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Domestic Solid Waste Discharge: Volume, Structure and Determinants in Rural China

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Domestic Solid Waste Discharge: Volume, Structure and Determinants in Rural China

Abstract

The purpose of this paper is to make a quantitative analysis of the rural domestic solid wastes discharge volume, structure and Determinants. The data comes from one large field survey in 6 provinces in China, The results show that, in 2010, the discharge volume of rural domestic solid wastes was 236 million tons. Policy factors and socio-economic conditions significantly influence the discharge volume of rural domestic solid waste. The implementation of certain policies can significantly reduce the discharge volume. The relationship between discharge volume and income per capita shows an obvious inverted U-shaped curve.

Key words: Domestic solid waste discharge, Determinants, Rural China

Domestic Solid Waste Discharge: Volume, Structure and Determinants in Rural China

In recent years, the discharge of rural domestic solid wastes of China shows a rapid increase. According to the investigation made by Tang on 141 villages of 26 provinces (autonomous regions, municipalities directly under the Central Government) in 2008, the proportion of rural domestic solid wastes accounts for 53% of all rural pollution sources, and becomes a primary environmental pollution source at present (Liu et al., 2005). The massive discharge of rural domestic solid wastes has already posed serious impact on rural environments. According to 2009 Report on the State of Environment in China, in the environment satisfaction survey, the satisfaction degree of rural interviewees is universally lower than that of urban interviewees, especially in respect of waste treatment and drinking water quality (SEPA, 2009). The reason probably is that the economic development and improvement of the living standard of farmers lead to a rapid increase of manufactured goods wastes. At the same time, the transformation from traditional agricultural economy to modern agricultural economy have caused a gradual declination of traditional recycling mode and a rapidly descended self-treatment capacity of wastes (Tang and Ting, 2008).

The issue of rural domestic waste pollution has attracted the attention of the Chinese government. The Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Wastes, revised in 2005, incorporates rural domestic wastes into the scope of public administration for the first time; the Circular of Opinions from the State Council on Enhancing Rural Environmental Protection, released in 2007, points out that efforts must be made to vigorously drive rural domestic pollution control and to carry on rural waste pollution control according to local conditions; In April 2009, the Ministry of Finance and the Ministry of Environmental Protection issued Interim Measures for the Management of Special Funds of the Central Government for Rural Environmental Protection, which regulates to use awards to promote pollution control for villages involved in the overall control of rural environment; the No. 1 document of the Central Government in 2010 emphasizes to “well control wastes and sewages to improve the living environment of rural areas”. Some local governments have presented management measures for rural wastes, for instance, such developed regions as Beijing, Shanghai and Zhejiang have successively carried on rural waste harmless treatment project (Tang and Ting, 2008). Since the “10th five-year plan”, the state and local governments have been increasing investment in the treatment of village and town domestic wastes (Luo, 2006).

In spite of that, the inherent characteristics and inadequacy hardware and software bring lots of difficulties to the control of rural domestic waste pollution. Comparing to the discharge of urban domestic wastes, the discharge of rural domestic wastes is much more decentralized and casual, and spreads widely with strong externality, which cause a high costs for discharge supervision and control (SEPA, 2009). Besides, since the scale of domestic wastes produced by rural households is relatively small in traditional agricultural economy, the software and hardware used to dispose wastes are thereby underdeveloped. In recent years, the support from the state and local governments in policies, resources, funds and technologies is far from enough to make up these inadequacies, so the problem of rural domestic wastes is becoming more and more serious in most of regions in China (He et al., 2010).

Since the Chinese government and researchers have just started to put concern on rural domestic solid wastes issues, not only statistical data about the discharge of rural domestic solid wastes unavailable, the quantitative understanding on the determinants of discharge is even harder to be found. A majority of scholars make summarization only based on sporadic data collected through small scale investigation or demonstration project. From the researches have made, the data samples are very limited, except for the large-scale investigation analysis made by Wei based on the status quo of China drinking water and environmental sanitation. For instance, Ren pointed out that the total discharge of rural domestic solid wastes in China is in a phase of rapid rise (2006) based on the investigation and research on six villages of Zhejiang Province (Ren, 2006); the results of research made by Wang (2004) on nine villages of six provinces of the country show that, the discharge structure of rural domestic wastes is transformed from simplification, harmlessness to sophistication and harmfulness (Wang et al., 2004). The qualitative investigation made by He (2010) on three villages of Zhejiang Province shows that, the domestic waste output per capita in village and town residential communities is positively correlated to regional economic development level (Li and Shao, 2007).

In order to provide sufficient evidence for the decision makers to implement relevant policies to control the rural waster pollution, we have to answer the following questions: What is the total discharge volume of rural domestic solid wastes in China? How about the characteristics of the rural domestic solid wastes discharge? Are there regional differences on the discharge volume and structure of rural domestic solid waste? What are the determinants of discharge volume of the rural domestic solid wastes in China? The objectives of this paper are to answer these questions through conducting in-depth quantitative analysis on the discharge volume, structure determinants of rural domestic solid waste.

The following paper has been organized as four sections. The first section is to describe the data and define the domestic solid waste. Section 2 is to discuss the discharge volume, structure and characteristics of rural domestic solid wastes. Applying both descriptive and econometric approaches, section 3 is to analyze the determinants of the discharge of rural domestic solid wastes. The final section is conclusion and relevant policy recommendations.

1. Data and Definition of Domestic Solid Waste

In 2010, a large-scale on-site investigation on villages and rural households was carried out in six provinces (or municipality) of China, as Beijing, Jilin, Hebei, Anhui, Sichuan and Yunnan. The selection of these provinces gave consideration not only to the differences of areal distributions of South China and North China, but to the different socioeconomic development levels. For instance, we included not only three representative provinces of North China (Beijing, Jilin and Hebei), but also three representative provinces of South China (Anhui, Sichuan and Yunnan). From the perspective of socioeconomic development level, the GDP per capita of Beijing City take the lead in China, ranking the 3rd; the GDP per capita of Anhui Province, Sichuan Province and Yunnan Province fall behind, respectively ranking the 27th, 28th and 31st; the GDP per capita of Jilin Province and Hebei Province are in a national average level, respectively ranking the 12th and 14th place.

The method of stratified random sampling was used in each province to select samples. Firstly, we divided all counties in each province into such three groups as high, medium and low groups, according to the per-capita disposable income of rural residents in 2009. Then randomly select one county from each group, thus we selected three counties from each province. We selected three counties from Beijing too, however, actually there were only two counties are selected for data analysis in this paper. In order to guarantee data quality, another county was selected as field training investigation county, so it was excluded from final samples. After county selection, we select two townships from each county and three villages from each township. And then select 10 to 12 rural households from each village for investigation in a random way. Therefore, the investigation samples totally included 17 counties, 34 townships, 105 villages and 1104 rural households of six provinces.

The investigation applied the mode of face-to-face questionnaire, which was divided into two types: village questionnaire and rural household questionnaire. The answerers of the village questionnaire were mainly village leaders such as village Party secretary, village head and accountant et al., while the answerers of the rural household questionnaire. were mainly householders of rural families. We conducted strict indoor training for all investigators and then carried on field training in the suburbs of Beijing before formally starts this investigation. The questionnaire covers a wide range of contents, including not only the discharge volume and structure and management system arrangement of rural domestic solid wastes, but also some natural, social and economic features in respect of villages and rural households.

In this investigation, rural domestic solid wastes were defined as kitchen wastes, various plastics, glasses, papers, textiles and leather, metal, clinker and their products generated in rural life. This definition is basically identical with that made by Yang and Tiesong (2006), except for some small differences, for instance, our definition did not include harmful wastes. In addition, this definition did not include rural architectural wastes and farm production wastes into rural domestic solid wastes. For the convenience of analysis and grasp of waste discharge characteristics, we classified rural domestic solid wastes into the following three categories: 1) organic or compostable wastes: Characterized by perish ability, mainly include kitchen wastes, plant ashes and plant residues etc. 2) inert wastes: They mainly include cinders, ash soil cleaned from houses and yards building wastes; 3) recyclable wastes: including plastic wastes, papers, glasses, metal, disused furniture and electric apparatuses, textiles, leather and rubbers.

2. Discharge and characteristic**s of rural domestic solid wastes**

According to the investigation and research data, the discharge volume and geographical distribution of rural domestic solid wastes have the following characteristics:

First, the discharge per capita per day of rural domestic solid wastes is close to 1kg, slightly lower than the urban level. The investigation data shows that, the discharge per capita per day of rural domestic solid wastes in 2010 is 0.96kg, which is slightly larger than the data (0.9 kg) got in 2006 based on China drinking water and environmental sanitation status quo investigation made on 6590 villages of 31 provinces (autonomous regions and municipalities directly under the Central Government); but slightly lower than the 1.34 kg got by Wang according to the investigation made on nine villages and six provinces (Table 1). As for sample representation, our investigation and research result and that of China drinking water and environmental sanitation status quo are more representative of the national average level. The result of our investigation made in 2010 is slightly larger than that of 2006, and may be a reflection of the discharge of rural domestic solid wastes being in a rise phase. The discharge per capita per day of urban domestic solid wastes is 1.2 km (Geng, 2010), that is to say, the discharge per capita per day of rural domestic solid wastes is 80% of that of urban domestic solid wastes.

Second, although the discharge per capita per day of rural domestic solid wastes is relatively low, its pollution for environment is much serious than that of the urban domestic solid wastes. This is primarily because most of our rural areas do not have the relatively good recovery and treatment capacities as urban areas. According to our investigation, only 52% of the 105 sample villages were equipped with facilities as waste storage tanks and waste bins. From the perspective of waste collection and transportation, relatively few villages, only 72% of the sample villages have the capacity of waste collection and transportation. What more important is that the waste treatment modes of those villages with waste treatment service generally fall behind. According to our investigation, only 39% of the villages with waste treatment service apply harmless treatment mode, that is to say, the calculated harmless treatment ratio of rural domestic solid wastes is only 28%. However, the situation in urban areas is much better, the harmless treatment ratio in 2009 has already reached 71% in urban,(NBSC, 2010).

Third, the annual average discharge volume of rural domestic solid wastes presents a rising trend and the growth rate of rural domestic solid wastes exceed that of urban domestic solid wastes. In 2010, rural population in China was 674.5 million (NBSC, 2010), and it is estimated that, based on 0.96 kg of discharge per capita per day, the total discharge of rural domestic solid wastes in China was about 236 million tons/year. It is estimated that, the output of rural domestic solid wastes reached 140 million tons(Yang and Tie, 2006), and based on present discharge of 236 million tons, we can estimate that the discharge of rural domestic solid wastes during the period from Year 2000 to 2010 actually increased by 68.6%. In the same period, the discharge of urban domestic solid wastes increased from 114 million tons to 157 million tons, up by 37.7% (NBSC, 2010; NBSC, 2001). That is to say, the discharge of rural domestic solid wastes shows a more rapid rate of growth than that of urban area.

Fourth, the discharge per capita per day of rural domestic solid wastes differs greatly in provinces of China. The investigation and research result shows that, the average discharge per capita per day of rural domestic solid wastes is between 0.58~1.46 kg in the six sample provinces. Among them, Yunnan province only discharges 0.58 km per capita per day, which is only 39.7% of that of Beijing (1.46 kg). What calls for special attention is that, if we classify such provinces into Northern provinces and Southern provinces, as per the traditional division line of Qinling- Huaihe, we will find that the average discharges per capita per day of rural domestic solid wastes of the three Northern provinces are all higher than 1 kg, at an average of 1.28 kg, while those of the three Southern provinces are all lower than 1 kg, at an average of 0.69 kg (Figure 1). The test result of inter-group average value difference is 3.54, showing that the average discharges per capita per day of rural domestic solid wastes of Northern provinces are evidently higher than those of Southern provinces.

Finally, from the perspective of discharge structure, recyclable wastes are a primary part of rural domestic solid wastes, accounting for 39.5% of the total discharge. The other two categories of solid wastes, namely, organic or compostable wastes and inert wastes account for 36.9% and 23.5% respectively. In addition, the discharge structure of domestic solid wastes differs to some degree in different regions. Some regions focus on recyclable wastes, for instance, the proportions of recyclable wastes of Anhui is the highest among all domestic solid wastes in the waste structure, say over 50%; while some other regions focus on organic or compostable wastes and inert wastes, for instance, organic or compostable wastes and inert wastes of Beijing and Sichuan occupy the largest proportion in their waste structures; while some even focus on inert wastes, for instance, in Hebei Province, the inert wastes occupy 45.5% of the total domestic solid wastes, which is the largest in its waste structure (Table 2).

3. The Determinants of the Discharge Volume of Rural Domestic Solid Wastes

3.1 Descriptive statistical analysis

Policy factors may of negative correlation with the discharge per capita of rural domestic solid waste. Through investigation, we found out that the common rural domestic solid waste policy in China is the Solid Waste Recycling and Disposal policies; in rural area, where this kind of policy have implemented, people were trained to treating and recycling domestic solid waste. In our sample, 11villages had trainings about waste treatment or recycle, the discharge per capita of rural domestic solid waste is 0.93kg. However, in the rest 94 villages where have not implemented this kind of policy, the discharge per capita of rural domestic solid waste is 0.97kg (Figure 2). We make the following assumption: the trainings about waste treatment or recycle can significantly reduce the discharge per capita of rural domestic solid waste.

Socio-economic conditions may significantly impact the discharge per capita of rural domestic solid waste. We choose three variables, per capita net income of farmers, and number of enterprises in village and proportion of non-agricultural labor force, as the representation of socio-economic conditions. We will discuss these three variables in the following:

First, the relationship between the discharge per capita of rural domestic solid wastes and income per capita may show an obvious inverted U-shaped curve. From the experience of developed countries, the relationship between the discharge of domestic solid wastes and socioeconomic development level shows an obvious inverted U-shaped curve (MazzantiIs, 2008; Daisuke et al., 2011). Through the analysis on the investigation and research data, we find that the inverted U-shaped curve of relationship between the discharge of rural domestic solid wastes and per capita annual net income also exists obviously in China. According to per capita annual net income of farmers, we classified the per capita waste output data into six groups, at a group interval of RMB 2,000. The result shows that, along with the growth of per capita annual net income, the waste discharge per capita first rose then fell in the course (Figure 3). We make the following assumption: the relationship between the discharge per capita of rural domestic solid wastes and income per capita shows an obvious inverted U-shaped curve.

Second, daily solid waste discharge per capita and the number of intra-village enterprises may of positive correlation. The intra-village enterprises refer to the enterprises built in the village, including collective enterprises and private enterprises. According to number of intra-village enterprises in each village, we classified the per capita waste output data into six groups, at a group interval of one enterprise. The result shows that, along with the growth of number of intra-village enterprises, the waste discharge per capita showed a rising trend (Figure 4). We make the following assumption: daily solid waste discharge per capita and the number of intra-village enterprises are of positive correlation.

Last, daily solid waste discharge per capita and the proportion of non-agricultural labor force may of negative correlation. The proportion of non-agricultural labor force means the proportion of people engage in non-agricultural in the total labor force of a village, including both working inside the village and outside the village. According to the proportion of non-agricultural labor force, we classified the per capita waste output data into five groups, at a group interval of ten percent. The result shows that, along with the growth of proportion of non-agricultural labor force, the waste discharge per capita showed a decline trend (Figure 5). We make the following assumption: daily solid waste discharge per capita and the proportion of non-agricultural labor force are of negative correlation.

3.2 Econometric model analysis

The above descriptive statistical analysis has made certain judgment on the determinants of per capita daily discharge of domestic solid waste; however, this analysis only takes into account the impact of single factors, and does not analyze the results of the common functions of these factors from the perspective of integration of multiple factors. That is to say, in single-factor analysis, we fail to control the impact of other factors, and thus can not separate the impact of each factor on daily discharge per capita of domestic solid wastes. Therefore, in order to grasp the determinants of per capita daily discharge of domestic solid waste more deeply and accurately, we have established the following metrology model based on the village-level investigation and research data of six provinces in China, which is set as follows:

$$W_i = \alpha + \beta P_i + \delta I_i + \rho D_i + \varepsilon \quad (1)$$

In the above equation, dependent variable W_i represents the daily discharge per capita of domestic solid wastes of a village (kg). Among the independent variables in the right of the equation, P_i is policy variable, The policy variable is expressed by whether waste treatment and recycling utilization trainings are conducted or not, and it is a dummy variable and equals 1 (if conducted), or 0 (if not conducted).I_i represents the socio-economic conditions, expressed by per capita annual net income of farmers in. village (RMB 10000/year), the square of per capita annual net income of farmers in i village, enterprises in the village and the proportion of non-agricultural labor force. The square of per capita annual net income of farmers is used to analyze the nonlinear correlation between the per capita net income and daily discharge per capita of domestic solid wastes of farmers.

D_i is a control variable, expressed by the proportion of labor force received above high school education (%), the proportion of labor force in total population (%) , the distances from the village to the nearest highway in township-level or above (km), per household irrigation area (mu), whether residential areas are centralized or not (1=yes; 0=no), Landform (1=Plain; 0=Mountainous area), household electricity price (Yuan/kwh), proportion of rural households using coal as living energy (%), county dummy variable. α is an absolute term, *β, δ, ρ* are parameters under estimate, ε is a random disturbance term.

The econometric model estimate falls out well (Table 3). The R^2 of model was estimated 0.28, is much higher as for cross section data. The statistical test of a large number of control variable estimate results is remarkable, and the system symbol also meets the expectation. For instance, the coefficient of the proportion of labor force received above high school education is negative and remarkable which shows that the higher the labor force received education, the less the daily waste discharge per capita is. This may due to the fact that if the labor force received more education, they may have more knowledge about how to recycling waste, then reduce the discharge of waste.

The coefficient of the proportion of labor force in total population is positive and remarkable which shows that the higher the proportion of labor force in total population, the larger the daily waste discharge per capita is. This may due to the fact that the labor fore at the same time is the main consumer in village, they may consume more merchandise, then discharge more waste. Daily waste discharge per capita and the decentralization of residential areas are of remarkable negative correlation, which means the lower the degree of centralization is, more difficult the waste management is (especially the recycling utilization of wastes) and with lesser self-absorbed wastes, and thus the larger the number of wastes discharged is.

What’s more, the model estimate shows the same result as our descriptive statistical analysis: Policy factors have remarkable negative correlation with the discharge per capita of rural domestic solid waste. The coefficient of whether trainings about waste treatment or recycle are conducted or not is negative and remarkable in 10% level, the implementation of solid waste recycling and disposal policies can significantly reduce the discharge per capita of rural domestic solid waste. The reason may be that, though the trainings about waste treatment or recycle, farmers can get more knowledge about how to recycling waste, and they also may realized they can get revenue form the recycling of waste. For example, after the training, farmers may build up methane tank to recycling Organic or compostable wastes, and then the discharge of domestic solid waste will significantly reduced.

The relationship between the discharge of rural domestic solid wastes and per capita annual net income of farmers shows an obvious non-linear inverted U-shaped curve. The model estimate result shows that the coefficient of monomial term of per capita annual net income of farmers is positive and remarkable in 10% level. The quadratic term coefficient of per capita annual net income of farmers is negative and remarkable in 5% level. This verifies our conclusion made in descriptive statistical analysis, that is, when the per capita annual net income of farmers is relatively low, the per capita daily waste discharge begins to show a rising trend along with the growth of income. But while the income level rises to a certain degree, the per capita waste discharge decreases along with the growth of income.

The inverted U-shaped curve relationship between the discharge of domestic solid wastes and income per capita might be closely related to the change of some consumption customs caused by the improvement of income. When the per capita net income is relatively low, along with the growth of the per capita net income, farmers are affordable to purchase more processed food or packed food. Meanwhile, the excitation of waste recovery decreased at this stage, thus leading to more wastes. When the income climbed to a certain height, the consumption structure of farmers will change, and they will tend to purchase high quality and small quantity food, and to replace coal with such clean energies as electricity and natural gas in energy consumption, which leads to the decrease in waste output.

According to the monomial and quadratic term estimate coefficients of per capita annual net income of farmers, we calculated the inflection point of the inverted U-shaped curve which is RMB 5,710 (Yuan). The inflection point we calculated differs greatly from that got by Mazzanti et al. (USD 35,000~39,000/ year) (2008). What Mazzanti et al. studied into was the discharge of urban domestic wastes in developed countries, and the per capita income level is measured by per capita GDP. Since the socioeconomic conditions of rural areas and urban areas, of China and developed countries differ significantly, and the measurement methods for per capita income level are also different, so such difference is understandable. What the most important is the research shows no matter in rural areas or urban areas, the relationship between the discharge of domestic solid wastes and per capita income shows an obvious non-linear inverted U-shaped curve.

Daily solid waste discharge per capita and the number of intra-village enterprises are of remarkable positive correlation. The model estimate result shows, the coefficient of the number of intra-village enterprises is positive and remarkable in 5% level. This verifies our conclusion made in descriptive statistical analysis, that is, along with the growth of number of intra-village enterprises, the waste discharge per capita showed a rising trend. We have two explanations for this fact: first, if there have more enterprises in the village, the commercialization degree of the village will be better, and then farmers may purchase more processed food or packed food, thus leading to more wastes. Second, if there have more enterprises in the village, farmers will have more opportunities to work in the enterprise, the opportunity cost of labor will increase, farmers will choose to invest less time in waste recycling.

Daily solid waste discharge per capita and the proportion of non-agricultural labor force are of remarkable negative correlation. The model estimate result shows, the coefficient of the proportion of non-agricultural labor force is negative and remarkable in 10% level. This also verifies our conclusion made in descriptive statistical analysis, that is, along with the growth of the proportion of non-agricultural labor force, the waste discharge per capita showed a reducing trend. This may because, according to China's situation in rural areas, a large proportion of non-agricultural labor force are working out the village, there only a very short time they living in the village, and the waste they discharge outside their village will not included in out statistics.

4. Conclusions and Policy Recommendations

Based on the on-site investigation and research data of 1,104 rural households in 105 villages of 6 provinces (cities) of China made in 2010, this paper analyzes the discharge volume, structural characteristics of rural domestic solid wastes in China, and makes a quantitative research on the influence factors of discharge per capita of domestic solid wastes. The research result shows that, the daily discharge per capita of rural domestic solid wastes in China in 2010 was 0.96 kg; this is approximately 80% of that of urban areas. The daily discharge per capita in rural areas are lower than that of urban areas, however, the harmless treatment ratio in rural areas is only 1/3 of that of urban areas. When considering the huge rural population, we can reach the conclusion that the pollution of the environment caused by rural domestic solid wastes may be much more serious. In addition, from the perspective of the overall discharge of domestic solid wastes, rural areas reached 236 million tons in 2010, at a growth rate higher than that of urban waste discharge.

Rural domestic solid wastes differ markedly in Northern areas and Southern areas of China. The daily discharge per capita of domestic solid wastes is much higher in Northern provinces than that of Southern provinces. The Chinese government had better formulate different waste management policies according to the conditions of different areas. In addition, the research also shows, recyclable wastes occupy the largest proportion in the discharge structure of rural domestic solid wastes, say, 39.5%, while organic or compostable wastes and inert wastes respectively occupy 36.9% and 23.5%. It is obvious that the Chinese government might subsidize waste recovery deeds and implement effective measures to improve recovery rate and reduce pollution.

The results of descriptive statistical analysis and econometric model analysis reveal that, the implementation of solid waste recycling and disposal policies can significantly reduce the discharge per capita of rural domestic solid waste. Chinese government can reduce the discharge per capita of rural domestic solid waste by implement more of such policies, for example, carry out training of waste recycling and encourage more farmers to use methane tank.

In addition, the relationship between daily discharge per capita of rural domestic solid wastes and per capita annual net income of farmers is of an obvious inverted U-shaped curve. The income inflection point of daily discharge per capita of rural domestic solid wastes is RMB 5,710 Yuan. The daily discharge per capita of rural domestic solid wastes shows a trend of increase in areas with a relatively low income level. Therefore, the state shall put more concerns on such areas and help improve their waste treatment and management.

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Table 1. Comparison of the Results of Rural Domestic Solid Wastes Discharge Volume from different researches (kg/person• day)

Samples	Year	Investigation Method	Discharge per capita	Data source
123 villages of such seven provinces (municipalities) as Beijing, Jilin, Hebei, Zhejiang, Anhui, Sichuan and Yunnan	2010	questionnaire	0.96	This paper
6590 villages of 31 provinces (municipalities, autonomous regions)	2006	questionnaire	0.90	Wei X. et al., 2007
9 villages of such six provinces (municipalities) as Shanghai, Zhejiang, Qinghai, Shandong, Henan and Beijing	2004	demonstration project	1.34	Wang J. et al.,2004

Table 2. Composition of Rural Domestic Solid Wastes (%)

District	Organic or compostable wastes	Inert wastes	Recyclable wastes
Beijing	49.8	10.9	39.3
Sichuan	40	30.1	29.9
Jilin	39.1	17.9	42.9
Anhui	34.6	12.4	53
Hebei	32.8	45.4	21.8
Yunnan	31.5	24.3	44.2
Total	36.9	23.5	39.5

Data source: author’s survey

Table 3. Econometric regression analysis of the determinants of the Discharge of Rural Domestic Solid Wastes (OLS)

	Per capita waste discharge (kg/person• day)
Policy variable	
Whether trainings about waste treatment or recycle are conducted or not	-0.600
(1=Yes; 0=No)	(1.78)*
Socio-economic conditions	
Per capita net income of farmers (RMB 10000/year)	2.494
	(1.81)*
Square of per capita net income of farmers (RMB 10000/year)	-2.184
	(2.42)**
Number of enterprises	0.046
	(2.19)**
Proportion of non-agricultural labor force (%)	-1.366
	(1.83)*
Control variables	
Proportion of labor force received above high school education (%)	-2.960
	(2.14)**
Proportion of labor force in total population (%)	2.642
	(2.82)***
Distance from the nearest highway of township-level or above (km)	0.007
	(0.18)
Per household irrigation area (mu)	-0.070
	(1.47)
Whether the residential areas are centralized or not (1=Yes; 0=No)	-0.584
	(2.32)**
Landform (1=Plain; 0=Mountainous area)	-0.139
	(0.47)
Household electricity price (Yuan/kwh)	-0.178
	(0.74)
Proportion of rural households that use coal as living energy (%)	-0.305
	(0.44)
County dummy variable	Not reporting
Intercept	1.319
	(1.61)
Observed value	105
Adj R^2	0.284

Note: 1. " * ", " ** " and "*** " respectively represents that the test significance levels are 10%, 5% and 1%.

2. Figures in parentheses indicate *t* statistics.

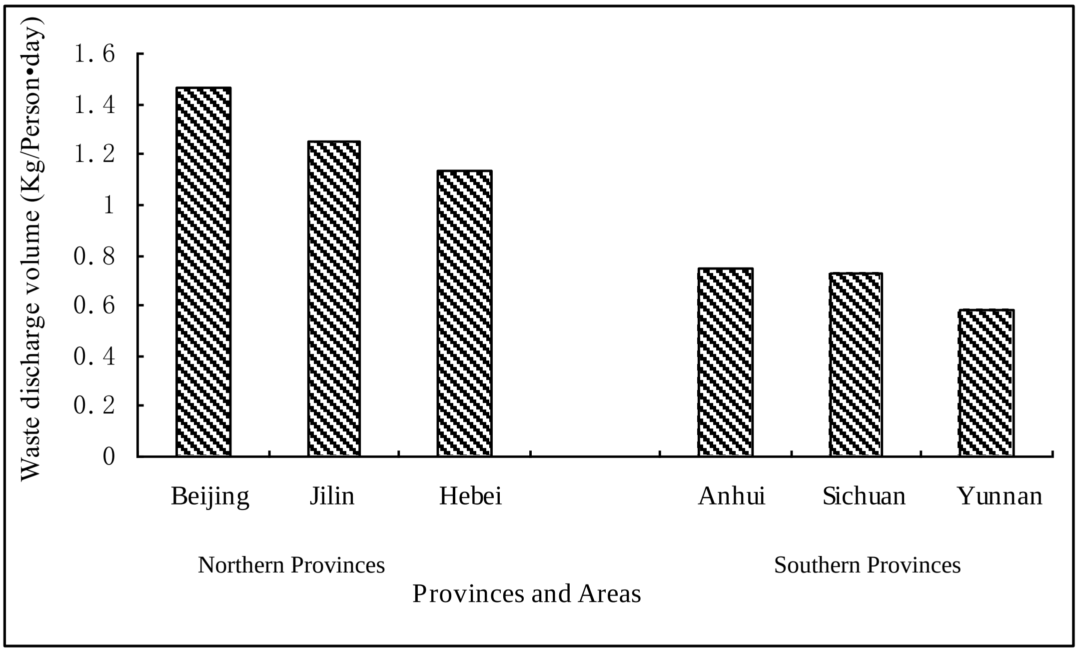

Figure 1. Discharge of Rural Domestic Solid Wastes Per Capita Per Day in Different Areas of China

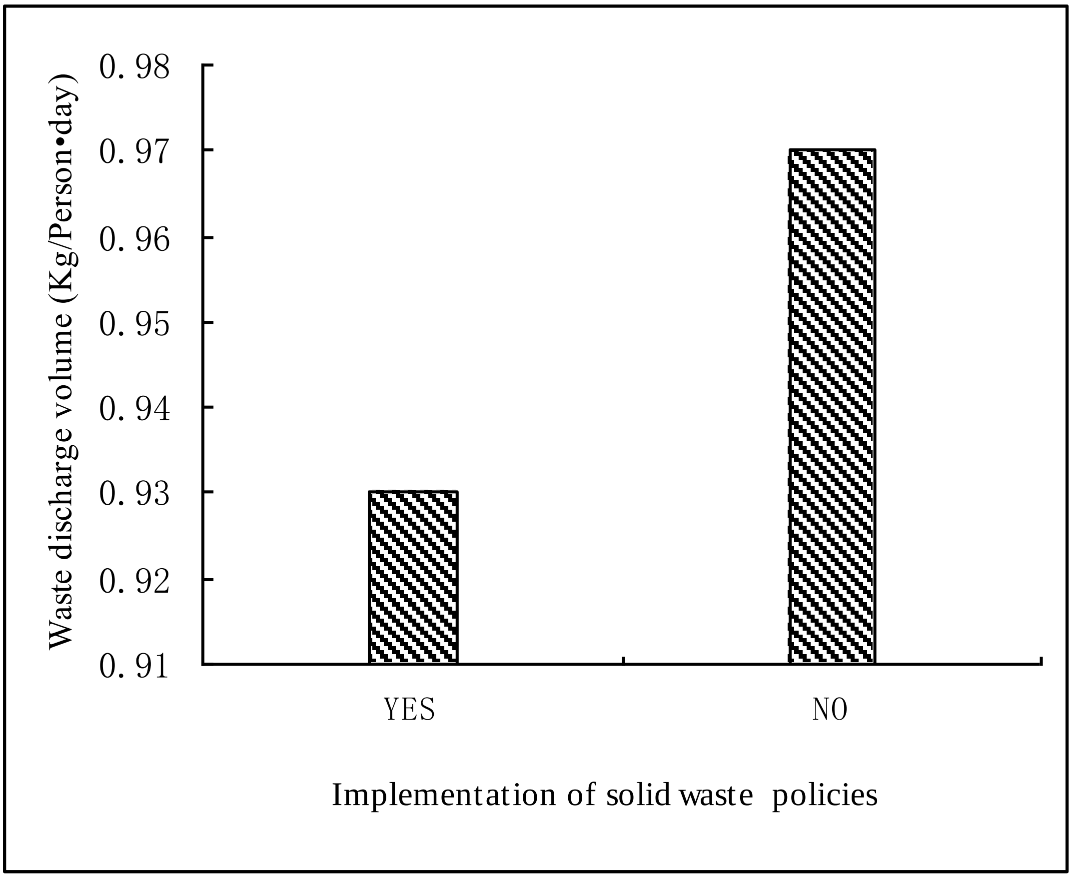

Figure 2. Relationships between Implementation of Solid Waste Recycling and Disposal Policies and the Per Capita Waste Output

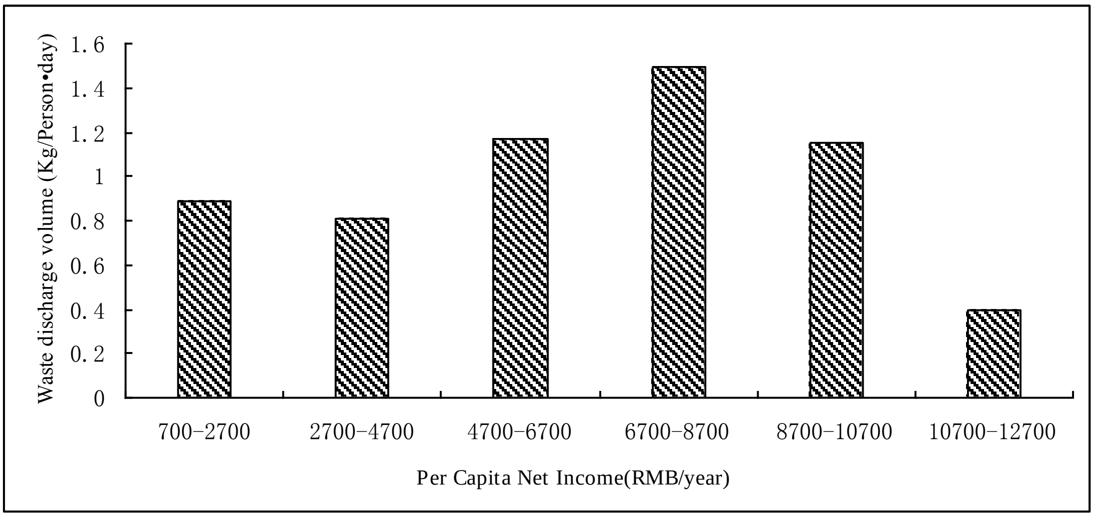

Figure 3. Relationships between Per Capita Net Income and Per Capita Waste Output

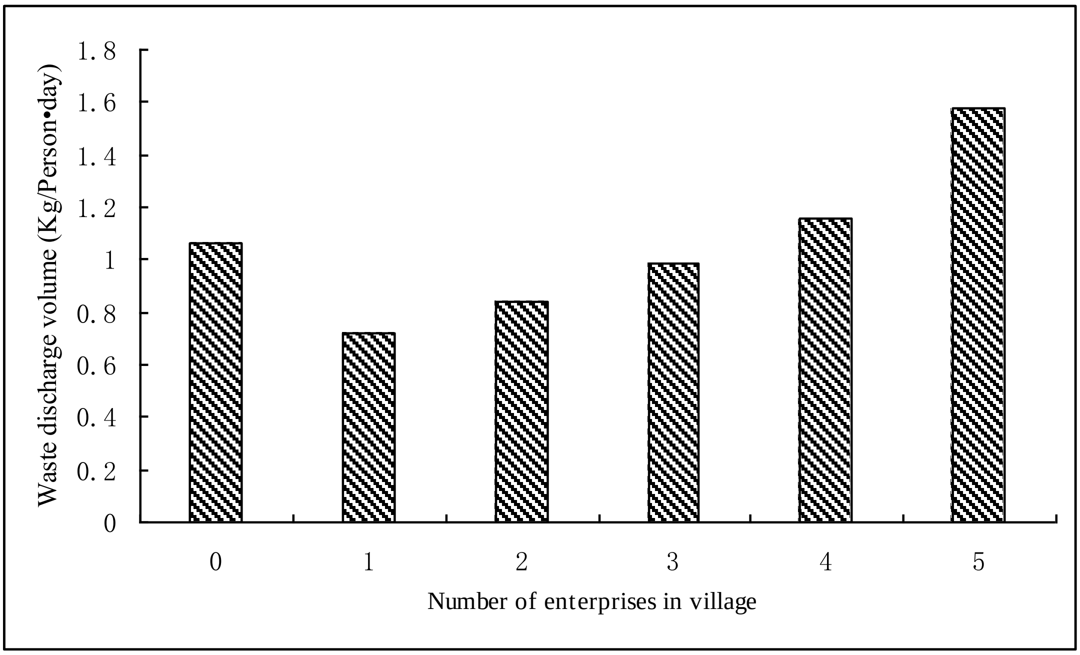

Figure 4. Relationships between Number of enterprises in Village and Per Capita Waste Output

Figure 5. Relationships between Proportion of Non-agricultural Labor Force and Per Capita Waste Output