Low-income Settlement Reconstruction and Subjective Well-being —Based on Six Cities' Sample Survey in Liaoning Province

Chao Li & Shangchao Liu*

Abstract

Low-income settlement is a common problem existing in many countries. By using 2012 survey data of UN-HABITAT and CASS, this paper focuses on the change of original residents' subjective happiness during the process of low-income settlement reconstruction in six cities of Liaoning province. Several conclusions are obtained: (1) Low-income settlement reconstruction had significant effects on original residents' happiness, the relation between income level and happiness exhibits an inverted-U shape after reconstruction; (2) Quantile regression estimation shows that the community life quality improvement affected positively on different happiness levels of original residents, while new communication methods and the change of neighbor relationship after reconstruction cannot improve subjective well-being; (3) According to the low-income class, the influencing factors of happiness is so different with other groups and also government's indirect pro-poor policies received slightly less positive effect. Therefore, authorities should pay more attention to both explicit and implicit effects of low-income settlement reconstruction.

Keywords: low-income settlement, social effect, subjective well-being, Liaoning province

1. Raising issue

Low-income settlement is a universal issue existing in many countries with different income levels. "2010-2011 State of the World's Cities" shows that by carrying out of low-income settlement, 227 million people moved out from slums in last ten years, meanwhile, the population of slum residents increased from 776.7 million in 2007 to 827.6 million in 2010 with a net increase of 55 million. Since the Chinese reform and opening up, the largest scale of accelerating urbanization process in human history has happened in China, simultaneously the low-income settlements has been spreading out in many large cities. Shanty town is a typical representative of Chinese low-income settlements. Until the end of 2008, 11.48 million households lived in various kinds of shanty towns, including 7.44 million households with middle or low-income lived in city shanty towns. In Liaoning province, an old industry base in north-east China, the problem of shanty towns was particularly serious that 29 million square meters centralized shanty towns held more than 700,000 households and 2.1 million residents. Since 2005, when State Council approved the project of shanty town reconstruction in north-east China, Liaoning provincial government started the comprehensive integrated shanty town reconstruction. Official statistics shows that 29.1 million square meters shanty towns were rebuilt and houses for 706,000 households and 2.11 million residents were provided from 2005 to the end of 2011. The final goal of shanty town reconstruction in Liaoning is to pay more attention on original resident's housing condition and welfare level, thus the final reconstruction performance depends on both improvement of living space, environment and subjective well-being growth. However, does the affordable housing engineering reach its expected social effect after seven years? Does low-income settlement have significant influence on individual subjective well-being? This paper will

comprehensively discuss the above topics in depth.

Concerning the overall condition of sampling survey this time, most of the original residents participating in shanty town reconstruction are vulnerable group. Comparing with general city residents, their basic features are low income, low education, including the old, the sick and the disabled. More than fifty percent shanty town residents are staffs who working in low profit manufacturing enterprises and industrial mining enterprises. Their family annual incomes are about RMB 30,000 while Engel's Coefficient is 66.2%, belonging to typical low-income class. People of such class have made great contributions to north eastern old industrial base construction, but they stuck in survival and development difficulties because of system obstacle. They cannot improve living condition through their own efforts with the absence of bottom-up self-renewal capacity. As a result we consider that sustained attention to low-income settlement reconstruction and residents' welfare is not only assessment towards engineering efficiency but also value orientation concerning about social equity policy.

2. Literature review

Improving resident welfare is the final purpose of government public policy (Huang Youguang, 2005). Of course, a number of local governments are committed to win the politic championship on seeking partly the growth of total GDP in recent years, but housing problem which is concerned with resident welfare has not been emphasized enough from government. Driven by land financing, some local governments turn a deaf ear to soaring house price. At the same time, accompanying with economic accumulation and space aggregation since the Chinese reform and opening up, house price has rocketed in some first-tier cities due to the effect of supply and demand. In large cities such as Beijing, Shanghai and Shenzhen etc., house price is even 21 times of citizen's yearly income, which is far beyond citizen's affordability (Lu Jianglin, 2010). In fact, soaring house price has become a visible threshold for which common people can hardly achieve well-being. With the help of CGSS database, Lin Jiang (2012) conducted a practical analysis of the relation among city house price, house property and citizen well-being. Four conclusions are discovered as following: first, the degree of raising city house price has a negative effect on resident well-being; the higher house price is, the lower resident well-being will be. Second, resident's house property is notably related to their well-being. For example, well-being of residents owning a unit house and more unit houses is remarkably higher than that of tenants; similarly well-being of residents owning more unit houses is remarkably higher than that of residents owning a unit house. Third, the increase of house price has negative effect on tenant's well-being and has positive effect on well-being of residents owning one unit house or more unit houses. Well-being of residents owning more unit houses is remarkably higher than that of residents owning one unit house while house price goes up quickly. Fourth, house quality also affects resident's well-being.

If living condition plays an important role in residents' subjective well-being, then the government's public policy should certainly concentrate on improving residential condition for low-income class. Peer Group Effect shows that the existence of low-income settlement is largely due to the city governments' unequal public financial distribution among communities (Wan Guanghua, Cai Fang, 2012). Murray (1998), Hussar and Sonnenberg (2000) studied that there is a notable difference in expenditure per capita among pupils living in different communities while such difference could easily transmit to future labor market so that the inequality would be more

serious. Furthermore, if the city communities were originally consisted of low-income residents, then the neighbor effect would bring interaction among communities. Such effect will be intertemporal and transmittable between generations. Learning from global experience, existence of low-income settlement relate to a series of economic and social factors. Although in some countries and areas this problem was already die hard, but it should be effectively controlled via policy adjustment, and this opinion has reached broad consensus (Wan Guanghua, Cai Fang, 2012).

The role and function of government on low-income settlement reconstruction is where the academia has dispute (Glaeser & Saiz, 2003). Turner (1972) considered that the government can only reconstruct the living environment around low-income settlement areas but does not need to pull down the old houses. That is residents-oriented bottom-up reconstruction mode. This participative mode has been accepted by many experts (Korten, 1989) who think that the government has complex levels and low efficiency comparing with market-led reconstruction mode. During 1990s, World Bank used a top-to-down mode to carry out the low-income settlement reconstruction in three cities of Calcutta, Jakarta and Manila. Looking from short term assessment, it appeared quick return and low cost, however, from long term observation, those projects did not thoroughly improve living condition for the low-income residents, and they got much of the blame as the surrounding environment was even worse (Word Bank, 1994; Thomas, 1997).

Experience studies tell that completed market-led or only government-led modes, or focusing on only improving of housing but neglect social effect will lead to a huge loss of the reconstruction efficiency. A kind of investment mode that can reach balance between equality and efficiency is in exploration. Bugg-Levine and Emerson（2011）criticized the dichotomy idea of public welfare and business by analyzing a precedent in which Quaker Presbyterians had mixed faith, business and community together in the 17th century. They proposed a concept of “blended value”, that is to say it is not necessary to make one’s choice between social benefit and economic interest and yet aim to make the maximum of blended value. Investment performance should be evaluated by “Social Return on Investment”, a standard of comprehensive consideration of economic, social and environmental benefits, regardless of government and NGO or profit and nonprofit, so that the desire of doing public welfare can be satisfied and expect return can also be obtained. British government’s “Bootstrap” policy in late 1960s, and also the municipal government of Sao Paulo’s “Poor settlements in urban renewal plan” in 1989, even Obama administration’s “Featured residential plan” contain the same ideal to a certain extent.

At the technical level, the change of assessment systems will be implemented if social effect is measured scientifically. So far, a generally recognized method measuring social effect has not been formed because of different perspectives, ideas and complex subjective or objective factors. Happiness is not only a standard to evaluate social development, but also a goal and base of government performance (Zheng Fanghui, 2011). In 1972, Jigme Singye Wangchuck, king of Kingdom of Bhutan, firstly proposed the concept of citizen happiness index, resulting in gross national happiness (GNH) which consists of economic growth, environment protection, culture development and government administration, and blended social effect and happiness together. The World Values Survey, directed by Ronald Inglehart, Professor of University of Michigan, announced a generally recognized index system in which interviewees had made direct answer to the two dimensions question of personal happiness and satisfactions. From the demand perspective, academic field has proposed three kinds of index system: an index system relates to

the degree of life satisfaction in the field of cognitive categorization, including the degree of living satisfaction (such as job, income and social security), the degree of life quality satisfaction (such as housing, healthcare and education). B index system is composed of emotional status and pleasure level. C index system is aimed at interpersonal relationship as well as harmonious degree of individuals and society. Therefore, well-being is a key variable connecting closely with social effect in literatures mentioned above.

Besides the key influencing variable such as housing condition, community environment and social effect etc., the relation between income and happiness is also a hot issue. More and more studies show that subjective well-being has negative relation with GDP growth after income reaches a certain level, called Easterlin paradox (Easterlin, 1974; 2001). With research goes further, a number of effective factors are also taken into account, including: first, relative income and income gap will affect personal well-being, in other words, a phenomenon of 'keeping up with the Joneses will affect personal well-being. Thus some researchers often think that well-being has no relation with absolute income and relative income will affect well-being (Luis & Becker, 2007). Second, history and expectation is also called time comparison, the change of human physiological indices will affect well-being (Chen Huixiong, 2008). Third, hidden factors related to personal life, such as health, family love and personal relationship play a great role in well-being improvement. Fourth, other macro factors such as inflation, jobless, government expenditure and environment etc. also influence well-being (Lu Yuanping and Wang Tao, 2010). In addition, some researchers think that well-being has to be excited by pulsatile variation, even though high income people have no satisfaction well-being without pulsatile variation. The less a rare enjoy is, the higher well-being is. In general, diversity of affective factors is helpful for human being to gain insights of well-being, but it is clear that these factors do not exist independently but rather connect with one another. That is to say, these factors are largely collinear and endogenic.

Based on former research, this paper mainly probes into the influence of key variable on subjective well-being before and after low-income settlement reconstruction through family, community and social levels. Because well-being values come from the individual's subjective feeling, so we adopt the approach of Bruni, etc. (2007), specifically, this paper controls age, educational status, relationships and other individual characteristics. The structure of paper is as following: Section 3 contains the modeling and the utility function used to set up research framework. Section 4 is concerned with data processing, statistic description and empirical test. Section 5 provides robustness test and Section 6 is conclusions and relative policy suggestions.

3. Theoretical model and research setting

3.1. Modeling

According to the study of Glaeser et al (2001), the paper first analyzes a consumer whose utility function could be properly estimated by Cobb-Douglas function. The consumer's utility function is defined as $U = \theta H^{\alpha} X^{1-\alpha}$, where U is the consumer utility function, θ is the quality of life in community, H is the housing consumption, X is the consumption of other commodities, which satisfies the following budget constraint $W = P_H H + P_X X$, where P_H is the housing price, Px is the price of other commodities and is normalized to 1. According to the utility function and budget constraint equation, the first order condition is derived as follows:

$$H(P_H, W) = \alpha W / P_H \ , \tag{1}$$

where α is the proportion of housing consumption in the household income, $0 < \alpha < 1$. The indirect utility function is defined as:

$$U = \frac{k\theta W}{P_H^{\alpha}} \tag{2}$$

where $k = \alpha^{\alpha}(1-\alpha)^{1-\alpha}$ (3)

The first order Taylor series expansion of *Eq.*(3) derives $k = \omega\alpha$, where ω is a constant. We take the natural logarithm of both sides of *Eq.*(2) and derive:

$$InU = In\omega\alpha + InW + In\theta - \alpha InP_H \tag{4}$$

As mentioned above, since utility is a vague concept, economists have difficulties in its accurate measurement. According to Huang Youguang's study (2005), we can use the subjective well-being as an alternative indicator to evaluate the utility. And in order to evaluate the change in subjective well-being before and after the shanty town reconstruction and relative factors, we can classify the explanatory variables into four categories according to the variable and indicator system by Zheng Fanghui (2011) and Zheng Siqi et al. (2011).

The first category is residents' profiles, including age *age*, education *edu*, interpersonal relationship *int* ,which is measured by the proportion of expenditure on interpersonal relationship in total expenditure, and etc. The second category is households' profiles, including household size *size*, household income *inco*, the quadratic term of household income $inco^2$, the increase in housing area after shanty town reconstruction *Δarea*, the cost of housing reconstruction P_h [1], and the change in household consumption pattern *Δeng* (represented by Engel coefficient). The third category of variables measures the quality of life in community, including the improvement of drinking water quality *wat*, green area augment *gre*, functionality and convenience of telecommunication network *comm*, public transportation accessibility *tras*, and neighborhood friendship *neig*. The fourth category is concerned with social impact, including security improvement after the reconstruction *sec*, political participation increase *pol*, satisfaction with government efforts in low-income settlement reconstruction *gov*, and recognition of poverty alleviation policies *help*.

With the above four categories of variables cover progressive from individuals, households, communities to society, the overlap and interplay between variables are minimized. And we choose different indicators in each type of variables to decrease the colinearity between variables. According to the above classifications, the basic regression equation is defined as follows:

$$\begin{aligned} InHappiness_i = \Phi(&\lambda' InIndividual_i + \eta' InFamily_i \\ &+ \xi' InCommunity_i + x' Insociety_i) + \varepsilon_i \end{aligned} \tag{5}$$

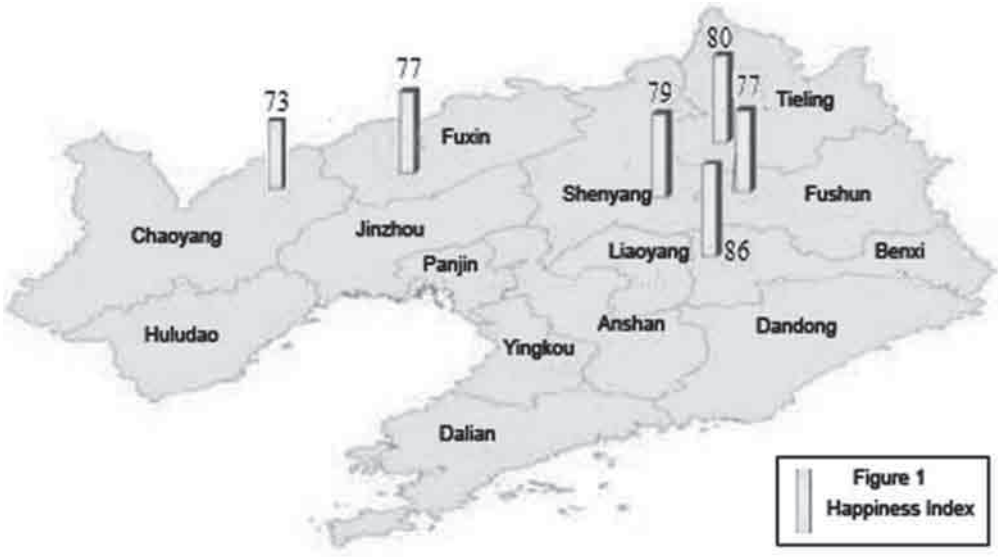
3.2. Sample data and variables

The data in the paper is collected from the representative sample surveys conducted by the joint research group of UNHUBITAT and CASS in Liaoning Province in 2012. We obtain the

samples in Shenyang, Fushun, Benxi, Beipiao of Chaoyang, Tieling and Fuxin in which the low-income settlements are the most concentrated[2]. The shanty towns in the six cities take over 80% of all the shanty towns in Liaoning. We control the sampling errors in the following ways: first, we obtain samples by including the representative areas and the representative shanty town reconstructions in the six cities. Most samples are obtained in Beipiao where the shanty towns are concentrated. Second, the survey sites are diversified with at least 3 sites in each city and different residential sub-districts in each site as the samples. Third, in case the respondents are of the same gender or household, only one data is chosen to keep the surveys individual. Fourth, to keep the encounter surveys random and the interviewees' occupations diverse, snowball sampling is avoided. Fifth, the data quality is strictly controlled in the following ways: we have a summary upon the completion of the trial surveys and standardize the measurement requirements for all the problems; each sample, once completed, is immediately checked by interviewers and double checked by supervisors. Personal errors are controlled effectively before, during and after the surveys accordingly. There are 1,311 copies collected in the representative sample surveys with a confidence of 95% and an error of ±3.5%. Our test on the internal consistency reliability of the questionnaire completed shows a coefficient of 0.936 (Cronbach α).

The descriptive statistics of all variables are shown in Table 1 in which the dependent variable is happiness index (*hap*). The respondents are asked in the questionnaire to score their happiness from 0 to 100. Higher scores stand for higher degrees of happiness. The happiness index of Benxi and Tieling are 86 and 80 while the rest are roughly over 70 (see Figure 1)

Figure 1: Happiness Index of the Post-Reconstructed Shanty Towns in the Six Cities in Liaoning



Among the explanatory variables, we control the individual variables such as age and education and use the proportion of social relations expenses in total expenses to measure social relations. The household size, household income and the quadratic term, the increase in the house area, the price of house reconstruction and the change in consumption structure are all included in the questionnaire. The variables at the community and social level chosen in the paper are two types. The first are dummy variables with the values of 0 and 1. For instance, for the variable *wat*

which measures the improvement of drinking water, the question in the questionnaire is "is the quality of the drinking water improved after reconstruction?" The value of Yes is 1 and the value of No or As same as before is 0. The second are perception of the community and society which are divided into the levels from 1-5 and 1-7 respectively in terms of satisfaction. According to the correlation matrix among variables[3], there is a big correlation coefficient and a high degree of significance between the explained variable *hap* and the other explanatory variables (see appendix 2). Meanwhile, since most explanatory variables are independent data in the questionnaire, their correlation coefficient and degree of significance are low, which eliminates the multicollinearity. So we can reach an objective analytical result using a linear regression model for the variables.

Table 1: Descriptive data of main variables

Variables	Name	Abbr	Questionnaire design	Sample	Average	Standard error
Dependent variable	Happiness index	*hap*	Self evaluation	1311	78.316	14.224
Individual level	Age span	*age*	Five age spans from 20 to 60	1311	3.599	1.082
	Education	*edu*	Five levels from pupils to graduates	1311	2.240	0.725
	Interpersonal relationship	*int*	Proportion of expenditure on interpersonal relationship to total expenditure	1311	0.077	0.057
Household level	Household size	*size*	Five levels of household size from 1 to above 6	1311	2.963	1.005
	Household income	*inco*	Total household income	1311	31035.030	13436.490
	Quadratic term of household income	$inco^2$	Quadratic term of total household income	1311	1.14×10^9	1.04×10^9
	Increase of housing area	$\Delta area$	Increase in housing area after shanty town reconstruction	1311	15.674	24.339
	Cost of housing reconstruction	P_h	Cost per m^2 in the shanty town reconstruction	1311	416.004	378.483
	Change in household consumption pattern	Δeng	Change of Engel coefficient after shanty town reconstruction	1302	0.003	0.141
Community level	Water quality	*wat*	Where increase is 1, or it is 0	1311	0.695	0.461
	Green area	*gre*	Where increase is 1, or it is 0	1312	0.784	0.411
	Telecommunication network	*comm*	Seven levels from 1 to 7	1311	5.679	0.900
	Transport	*tras*	Seven levels from 1 to 7	1311	5.566	0.977
	Neighborhood	*neig*	Seven levels from 1 to 7	1311	5.273	1.082
Social level	Security	*sec*	Seven levels from 1 to 7	1311	5.407	0.964
	Political participation	*pol*	Seven levels from 1 to 7	1311	5.230	1.048
	Satisfaction with government work	*gov*	Five levels from 1 to 5	1311	2.576	0.866
	Recognition of poverty alleviation policies	*help*	Seven levels from 1 to 7	1311	4.943	1.220

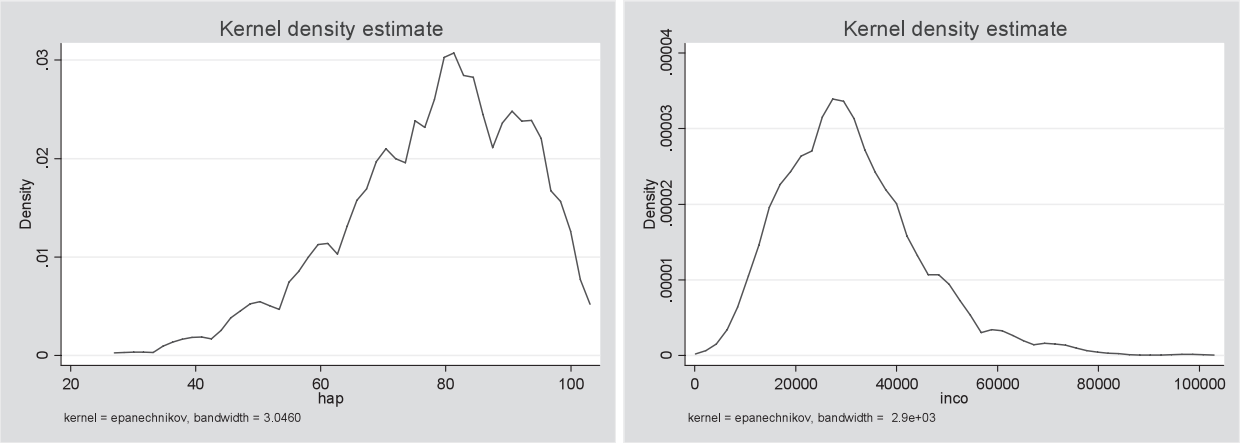
Source: The data is from the representative sample surveys conducted by the joint research group of UNHABITAT and Chinese Academy of Social Sciences in Liaoning Province in 2012.

4. Empirical results and analysis

Along with the ideas mentioned previously, we analyze the results of the sample surveys comprehensively. Model 1 and Model 2 are OLS estimations before and after the control variable for social impact is added. The model's goodness of fit is improved substantially after the variable is added. It shows that the social impact created before and after the reconstruction has a significant impact on the subjective well-being with a highly positive correlation ($p<0.01$) between the satisfaction with government work *gov*, recognition of poverty alleviation policies *help* and well-being. It is noticeable that besides regular reconstructions of houses, community and urban structure etc., there are also some indirect poverty alleviation policies such as free training programs to avoid the local residents' returning to poverty. It is empirically proved that such an approach of *blood-generation* as the indirect policies is more effective than *blood transfusion* as the direct policies. Interpersonal relationship has a more significant positive correlation with subject well-being than age and education, no matter social impact is controlled or not. As for the variables about households after social impact is controlled, the variable of housing reconstruction cost P_h has a stronger impact on well-being than housing area increment $\Delta area$. The fitting of the models from 1 to 5 shows that the coefficients of household income *inco* and its quadratic term $inco^2$ after low-income settlement reconstruction are positive and negative respectively, in an inverted U shape. Therefore, there is a threshold value between income and well-being index in the special group of original residents in low-income settlements. More income results in higher well-being below the threshold value, and vice versa, which is supported by Seligman et al (2006). However, the inverted U shape, which is common in academic researches, exists in the residents in low-income settlements, indicating that the original middle-income residents have higher well-being than low-and high-income ones during reconstruction. Hence, more attention should be paid to the well-being of low-and high-income residents in the future. The change in household consumption pattern (Engel coefficient), nevertheless, has little impacts on well-being.

Similarly, at different well-being levels, the factors for subjective well-being may be different, and people of different income levels may perceive well-being very differently. As shown in Figure 2, the subjective well-being and household income are scattered widespread in some sections and concentrated in other sections. Therefore, it is necessary to analyze the samples at different stages and levels. In contrast to OLS estimation for the whole sample of Model (1) and Model (2), the estimation for Model (3), (4), (5) shows a quantile regression estimation result of 25%, 50% and 75% of the whole sample respectively. And the estimation for Model (6) produces a regression estimation result of a low-income group (namely, the household whose income is below 20, 000 RMB per year).

Figure 2: Kernel density estimation of subjective well-being and household income



The results of the whole sample and the quantile regression estimation show that the community level variables such as improvement of drinking water quality *wat*, green area increase *gre* and high transport accessibility *tras* have a positive correlation with happiness index *hap*. So we think that the improvement of quality of life in community has positive effects on original residents with different well-being levels during the reconstruction. It is worth mentioning that good telecommunication network *comm* has a negative correlation with happiness index, unexpectedly different from our projection. The field investigation conducted by the research group shows that it still takes some time for many residents to get used to the new things such as network and instead they prefer a face-to-face communication method. This can be explained by the variable of friendly neighborhoods *neig*. For the whole sample and quantile regression analysis, the regression coefficient and significance level of *neig* are low, which indicates that there is no expected increase in the well-being from friendly neighborhoods. There is a question in the questionnaire survey: "from whom will you ask for help when you have troubles in job?" 11.4% of the respondents choose to go to their neighbors for help before relocation, but this ratio goes down to 9% after relocation. The larger the cities are, the lower the ratio is. For example, the ratio is less than 7% in Shenyang and Fushun. Attention should be paid to the change in communication and interpersonal alienation after relocation.

The regression estimation of low-income groups shows that the improvement of drinking water quality *wat* and satisfaction with government work *gov* during the reconstruction are closely related with subjective well-being with the regression coefficients up to 6.2151 and 5.2993, much larger than the marginal effect of other coefficients with higher significance levels. Although the poverty alleviation policies have remarkable impacts on the subjective well-being of low-income groups, the regression coefficient is less than the whole sample and the regression estimation under the quantile of 25%, 50% and 75%. It indicates that the indirect policies work on low-income groups less effectively than on other groups. Moreover, compared with other models, the regression coefficients of the interpersonal relationship, household income and household consumption pattern of low-income groups are remarkably different from other model estimations and the significance level is lower. Therefore, it is suggested that some different policies should be proposed for the low-income groups in the future reconstruction.

Table 2: Estimation of the subjective well-being factors for the original residents in low-income settlements

hap	Model（1）	Model（2）	Model（3）	Model（4）	Model（5）	Model（6）
age	-0.2518 (0.369)	-0.2081 (0.341)	-0.2397 (0.464)	-0.2477 (0.418)	-0.3616 (0.447)	0.9051 (0.979)
edu	0.9767* (0.561)	0.1812 (0.521)	0.7292 (0.694)	-0.1750 (0.635)	0.3163 (0.685)	-0.2471(1.332)
int	24.3717***(6.360)	25.4318***(5.914)	26.0138***(8.663)	24.4977***(7.208)	42.7550***(6.561)	7.8113(12.832)
size	-0.2607(0.402)	0.1240(0.372)	0.5647(0.513)	0.4307(0.454)	0.2284(0.471)	-1.7008*(1.015)
inco	0.5417***(0.100)	0.4330*** (0.093)	0.4488*** (0.129)	0.5558*** (0.113)	0.5045*** (0.114)	2.8157* (1.601)
$inco^2$	-0.0058***(0.001)	-0.0046***(0.001)	-0.0051***(0.002)	-0.0061***(0.001)	-0.0060***(0.001)	-0.1068*(0.059)
Δarea	-0.0056(0.016)	0.0062 (0.015)	0.0054 (0.020)	0.0118 (0.019)	0.0062 (0.019)	-0.0044 (0.035)
Ph	-0.0021* (0.001)	-0.0023** (0.001)	-0.0047***(0.001)	-0.0024* (0.001)	-0.0006 (0.001)	-0.0033 (0.003)
Δeng	-0.9154(2.545)	-1.8461(2.354)	-1.6546(3.458)	0.9686(2.877)	-0.0366(2.830)	-6.7451(5.003)
wat	4.5236***(0.909)	1.8979**(0.858)	2.2049*(1.126)	1.3923(1.051)	2.5739**(1.104)	6.4151***(1.944)
gre	7.5281***(1.063)	3.9634***(1.014)	5.1545***(1.335)	5.2774***(1.243)	1.9536(1.317)	4.9209(3.056)
comm	-1.3345***(0.481)	-2.2483***(0.456)	-1.3069**(0.624)	-2.1415***(0.557)	-3.0316***(0.573)	-1.2455(1.262)
tras	1.2170***(0.437)	1.2387***(0.411)	0.9677*(0.555)	0.9597*(0.504)	0.4877(0.555)	-1.3742(1.023)
neig	2.3894***(0.357)	0.1953(0.390)	0.2891(0.533)	0.3839(0.476)	0.0408(0.492)	0.0435(0.944)
sec		-0.2909(0.414)	0.9569*(0.539)	-0.3736(0.505)	-0.9411*(0.543)	1.3430(1.024)
pol		0.2596(0.419)	0.3911(0.579)	0.2388(0.514)	-0.1071(0.552)	0.6758(0.990)
gov		3.8639***(0.453)	5.6239***(0.625)	4.3794***(0.553)	2.5096***(0.553)	5.2993***(1.160)
help		3.4470***(0.359)	2.9830***(0.478)	3.1907***(0.439)	3.7527***(0.427)	2.5188***(0.947)
constant	44.0912***(3.932)	60.6653***(4.286)	44.0661***(6.055)	61.5644***(5.231)	78.8583***(5.155)	52.5549***(15.69)
N	1302	1302	1302	1302	1302	231
R^2	0.201	0.322	——	——	——	0.409
F	23.12	33.85	——	——	——	8.14

Notes: Those in the brackets are standard errors, "*" represents the significance level, where "*"is p<0.1, "**" is p<0.05, "***" is p<0.01. As the variable inco is bigger than other variables in value, we divide it by 1000 in all regression models, the same for Table 3.

Source: The data is from the representative sample surveys conducted by the joint research group of UNHABITAT and Chinese Academy of Social Sciences in Liaoning province in 2012.

5. Robustness test

In the previous section we take well-being index as a continuous dependent variable (range from 30 to 100) in the regression with several results achieved. However, there is still plenty of room for improvement, which is mainly concerned with the truncation issue for the dependent variable. Individual's well-being index is designed to be in the range from 0 to 100 in the questionnaire, nevertheless, according to empirical statistics, we have not found any individual whose well-being index is less than 30. In other words, those individuals with well-being index

under 30 have been truncated. This seems to be a common problem in social surveys, since in surveying process, if a surveyor enquires about respondent's well-being degree, the respondent tends to give over-evaluated answers after taking account of personal privacy, face saving, etc. Particularly for groups with low well-being index, they are more likely to evade or quit from the survey. Hence, we could only observe samples with well-being index greater than 30. This could be seen from Figure 2 obviously that the well-being index curve in kernel density estimation inclines to right sharply, namely has the relatively significant right tailing phenomenon; however, on the left of the curve, points with well-being index less than 30 are truncated, this left truncation problem of samples seems to be caused by the survey quit of individuals with less than 30 well-being index.

According to modern micro-econometrics theories, simple OLS prediction would be biased if independent variable is truncated or censored. Generally, in this case of limited dependent variable prediction, we need to adopt the maximum likelihood estimate using the Limited Dependent Variable Regression model, in specification:

Table 3: Truncated Regression Analysis Results

Variable	Coefficient, Standard Error	Variable	Coefficient, Standard Error
age	-0.2068	*wat*	1.8977**
	(0.340)		(0.855)
edu	0.1790	*gre*	3.9825***
	(0.519)		(1.011)
int	25.3757***	*comm*	-2.2654***
	(5.889)		(0.455)
size	0.1203	*tras*	1.2414***
	(0.371)		(0.410)
inco	0.4343***	*neig*	0.1960
	(0.093)		(0.389)
$inco^2$	-0.0046***	*sec*	-0.2919
	(0.001)		(0.413)
Δarea	0.0061	*pol*	0.2683
	(0.015)		(0.419)
P_h	-0.0023**	*gov*	3.8758***
	(0.001)		(0.451)
Δeng	-1.8397	*help*	3.4679***
	(2.344)		(0.359)
		constant	60.5903***
			(4.273)

Note: Standard error in brackets; *** p<0.01, ** p<0.05, * p<0.1.

Source: Typical sampling survey in Liaoning Province done by the joint project team of United Nations Human Settlements Program and Chinese Academy of Social Sciences.

From the above table we can see that truncated regression model results are similar to OLS results, significance level for each coefficient is almost completely consistent in spite of the slightly different coefficient values. In the truncated regression model, regression coefficients for the four variables *sec*, *pol*, *gov*, *help* at social level are higher than those estimated in OLS model (refer to Table 2 Model 2), which indicates that simple OLS model has under estimated the social effects' impacts on subjective well-being in low-income settlement reconstruction process. Therefore, in low-income settlement reconstruction, the key factors to improve subjective well-being are the social effects caused by reconstruction project itself, such as satisfaction improvement on government efforts, democratic participation level increase, approval of government's poverty relief policy, and etc.

6. Conclusions and discussions

By analyzing the results of typical sampling survey conducted in six cities in Liaoning province, this article demonstrates that the "government leading and market participating" low-income settlement reconstruction engineering is significantly effective. One of the main achievements is residents' well-being improvement. Based on the idea of "blended value", the reconstruction engineering not only meets the requirement of supporting public welfare to a certain extent, but also brings expected social return. The conclusions of empirical study can be summarized as following: first, social effects brought by low-income settlement reconstruction, particularly increased satisfaction level on government and approved poverty relief policy of government, have significantly positive effects on residents' subjective well-being. Compared with traditional direct blood-transfusing poverty relief approach, indirect blood-generating approaches organized by government such as employment training programs are more effective. Second, at individual level, interpersonal relationship is highly significant with relatively large coefficient at each quantile level for all the samples except for the low-income groups. With respect to low-income groups, their well-being is closely related to quality improvement of drinking water and their satisfaction on government's efforts in reconstruction engineering. In addition, government's indirect poverty relief policy is less effective for low-income group compared with others. Third, at family level, original resident's family income and well-being index exhibit the "inversed-U" shape curve, which is a common correlationship for normal groups, indicating that through the low-income settlement reconstruction engineering in Liaoning province, middle-income original residents have obtained relatively higher well-being; hence well-being for both low-income and high-income groups should be more intensively addressed by government in the future. Fourth, whole sample and quantile regression results show that living quality improvement in communities has positive influence on original residents of each different well-being level, while some variables that emerge before and/or after the construction like new communication pattern and change of neighborhood relationship cannot promote resident's well-being effectively. Therefore, these issues should be highly stressed by relevant departments as well.

Low-income settlement reconstruction is not only an economic but also a social issue. Long-lasting social care for low-income groups is the unavoidable responsibility and obligation for government. Government's objectives are not merely to guarantee low-income residents "have places to live in", but also to make them "live stably" and "live well", which are consistent with our concept of "inclined and smooth city development". "Inclination means that policies

and institutions incline to or favored certain cities or areas in terms of space planning and urban development; “smoothness” means that basic systems and public service supply, particularly for the public service at individual level, should be smooth and equal. This is a bottom line in achieving “harmonious society” and “happy city” Finally, well-being is a subjective concept, but the fundamental facts that lead to or support well-being are objective. Well-being is composed by various factors, as citizens, we can do little with congenital factors, but we expect that government could lay the foundation of our well-being, namely a fair and equal public service system.

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[1] The cost of housing reconstruction here refers to the cost per m^2 in the shanty town reconstruction, generally lower than market price.

[2] The introduction of Sample cities will be presented in Appendix 1.

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Appendix 1: Introduction of Sample cities

Shenyang is the capital and largest city of Liaoning Province, as well as the largest city in Northeast China. Currently holding sub-provincial administrative status, the city was once known as Shengjing or Fengtian Prefecture. In the 17th century, Shenyang was conquered by the Manchu people and briefly used as the capital of the Qing Dynasty. Along with its nearby cities, Shenyang is an important industrial center in China, and serves as the transportation and commercial hub of China's northeast−particularly with Japan, Russia, and Korea. A titan of heavy industry since the 1930s, and the spearhead of the Chinese central government's Northeast Area Revitalization Plan, the city has been diversifying its industry and now has a solid industrial foundation, a good land and air transport network, abundant natural resources, and a skilled workforce. Shenyang has a population of 7.2 million and its total GDP is 660 billion yuan in year 2012.

Fushun is a about 45 km east of Shenyang, with a population of 2,138,090 inhabitants (2010 census) and a total area of 11,271 km2, 713 km2 of which is the city proper. Fushun is one of the industrial and economic development hubs in Liaoning. It has developed as a thriving center for fuel, power and raw materials and is also offering more and more opportunities in textiles and electronics. The world's largest open-pit coal mine, known as the Magnificent West Pit, is located not far from downtown. It has been in operation since about the 12th century. Fushun has a major aluminum-reduction plant and factories producing automobiles, machinery, chemicals, cement, and rubber. Fushun has a population of 2.2 million and its total GDP is 124 billion yuan in year 2012.

Benxi is located in the eastern mountainous region of Liaoning Province. It covers an area of 9,348 sq km. The population of the city amounted to 1.53 million and its total GDP is 111.2 billion yuan by the end of 2012. Famous for its geology, Benxi is rich in mineral resources including coal, iron, and copper. Reserves of coal total approximately 200 million tons, top ranking among all prefecture-level cities in the province. Forests cover 74.0% of the city's lands and contain timber reserves of 48.6 million steres, contributing 26% to Liaoning's total. In addition, Benxi is replete with water resources. There are approximately 200 rivers running through the city, producing annual surface runoff of 3.5 billion cubic meters. During the past decades, Benxi has undergone drastic economic, social, and urban development, becoming one of the largest cities in Liaoning. Benxi Iron and Steel Company is the largest employer in the city, and used to be the fourth-largest steel company in China.

Beipiao is a city in Chaoyang prefecture, Liaoning province. It has a population of 582282 and its total GDP is 26.2 billion yuan in year 2012. The main industry in the area is coal mining. With vertical shafts of almost 1000m, these are some of the deepest coal mines in China. The coal produced is used for coking. Daheishan National Forest Park is located in the northwestern part of Beipiao city. The dinosaur Beipiaosaurus was named after the city where its fossils were found nearby.

Tieling is one of 14 municipalities of Liaoning Province. It lies in the middle section of Songliao Plain. Tieling is composed of 45 percent of water, 45 percent of fields, 10 percent of

roads and manors as well. The mountain area on the east of Tieling is located in the branch-range of Changbai mountain. The total grain output being more than 3 billion kg, Tieling has the reputation of “Northern Liaoning Barn”. There are also four large-scale reservoirs in the city. The gross amount of water resources reaches 5 billion cubic meters. Having the oversized coal base with industrial reserves of coal of 2.259 billion tons and the annual production capacity of 21 million tons , as well as two oversized steam power plants in our country with installed capacity of over one million kilowatts. Tieling has a population of 3.02 million and its total GDP is 97.5 billion yuan in year 2012.

Fuxin is a prefecture-level city in northwestern Liaoning Province. The total population of the prefecture is 1.91 million and the total GDP is 56 billion yuan in 2012. Fuxin is a mining center in an agricultural region, producing mostly coal and agate. Fuxin is known as China’s ‘Agate City’, with 50% of the nation’s known deposits of the mineral being located there. The city also accounts for more than 90% of the country’s agate products. The city suffers from the over-mining of coal, which is low in supply while fundamental to Fuxin’s economy. As the coal mines run dry, Fuxin is trying to find other industries to keep its economy going. Measures taken have included the development of a part of the city as a ‘Special Economic Zone’, by which the city hopes to attract international investment.

Appendix 2: Correlation Matrix between Explained Variable and Other Explanatory Variables

	hap	*age*	*edu*	*int*	*size*	*inco*	*Δarea*	*ph*	*Δeng*	*wat*	*gre*	*comm*	*tras*	*neig*	*sec*	*pol*	*gov*	*help*
hap	1.000																	
age	-0.026*	1.000																
edu	0.052*	-0.402*	1.000															
int	0.122***	0.053*	-0.098*	1.000														
size	0.012*	-0.122	0.022	-0.018	1.000													
inco	0.097***	-0.079*	0.201	0.051*	0.415	1.000												
Δarea	-0.124***	0.151*	-0.108***	0.149*	-0.543**	-0.248*	1.000											
ph	-0.118***	-0.019	0.116***	-0.101*	0.099**	0.153***	0.157*	1.000										
Δeng	-0.015*	0.031	0.034	-0.006	-0.045	-0.054*	0.071**	-0.015	1.000									
wat	0.295***	-0.056**	-0.004	0.082**	-0.009	-0.005	-0.123***	-0.285*	0.044	1.000								
gre	0.301***	0.133*	-0.110***	0.058**	-0.110*	-0.108*	-0.017	-0.361*	0.015	0.482	1.000							
comm	0.015	0.048*	0.123**	-0.055**	-0.102**	0.101	0.023	-0.137	-0.030	-0.025	0.029	1.000						
tras	0.120***	-0.030	0.091*	0.032	-0.038	0.085*	-0.021	-0.157	-0.024	0.097*	0.038	0.521***	1.000					
neig	0.267***	0.054*	0.013	-0.004	-0.066*	0.023	-0.055**	-0.204	-0.051*	0.193*	0.275	0.259	0.254	1.000				
sec	0.171***	0.075*	-0.007	0.035	-0.096***	0.016	-0.020	-0.304	-0.043	0.158*	0.229*	0.370*	0.356*	0.391*	1.000			
pol	0.283***	0.054*	0.016	0.026	-0.069*	0.057*	-0.055	-0.212	-0.002	0.226*	0.302*	0.307	0.305	0.559	0.437	1.000		
gov	-0.414***	0.043	-0.073*	-0.090*	0.079*	0.028	0.092*	0.277	-0.045	-0.367	-0.383	-0.136*	-0.132*	-0.303	-0.250	-0.328	1.000	
help	0.431***	0.044	0.075	-0.055*	-0.090*	0.057*	-0.153*	-0.240*	-0.013	0.273*	0.334	0.272	0.206	0.523	0.392	0.535	-0.414	1.000