



The distribution of "hidden income" according to class in Table 3 and Fig. 1 obviously differs from the Wang's (2012) result (Table 4-4 and Fig. 4-2). The differences are stem formtwo factors. At first, it is shown by Fig. 2 and Fig. 3, the distribution of the per capita income differs from that of Engel's coefficient given by CHIP (2007). As the result, as shown in Fig. 4, the correlation between two variables (per capita income and Engel’s coefficient) becomes very weak (a correlation coefficient is abbreviation −0.2264). We have the similar results by using CHIP(2008) data. That is, it is hard to think that Engel's law which the Wang (2012) assumes is materialized.

Second, as shown in Table 2, if we try to deduce the same Engel's coefficient in accordance with a Wang's (2012) method from CHIP(2007) to Engel's coefficients according to income bracket in the published data by NBSC, the data range of the relevance used is restricted. Moreover, we only can deduce the same Engel's coefficient values to which classified by class of the NBSC data (Table 3) under the duplication use of the data of the narrow relevant range. We consider this point in more detail. Table 1 is summarizing the fundamental statistic of a part of variable of CHIP(2007). According to the Table1, it turns out that the estimated Engel's coefficients are in the range of 0.05 to 0.975.

In Table2, however, it is restricted from 0.05 to 0.6 that the range of Engel's coefficient used in order to deduce equivalent values to the Engel's coefficient levels in seven classes in NBSC data. And as shown in Table 2, the data of the same range is used repeatedly.

As the result, the range of the deduced income is restricted form 1857.14 yuan to 291428.6 yuan, although the range of the income of data in CHIP(2007) is from 1095.24 yuan to 390476.2 yuan. Besides . as like the estimation of Engel's coefficient, the same data is used repeatedly. The biggest problem is that, in this calculation, it is used that only a part of per capita income in the bottom and the highest income class.

Figure2　Histogram of per capita income

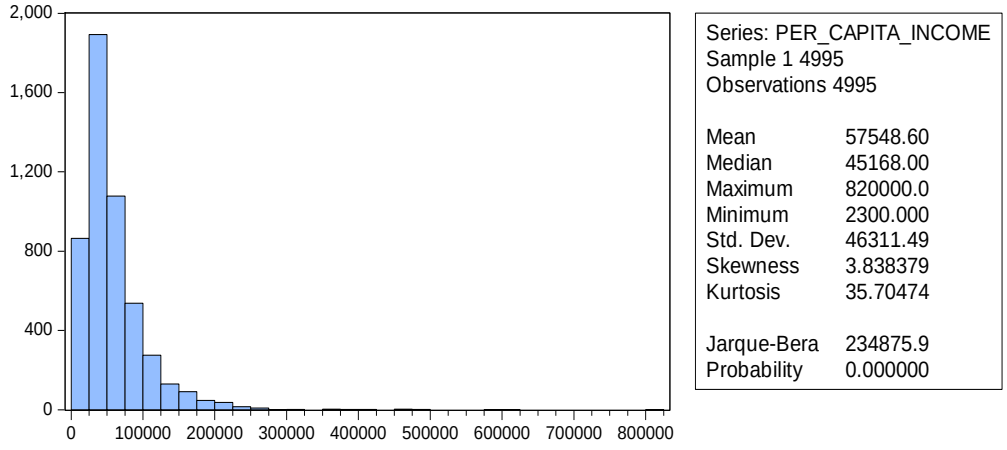


Figure3　Histogram of Engel's coeffecient

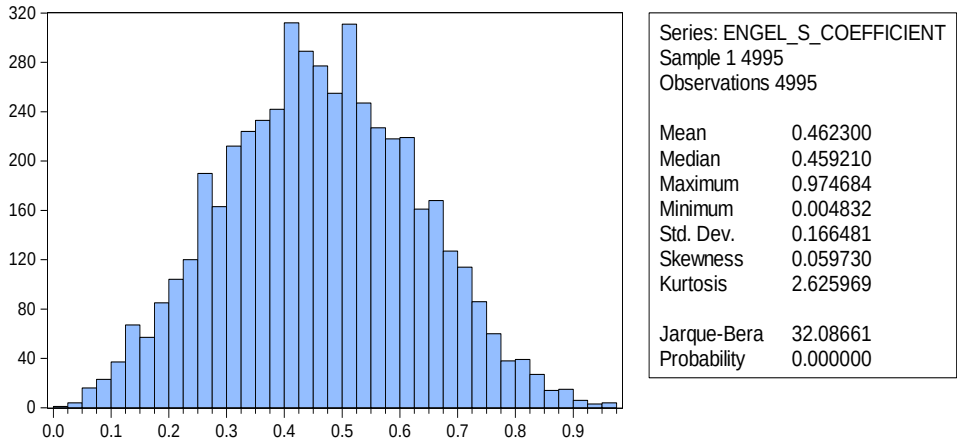
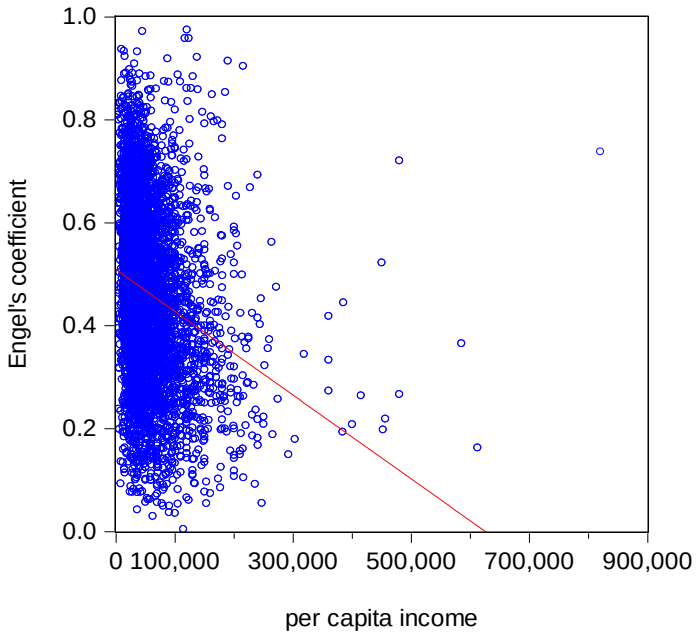


Figure4　Scatter plot of per capita income and Engel's coefficient

(coefficient of correlation :　-0.2264)



4-2　Measurement (2) : Measurement Depended at Least on Decile and quintile.

As mentioned above, although CHIP(2007) data can also measure and show "a hidden income" by the same method as a Wang (2012), as shown by Table 2 and Table 3, these results are different from a Wang (2010). So, these results are not appropriate to consider the estimation income of "according to

class". Hence, it can be said at least that a Wang's (2012) method is not adapted for this dataset[10]. Then, we modify the measuring method considering the Engel's law between income and Engel's coefficient and estimate the income of "according to class" from the CHIP(2007) data.

In Table 4 (the measurement method which is based on Engel's coefficient), and Table 5 (the measurement method which is based on per capita income), we estimate that "average Engel's coefficients of in each class" and "per capita income" and then, deduce "the income of according to class" and the "hidden income" according to the same way of NBSC. The measurement method of each table is as follows.

In Table 4, we firstly divides Engel's coefficient into decile and quintile. Then, we deduce average Engel's coefficients from equation (6b). Next, we calculate average per capita income according to each average Engel's coefficients. Finally, we summarize results in decile and quintile with class classification of NBSC. In Table5, we firstly divides per capita income into decile and quintile and deduce average per capita income according to each class from (6a). At last we obtain average per capita income and average Engel's coefficient in each class. As like table 4, each calculation result the measured decile and quintile is summarized according to a classification of the NBSC.

To compare the Wang's results(Wang(2012)), we make table 6 and table7. In table 6, we calculate average per capita income in each class which is according to the same classification by Wang (see table 6), and calculate average Engel's coefficients according to the class in per capita income level(see Table 7). Since Wang classifies income level in order to fit into classes of the NBSC data, both of Table 6 and Table 7 becomes the same classification of NBSC that are classified by the same way as a Wang (2012).

Fig. 4 to Fig. 6 are illustrating the measurement result of Table 4, Table 5, and Table 7, respectively.

Figure4　Per capita income estimated by decile and quintile(by table4)

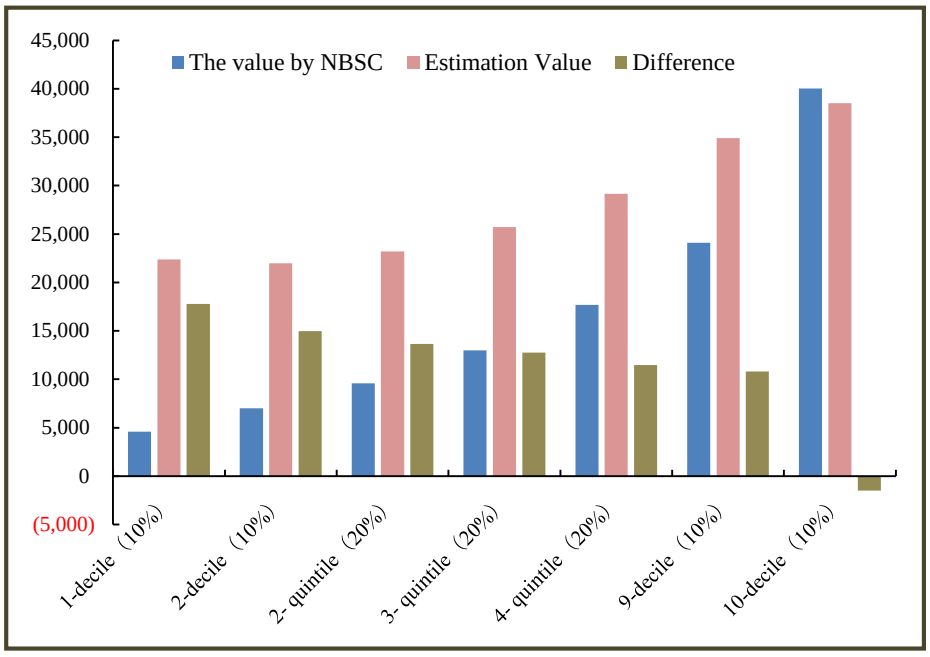


Figure5　Per capita income estimated by decile and quintile(by table5)

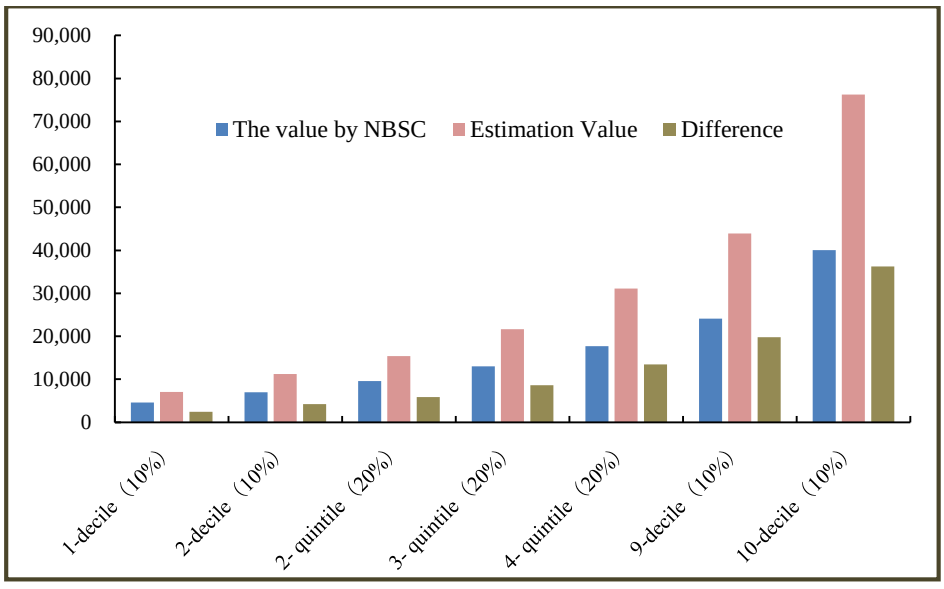
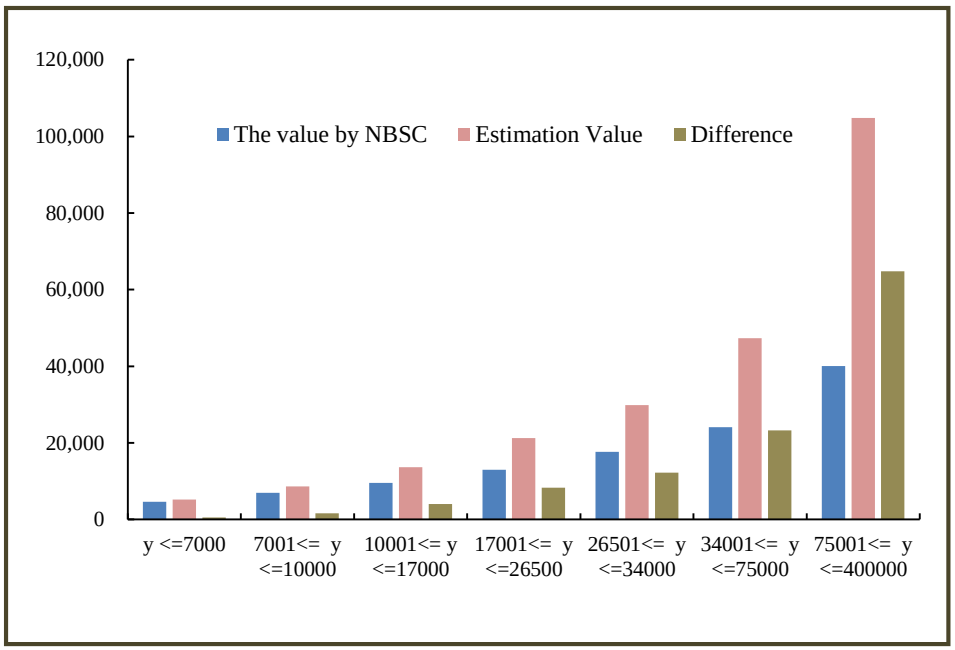


Figure6　Per capita income estimated by decile and quintile(by table6)



The "hidden income" distribution by which Table 5 (Fig. 5) and the Table 7 (Fig. 6) are very similar to a Wang's (2012) result (Table 8). Except the value of Engel's coefficient is a little higher than the value of the NBSC (the different from NBSC data is from 0.078 to 0.081), Table 5 (Fig. 5) and the Table 7 (Fig. 6) measurement result are similar to a Wang's (2012) result. These results mean that we can obtain the similar results to Wang (2012) by more general method (for example, method decile and quintile) than "Engel's coefficient method" which are forcibly united with the Engel's coefficient value of NBSC data. In this sense, the measurement method of this paper is considered more general.

Probably, existence of a "hiding income" or a "gray income" is a correct fact. However, it seems to be required that the verification based on an analysis by a theoretic model whether the difference of the estimation income obtained in this paper and the official announcement income of the NBSC as a "hiding income" or a "gray income". Let this be a future subject. In the following section, we argue the "hiding income" or a "gray income" according to a Wang's (2012) view.

4-3　Measurement (3): "Gray Income" versus GDP Ratio

How large is the Chinese "hiding income" or "gray income"? As mentioned above, a Wang (2012) estimated that the "hidden income" is equivalent to about 29% of GDP of the year in (2008). Besides,

it is indicated that the "gray income" is occupied no less than 17.2% of GDP of the year.

Table 9 summarize the scale of Chinese "hidden income" and "gray income" in (2007) using the measurement result of the estimation income of Table 5 and Table 7 and the view of the Wang (2012); "total gray income amount" ="aggregate estimated households income" − "total household income in official announcement by NBSC" and The "total hidden income amount" = "aggregate estimated households income"－"aggregate disposable incomes (the fund flow data)".

Although the ratio of an estimated "hidden income" to GDP in this paper is smaller than the Wang's (2012) result, the Chinese "a hidden income" in 2007 is from 4,680 billion yuan to 6,730 billion yuan (about from 78,900 billion yen to 104,800 billion yen) which is equivalent to from 17.6% to 25.3% of GDP. It is never a low level. If it exists as a fact, the Chinese government will not be able to ignore this. In addition, from the table 5 which is based on our modified measuring method, we find that the ratio of the average income of about the highest people and the bottom people to the total income are 39.6% and 3.4% respectively, and the gap between both people becomes 1100%; the average income of highest people is 11times as that of the bottom people. Also, Table 7 which is based on the Wang's measuring method shows that the ratio of the average income of about the highest people and the bottom people to the total income are 45.4% and 2.2% respectively, and the gap between both people becomes 2000%; the average income of highest people is 20times as that of the bottom people. Both of them indicates the income gap in China is very serious and the knowing the "gray income" or "hiding income" and resolving the gap is the subjects of the top priority for the present Chinese government.

5. The conclusion and future issue.

This paper verified using the CHIP data in (2007) about the existence and its measurement method of Chinese "gray income" or "hiding income". The CHIP data is the random family-income-and-expenditure-survey data performed on a scale of the whole country. It is different from the Wang's survey data in Wang (2012). We can summarize our results in three points as follows.

First, although CHIP(2007) data can also measure and show "a hidden income" by the same method as a Wang (2012), a measuring result has arbitrariness and the result is not appropriate for "an estimation income according to class."

Second, we improve Wang's (2012) measurement method and estimate the "income according to class" by using both Decile and quintile, having bearing in mind the relation between Engel's coefficient and an income (Engel's law). Using this modified method, we have the similar result to a Wang's (2012) estimation, and the estimation income in each class has far exceeded the published income data by the Statistics Bureau. The largest difference between the official announcement and estimated income is 161.9%. Moreover, we show that the ratio of the bottom income class in total income is from 2.2% to 3.4%, and ratio of the highest income class in total income becomes from

39.6% to 45.4%. This result suggests that the income gap in China is very serious.

At last, we estimate the Chinese "hidden income" in (2007) is from 4,680 billion yuan to 6,730 billion yuan (? of about 78,900 billion yen 104,800 billion yen) which is equivalent to from17.6% to 25.3% of GDP in China. Thus, the "hidden income" in China is not negligible.

As mentioned above, it is very important for the government to know the size of "gray income" quantitatively when they consider a future tax reform or income redistribution policy. The big problem, however, remains about the measuring method. It is a future subject to improve the measuring method which is applicable to more generalized data like CHIP(2007).

＜footnotes＞

1. All are calculated by an average monthly wage income. We explain the CHIP data in detail later.

2. Wang is the vice president at Ntional Economic research Institute, China reform Foundation, and he is an economist who has influence on an economic policy in China.

3. http://news.searchina.ne.jp/disp.cgi?y=2010&d=0308&f=politics_0308_007.shtml

4. In "China Society of Economic Reform" URL (http://www.cser.org.cn/index.php/54pk), the circumstances of the dispute about Chinese "gray income", are introduced collectively.

5. According to a Wang's (2012) opinion, " in various consumer spending, the wining and dining expenses is free from untruth, and the Engel's coefficient shows the relation between wining and dining expenses and aggregate consumption or an income. It is supposed that Engel's law that Engel's coefficient becomes low when an income level becomes large generally holds, the average incomes which is deduced based on Engel's coefficient are more nearly actual incomes, i.e., a true income."

6. "The urban and rural households income" is the sum of "a per capita disposable income of city residents" and "per capita net cash flow of farm village residents ", and "the aggregate household economy disposable incomes" is published in "the fund flow table (real trade)" in the China statistical yearbook.

7. In Wang (2007), (2010), there is no theoretical explanation about deduction of the average income by an Engel's coefficient method.

8. The income bracket's classification method follows seven classifications of the National Bureau of Statistics of China. That is, the 1st decile is a bottom income bracket (10%), and the second decile is a low income group (10%).

The 2nd quintile is middle-lower order income bracket (20%), the 3rd quintile is a middle income bracket (20%), and the 4th quintile is middle –high income brackets (20%). The 9th decile and 10th decile are a high income (10%) and the highest income(10%), respectively.

9. As mentioned above, the Wang (2012) distinguishes and defines "the hidden income" and the "gray income." "An estimation income − urban and rural hoseholds income (residents income)" is "a hidden income", and "estimation income − household economy disposable income" is the "gray

income." The ”residents income” is the sum of per capita income of city and a farm village residents, and home disposable income is the sum total of disposable income per capita of a city and a farm village.

As mentioned above, the former is a concept of 1st order distribution and the latter is a concept of secondary distribution. However, in official announcement data, although the former has data according to income bracket, that to which the latter it is not published.

10. If it measures by a Wang's (2012) method even if it uses the CHIP data of which year, probably only the same result will be obtained. Even if we use CHIP data of different year, estimating income following Wang(2012), we must have the same results. As we will tell you later, since Engel’s coefficient depends on the other factors, Engel’s low is not always satisfied in a real economy. CHIP data may show it.

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Table1 Basic statistics of the sample

Variable	Obs	Mean	Std.Dev.	Min	Max
Per Capita Annual Income of Urban Households	4995	27404.10	22053.09	1095.24	390476.20
Consumption Expenditure	4995	34351.80	27914.88	2850.00	745000.00
Food Expenditure	4995	14398.67	10494.33	1000.00	180000.00
Engel's Coefficient	4995	0.462	0.166	0.005	0.975

Table 2 Sample statistical indicators

	Mean	Obs	Percentage of observations	Min	Max
Engel’s coeffecient	0.276	1597	31.98	0.050	0.382
	0.331	1514	30.32	0.231	0.410
	0.366	1832	36.68	0.260	0.453
	0.389	1985	39.75	0.280	0.480
	0.413	1881	37.67	0.320	0.500
	0.435	2232	44.69	0.331	0.536
	0.472	2606	52.18	0.350	0.600
Per Capita Annual Income of Urban Households(RMB)	34506.79	1597	31.98	2095.24	291428.60
	31385.24	1514	30.32	1857.14	278571.40
	30331.23	1832	36.68	1857.14	278571.40
	28742.66	1985	39.75	1857.14	278571.40
	27709.02	1881	37.67	1857.14	278571.40
	26911.13	2232	44.69	1857.14	278571.40
	25695.81	2606	52.18	1857.14	278571.40

Table3 The estimation of Household income based on Engel's coeffecient method using National Bureau of Ststisties of Chaina (NBSC)

	Estimation Value			The value by NBSC		(c) Difference	The ratio of deviation	
	Engel's coeffecient	(a) Per Capita Annual Income of Urban Households(RMB)	Number of observations	Engel's coefficient	(b) Per Capita Annual Income of Urban Households(RMB)	(a-b)	c÷b (%)	ci÷Σci (%)
1-group	0.472	25695.81	2606	0.472	4604.09	21091.72	458.11	23.61
2-group	0.435	26911.13	2232	0.435	6992.55	19918.58	284.85	22.30
3-group	0.413	27709.02	1881	0.413	9568.02	18141.00	189.60	20.31
4-group	0.389	28742.66	1985	0.389	12978.61	15764.05	121.46	17.65
5-group	0.366	30331.23	1832	0.366	17684.55	12646.68	71.51	14.16
6-group	0.331	31385.24	1514	0.331	24106.62	7278.62	30.19	8.15
7-group	0.276	34506.79	1597	0.276	40019.22	-5512.43	-13.77	-6.17
Average	0.383	29325.98		0.383	16564.81			
Sum		205281.88			115953.66	89328.22		100.00

Table4 The estimation by decile and quintile (Engel's coefficient which is a standard)

	Estimation Value			The value by NBSC		(c) Difference	The ratio of deviation	
	Engel's coeffecient	(a) Per Capita Annual Income of Urban Households(RMB)	Percentage of observations	Engel's coefficient	(b) Per Capita Annual Income of Urban Households(RMB)	(a-b)	c÷b (%)	ci÷Σci (%)
1-decile（10%）	0.754	22372.24	9.99	0.472	4604.09	17768.15	385.92	22.24
2-decile（10%）	0.643	21972.17	10.01	0.435	6992.55	14979.62	214.22	18.75
2- quintile（20%）	0.554	23205.82	20.00	0.413	9568.02	13637.80	142.54	17.07
3- quintile（20%）	0.461	25721.67	19.72	0.389	12978.61	12743.06	98.19	15.95
4- quintile（20%）	0.370	29159.02	20.28	0.366	17684.55	11474.47	64.88	14.36
9-decile（10%）	0.282	34908.44	9.99	0.331	24106.62	10801.82	44.81	13.52
10-decile（10%）	0.178	38515.57	10.01	0.276	40019.22	-1503.65	-3.76	-1.88
Average	0.463	27979.28		0.383	16564.81			
Sum		195854.93	100.00		115953.66	79901.27		100.00
1-decile /Total (%)		11.42			3.97			
10-decile/Total (%)		19.67			34.51			

Table5 The estimation by decile and quintile (per capita annual incom which is a standard)

	Estimation Value			The value by NBSC		(c) Difference	The ratio of deviation	
	Engel's coeffecient	(a) Per Capita Annual Income of Urban Households(RMB)	Percentage of observations	Engel's coefficient	(b) Per Capita Annual Income of Urban Households(RMB)	(a-b)	c÷b (%)	ci÷Σci (%)
1-decile（10%）	0.531	7020.42	10.79	0.472	4604.09	2416.33	52.48	2.67
2-decile（10%）	0.504	11219.46	9.31	0.435	6992.55	4226.91	60.45	4.66
2- quintile（20%）	0.488	15425.60	19.90	0.413	9568.02	5857.58	61.22	6.46
3- quintile（20%）	0.468	21626.00	20.04	0.389	12978.61	8647.39	66.63	9.54
4- quintile（20%）	0.439	31110.34	20.16	0.366	17684.55	13425.79	75.92	14.81
9-decile（10%）	0.418	43901.73	9.81	0.331	24106.62	19795.11	82.11	21.84
10-decile（10%）	0.378	76276.11	9.99	0.276	40019.22	36256.89	90.60	40.01
Average	0.461	29511.38		0.383	16564.81			
Sum		206579.66	100.00		115953.66	90626.00		100.00
1-decile /Total (%)		3.40			3.97			
10-decile/Total (%)		36.92			34.51			

Table6 Classification of the income hierarchy by classification method of Wang (2012)

	CHIP 2007					Wang(2012)		
	Min	Max	Mean	Number of observations	Percentage of observations	Mean	Number of observations	Percentage of observations
$y \leq 7000$	1095.24	7000.00	5183.83	231	4.62	5685	365	8.70
$7001 \leq y \leq 10000$	7047.62	10000.00	8628.66	369	7.39	8646	622	14.83
$10001 \leq y \leq 17000$	10057.14	16985.71	13625.23	1163	23.28	13392	927	22.10
$17001 \leq y \leq 26500$	17005.71	26422.86	21251.47	1347	26.97	20941	650	15.49
$26501 \leq y \leq 34000$	26563.81	34000.00	29902.18	634	12.69	29910	355	8.46
$34001 \leq y \leq 75000$	34079.05	74857.14	47362.93	1080	21.62	47772	635	15.14
$75001 \leq y \leq 400000$	75238.09	390476.20	104796.60	171	3.42	164034	565	13.47
Sum.				4995	100.00		4195	98.19

Table7 The estimation by decile and quintile (the classification method of Wang (2012) which is a standard)

	Estimation Value			The value by NBSC			(c) Difference	The ratio of deviation	
	Engel's coeffecient	(a) Per Capita Annual Income of Urban Households(RMB)	Percentage of observations	Engel's coefficient	(b) Per Capita Annual Income of Urban Households(RMB)	Percentage of observations	(a-b)	c÷b (%)	ci÷Σci (%)
$y \leq 7000$	0.548	5183.83	4.62	0.472	4604.09	10	579.74	12.59	0.51
$7001 \leq y \leq 10000$	0.523	8628.66	7.39	0.435	6992.55	10	1636.11	23.40	1.43
$10001 \leq y \leq 17000$	0.493	13625.23	23.28	0.413	9568.02	20	4057.21	42.40	3.53
$17001 \leq y \leq 26500$	0.471	21251.47	26.97	0.389	12978.61	20	8272.86	63.74	7.21
$26501 \leq y \leq 34000$	0.437	29902.18	12.69	0.366	17684.55	20	12217.63	69.09	10.64
$34001 \leq y \leq 75000$	0.410	47362.93	21.62	0.331	24106.62	10	23256.31	96.47	20.26
$75001 \leq y \leq 400000$	0.363	104796.60	3.42	0.276	40019.22	10	64777.38	161.87	56.43
Average	0.464	32964.41		0.383	16564.81				
Sum		230750.90	100.00		115953.66	100	114797.24		100.00

Table8 The estimation of gray income by Wang (2012, table4-7)

	Estimation Value/The value by NBSC（2005）	Estimation Value/The value by NBSC（2008）	Distribution of gray income（2008）
1-decile（10%）	99.10	112.50	0.40
2-decile（10%）	101.80	100.90	0.00
2- quintile（20%）	106.90	117.40	2.30
3- quintile（20%）	114.00	128.00	5.10
4- quintile（20%）	130.60	143.10	10.90
9-decile（10%）	138.70	209.10	18.80
10-decile（10%）	337.60	318.70	62.50

Table9 The estimation of "Hide Income" and "Gray Income"

	Estimation (1) (by table 5)	Estimation (2) (by table 7)	Estimates of Wang (2008)
(1) Total Net Income of Rural Households (100 million yuan)	30121.2	30121.2	37301.0
a. Annual Per Capita Net Income of Rural Households (yuan)	4140.4	4140.4	5171.0
b.Rural Population(100 million persons)	7.3	7.3	7.2
(2) Total Disposable Income of Urban Households (yuan)	81858.4	81858.4	102436.2
(3) Total Estimation Income of Rural Households (100 million yuan)	175235.0	195738.6	195068.7
c.Annual Per Capita Disposable Income of Urban Households (yuan)	13785.8	13785.8	16885.0
d.Urban Population(100 million persons)	5.9	5.9	6.1
e.Annual Per Capita Estimation Income of Rural Households (yuan)	29511.4	32964.4	32154.0
(4) Total Income of Households (100 million yuan)	111979.7	111979.7	139737.2
(5) Total Estimation Income of Households (100 million yuan)	205356.2	225859.9	232369.7
(6) Total Hide Income(100 million yuan)	46797.5	67301.2	92632.4
(7) Total Disposable Income(100 million yuan)	158558.6	158558.6	182429.5
(8) Total Gray Income(100 million yuan)	93376.5	113880.2	49940.1
(9) GDP(100 million yuan)	265810.3	265810.3	314045.4
(10) Hide Income to GDP ratio (%)	17.6	25.3	29.5