Estimating the Home-Purchase Cost of Seoul Citizens

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ABSTRACT

Seoul citizens are currently suffering from high housing price. Home prices have risen more rapidly than salaries so owning a housing unit (apartment, condominium, or single-family home) in Seoul is becoming more difficult than ever. Therefore, this research examines the behavior of average Seoul citizen in owning housing unit in Seoul, Korea, particularly in terms of the length of time required to afford a house unit. This research estimates that the optimal feasible range of growth rate of housing price that people can purchase the housing units and complete the loan payment shall be below 4.4% and it will take about 18.75 years in maximum after getting a job to own housing unit in Seoul that is currently valued at $300,000 where the growth rate of income is 2.97% and consumption prices are increasing at a rate of 2.95%.

KEYWORDS: home-ownership, housing affordability, system dynamics, income (salary), expenditure, housing price, wealth effect.

INTRODUCTION

Home-ownership is very important to Korean people. It is regarded as a sign of success: thus, the Korean people think they have to own houses within their lifetime. Furthermore, owning real estates in Korea is the most common investment method utilized to increase the wealth of both people and companies. This is largely because the value of real estate increases more than any other assets. As housing prices rise, the investment on housing unit's construction will increase because of high return on investment (ROI); thus, the cost of home-ownership will increase. (Linneman *et al.* 1992)

This rising housing price lets homeowners realize a high return by selling their homes while people with no home-ownership, especially young people in Seoul give up or postpone owning housing unit because home-ownership is not affordable. This is due to the increasing gap between housing prices and their incomes. Due to skyrocketing housing prices in Seoul, households that are headed by individuals aged 30~44 are reported to be less able to afford home-ownership than older people[1]. It is also reported to take 22~24 years to own an apartment of 3-bedrooms and 2-bathrooms in Seoul[2]. So, young people

[1] http://news.donga.com/3/all/20091221/24946023/1
[2] https://member.pressian.com/article/article.asp?article_num=30050609115005&Section=02

have to rent, rather than to own.

The goal of this research is to examine when it is possible for young people in this current economy to own housing unit after getting their jobs. The behavior of average people in purchasing a housing unit shall be simulated. When the normal household in Seoul can own a housing unit with the assistance of a mortgage loan program and how long it takes for the household to be released from the pressure of a mortgage loan shall be investigated together. Furthermore, the optimal range of housing price growth rate for people to own housing units and complete the loan payment will be examined and discussed.

CURRNET STATUS OF SEOUL CITY

According to the statistics of Seoul city (2007), 44.59% of citizens own housing units while 55.14% rent as shown in Figure 1 below. It can be inferred that high cost of owning a housing unit has become a big burden on the family and has resulted in more people renting housing units to save money. Yet, Figure 1 tells us that renting has decreased as time progresses while owning a home has increased. It is thought to be because of a high expected ROI on housing units as housing price rises. From 2005 to 2008, housing prices rose faster than consumption prices so a high ROI was guaranteed (refer to Table 4).

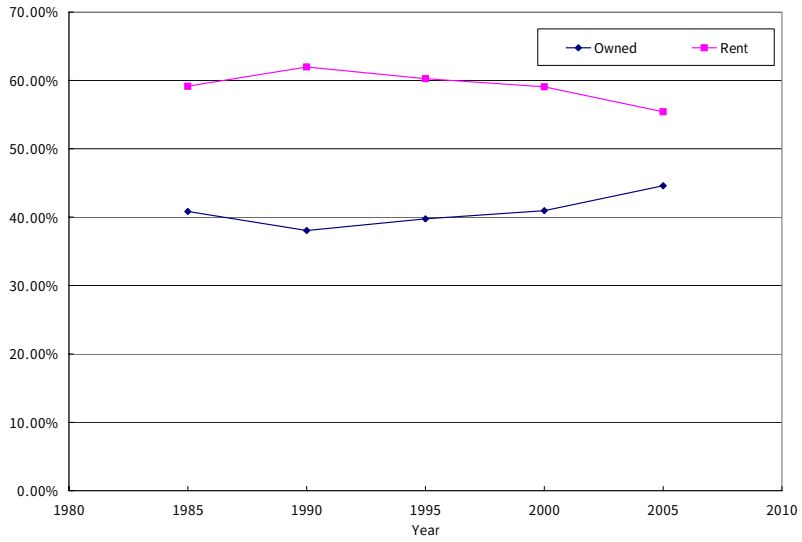

Figure 1 Trend of renting and owning housing unit

Specifically, rent is classified into lump-sum deposit, monthly rent, and free rent (Statistics of Seoul City 2007). Lump-sum deposit is the authentic policy that is popular in Korea. This policy allows tenants not to pay monthly as they deposit a much larger amount of money to the landlords than the monthly rent fee. Landlords can earn money by depositing the money into an interest accruing bank account which would allow the landlord to acquire the monthly rent fee from the interest paid to the account (Hando 1998). Portions of these three rent types are compared in Figure 2 below. It shows that lump-sum deposit is much more popular than monthly rent in Seoul.

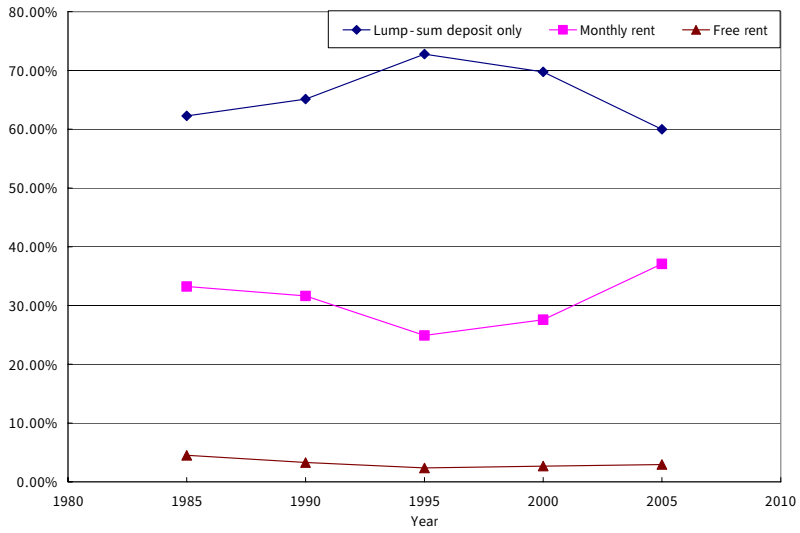

Figure 2 Comparison of rent types

There are five types of housing units in Seoul: a house, an apartment, a row house, an apartment unit within a private house, and a dwelling unit in a non-residential building (Statistics of Seoul City 2007). Table 1 below shows the number of housing units per type. As the number of apartments and apartment units in a private house has increased, total number of housing units has also increased. However, during this increase in the number of the two apartment types, the other types of housing units have decreased. Apartments have taken over 50% of the total housing units. This increase in the number of apartments is partially due to the preference of Seoul citizens to reside in an apartment over other types of housing units and the high expected ROI on an apartment caused by rising housing

prices.

Table 1 Types of housing unit

Year	House	Apartment	Row house	Apartment units in a private house	Dwelling unit in a non-residential building	Total
2005	455,857	1,258,658	146,877	430,502	30,055	2,321,949
2006	450,818	1,307,113	145,278	436,479	30,055	2,369,743
2007	443,702	1,330,658	143,852	442,769	30,055	2,391,036

Source: Statistics of Seoul City 2007

Next, household income in Seoul shall be investigated. In 2007 the average monthly income and expenditure for salary and wage earners' households in Seoul are 3,691.5 and 2,743.2 thousand Korean won. Table 2 and Table 3 below show the specific income and expenditure, respectively. As shown below, monthly income has grown from 2,819 thousand Korean won in 2002 to 3,691.5 thousand Korean won in 2007. Monthly earnings are 3,223.7 thousand Korean won in 2007 and the earnings from the household head take the largest portion in total earnings. This means that the Korean family largely depends on the household head's earnings. Average growth rates of monthly income and earnings are calculated as 5.58% and 6.12%.

Table 2 Monthly income

(Unit: Korean won in thousand)

Year	Income	Earnings				Other
		Total	Household head	Spouse	Other household members	
2002	2,819.0	2,405.7	1,880.3	296.0	229.4	413.3
2003	3,082.1	2,742.0	2,132.5	333.3	276.2	340.1
2004	3,188.9	2,827.7	2,208.0	359.4	260.3	361.2
2005	3,223.4	2,849.6	2,203.6	363.4	282.6	373.8
2006	3,409.8	3,006.6	2,297.4	388.6	320.6	403.2
2007	3,691.5	3,223.7	2,449.3	428.5	345.9	467.9

Source: Statistics of Seoul City 2007

The annual growth rate of monthly expenditure, 4.58%, is lower than that of monthly income. On average expenditure has been 77.15% of income and 87.78% of earnings. The maximum ratio of expenditure to income is 78.0% and the minimum is 76.1%. For the ratio of expenditure to earnings, the maximum is 91.23% and the minimum 86.32%.

Table 3 Monthly expenditure

(Unit: Korean won in thousand)

Year	2002	2003	2004	2005	2006	2007
Expenditures	2194.7	2366.8	2452.5	2515.5	2596.3	2743.2
Consumption expenditures	1904.6	2036.7	2074.8	2124.3	2163.8	2299.6
Food & beverages	508.3	535.2	554.0	559.7	552.0	570.1
Housing	69.8	69.9	68.2	74.8	90.4	92.3
Fuel, light & water charges	90.5	92.9	95.9	101.7	105.4	107.1
Furniture & utensils	78.0	78.0	73.5	86.9	90.8	101.2
Clothing & footwear	106.5	113.4	103.4	112.4	119.5	134.8
Medical care	81.9	95.5	97.8	106.0	106.2	108.5
Education	201.0	237.3	259.1	271.7	264.2	300.7
Culture & recreation	105.8	112.9	111.5	109.9	105.1	119.7
Transportation & communication	302.6	344.7	343.9	352.8	362.7	360.9
Other consumption expenditure	360.2	356.9	367.5	348.4	367.5	404.2
Non-consumption expenditures	290.1	330.1	377.7	391.2	432.5	443.6

Source: Statistics of Seoul City 2007

Table 4 below shows the growth rate of salary, the consumer price index, and the unit price of apartment in Seoul from 2005 to 2008. This table tells us that the growth rate of salary oscillates over years but the consumer price index and the apartment price per $3.3m^2$ are ever-increasing. Average growth rates of salary, the consumer price index, and the apartment price are calculated as 2.97%, 2.95%, and 13.27%. These growth rates shall be applied in this simulation.

Table 4 Trends of growth rate of salary, consumer price index, and apartment price

Year	Growth Rate of Salary (%)	Consumer Price Index	Apartment Price per 3.3 m^2 (Korea won in thousand)
2005	3.29	100	12,405.0
2006	6.00	102.1	15,248.0
2007	4.20	104.8	17,408.0
2008	-1.60	109.1	17,885.0

Source: Statistics of Seoul City 2007

SCENARIO

In Korea, the earnings from the head of household are the largest portion of a family's earnings (refer to Table 2) so it is assumed that the household income comes only from the head of household. Figure 3 depicts the scenario of a head of household for his career and family over life. He gets a job at age 25 and retires at 58. He gets married at 32 and has two children in his lifetime.

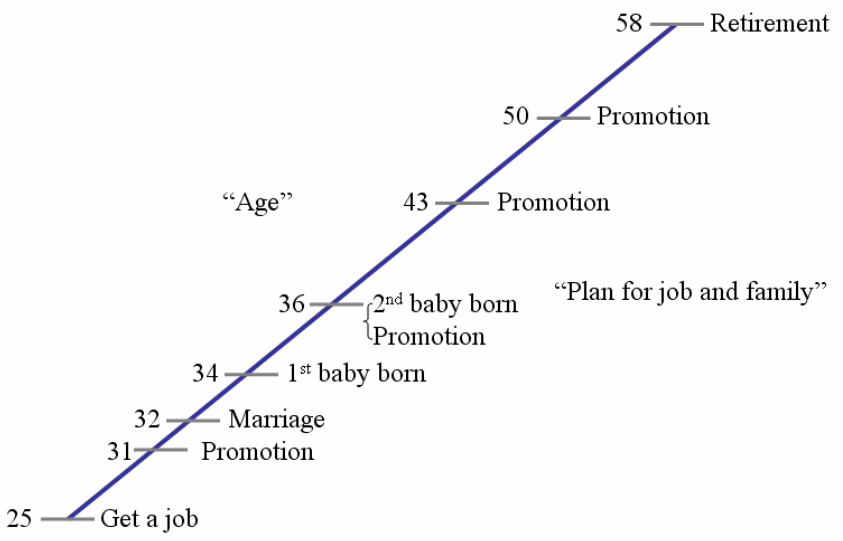

Figure 3 Scenario for job and family

His salary increases as he is promoted. After retirement, he will get another job that provides him with a lower salary. His income is assumed to be as follows:

-age 25 ~ 30: $25,000/year,

-age 31 ~ 35: $32,000/year,

-age 36 ~ 42: $38,000/year,

-age 43 ~ 50: $46,000/year,

-age 51 ~ 58: $50,000/year,

-and age over 58: $25,000/year[3].

The income before retirement shall be increased annually by the growth rate of salary (2.97%). Initial income after retirement is set to be $25,000 and shall be increased by 2.97% annually after retirement age of 58.

Expenditure is assumed to increase as family members increase. The household spends $12,000 annually before marriage, that is, in the case of a single member family, and spends $20,000 per year in total after marriage but before having baby. As one baby is born, annual expenditure of household becomes $24,000 and after another baby is born, the household spends $28,000 annually. These expenditures shall be increased by the annual growth rate of consumer price (2.95%) in this simulation.

Income tax is assumed to be differentiated by the number of family members because the amount of deduction increases as family members increase. Income tax rates are depicted as follows:

-1 family member: 10%,

-2 family members: 8%,

-3 family members: 6%,

-and 4 family members: 4%.

A mortgage loan program can cover up to 60% of the housing price so a household can own a housing unit when it has about 50% of the housing price (40% of the housing price plus other costs). The household deposits the amount of (income minus tax minus expenditure each year) until its deposit becomes more than 50% of the housing price. As its deposit reaches the desired amount, the household buys a housing unit. After buying it, the household pays the mortgage loan, interest and a portion of principal. While paying the mortgage loan, it is assumed that the household shall not deposit money for a home purchase into its bank account.

The interest rates on deposit and mortgage are set as the fixed rates of 4.5% and 6.1%, respectively. The latter is the average interest rate of mortgage loan programs in Korea[4].

[3] For calculation convenience, the currency of Korean won to dollar is assumed to be 1000 Korean won per dollar.

[4] http://www.khfc.co.kr/mortgage/mortgage_rate.jsp

The tax rate for buying housing unit is set to be 6% of the housing price and other cost is 5%. Finally, the housing price is initially set to be 300,000 dollars and shall be increased annually by the growth rate of housing price.

SIMULATION

This research is described by the Causal Loop Diagram (CLD) as shown in Figure 4 below. As the income and the number of family members increase, the expenditure will increase but the residual income will decrease due to the increase in expenditure. The increase in residual income proportionally increases the deposit and as the deposit increases the probability to purchase the housing unit will increase. As people purchase the housing unit, the mortgage loan program begins and people start paying the loan off. This loan payment may decrease the expenditure in the case of slight increase in housing unit values at the beginning of loan payment but will increase it due to the wealth effect that explains the tendency that people consume more as their asset values are expected to increase and make them feel wealthy, though assets are not converted into cash (Lee 2005)[5]. That is to say, as people purchase their housing units whose values are expected to increase, people think they are wealthy so they consume more although they pay the loan off and housing units are not sold and converted into cash.

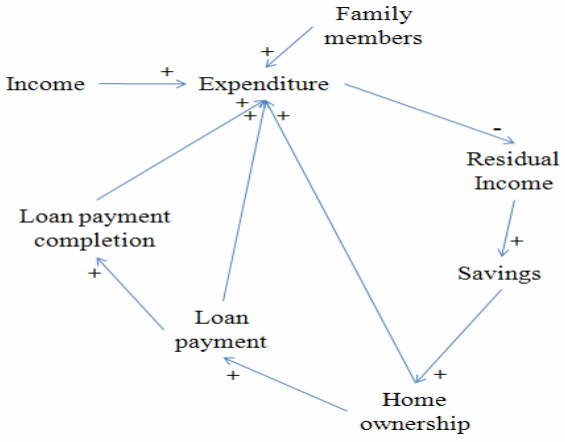

Figure 4 The causal loop diagram

[5] http://en.wikipedia.org/wiki/Wealth_effect

This simulation shall be performed in Vensim™ program according to scenario explained above. The simulation model is formulated to be composed of 3 sectors: salary, mortgage, and deposit and loan payment. The salary sector deals with the dynamics of income, expenditure, tax, and residual income; the mortgage sector deals with the dynamics of housing price and mortgage loan; and the deposit and payment sector deals with the behavior of deposit and loan payment from residual income. Diagrams of the three sectors are shown in Figures 5 through Figure 7 below. The annual income and expenditure are shown in Figure 5 below and the growth rates have been adapted to examine the dynamic behaviors of income and expenditure. In Figure 7, the salary earner's household deposits the residual income into the bank account until the deposit reaches the amount of money necessary to own a housing unit, (total cost for housing-deposit) (refer to Figure 6). Then the household doesn't deposit until it pays off the mortgage loan, both the principal and the interest, completely. After completely paying the loan, the household restarts its monthly deposits.

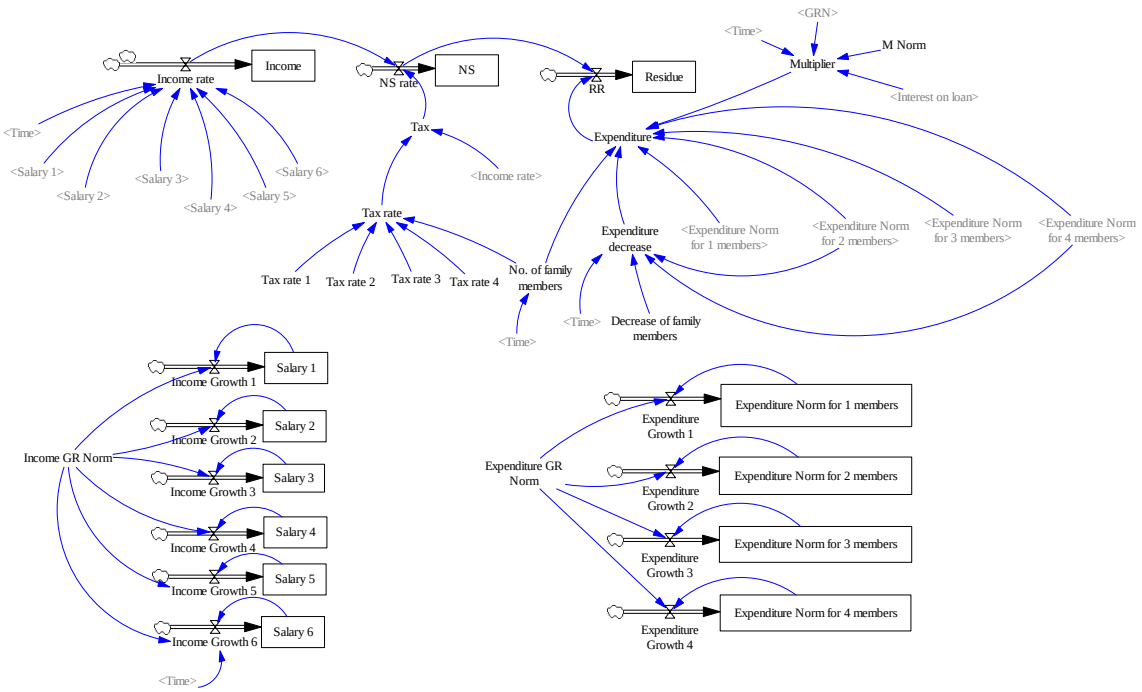

Figure 5 SFD of Salary

There are three main stock and flow diagrams (SFD's) for income, net income (expressed

as “NS”), and residual income (“Residue”) in the upper side of Figure 5. Six sets of salary are set to grow 2.97% (“Income GR Norm”) annually in the lower left side and four sets of expenditure differentiated by the number of family members in the right side are also set to grow 2.95% (“Expenditure NGR Norm”) annually. To express the wealth effect in this model, the multiplier shall be applied. The multiplier in this model is programmed as
“if then else (Interest on loan=0, if then else (Loan period=0, 1-M Norm, 1+M Norm), 1)”
where M Norm is set as 0.1. This equation means if interest on loan and loan period are equal to zero, that is to say, if there is no home purchase, the multiplier shall be 0.9, if interest on loan is equal to zero but loan period is not zero (if there is a home purchase), the multiplier shall be 1.1, and finally if interest on loan is not equal to zero, the multiplier will be one (1), and reflects the wealth effect explained above.

Consider next the structure shown in Figure 6. “Housing price” is the core variable in the mortgage sector of the model shown in Figure 6. Almost all variables inside this sector are related to and are calculated from it. Another important variable is “Gap between loan and total cost” expressed as “(total cost for housing-mortgage loan)” in this simulation. It is the amount of money necessary to buy a housing unit. “Growth rate Norm of housing price” is set as “if then else (Deposit="Gap between loan and total cost", 0, GRN)” where GRN varies for calculation convenience.

In Figure 7, as the household deposits more funds each year, interest on the deposit accrues. The deposit continues to grow from contributions and compounded interest. When the deposit exceeds the required gap between the price of the home and the maximum principal amount, the household buys the housing unit with the assistance of a mortgage loan program and then makes payments on the loan. This means the flow of annual residual income (“RR”) is moved from the “Deposit rate” to the “Loan payment” if the deposit is greater than or equal to the necessary cash to own the housing unit. To simulate this dynamic movement, “Deposit rate” and “Loan payment” are set as “if then else (Time=25, RR + Interest, if then else (Deposit=Gap between loan and total cost, 0, RR + Interest))” and “if then else (Time=25, 0, if then else (Time>25, if then else (Loan=0, 0, if then else (Deposit=Gap between loan and total cost, if then else (RR=0, 0, RR), 0)), 0))”, respectively.

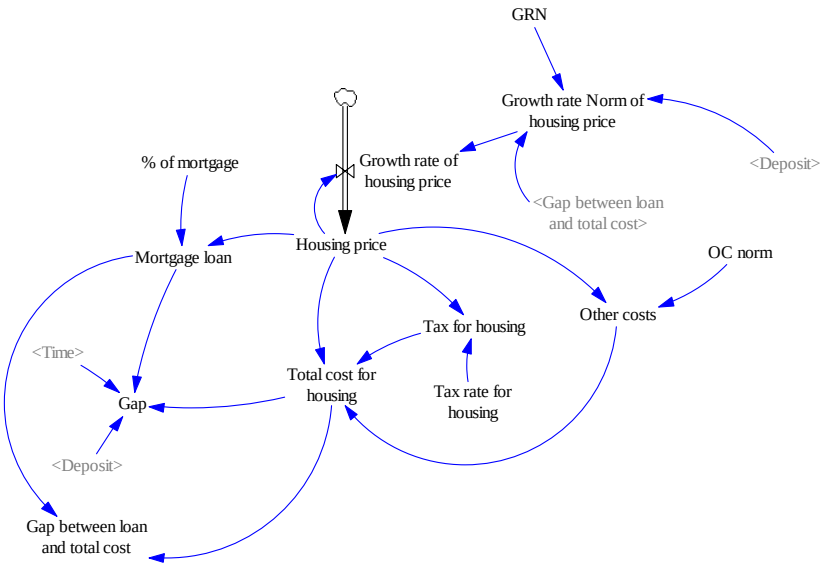

Figure 6 SFD of mortgage

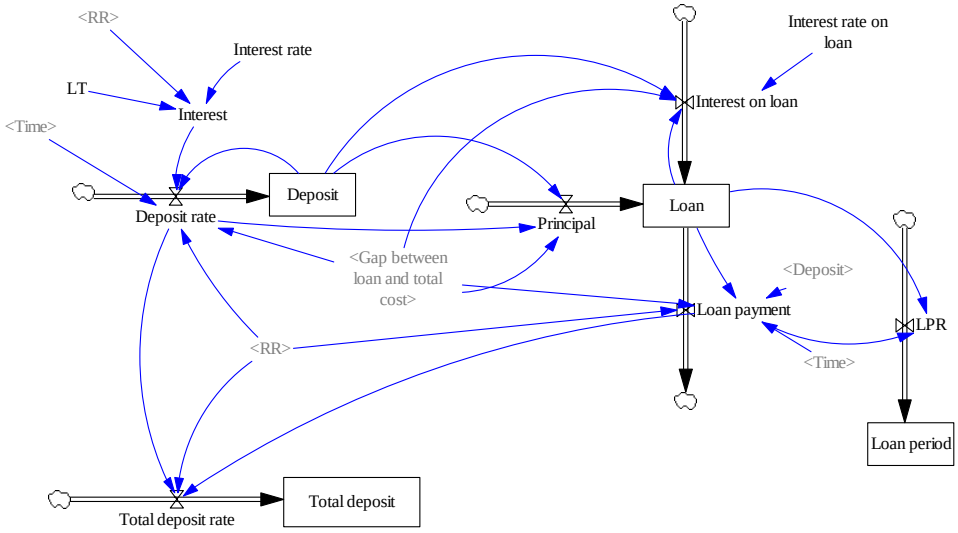

Figure 7 SFD of deposit and loan payment

Let's denote the growth rate of salary and the initial values of six salary sets as follows: growth rate of salary= GR_I =2.97%,

S_1^0 =\$25,000/year, S_2^0 =\$32,000/year, S_3^0 =\$38,000/year, S_4^0 =\$46,000/year,

S_5^0=\$50,000/year, and S_6^0=\$25,000/year where S_i^0 is the initial value of the i[th] salary level.

Salary is assumed to grow by the annual growth rate so the general term of salary except S_6^t is

$$S_i^t = (1+GR_I)^t * S_i^0 \quad (t \geq 25) \text{ for} 1 \leq i \leq 5.$$

As S_6^t is assumed to increase when t>58, it is written as

$$S_6^t = (1+GR_I)^{t-58} * S_6^0 \quad (t > 58).$$

This S_i^t is the annual income rate at t and the sum of income rate is total income so income rate and total income are expressed as follows:

$$IR = \frac{d(TI)}{dt} = 0 \text{ when } t < 25,$$

S_1^t for $25 \leq t \leq 30$,

S_2^t for $30 < t \leq 35$,

S_3^t for $35 < t \leq 42$,

S_4^t for $42 < t \leq 50$,

S_5^t for $50 < t \leq 58$,

and S_6^t for $58 < t \leq 80$;

Total income= $TI = \int_0^t (IR)dt = \int_{25}^{30} S_1^t dt + \int_{30}^{35} S_2^t dt + \int_{35}^{42} S_3^t dt + \int_{42}^{50} S_4^t dt + \int_{50}^{58} S_5^t dt + \int_{58}^{80} S_6^t dt$.

Consider next household expenditures. For expenditures, the growth rate and the initial values of four expenditure norm sets are denoted as follows: growth rate of consumption price= GR_E =2.95%,

EN_1^0 =\$12,000/year, EN_2^0 =\$10,000/year, EN_3^0 =\$8,000/year, and EN_4^0 =\$7,000/year

where EN_k^0 is the initial value of expenditure norm when the number of family members is *k*.

The expenditure norm increases by the growth rate so the general term of expenditure norm is

$EN_k^t = (1+GR_E)^t * EN_k^0$ where $1 \le k \le 4$. Annual expenditure is calculated by

$AE = m * k * EN_k^t$ where the multiplier m is classified by purchasing the housing unit and paying the loan off as follows:

m=0.9 before purchasing the housing unit,

m=1 during loan payment,

and m=1.1 after completing loan payment.

As it is projected into the time frame, it is expressed as $AE = 0$ when $t < 25$,

$m * E_1^t$ for $25 \le t \le 32$,

$m * 2 * E_2^t$ for $32 < t \le 34$,

$m * 3 * E_3^t$ for $34 < t \le 36$,

$m * 4 * E_4^t$ for $36 < t \le 58$,

and $m * 2 * E_2^t$ for $58 < t \le 80$.

Annual residual income is calculated by $RR = IR - Tax - AE$. This goes to deposit rate as the household deposits. Total deposit is expressed as

$$D_t = \int_0^t DR_t dt = \int_0^t RR_t * (1+I_d) dt$$

where D_t is the total deposit, DR_t is the annual deposit rate ($DR_t = RR_t * (1+I_d)$), RR is the annual residual income, and I_d is the interest rate on deposit.

The housing price is calculated by

$$HR_t = (1+GR_{HR})^t * HR_0$$

where GR_{HR} is the growth rate of housing price, HR_0 is the initial housing price, and HR_t is the housing price at time t.

The gap between total cost in buying a housing unit and amount of loan means minimum

deposit amount needed to buy a housing unit expressed as

$G_t = C_t - L_t = 1.11 * HR_t - 0.6 * HR_t = 0.51 * HR_t$

where C_t is the total cost of buying a housing unit and L_t is the amount of loan.

The principal of loan is generally calculated by

$P_t = P_{t-1} * (1 + I_l) - S_t \quad (t \geq 1)$

where P_t is the principal at time t, S_t is the payment of loan, and I_l is the interest rate on loan.

The principal, P_t, increases when $S_t < P_{t-1} * I_l$ and decreases when $S_t > P_{t-1} * I_l$. It can be expressed mathematically as follows:

$P_t > P_{t-1}$ when $S_t < P_{t-1} * I_l$;

$P_t < P_{t-1}$ when $S_t > P_{t-1} * I_l$.

Initial value of the principal is $0.51 * HR_t$ in minimum because the household buys a housing unit when $D_t \geq 0.51 * HR_t$.

RESULTS

In this simulation, the assumed salary variable trajectory is shown in Figure 8 below. After getting a job, income increases incrementally as the individual is promoted but declines heavily after retirement. So, the period leading from the age of getting a job to retirement age is the time to save money for life after retirement. Figure 9 shows that expenditure increases by annual growth rate in spite of the reduced family members after retirement and is varied with the multiplier values. This various expenditure causes the various residual incomes shown in Figure 10. The residual income, that is, the available income to deposit or pay the loan, means that the available salary to deposit before buying a housing unit and pay the principal and the interest of loan after buying it. Figure 10 below depicts the residual income after getting a job. As we can see, during the period of from age 25 to 58, there is a positive available salary but after 58, as salary is reduced after retirement, there is a shortage of available money. To solve this monetary shortage, the individual needs to have some additional jobs or sell the housing unit to replenish funds

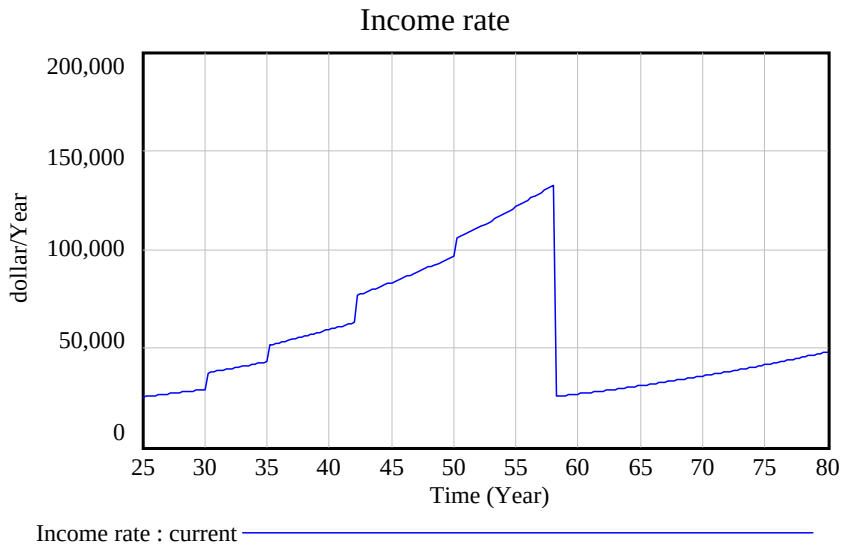

Figure 8 Annual income

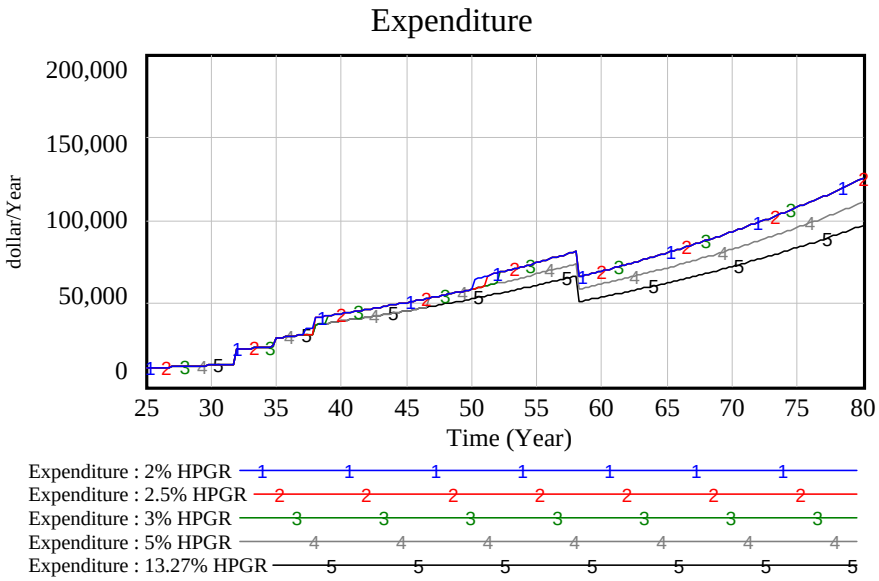

Figure 9 Expenditure with flexible m

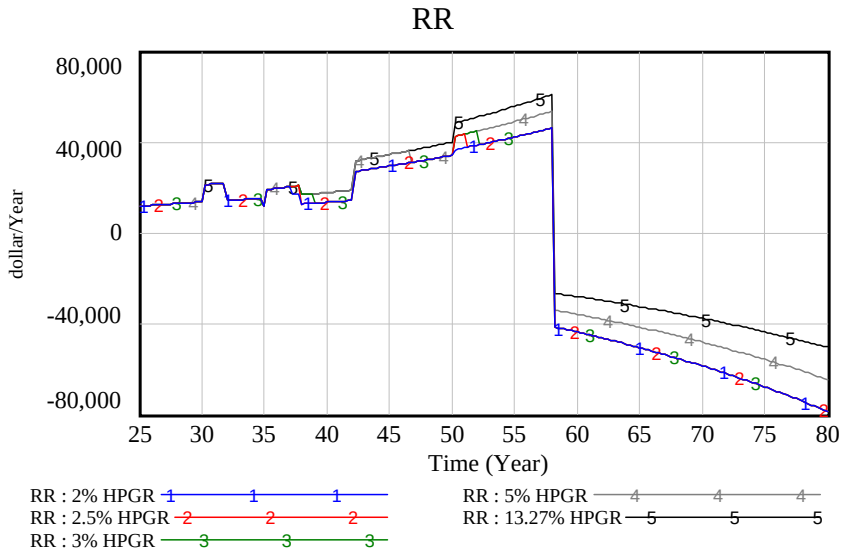

Figure 10 Residual income with flexible m

Figure 9 and Figure 10 above show that 13.27% growth rate of housing price has the least expenditure and the greatest residual income because of unavailable home purchasing within lifetime. In this case, people cannot purchase their housing units until age 80 as housing price grows faster than the income growth rate so the expenditure is revealed to be the least and the residual income the greatest because m=0.9. The case of incomplete loan payment is the second least expenditure and the second greatest residual income (m=0.9 before purchasing and m=1 after purchasing).

First, a simulation shall be performed for the following growth rates of housing price, 13.27%, 5%, 3%, 2.5%, and 2%. This will be performed to determine the optimal growth rate of housing price. This simulation will allow us to know which growth rate of housing price related to those of salary and expenditure is optimal. Figures 11 through Figure 13 are the simulation results. These three figures show us that a 13.27% growth rate of housing price can lead the average Seoul citizen not to own a housing unit because the growth rate of the individual's salary is much lower than that of housing price. In the case of 5% growth rate of housing price, it is estimated to be possible to own at age 46.75 but the head of household is supposed to retire at age 58 so the household can't afford to pay the loan completely. Furthermore, the family income declines after retirement, which results in the household selling the housing unit to replenish funds for life after retirement. In the cases

of 2% and 2.5% growth rates of housing price, the head of household is estimated to have sufficient funds on deposit at age 37.25 and 38, respectively and to pay the loan off perfectly at age 50 and 51, respectively. In the case of a 3% growth rate of housing price, it is estimated that the head of household will have sufficient funds on deposit to buy a housing unit at the age of 39 and pay off the loan perfectly at age 52.

The period of loan, that is, the time it takes in paying off the loan principal is estimated to be 12.75 years in the case of 2% growth rate of housing price and 13 years in the cases of 2.5% and 3% (refer to Figure 13). The case of 2% growth rate of housing price is estimated to have the shortest loan payoff period (time between start of loan a retirement age 58) among five cases.

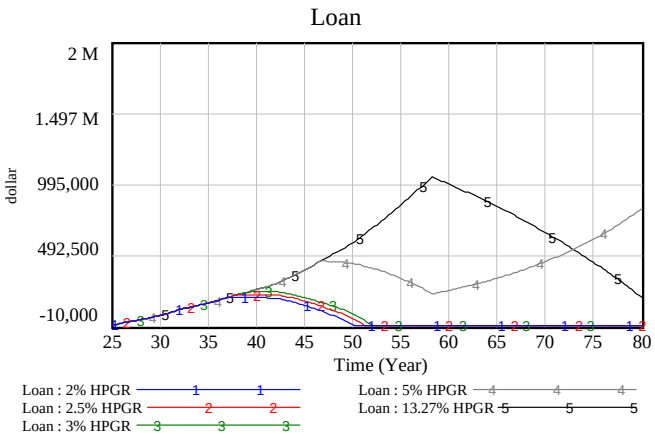

Figure 11 Total amount of loan

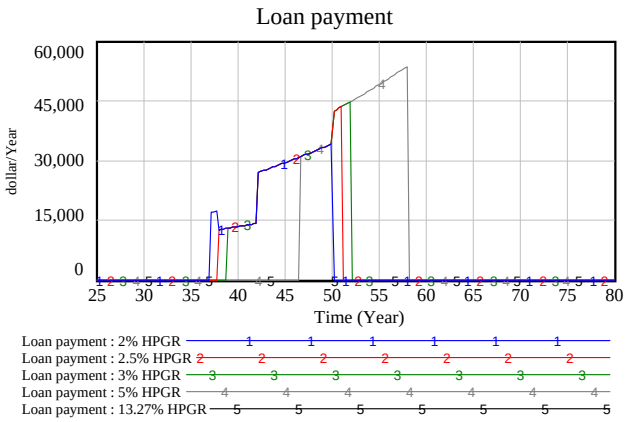

Figure 12 Loan payment

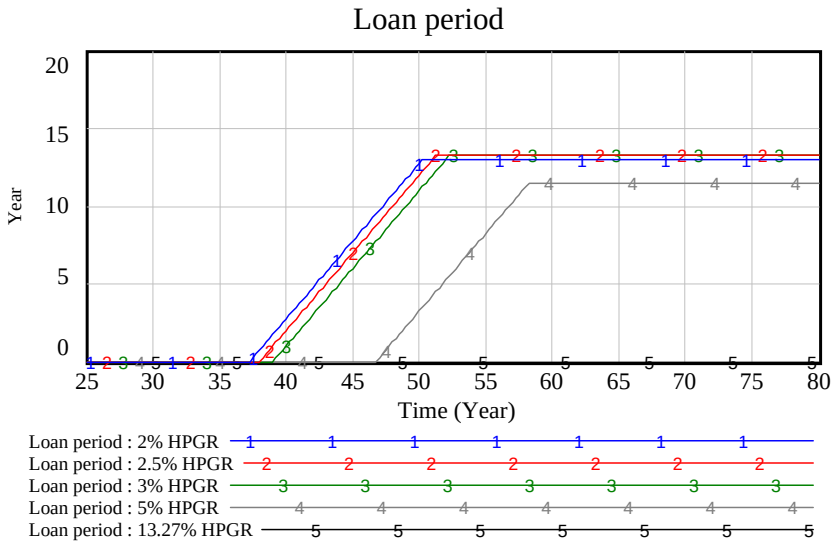

Figure 13 Loan period

To obtain the feasible, incomplete-loan and infeasible ranges of growth rate of housing price, we shall perform simulation varying the growth rate of housing price from 2% to 6% with the interval of 0.5%. Table 5 shows the results of this simulation.

Table 5 The summary of simulation results

Growth rate of housing price	Age at which head of household can purchase house	Loan payment period	Completion of loan payment*	Years remaining to payoff mortgage
2.0%	37.25	13	1	20.75
2.5%	38	13.25	1	20
3.0%	39	13.25	1	19
3.5%	41	12.75	1	17
4.0%	42.75	12.75	1	15.25
4.4%	43.75	13.75	1	14.25
4.5%	44.5	13.75	0	13.5
5.0%	46.5	12.25	0	11.5
5.5%	51.25	7	0	6.75
5.8%	56.75	1.5	0	1.25
5.9%	-	-	-	-

6.0%	-	-	-	-
13.27%	-	-	-	-

* This simulation is performed under the assumption of 2.97% expenditure growth rate and 2.95% income growth rate.

* 1 means the complete loan payment and 0 means the incomplete payment.

Let's see the infeasible range of housing price growth rate to purchase the housing unit. For people to purchase the housing units during their life time, the growth rate of housing price should be below 5.9%. This means if the housing price growth rate is equal to or greater than 5.9%, people will give up their home purchase in their life when the growth rate of expenditure is 2.97% and the income growth rate is 2.95%. The second range to investigate is the incomplete loan range of housing price growth rate. When the housing price growth rate is equal to or greater than 4.5% and is below 5.9%, people will buy and own their housing units but cannot complete the loan payment until 80. In this range, it will be better to sell the housing units than to own to replenish the funds. The timing to sell housing units will be the retirement age at which the fund shortage will occur.

The third range is the feasible range of housing price growth rate. From Table 5 above, the feasible range is revealed to be from 2.0% to 4.5%. In this range, people can purchase the housing units and complete the loan payment before retirement. People will purchase at age 37.25 to 43.75. This means people own their housing units 12.25 to18.75 years after getting jobs and 5.25 to 11.75 years after marriage. The loan payoff period is ranged from 12.75 to 13.75 years in this range of housing price growth rate. Loan payment period is 12.75 years in the cases of 3.5 % and 4% of growth rate of housing price. This means though people can purchase the housing units later than other lower growth rates, people will pay the loan off faster than other cases. The age of head of household at which the loan payoff is completed is ranged from 50.25 to 57.5. This means the head of household will release the burden of loan payoff at fifties. So people will own their housing units with no debt about 20 years after marriage.

CONCLUSION

Simulation results show that if the growth rate of housing price is equal to or greater than 5.9% people shall give up their home purchase, if it is within the range of from 4.5% to

5.9% people will not complete the loan payment though they purchase the housing units, and if it is within the range of below 4.5% people will purchase their housing units and complete the loan payment before retirement under the assumption of 2.97% salary growth rate and 2.95% expenditure increase rate (refer to Figure 14). Regarding the loan period, the minimum is estimated to be 12.75 years in the cases of 3.5% and 4% of growth rate of housing price, and the maximum 13.75 years in the case of 4.4% housing price growth rate.

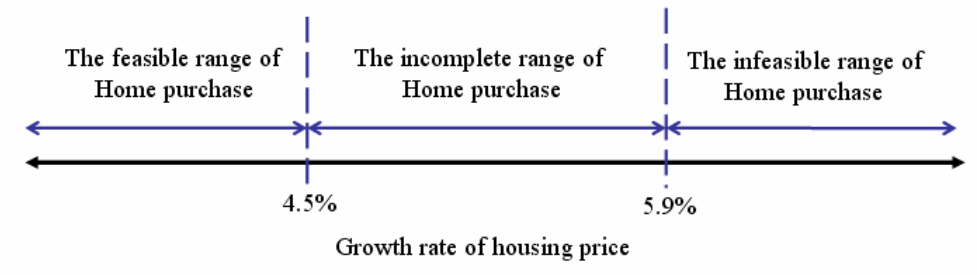

Figure 14 The feasible, incomplete and infeasible range of growth rate of housing price

Housing price is an important determinant of the home-ownership affordability. Rising prices impede prospective home-buyers' accumulation of home down payments, as a percentage of home price. Rising prices also raise the required monthly mortgage payment for a mortgage loan of a given type; as a result, buyers must have higher incomes to meet qualifying criteria. Thus, housing price is very critical in the housing market (Linneman and Megbolugbe 1992). So, Korean government should try to stabilize the housing price to alleviate the increasing burden of owning housing unit, to prevent the derivative effect of rising housing prices, and to stabilize the housing market.

This research has investigated the optimal growth rate of housing price under fixed growth rates of salary and expenditure and fixed interest rates on deposit and loan. In other words, these rates are set as exogenous. Further studies will investigate the optimal housing price appreciation rate under varying and inter-relating the growth rates of salary and expenditure and interest rates. This means these rates shall be endogenous in the future research to provide more dynamics to the model. These relationships can limit the variables--salary, expenditure, interest and housing price--so it may more specifically reflect reality. To inter-relate these rates, economic growth rate can be adapted basically. The source of these rates shall be the economic growth rate and it will let all variables except economic growth rate endogenous and reflect the real dynamism.

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