Efficiency study of housing subsidy system: a comparison between Hong Kong and the Mainland China

by

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Contents

Chapter One Introduction

Housing subsidy system is to help low and moderate income households to live in "descent" housing by providing subsidy in the forms of in-kind subsidy, cash grant or favorable loans etc.

1.1 Housing Subsidy System in Hong Kong and the mainland China

Housing policy in Hong Kong has moved from ad-hoc planning in the early years of public housing provision to more comprehensive planning in recent years (Yeh,1990) . At present, the housing subsidy system in Hong Kong includes rental public housing program, home ownership scheme, the private sector participation scheme, the home purchase loan scheme, buy-or-rent option, mortgage subsidy scheme, and tenant purchase scheme. The 1999~2000 Housing Authority annual report shows that there are about 2.2 million people, up to 35% of the total population, living in rental public housing in Hong Kong. Apparently, rental public housing program is one of the most important part of housing subsidy system in Hong Kong.

On the other hand, the housing subsidy system in the mainland China is still at its initial stage since the urban housing reform did not enter the substantial stage until 10 years ago. Housing was regarded as a welfare subsidy rather than a commodity before the urban housing reform thus the rents of public housing was kept at

extremely low level. Urban housing reform began in 1990s and has taken the forms of public housing rents increase, the sale of public housing, the development of affordable housing, housing subsidy monetarization, and the introduction of social rental housing etc. Although the urban housing reform does have made substantial progress on improving housing conditions, these is still great mismatch between housing demand and supply, specifically, most of the families still can not afford a set of decent housing. Although the old system of in-kind housing allocation has officially terminated in 1998, about half of the households in China are still living in rental public housing in the urban cities, which indicates that the rental public housing is still playing the most important role in the housing subsidy system of the mainland China. In particular, the rental public housing is to be incorporated into proposed social rental housing (SRH) program in the future. To investigate the efficiency and equity of the public housing program will be conducive to the development of SRH program. It may be easier to build in a mechanism to avoid unfair subsidy at the early stage of a housing policy than to introduce it at a later stage. This study attempts to provide helpful suggestions for the development of at-initial-stage SRH program.

The rental public housing programs in Hong Kong and the mainland China both provide in-kind subsidy with housing rent much lower than that on private housing market, and they are both of great importance in the housing subsidy system. Therefore, this study aims to compare the public housing programs in the two areas from the efficiency perspective. The comparisons of other programs in the housing

subsidy system in the two areas are not included in this study.

1.2 Methodology

The methodology adopted in this study is developed on the basis of numerous previous works. In order to examine the efficiency of the program the benefits and costs must be measured. Both the Cobb-Douglas model and Stone-Geary model are adopted for benefits measurements, while the costs are estimated by market rents of the public housing. Then three comparable efficiency indexes are established. They are the ratio of benefits to costs, the ratio of benefits to nominal subsidy, and the ratio of benefits to household income. Furthermore, the distribution of benefits among households with different households characteristics and housing/nonhousing consumption changes are investigated. In summary, the analysis framework is composed of benefits and costs measurements, efficiency indexes comparison, benefits distribution and housing/nonhousing consumption changes investigation.

1.3 The Data

The data on household income, rent-to-income ratio, market rent and subsidized rent of the public housing, and other household characteristics are needed in this study. The latest official data available in Hong Kong is 1% sample of By-census in 1996 provided by Census and Statistics Department of Hong Kong SAR. There are a total

of 16,366 households in this sample including 6,733 public housing tenants, 2,129 private housing tenants and other 7,504 homeowners.

The household data for the mainland China in this study are not available from any official institution so that the only way to collect the data is by field study and questionnaire surveying. A field study trip was made in October 2000 to Chongqing and Shanghai. With the help and cooperation of the municipal housing reform committee, twenty one units were visited and 7,200 questionnaire forms were distributed in the two metropolises. The response rates of questionnaire are 50.6% and 37.4% in Chongqing and Shanghai respectively.

Chapter Two Literature Review

2.1 Evolution of benefits and costs methodology

To evaluate the efficiency of a subsidy program, we must measure the benefits and costs of the program.

2.1.1 Benefits

Studies evaluating the tenant benefits of housing subsidy programs can be classified according to the benefit measures employed in the study.

The first measure is to evaluate the direct benefits to the households participating in the subsidy program. For rental housing programs, the benefits are the difference between the market rent of the housing unit and the rent paid by the family. Prescott (1967), Smolensky (1968), Bish (1969), Aaron (1971) are examples of studies that use this measure.

A second measure that has been used for evaluating housing subsidy program is based on Marshall's consumer surplus theory. A number of studies adopt this measure. They are Olsen and Prescott (1969), Olsen (1972), Kraft and Kraft (1979), Mayo(1982), Yu and Li (1985), Struyk and Turner (1987), Ding (1993). In this

method, benefits are defined as the change in consumer's surplus along Marshall's demand curve. The benefits result from changes in housing prices and consumption because of participation in a housing subsidy program.

Thirdly, the tenant benefits can also be measured by the Hicksian price equivalent variation. With this measure, tenant benefits are the amount of additional income the participating family requires in order to be as well off without the housing subsidy program as with it. The examples of this study include Desalvo (1971), Desalvo (1975), Murry (1975), Kraft and Olsen (1977), Olsen and Barton (1984), Reader (1985), Deborger (1985), Hammond (1987), Wong and Liu (1988) and Wong (1998).

2.1.1.1 Direct tenant benefits estimation

The amount of direct tenant benefits is the difference between the market value of the subsidized housing and the actual rent paid by the tenant. The most important assumption of this measure is that the price elasticity of housing demand is equal to −1.

Bish(1969) assumes that the housing industry is a constant-cost industry over the range of expansion due to the public housing program, and the housing supply is a horizontal line. Figure 1 illustrates the change in housing consumption of a hypothetical family due to a public housing subsidy. Initial consumption is OH, for

which the outlay is OBCH. With the move to public housing, housing consumption becomes OG and HG is the increased amount of consumption. The market value of his increase in housing consumption (HCEG), without a change in individual family outlay, is the amount by which the value of housing consumption exceeds outlay and is the measure which should best reflect the individual "direct benefits" resulting from the public housing subsidy program. Under the assumption that the price elasticity of housing demand is –1, HCEG is equal to ABEF. ABEF is the difference between the

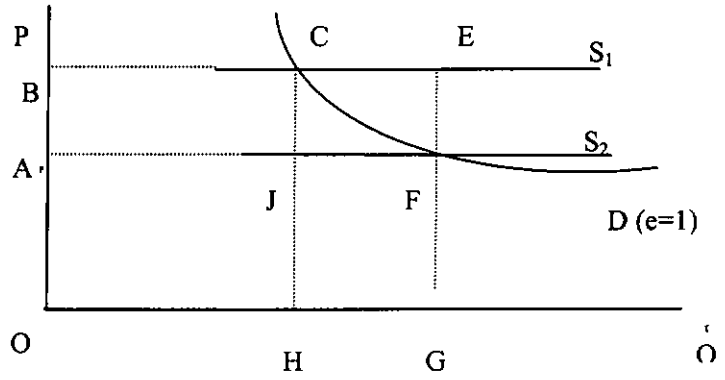


Figure 2.1: Subsidy-induced change in housing consumption---constant costs

industry supply curve (S1) and the supply point observed by the purchaser of subsidized housing (S2) multiplied by OG. Also ABEF is equal to the market value of the housing (OBEG) minus the rent actually paid by the resident (OAFG).

If the constant-cost assumption is dropped, the supply curve will be an ascendant line showed in Figure 2. Initial housing consumption is OV with the rent of OKPV. After the subsidy is introduced the housing consumption becomes OU and its value is OLNU. However, the rent of OU remains at amount OJTU (OJTU=OKPV). Therefore,

the increased amount of consumption measured in current price is represented by KLNUVP (KLNUVP= JLNT).

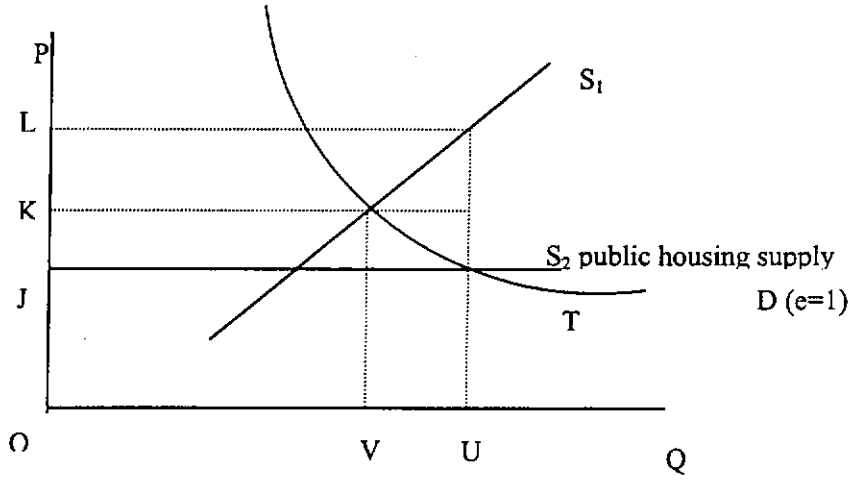


Figure 2.2: Subsidy-induced change in housing consumption---increasing costs

The benefits are divided into three parts: 1) an actual increase in consumption value in constant prices equal to VPRU; 2) the increased prices necessary to draw factors into housing production, equal to PNR; 3) a producers' surplus accruing to factors already in the housing industry, equal to KLNP.

Because the degree of housing market elasticity is unknown, Bish(1969) estimated direct benefits under the constant-cost assumption. To calculate the direct tenant benefits, the private market value of public housing and the subsidized rent paid for the housing must be obtained. The estimate of private market values of public housing is obtained by manipulating data collected by local and federal housing authorities. In the United States, the law provides that a 20% gap must exist between the private market value and the maximum rent charged for a public housing unit. Also,

regulations set the rent paid by public housing families at 20% of their income. Therefore, knowledge of the published admission limits for public housing units enables one to work backward to estimate the equivalent private market renal value of a public housing unit (Bish, 1969).

The evaluation of direct benefit is not alone sufficient for an efficiency analysis of the public housing program because it gives no consideration either to the costs of the program or to benefits supposed to accrue to other members of the community. However, this direct benefit is a crucial part of any efficiency analysis of public housing program and makes a contribution to understanding the effects of these programs.

In summary, this method has two main assumptions: 1) the price elasticity of housing demand equals to –1; 2) housing is a constant-cost industry; 3) the difference of market rent and subsidized rent has completely transformed to direct tenant benefits. In addition, the estimation of direct benefits depends on the accuracy of income limit as a base for estimating private market values. Further, this benefit measure is unsatisfactory because the participating family is not indifferent between all public housing providing the same subsidy. Therefore, different public housing providing the same subsidy should not have the same measured benefit.

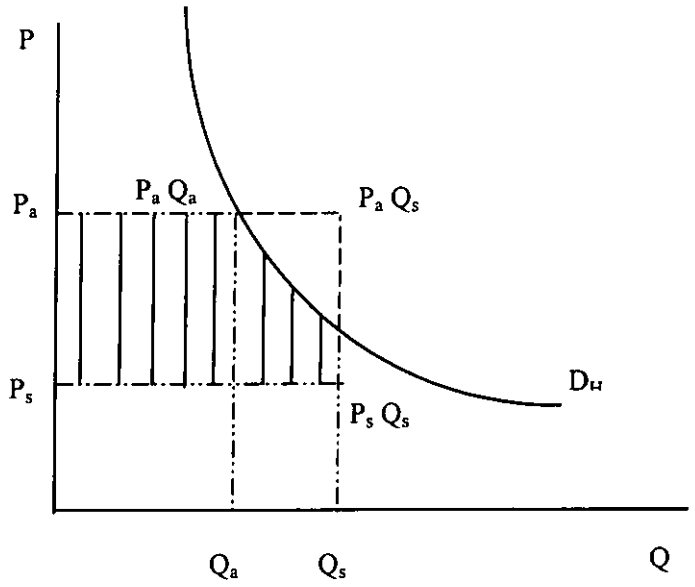
The main drawback of this method is assuming that the direct tenant benefits are

exactly the difference between the market rent and subsidized rent of public housing. In fact the difference between the market rent and the subsidized rent is the benefits provided by the program. Since the public housing program is a typical in-kind transfer, the tenants will usually underestimate the benefits provided by the program. Therefore, a better way to evaluate the tenant benefits is to develop methods based on consumer's utility theory. The two utility theories of cardinal utility and cardinal utility lead to the following two measures: Marshall's consumer surplus measure and Hicksian's price equivalent variation measure.

2.1.1.2 Marshall's consumer surplus measure

Marshall's consumer surplus concept derives from the cardinal utility theory. Based on Marshall's consumer surplus concept, this method assumes that there are two goods—housing service and nonhousing goods and services, and three markets---the subsidized housing market, the uncontrolled housing market and the market for nonhousing goods and services. All markets are perfectly competitive and the long-run supply curves in both markets are perfectly elastic. The price of any housing unit reflects differences in services associated with the characteristics of the housing. This method can be illustrated by Figure 2.3. D_H is the demand curve for housing service. At the market price P_a, the tenant will buy Q_a of housing service in the private market if there is no subsidy program.

The market rent is $P_a Q_a$. Suppose that, under particular housing subsidy program, the tenant will occupy a dwelling of Q_s units housing services with the subsidized rent P_s and pay a total rent $P_s Q_s$. Notice that (P_s, Q_s) is not on the demand curve D_H. The consumer of public housing receives a subsidy of $(P_a - P_s)$ per unit.



P_a: market price of housing service without subsidy

P_s:price or rent paid with subsidy;

Q_a:units of housing service without subsidy;

Figure 2.3: Demand for housing service and tenant benefit

This amount is not the value of the subsidy to the consumer, but is the value of the subsidy to the supplier of the subsidy. Since the consumers of public housing must, in fact, accept a fixed quantity of housing without a choice, they place a lower value on the subsidy than the market value. The net benefit to the consumer is the excess of the

consumer surplus at (P_s, Q_s) over the consumer surplus at (P_a, Q_a). Then the net tenant benefits (B_t^n) are represented by the shaded area which can be expressed algebraically as follows:

$$B_t^n = P_a Q_a - P_s Q_s + \int_{Q_a}^{Q_a} D_H \qquad (2.1)$$

If we suppose that the demand function D_H takes the form :

$$P = \beta Q^{1/\alpha} Y^{\gamma/\alpha}$$

Where α is the price elasticity and γ is the income elasticity and they are both constants; P and Q are the price and quantity of housing service respectively; Y is the household income; β is a scaling constant equal to $P_a Q_a^{-1/\alpha} Y^{-\gamma/\alpha}$. Then

$$B_t^n = P_a Q_a - P_s Q_s + P_a Q_a [\ln P_a Q_s - \ln P_a Q_a] \qquad (2.2)$$

From expression (2.4), it can be seen that if we know his expenditure for public housing $(P_s Q_s)$, his expenditure for housing in the absence of the program $(P_a Q_a)$ and the market rent of public housing $(P_a Q_s)$, the net tenant benefit can be estimated.

2.1.1.3 Hicksian's price equivalent variation

Besides the cardinal utility theory aforementioned, the other utility theory is ordinal utility theory. Hicksian's price equivalent variation is based on the ordinal utility theory which can be illustrated by indifference curves. With this measure, tenant benefits are defined as the amount of additional income the participating family requires in order to be as well off without the housing subsidy program as participating in it.

Standard practice in housing studies based on Hicksian's consumer surplus concept has assumed the existence of two composite commodities—"housing service" and "nonhousing goods and services". The participating household's preferences are assumed to be represented by a particular utility function, $U = f(H, X)$ where H is the quantity of housing services and X is the quantity of all nonhousing goods and services.

By maximizing this utility function subject to the family's budget constraint, an indirect utility function can be derived, $U' = g(Y, P_h, P_x)$ which gives the highest level of utility that can be obtained given household income Y and market price of housing service and other goods and services, P_h and P_x, respectively. Therefore, $Y = g^{-1}(U', P_h, P_x)$ gives the level of income the household must have in order to attain utility level U' with market price of P_h and P_x. Participation in the housing subsidy program allows the household to achieve a certain level of utility U_s, $U_s = f(H_s, X_s)$, where H_s is the quantity of housing services offered in the program and H_s is the quantity of other goods and services that are purchased by the households after it has paid its subsidized rent. The household will participate in the housing subsidy program if $U_s > U'_0$, $U'_0 = g(Y_0, P_h, P_x)$ where Y_0 is the household's initial income without the subsidy program. The Hicksian's measure of benefits are defined as the difference between the amount of income that allows the household to attain U_s without the subsidy program and Y_0. Thus benefits can be

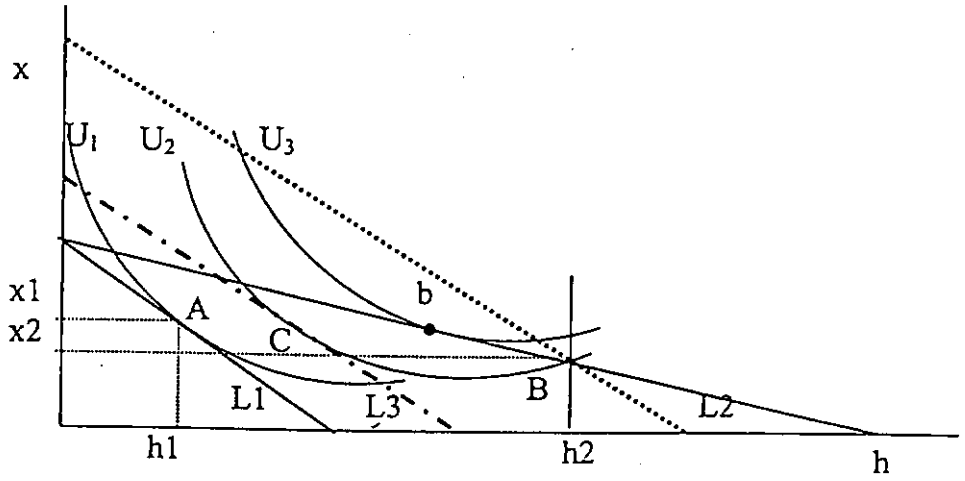


Figure 2.4: Net tenant benefits by Hicksian's equivalent variation measurement expressed as: $B = g^{-1}(U_s, P_h, P_x) - Y_0$. Desalvo (1971) was the first to adapt this methodology to housing subsidy program. His analysis can be illustrated in Figure 2.4. The composite commodities are housing services (h) and nonhousing goods and services (x). Housing subsidy program only provides an all-or-none choice. Participants will either accept a particular apartment at subsidized rent or do not participate in the program at all. The preprogram position is indicated by A (x_1, h_1). The vertical line h_2 represents the fixed amount of housing the tenant must purchase under the housing program. Faced with a fixed income, a fixed price of other goods and services, and the subsidized rent of $\alpha P_h h_2 (0 < \alpha < 1)$ for the amount of housing service h_2, the amount of x is determined at x_2. In other words, the participant's post-program position is indicated by B (x_2, h_2) and B is on the indifferent line

U_2. Notice that if the participant had been given freedom of choice along budget line L_2, he would have chosen point b rather than B and achieved a higher level of satisfaction U_3 by trading off some housing for some other goods and services.

It should also be noted that h_2 could be low enough so that the consumer would prefer to trade off some of other goods and services for more housing. Conversely, it is even conceivable that the all-or-none quantity of housing is so great that the consumer would be worse off as a program participant than as a non-participant. However, Figure 2.4 is probably the more realistic case, i.e., where the participant is required to purchase more housing than he would prefer at prices P_x and αP_h but not enough to preclude participation.

Since the participant can pay less-than-market rent for h_2, the highest utility he can have is U_2 under the program. If he were to obtain the same level of utility as U_2 but required to pay market rental for his housing, he would need an income represented by the dashed line which is tangent to the U_2 indifference curve at C. The dashed line is parallel to the initial budget line L_1 to reflect that the prices of x and h are the same in both situations. If the income associated with point C is represented by Y and the individual's actual income is Y_0, then the net tenant benefits (B_t^n)of the program are:

$$B_t^n = Y - Y_0$$

Desalvo (1971) assumes a Cobb-Douglas utility function :

$$U = h^{\beta} x^{1-\beta} \tag{2.3}$$

where h denotes the quantity of housing service, x denotes the quantity of other goods and services, β is the rent -income ratio; and that the budget line is : $Y = \alpha P_h h + P_x x$.

The following relations are derived from maximization of the utility function subject to the budget constraint:

$$h = \frac{\beta Y}{\alpha P_h} \tag{2.4}$$

$$x = \frac{(1-\beta)Y}{P_x} \tag{2.5}$$

The utility level associated with h_2 and x_2 is: $U_2 = h_2^{\beta}\ x_2^{1-\beta}$.

Therefore, the net tenant benefits

$$B_t^n = [\frac{P_h h_2}{\beta}]^{\beta} [\frac{Y_0 - \alpha P_h h_2}{1-\beta}]^{1-\beta} - Y_0 \tag{2.6}$$

We can see from (2.6) that it is necessary to have observation on market rent of the unit ($P_h h_2$), the household income (Y_0), subsidized rent of the unit ($\alpha P_h h_2$), and the rent-to-income ratio (β).

Desalvo (1975) applies this methodology in an analysis of New York City's

Mitchell-Lama middle income housing program. He estimated the market rent of the subsidized housing by using the opinions of experts within the New York State Urban Development Corporation. He also estimated β by establishing a function relating the rent-to-income ratio to household size, age and sex of household head.

Kraft and Olsen (1977) also apply the Desalvo methodology in a study of benefits of public housing in five cities using a more sophisticated method for estimating market rent than reliance on expert opinions. The rent-to-income ratio of households renting housing on the private market is regressed on race, sex, and age of head of household and number of household members for each city. To estimate market rent, Kraft and Olsen rely on previously estimated relationships between market rent and housing characteristics calculated by Gillingham (1973) for each of the five cities and incorporate numerous housing characteristics such as age of structure, number of rooms, number of bathrooms, condition of unit, air conditioning etc.

Murry (1975) extends Desalvo's methodology in a study of tenant benefits from eighty-six public housing project in seven cities in 1968. He estimates the parameters of three utility functions, the Cobb-Douglas, the constant elasticity of substitution (CES), and the generalized CES, in order to test the hypothesis that the true specification is Cobb-Douglas or ordinary CES. He also estimates benefits using two of these utility functions in order to determine "whether the Cobb-Douglas specification serves as a useful approximation to generalized CES even when it is

statistically rejected as the true specification". As a result, Murry finds that there is not much difference in average benefits estimation based on the Cobb-Douglas and generalized CES specification respectively whilst there do exist significant different benefits distribution.

Unlike the previous studies that adopt Cobb-Douglas utility function, Olsen and Barton (1983) are the first to use Stone-Geary utility in their study of public housing in New York City. The Stone-Geary utility function is more general than the Cobb-Douglas function and is an easier function to estimate benefits than the generalized CES. The Stone-Geary utility function takes the form as follows:

$$U = (h - \beta_h)^{\gamma_h} (x - \beta_x)^{(1-\gamma_h)} \tag{2.7}$$

where h and x are quantities of housing and other goods and services respectively; the parameter γ_h is the marginal propensity to spend on housing, and β_h and β_x are displacement parameters.

The Stone-Geary utility function is more general than the Cobb-Douglas utility function because it permits price and income elasticity to vary with prices and income, although they monotonically approach unity as income increases. Furthermore, the Stone-Geary utility function, unlike the generalized CES function, leads to an explicit benefit formula.

The benefits formula for the Stone-Geary utility function is:

$$B = [(P_h h_s - P_h \beta_h / \gamma_h]^{\gamma_h} [(P_x x_s - P_x \beta_x / (1-\gamma_h)]^{(1-\gamma_h)} + P_h \beta_h + P_x \beta_x - Y_0 \qquad (2.8)$$

where h_s and x_s are the quantity of housing and nonhousing consumption respectively after participating in the housing subsidy program.

On the basis of the previous studies, Hammond (1987) develops the benefits measure further. According to the theory of intertemporal consumer demand, She establishes an intertemporal model to estimate tenant benefit. In traditional single-period consumer demand theory, consumers are assumed to spend their entire income during the current period and to maximize a utility function that depends only on the commodities consumed during that period. One criticism of this theory is that it requires consumers to be myopic by constraining current consumption decisions to be based solely on present realities with future expectations playing no role. Intertemporal theory drops the assumption of myopia and analyzes the behavior of consumers who plan for the future. The model in Hammond's study includes an intertemporal Stone-Geary utility function, expenditure constraints and demand equations. This model focuses on the whole rental housing subsidy program across the entire nation and benefits are measured assuming an intertemporal utility function and budget constraint with a fifty-four-year planning horizon.

2.1.2 Costs

With the respect to costs, we only observe the resource costs which can be divided

into two parts:

1) the part which is contributed by the program participant himself; i.e., project rent R_p;

2) the part which is contributed by nonparticipant of the program i.e., C_{nt}.

Therefore the total costs are the sum of these two: $C = R_p + C_{nt}$

There are two ways to measure the total resource costs: 1) to directly estimate the total resource cost of a housing subsidy program based on extensive cost data on development expenses and subsequent operating expenses; 2) to assume that the costs equals to market rent of the housing. If we assume that the housing subsidy program is as efficient as the private housing market, we may expect the market rent of a housing unit to approximate the resource cost of the unit. Moreover, even if it can not be convincingly argued that the program is efficient, using market rent as an estimate of total resource cost would provide a lower bound to the true resource cost of housing subsidy program and could be used as a check on any alternative cost estimating procedure.

2.2 Literatures on housing subsidy programs in Hong Kong and the mainland China

2.2.1 Hong Kong

There have been several studies on housing subsidy program evaluation in Hong Kong. Leung(1976) is the earliest studies of economic analysis of housing policies in Hong Kong. He concluded in his research that for every 100 dollars of housing subsidy, there is around 57 to 67 dollars of net tenant benefit. He adopted the Cobb-Douglas utility function and assumed unit price and income elasticity of demand for housing service.

Using the more flexible approach suggested by Olsen (1972), Yu and Li (1985) presented an alternative measure of the net tenant benefit brought by Hong Kong public housing program in 1979. This measure is based on Marshall's consumer surplus concept. It comes to the conclusion that Hong Kong's public housing program had substantial impacts on household's consumption patterns: it raises, on average, housing consumption by 120 per cent and non-housing consumption by 17 per cent. Further more, the ratio of net benefit to nominal subsidy ranges from a low of 26.4% for large household to a high of 100% for small households and the unweighted mean of this ratio is 75% for the space allocation standard of 3.25 square meters per adult. In other words, the welfare cost of Hong Kong public housing program is some 25

dollars per 100 dollars expenditure. Compared with the welfare cost around 50% in the studies of Muth(1973) and Desalvo (1975) in United States, it can be concluded that Hong Kong's public housing program has a higher efficiency.

Wong and Liu (1988) analyzed the distribution of benefits among public housing tenant in Hong Kong. They examined the effects of the program on consumption patterns and the distribution of benefits among public housing tenants. These two aspects are closely related to the efficiency and equity aspects of the public housing program. The ratio of benefits to nominal subsidy is found to be around 60%. This research reveals that the program is inefficient not because it made public housing tenants consume too much housing, but because it made the rich tenants consume too little of it and the poor tenants consume too much of it. Poor public housing tenants obtained more benefits than did rich ones, but many of the poor were not in the public housing program. The author suggested that a policy of progressively narrowing the difference between public and private rents can be justified on both equity and efficiency grounds.

The underlying premise of public housing policy in Hong Kong is to provide public rental housing (PRH) subsidy to low income families who are in need of assistance. However, due to the economic boom in the 80s and 90s, many of the original occupants of the PRH have prospered and their affordability has improved beyond the income limit set by Hong Kong Housing Authority. This will undoubtedly affect the

equity and efficiency aspects of the public housing program. In order to ensure a rational allocation of PRH resource, Hong Kong Housing Authority proposed a policy in its consultant document in 1995. According to the policy, PRH tenant's eligibility for receiving PRH should be reviewed after a period of residence. They have to justify their continuous need for PRH from time to time. It is in the long-term interest of Hong Kong that scarce public housing resource should be allocated strictly in accordance with need. Mo and Ng (1997) review the issues relating to the need for that policy and examine the implication of the implementation of this policy. They found that the policy leads to controversial response among the public. The arguments against it are queries if PRH is indeed subsidized housing, if separating the rich form the poor would give rise to social mix disturbance in the community, and most important, if the charge of market rent is the appropriate answer to the problem of public housing shortage.

Yeh (1990) discussed the vertical equity and horizontal inequity and the effectiveness of some measures used to tackle the problems of unfair housing subsidy in Hong Kong. The horizontal inequity refers to that the households of the same income and similar size receive a different level of subsidy while the vertical inequity means that the lower-income households receive lower subsidies than higher-income households. The three measures addressing the above inequity are double rent payment, homeownership scheme and home purchase loan scheme.

The latest efficiency study on public housing program in Hong Kong is "On privatizing public housing"(Wong ,1998). Based on his study in 1988, Wong adopts the same method to analyze the sample data in 1991. It is found that the ratio of benefits to nominal subsidy increases from 58.7% to 71.9% from 1981 to 1991. However, he concludes that privatizing the public housing stock is the only practical and desirable solution to the housing situation. The evidences are, firstly, there is little difference in the distribution of income between tenant families in public and private housing units, and secondly the inefficiency cost of the program is shockingly high and has resulted in enormously distorted consumption patterns for large sections of the population.

2.2.2 The mainland China

China's urban housing system has become a hot topic since China entered a substantial stage of urban housing reform in 1994. These studies include Pudney and Wang (1995), Chen (1996), Wu (1996), Zhou and Logan (1996), Chen and Wills (1997), Gu and Colwell (1997), Shaw (1997), Lai (1998), Logan and Bian (1999), Lee (2000), Rosen and Ross (2000), Wang (2000).

However, there have been very few economic analysis or evaluation on the urban housing reform in China. The only study on housing program efficiency is the research done by Pudney and Wang (1995). They evaluate the efficiency of housing

reform from three perspectives: 1) to describe the distribution of public housing in urban China; 2) to investigate the likely extent of misallocation relative to a market rental system; 3) to explore the distribution consequences of rent reform under alternative schemes of cash compensation. The result of the analysis cannot find unambiguous evidence of misallocation of housing resources at the individual level. They attribute the small degree of allocating inefficiency to unobservable individual variations in preferences. Therefore, they came to the conclusion that the major source of economic inefficiency in China's urban housing system is likely to be at the macro level: the system of aggregate supply rather than allocation.

Although there are many other research works on urban housing reform in China, Wang (2000) is the first and latest one to pay close attention to the housing of urban poor in China. The new housing reform initiative put forward in 1998 requires local authorities to make provision for subsidized social rented housing for low-income families. However, although the housing problems of the official urban poor have been recognized, there is no formal policy yet on housing provision for the unofficial poor.

2.3 Summary

The methodology for evaluating tenant benefits has evolved from the simplest way of calculating the difference between the subsidized rent and market rent to a more

complicated way of measuring the difference of Marshall's consumer surplus and then to measuring Hicksian's price equivalent price variation. The utility function adopted in Hicksian's price equivalent variation measure has been developed from the simplest Cobb-Douglas utility function to the intertemporal Stone-Geary utility function in order to measure the benefits distribution accurately.

However, most of the studies are applied in public housing projects of the United States and few of these studies have ever been applied in housing subsidy programs in developing countries such as the mainland China. The previous research works on public rental housing in Hong Kong adopt the restrictive Cobb-Douglas utility function, whilst this present study is the first attempt to adopt Stone-Geary utility function in benefits analysis. The most prominent advantage of this Stone-Geary utility function is to relax the restrictions of Cobb-Douglas utility function that is based on the unitary income and price elasticity of housing demand. Since there are substantial differences between the public housing programs of China and that of the United States, the application of the utility function, specifically, the estimation of the function parameters are adjusted accordingly. Although previous empirical studies show no significant difference between the average tenant benefit estimated by Cobb-Douglas and Stone-Geary utility function, this study attempts to adopt both of the two functions to estimate the average tenant benefits and see whether the difference is really significant or not.

Also, this is an original study to investigate the rental public housing program in the mainland China from the perspectives of both equity and efficiency. Before the urban housing reform in the mainland China, the rental public housing was regarded as welfare goods to every qualified household. After the substantial urban housing reform, most research works focus on the privatization of public housing and commercial housing so that the issues of equity and efficiency on subsidized rental public housing were neglected. However, there are still over 50% of the total population in the mainland China living in rental public housing. Besides, the new housing reform initiative put forward in 1998 required local authorities to make provision for subsidized social rented housing for low-income families. The welfare issues of such a big group of people living in rental public housing should not be neglected.

Furthermore, this study tries to compare the two rental public housing programs in both Hong Kong and the mainland China. In fact, it was not until after the urban housing reform in the mainland China that the two programs became comparable with each other. It is an attempt to compare the programs from the following three aspects: 1) the comparison by the three efficiency indexes; 2) the benefits distribution among different households; 3) the housing/nonhousing consumption changes by participating in the housing subsidy program. The comparison is quite meaningful since the urban housing reform in the mainland China seems to follow the footsteps of that in Hong Kong in recent years. However, whether this following is appropriate

still needs further investigation. This study tries to bring this issue up to open discussion and distinguish the positive experiences that should be learned from and the negative lessons be avoided.

Chapter Three Research Methodology

3.1 Introduction

This study chooses the Stone-Geary utility function but does not adopt the intertemporal model for benefits estimation. First, Cobb-Douglas utility function assumes the unitary income and price elasticity, which is the biggest restriction of the previous studies for benefit analysis. Murry (1975) finds that the benefits estimation based on the Cobb-Douglas function and generalized CES specification exhibit significant different distribution patterns, although there is no big difference in average benefit. The conclusion is that the Cobb-Douglas specification is not an adequate substitution for or approximation to the generalized CES. Adopting Stone-Geary utility function is an attempt to relax the restriction of the unitary price and income elasticity. It is more general than Cobb-Douglas because it permits price and income elasticity to vary with price and income, although they monotonically approach unity as income increases. On the other hand, the Stone-Geary utility function, unlike the generalized CES function, leads to an explicit benefit formula. However, since the Cobb-Douglas specification is acceptable for evaluating the average benefits, it will be used to measure the mean tenant benefits of the housing program in this study and the result will be compared with that by adopting Stone-Geary function.

Second, although the fundamentals of the intertemporal model developed by Hammond(1987) seem appropriate, there are several obstacles in its application. The model needs the data on housing and nonhousing price and household income throughout the whole planning horizon. Although the previous statistics may provide housing and nonhousing price, it's difficult to get those price for the forthcoming years except by certain restrictive and even unreasonable assumptions. It's also impossible to predict the household income during the previous years and forthcoming years since the only information available is the current household income. Hammond assumes the household income shares the growth of the economy. However, it is not likely that the economy will grow continuously. Since the housing price, nonhousing price and household income are the most important variables in the intertemporal model whilst their estimation are questionable, it is hard to produce a convincing conclusion.

The last but not least argument for not adopting the intertemporal model is on policy objective consideration. The basic objective of rental public housing is to help those in need to live in a more descent housing than without the subsidy program. Most importantly, it is expected that the tenants will accumulate their fortune during the transitional period to become potential housing buyers on private market where there are more freedom for housing choices for their specific needs. Therefore, the assumption that the households will live in rental public housing from 21 to 75 years old is completely opposite to the policy objective and practical situation. Particularly,

the government of Hong Kong and the mainland China are all encouraging households to own their own property as much as possible, so that this assumption is not reasonable for the analysis.

3.2 The models

To compare the efficiency of two different housing subsidy programs, we must at first evaluate the benefits and costs of the programs and then establish appropriate efficiency indexes for comparison. Then the benefits distribution and housing/nonhousing consumption changes are investigated. In addition, we will estimate the variables in the evaluation models and collect data to apply them in the models and indexes. Therefore, the research methodology of this study mainly includes two parts: 1) benefits and costs evaluation methodology; 2) variables estimation and data collection

3.2.1 Benefits estimation model

As discussed in Chapter two, the tenant benefits can be measured by the following expression according to the Cobb-Douglas utility function:

$$B_t^n = [\frac{P_h h_s}{\beta}]^{\beta}[\frac{Y_0 - \alpha P_h h_s}{1-\beta}]^{1-\beta} - Y_0 = [\frac{R_m}{\beta}]^{\beta}[\frac{Y_0 - R_s}{1-\beta}]^{1-\beta} - Y_0 \qquad (3.1)$$

where h_s denotes the quantity of housing service consumed under the subsidy

program, P_h is the market rent of the housing provided by the subsidy program, β is the rent -to-income ratio; R_m is the total market rent of the housing provided by the subsidy program, and R_s is the total subsidized rent of the housing provided by the subsidy program; the budget line is $: Y = \alpha P_h h + P_x x$; Y_0 is the initial household income.

According to the Stone-Geary utility function, the tenant benefits will be expressed as:

$$B = [(P_h h_s - P_h \beta_h / \gamma_h]^{\gamma_h} [(P_x x_s - P_x \beta_x / (1 - \gamma_h)]^{(1-\gamma_h)} + P_h \beta_h + P_x \beta_x - Y_0 \qquad (3.2)$$

where h and x are quantities of housing and other goods and services respectively; the parameter γ_h is the marginal propensity to spend on housing, β_h and β_x are displacement parameters, and Y_0 is the initial household income.

3.2.2 Costs estimation model

We assume that total resource costs equal to market rent of the housing. It is based on the assumption that the housing subsidy program is as efficient as the private housing market and we may expect the market rent of a housing unit to approximate the resource cost of the unit. Moreover, even if it can not be convincingly argued that the program is efficient, using market rent as an estimate of total resource cost would provide a lower bound to the true resource cost of housing subsidy program and could be used as a check on any alternative cost estimating procedure.

Therefore, the costs model is simply expressed as:

$$C = R_m \tag{3.3}$$

where R_m is the market rent of subsidized housing

3.2.3 Efficiency indexes for comparison

After having the magnitude of benefits and costs of the housing subsidy program, we need to establish efficiency indexes to compare the different subsidy programs under different housing subsidy systems. Before establishing efficiency indexes, we must define the following terms:

1. Net tenant benefits (B_t^n): the increment of consumer's surplus after participating in the housing subsidy prgram; or the amount of additional income the program participant needs to be as well off without the program as with it;
2. Gross tenant benefits (B_t^g): the dollar value of the program to the tenant, i.e., net tenant benefits plus the amount he actually pays for the subsidized housing;
3. Total resource cost (C): cost of economic factors required to provide a flow of housing services from the program unit.
4. Nominal subsidy (S): the difference between market rent and subsidized rent of the program unit.

It is impossible to compare the efficiency of housing subsidy programs in Hong Kong and the Mainland Chian by using the absolute number of benefits and costs

because they are in different economic and social circumstances. Even within the mainland China, there are economic and social factors that makes the benefits and costs results of different areas incomparable. Therefore, it is better to use efficiency indexes for comparison between different programs in different areas.

According to the fundamentals of cost-benefit analysis, the ratio of net tenant benefits to total resource costs is the first efficiency index showing how much benefits are produced by costs. The efficiency index EI_1 is:

$$EI_1 = \frac{B_t^n}{C} * 100\% \qquad (3.4)$$

Since the public housing programs are in-kind transfers, there must be some efficiency loss due to the mismatch of tenant demands and subsidized housing supply. The ratio of net tenant benefits and nominal subsidy shows to what extent does the nominal subsidy have efficiently transformed into net tenant benefits. Thus the second efficiency index EI_2 is:

$$EI_2 = \frac{B_t^n}{S} * 100\% \qquad (3.5)$$

Furthermore, we need to investigate the ratio of net tenant benefits and household income which varies among different areas. This is important because it shows the impact of the subsidy program and to what extent does the subsidy improve the household income. Higher average benefits in a district do not definitely imply higher

efficiency with the consideration of household income. This leads to the third efficiency index EI_3:

$$EI_3 = \frac{B_i''}{I} * 100\% \qquad (3.6)$$

where I is the average household annual income for specific district

3.2.4 Changes of housing and nonhousing consumption

The goal of housing subsidy program is not just to increase the welfare of the subsidized families but also to increase their consumption of housing beyond what would result from the absence of the subsidy program or even with unrestricted cash grants. Hammond's study shows that the subsidized households consumed 40% more housing that they would have in the absence of the program. Wong (1998) find that 52% and 64.5% of the households in 1981 and 1991, respectively, consume more housing services under the public housing program. Hammond further finds that cash grants are less stimulative of housing consumption and more stimulative of nonhousing consumption than these programs.

The proportional changes in household's consumption of housing and nonhousing goods resulting from the housing subsidy program are given by expressions as follows:

$$HC = \frac{P_h Q_h^s - P_h Q_h^m}{P_h Q_h^m} * 100\% \qquad (3.7)$$

$$XC = \frac{P_x Q_x^s - P_x Q_x^m}{P_x Q_x^m} * 100\% \qquad (3.8)$$

where P_h is the market price of housing and nonhousing service, Q_h^s, Q_x^s are the quantity of housing and nonhousing consumption under the subsidy program, Q_h^m, Q_x^m and are the quantity of the housing and nonhousing consumption in the absence of the subsidy program.

3.2.5 Distribution of the benefits among the participating households

The distribution pattern of the benefits among the participating households is also an important way to measure the efficiency of the housing subsidy program. Ordinary Least Square (OLS) is adopted for the regression model that can be expressed as:

$$B = \alpha + \sum_{i=1}^{n} \beta_i X_i ... + \mu \qquad (3.9)$$

where X_i represent the variables including household income, age of household head, household size etc. The distribution pattern helps to find out whether the benefits are appropriately allocated among the households in need, for instance, whether the lower income households will get more benefits than the rich ones.

3.3 Variables estimation

3.3.1 Variables in model based on Cobb-Douglas utility function

In equation (3.1), there are four variables that need to be estimated:

1) R_m (i.e.: $P_a Q_s$): the total market rent of the housing provided by the program;

2) R_s (i.e.: $P_s Q_s$): the total subsidized rent of the housing provided by the program;

3) Y_0: the average annual income of household participating in the subsidy program;

4) β : rent-to-income ratio.

Since R_s and Y_0 can be obtained directly from the sample data in Hong Kong and the mainland cities in China, only β and R_m need to be estimated.

Estimating R_m

Measuring R_m poses difficult problems because market rents for public housing units are not observable. The easiest way to get R_m is simply to ask someone with knowledge of housing market in which the program operates to estimate the market rent of subsidized housing. Another approach is to apply hedonic indices estimated for market housing to public housing. With our data, it is possible to construct very crude indices. Wang & Liu (1988) mentioned the most severe problem is that public housing units possess special features often unavailable in the free market.

Furthermore, there is no reason to believe that public housing tenants value the particular bundle of features contained in public housing units in the same way that they would in the free market. The alternative measure is to assume a constant rate of subsidy for all households and to determine how tenant benefits vary with different assumed rates of subsidy. We adopt this last measure in the program study in Hong Kong. Since there is no such assumed rate in the mainland China, the market rent of the public housing is obtained from questionnaire surveying.

According to the Hong Kong Housing Authority Annual Report, public housing rents were about 20% to 30% of private housing rents.[1] This implies subsidy rates between 70% and 80% on average. This estimate was obtained by making comparisons between public housing rents and private housing rents on new lettings of comparable accommodation in the same district. This provides us with a benchmark value for assessing the approximate gains to public housing tenants. In the case of Mainland China, there is not an open and free market of the rental housing due to the special urban housing system. However, there are a lot of private transactions between the tenants and their "lessee". Therefore, the only way to get the information on market rent of the subsidized housing is by surveying.

[1] See Hong Kong Housing Authority Annual Report from 1996 to 2000.

Estimating β

Among the four variables in the equation, the rent-to-income ratio of β is the most difficult one to estimate. Different households have different ratios according to the various household characteristics. Although it is widely accepted that the ratio can be estimated by regression on the household characteristics, the specific regression methodology and the regressors selected in the model still vary considerably from one another. For instance, Olsen (1972) assumes a stochastic model incorporating regressors such as household income, age of head of household, number of persons in the household, the race and sex of the household head. Whilst Wong and Liu (1985) choose thirteen regressors including age of household head, the marry status of head, number of children and education years etc. Since β and the Cobb-Douglas function is not the focus of our interests in this study, we adopt the ordinary least-square (OLS) regression to estimate β.

3.3.2 Variables in model based on Stone-Geary utility function

In equation (3.2), the variables that need to be estimated are parameters in the Stone-Geary utility function, the subsidized rent of public housing, the market rent of the public housing and the household income. Except for the estimation of the three parameters (β_x, β_h, γ_h) in the Stone-Geary utility function, the estimation of the other three variables are the as same as abovementioned for Cobb-Douglas function.

Estimation of β_x, β_h, *and* γ_h

It has been assumed that each family has a Stone-Geary indifference map. It is not assumed that the parameters are the same for all families. Instead, families are divided into types defined in terms of size and age and marital status of the head of the household. Olsen and Barton (1983) assumed that all families of the same types have the same displacement parameters β_x, β_h but different parameters $\gamma_h(i)$. Let γ_h be the mean of the $\gamma_h(i)$ for all families of a particular type. Then, for any family in this type, $\gamma_h(i)$ can be written as the sum of γ_h and some new variable $w(i)$ which has mean zero.

Under this assumption, a maximizing family which can buy as much of each good as it can and pay at market housing and nonhousing prices $P_h(i)$ and $P_x(i)$ will spend a fraction of its income to housing as expressed in equation 3.10:

$$P_h(i)Q_h(i)/Y(i) = \gamma_h + (1-\gamma_h)\beta_h P_h(i)/Y(i) - \gamma_h \beta_x P_x(i)/Y(i) + [1-(P_h(i)\beta_h + P_x(i)\beta_x)/Y(i)]w(i) \qquad (3.10)$$

where $P_h(i)$, $P_x(i)$, $Q_h(i)$, $Y(i)$ and $w(i)$ are jointly random variables. This study adopts Olsen and Barton's method in dealing with the problem of insufficient variation in relative prices in the sample. First, the units of the goods are defined so that the price of each is 1, thus the stochastic equation can be transformed into:

$$Q_h(i)/Y(i) = \gamma_h + \alpha_h / Y(i) + u(i) \qquad (3.11)$$

where $\alpha_h = (1-\gamma_h)\beta_h - \gamma\beta_x$, and $u(i) = [1-(\beta_h + \beta_x)/Y(i)]w(i)$. Then the random variables $Y(i)$ and $w(i)$ are assumed to be independent, which implies that that $1/Y(i)$ and $u(i)$ are uncorrelated and the weighed least-squares estimators of γ_h and α_h are consistent. Since units of housing service have been defined so that the price of this good is one, β_h can be interpreted as minimum expenditure as well as minimum quantity of housing service. The estimate of this parameter for each family type is the smallest housing expenditure among sample families of that type living in uncontrolled private rental housing. Since the sample minimum is a consistent estimator of the population minimum and we assume that the population minimum is β_h, $[(1-\gamma)\beta_h - \alpha_h]/\gamma_h$ is a consistent estimator of β_x.

Chapter Four The efficiency of public housing program in Hong Kong

4.1 Introduction

The 1% sample of the Hong Kong 1996 By-census is used in this study. The 1996 Population By-census was conducted during 16 to 24 March 1996 by Hong Kong Census and Statistics Department. It was a large-scale sample enquiry on a broad range of demographic and socio-economic characteristics of the population. About one-seventh of all quarters in Hong Kong were included in the sample and all households therein were included in the enquiry.

There are a total of 80,625 records including quarters record, household record and person record in the 1% sample By-Census database. Through data processing, 16,366 household records with the information of the household head are available for analysis in this study. Among the 16,366 households, 6,733 households are public housing tenants, 2,129 are private housing tenants while the other 7,504 are homeowners.

Each household record has 56 columns of information. The field name and its brief description of the selected columns in this study are shown as follows while those columns unrelated to housing choice and consumption are omitted:

Table 4.1 Field name and description of the selected columns from the 1% sample

Field name	Description
QRNO	Quarters serial number
HHN	Household serial number
PPN	Person serial number
QRTYP	Type of quarters
ACCOM	Type of accommodation
DEG_SH	Degree of sharing
HHTYPE	Type of household
TENURE	Tenure of accommodation
ALLOWN	Whether with housing allowance
RENT	Rent paid
UHSIZE	Household size
DJHHINC	Household income
NCL_CT	Family nucleus count
WORKPP	Number of working household members
ELDER_PP	Number of elderly persons in household
CHILD15	Number of children aged under 15 in household
RENT_INC	Rent to income ratio
SEX	Sex
AGE	Age
MARIT	Marital status
NAT1	Nationality
DUR_HK	Duration of residence in Hong Kong

4.2 Empirical Analysis

4.2.1 General description of the sample data

There are 6,733 households that are public housing renters in the 1% sample. Since household income, rent-to-income ratio, subsidized rent are the three major variables in the benefit model, the general descriptive statistics are given in Table 4.2.

Table 4.2 shows that the mean rent-to-income ratio of the public housing renters is 10% with a standard deviation of 0.08. The public housing rents per month has an average of 1153.15 and the household size ranges from 1 to 12 with a mean of 3.61.

Table 4.2 General Descriptive Statistics

	Minimum	Maximum	Mean	Std. Deviation
DJHHINC	400.00	150000.00	16369.16	12225.45
RENT_INC	.00	.55	.10	8.00E-02
RENT	.00	5512.00	1153.15	577.79
UHSIZE	1.00	12.00	3.61	1.58

There is a big standard deviation of the surveyed household income ranging from 400 to 150000. Specifically, we compare the eligibility criteria for rental public housing in 1996 issued by Housing Authority with the actual income of the 6,733 public households. The result shows that about half of the surveyed households' income is beyond the eligibility criteria. For example, 56% of the 3-person households have monthly income of over 12,000.

Table 4.3 The housing authority eligibility income criteria and the percentage of households with income beyond that criteria

Household size	Eligibility criteria (HK$)	Percentage of households with income beyond the eligibility criteria
1	6000	45.1%
2	9900	46.9%
3	12000	56%
4	14700	51.5%
5	15900	55.8%

The issue of changing household income and their qualification of the better-off households has been a hot topic of discussion in Hong Kong. The above table once again confirms that about half of the public housing renters are not qualified for the quarters they are living in. This situation will affect the efficiency of the public housing program.

The 1% sample contains the subsidized rent paid by the public housing renters but the market rent of the subsidized housing is not available. According to the Annual Report of Housing Authority in 1995~1996, public housing rents are 27% of the market housing rents. Therefore, the simplest way to estimate the market rent of the public housing is to divide subsidized rent by 27%.

4.2.2 Estimates of rent-to-income ratio and parameters

According to the benefits model discussed in Chapter three, the rent-to-income ratio β of the public housing renters and the parameters in Stone-Geary benefit model must be estimated before measuring the benefits.

4.2.2.1 *Estimates of rent-to-income ratio* β

The rent-to-income ratio in the 1% sample of By-census is the ratio of the subsidized rent and the household income. Since the subsidized rent is under control, it does not represent the households' real willingness to pay on housing. Therefore, the *real* rent-to-income β must be estimated.

Wong and Liu (1988) proposed an improved model of estimating β so that β can be bounded between 0 and 1:

$$\Phi^{-1}(\beta) = bX + u_0 \qquad (4.1)$$

where X is a vector of observed family attributes, b is a vector of corresponding coefficients, and u_0 is a random error term. Φ is the standard normal distribution function. b can be estimated using the sample of private housing tenants and then the coefficients can be used to impute β for public housing tenants

Table 4.4 Multinomial logit estimates of housing tenure choices

	Tenure 1	Tenure 2
Intercept	-2.835	2.64
	(-14.14)	(14.12
ALLOWN	-0.438	0.436
	(-2.95)	(3.86)
UHSIZE	0.386	-0.312
	(15.3)	(-7.08)
DJHHINC	-0.343	0.003
	(-33.34)	(0.36)
NCL_CT	-0.440	-0.740
	(-7.91)	(-9.49)
WORKPP	0.179	0.021
	(6.20)	(0.45)
ELDER_PP	-0.183	-0.200
	(-5.23)	(-3.25)
CHILD15	-0.108	0.201
	(-3.37)	(3.59)
SEX	0.383	-0.164
	(8.79)	(-2.58)
MARIT	0.212	0.021
	(5.88)	(0.46)
NAT1	-0.171	-0.105
	(-8.11)	(-3.35)
DUR_HK	0.365	-0.589
	(8.33)	(-19.04)
AGE	0.292	-0.000
	(14.11)	(-0.02)
-2 log likelihood	-13520.367	
Number of observation	16364	

Note: t values are in parenthesis.

Since there are totally three housing choices in Hong Kong, i.e., rental public housing, rental private housing and home ownership, we denote the probability of choosing

one of the three tenure choices as Tenure 1 (T_1), Tenure 2 (T_2) and Tenure 3 (T_3). A McFadden multinomial logit model is proposed to estimate the coefficients.

$$\ln(\frac{T_i}{T_3}) = b_i X + u_i \qquad i = 1,2 \qquad (4.2)$$

where X is a vector of observed family attributes, b_i is a vector of corresponding coefficients for those choosing T_i, and u_i is a random error term. The maximum likelihood estimates of the logit model are listed in Table 4.4.

In addition, the two-stage method proposed by Heckman (1979) to correct sample selection bias in estimation β is adopted. The specific formulation for trichotomous choices used in this study is base on Lee (1983). The basic idea is to include the selectivity bias control variable λ as an additional regressor in the equation (4.1) to correct for the misspecification arising from sample selection. So equation (4.1) becomes to:

$$\Phi^{-1}(\beta) = bX - \delta\lambda + u_0 \qquad (4.3)$$

where $\lambda = [\Phi^{-1}(\hat{T}_2)] / \hat{T}_2$ and $\hat{T}_2$ is the predicted probability of choosing private housing tenure imputed on the basis of the estimated coefficients of equation (4.2).

The Ordinary least squares estimates are given by Table 4.5. The estimated R^2 is a

very low value of 0.113. However, since the dependent variable is $\Phi^{-1}(\beta)$, R^2 is not an appropriate way to explain the power of the model. Wong and Liu (1988) defines $\hat{R}^2$ as the ratio of the sum of the squares of the predicted rental share to the sum of squares of the actual rental share and use it to assess the explanatory power of this model. In this way, $\hat{R}^2$ is much higher and has a value of 0.916.

Table 4.5 OLS estimates of rental share of private renters

Intercept	-0.774
	(-7.804)
WORKPP	-0.18
	(-9.067)
UHSIZE	0.09794
	(4.622)
NAT1	0.196
	(7.129)
DJHHINC	-0.02621
	(-5.805)
ALLOWN	0.09034
	(2.070)
SEX	0.05939
	(2.212)
ELDER_PP	-0.05785
	(-2.046)
NCL_CT	0.008828
	(0.25)
CHILD15	-0.01977
	(-0.756)
MARIT	0.0326
	(0.946)
DUR_HK	-0.04064
	(-3.719)
AGE	0.002007
	(0.174)
λ	-0.001071
	(-1.239)
R^2	0.113
$\hat{R}^2$	0.916
Cases	2129

Note: t values are in parenthesis.

4.2.2.2 *Estimates of parameters* γ_h, β_h, β_x

In the Stone-Geary benefits model, the three parameters of γ_h, β_h, β_x need to be estimated. According to the estimation method discussed in Chapter three, the estimation results are presented in Table 4.6:

Table 4.6 Parameters estimates of the Stone-Geary benefit model

Household size	γ_h	β_h	α_h	β_x
1	0.07856	724.61	310.620	4545.12
2	0.06619	964.26	468.439	6526.61
3	0.03922	1118.9	732.579	8730.92
4	0.03168	1225.55	890.508	9350.27
5	0.03479	1335.56	976.859	8974.90

With the parameters estimation results, we find that some households' housing consumption or nonhousing consumption is below β_h or β_x, thus the exponential function will produce invalid number. These households are temporarily regarded as missing information but will be analyzed in Chapter six.

4.2.3 Benefits measurement

The net tenant benefits per month for each household are measured based on both the Cobb-Douglas benefit model and Stone-Geary benefit model.

Based on Stone-Geary benefit model, the mean benefits per month for each household

is HK$962.8 in 1996. Since the number of household with 6 and more members are below 500, it is difficult to estimate the three parameters accurately based on such small sample data and the large families do not represent the typical household in Hong Kong thus they are omitted in this section of benefit measurement. Besides, there are about 2000 households whose nonhousing expenditure is less than β_x so that exponent function becomes meaningless. That is why the number of valid case is decreased from 6733 to 4055.

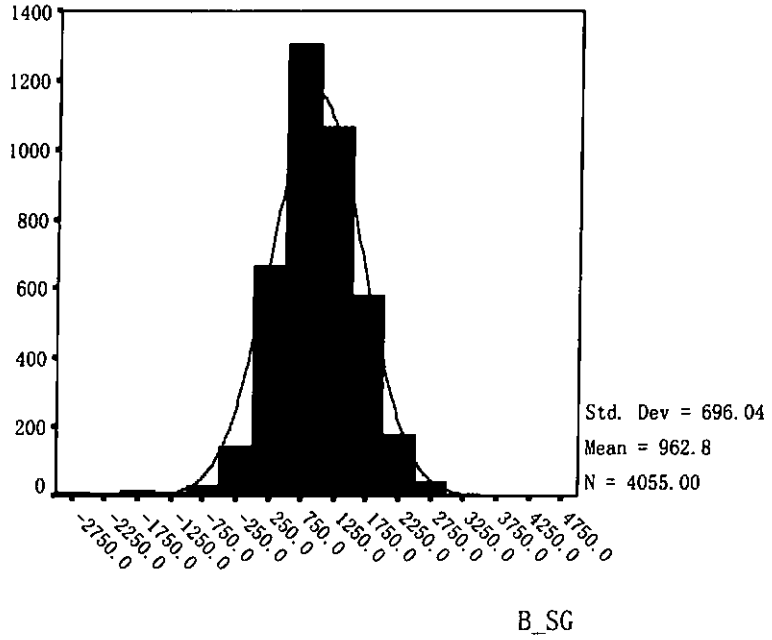


Figure 4.1

Table 4.7 Statistical description of B_SG for different household size

Household size	N	Minimum	Maximum	Mean	Std. Deviation
1	340	-3156.88	3199.05	812.20	778.76
2	600	-3256.39	5564.64	993.69	752.18
3	869	-2630.34	2640.67	887.83	597.55
4	1382	-3237.70	4706.60	903.29	643.76
5	864	-3349.45	4149.75	1170.77	747.17
Total	4055				

Specifically, Table 4.7 gives the mean, minimum and maximum value and standard deviation of benefits for different household size. The mean benefits generally increase as household size expands from 1 to 5. The only exception is that the two-person household has more benefits than three-person household.

The other benefits measurement based on Cobb-Douglas model gives different results. The mean benefit is up to HK$1751.4 per month for each household in 1996 with a very big standard deviation of 2721.93. It is about two times of that based on Stone-Geary model.

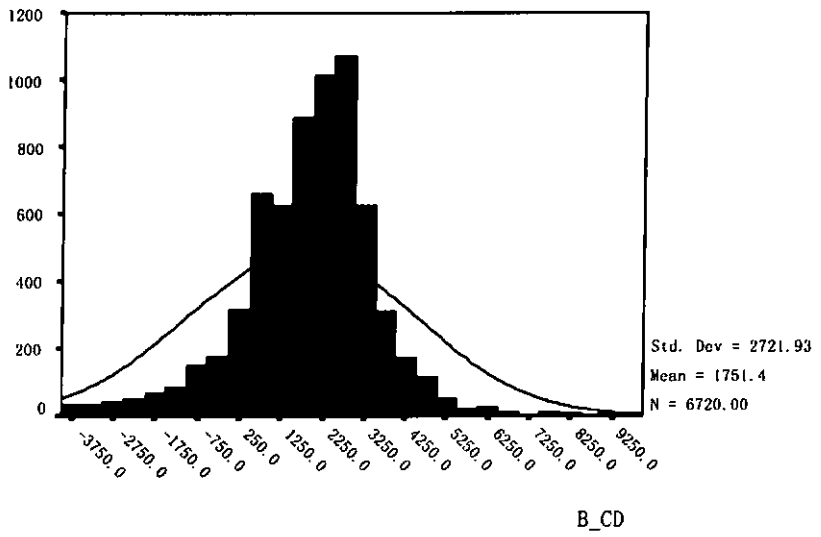


Figure 4.2

Table 4.8 Statistical description of B_CD for different household size

Household size	N	Minimum	Maximum	Mean	Std. Deviation
1	723	-15000	9522	888.15	1756.77
2	973	-29000	10325	1485.21	2142.63
3	1291	-25138	11021.34	1795.86	1925.30
4	1929	-25363	11501.71	1997.55	2066.87
5	1122	-49219	11599.67	2014.21	2917.43
Total	6730				

Similarly, the mean, minimum and maximum of benefit and the standard deviation for different household size are listed in Table 4.8 respectively. The mean benefit also increases at a decreasing rate as household size becomes bigger.

According to the Cobb-Douglas model, 11.3% of households have negative benefits. These abnormal values provide hints for investigating the reasons behind the inefficiency. For example, the household with the lowest benefits of –49219.6 has monthly household income of 150,000 while only pays 319 on housing rent. It is hard for us to track the specific situations of this household but it really indicates that the coexistence of formidably high income and extremely low housing rent payment definitely compromises the efficiency of the housing subsidy program that is originally initiated to help the poor households.

4.2.4 Efficiency indexes

As discussed in Chapter three, there are mainly three efficiency indexes to evaluate the public housing program based on the two benefit models respectively. The first index is EI1_SG that denotes the ratio of the net tenant benefits based on Stone-Geary model to costs. Similarly, EI2_CD is the ratio of the net tenant benefits based on Cobb-Douglas model to nominal subsidy (i.e., the difference between the market rent and subsidized rent of the public housing). The third index is the ratio of the benefits and household income.

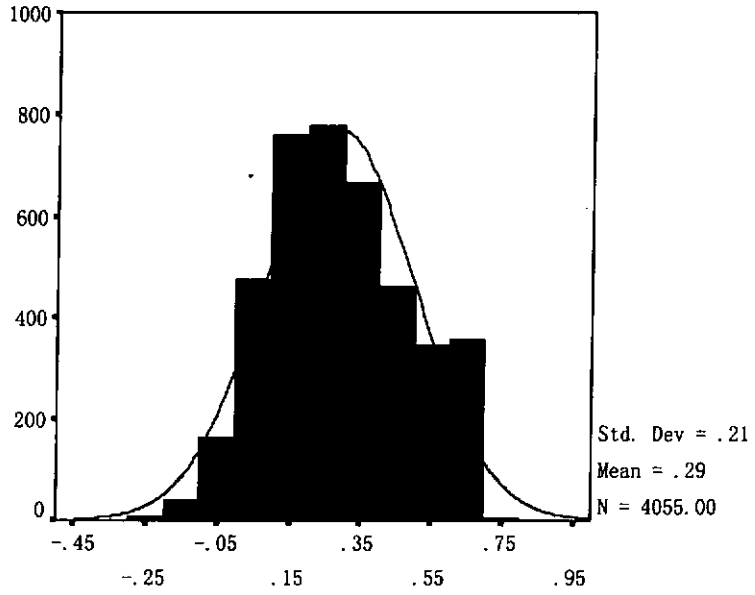
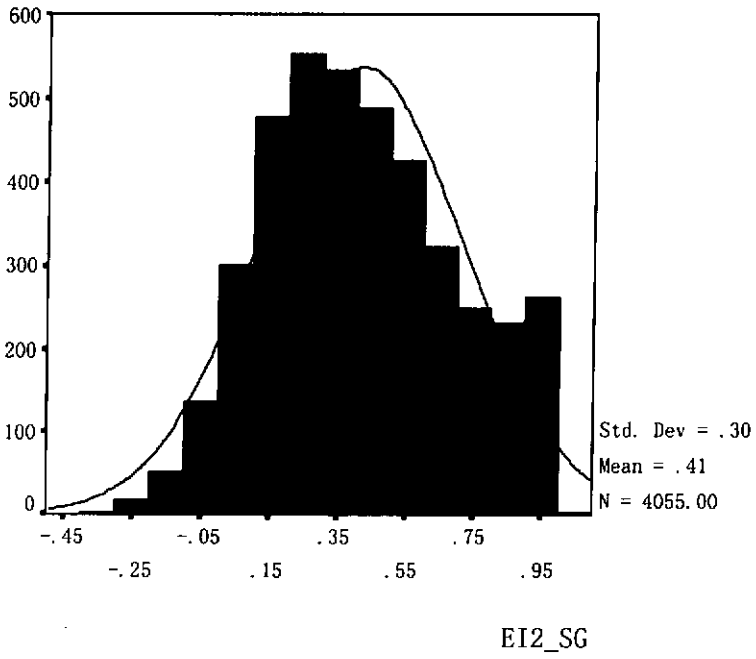


Figure 4.3



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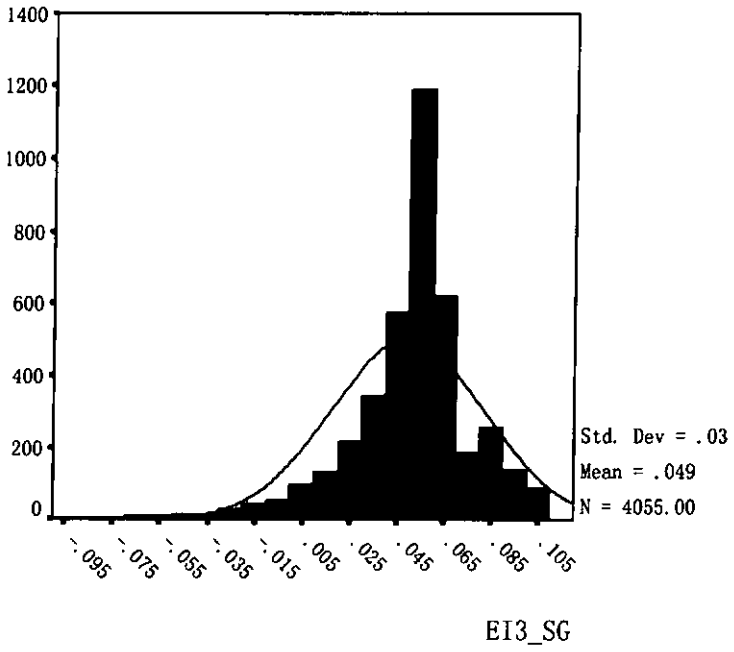

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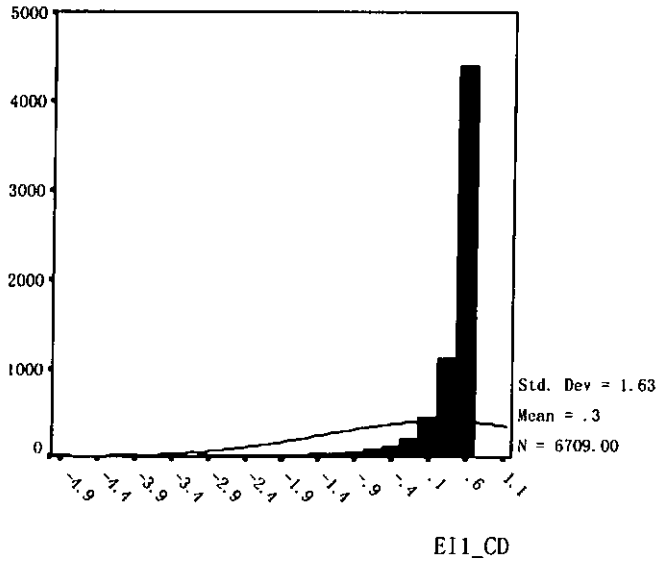

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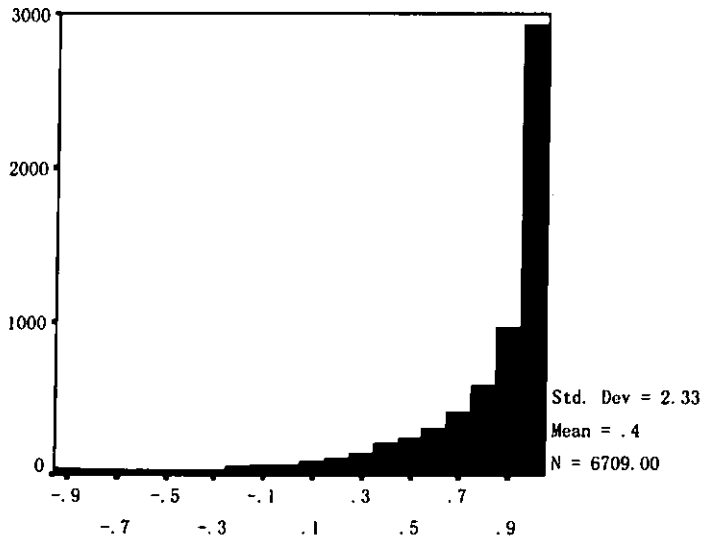

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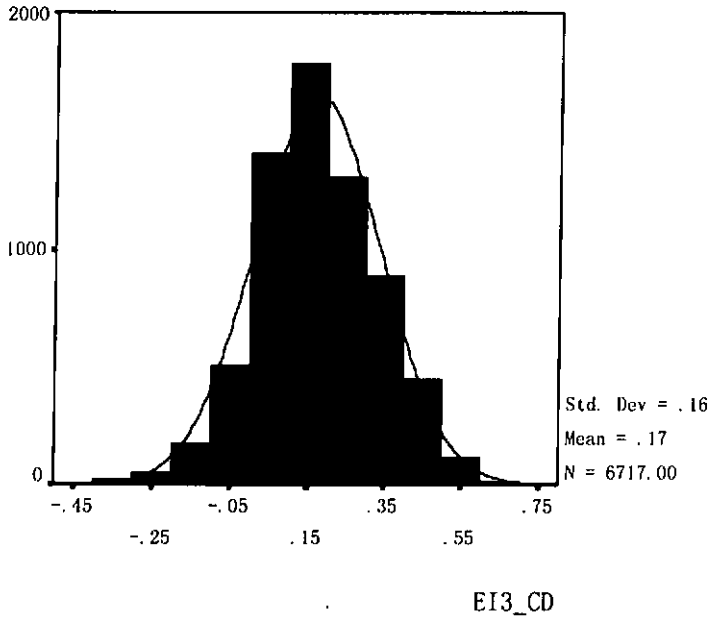


Figure 4.8

Table 4.9 Descriptive statistics of the efficiency indexes

	N	Minimum	Maximum	Mean	Std. Deviation
EI1_SG	4055	-3.101	.700	.28997	.21056
EI2_SG	4055	-4.430	1.00	.414	.300
EI3_SG	4055	-.527	.105	.049	.334
EI1_CD	6709	-55.870	.700	.301	1.631
EI2_CD	6709	-79.814	1.000	.430	2.330
EI3_CD	6717	-1.000	.799	.173	.162

The histogram figures present the distribution of the efficiency indexes. Figure 4.3 and Figure 4.6 show that the average ratio of net tenant benefits to costs for each household participating in the public housing program are 29% and 31% respectively. Although there are probably other benefits except for net tenant benefits, this low ratio still indicates large amount of losses and low efficiency. At the same time, the ratio of net tenant benefits to nominal subsidy is around 40%. In other words, for every one dollar of subsidy spent on each household, only 40 cents transform into net tenant benefits. Thirdly, we examine the ratio of net tenant benefits to household income. EI3_SG has a mean value of 4.9% whilst the mean of EI3_CD is up to17%.

Table 4.10 The mean of efficiency indexes for different household size

	Stone-Geary			Cobb-Douglas		
Household size	EI1_SG	EI2_SG	EI3_SG	EI1_CD	EI2_CD	EI3_CD
1	0.381	0.545	0.066	0.113	0.161	0.223
2	0.340	0.486	0.064	0.32	0.457	0.203
3	0.275	0.392	0.046	0.33	0.473	0.176
4	0.256	0.366	0.042	0.384	0.549	0.167
5	0.289	0.414	0.048	0.27	0.386	0.158

The efficiency indexes based on Stone-Geary model improves as household size decreases from 4 to 1 while two efficiency indexes (EI1_CD and EI2_CD) based on

Cobb-Douglas model have a maximum mean value for the four-person households. EI3_CD has the similar trend as EI3_SG with decreasing values as household size increases because generally larger households have higher income.

4.2.5 Benefits distribution

Although the histogram shows the general distribution of the benefits, it is also necessary to investigate their statistical distribution among the different households with different household characteristics. The ordinary least square estimation is adopted to regress the benefit based on Stone-Geary model. Since Murry(1975) has concluded that the Cobb-Douglas specification is not an adequate substitution for the generalized CES thus the regression of the benefits based on Cobb-Douglas model is not appropriate for the benefits distribution analysis. This is why we only regress the benefits based on Stone-Geary model in this study. The results are presented in Table 4.11.

The distribution of benefits based on Stone-Geary model shows that the household size, household income and duration of residence in Hong Kong are highly significant with the benefits. However, the interesting thing is that an increase in household income raises benefits received whilst the larger households receive less benefits than small households. It is reasonable that the duration of residence in Hong Kong is positively significant with benefits.

Table 4.11 B_SG distribution among different households

Constant	-207.675
	(-1.961)
ALLOWN	-221.267
	(-2.503)
UHSIZE	-125.210
	(-10.996)
DJHHINC	278.812
	(54.296)
NCL_CT	4.676
	(0.176)
WORKPP	29.108
	(2.466)
CHILD15	28.331
	(1.968)
SEX	-30.845
	(-1.846)
AGE	-1.512
	(-0.194)
MARIT	95.349
	(2.352)
NAT1	-23.659
	(-1.321)
DUR_HK	84.434
	(3.499)
R^2	0.495
CASE	4055

4.2.6 The changes of housing and nonhousing consumption

The housing consumption change (HC) and nonhousing consumption change (XC) are defined as the ratios of the difference between housing/nonhousing consumption under the housing subsidy program and in its absence. Specifically, the housing consumption under the program refers to the market rent of the subsidized housing. As reported in Figure 4.9 and 4.10, the households participating in the program averagely increase their housing and nonhousing consumption by 1.8% and 26% respectively. However, these consumption changes varied considerably with different

household income lever as given in Table 4.12. The results indicate that the lower income households have higher housing consumption change ratio and lower nonhousing change ratio. Further, the households under the program with income more than 15,000 consume less housing than in the absence of the program. It proves once again that the households with income beyond the eligibility criteria to great extent affect the efficiency program. Since the lower income households do benefit from the program and consume considerably more housing than they can in the absence of the program, it is only the program management and control not the program itself that should be blamed for the inefficiency.

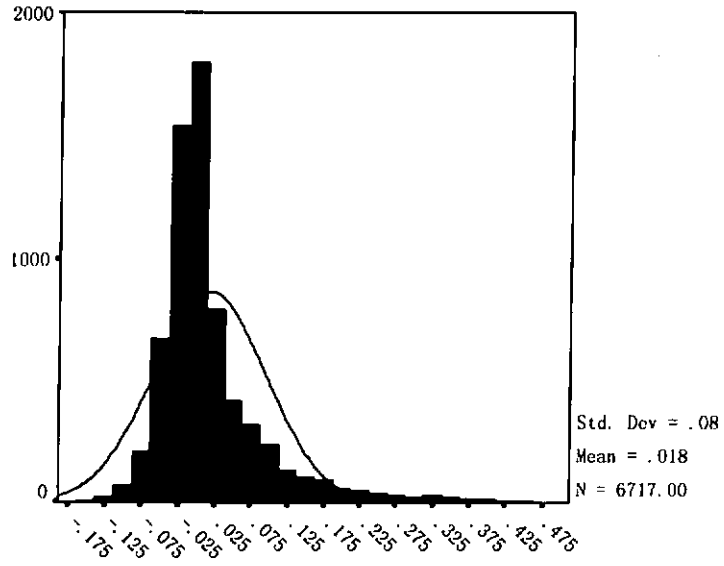


Figure 4.9

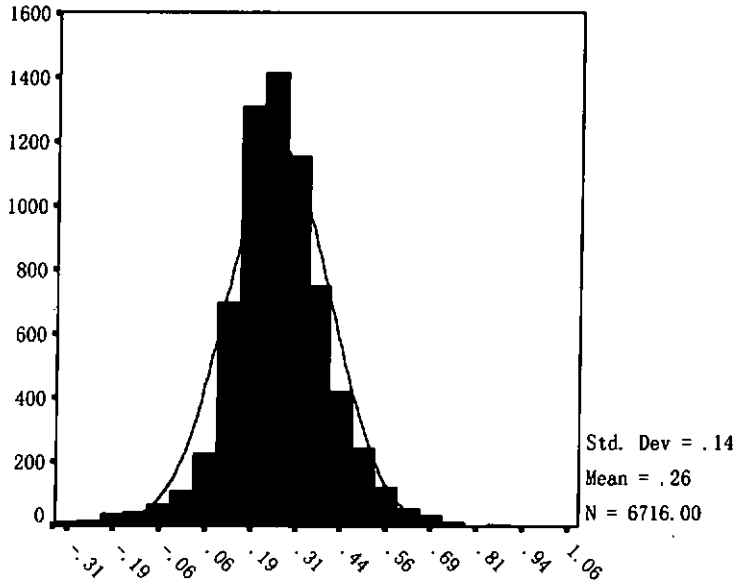


Figure 4.10

Table 4.12 The mean of housing/nonhousing consumption change for different household income level

Household income level (monthly)	Mean of HC	Mean of XC
<5000	0.16	0.08
5001~10000	0.04	0.28
10001~15000	0.00	0.31
15001~20000	-0.02	0.30
20001~25000	-0.02	0.27
25001~30000	-0.02	0.26
30001~35000	-0.02	0.23
35001~40000	-0.02	0.22
40001~45000	-0.02	0.20
45001~50000	-0.02	0.19
50001~100000	-0.02	0.18
>100001	-0.02	0.17

4.3 Summary

In this chapter, the efficiency of rental public housing program in Hong Kong is evaluated based on the 1% 1996 By-Census sample data. Both of the Stone-Geary and

Cobb-Douglas benefit models are adopted in this study. This housing subsidy program is examined from four aspects: net tenant benefits per household under the subsidy program, three efficiency indexes, benefits distribution among the households with different household characteristics and housing/nonhousing consumption changes under the program and in its absence.

The empirical analysis indicates that the average net tenant benefits per household is 962.8 per month for the Stone-Geary benefit model while for the Cobb-Douglas model the value is up to 1751.4. However, there is no significant difference between EI1 and EI2 based on the two models. The average ratio of benefits to costs is about 30% and the average ratio of benefits to nominal subsidy 40%. Both of the two indexes imply great efficiency losses in the program. Compared to the previous study by Wong and Liu(1988) on EI2 of 60% and 71% based on sample data in 1981 and 1991, this study shows that inefficiency is actually deteriorating. The benefits based on Stone-Geary model is about 4% of the participating household income while the benefits based on Cobb-Douglas model up to 17%. Besides, the benefits distribution analysis shows highly significant relationship between household size, household income and duration of residence in Hong Kong. However, the benefits decrease when the household size increases and household income decreases. Finally, households participating in the housing subsidy program averagely increase housing consumption by 1.8% and nonhousing consumption by 26%. We further find that the lower income households have more housing and nonhousing consumption changes

than the higher income households. Specifically, the households with income 15000 under the housing subsidy program all consume less housing than they would have consumed in the absence of the program. In other words, the household income control in the housing subsidy program is the biggest issues behind the program efficiency.

Chapter Five The efficiency of public housing program in the mainland China

5.1 Introduction

Two metropolises in the mainland China are selected for this study—Shanghai and Chongqing. Shanghai is the most developed city in east China with a space of 6,340 square kilometers and a population of 13 million. Chongqing is the biggest municipality of 82,000 square kilometers and its population is over 30 million. Both of these two metropolises are densely populated and are facing serious urban housing problems. Besides, they are both old and traditional industry base with lots of state-owned enterprises and unemployed workers.

As abovementioned, the public housing program is the focus of this study. In the old welfare housing system in the mainland China, the rent for public housing is extremely low because housing was regarded as a welfare good not a commodity to each household. On the other hand, the income was kept at a low level since the housing expenditure factors were not incorporated into wages. During the urban housing reform, public housing rent was originally increased to maintain a reasonable rent-to-price ratio so that the better-off people would be willing to give up welfare rental housing and purchase commercial housing on the private housing market. However, the rent increase policy treats the households at completely different income

levels in the same way. As a result, the early rent reform was almost an utter failure when the rent was only slightly increased. The reason is very simple since the real better off people consider it not worthwhile to give up the welfare public housing. Afterwards, there was more significant increase in public housing rent so that more and more people began to buy the public housing or even commercial housing. However, the low-to-medium income households who cannot afford to buy any housing have to suffer the continuous rent increase for they are not treated separately in the housing subsidy system. When the housing policy makers were focusing on the selling of the public housing and commercial housing, the welfare issue of the poor household in need is unfortunately neglected.

Table5.1 and Table 5.2 demonstrate the disproportional increase of the low-to-medium income and public housing rent level in the two metropolises from 1996-1999. For example, the income and rent index in 1996 is assumed to be 100 and the rent of Chongqing in 1997 increased to 293% of the rent in 1996. Also, this rent continued to raise by 47% in 1998 to 1.29 RMB per month per square meter. On the other hand, the income only increased by 19% to 34% for the low to medium income households. There is unusual decrease in household income from 1997 to 1998 in Chongqing, which is partially due to the expansion of the administrative district in 1998 when Chongqing became the biggest Municipality. The average income may be lower if the peripheral less-developed districts are incorporated into the calculation. Similarly, the public housing rent was raised by about 50% in 1998 and 1999 whilst the income

increases by about 5% and 20% respectively.

Table 5.1 Low to Medium Income and Public Housing Rent in 1996-1999 in Chongqing

	Low income (RMB per capita)		Medium-Lower income(RMB per capita)		Medium income (RMB per capita)		Public housing rent (RMB/M^2)	
	amount	index	amount	index	amount	index	amount	index
1996	3598.75	100	4161.24	100	4880.03	100	0.30	100
1997	4289.4	119	5402.28	129	6555.48	134	0.88	293
1998	3577.9	83	4370.43	81	5236.25	80	1.29	147
1999	3703.23	104	4450.12	102	5442.15	104	1.29	100

ɔurce: Chongqing Statistical Yearbook 1997~2000, Chongqing Statistical Bureau.

able 5.2 Low to Medium Income and Public Housing Rent in 1996-1999 in Shanghai

	Low income (RMB per capita)		Medium-Lower income(RMB per capita)		Medium income (RMB per capita)		Public housing rent (RMB/M^2)	
	amount	index	amount	index	amount	index	amount	index
1996	5170.08	100	6111.60	100	7551.84	100	1.17	100
1997	5388.31	104	6495.21	106	7963.72	105	1.25	106
1998	5657.81	105	6778.81	104	8166.49	103	1.88	150
1999	6867.68	121	7984.53	118	9577.54	117	2.81	150

ɔurce: Shanghai Statistical Yearbook 1997~2000, Shanghai Statistical Bureau.

5.2 Investigation and surveying method

In order to investigate the efficiency of public housing program in further details, a field study trip to Shanghai and Chongqing was made in October 2000. This study owes a great to the support of the municipal housing reform committee in the two cities. The directors of the offices introduced and recommended about 50 units for this study. These units include companies, banks, universities, and institutions that are considered to be active and creative in housing reform during recent years. Eleven

units in Shanghai and ten units in Chongqing were selected respectively as preliminary investigation when a few people in each unit tried to fill out the questionnaire forms. Based on the preliminary investigation, the original questionnaire was revised accordingly. Then the revised questionnaire was sent back to the selected units and distributed to individual households with the help of the office or department in charge of housing policy making and housing management in each unit. It is the uniqueness of the old housing welfare system in China that most units have a specific administrative section (usually called housing reform office, HRO) in charge of housing policy making, housing distribution, and housing management.

The greatest advantage of the above method is to ensure a relatively higher rate of response since the work is regarded as an administrative task and the individuals are required to return the filled questionnaire back to HRO. However, there are also disadvantages in the surveying. Firstly, although the questionnaire is anonymous, people may still be reluctant to reveal their real household income and other information. Secondly, some people are extremely dissatisfied with the housing reform office so that they may vent their anger on the questionnaire and be irresponsible for this work. However, given the lack of housing and household statistics in the mainland China, this surveying method is the only way to ensure higher response rate and to trade off between quality and quantity of the data needed. Besides, the random distribution of the questionnaire cannot effectively avoid

disadvantages either. Therefore, it is reasonable to come to the conclusion that the advantage of this method considerably outweighed the disadvantages and should be an appropriate and practical surveying methodology for this study. Figure 5.1 illustrates this distribution method clearly.

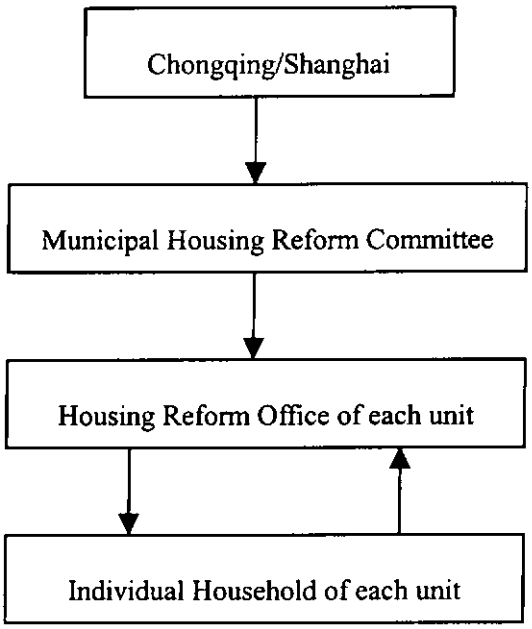


Figure 5.1

5.3 Chongqing

5.3.1 Brief introduction

There are totally 11 districts and 32 counties in Chongqing which is the southwest metropolis with the largest space area and population. Among the 30 million people, about 20% of them are urban population and the other 80% are rural population. According to the Chongqing Statistical Yearbook, there are 46.7% and 51.7% of the

total employees engaged in the second and third industry respectively. And the average yearly income per employee in 1999 is 7,182 RMB and average living space in 1998 has reached 9 square meters per capita.

The director of Chongqing municipal housing reform committee introduced the housing reform progress in recent years. The urban housing reform in Chongqing started officially in 1992 and entered its substantial stage in 1997. The reform measures have taken the forms of rent increase, public housing selling, second housing market development, welfare and comfortable housing project, and Provident Fund system. The average rent for public housing has been raised for four consecutive times from 0.10 RMB per square meter to 1.56 RMB in 1998. The average ratio of housing expenditure to household income has also increased from 0.95% in 1990 to 8.19% in 1999 by 8.62 times.

5.3.2 Selection of surveyed units

Ten representative units were visited for surveying in Chongqing. Table 5.3 shows the industry of the units, and the number of questionnaire distributed and returned in those units. According to the agreement between the surveyed units and us, we do not reveal the name of the units here.

Table 5.3 Ten surveyed enterprises and institutions in Chongqing

Name	Industry Category	Distributed questionnaire	Questionnaire response
A	Automobile industry	500	280
B	Motocycle industry	500	380
C	Educational institution	200	85
D	Iron and steel industry	300	127
E	Food industry	200	85
F	Bank industry	200	73
G	Machinery industry	200	65
H	Electronics industry	500	107
I	Pharmacy industry	400	216
J	Material industry	500	101
Total		3000	1519

From the above table, the total response rate of the questionnaire is 50.6%. However, 354 of the returned questionnaire are not completely filled out so that the number of questionnaire available for analysis is actually 1165. The surveyed households are from 9 different districts of Chongqing that covers 81.8% of the total 11 urban districts.

5.3.3 Empirical analysis

5.3.3.1 General Description of Sample data

Household size

Among the 1165 households, about 65% of them are 3 person households which are the most typical household structure. The histogram figure shows that the mean

household size is 3.2 and the standard error is 0.87. This result is reasonable and within our expectation because the three-person household has become the most typical household structure since the implementation of one-child policy in the mainland China.

Table 5.4 Frequency of household size

Household size	Frequency	Percent
1	44	3.8
2	108	9.3
3	729	62.6
4	173	14.8
5	106	9.1
6	5	.4
Total	1165	100.0

Household income

Table 5.5 The mean of household income for different household size

Household size	Mean of household income
1	836.36
2	1520.65
3	1642.93
4	1997.30
5	2467.92
6	4260.00

Figure 5.2 is the monthly income distribution of all surveyed households. Most of the monthly income of all surveyed household ranges from 1,000 to 2000 RMB with a mean of 1,740.1 RMB and standard error of 766.29.

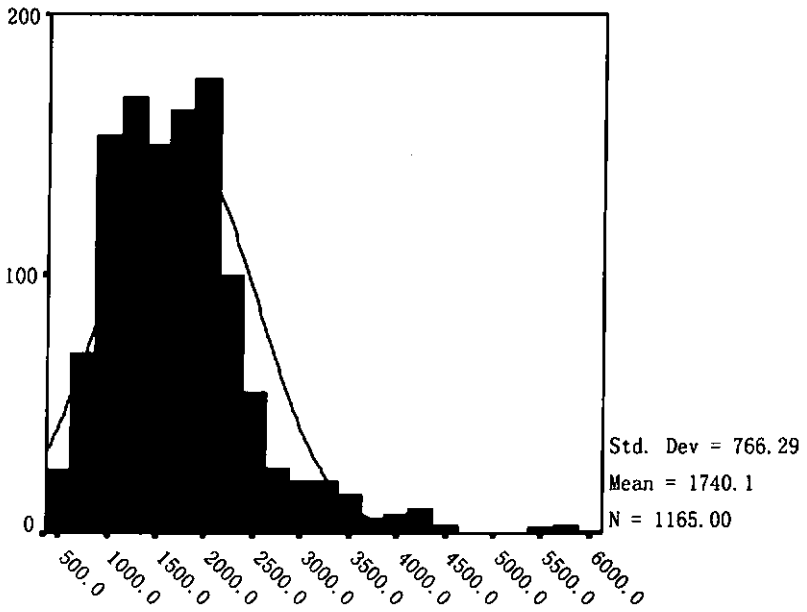


Figure 5.2

Rent-to-income ratio

Since the public housing rent is still kept under control by the government, the practical rent-to-income ratio is distorted and does not reflect the households' real willingness to pay on housing rent. However, each household can objectively evaluate their own willingness to pay on housing rent according to their income and market rent level. Although there is no comprehensive private rental housing market in China yet, the informal rental housing transactions are developing rapidly these years. Therefore, the surveyed households are asked to estimate what proportion they are able and willing to spend on housing rent given their present income and housing market. This ratio is adopted in this study as the *real* rent-to-income ratio for analysis.

It falls into the range from 5% to 15% and its mean is 9.1% for all the surveyed households. With the mean household income of 1,740.1 RMB per month and the mean rent-to-income ratio of 9.1%, an average household is willing to pay about 158.34 RMB for housing rent per month.

Table 5.6 Rent-to-income ratio of different household size

Household size	Mean of rent-income ratio	Standard deviation
1	0.106	0.018
2	0.0903	0.025
3	0.09	0.023
4	0.09	0.016
5	0.09	0.024
6	0.1	0.000
Total	0.091	0.02

Market rent of public housing

It is hard to collect the data on market rent of the subsidized housing since there is no matured rental housing market. However, the privatization of the public housing and the increasing housing lease and rent transactions to great extent help the households to evaluate the market rent of their public housing. The surveyed households provide this rough estimation that is used as market rent in this study. However, this is the only method to obtain the data on market rent of public housing before there are reliable households statistics available in the mainland China. Since most of the public housing were built in 1970s and 1980s when housing standard was relatively lower than that of today, it is reasonable to find out that the market rent of the

surveyed public housing ranges mostly from 250 to 500 RMB per square meters per month.

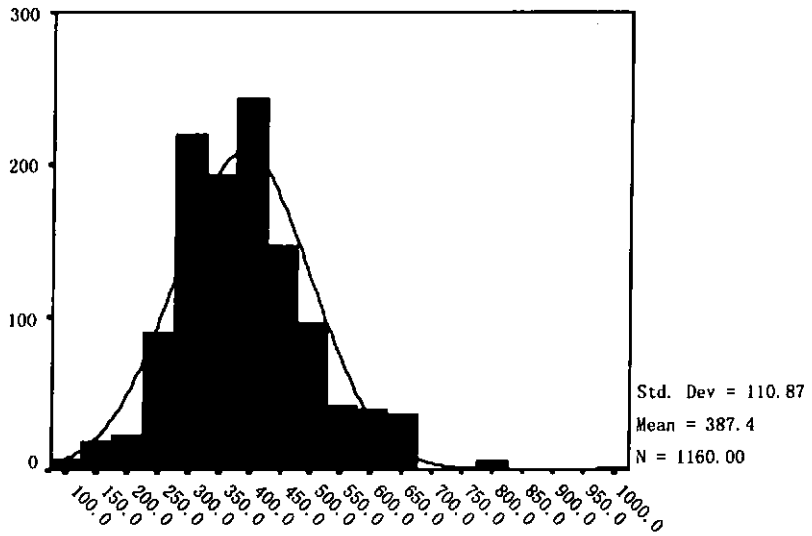


Figure 5.3

Subsidized rent of public housing

The subsidized rent of public housing has been raised several times since 1996. The most significant increase occurred in 1997 when the rent was raised by 193% to the average rent of 0.88 RMB per month per square meters. Then it reached 1.29 RMB in 1998 which is about 1.5 times that of 1997.

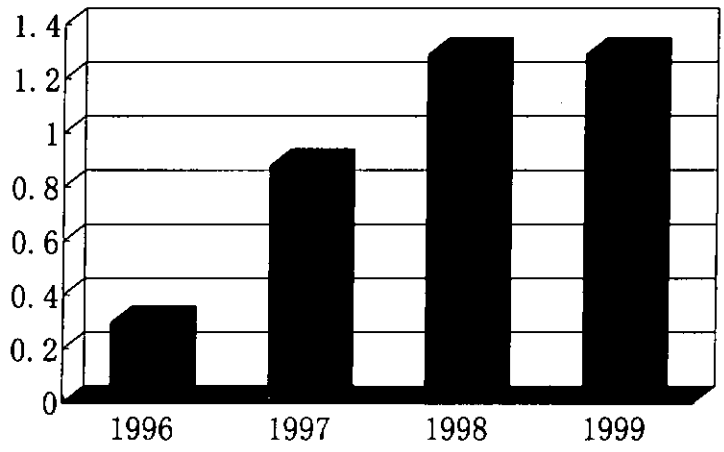


Figure 5.4: Average public housing rent in Chongqing

5.3.3.2 Benefits measurement

As mentioned in Chapter 3, the benefits model based on Cobb-Douglas utility function can be expressed as in Equation 3.1:

$$B_t^n = [\frac{P_h h_s}{\beta}]^{\beta} [\frac{Y_0 - \alpha P_h h_s}{1-\beta}]^{1-\beta} - Y_0 = [\frac{R_m}{\beta}]^{\beta} [\frac{Y_0 - R_s}{1-\beta}]^{1-\beta} - Y_0$$

Since the four variables in this equation are all known by surveying, it is easy to measure the benefits of each household in 2000. Table 5.7 and Figure 5.5 are the statistical description of the benefits based on Cobb-Douglas utility function (B_CD). The average benefits per household per month are about 237 RMB and the standard error of mean is 2.9595. The maximum benefits are up to 632.94 while the minimum number is 36.33. Figure 5.7 shows that most of the households get benefits ranging

from 125 RMB to 300 RMB per month in 2000.

Table 5.7 Statistical description of B_CD

Household size	Minimum	Maximum	Mean	Standard deviation
1	68.15	286.47	151.41	65.78
2	76.44	565.18	223.96	115.31
3	36.33	632.94	228.83	98.08
4	100.86	456.24	271.23	87.86
5	120.91	543.57	276.70	81.76
6	523.14	532.00	528.87	3.83

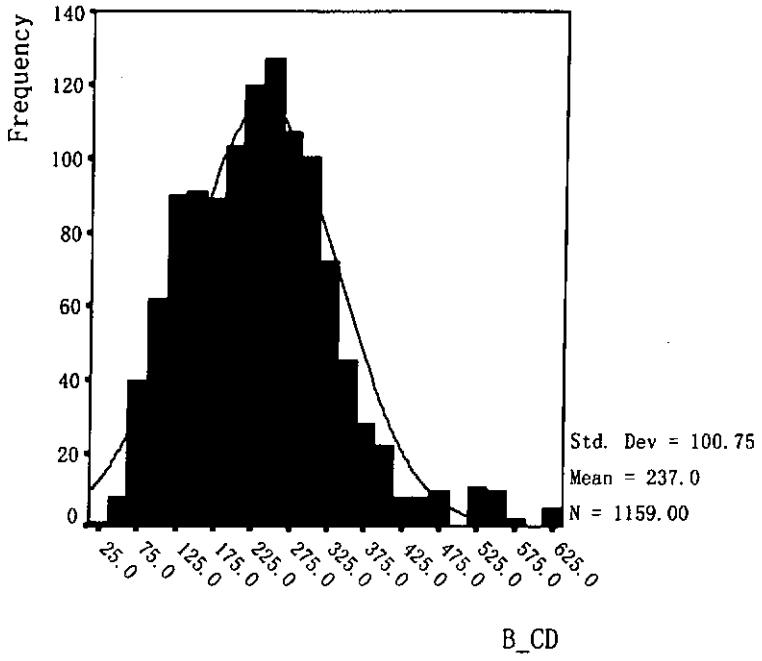


Figure 5.5

Given that the benefits model based on Cobb-Douglas utility function has several restrictive assumptions aforementioned, the improved Stone-Geary utility function is adopted to measure household benefits. As expressed in Equation 3.2, the benefits model is:

$$B = [(P_h h_s - P_h \beta_h / \gamma_h]^{\gamma_h} [(P_x x_s - P_x \beta_x / (1-\gamma_h)]^{(1-\gamma_h)} + P_h \beta_h + P_x \beta_x - Y_0$$

As mentioned in Chapter 3 of research methodology, the households are classified into different groups according to different household size. Table 5.8 shows the classified groups and the number of households in those groups respectively. Since the numbers of one-person and six-person households are too small, we only focus on the other four groups in this study.

Table 5.8 Number of households in different household size group

Households size	Number of households	β_h
1	44	
2	108	360
3	729	300
4	173	672
5	106	660
6	5	
Total	1165	

In summary, the estimation results of the parameters in Equation 3.9 and 3.10 can be illustrated in Table 5.9:

Table 5.9: Estimation of the parameters in benefit model

Household size	2	3	4	5
β_h	360	300	672	660
r_h	0.154	0.135	0.117	0.122
	(39.883)	(105.672)	(46.733)	(27.654)
a_h	-1050.73	-754.56	-545.987	-725.14
	(-16.862)	(-37.752)	(-11.568)	(-7.939)
β_x	8800.58	7511.56	9738.17	10693.60
Cases	108	729	173	106

Given the estimated parameters, the benefits base on Stone-Geary utility function (B_SG) of each household in different groups can be measured. The result summary is as follows:

Table 5.10 Descriptive Statistics for B_SG of the different household size groups

Household size	N	Minimum	Maximum	Mean	Std. Deviation
2	105	31.33	545.38	219.83	116.9019
3	709	5.98	576.33	232.87	96.2872
4	172	27.75	450.57	260.87	96.0119
5	106	100.02	533.16	285.73	78.6966
Total	1092			241.2	

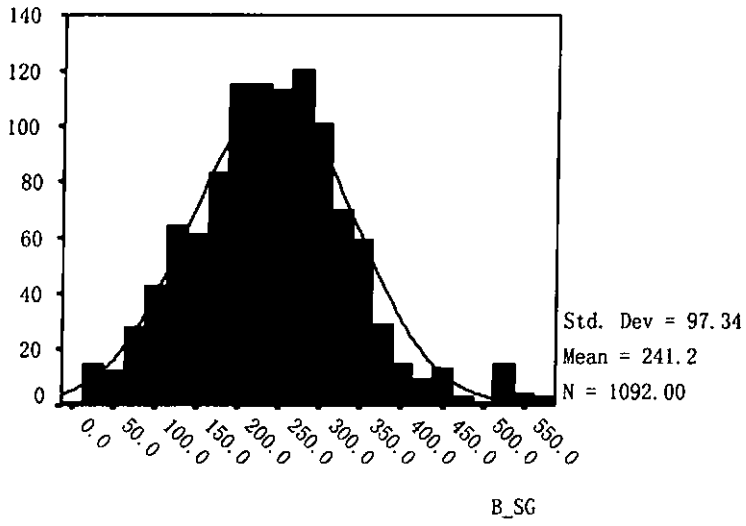


Figure 5.6

From the above table and figure, we find that the mean monthly benefit increases as household size increases from 219.83 RMB for 2-person household to 285.73 RMB for 5-person household. The mean benefit of all households is 241.2 RMB with a standard deviation of 97.34. Further, B_SG has no significant difference in both

distribution and mean with B_CD.

5.3.3.3 Efficiency Indexes

Three efficiency indexes are established to examine the public housing program. As explained in Chapter 3, EI^1 , EI^2 and EI^3 are the ratio of benefits and costs, the ratio of benefits and nominal subsidy, and the ratio of benefits and household income respectively. They are illustrated in the following figures from Figure 5.7 to Figure 5.12.

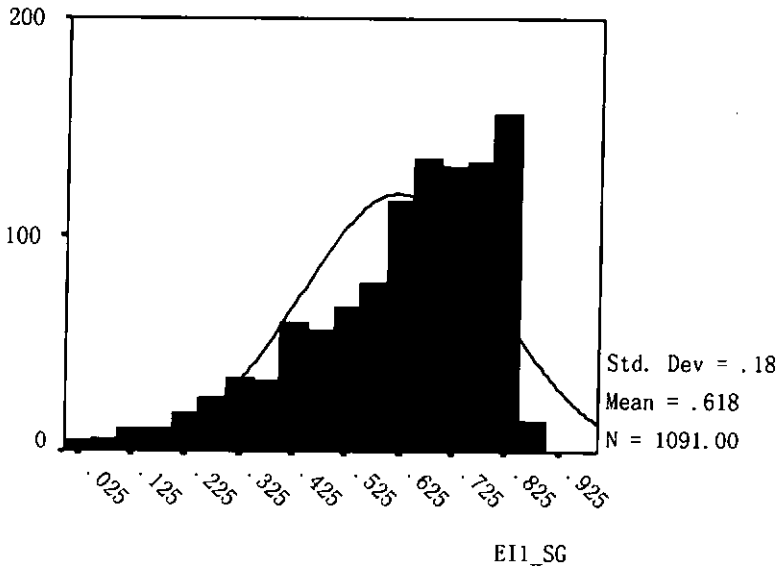


Figure 5.7

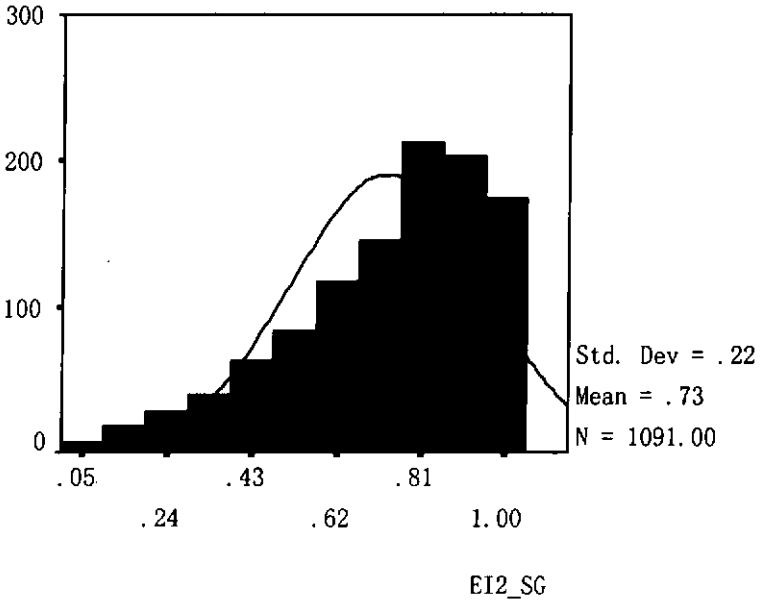


Figure 5.8

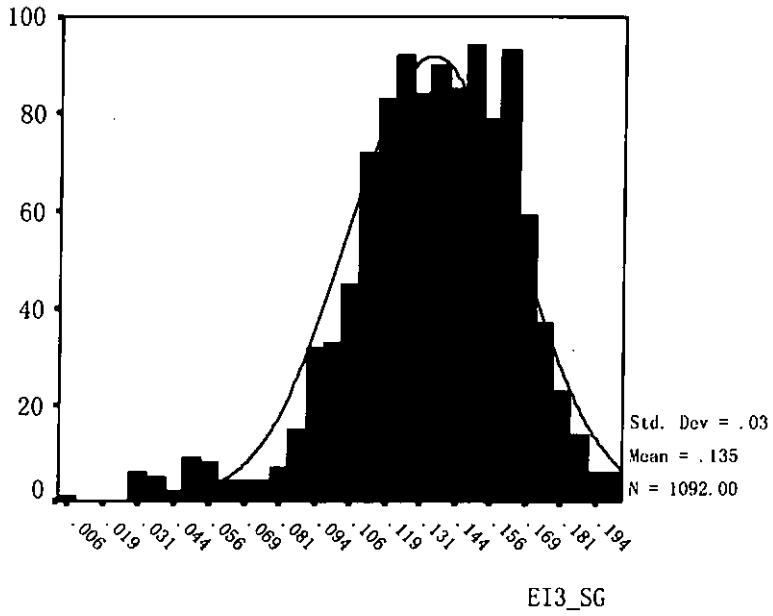


Figure 5.9

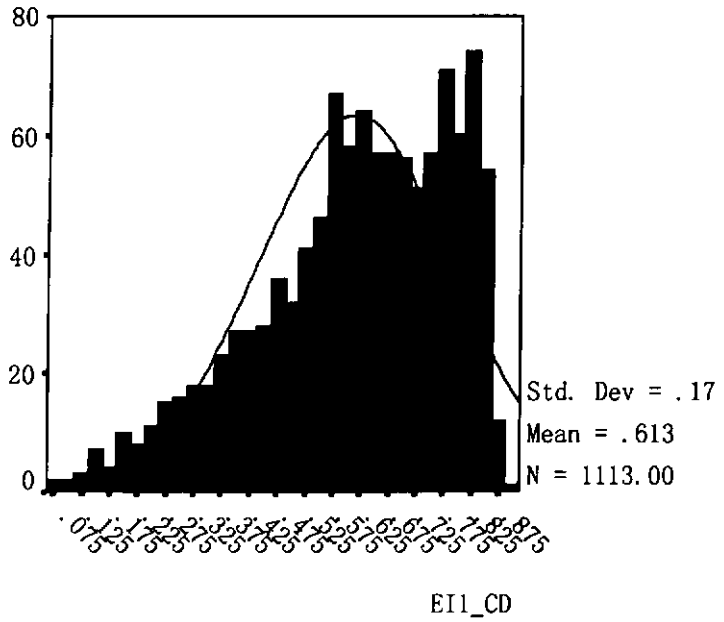


Figure 5.10

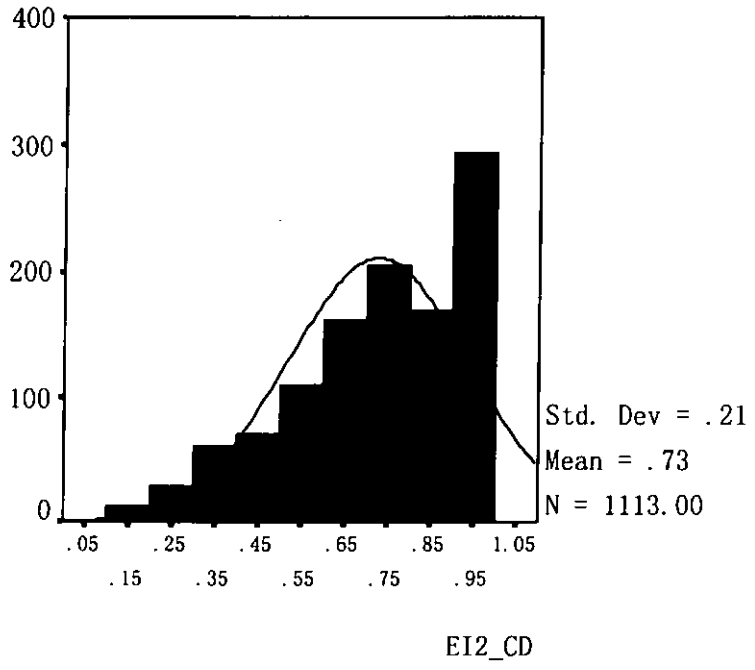


Figure 5.11

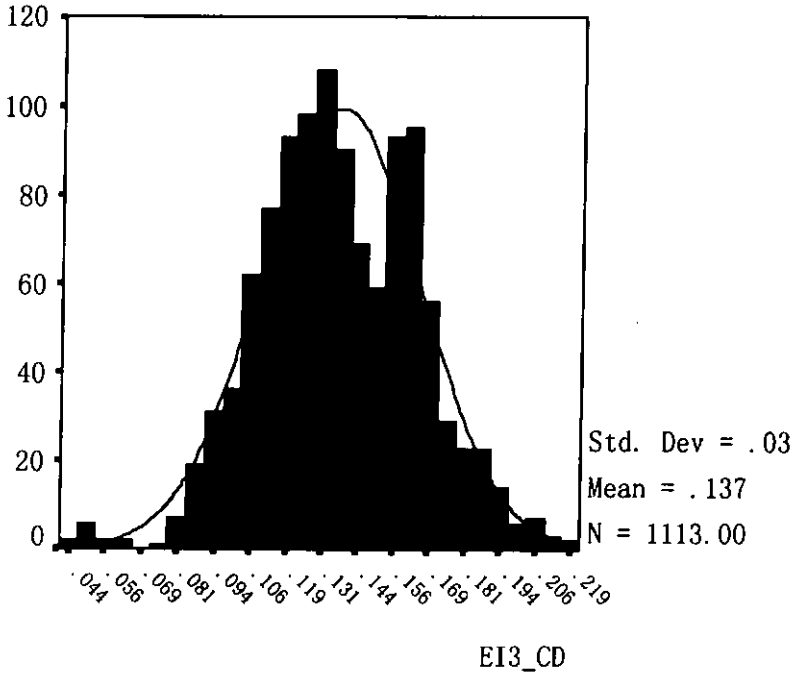


Figure 5.12

From the above figures, we find that the mean ratio of benefit to cost EI1 in Chongqing is about 61%. In other words, there is about 39% loss per unit of cost. Secondly, 73% of every unit of nominal subsidy provided by the government is transformed into net benefit to the tenant while the other 27% is efficiency loss. Finally, the benefits received by the public housing households in Chongqing is about 13% of their household income on average in 2000.

5.3.3.4 Benefits distribution

In order to investigate how the benefits are distributed among the different households with different characteristics, benefits (B_SG) are regressed by household income, area of housing, household size, rank and age of the household head, and housing

location. The results are presented in Table 5.11.

From Table 5.11, the benefits distribution models show that households with higher income and larger area of housing get more benefits than those with the lower income and smaller area of housing, while the larger households get less benefits than the small ones. On the other hand, the benefits distribution has no significant relationship with the rank and age of the household head and the housing location.

Table 5.11 Benefits (B_SG) distribution among different households

(Constant)	29.115
	(2.72)
Household size	-16.976
	(-7.054)
Household income	.106
	(39.202)
Age of the head	-7.411E-03
	(-0.033)
Rank of the head	-.374
	(-1.07)
Location	1.156
	(1.474)
Area of present housing	1.317
	(8.064)
R^2	0.689
Cases	1091

Note: t statistics are in parenthesis.

This distribution pattern is apparently unfair because the households with higher income and larger area of housing should not get more benefits from the housing subsidy program than those with lower income and smaller area of housing who are the really targeted by the program. It is unreasonable that the households really in

need are in a disadvantageous condition than those better-off households in this public housing program. Note that the household income is the average individual income for specific household rather than the total household income.

In summary, according to the 1165 households surveyed in Chongqing in 2000, the average benefit resulted from the public housing program is around 240 RMB per household. The ratio of benefits to costs, i.e. EI1, is about 60%; the ratio of benefits to nominal subsidy and the ratio of benefits to household income are about 73% and 13% respectively. In addition, the benefits distribution is found to be positively significant with household income and area of housing, while negatively significant with household size.

5.3.3.5 Changes of housing and nonhousing consumption

As a result of participating in the housing subsidy program, the subsidized households are expected to consume more housing than the unsubsidized. According to Equation 3.6 and 3.7, the proportional changes in household's consumption of housing and nonhousing goods are calculated. The following figures and table present the results of the results. The average change of housing consumption is 220% for all the surveyed households while the change varies considerably among households with different household income. In other words, the lower income households have much more housing consumption change than the higher income households after

participating in the public housing program. At the same time, the subsidized households also consume 30% more nonhousing goods on average under the subsidy program.

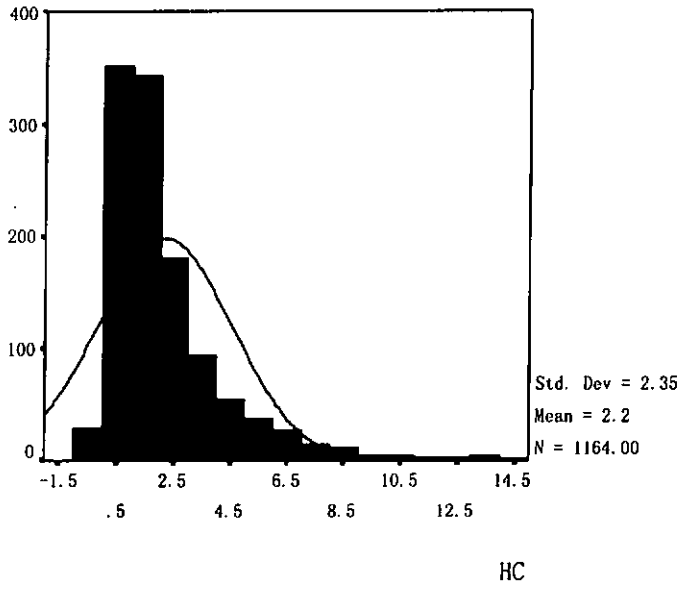


Figure 5.13

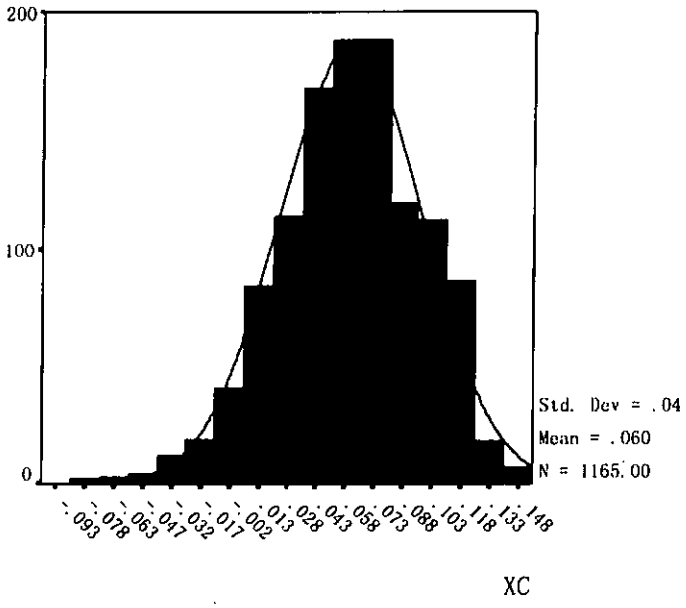


Figure 5.14

Table 5.12 Mean of housing and nonhousing consumption change for different household income level

Household income level	Mean of HC	Mean of XC
<250	9.831	-0.018
250~500	5.363	0.015
501~1000	2.816	0.041
1001~1500	1.385	0.068
1501~2000	0.783	0.087
2001~2500	0.493	0.101
2501~3000	0.265	0.115
3001~3500	0.037	0.121
3501~4000	0.129	0.113
4001~4500	-0.368	0.128

5.4 Shanghai

5.4.1 Brief introduction

Shanghai covers an area of 6,340.5 square kilometers, 0.1% of China's total territory. There are 17 administrative districts in Shanghai and its population is over 13 million. The average population density in the city is 2,071 people per square kilometer, but the figure is up to 2,872 people in the 10 urban administrative districts.

In 1999, the average per capita GDP in Shanghai reaches 30,805 RMB and the average worker's annual salary is 14,147 RMB. According to the Shanghai Statistical Yearbook, the average per capita annual income in 1999 among urban families for the first time exceeded 10,000 RMB to reach 10,931 RMB, 24.6% higher than that of

1998 and 13.2% over the previous year base on the comparable prices. As the income increases, the average housing expenditure per capita also is raised to 720.33 RMB which is about 8.7% of the total consumption expenditure.

Employment changes continuously in the three basic industrial groups, with more people switching to the services industry. At the end of 1999 the employment in services industry climbed to 42.1%, 0.6 percentage higher than the previous year. The proportion for agriculture is 11.4%, and the proportion for industry is 46.5%.

According to the introduction of the director of the municipal housing reform committee, Shanghai has been leading the housing reform throughout the whole country. The substantial housing reform in Shanghai began in 1991 and it mainly includes Provident fund system development, public housing rent reform, and public housing selling. One objective of the housing reform is to enhance living space per capita to 10 square meters at the end of the 20th century. Specifically, the public housing rent was doubled in 1991 for the first step, and then raised 50% to 0.75 RMB per square meter in 1996. Further, the rent continued to increase by 50% to 1.17 RMB in 1997. The objective of rent reform is to raise the rent-to-income ratio to 15%.

5.4.2 Selection of surveyed units

Eleven representative units are selected for surveying in Shanghai. Table 5.13 shows the industry of the units, the number of questionnaire distributed and returned in those units. For the same reason as mentioned before, the names of the units are not revealed.

Table 5.13 Eleven surveyed enterprises and institutions in Shanghai

Name	Industry category	Distributed questionnaire	Questionnaire response
A	Light industry	500	280
B	Food industry	500	210
C	Automobile industry	1000	345
D	Iron&steel industry	500	149
E	Academic institution	200	59
F	Light industry	300	87
G	Bank industry	100	52
H	Bank industry	200	101
I	Chemistry industry	500	140
J	Educational institution	200	92
K	Educational institution	200	56
Total		4200	1571

From this table, the total response rate of the questionnaire is 37.4%. Unfortunately, nearly half of the questionnaires are useless because they are either incomplete or incorrect. As a result, the number of questionnaire available for study is only 880. The surveyed households are from the 10 urban administrative districts of Shanghai.

5.4.3 Empirical analysis

5.4.3.1 General description of the sample data

Household size

Among the 880 households, 52.3% of them are 3 person households while the percentage of the four and five person households are 19.3% and 21% respectively. Although three person households are still the most common type, the larger households also have considerable proportion. The household size in Shanghai is a little bit larger than that of Chongqing on average.

Table 5.14 Frequency of household size

Household size	Frequency	Percent
1	5	.6
2	25	2.8
3	460	52.3
4	170	19.3
5	185	21.0
6	35	4.0
Total	880	100.0

Household income

Figure 5.15 shows that the mean of household income in Shanghai is 3,568.5 RMB per month and its standard deviation is 1,317.75. Most of the household income is

between 2,500 and 3,000 RMB.

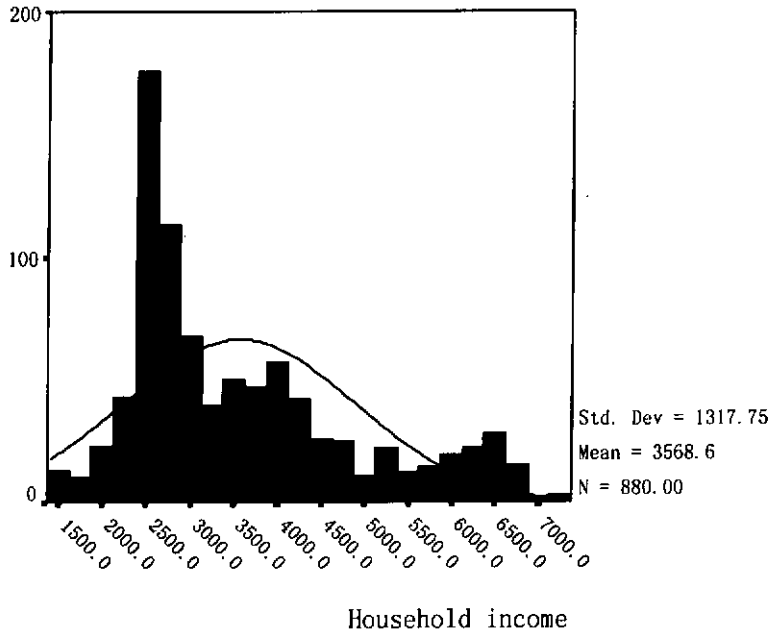


Figure 5.15

Table 5.15 The mean of household income for different household size

Household size	Mean of household income
1	2310.20
2	3180.00
3	3182.62
4	3742.96
5	4150.88
6	5174.29

Rent-to-income ratio

For the same reason explained in 5.3.3.1, the surveyed households are asked to estimate what proportion they are able and willing to pay for housing rent given their present income and housing market. The results indicate that the average ratio is 12%

with a standard deviation of 2%. The ratios for different household size are listed in Table 5.16.

Table 5.16 Mean of rent-to-income ratio of different households

Households size	Mean of rent-to-income ratio	Standard deviation
1	0.20	0.00
2	0.19	0.04
3	0.12	0.02
4	0.11	0.02
5	0.11	0.01
6	0.12	0.01
Total	0.12	0.02

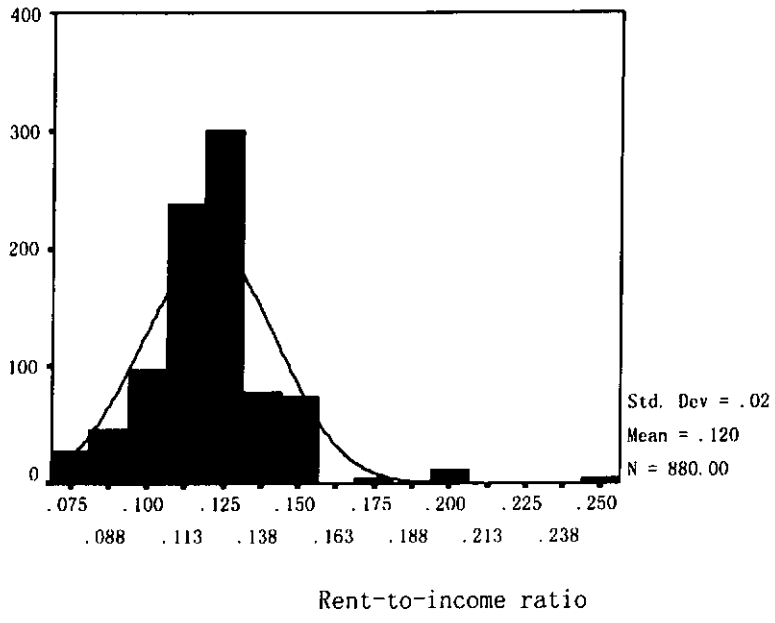


Figure 5.16

Market rent of public housing

The average market rent per set of public housing is about 445 RMB per month. However, the area of these houses is relatively small and only has a mean of 33.8

square meters with a standard deviation of 12.09. Therefore, the market rent of the public housing has a price around 13 RMB per square meters per month.

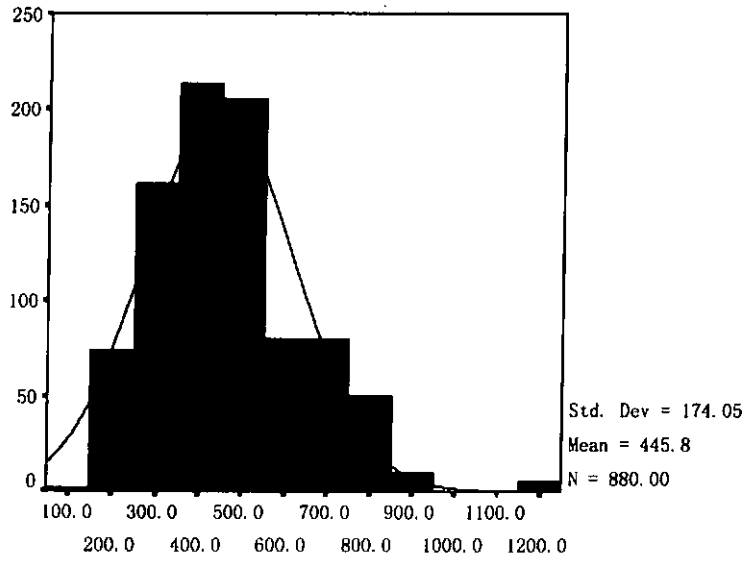


Figure 5.17

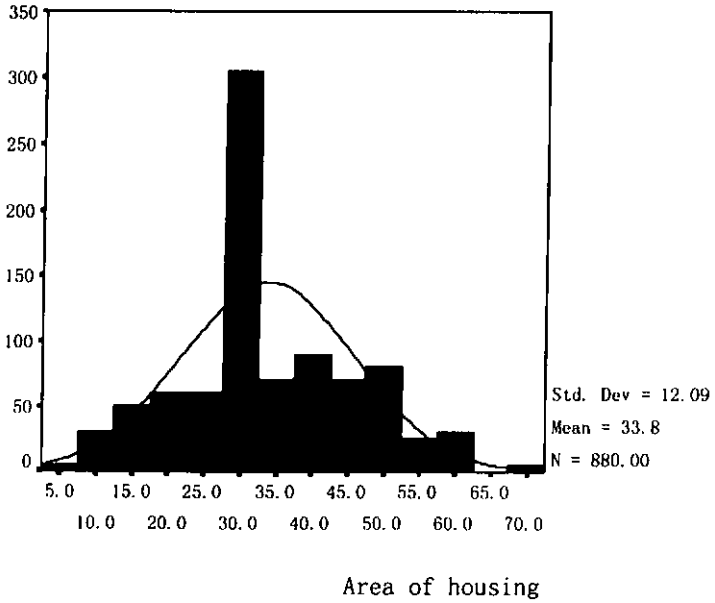


Figure 5.18

Subsidized rent of public housing

The subsidized rent of public housing was raised consecutively since 1996. It was around 1.17 RMB per square meter per month in 1996 and increased by 50% twice in 1998 and 1999 and reached 3.0 RMB per square meter per month.

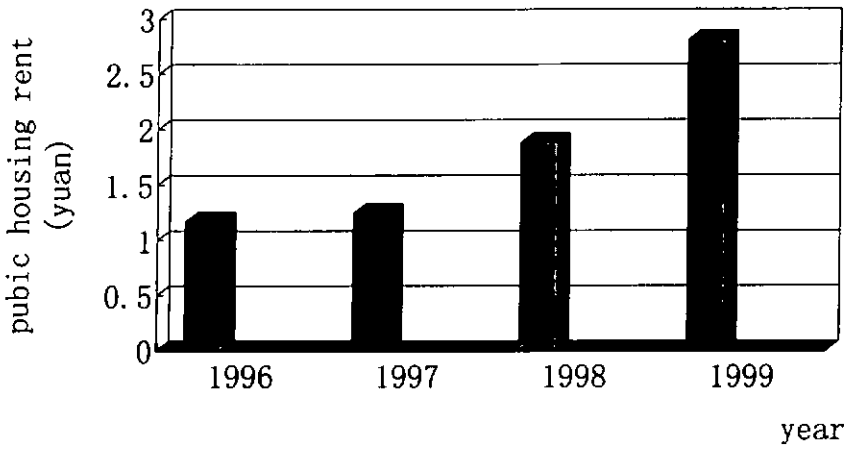


Figure 5.19

5.4.3.2 Benefits measurement

According to the same method aforementioned in section of 5.3.3.2, the benefits based on Cobb-Douglas and Stone-Geary models are measured and their results are presented in the following figures and tables.

Table 5.17 Descriptive Statistics of B_CD

Household size	Minimum	Maximum	Mean	Standard deviation
1	-158.64	-104.59	-131.34	22.26
2	-435.41	168.86	-140.69	227.25
3	-299.68	541.37	268.40	121.17
4	47.11	944.08	335.00	155.54
5	-47.06	695.76	377.94	132.34
6	-78.49	631.13	289.42	209.11
Total			291.2	166.24

The analysis shows that the average benefits are 291.2 RMB per month for each participating household in the housing subsidy program. However, Table 5.17 indicates that smaller households are suffering from the program and get negative benefits. At the same time, the six-person households get less benefit than the small households and have a relatively big standard deviation. Given that there are only 35 six-person households, this wide standard deviation indicates substantial difference among the household benefits.

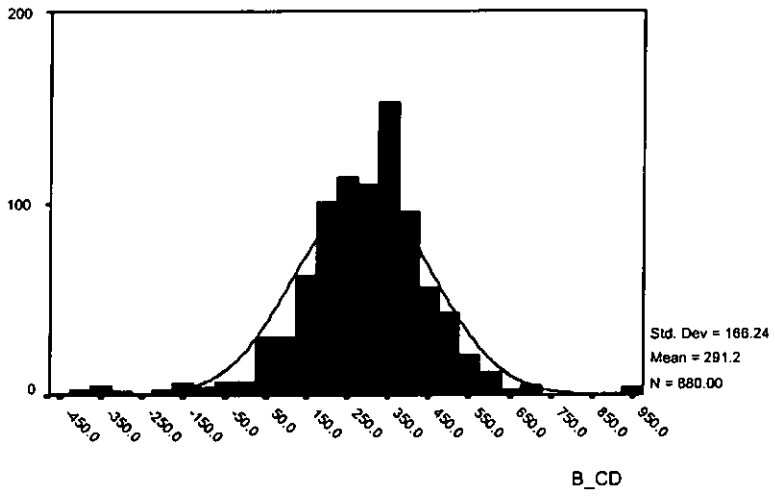


Figure 5.20

In addition, the benefits based on Stone-Geary model are also calculated by adopting the same method explained in section 5.3. The parameters estimation is given by Table 5.18. Since the sample number for one-, two- and six-person households are under 30, it is impossible to estimate the parameters accurately thus they are omitted in the section of analysis.

Table 5.18: Estimation of the parameters in Stone-Geary benefit model

Household size	3	4	5
β_h	1282.5	1710	2519.4
r_h	.166	.170	.171
	(115.544)	(71.944)	(39.931)
a_h	-1484.305	-2380.337	-2703.800
	(-32.203)	(-25.979)	(-13.082)
β_x	10227	22355	28014
Number of cases	461	170	185

Note: t statistics in parentheses.

Table 5.19 Descriptive Statistics for B_SG of the different household size groups

Household size	N	Minimum	Maximum	Mean	Std. Deviation
3	461	-399.91	568.27	238.77	163.94
4	168	-73.97	942.64	317.21	173.97
5	181	-180.23	681.03	369.61	139.69
Total	809			284.3	

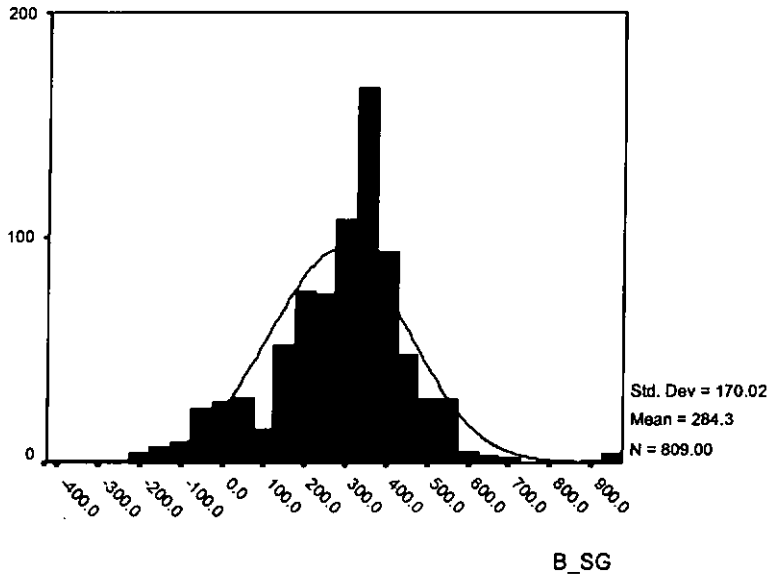


Figure 5.21

The above tables and figures indicate that the average benefits based on Stone-Geary model are 284.3 RMB per month per household. The benefits increases accordingly as household expands although there is a big standard deviation that implies considerable difference among the benefits of households with the same household members.

5.4.3.3 Efficiency indexes

The three efficiency indexes based on the two models are calculated and presented from Figure 5.22 to 5.27. We find that the mean ratio of benefit to cost EI1 in Shanghai is about 60% which means that there is about 40% loss per unit of cost. Secondly, 75% of every unit of nominal subsidy provided by the government is transformed into net benefit to the tenant while the other 25% is efficiency loss.

Finally, the benefits received by the public housing households in Shanghai is about 8% of their household income on average in 2000. There is very little difference between the results from the two different models.

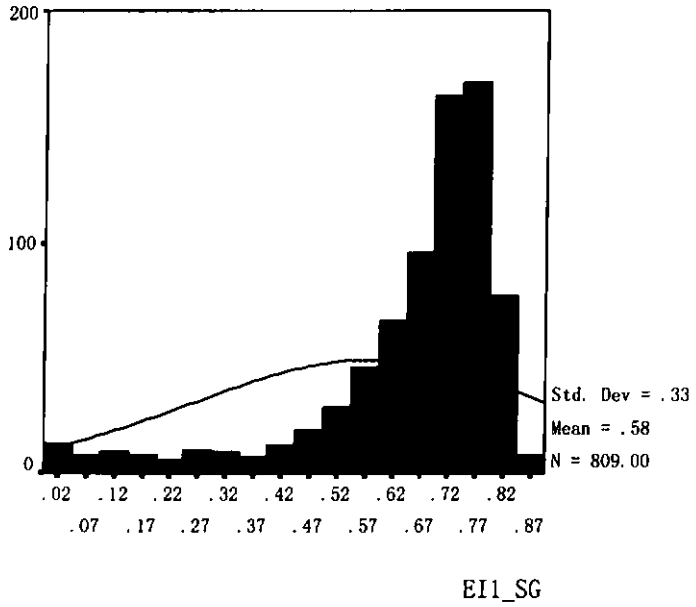


Figure 5.22

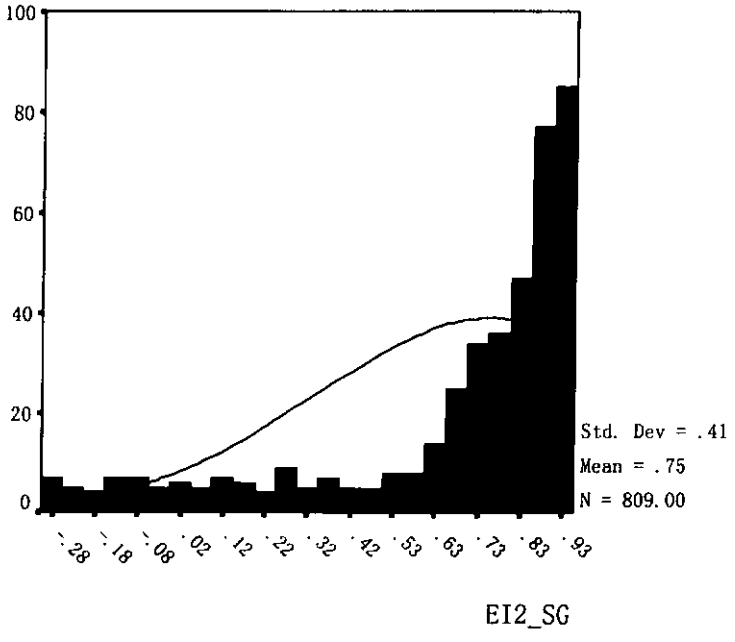
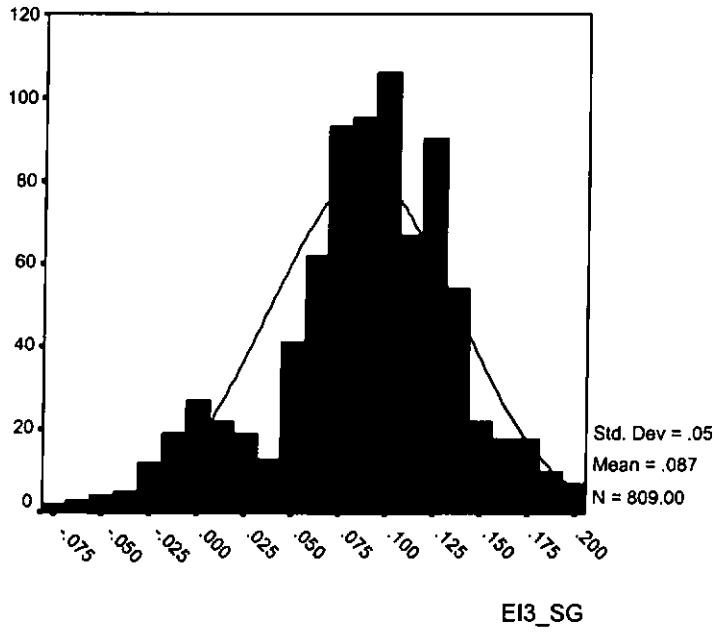


Figure 5.23



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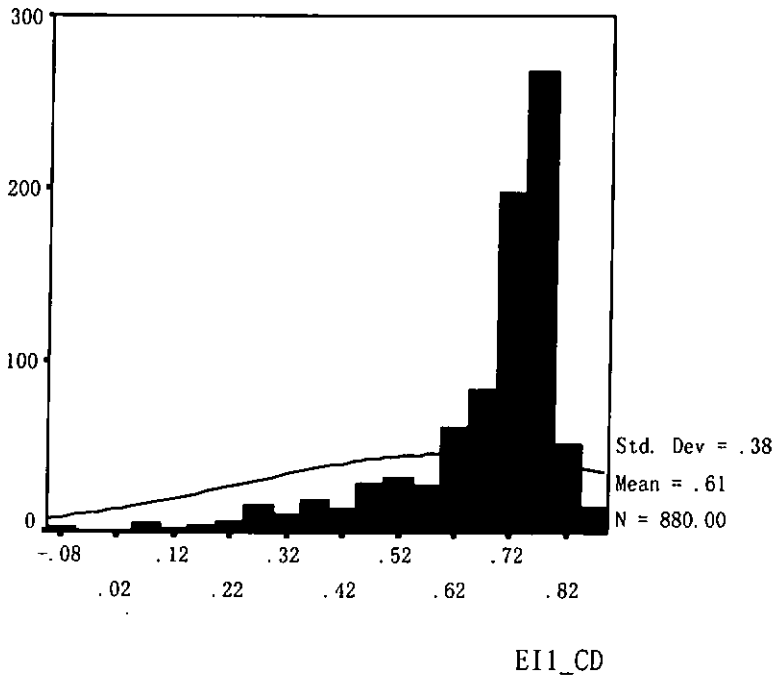

Figure 5.25

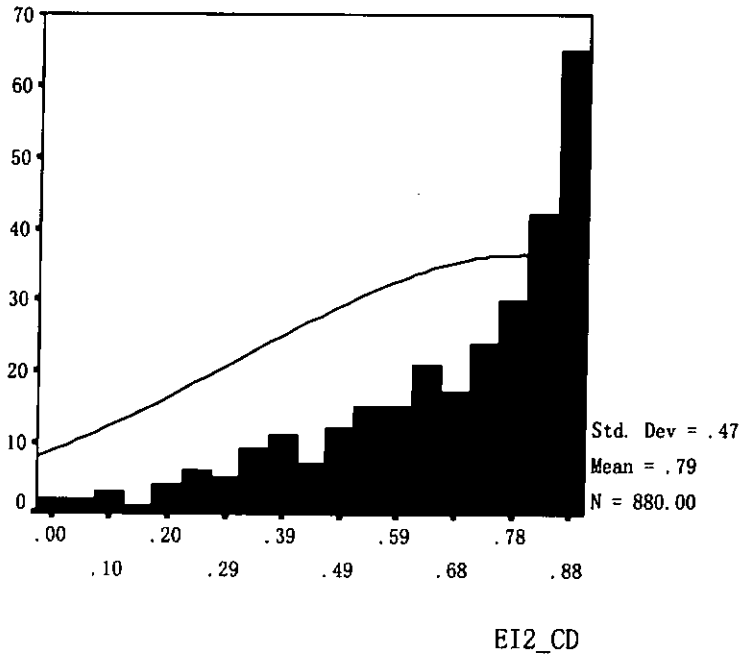

Figure 5.26

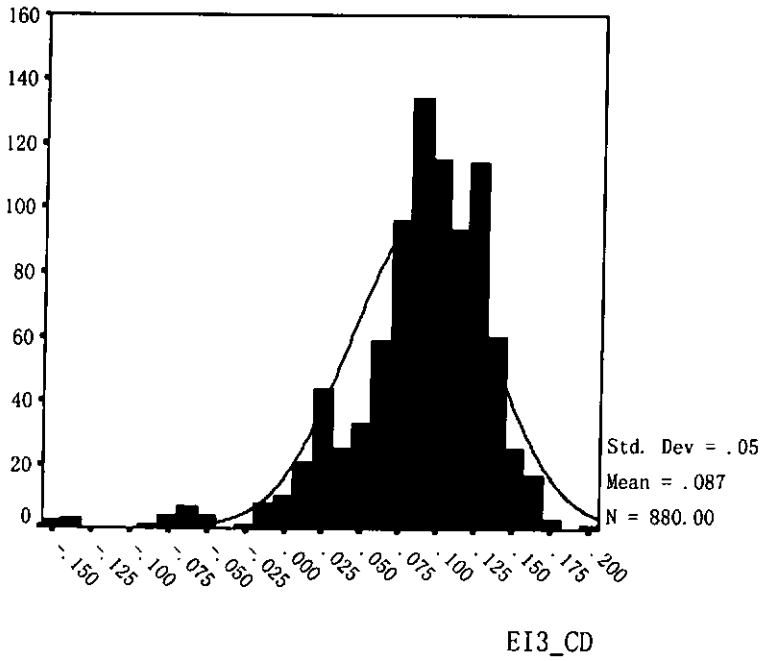

Figure 5.27

5.4.3.4 Benefits distribution

The benefits are regressed on household size, household income, age of household head, rank of household head, area of housing and housing location. Except for the housing location, all the other variables are significant with benefits. It is reasonable to find out that the benefits increases as household size become bigger and household income decreases. However, it is hard to explain why higher rank of household head will lead to less benefit.

Table 5.20 Benefits distribution among households

(Constant)	-280.728
	(-6.940)
Household size	12.898
	(2.452)
Household income	-1.711E-02
	(-4.080)
Rank of household head	-57.149
	(-6.087)
Age of household head	5.851
	(6.532)
Area of housing	11.337
	(26.7720
Housing location	1.054
	(1.074)
R^2	0.59
CASES	809

5.4.3.5 Changes of housing and nonhousing consumption

According to Figure 5.27 and 5.29, we find that the households participating in the housing subsidy program averagely consume 18% more housing and 10% more nonhousing goods than they would have in the absence of the program. From this perspective, the program does improve households' affordability for both housing and nonhousing services. However, Table 5.21 indicates that the program depressed the housing demand of the higher income households because they consume less housing than they would have in the absence of the program. On the other hand, the higher income households have more nonhousing service consumption than the lower income households.

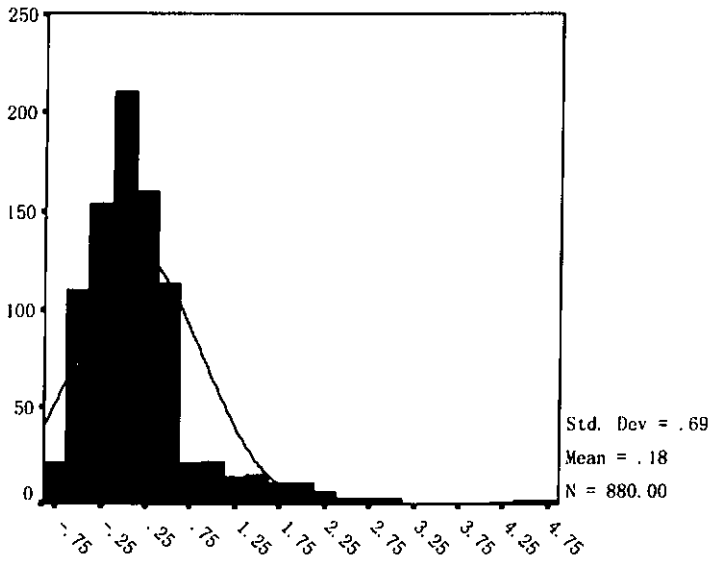

Figure 5.28

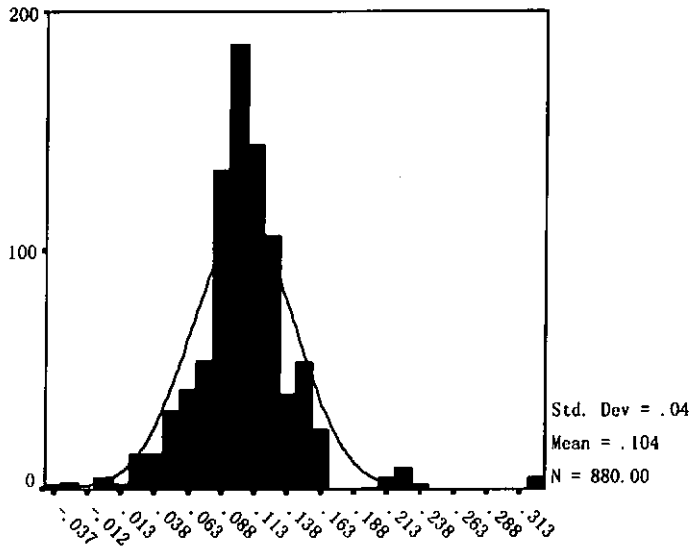

Figure 5.29

Table 5.21 The mean of housing/nonhousing consumption change for different household income level

Household income level (monthly)	Mean of HC	Mean of XC
<250	N/A	N/A
250~500	N/A	N/A
501~1000	N/A	N/A
1001~1500	1.227	0.063
1501~2000	2.321	0.022
2001~2500	0.358	0.097
2501~3000	0.245	0.102
3001~3500	0.118	0.102
3501~4000	0.064	0.100
4001~4500	-0.011	0.104
4501~5000	-0.194	0.123
>5000	-0.258	0.134

5.5 Summary

This chapter examines the public housing program in two metropolises in the mainland China—Chongqing and Shanghai.

Firstly, the average benefits to participating households are about 240 RMB in Chongqing and 290 RMB in Shanghai. Secondly, three efficiency indexes are adopted to evaluate the efficiency of this housing subsidy program in the two cities. For Chongqing, the benefits to costs ratio (EI1) is around 60%, benefits to nominal subsidy ratio (EI2) 73% and benefits to household income ratio(EI3) 13%. On the other hand, EI1 in Shanghai is also around 60% and EI2 and EI3 are 75% and 8% respectively. Comparing the efficiency indexes in the two areas, there is no significant difference between EI1 and EI2, but the EI3 in Shanghai is lower than that of Chongqing. Given that Shanghai has higher average benefits magnitude than Chongqing, this lower EI3 mainly results from much more higher household income in Shanghai than Chongqing.

The third aspect of examination is benefits distribution. The OLS regression gives two different stories for the two metropolises. The benefits distribution is positively significant with household income and area of housing while negatively significant with household size in Chongqing. However, the analysis in Shanghai shows negative

significant relationship between benefits and household income, rank of household head, and positive significant relationship with household size.

Finally, we find that the public housing program helps participating households consume 220% and 18%more housing than they would have done in the absence of the program in Chongqing and Shanghai respectively. And the households under the program also consume 6% and 10% more nonhousing services in the two cities. These figures indicate that the housing subsidy program does improve the housing conditions considerably, especially for the lower-income households with very weak housing affordability.

It is still, however, too early to draw the conclusion on the effectiveness of the program in the two metropolises. The reasons behind these figures will be further investigated through comparison in the next chapter.

Chapter Six Efficiency Comparison of the Public Housing Program in Hong Kong and the mainland China

6.1 Introduction

After evaluating the public housing programs in both Hong Kong and the two mainland metropolises separately, we will compare the efficiency of the programs.

Both of the housing subsidy programs provide public housing with subsidized rent much lower than the private rental market. The consumer surplus in the housing market represents the net tenant benefits. Therefore, the magnitude of benefits is the most important indicator of the effectiveness of the program. Given that the absolute value of net tenant benefits is not appropriate for comparison, three efficiency indexes are adopted. Thirdly, we compare how the benefits are distributed among the households with different characteristics. The abnormal relationship will imply some reasons behind the efficiency or inefficiency. The last aspect for comparison is on the extent of housing or nonhousing consumption change brought by the housing subsidy program.

However, one weakness in this comparison study is the different data source. The 1% By-census sample data in Hong Kong was conducted by Census and Statistics Department of Hong Kong SAR in 1996. Whilst the sample data for Chongqing and Shanghai are from field study and questionnaire survey in 2000. The sample in the

mainland cities is much smaller than that in Hong Kong. Besides, it is obvious that the surveyed households do not represent random sample of each city very well since we select the units according to the recommendations of the municipal housing reform committee. Further, the contents of the public housing program in Hong Kong and the mainland are not exactly the same with each other. All of these differences will to certain extent affect the comparison analysis.

6.2 Comparison Analysis

6.2.1 Comparison of benefits magnitude

From the analysis in Chapter 4 and 5, the average monthly benefits from the program for each household is HK$962.8 in Hong Kong, 240 RMB in Chongqing and 290 RMB in Shanghai. Specifically, the benefits value for three-person household is HK$887.63 in Hong Kong, 232.87 RMB in Chongqing and 238.77 RMB in Shanghai.

Although it is meaningless to compare the absolute values, there are some interesting findings. The households with negative benefits are usually living in small housing but with extremely high income. One example in Hong Kong is a household with monthly income of HK$100,000 only pays HK$430 on housing rent. This household gets negative benefits of HK$–2544.74. Ironically, this negative figure does not mean the household is actually suffering from the program. In fact, it consumes 20% more

nonhousing services. With these households under the program, the mean benefits of the sample data will be greatly decreased thus will results in lower efficiency indexes. We find that if the households with income beyond the eligibility criteria are excluded from the sample, the mean benefit in Hong Kong will increase by 30% ~40% and the efficiency indexes will also improve accordingly.

6.2.2 Comparison of efficiency indexes

The ratio of benefits and costs is 29% in Hong Kong and 60% in the two mainland cities. The result is completely out of our expectation since we had hoped that the efficiency of public housing program in Hong Kong must be higher than that of the less developed mainland. One of the reason is as mentioned in section 6.2.1 on the inefficiency resulted from the higher income households. Among other things, the income gap among the surveyed households in the mainland cities is much smaller than that in Hong Kong so that the efficiency loss is not so serious as in Hong Kong. The other possible reason is that the costs in Hong Kong is considerably higher than that of the mainland since we substitute private market rent of the public housing for the practical costs of the program. The second efficiency ratio of benefits to nominal subsidy can be explained in the similar way. The EI2 in Hong Kong is only 41% while that in Chongqing and Shanghai is about 75%. Compared to 60% and 70% in 1981 and 1991 in Wong (1998), this study shows that the efficiency is deteriorating rather than improving in Hong Kong.

As far as EI3 is concerned, there is not a widely accepted criteria to draw a conclusion whether the ratio is high or low enough. Strictly speaking, EI3 is only a supplementary efficiency index for policy makers to evaluate and compare the impact of the housing subsidy program. In Hong Kong the benefit averagely amount to 4% of the household income but in Chongqing the figure is up to 17%. Shanghai has a ratio value between these two—8%.

6.2.3 Comparison of the benefits distribution

Since the sample data structure in Hong Kong is quite different from that in the mainland cities, the regression variables of benefits distribution are accordingly different from each other. However, the most important variables are household income and household size and age of household head. These three variables are found to be significant in the regression models in the three cities.

The regression results indicate that smaller and higher income households in Hong Kong and Chongqing get more benefit from the program than the larger and lower-income ones. However, the opposite situation occurred in Shanghai where larger size and lower-income households get more benefits. Moreover, the older household get more benefits in Shanghai possibly because the older people will be distributed more housing in the previous welfare housing system. On the contrary, the elder people in

Hong Kong and Chongqing are in a disadvantageous situation although the relationship between age of household head and benefits are not highly significant given the small *t* values in the parenthesis. The above analysis is for the general distribution trend rather than the extreme cases mentioned before where higher income households are receiving negative benefits.

The benefits distribution pattern in Shanghai is relatively reasonable since larger household size results in more housing demand while lower-income households usually fail to meet this demand. It is exactly the objective of the housing subsidy program to help the households in need so that this type of households will give the program higher evaluation thus leads to higher benefits and efficiency.

6.2.4 Comparison of housing and nonhousing consumption change

On average, the public housing program in Hong Kong only helps participating households consume 1.8% more housing while in Chongqing and Shanghai this figure is up to 220% and 18%. Specifically, the program helps the household with monthly income lower than HK$5000 at Hong Kong consume 16% more housing. The lower-income households in both Chongqing and Shanghai also have more consumption increase than higher income households. These results again indicate that the program has better effectiveness on the lower income households that are really in need of the in-kind subsidy to improve their housing condition.

The extremely low ratio of HC in Hong Kong implies that the public housing program depressed the housing demand of the higher-income households. Since about half of the households living in public housing have household income beyond the income eligibility set by the Housing Authority, it seems that the higher-income households still prefer to live in the public housing even if they have to pay 1.5 times or double rents. From the perspective of program efficiency, these households get negative benefits that means great efficiency loss. Ironically, for the households themselves, they are not suffering from the inefficiency. They may benefit a lot from other activities including purchasing another set of apartment while still possessing the subsidized housing. Since the entrance into public housing is strictly controlled, we may conclude that the extremely high-income households living in public housing result from dramatic economic improvement after entering the program.

The inefficiency resulted from higher-income households are not so prominent in Chongqing because of low income level and range. But the analysis in Shanghai shows that the households with income more than 4000 RMB per month consume less housing than without the program. Therefore, if there is no proper management and control on household income, it is likely that the efficiency loss in Shanghai will also deteriorate as the case in Hong Kong.

Chapter Seven Summary and Conclusions

7.1 Summary

This thesis is composed of seven chapters. Chapter one briefly introduces the background and development of housing subsidy system in Hong Kong and the mainland China, the analysis and comparison methodology and data sources in the study. Chapter two reviews the literature on housing subsidy program evaluation thoroughly. On the basis of the literature review, the originalities of the study are presented at the end of the chapter. Further, the specific methodology adopted in this study is explained in details in Chapter three. The analysis and comparison framework is established in this chapter and it includes measuring benefits and costs, developing efficiency indexes, analyzing benefits distribution and housing/nonhousing consumption changes. The following Chapter four and Chapter five give detailed calculation and evaluation of public housing program in Hong Kong and the mainland China according to the framework developed in Chapter three. Efficiency comparison analysis is done in Chapter six and Chapter seven is a brief summary with conclusions and suggestions.

7.2 Conclusions and suggestions

After evaluating and comparing the efficiency of the public housing program in both

Hong Kong and the two mainland cities of Chongqing and Shanghai, we can come to the following conclusions:

1. The public housing program was designed originally to induce low and moderate income households to occupy better housing than they would without the subsidies. The results confirm that there are large number of low and moderate income households that really need housing subsidy, and the present system of in-kind subsidies does considerably improve their housing condition and consumption. In addition, this study indicates that the lower income households have much more housing consumption increase after participating in the subsidy program than the higher income households. Therefore, to make sure the households in real need benefit from the program is the priority to secure effectiveness of this housing subsidy.
2. Although the housing subsidy program does improve the housing condition of the participating households, the extent of housing consumption increase varies considerably. Based on these figures, it is hard to draw conclusions on whether the housing condition has reached the program objectives since greater housing consumption increase may only result from poorer housing before entering the program. It is suggested that a set of multi-category and flexible housing criteria (i.e., criteria includes the main characteristics of housing quality for different level of households) rather than the only lowest basic one for the subsidized households be developed in the mainland China to gauge whether specific households have or

have not reached that criteria. For example, 5.5 square meters per person is the lowest criteria while 7 square meters per person is the medium-lower criteria in Hong Kong. These housing criteria, together with household income eligibility, will help assess the efficiency and objective of the housing subsidy program.

3. For the low and moderate income households that really need the housing subsidy, the benefit magnitude and efficiency indexes indicate better effectiveness than those better-off households that should have moved out of the public housing. Therefore, the efficiency loss partly stems from the nature of in-kind subsidy itself but also partly from the failure to exclude the households whose economic condition has been improved dramatically after entering the public housing. It is unfair to let them occupy the limited public housing while at the same time keep those in real need on the waiting list for a long time. Chongqing and Shanghai shows higher efficiency than Hong Kong. One possible reason is due to the smaller income gap in the mainland cities than that in Hong Kong. However, with the rapid economic development in China, the income gap is becoming wider and wider. Lack of appropriate control on household income will probably result in similar efficiency loss in Hong Kong.

4. The goal of the housing subsidy program is not just to increase the welfare of the subsidized families but also to increase their consumption of housing beyond what would result from unrestricted cash grants. This is why the in-kind housing subsidy

program is still widely practiced despite of its efficiency loss. This study is not an exception and shows great efficiency loss also. However, it may be possible to complement consumer subsidies with producer subsidies as the housing shortage is reduced and the affordability of housing in the society increases. In this way, households would be given a cash grant on the condition that they occupy housing that meets certain housing standard. By adjusting the in-kind and cash grant subsidy according to household income and housing condition, we can achieve the objective of providing "decent' housing to low-income people. This way of combination should be the direction of public housing program or other housing subsidy program in the future for both Hong Kong and the mainland cities.

5. Why do the better-off households still prefer to stay in the public housing? One reason is the lack of continuous income trace and control of the households as mentioned before. Another possible reason is that the housing subsidy program provides housing beyond the basic housing standard thus "attracts" the better-off families. Without specific housing standard control, it's possible for the subsidy program to deviate from the objective of helping the low and moderate income household. The welfare housing project in the mainland China is facing this problem since the *welfare* housing is too *luxurious* for the low income people to buy. The third reason may stem from lack of affordable housing on the private housing market for the better-off households living in public housing. They do become better off but can not yet afford the terribly high price of the commercial housing so that they are unwilling to give up the low-rent public housing. Previous studies

show that the private housing price in the mainland China can be reduced dramatically by cutting the numerous abnormal expenses or taxes during the housing development process. Therefore, to strengthen the management of private housing market can also ensure or even enhance the efficiency of the housing subsidy program.

6. To ensure the housing resources in Hong Kong are allocated as fairly as possible, the policy for safeguarding the rational allocation of housing resources was introduced in 1996. Tenants with income and net assets exceeding prescribed ceilings and those who choose not to declare their assets, pay full market rentals. In addition, to strengthen tenancy controls, an honest system was introduced in 1998 in Hong Kong. Under this system, domestic public rental housing tenants have to declare their occupancy position, which is verified by estate staff, on a biennial basis. All these measures may improve the efficiency and their effectiveness will be further investigated. The public housing program in Hong Kong provides both positive experiences and negative lessons for the proposed social rental housing scheme in the mainland cities. It is easier to build a mechanism to avoid unfair subsidy at the early stage of a housing policy than to introduce it at a later stage. Otherwise, it is very difficult to get the better-off tenants to give up the housing subsidy system or to reduce the amount of subsidy once they have gained political power, as in the case of Hong Kong (Yeh, 1990). It is of great importance for the mainland China to take an objective view at the housing subsidy programs in Hong Kong and develop its own comprehensive housing subsidy system.

However, due to the lack of comprehensive and authentic data from the mainland China, this research results are limited. Further research is needed when those data in the mainland China are available. Based on the comprehensive data, the results from benefits and costs evaluation, benefits distribution and housing or nonhousing consumption change investigation will be more reliable and comparable with that from Hong Kong.

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