Development of a Simulation Model for Housing Market Policy Considering Demand-Supply Shift between Sales and Rental Market

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Abstract: The housing market is divided into several sub-markets that operate independently. One of them is the distinction between rental and sales markets. Simultaneously, since the housing is a commodity as well as an asset, it has a close relationship between the rental market and the sales market. Due to the unique structure of Korea, it is difficult to apply the general method to analyze the housing market. This means there is a great deal of concern about side effects from the policy. Actually, the government's subsequent regulation of speculative demand in the future may be necessary to prevent market overheating, but at the same time, there is a fear that the rent will rise. Although changes in policy direction may be inevitable due to changes in market conditions, frequent and sudden changes in policy cause confusion in market participants, causing unrest in the housing market. This study aims to derive main factors and correlation with other housing market factor. These factors will be a base of qualitative housing market model to analyze the market effect of the demand-supply shift. Modeling is based on the system dynamics methodology, which is useful for identifying interactions between variables reflecting various variables in the housing market. The model discussed in this study is expected to provide integrated insight into the key variables of the housing market, away from the monopolistic thinking. It can also be useful as a means of assessing the effectiveness of policies.

Key words: Housing Market, Housing Policy, System Dynamics, Supply and Demand,

1. INTRODUCTION

Housing prices and rents, which are indicators of housing market stability, are affected by the law of demand and supply. To stabilize the market, government implement controlling demand and supply policies such as supply regulation, tax regulation, and financial regulation. The housing market is divided into several sub-markets that operate independently.[1] One of them is the distinction between rental and sales markets. Simultaneously, since the housing is a commodity as well as an asset, it has close relation between the rental market and the sales market. Because of this, the interpretation of the housing market has been difficult and many attempts were made to explain the link between the two markets. The DiPasquale-Wheaton(DW) model is a representative for explaining the link between asset market and space market.[2] However, due to the unique structure of Korea, it is difficult to apply the DW model and it is not easy to analyze the housing market. This means there is a great deal of concern about side effects from the policy.

From 2010 to 2013, the Korean rental market suffered from extreme rent surge. At that time, there was a stagnation in the sales market and the expectation for the sales price increase was low. The rental market was affected by this, leading to overdemand. In order to stabilize rental market that rent continuously increasing, Korean government has been trying to expand the rental supply and has been increasing the number of public rental housing. However, since 80% of Korea's rental house is supplied

by private individuals, multi-homeowners become suppliers in the rental market, and the expansion of public rental housing has been limited due to the financial problems of the government. Thus, the government implemented real estate stimulus policies such as tax deregulation to raise the expectation of rising house prices. They expected the increase of rental housing supply by multi-homeowners and demand conversion from rental to housing market, and to resolve the demand-supply mismatch.[3]

Since then, the sales market, which has been stagnating for a long time, has recovered since 2015. And signs of speculative overheating have begun to appear recently. Since 2016, the Korean government has introduced a regulatory policy to prevent speculative overheating such as designating speculative superheat districts, strengthen financing restrictions. Even with such efforts, housing prices have risen, and they have recently introduced even more intense measures. It is intended to further strengthen the previous regulations and to impose a high transfer tax on multi-homeowners housing transactions to control speculative demand. This set of policies can be seen as a demand control policy to curb the speculative demand and prevent the increase of the selling price.

The rent surge was caused by the recession of the real estate, and as the sales market stimulus was implemented to solve it. After that, the rise of the rental fee is stabilized, but it again caused the market to overheat again. Both the stability of housing prices and the rents are at the core of the stabilization of housing, but they are having difficulty in establishing policies due to the unique rental market form in Korea where investment demand is the main rental housing suppliers. It is necessary to adjust the supply and demand of the sales and rental market for price control. But the two markets are closely related, and the demand-supply adjustment of one market may adversely affect other markets.

From this point of view, the government's subsequent regulation of speculative demand in the future may be necessary to prevent market overheating, but at the same time, there is a fear that the rent will rise again. From this point of view, the government's subsequent regulation of speculative demand in the future may be necessary to prevent speculative overheating, but at the same time, there is a fear that the rent will rise again. If rents rise again to cause housing insecurity, we will have to revise our policies again, repeating the past. Although changes in policy direction may be inevitable due to changes in market conditions, frequent and sudden changes in policy cause confusion in market participants, causing unrest in the housing market.

This study aims to develop a qualitative housing market model to analyze the market effect of demand-supply shift. Modeling is based on the system dynamics methodology, which is useful for identifying interactions between variables reflecting various variables in the housing market. The scope is limited to apartment houses such as apartments that occupy the majority of the housing market. The research process will be framed as : 1) Derive main variables that can explain the relation between submarket (sales-chonsei-monthly rent) through consideration of Korean housing market. 2) Analyze the correlation between main variables and other market variables. 3) Create a causal loop diagram by analyzing correlations between variables. 4) Analyze the shift in supply and demand of the current market based on the causal loop diagram and evaluate the current policies. In this paper, the derivation of major variables and the correlation between variables were performed and set the necessary assumptions for model development.

2. PRELIMINARY STUDY

2.1. A study on Korean housing market

The housing market can be seen to be a combination of sales market and rental market. The Dipasquale-Wheaton model(DW) has been developed to explain more clearly the behavior of the housing market, which is closely related to two markets. In the DW model, the cap rate is considered as the main variable that connects the rent and the house price. Based on the demand-supply law, it suggests a balance point of combining the asset market and the space market.

In Korea, there has been an attempt to analyze the real estate market by recognizing the advantages of the DW model and modifying the model to fit the Korean housing market.[4]. But there was a difficulty in interpreting because of the unique rental system, *Chonsei*. It is Korea 's own housing rent system that the landlord keeps the deposit of 40 ~ 70% of the sales price during the contract period and returns it at the end of the contract. The reason for the existence of this system is that it was possible to utilize the chonsei as an easy funding means for the landlord when the financial market did not develop in the past. [5] In addition, the continued existence of this system after the financial market development in the

1970s indicates that chonsei contracts have benefited the landlord, in addition to simply funding convenience. About this, the previous study showed that the landlord can get capital gains through the purchase of another house by using the lease deposit and can interpret it as the leverage effect of the deposit. The chonsei system was advantageous as a means of saving even for tenants who want to purchase a house in the future, and it was a renting method with less rental cost than monthly rent.

Therefore, there are three sub-markets in the Korean housing market: sales, chonsei, and monthly rent, as shown in Fig. 1. Due to this structure, there is a limit to apply the market analysis methodology that interprets the Korean housing market based on the dual structure of the sales and rental market.[6] In order to reflect this, it is reasonable to analyze the Korean housing market in terms of three-dimensional structure (sale, chonsei, monthly rent). In recent years, the ratio of monthly rent to chonsei has increased due to various socio-economic reasons such as changes in ownership from housing to low rents, prolonged low-interest rates. So, this approach is even more important.
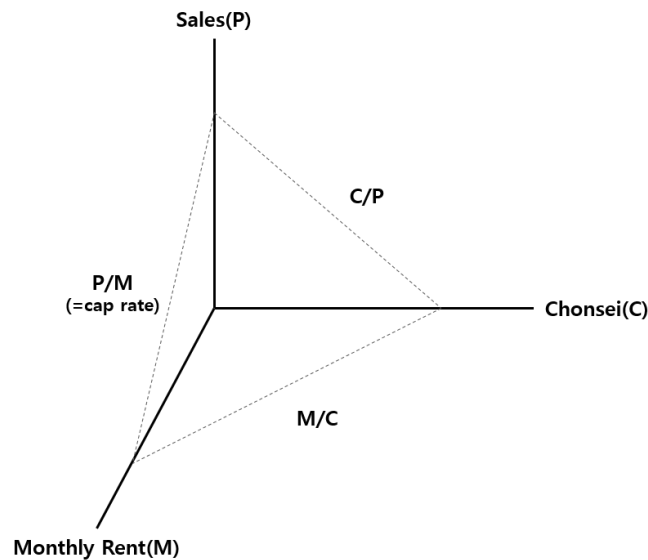

Fig. **1.** Three-Dimentional Structure of Korean Housing Market

It means market indicators to be analyzed also include not only the cap rate(P/M) that links the sale and monthly rent, but also the ratio of chonsei to sales price(C/P) which connects the sales market with the chonsei market, and the ratio of monthly rent to chonsei(M/C) which links the chonsei market with the monthly rent market. Each ratio determined by changes in the market will not function only as the other indicator of market conditions and will affect demand and supply again. For example, investment using high C/P called gap investment has been increasing, and the high M/C is causing the tenant to bear the burden of housing, so the M/C regulation is being implemented.

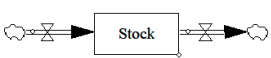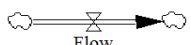### 2.2. Literature review about Korean unique parameter

Previous studies use statistical methodologies such as time series analysis and regression analysis to analyze the correlation between the variables and find out how C/P and M/C are determined by various variables of the housing market. Through this analysis, it was used as a useful indicator for analyzing the unique market in Korea and understanding the current market.

However, these indicators again affect market participants and change demand and supply. In addition, structural changes in the domestic housing market directly affect demand and supply in other markets. Since housing policy is regulated by the shift of demand and supply, systematic thinking is needed to encompass the various responses of market participants to the policy in order to analyze the effectiveness of the policy and to analyze the side effects. The application of monopoly policy makes it difficult to influence other market variables other than the target of each policy.[7] In addition, the housing market is very important to the of sales price expectations of particapants. Previous study cognizes that expectation of sales price increase is an important variable, but it is difficult to quantify. Even in the case of the M/C, there is a problem in the reliability of the empirical approach due to the lack of reliable data and a dynamic approach is needed in the analysis of the housing market.

2.3. System Dynamics

System dynamics is a useful modeling method for analyzing complex nonlinear systems such as industry, economy, and society.[8] It interprets dynamics of system with inherent feedback. The real estate is a complex market where various factors interact. Changes in variables due to market effects will again affect the market. It has a cyclical causal relationship that is repeated. The system dynamics method, which constructs a dynamic relationship model in the analysis of the real estate market influenced by various variables and participants, may be more appropriate than statistical techniques. [9] In particular, the dynamic methodology may be more useful than the empirical methodology because the data are not accumulated enough or are difficult to quantify in the case of the conversion rate(C/P, M/C) or expected price increase rate, which are the main variables of this study. System dynamics approach provides a clear understanding of the various feedback relationships that exist in the Korean housing market. Table 1 shows legends in the causal loop diagram in system dynamics modelling.

Table 1. Legends in the Causal Loop Diagrams

No.	Legends	Expalnation	
1	A ——————+→ B	When other conditions are the same	When factor A increases(decreases), Factor B increases(decreases)
2	A ——————-→ B		When factor A increases(decreases), Factor B decreasese (increases)
3	A ——‖→ B	Including weighted delayed time between two factors	
4	↑ R	Positive feedback or self-reinforcing loop	
5	↑ B	Negative feedback or self-reinforcing loop	
6	Stock	Stocks : Define the state of a system and represent stored quantities, also called 'Levels'	
7	Flow	Flows : Define the rate of change in system states and control quantities flowing into and out of stocks, also called 'Rates'	

3. MODEL DEVELOPMENT

3.1. Assumption of the model

This study develop the model to interpret how C/P and M/C affect on Korean housing markets systematically. For this, causal loop diagrams are created for analyzing influence of C/P and M/C to demand-supply shift. The model is based on and the basic law of demand-supply and the causal relationship between the indicators known in the Korean housing market.
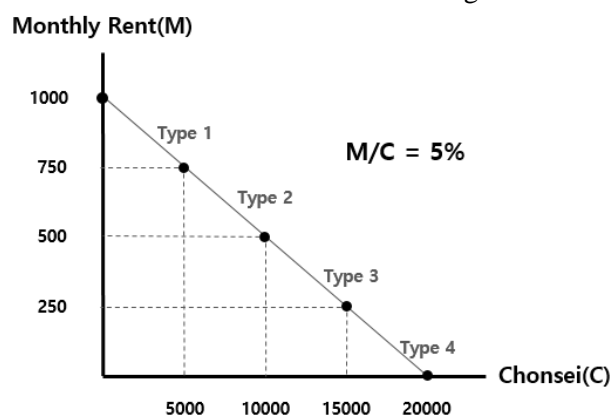

Fig. 2. Example of Various rental contract type in Korean housing market

The assumptions made in this model are as follows: 1) Demand and supply in each market are variables that are shifted into markets and are regarded as stocks. 2) In actual market, a monthly contract has various forms according to the ratio of deposit and monthly rent, as shown in Fig. 2. In this study, 'monthly demand/supply' is regarded as demand and supply to contract with a higher proportion of monthly rent.

3.2. Sales market-chonsei market demand shift

In the sales market in Korea, there are two types of demand; actual demand and investment demand. Actual demand means a person who wants to purchase the house to live. Investment demand refers to the demand that expects profit from increase house price. Two variables are influenced by sales price and expected price increase rate, and effect to both. And actual demand and chonsei demand can shift each other. It means variables in sales market are also effects to chonsei market, and the C/P that links two markets is important.

C/P has been used as the main variable of the study for the analysis of the housing market and it is an important indicator for the policy. The reason why the C/P rises is that the sales price has fallen or the rent price(chonsei price) has risen. If the C/P rises due to the two factors, the demanders in the chonsei market will think that it is better to buy a house, and the tenants in the chonsei market will turn to the actual demand of the sales market. In addition, investment demand will also increase because they can purchase the house using leverage effect by chonsei deposit. As a result, the increase of C/P can lead to sales price rise in the sales market, and sales price effects to C/P again.(B2-1, B2-2)

C/P also effects to chonsei market. As mentioned, the fall in C/P decreases the actual demand, which means an increase in the demand for chonsei. As demand for chonsei increases, suppliers are forced to set higher rent prices, which in turn increases the price of the market. This will cause the tenant to feel the burden of the chonsei price and reduce the demand again so as to operate the self-regulating loop by the demand-supply logic.(B1) But the rent is not the only price that is formed by the demand-supply logic. In general, people perceive the chonsei price that multiplied by the C/P and sales price. Therefore, if the sales price is fixed and the chonsei price increase for any reason, market C/P will rise and the next contract will require a higher price.(R2)[10]
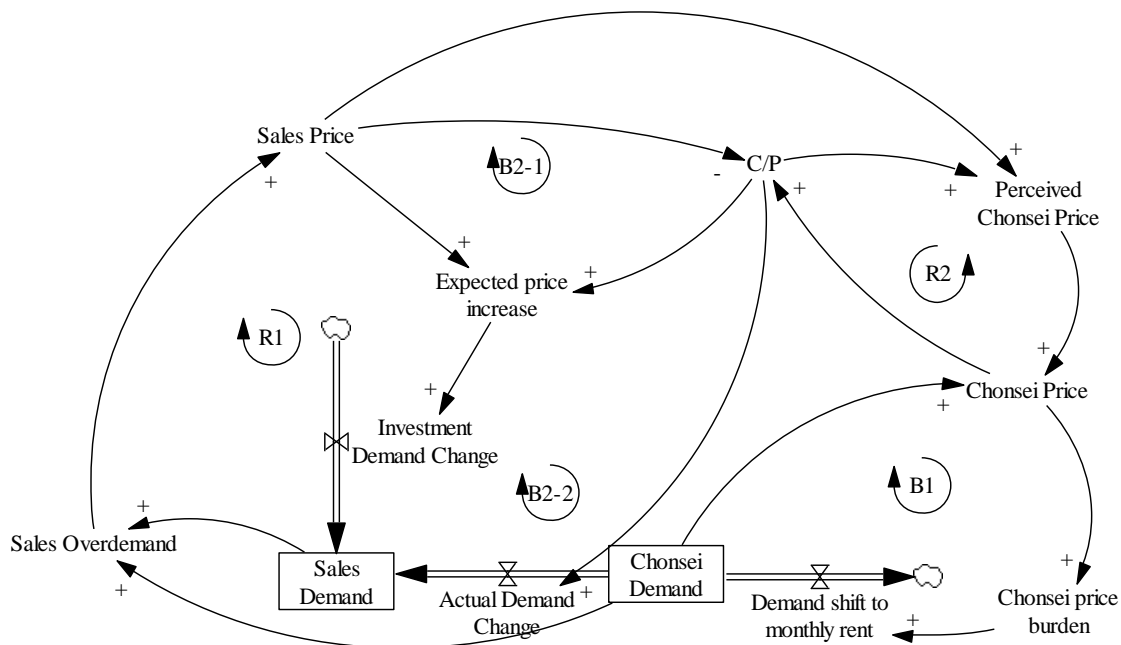

Fig. 3. Sales market-chonsei market demand shift model

3.3. Chonsei market-monthly rent market demand shift

The M/C is an indicator of how much of the deposit is converted into the monthly rent. Therefore, high M/C means that the tenant will pay more rental fee when part of the deposit is converted. The M/C

supply is determined by the difference between the landlord's expected monthly income. Profit of chonsei contract is leverage benefits and interest income from deposits. As we have analyzed in the literature review, the reason why the chonsei survived was that the expectation profit of the chonsei contract was higher than the monthly rent due to the high house price rise. This means that when a tenant asks for a monthly rent, contract occurs at a level similar to expected chonsei profit. The burden on the monthly rent increases the chonsei demand of the tenant and leads to the increase of the chonsei price.

The Korea housing market maintained its high M/C because the R3-2 reinforcing loop was operating as shown in Fig 4. Simultaneously, chonsei price burden from high chonsei price reduces the chonsei demand(B3). So, M/C was about 10%, which is much higher than now. However, as the housing market stagnated and the low-interest rate structure became prolonged, the R3-2 loop operated in the negative direction and the M/C fell to 5% as chonsei income decreased. This reinforcing loop can be interpreted as a structural change in the rental market.
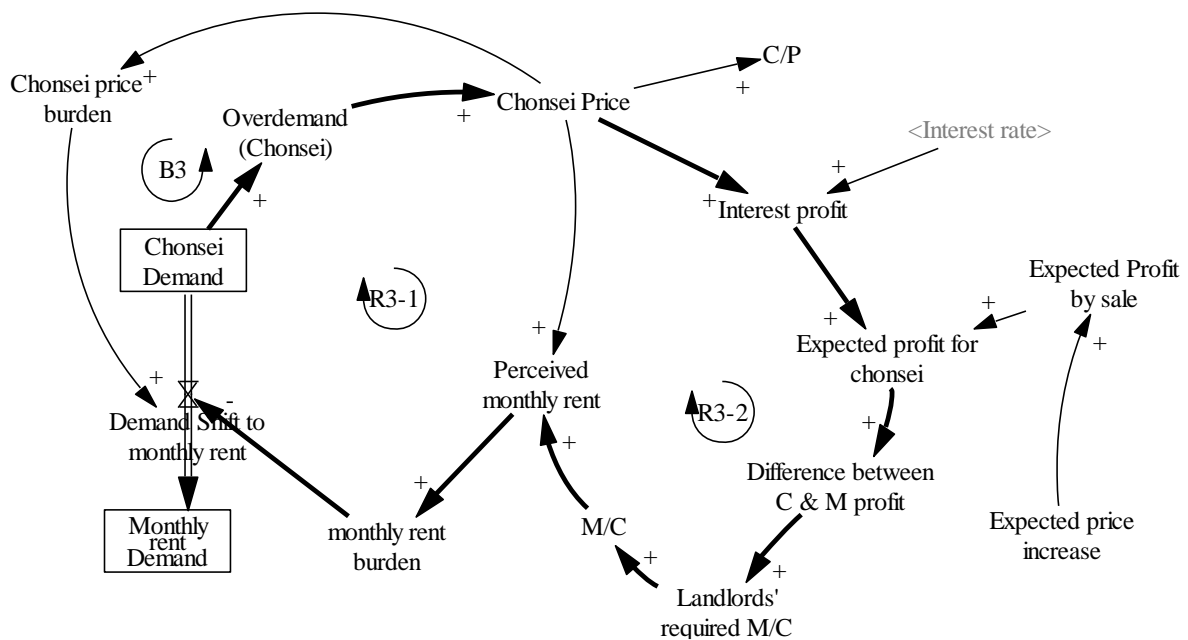

Fig. 4. Chonsei market-monthly rent market demand shift model

4. CONCLUSIONS

In this paper, the system dynamics model has been developed to explain the supply and demand shifts between the Korean sales market and the rental market. The movement of supply and demand is an important factor in determining the price of each market. In addition, the C/P and the M/C, which are connecting each market, were the main variables. These variables and demand and supply of each market are influenced by each other.Thus, the model could reflect the recent structural changes in the housing market, which had a long-term rise in the C/P and a low M/C.

Through this model, the effect of the policy can be anticipated by simulating the Korean housing policy. Recent speculative deterrence policies have an impact on the operation of the feedbacks embedded in the housing market, and thus the behavior of the entire system can be predicted. The model discussed in this study is expected to provide integrated insight into the key variables of the housing market, away from the monopolistic thinking. It can also be useful as a means of assessing the effectiveness of policies.

Further research needs to expand and integrate each models to be able to elucidate demand and supply shift mechanism. After that, policy simulation should be performed with actual market data to show housing market dynamics.

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