

Chapter 6

Social Infrastructure Demand for Low Income Housing

1 Introduction

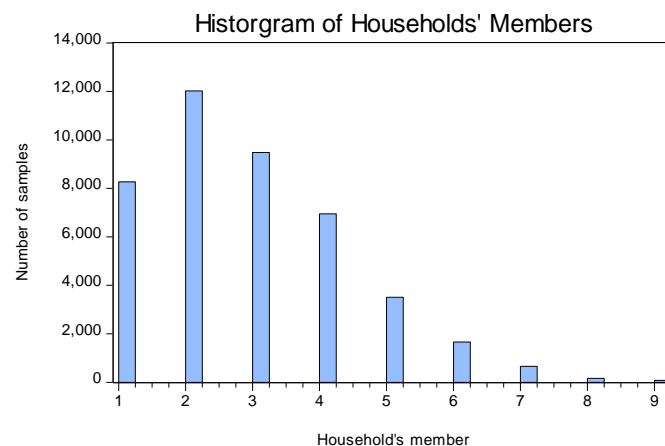
In this chapter, we would like to project the demand for low-income housing need and see whether they can be affordable with income growth in Thailand. Firstly, a simple household profile is narrated. We also show a simple regression analysis which applies surveyed data from the Household's Socio-Economic Survey (SES) to test a hypothesis of 'ownership'. Later, a comprehensive model is proposed with policy scenarios.

1.1 Household Profile

Base on Household's Socio-Economic Survey 2015, the profile of approximately 43,000 households' sample is summarized as follows:

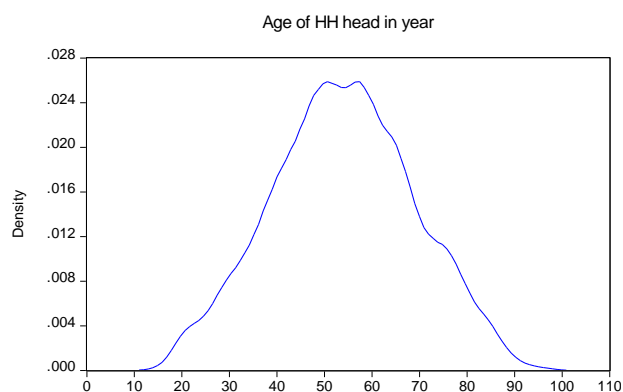
According to the SES 2015, the average household size is relatively small to 2.8 persons per household (skewness =0.817). The mean age of household head is relatively normal with mean 53.87-year-old (skewness =0.002). It should be noted that household size in Thailand has become smaller than in the past. (not shown here)

Figure 6.1: Distribution of Household Members 2015



Source: SES 2015

Figure 6.2: Normal Density Distribution of Age of Household's head



Source: SES 2015

We have investigated the age distribution of household's head and found that it is normally distributed as shown.

Figure 6.3: Histogram of Household Size by Age of Head

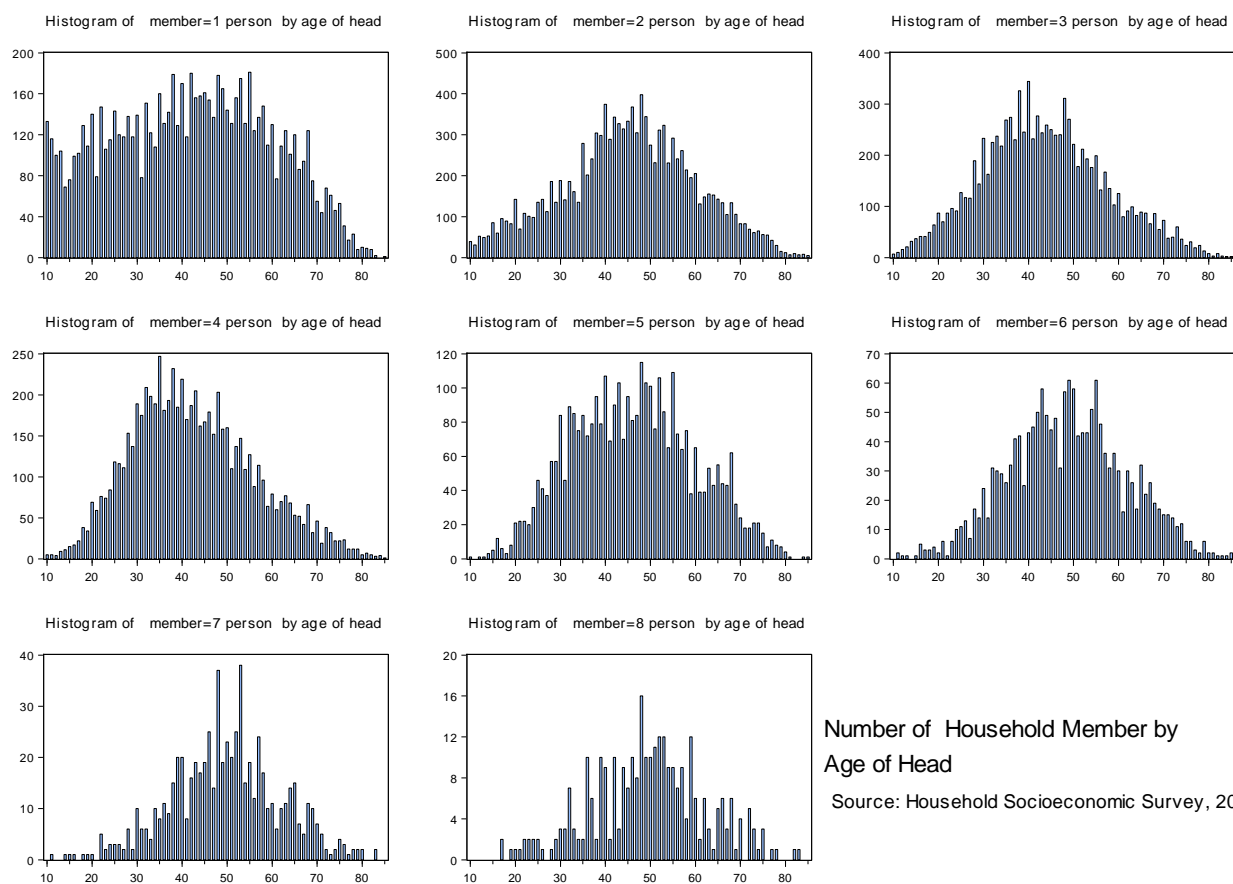
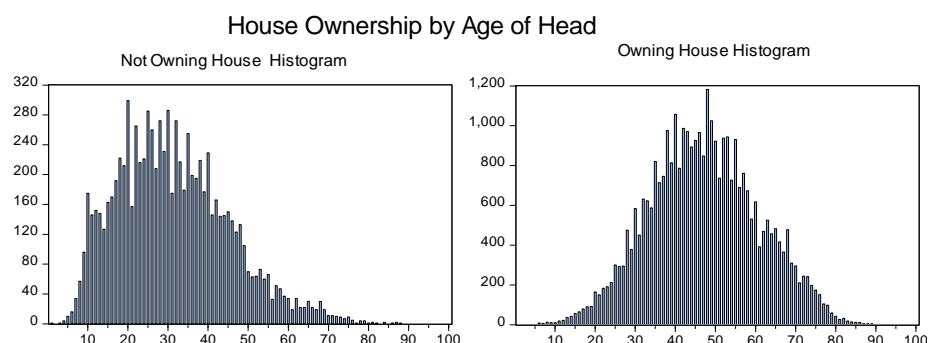
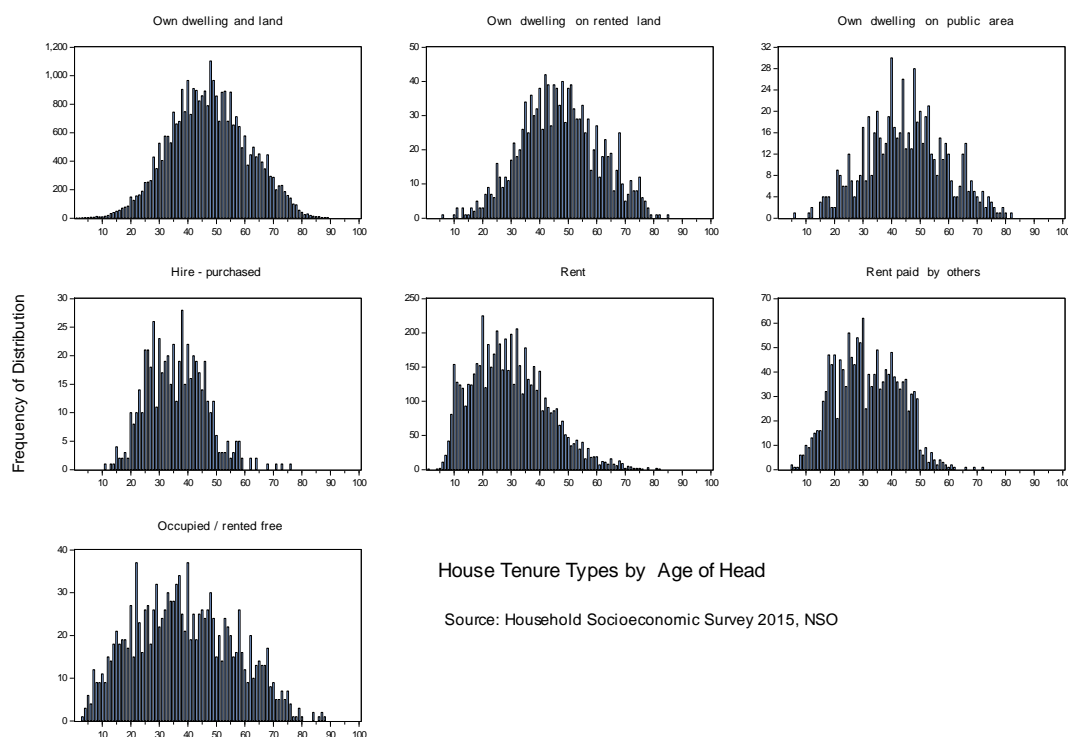


Figure 6.4: Household Ownership by Age of Head



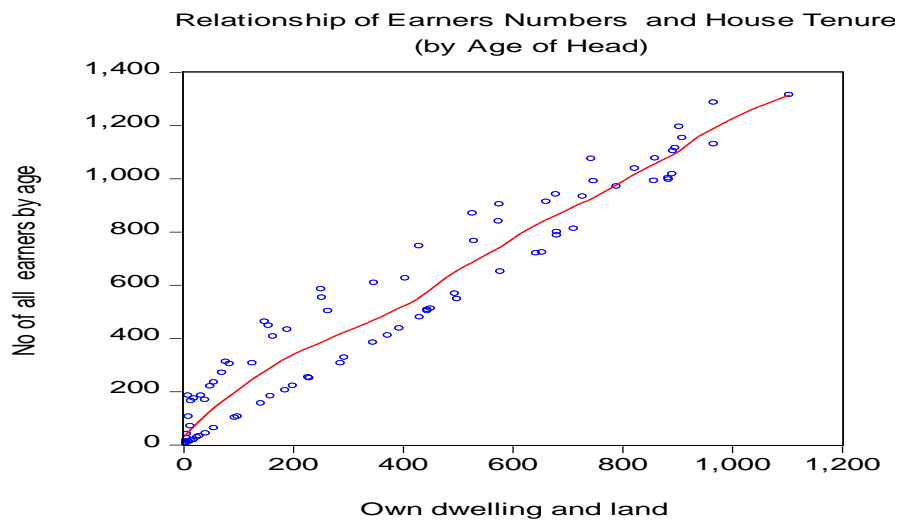
Given the age of household head's distribution, we plot the histogram of household size by a number of members i.e., a size where the age of head is around the mean age. It is found that household member distribution is relatively normal (bell shape), except the size of 1 member household.

Figure 6.5: House Ownership Tenure Characteristics



The ownership of a house is distributed normally with age of head. *A household with a younger mean age of head has a lower probability to own house.* House tenure by age of head indicates that ownership of the house by type of dwelling on own land, rented land, as well as public land, are normally distributed across age of head. Households with tenure as 'rent' and 'hire purchase' have a younger age of head.

Figure 6.6: Positive Relationship of Ownership Tenure (Scattered plot by controlled by age of head).



The household formation mentioned above can be further analyzed in terms of the *economic behavior*. The most crucial determinants of housing need are 'income' and/or 'expenditure' of households. Households' income distribution in 2015 is approximately followed the *log-normal* distribution. This implies that most of the households belong to lower income ranges. The mean income is 23,464 baht per month while median income is 17,316 baht per month respectively.

Figure 6.7: Household Income followed the Log-Normal Distribution

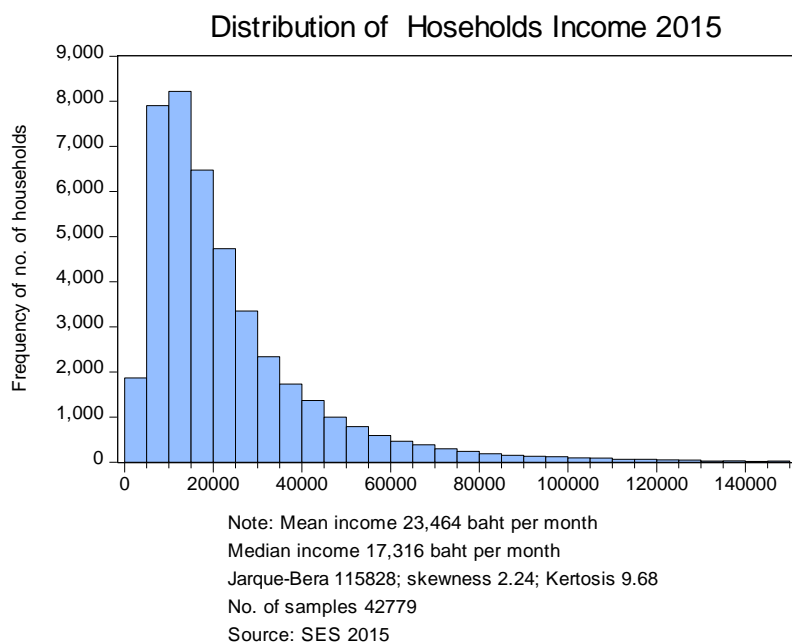


Figure 6.8: Household Income Distribution (Histogram plot controlled by age of head)

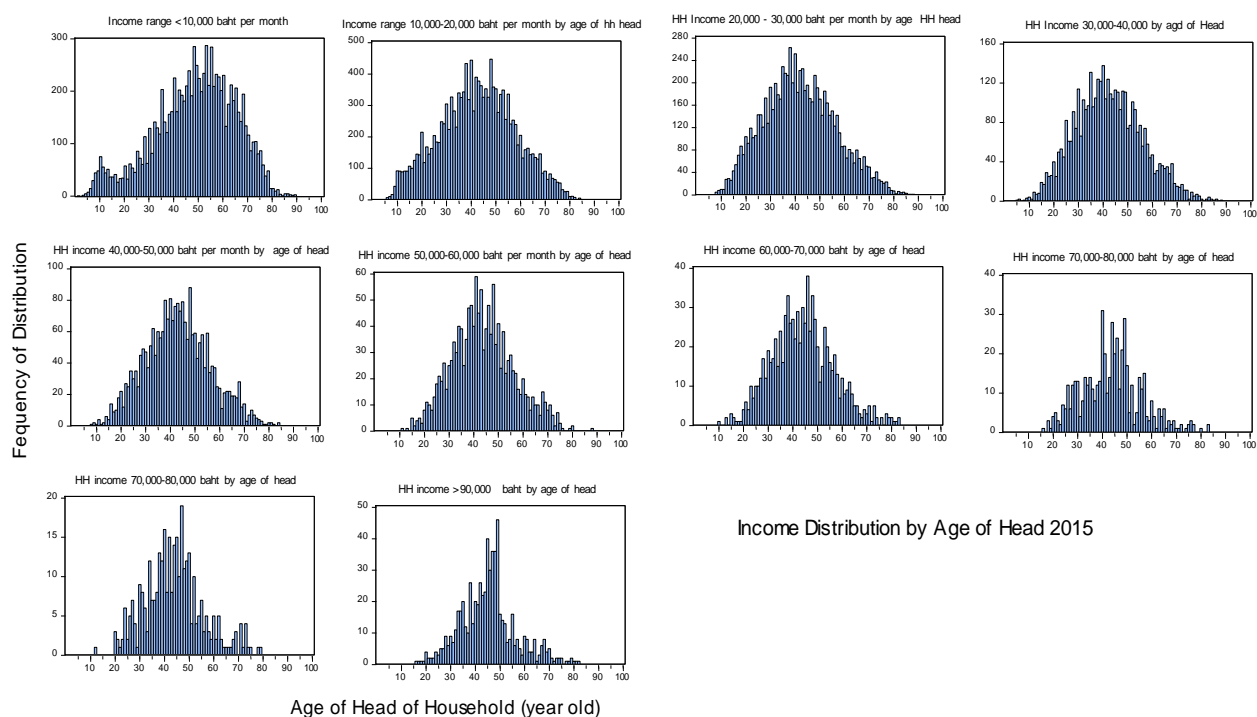
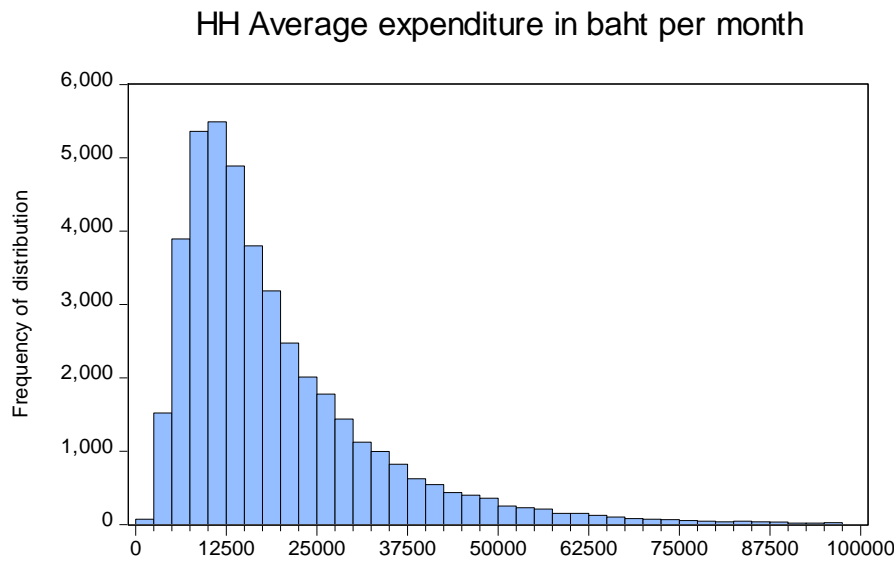
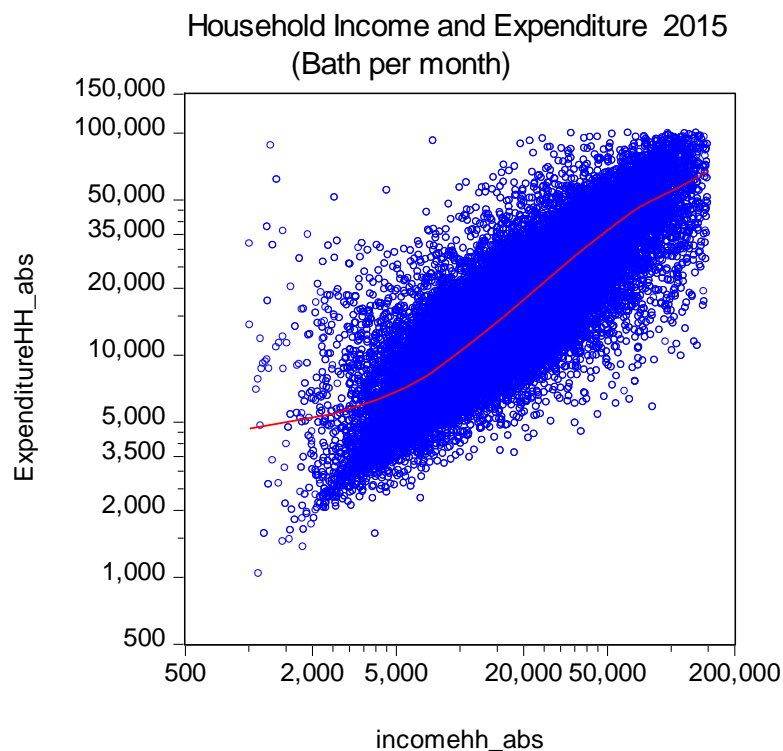


Figure 6.9: Household Expenditure followed the Log-Normal Distribution



Source: SES 2015

Figure 6.10: Relationship between Household Income and Expenditure 2015



We have estimated the determinant of ownership of a house. The 'owning ratio' or *ownership-ratio* is ratio between 'number of households with status of house ownership' over the summation of households 'owning house and those with rental status' is determined

from right-hand variables. These are households belong to income deciles 1- 4 and those who belong to income deciles 5-10th ($\sum INC_i$). (See Table 6.1).

We have applied the Generalized Method of Moment (GMM) after controlled by age of head to get rid of 'over-identification problem'. We have controlled for the 'endogenous biased' by applying instruments variables on *house types* ($TYPE_i$) as well as *member sizes* ($\sum MEMBER_h$).

The estimation result indicates that household with income 1- 4 classes have a significant *negative* relationship with ownership ratio. The household with income 5-10 classes show a significant *positive* relationship with the ownership ratio.

An uncontrolled version of regression applying 'logistic model' which included the dimension of location has found similar results. For the municipal area, the model indicates that *probability* of being house ownership has a *positive* relationship with *total income and age* but *negative relationship with members of the family* of an individual. *These mean as total income, age or a percentage change in age increase, a person will have higher tendency to own a house.* In addition, as the number of members in family increases, a person will have lower tendency to own a house for municipal area.

For Bangkok area and vicinities, the probability of owning a house has a *positive* relationship with total income and age but *negative* relationship with members of the family of an individual. In addition, as the number of members in family increases, a person will have lower tendency to own a house for Bangkok area and vicinities.

In conclusion, as people become older, they want to purchase their own houses for observations from the entire country, municipal area, and Bangkok area and vicinities. However, the higher total income of an individual induces purchasing a house only in the municipal area, and Bangkok area and vicinities. Surprisingly, a number of members in a family is significantly associated with lower tendency to purchase houses for all 3 groups of observations.

Table 6.1: Determination of House Ownership (Ratio of Owning House – Rental House Status)

Dependent Variable: OWNING_RATIO				
Method: Generalized Method of Moments				
i=income class by deciles i=1,2,...10 open ended; j= house type j= 1...7; and h=household member h=1,..8 and over				
Instrument specification: TYPE1 TYPE2 TYPE3 TYPE4 TYPE5 TYPE6 TYPE7 MEMBER1 MEMBER2 MEMBER3 MEMBER4 MEMBER5 MEMBER6 MEMBER7 MEMBER8_OVER				
A 'Constant' term is added to instrument list				
Lagged dependent variable & regressors added to instrument list				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.004455	0.040335	24.90311	0.0000
INC1+INC2+INC3+INC4	-9.30E-05	3.30E-05	-2.816813	0.0064
INC5+INC6+INC7+INC8+INC9+INC10_OPEN	0.000489	0.000174	2.809408	0.0065
AR(1)	0.955577	0.008733	109.4258	0.0000
R-squared	0.990279	Mean dependent var		0.745002
Adjusted R-squared	0.989844	S.D. dependent var		0.266097
S.E. of regression	0.026817	Sum squared resid		0.048182
Durbin-Watson stat	2.518718	J-statistic		11.93173
Instrument rank	18	Prob(J-statistic)		0.611786
Inverted AR Roots	.96			

Source: this study, applying SES 2015.

Table 6.2: Logistic Regression Output of House Ownership for Entire Country

Variable	Full	<i>l_full</i>	<i>drop_members</i>	<i>drop_age</i>
<i>ttlinc</i>	-5.50E-07		4.19E-07	6.208e-06**
<i>members</i>		-.27902681***		-.30645988***
<i>age</i>		.08957908***		.09061646***
<i>l_ttlinc</i>			-.22138641***	
<i>l_members</i>			-.68900411***	
<i>l_age</i>			3.4675945***	
<i>_cons</i>	-3.8485078***	-11.106518***	-4.760824***	-.42335504***
<i>N</i>	5376	5375	5376	5376
<i>aic</i>	15873848	15937594	16232632	18433407
<i>bic</i>	15873874	15937621	16232652	18433426

Note: 1) legend: * $p < .1$; ** $p < .05$; *** $p < .01$

1. Full model "full", which includes all independent variable 2. Log full model 'L_full',

2. which includes natural log of all independent variable. 3. "Drop members", which excludes a number of the family member from the model.

Table 6.3: Logistic Regression Output of House Ownership for Municipal Area

Variable	full	l_full	drop_membe rs	drop_age
<i>ttlinc</i>	7.970e-06**		8.122e-06**	.0000148***
<i>members</i>	-.09741994*			- .11781796***
<i>age</i>	.09581992***		.09577326***	
<i>l_ttlinc</i>		0.0915607		
<i>l_members</i>		-0.13988323		
<i>l_age</i>		3.8909211***		
<i>_cons</i>	-	-	-	-
	5.3455629***	16.623346***	5.6475818***	1.6136944***
<i>N</i>	2538	2537	2538	2538
<i>aic</i>	5046903.9	5068449.9	5063470.7	5919845.9
<i>bic</i>	5046927.3	5068473.3	5063488.2	5919863.4

Table 6.4: Logistic Regression Output of House Ownership for Bangkok Area and Vicinities

Variable	full	l_full	drop_members	drop_age
<i>ttlinc</i>	.00001377***		.00001382***	.00001935***
<i>members</i>	-.14121318**			-.11503283*
<i>age</i>	.10279559***		.10134006***	
<i>l_ttlinc</i>		.61156397***		
<i>l_members</i>		-0.32601779		
<i>l_age</i>		4.2479191***		
<i>_cons</i>	-5.9516206***	-23.080995***	-6.3428299***	-2.0298528***
<i>N</i>	1635	1635	1635	1635
<i>aic</i>	2597053.9	2542555.6	2613837.1	3077564.5
<i>bic</i>	2597075.5	2542577.2	2613853.3	3077580.7

legend: * $p < .1$; ** $p < .05$; *** $p < .01$

2. Low-Income Housing Needs and Affordability Model

The model starts with the population projection 2015-2030. Here also, given the population by single year age ' a ' (assuming fertility rates), gender ' s ' (*male, female*), we project the household h (*intact, one person, single head, and other household types*) respectively. The brief description of the projection modules used in this study is as follows:

1) Population Module

The number of households by type h and age a is determined from the population by single age *population* multiplied by *headship rate*.

$$HH_{a,h} = (hs_{a,h,s}) PoP_{a,s}$$

Number of household by type ' h ' is a summation of household by single age a

$$HH_h = \sum_a HH_{a,h}$$

Total number of household

$$HH = \sum HH_h$$

HH = total number of households,

HH_h = number of household formation by type h ,

$HH_{a,h}$ = number of household formation by age a , type h , and

$hs_{a,h,s}$ = headship rate to form household type h i.e., the rate of family formation

$PoP_{a,s}$ = Population with single age a , and gender s , over the forecasting horizon
($t=2015-2030$)

2) Housing need from the household formation (demand side)

Housing inventories at a point in time (HI) are determined by the number of households, assuming one household would need one house unit. Since there are vacancies of house units during the forecasting horizon, the gross house inventory stock is the summary of 'basic need' of house stock equivalent to a number of households adjust by vacant house unit ($0 < av < 1$) at a point in time. The result is net house inventory stock.

In reality, households may reside together in one house unit. We, therefore, adjust the number housing need with 'doubling up rate' ($0 < af < 1$) to get the adjusted number of net house inventory.

$$HI = (af) (1+av)HH$$

HI = adjusted house inventor stock (net)

af = doubling up rate, ($0 < af < 1$)

av = vacancy rate, $0 < av < 1$

We are interested in the housing need at each time period t (year). The change in housing inventory or incremental housing need in each sub-period (year) is therefore

$$\Delta HI_t = HI_t - HI_{t-1}$$

Housing withdrawal owing to replacement age of house stock is determined by withdrawal rate aw at each time t , from existing house inventory HI_t .

$$WH_t = (aw) HI_t$$

The *housing 'start'* would be constructed to replace the withdrawal units and to fulfill the inventory change. This new *housing needs* or *housing start* (HSS_t) is determined as

$$HSS_t = WH_t + \Delta HI_t$$

3) Affordability of housing need

The household's affordability of housing need is not automatic. Normally, the low-income household is not able to access the private housing market. Low-income household such as those belonging to income deciles 1-5th class may face with income and saving constraint. A low-income household cannot do monthly mortgage service with the short-term loan, high market interest rate, high down payment, and high market's house price. The following affordability module will be used in our study to arrive at feasible public policy on social infrastructure investment of Thailand in the next decades.

GDPR = Gross Domestic Product at Constant Price

PGDP = GDP deflator or general price e=level

Y_m = Average monthly mean income from SES

Y_{mh} = monthly mean income of household h -th (h = intact, single head, one person, and others type of households)

$Y_{mh,i}$ = monthly mean income of household h -th, income class i -th ($i=1,2,...,10$)

$YD_{h,i}$ = Disposable income of household h -th, income class i -th ($i=1,2,...,10$)

@ = Adjustment coefficients between monthly income survey by the NSO and estimated by the National Accounts (NESDB)

d_h = Coefficient of *total* average income and average income of each household h -th

d_{hi} = Coefficient of income distribution of household h -th by income class i -th, ($i=1,2,3,...,10$)

P_{hi} = Probability that any household belongs to income class i -th in household type h -th

$N(Z; 0,1)$ = standard normal distribution with mean and variance (0,1)

Z_{hi} = Standard score of random variable of income of the function $N(Z; 0,1)$ of household h -th

U_h = Mean income of household h -th which has income distribution function as a log-normal Distribution function

SD = standard deviation of income of household h -th

Step 1: Household Income Projection by income class

This module identifies the income of household h -th by income class i -th. Note that (1) time subscript is omitted for sake of simplicity. (2) The growth of income per head projected by Macro-econometric model or published by official sources (NESDB, BOT) over the planning horizon (2015-2030) can be used for projection of the left-hand side variables.

$$Y_m = @GDPR * PGDP$$

$$Y_{mh} = (d_h) Y_m$$

$$Y_{mh,i} = (d_{h,i}) Y_{mh}$$

$$HE_{h,i} = (e_{h,i}) (Y_{mh,i})$$

$$HSE_{h,i} = (she_{h,i}) (HE_{h,i})$$

$HE_{h,i}$ = Income of class i -th ($i=1,2,3,\dots,10$) of Household h -th

which can be disposed for household expenditure

$HSE_{h,i}$ = Income of class i -th ($i=1,2,3,\dots,10$) of household h -th, which can be disposed for housing expenditure

$e_{h,i}$ = Ratio of income in each class i -th ($i=1,2,3,\dots,10$)

which can be disposed in general by household h -th,

$she_{h,i}$ = Ratio of expenditure of household h -th in income class i -th ($i=1,2,3,\dots,10$)

disposed for housing expenditure

Step 2: Projection of household expenditure on housing acquisition

$NHE_{h,i} = (1 - re_{h,i})(HSE_{h,i})$

$NHE_{h,i}$ = Household expenditure on housing by household h -th, income class i -th ($i=1,2,3,\dots,10$). This expenditure is inclusive of household's saving for down payment in hire purchase of house.

$re_{h,i}$ = recurring expenditure by household h -th, income class i -th ($i=1,2,3,\dots,10$)

Step 3: Projection of housing affordability through monthly mortgage service. Service can be allocated from household saving after recurring expenditure.

$MGS_{h,i} = (NHE_{h,i}/HE_{h,i})(Ym_{h,i})$

$MGS_{h,i}$ = monthly mortgage service of household h -th in each income class i -th ($i=1,2,3,\dots,10$)

The capitalization factor (CF) is found to be

$$CF = \{1 - (1+r)^{-T}\}/r$$

We can evaluate the capital value of house of household h -th in each class i -th ($i=1,2,3,\dots,10$)

$$AF_{h,i} = \{(CF)(MGS_{h,i})\}/\{1-dp/100\}$$

Given the post finance parameters as follows:

r = annual rate of interest in mortgage service which government subsidy can be intervened,

T = term loan (in year)

dp = Percentage of 'down payment' before mortgage service.

4) Government Low-income housing Policy

$$NH_{h,i} = (p_{h,i}) NH_h$$

$NH_{h,i}$ = Number of household type h-th which belong to deciles class of $i=1,2,3,4$ where i-th is lower than affordability level with probability $p_{h,i}$

Given the availability of data from government and private sources as

(1) Household data surveyed by the National Statistical Office, namely Household Socio-Economic Survey several years to estimate the necessary parameters mentioned above.

(2) The official population projection 2015-2040 is from National Economic and Social Development Board.

(3) We apply our macroeconomic model to forecast the GDP growth and derive the mean income of households at a national level.

(4) The mean income is transformed to the monthly income of household to match with a month income baseline from SES.

(5) House price data is randomly selected from private housing market sources.

(6) Other financial data are from government sources like Government Housing Bank, Government Saving Bank and the Bank of Thailand etc.

The government (NHA) can propose the Ministry of Human Security and Social Welfare the number of housing needs of the low-income group. The simulation of policy instruments can be tried to arrive at possible solution and cost of social infrastructure investment as well as the cost of policy intervention.

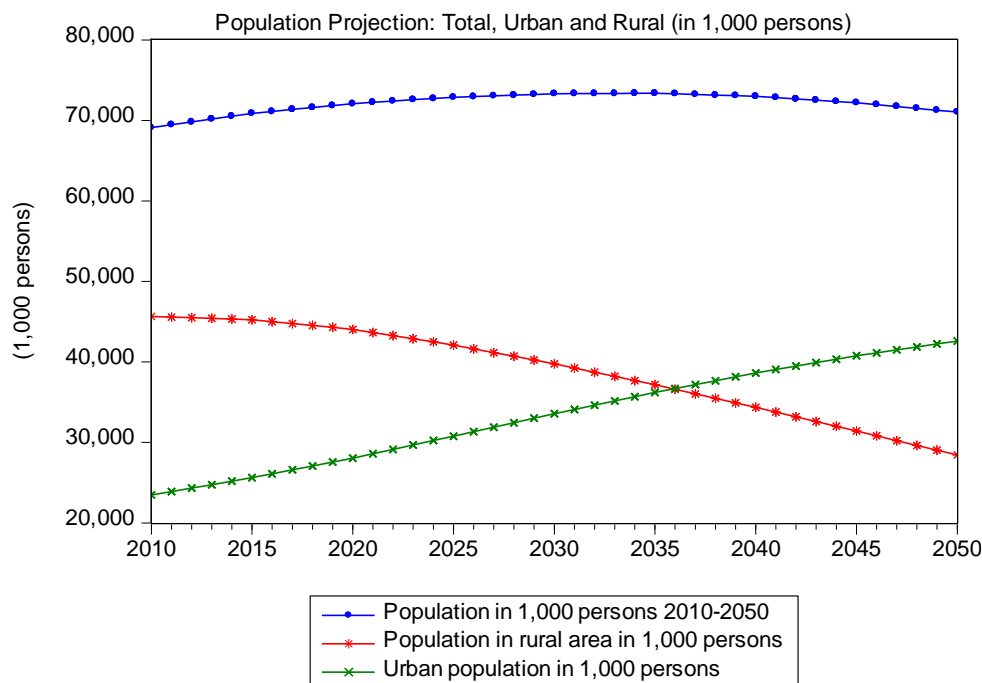
3. Low-Income Housing Needs and Affordability, Model Simulation

Population Projection

The changing structure of household and income distribution in Thailand determines the demand for housing. Firstly, we applied an official number of the population projected by NESDB¹ it's under the assumption of declining fertility.

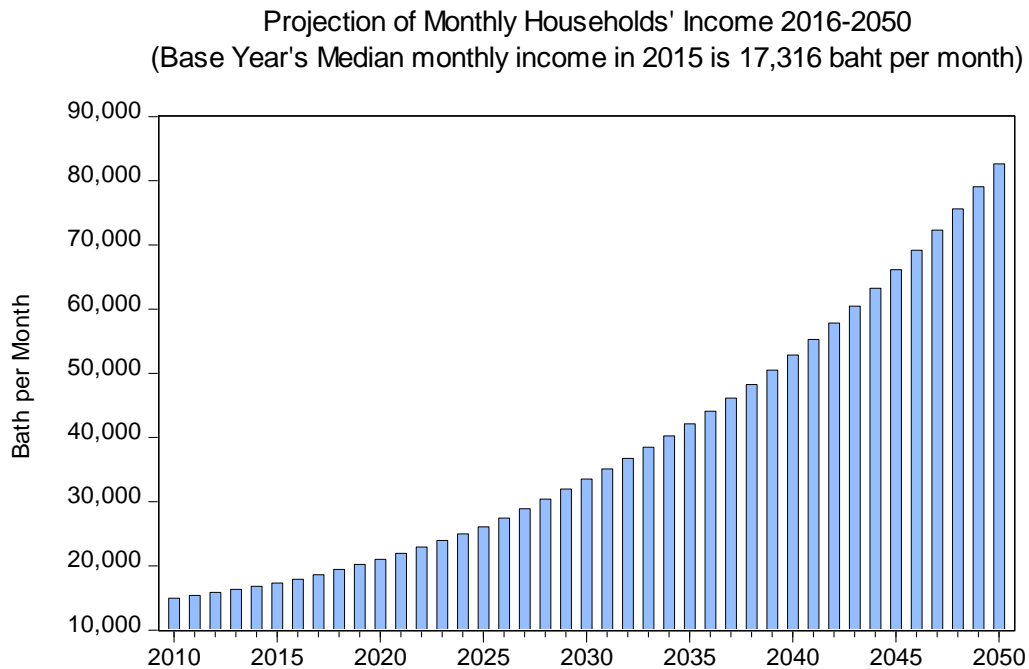
The population projection series from the NESDB is shown in the graph below. It is clearly shown that the urban household is growing to substitute for the rural household in the coming decades. Thus, urban housing policy is a very crucial issue. Secondly, we have drawn a number of households by types i.e., 'Intact', 'Single head', 'One person', and 'Others' from the Population Census 2010 and related reports of NESDB 2015-2050. Given *headship rates* the parameters to signify the probability to be household head over the total number of households, we obtain the household by types of household's head. The number of households by types is shown in tables 6.5 below.

Figure 6.11: Population Trend in Thailand, Urban and Rural Area 2010-2050



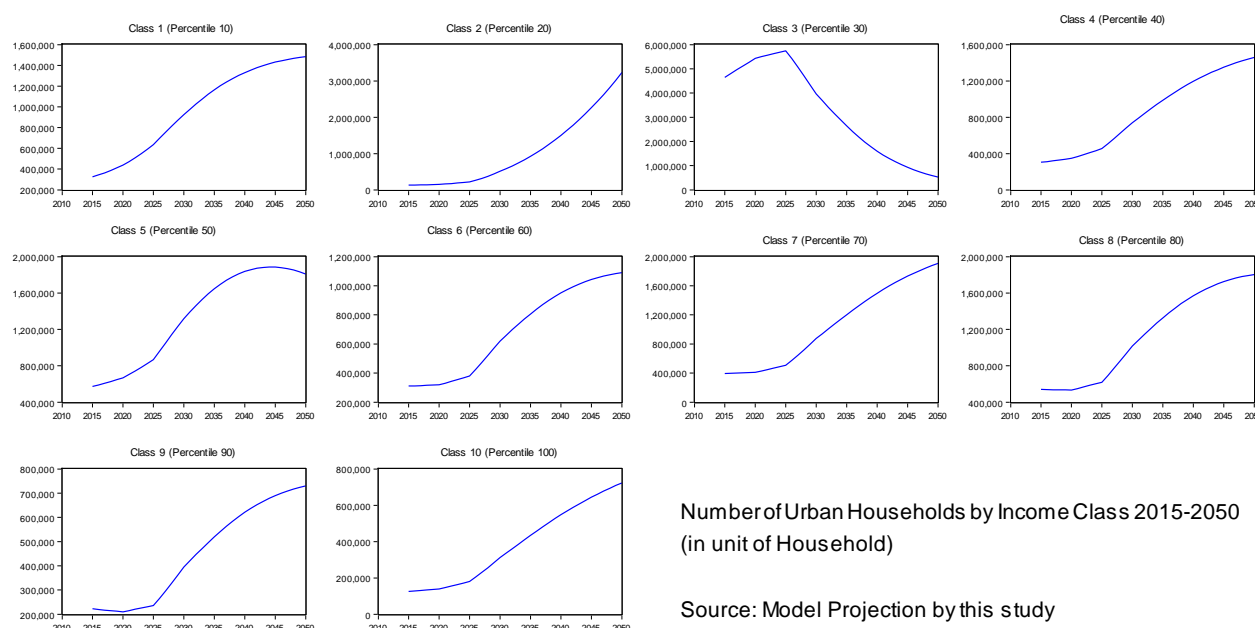
¹ The National Economics and Social Development Board, Population Projection Thailand.

Figure 6.12: Projection of Monthly Households' Income 2016-2050



From the macro-econometric model, we have forecasted the real and nominal GDP and other macro variables. From the reference path of income at the national level, household numbers, we have estimated the mean income per month earned by an average household. From this information, we use the probability model to estimate the distribution of households by income percentiles. A number of households in all classes accepts class 3th are projected to increase over time 2015-2050. From a policy point of view, poorest class 1st and 2nd are not able to mobilize to higher classes and need to be continuously taken care by the public residential system. The rest of households may be able to enter the housing market via rent, hire purchase if with public debates and subsidies. For class 6th – 10th, we expect that their demand for housing will be borne by own savings and private house market with market base financial cost.

Figure 6.13: Household Distribution by Income Class in 2015-2050



Assumptions of Model Parameters:

(1) Doubled up rate trend is different among household types and between HH urban and total HH. (2) Distribution of household's types change over time i.e., lower share of 'intact household' and replaced by the rising share of 'Single head' as well as 'One person and Others' households respectively. (3) Withdrawal rate and vacancy rate are assumed as its past trend. (4) Total household's mean income is consistent with national GDP's growth trend. This is obtained from macroeconomic model forecasting. (5) The mean income by percentile income class is obtained from applying SES household income distribution in 2015.

We start from the household formation into 4 types as mentioned above. The household would need at least one dwelling. It can be doubled up with other households i.e., more than one household in one dwelling. Households can own various types of houses either single house, twin house, flat, condominium etc. They can have many ownerships status from owning a house, having rental status, live on own land plot but build own house or rent land and house or build a house on government land etc. The most serious urban problem is however urban poor has to encroach on public land e.g., state enterprises' land property like national railway land around the railway station or along the rails on both sides. They once were a construction labor in public project and decided to settle down on public land along the canal. How to provide both dwelling and jobs to these urbanites are serious social issues in every developing country. Thus, housing needs in case of developing countries are not totally congruent with the definition in developed countries. Therefore, in

model forecasting it is difficult to find proper parameters like 'housing withdrawal' 'vacancy rates' as well 'doubled up rate' etc.

In our study, we have applied the simple model of housing needs and affordability believed to be consistent with the situation in Thailand and many other Asian countries. Firstly, the projection of housing inventory would be sufficed to calculate using a spreadsheet as below. The changing of housing inventory adjusted by housing withdrawal and vacancy rate can be projected. With further calculate the change in inventory; we finally obtain the housing start to be built to fulfill house need from the population and human settlement concept. We are interested in the settlement in the urban area. The housing starts to be planned for human settlement in the urban area as incremental from the past inventory stock is found in the row of Table 6.5, it is in the magnitude of 400-500 thousand units approximately for each sub-period. Bear in mind that these housing starts are for all income classes either rich or poor households. We are interested only in the low-income housing provision namely those who cannot enter the private housing market. They may have to either rent government house or heavily subsidized for hire purchase with lengthy of mortgage services say 30 years with affordable lower than market interest rates, and down payment.

In order to match household needs with affordability, we need a projection of future mean income. From official projection at the national level, it can be translated into the level of mean income of household by income class. Next step is to follow the matching of mortgage services per month with housing expenditure for house payment as shown in the system of equations above.

Table 6.5: Total Households by Types and Housing Inventory and Housing Start 2009-2037

	2009	2015	2020	2025	2030	2035	2037
Total household (1,000 units)	19,579	21,326	22,535	23,599	23,603	23,882	23,991
Intact household	13,848	13,917	13,851	14,387	12,501	10,380	9,708
one person household	1,442	2,492	3,268	3,540	4,721	5,851	6,238
single head household	4,281	4,909	5,408	5,664	6,373	7,642	8,037
others household	9	8	8	8	8	9	9
Intact household share	100.00	100.00	100.00	100.00	100.00	100.00	100.00
one person household share	70.73	65.26	61.46	60.96	52.96	43.46	40.46
single head household share	7.36	11.69	14.50	15.00	20.00	24.50	26.00
others household share	0.05	0.04	0.04	0.03	0.03	0.04	0.04
Urban household (1,000 units)	6,485	7,572	8,648	9,839	10,671	11,649	12,045
Rural household (1,000 units)	13,094	13,754	13,887	13,761	12,932	12,233	11,945
1 Intact household (1,000 units)							
intact household: <i>urban</i>	4,587	4,941	5,382	6,063	6,151	5,823	5,717
AF = doubling rate	0.42	0.42	0.45	0.50	0.65	0.75	0.75
AF Urban	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AV = vacancy rate	0.02	0.02	0.02	0.02	0.02	0.02	0.02
adjusted house inventory stock (HI) :intact = = (AF)(1-AV)*(sumHH at t)	5,670	5,698	6,093	6,741	7,858	7,586	7,089
<i>change</i> in adjusted house inventory stock (delta_HI) :intact	-	146	(26)	179	465	(158)	(161)
adjusted house inventory stock (HI) : <i>urban</i> intact = (AF)(1-AV)*(sumHH at t)	4,518	4,867	5,301	5,972	6,059	5,736	5,631

<i>change</i> in adjusted house inventory stock (delta_HI) : <u>urban</u> intact	-	102	107	300	34	24	13
withdrawal rate (aw)		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
No. of housing withdrawal (WHt) : intact = aw*HI		114	122	135	157	152	142
No. of housing withdrawal (WHt) : <u>urban</u> intact = aw*HI		4	6	7	11	14	16
<i>housing start (HS) : intact = WHt + delta_HI</i>		260	95	314	622	(6)	(19)
<i>housing start (HS) : <u>urban</u> intact = WHt + delta_HI</i>		216	229	435	191	175	155
2 One person household (1,000 units)							
withdrawal rate (aw)		0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
No. of housing withdrawal (WHt): one person = aw*HI		12,396	16,256	17,611	23,485	29,109	31,032
No. of housing withdrawal (WHt): <u>urban</u> one person = aw*HI		4,401	6,238	7,342	10,618	14,198	15,581
<i>housing start (HS) : one person = WHt + delta_HI</i>		552	166	(182)	259	280	164
<i>housing start (HS) : <u>urban</u> one person = WHt + delta_HI</i>		193	81	(51)	148	176	126
3. single head household (1,000 units)							
single head household: <u>urban</u>	1,411	1,734	2,065	2,349	2,867	3,709	4,015
AF = doubling rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AF Urban	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AV = vacancy rate	0.01	0.01	0.01	0.01	0.01	0.01	0.01
adjusted house inventory stock (HI) :single head = (AF)(1-AV)*(sumHH at t)	4,260	4,885	5,408	5,664	6,373	7,642	8,037
<i>change</i> in adjusted house inventory stock (delta_HI): single head	-	258	176	(414)	236	257	138

adjusted house inventory stock (HI) : <u>urban</u> single head = (AF)(1-AV)*(sumHH at t)	1,411	1,734	2,065	2,349	2,867	3,709	4,015
<u>change</u> in adjusted house inventory stock (delta_HI): <u>urban</u> single head	-	84	96	(132)	149	177	125
withdrawal rate (aw)		0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
No. of housing withdrawal (WHt): single head = aw*HI		24,424	27,042	28,319	31,864	38,211	40,184
No. of housing withdrawal (WHt): <u>urban</u> single head = aw*HI		8,672	10,326	11,747	14,334	18,545	20,075
housing start (HS): single head = WHt + delta_HI		283	203	(386)	268	295	178
housing start (HS): <u>urban</u> single head = WHt + delta_HI		92	106	(120)	164	196	145
4. other household (1,000 units)							
others household: <u>urban</u>	8.64	7.81	8.02	8.40	8.40	8.50	8.54
AF = doubling rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AV = vacancy rate	0.01	0.01	0.01	0.01	0.01	0.01	0.01
adjusted house inventory stock (HI) : <u>urban</u> others = (AF)(1-AV)*(sumHH at t)	8.59	7.77	7.98	8.36	8.36	8.46	8.50
change in adjusted house inventory stock (delta_HI): <u>urban</u> others		162	95	79	0	20	19
withdrawal rate (aw)		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
No. of housing withdrawal (WHt): <u>urban</u> others = aw*HI		0.16	0.16	0.17	0.17	0.17	0.17
housing start (HS): <u>urban</u> others = WHt + delta_HI		0.32	0.25	0.25	0.17	0.19	0.19
Housing start (HS): Total = 1+2+3+4 (1,000 units)		1,094.73	463.94	(253.79)	1,149.23	569.51	323.91
Housing start (HS) <u>urban</u> = 1+2+3+4 (urban) (1,000 units)		501.28	415.53	264.20	503.57	547.64	426.13

Note: (..) indicates negative numbers. Housing inventory is stock adjustment annually, while housing start is regarded as the changing of inventory each period after taking into account the housing withdrawal owing to dismantle or causing fire etc., and has to be cleared from the inventory.

We have developed low-income housing need and affordability model, on a spreadsheet to project the housing inventory and housing starts for all households and urban households. The housing start is a change in housing inventory which is an adjustment between demand and supply of housing. It can be regarded as the *excess demand* at equilibrium which can exhibit market signal either *positive or negative* value given that the house *price is always positive*. This is because even though the change in inventory is negative the price can never be zero since there is still stock of house in the market to be cleared by demand side.

The foregoing analysis has shown that urbanization that would take place in Thailand in the coming decades has expressed housing demand in urban area of 415.53 thousand units in 2020. The housing demand would be 503.57 thousand units in 2030 and 426.13 thousand units in 2037 respectively. As we have shown in Table 6.1 that low income household (deciles 1-4) could not afford to buy house from the private housing market. It is therefore a government role to provide housing for low income in urban area. We will see the affordability of low income in the next analysis concerning the house price and inverse housing demand.

4. Estimation of Inverse demand for house and Affordable House Price

In this section, we are going to estimate the *Inverse demand for house* applying a logistic estimation method. The demand represents the affordable power of existing house ownership by households, *ex-post*. The analysis covers three areas *entire country, municipal area, and Bangkok metropolitan and vicinities* respectively.

This analysis is to find the factor which affects the house price. It is, in fact, an '*inverse housing demand relationship*' applying data from SES 2007. Our hypothesis is whether the income of household affects the *imputed value of house or price of a house* (inverse demand for a house). Total income in this study consists of an average wage per month, overtime pay, bonus, an average money receipt from goods and products per month from all businesses, and an average operational expenditure per month from all businesses. The regression model is

$$\text{Imputed House Price} = \alpha_i + \text{Log}(\text{Total Income})_i + \text{Age}_i + \text{Members}_i + u_i$$

Data	Data Sources
Sales of Real Estate, and National Housing Authority's Housing Project	Real Estate Information Center (REIC)
Total income, age, members of a family, homeownership, housing expenditure, and house price of survey respondents	Socio-Economic Survey (SES) in 2007

Table 6.6: Determination of House Price and Housing Expenditure for Municipal Area

	<i>Municipal Area</i>	<i>BMR and Vacilities</i>
<i>Variable</i>	housepricemuni	housepricebkk
<i>l_ttlinc</i>	197953.47***	235392.91***
<i>members</i>	-3442.1383	-17488.975
<i>age</i>	11751.579***	16658.14***
<i>_cons</i>	-2037330.2***	-2511575.8***
<i>N</i>	2538	1635
<i>r2</i>	0.11458855	0.13149135

legend: * $p < .1$; ** $p < .05$; *** $p < .01$

It is found that higher percentage change in income level has a positive relationship with house price for both municipal area and BMR and vicinities area. Higher income growth may result in higher purchasing power to acquire for luxury or a bigger house. It seems that growing age of head will also accumulate more assets and wealth. The household can afford to buy a house with the higher price range.

This also means that low-income household may find difficulty in acquiring a house with a higher price and/or a large number of mortgage services a month. The poor households who belong to deciles 1-5 cannot access to the housing market even. Without proper housing policy for the poor, they will not be able to find a proper resident. In an urban area, the government may consider launching subsidies such as reducing interest rates for a home loan and assisting construction costs.

Firstly, we experiment with the hypothetical assumption of reducing the interest rates. Average of 6 major banks *floating mortgage rate* in 2016 is in the range of 6.69% to 6.85% per year according to information from the Real Estate Information Center (REIC). The mortgage interest rate of 7% is set with monthly payment such that the net income ratio does not exceed 33%² for major banks. The affordable monthly payment in the next 30 years, given the monthly income of ฿ 15,000 and annual interest rate of 7% can be estimated. As a result, the *affordable price* of a house by the assumed mortgage condition amounts to ฿ 760,456 a unit. If government

² <http://www.reic.or.th/RealEstateForPeople/Topic-AdviceHomeLoan02.asp>

subsidies are assumed, it would help lower the interest rates from 7% to be 6% and 5%, the affordable price of houses would increase to ฿839,879 - ฿933,865.0054 respectively.

Table 6.7: The projection of affordable price of houses given an income of ฿15,000

Scenario	No government subsidy	Subsidy with rate - 1%	Subsidy with rate - 2%
Monthly income	15,000		
Monthly payment to net income ratio	0.33		
Monthly payment	4,950		
Down payment	0		
Loan term(months)	360		
Annual rate	0.07	0.06	0.05
Monthly rate	0.005654145	0.004867551	0.004074124
Mortgage amount	760,456.7049	839,879.2775	933,865.0054

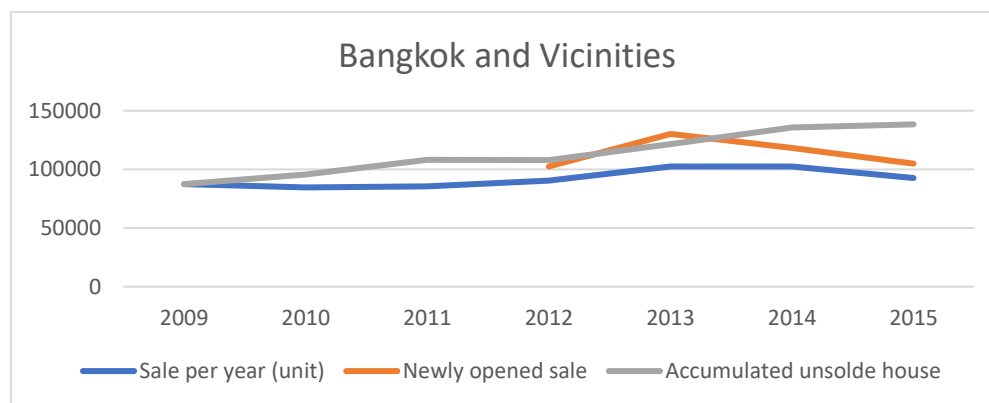
By varying income-level of household and interest rates, the affordable price of houses is higher as the interest rates are lower and individual monthly income increases as shown in Table below.

Table 6.8: The hypothetical affordable price of houses given income of ฿15,000-20,000 baht per month

Interest rates	Monthly income			
		฿ 10,000	฿ 15,000	฿ 20,000
	7.00%	฿ 506,971.14	฿ 760,456.70	฿ 1,013,942.27
	6.00%	฿ 559,919.52	฿ 839,879.28	฿ 1,119,839.04
	5.00%	฿ 622,576.67	฿ 933,865.01	฿ 1,245,153.34

Our analysis has found that government may need to assist the low-income household with a monthly income of 15,000 baht to access to government low-income housing provision at 650,000 baht a unit of 24 square meters (Flat type) by NHA. A mortgage service amount is approximately 4,500 baht a month for 30 years of housing loan with 7 percent interest rate. The low-income household is facing hard burden to make a mortgage service if without government assistance.

Figure 6.14: Sale, Newly Opened Sale and Accumulated Unsold Houses from 2009 to 2015



While low-income urbanites could not access the government housing market, the private provision of a house in the BMR has shown a slackened demand. The unsold units have accumulated during 2009 to 2015. According to the Real Estate Information Center (Thailand), the private supply in the housing market has started to show excess supply as result of economic slowdown. The newly opened sale has reduced sharply from 2013 to 2015 by 9% and 11%, respectively.

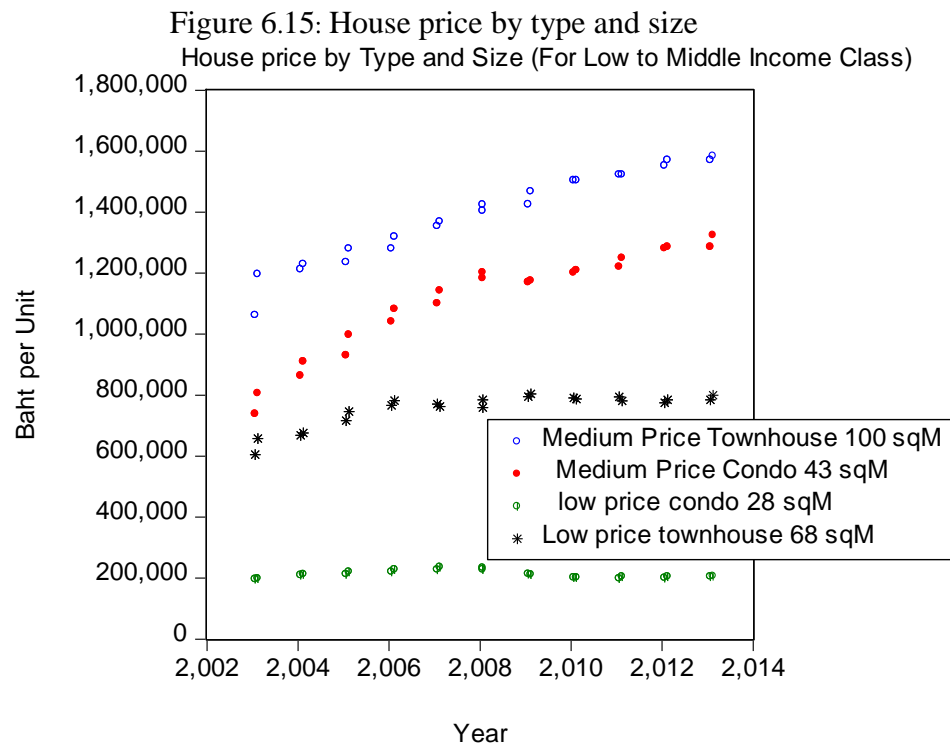
As a matter of fact, the house types that poor to lower middle class can access to the mortgage market are such as 'low price condo size 28 square meter' and 'medium price condo size 43 square meter' respectively. The Condo of size 28 square meters was unrealistically low as it was an average of both government and private house price. They may be located in the remote area of the province where the cost of land was still cheaper than the urban area. The size of 28 and 43 square meters Condo have shown *policy intervened trend* as compared with low-medium price townhouse. The former was a supply provisioned by a public organization like NHA while the latter's from the private market provision. They have a normal trend of rising cost of construction.

We have shown the price per square meter which determined the cost of construction, management, and sale, interest cost as well profit making etc. The housing policy in Thailand has put balance in the housing market. The low-income housing policy in Thailand may balance the rising sale price of houses in Thailand to some extent.

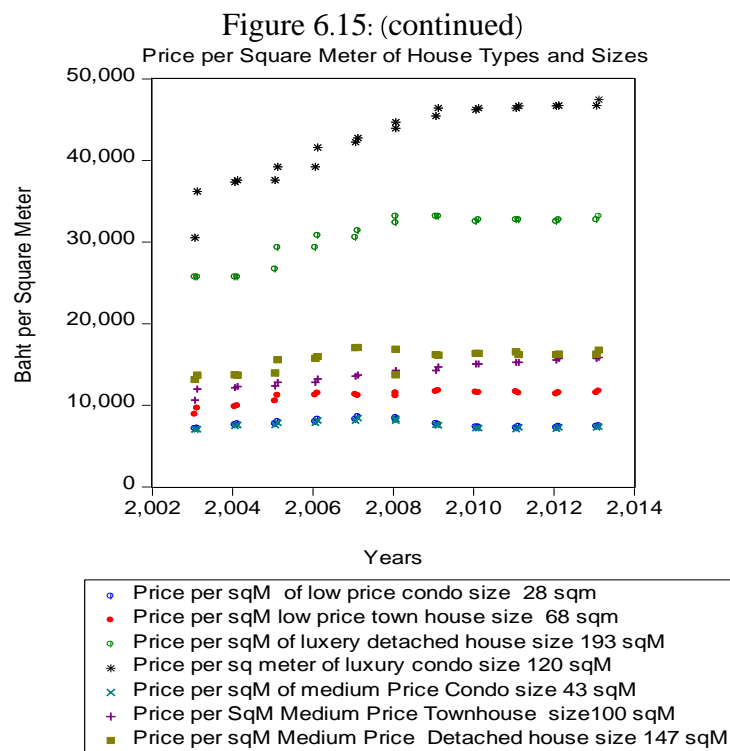
While luxury condo and luxury detached house are beyond the reach of middle-income class, the medium price townhouse and condo are still good alternatives. For low-income household, the choice is still open for low price townhouse of 68 square meters and perhaps medium price condo 43 square meters as well. Our model projection for housing needs and

affordability in the whole country and in particular the urban area has the following policy implications:

- 1) Most of households belong to medium-high income class (deciles 5-10th) can enter the private housing market in various types from detached house, Condo, and Townhouse with larger size and pricing. On the contrary, low income households (deciles 1-4th) cannot access to housing market by themselves and need assistance from government.
- 2) The role of government is therefore scoped down to concentrate in social investment role i.e. the provision of house for low income households.
- 3) The type of housing can be ranged from low price Condo of 28 square meters, Townhouse for those who can afford to service the mortgage (deciles 4th) to rental house for low income in various forms.(deciles 2-3rd).
- 4) The lowest income deciles households may need special treatment by the government.



Source: Agency for Real Estate Affairs 2013 (www.area.co.th)



The study here would like to propose how the government can perform social investment in dwelling for low income households as our main purpose. We have therefore to investigate the government plans on this social investment in the following section.

5. Government Effort in Residential development

The government project to assist the low-income households has been established by The National Housing Authority (NHA), Ministry of Social Development and Human Security under several governments. Currently, a project named '*Baan³ Pracha Rath*' and '*Baan Thanarak Pracharat* housing projects' provides loan for low-income people to own house with a price which does not exceed 1.5 million baht. The loan is provided by Government Housing Bank (GHB) and Government Savings Bank for buying, constructing, or fixing with a specified amount of money respectively.

Recently, the Cabinet has also announced an adjustment in criteria for low-income people without property in their possession. It is granted for housing loan that does not exceed 1.5 million baht. The project is eligible for employees who earn 20,000 baht a month or less.

³ 'Baan' literally means 'house'

In fact, every government has initiated a similar project for low-income housing. For example, a program which has launched in 2003 aimed to solve housing problem of poorest urban citizens named as the '*Baan Mankong*⁴ Collective Housing Program'. It has provided subsidies and soft loan for housing and land. So far, a total number of 858 projects has been approved for 90,813 families.

We would like to note the following 'Stylized Facts':

(1) Ownership of House

In 2013, among the total of 20.17 million households reported by the socio-economic survey (NSO) only 15.01 million households (75.19 percent) has owned house and land. The rest 5.01 million households have no ownership in one way or another. Some households own house but not land, other build house in public land, rent, hire purchase, reside with others free conditions etc.

(2) Income Distribution and Affordability

The NESDB has reported that only 1.931 million households (41 %) with average monthly income of 20,700 baht per month (or percentile 60) and can afford to buy a cheap house. The rest of households 2.751 million households (59 %) with income less than 20,700 baht a month (or lower than percentile 60) desperately need government support. This amounts to 2.726 million households.

The NSO reports further that household with monthly income 13,701 - 20,700 baht *cannot* afford a house in the housing market. They have to rely on a rental house from the market or public provision. Here, 1.579 million households with monthly income lower than 13,700 baht are facing the difficulty of settlement. The Community Organization Development Institute (CODI) has reported further 47% of the low incomes or 791,647 households residing in the slum area.

In fact, the accessibility to a standard qualified house for a low-income household is the most concern of any government. Based on a report by the NESDB, 80 percent of land ownership belongs to highest income group. The lowest income group of 20 percent owns only 0.3 percent of the land asset. This implies that low-income housing is constrained by land price as well.

(3) Government Policy

The current government by the Ministry Human Security and Social Welfare has put effort to mobilize a 10-year strategic housing development plan (2016-2025). They have tried to execute a 3-year low-income housing development plan (2016-2018) and achieved an immediate plan in 2016. The cabinet has decided to allow public-private investment for low-income

⁴ Literally 'housing security'

households including low salary government officials as well. The plan would also help finance squatter community along a canal, raising the quality of life of homeless by the non-governmental organization.

Following the guideline of SDG (2016-2030), the government has written up the 'The 10 Years Strategic Housing Development Plan (2016-2025)'. This plan aims to promote housing security that can raise a quality of life of low-income households. The plan has aimed to provide standard dwelling unit with proper environment for the community, equipped with basic infrastructure for 2.72 million low-income households.

The provision of 567,691 units on 27,241 *rai* of land with a planned budget of 569,524.70 million baht has the following features:

- 1) The housing provision for 'low-income' 1.707 million units by **NHA** and in cooperation with related agencies. They comprise rent and hire-purchase sub-groups: (1) rental house of 91,657 units for low income, with planned budget of 102,662.21 million baht (2) hire-purchase for low income 1.615 million units, consist of (2.1) 421,034 units for low income, with planned budget of 422,465.49 million baht (2.2) civil servant house 55,000 units, with planned budget of 44,497 million baht (2.3) the public-private cooperation (rent and hire purchase) or '*Ban Pracharat*' 1,139,746 units respectively.
- 2) The housing provision for 1.044 million low-income households in both urban and rural area by **CODI** 1.044 million units for 'rent'. These comprise (1) urban squatter community and low-income earners 692,510 households, with a planned budget of 126,725.84 million baht. (2) Rental house for rural low-income household 352,000 households, with a budget of 20,349 million baht.
- 3) Target Group by income-area-types of needs
The low-income without the property right which can be divided by area and income level such as
 - A. The household in Bangkok area and perimeter
 - (1) Rental household with 15,301 – 22,900 baht per month
 - (2) Rental household with 22,901 – 32,800 baht per month
 - B. Household in provincials' area
 - (1) Rental household with 8,801 – 13,500 baht per month
 - (2) Rental household with 13,501 – 19,900 baht per month

C. the low income in slum, trespassing community and homeless; the rural low income with a residential problem; and the low-rank government officers who need a house.

4) Implementation Target by Agencies

Dwelling security for 2,725,924 households comprises

- 4.1) *NHA* 1,707,437 housing for low incomes
 - (1) Rental group 91,657 households
 - (2) Hire purchase 1,615,780 households
- 4.2) the low income in slum trespassing community and homeless implement by *CODI* 692,510 household
- 4.3) the rural low income with residential problem Implement by *CODI* 352,000 household

5) Project Format

The 10 years Housing Development Plan (2016-2025) has set project format in response to target groups' need for affordable ability.

5.1) The residential development plan for the common low-income implement by *NHA* by cooperation with a related organization in private sector and government sector in an amount of 1,707,437 household consist of 4 categories:

(1) Quality of life improvement plan (rental) is developing a rental unit in an amount of 91,657 units in Bangkok and perimeter area 45,359 units and in a rural area 46,298 units.

This project format is a rental apartment for the low income with the 3-5 floors residential area has one bedroom with 28-32 square meters the ground floor of the building is 'Universal' design for the elderly and handicapped.

(2) Strengthening the housing security plan (hire purchase) in an amount of 421,034 units in the Bangkok and perimeter 161,248 units and rural area 259,786 units. This project format in the Bangkok area is condominium with 4-35 floors. In the rural area is a single house double house townhouse and condominium depend on the suitable of the local area the design is using a universal design with the infrastructure

(3) Government officer housing project in an amount of 55,000 units in a format of a house for government officials in an amount of 30,000 units and official residence in an amount of 25,000 units.

5.2) low-income housing (urban and rural) implement by *CODI* in cooperation with the local government for the low income in the amount of 1,044,510 units consisting of

5.2.1) Housing for the slum dwellers and urban low income in the amount of 692,725.84 household consist of 3 projects

- (1) *Baan Man Khong* project in the amount of 680,808 households, managed in form of cooperative by community
- (2) Canalside housing project in an amount of 11,004 units, for solve the trespassing of the canal side communities in Bangkok
- (3) Homeless' quality of life improving project, 698 households 1,395 people to support the homeless center which managed by a homeless network, to promote their quality of life

5.2.2) Rural low-income housing implement by CODI in co-operating with the local government in the amount of 352,000 households which support the renovate the old house in a rural area or rebuild the old and damage house

5.3) land donated by Department of Social Development and Welfare for the aforementioned projects in the amount of 960 *rai*⁵

6) Investment Budget

The Ministry of Finance will seek fund for the 10 years Residential development plan (2016-2025). See detail below in Table 6.9 which is planned figures.

⁵ 1 *rai* = 1,600 square meters or 0.16 hectare.

Table 6.9: 10 Years Housing Development Strategic Plan of National Housing Authority, Thailand
2016-2025
A: Immediate Plan 2016-2018

Plan	Project	Units	Immediate Plan			3 Years
			2016	2017	2018	2016-2018
1.1 Low Income Quality of Life by Rent	1. Rental housing for low income	10,107 26,000	5,261 2,490.40	3,240 1,617.15	1,606 787.85	10,107 4,895.40
	2. Rental Housing in Economic Zone	24,000		4,000 2,392.00	4,000 2,512.00	8,000 4,904.00
	3. Housing Improvement 1	20,292	334.00 613.76		1,247 1,849.01	1,581 2,462.77
	4. Housing Improvement 2	8,255				
	5. Housing Improvement 3	3,003				
	Sub Total	91,657	5,595	7,240	6,853	19,688
	Investment Source of Fund		3,104.16	4,009.15	5,148.86	12,262.17
	•Subsidy from Government		2,103.90	3,299.58	2,742.07	8,145.55
	•Loan		386.5	709.57	557.78	1,653.85
	•Borrow from Government		613.76	0	1,809.83	2,423.59
	•Own Revenue		0	0	39.18	39.18
1.2 Low Income Housing by Hire Purchase	1. Housing Development 1	24,901	13,314 8,975.27	11,587 8,936.80		24,901 17,912.07
	Housing Development	9,133	9,133 5,989.42			9,133 5,989.42
	2. Housing Development 2	35,000			35,000 29,960.00	35,000 29,960.00
	3. Housing Development 3	30,000				
	4. Housing Development 4 (period 1-6)	170,000				
	5. New town 5	48,000				

	6. Housing Development along the Train Route BMR First period	12,000 12,000		4,000 3,260.00	4,000 3,424.00	8,000 6,684.00
	7. New Town along the Speed Train Route Economic Corridor	80,000				
	Sub Units	421,034	22,447	15,587	39,000	77,034
	Investment Source of Fund		14,964.69	12,196.80	33,384.00	60,545.49
	• Subsidy from Government		2,174.51	2,054.49	8,871.00	13,100.00
	• Loan		10,981.65	8,767.82	21,174.60	40,924.07
	• Borrow from Government		0	0	0	0
	• Own Revenue		1,808.53	1,374.49	3,338.40	6,521.42
1.3 Housing for civil servants	1. Hire purchase (unit cost : baht)	30,000	3,000 2,328.00 (776,000)	3,000 2,445.00 (815,000)	3,000 2,568.00 (856,000)	9,000 7,341.00
	2. Government house for civil servant (unit cost : baht)	25,000	5,000 2,845.00 (569,000)	10,000 5,980.00 (598,000)	10,000 6,280.00 (628,000)	25,000 15,105.00
	Units	55,000	8,000	13,000	13,000	34,000
	Investment Source of Fund		5,173.00	8,425.00	8,848.00	22,446.00
	• Subsidy from Government		3,449.80	6,628.00	6,974.20	17,052.00
	• Loan		1,490.40	1,552.50	1,617.00	4,659.90
	• Borrow from Government					0
	• Own Revenue		232.8	244.5	256.8	734.1
1.4 Public -Private Partnership Housing Development	1. Government-Private Housing	1,139,746				
Grand Total	Units	1,707,437	36,042	35,827	58,853	130,722
	Investment Source of Fund		23,241.85	24,630.95	47,380.86	95,253.66
	• Subsidy from Government		7,728.21	11,982.07	18,587.27	38,297.55
	• Loan		12,858.55	11,029.89	23,349.38	47,237.82
	• Borrow from Government		613.76	0	1,809.83	2,423.59
	• Own Revenue		2,041.33	1,618.99	3,634.38	7,294.70

Table 6.10: 10 Years Housing Development Strategic Plan of National Housing Authority, Thailand 2016-2025
B: Medium-Long-term Plan 2016-2025

Plan	Project	Units	3 Years	Medium Plan (5 years 2016-20)		Long-Term Plan(10 years 2016-2025)					Total Investment (million baht)
			2016-2018	2019	2020	2021	2022	2023	2024	2025	
1.1 Low Income Quality of Life by Rent	1. Rental housing for low income	10,107 26,000	10,107 4,895.40		4,000 2,768.00	4,000 2,908.00	4,000 3,052.00	4,000 3,204.00	5,000 4,205.00	5,000 4,415.00	4,895.40 20,552.00
	2. Rental Housing in Economic Zone	24,000	8,000 4,904.00	7,000 4,925.00	3,000 2,403.00	3,000 2,523.00	3,000 2,649.00				17,404.00
	3. Housing Improvement 1	20,292	1,581 2,462.77		5,943 9,754.57		12,768 25,243.37				37,460.71
	4. Housing Improvement 2	8,255						4,445 9,186.74		3,810 8,563.36	17,750.10
	5. Housing Improvement 3	3,003				490 626.30		2,513 3,973.70			4,600.00
	Sub Total	91,657	19,688	7,000	12,943	7,490	19,768	10,958	5,000	8,810	
	Investment Source of Fund		12,262.17	4,925.00	14,925.57	6,057.30	30,944.37	16,364.44	4,205.00	12,978.36	102,662.21
	•Subsidy from Government		8,145.55	3,696.00	3,694.00	3,880.40	4,073.80	2,353.60	3,088.00	3,242.00	32,173.35
	•Loan		1,653.85	1,229.00	4,897.53	1,550.60	23,109.12	4,824.10	1,117.00	9,736.36	48,117.56
	•Borrow from Government		2,423.59	0	5,116.95	626.3	2,339.69	9,186.74	0	0	19,693.27
	•Own Revenue		39.18	0	1,217.09	0	1,421.76	0	0	0	2,678.03
1.2 Low Income Housing by Hire Purchase	1. Housing Development 1	24,901	24,901 17,912.07								17,912.07
	Housing Development	9,133	9,133 5,989.42								5,989.42
	2. Housing Development 2	35,000	35,000 29,960.00								29,960.00
	3. Housing Development 3	30,000		30,000 26,970.00							26,970.00
	4. Housing Development 4 (period 1-6)	170,000			25,000 23,600.00	25,000 24,775.00	30,000 31,200.00	30,000 32,760.00	30,000 34,410.00	30,000 36,120.00	182,865.00
	5. New town 5	48,000			20,000 18,880.00	28,000 27,748.00					46,628.00

Plan	Project	Units	3 Years	Medium Plan (5 years 2016-20)		Long-Term Plan(10 years 2016-2025)					Total Investment (million baht)
			2016-2018	2019	2020	2021	2022	2023	2024	2025	
	6. Housing Development along the Train Route BMR First period	12,000 12,000	8,000 6,684.00	4,000 3,596.00	3,000 2,832.00	3,000 2,973.00	3,000 3,120.00	3,000 3,276.00			10,280.00 12,201.00
	7.New Town along the Speed Train Route Economic Corridor Economic Corridor	80,000					20,000 20,800.00	20,000 21,840.00	20,000 22,940.00	20,000 24,080.00	89,660.00
	Sub Units	421,034	77,034	34,000	48,000	56,000	53,000	53,000	50,000	50,000	
	Investment Source of Fund		60,545.49	30,566.00	45,312.00	55,496.00	55,120.00	57,876.00	57,350.00	60,200.00	422,465.49
	•Subsidy from Government		13,100.00	8,262.00	12,287.00	15,285.80	16,601.00	17,783.00	18,148.00	19,414.00	120,880.80
	•Loan		40,924.07	19,247.40	28,493.80	34,660.60	33,007.00	34,305.40	33,467.00	34,766.00	258,871.27
	•Borrow from Government		0	0	0	0	0	0	0	0	0
	•Own Revenue		6,521.42	3,056.60	4,531.20	5,549.60	5,512.00	5,787.60	5,735.00	6,020.00	42,713.42
	1.3 Housing for civil servants										
	1. Hire purchase (unit cost :baht)	30,000	9,000 7,341.00	3,000 2,697.00 (899,000)	3,000 2,832.00 (944,000)	3,000 2,973.00 (991,000)	3,000 3,120.00 (1,040,00 0)	3,000 3,276.00 (1,092,00 0)	3,000 3,441.00 (1,147,00 0)	3,000 3,612.00 (1,204,00 0)	29,292.00
	2. Government house for the civil servant (unit cost :baht)	25,000	25,000 15,105.00								15,105.00
	Units	55,000	34,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	
	Investment Source of Fund		22,446.00	2,697.00	2,832.00	2,973.00	3,120.00	3,276.00	3,441.00	3,612.00	44,397.00
	•Subsidy from Government		17,052.00	743.4	794.4	850.2	910.2	975	1,042.80	1,115.40	23,483.40

Plan	Project	Units	3 Years	Medium Plan (5 years 2016-20)		Long-Term Plan(10 years 2016-2025)					Total Investment (million baht)
			2016-2018	2019	2020	2021	2022	2023	2024	2025	
	• Loan		4,659.90	1,683.90	1,754.40	1,825.50	1,897.80	1,973.40	2,054.10	2,135.40	17,984.40
	• Borrow from Government		0								0
	• Own Revenue		734.1	269.7	283.2	297.3	312	327.6	344.1	361.2	2,929.20
1.4 Public -Private Partnership Housing Development	1. Government-Private Housing	1,139,746		Operated by Ministry of Finance with Cooperation by NHA							
Grand Total	Units	1,707,437	130,722	44,000	63,943	66,490	75,768	66,958	58,000	61,810	
	Investment Source of Fund		95,253.66	38,188.00	63,069.57	64,526.30	89,184.37	77,516.44	64,996.00	76,790.36	569,524.70
	• Subsidy from Government		38,297.55	12,701.40	16,775.40	20,016.40	21,585.00	21,111.60	22,278.80	23,771.40	176,537.55
	• Loan		47,237.82	22,160.30	35,145.73	38,036.70	58,013.92	41,102.90	36,638.10	46,637.76	324,973.23
	• Borrow from Government		2,423.59	0	5,116.95	626.3	2,339.69	9,186.74	0	0	19,693.27
	• Own Revenue		7,294.70	3,326.30	6,031.49	5,846.90	7,245.76	6,115.20	6,079.10	6,381.20	48,320.65

Source: Ministry of Social Development and Human Security (2016), National Housing 10 Years Strategic Plan (2016-2025)

6. Synthesis and Implications on Social Investment Needs

The foregoing section is a planned supply provision by the National Housing Authority. Our housing needs model is a micro-based projection from population and households' survey (SES) as sources of parameterization. It has applied a base-line forecast of population as referenced path for housing needs and affordability of the low income household deciles.

The value of social investment needs for low cost housing in Thai in urban area can be estimated by synthesizing with average unit cost of public housing provision government plan as follows:

In order to estimate the cost of social investment from our micro-analysis low income housing needs in urban area during 2020-2037, we estimate the unit value of house price by extrapolating from Table 7.8, it assumes government's unit cost of house on average is 0.99 million baht in 2020. It increases to 1.86 and 2.23 million baht per unit in 2035 and 2037 respectively. Total cost of investment during 2020-2037 is in sum 3.487 trillion baht for all urban households.

Now, if we assume proportion of poor urban households to be 30 percent, we arrive at the cost of investment for low income housing in urban area of 1.046 trillion baht. If the proportion of low income households is 16 percent, the social cost of investment is 558.04 billion baht respectively. The methodology can be repeated with the foregoing example for other ASEAN countries.

Table 6.11: Estimated Cost of Social Investment on Urban Low Cost Housing

Cost of Social Investment (1,000 Million Baht)									
Year	Urban Housing Start (Units)	Unit Cost (Million Baht)	Value of Urban House (thousand Million Baht)	Assumptions on Poor Household Proportion					
				poor 40%	poor 30%	poor 25%	poor 20%	poor 15%	poor 16%
			Value of Urban House (thousand Million Baht)						
2020	415.53	0.99	409.85	163.94	122.96	102.46	81.97	61.48	65.58
2025	264.2	1.24	327.61	131.04	98.28	81.90	65.52	49.14	52.42
2030	503.57	1.55	780.53	312.21	234.16	195.13	156.11	117.08	124.89
2035	547.64	1.86	1,018.61	407.44	305.58	254.65	203.72	152.79	162.98
2037	426.13	2.23	951.12	380.45	285.34	237.78	190.22	142.67	152.18
All	2,157.07	1.57	3,487.73	1,395.09	1,046.32	871.93	697.55	523.16	558.04

Note: 1) unit cost is extrapolated from Table 6.9; 2) Urban housing start is from our model; 3) value of urban house is (3)=(1)x(2); 4) value of urban house by proportion of poor (4)= proportion x (3) respectively.