
System Dynamics Modeling of Korean Lease Contract Chonsei

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ABSTRACT: Since the sub-prime mortgage crisis from the US in 2008, the Korean housing market has plummeted. However, the deposit prices of the Korean local lease contract, Chonsei, had been increasing. This increase of Chonsei prices can be a threat to low-income people, most of whom prefer to live in houses with a Chonsei contract. In the housing and Chonsei market, there are many stakeholders with their own interest, hence, simple thoughts about housing and Chonsei market, such as more house supply, will decrease house price, would not work in a real complex housing market. In this research, we suggests system dynamics conceptual model which consists of causal-loop-diagrams for the Chonsei market as well as the housing market. In conclusion, the Chonsei price has its own homeostasis characteristics and different price behavior with housing price in the short and long term period. We found that unless government does not have a structural causation mind in implementing policies in the real estate market, the government may not attain their intended effectiveness on both markets.

Keywords: Chonsei, Joensei, System dynamics, Real estate

1. INTRODUCTION

After the 2008, financial crisis that originated in the United States, Korean local housing transaction volume decreased due to an expectation of price decrease. In contrast, price of Chonsei, which is the unique lease contract in Korea, has been increased since 2008[1]. It is highly probable that this phenomenon is from people who defer to buy a new house [2].

Meanwhile in Korea, as the Chonsei contracts are mostly used for low-income people and the young, the current soaring price of Chonsei would threaten them. The government announced various measures to solve the Chonsei shortage, however, these measures did not fully consider the characteristics of Chonsei. Since Chonsei has a profound relationship with housing market, the implementation was not able to see proper effectiveness.

Looking back to past years housing policies, the measures announced at 31th August 2010, was announced to increase tax of capital gains and real estate in order to control the price, however, the policy changed significantly from curbing to boosting real estate market due to the changed regime and financial crisis in 2008. However, the two policies for the Chonsei and housing market was for different reasons but shared the same demands, as if between the activation plans for unsold houses and public lease houses are sharing residential demand. Therefore, the policy may collide effectiveness one another. Similarly to the former example, each policy, which did not consider the complex causations in housing and lease market could not attain proper effectiveness [3],

[4]. Though these housing policies will influence the Chonsei market, the Korean government did not take into account of how Chonsei would be effected by the price. For these reasons, the Korean government policy to decrease(stabilizing) Chonsei prices have not succeeded since 2008. Therefore, this study analyzes the Chonsei market considering the housing market suggesting the behavior of Chonsei price which was effected from housing price.

Previous researches of housing and Chonsei market were about a co-relationship factor between housing and Chonsei market in a timeless condition. Moreover, those researches did not include a continuous feedback relationship of the entire market stakeholder. Every market, including the real estate, has many stakeholders who share similar interests simultaneously. Therefore, it is more effective way that analyzing feedback structure with certain variables which reflects market interests and decision making process, rather than analyzing simple co-relationship between the two variables. In this study, we tried to design a feedback structure diagram of the Chonsei market as well as housing market. Based on developed CLD(Causal-Loop-Diagram), this study also analyzes dynamical approach on the real estate market which could be used as policy estimate measures.

2. LITERATURE REVIEW

2.1 Chonsei Features

Chonsei is a Korean local lease contract which literally means ‘total rent’. Finding traces from a historical

convention records from Japan in 1910, Chonsei have been widely used for the lease contract since the 1940's. During that time, commercial stores were leased monthly and residential houses were rented through the Chonsei contract. Usual land did not use Chonsei contract [5]. The feature of Chonsei contract was that the landlord was first given an upfront lump-sum deposit first from the tenant, which ranges from 50 to 80 percent of the house price; when the contract expires, landlord should refund tenant the entire deposit. It is the key characteristic of Chonsei compared to the usual monthly rent. As this lease contract only exists in Korea, Chonsei researches have done only by domestic people.

Another key feature of Chonsei is that this contract had been used as a private mortgage loan when the landlord does not have sufficient financial aid due to undeveloped financial products in the past. That was estimated as an origin of Chonsei contract by previous researchers [6]. Even though there were various housing financial products since the mid- 1970s, Chonsei did not disappear because the Chonsei lease contract provided some advantages to both landlord due to continuous housing-price booming. During this time, which represents past Korean real estate trend from 1970 to 2008, landlords often used the earned deposit from the tenant to buy a new house. The intention of the landlord is defined as the so-called "Leverage effect of Chonsei" [7]. The tenant has an advantage of saving monthly rent which will be useful to buy a future house due to the Chonsei contract. Most people who wait to buy a first house prefer the Chonsei contract because of the money saving [8], [9].

As the stakeholders' mutual benefits from Chonsei, we can state that Chonsei contract have been able to exist so far. Recently, the number of Chonsei contracts is declining due to the stagnation of housing market price which caused people to expect lower benefits. In addition, low interest rate of bank interests may make the housholder hesitate to renting a chonsei house.

2.2 Previous Researches on Chonsei

The housing market researches, such as the analysis of price trend, have been studied for several years with various methods though, there are not sufficient for Chonsei researches; If it exists, it was about direct impact relationship between variables. Shim [10] illustrated that the housing price has a direct relationship with Chonsei transfer rate which means more people tend to live at Chonsei house when housing price is higher than before. Lee [11] suggested that Chonsei deposit has preceded housing price in sense of increasing Chonsei deposit causes tenant to buy new house. Previous two researches alluded that each price variable has affected each other simultaneously. This is why we need to consider price behavior to analyze with holistic manner and system dynamics approach.

The researches, which have suggested dynamical approaches among the variables in the Chonsei market include housing market, are the following: Ambrose and Kim [6] suggested that Korean Bank policy changes regarding mortgage deregulation lead to decrease of Chonsei house demands. Also, continuous decreasing of



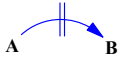
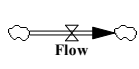
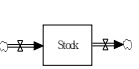
save interests could remarkably reduce the intrinsic price of Chonsei deposit. Lee [7] described capital gains and interest revenue of real estate market by illustrating the concept of "The leverage effect of Chonsei". Cho [12] asserted that having a house means having a real asset; In other words, Chonsei deposit means gaining a financial asset. Therefore, inflation and interest rate in terms of national economy could be the most important elements in analyzing housing and Chonsei markets. In the long term, Chonsei-House price ratio preceded housing price by the lower interest rather than inflation increasing.

All these previous researches have a limitation of econometrics that it is ambiguous to define the stakeholders and hard to understand the complex relationship between them. Therefore, econometrics analysis for the real estate problem may be not appropriate in analyzing how the prices will change when the market environment changes such as policy changes. Similar to the analysis of housing market by Hwang [4], system dynamics approaches can illustrate proper relationships through various causal loop diagrams among the stakeholders.

2.3 System Dynamics

The main method of this research is system dynamics methodology which is useful to describe nonlinear feedback systems including time dependent variables and stakeholders. System dynamics methodology, developed by Professor Forrester, MIT, has become one of the most widely used analytic methods for industrial, economic, social, and environmental systems. One of the strong characteristics of system dynamics is providing a dynamic method to analyze the complex nonlinear systems [13]. System dynamics model could illustrate quantitative result of variables through structural feedback loops with time passage that can be useful to describe environmental changes. Table 2-1 shows the legend of system dynamics.

Table 1 System Dynamics Diagram [14]

Diagram	Description	
	If all other conditions are identical	Variable A's increase (decrease) will increase (decrease) variable B.
		Variable A's increase (decrease) will increase (decrease) variable B.
	Critical time delay is to be included to satisfy the causal relationships between variable A and variable B.	
	Defined as rates or flow that changes stock in system	
	Defined as stock or level as a variable saved as a system result	

microeconomics explains individual level economy, demand model of housing market only takes into account individuals interaction at the limited region where microscopic economics does.

Expected price increase of house (EPIH) variable represents investors expectation of future trade gains as well as first house buyers' (First buy demand) expectation. In this part, the role of the variable is not distinguished since investors' expectation and first house buyers' expectation for the future house price increases have a similar role in terms of boosting housing market.

Model in Figure 1 can only explain individual decisions as if microeconomics does, since the model conceived to explain the individual decision consequences that are not related on national level housing supply decision. With this respect, Figure 1 does not represent the entire housing market, however, national level housing supply will be considered in the Figure 2.

Demand model of the housing market in a limited area regarding individual decision consequences, take reinforcing feedback loop into account with the variables Chonsei demand, House demand, and Existing house price (R1-a, R1-b). Mostly, house price is determined by supply and demand, but if we think about limited area with no additional housing supply, house demand would be the most determinant variable at the market. Existing house price was influenced by price change from the Perceived house price which is changed by house demand continuously. This purposely reflected that house price at individual transaction depends on EPIH, and despite transaction that merely exist in the current depression period, bid price or price estimation of house would respond when market circumstance changes. Hwang [20] suggested price model of housing market is determined by EPIH and demand. R1-a loop at the Figure 1 describes reinforcing loop that EPIH and investment demand continuously enlarging its influences at the housing market.

Most of low income people and the young who do not have any house in Korea prefer living at a Chonsei house in order to save money to buy a new one. As such, housing demand came from Chonsei residence, depicted at the demand model, is actual housing demand (First buy demand) regarding previous reasons, and it has a contrast with investment demands [8], [9]. In addition, accumulated First buy demand which was from Chonsei demand is also influenced by Chonsei-House price ratio and EPIH of certain, limited area (R1-b : transfer demand from Chosei to house). This explains that if Chonsei price is too high compared to house price, first buyer can promote to buy new one, otherwise, if house price decreases, both investors and first buyer defer to buy an additional house due to the low EPIH.

Investor demand illustrates housing demand which is only about future house price increase by the house owner. As this demand only represents the people who already have one or more house, their surplus house will be the supply of lease house market.

Using previous researched housing model, this study defines that Korean house price is determined by pursuing EPIH via house transaction as well as housing

demand and supply. In this point, every house buyer estimate future market circumstances because of their trade gains, however, Similarly after 2008, house price continuously have plummeted. EPIH could not estimate both investors and even first buyer, therefore they could not decide whether to buy a new house. For these reasons, R1 loop, which represent "autonomic activation of the housing market", was disconnected, therefore, housing demand could not be activated with disappearing investment demand, and will cause deficient of supply to the Chonsei house.

3.2 Supply model of housing market

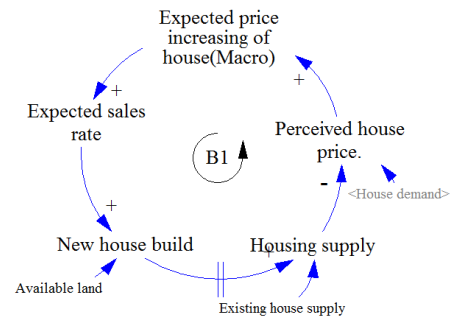


Figure 2 Supply Model of Housing Market

Since Korean domestic housing supply has been deficient, market could be defined as "supply driven market" [21]. The supply model of housing market is different with the demand model of housing market in terms of limitation. The supply model illustrates housing supply sequences at the level of national industry to explain construction of new house in the market. The model shows an inverse relationship between perceived house prices and housing supply by newly house build (House supply $\uparrow \rightarrow$ Perceived house prices \downarrow) [21]. This feedback loop is called the Balancing loop which is defined as every variable's state will be stable after a repetitive circulation. (B1: house price determination by housing supply in a macro level)

EPIH(Macro) is an important factor in estimating Expected sales rate for the house supplier (private company). However, the housing supply of the company appears in 3-5 years later because of the construction period, thus, housing supply at the end of construction would be different from past estimation. For instance, even though a construction company tried to estimate future market environment, as construction takes a long time of approximately 3-5 years, Expected sales rate changed and unsold houses will be inevitable. In addition, current stopped housing supply from the low Perceived housing price will cause house prices to increase and aggravate tenant not to buy new one.

As the supply model explained before, time-delays between EPIH and Construction of new house will break the supply model loop as well as that of the Supply-demand model of Chonsei market which will follow. Therefore, the recent sudden increase of Chonsei deposit has influenced the supply discontinuity of housing market that depicted at supply model as B1 loop.

3.3 Supply-Demand sequence models of housing market.

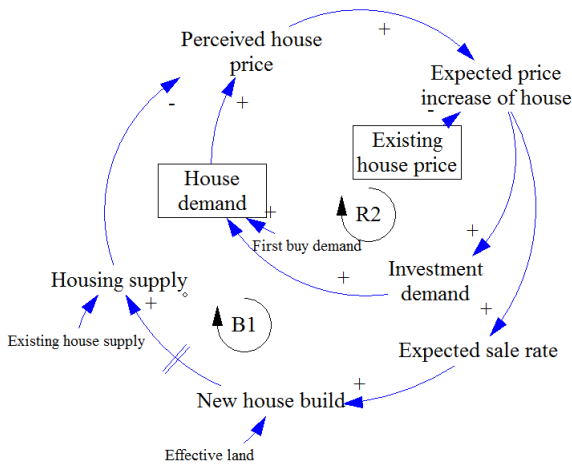


Figure 3 Supply-Demand Sequence Model of Housing Market

In Figure 1 and Figure 2, microscopic house demand model and macroscopic house supply model shares the EPIH as well as in Figure 3 illustrated above. For the individuals housing transaction of the individual, microscopic EPIH(Micro) is a prerequisite for the macroscopic construction of new house. In other words, perceived housing price would be the reason for macroscopic house supply, and microscopic house demand is determinant of the house price. Figure 3 illustrates the concept of “autonomic activation of the housing market” that demand from micro-economy link to macro level housing supply. To be specific, as activated housing market can only be initiated from the first house buyer (individual), then the demand influence the macroscopic house supply chain in Figure 2. This model is intended to obtain the concepts by integrating the macro and micro EPIH variables.

During the housing market stagnation, private company cannot expect to earn profits by housing sales, as well as common people cannot expect to trade gains. Therefore, investment demand, which is based on capital gains, was plunged as well as first buyers’ housing demand. Although housing demand transfer from Chonseidemand exhausted by market stagnation, accumulated Chonseidemand is significant factor to reactivate housing market with Chonseimarket when EPIH expected (R1, R2).

3.4 Supply-Demand models of Chonseid Market.

After first house buying, second, third house demand is an Investment demand which will always be the supply in the lease market. Meanwhile, the investor will find the most profitable lease contract compared to monthly rent with Chonseid deposit regarding bank interest rate. Lately, interest rate for saving is too low to get proper profit from Chonseid deposit, hence, Expected monthly rent revenue may be higher than expected Choseid revenue. Thus, current number of monthly lease contract is much greater than that of Chonseid. However, when the investor used

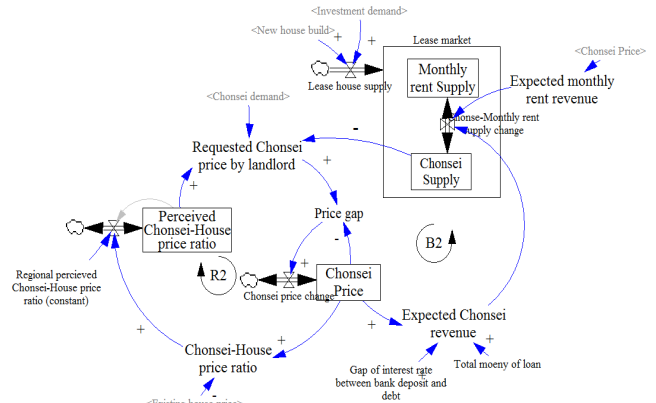


Figure 4 Supply-Demand model of Chonseid market

the loan to buy an additional house, Chonseid deposit from the tenant is likely to be used for debt. Not only in this case, but also Chonseid deposit could be used for other investments. This point is the definition of “Leverage effect of Chonseid” [7]. Regarding leverage effects of Chonseid deposit, it would be bigger than monthly rent revenue if considering debt interest rate, and it would be more profitable if investors loaned more money. In this case, investors additional house easily became Chonseid supply (B2: Leverage effect of Chonseid supply).

Requested Chonseid price by Landlord is offered deposit price by landlord, and determined by Chonseid supply, Chonseid demand and perceived Chonseid-House price ratio(PCHR). Although Requested Chonseid price by Landlord is an important factor for the deposit price, if the request of Chonseid deposit is much bigger than local market’s trend, contract will not succeed. Thus, decision of landlord is based on the PCHR which is accumulated by the previous contracts condition (Unlike PCHR, Chonseid-House price ratio is changing instantly from every individual transaction in order to describe each deal information influence PCHR).

Regional Chonseid price range have been determined by PCHR, for instance, a small-middle city’s Chonseid deposit is about 70-80% of the house price, which is a stark contrast compare to Seoul, and big metropolitan is about 50% [1]. In addition, since PCHR has a homeostasis characteristics in which people use this variable to estimate the implicit price band, PCHR cannot be change easily (R2: Homeostasis price forming by PCHR).

Meanwhile, Supply-Demand model of Chonseid market can explain social phenomenon from price changing sequence of Chonseid and house prices. First, if the Existing housing price decreases, the Chonseid-House price ratio would be constantly low; However, PCHR will not change immediately, due to its homeostasis characteristic mentioned above. Also, decrease in the Existing housing price to decrease causes Chonseid price decrease in a short time; investment demand decreases Requested Chonseid price by Landlord because of the EPIH causes Chonseid demand increase and supply decrease in a long time. (R2 ↓, B2 ↓)

On the other hand, if Existing housing price increases, Chonseid price will increase in a short time, however,

investment activation in a housing market can decrease Requested Chonseil price by Landlord ($R2 \uparrow$, $B2 \uparrow$).

4. VALIDATION

All part of models were developed based on the causation of previous researches. However, as several previous researches do not fully considered feedback circulation, but only simple causation between variables, they could not represent market behavior as well as implicit effects. Table 3 shows the researched causations which were used in the model.

System dynamics modeling methodology is based on experts' knowledge with inferring sequences with partial causations. As such, system dynamics model could be validated by expert system validation process. The Expert model used to validate in 3 processes [22].

First, during the face validity analyzing process, panel validated the model in point of holistic systemic appropriateness. Second, in a subsystem validity analysis process, each part of model was validated in point of relevant variable usages and model limitation. At the first process, panels' opinion was corresponded with this research's problem statement as well as model description.

At the second process, subsystem validity, there were a few suggestions for the limitation. For instance, for the housing supply model, as the panel suggested input tax and interest variable; the model refined to input an exterior variable.

Last, at the input-output process, reliability of model was discussed by using house and Chonseil price index from KB bank. Setting house price index as an input value, the Chonseil price index was observed for congruency with the developed model.

Figure 7, provided by KB bank, presents domestic price of large, medium and small apartment house price index. Setting the price of June 2011 price as a 100, past prices were represented in a ratio graph. However, as the graph had an intrinsic characteristic that converged to 100 in June 2012, last period data were not appropriate to use. From January 2007, house price was observed to have an increasing trend which changed into a stagnation (①). After October 2008 when US mortgage crisis appeared, house price decrease (stagnation) was observed(②). When we consider Figure 7, graph shows relationship between house prices and Chonseil prices. Since housing and Chonseil price increased at the same time of ①, it did not mean decrease of Chonseil-house price ratio; However, Chonseil-house price ratio decrease was observed in time ②(housing price increased but Chonseil price decreased). Hence, house price increase at ① led to increase of investment demand and housing market autonomy at ② that soon caused increase Chonseil supply; consequently, PCHR decreased. Similarly, at the time of ②, ③, house price decrease causes immediate Chonseil price decrease, after then, Chonseil price ratio increase continuously. In sum, housing price increase at ① periods, led to decrease Chonseil-house price ratio at ②; House price stagnation(②,③) periods brought about increase of

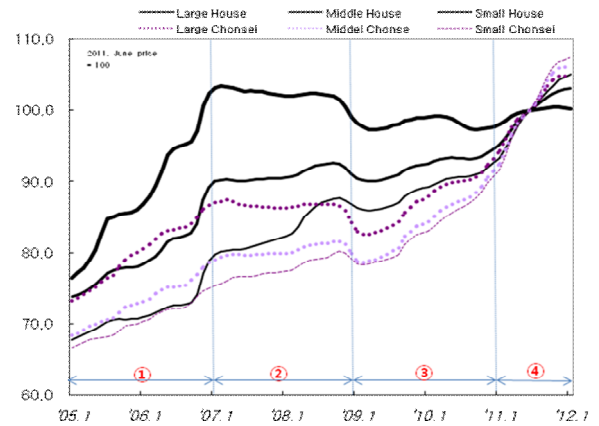


Figure 7 National Apartment House, Chonseil Price Index

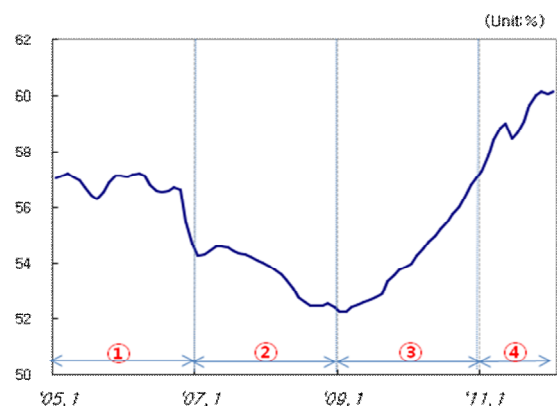


Figure 8 National Apartment House-Chonseil Price Ratio

Chonseil-house price ratio of time ③. This is due to the homeostasis of PCHR and low EPIH.

Price decrease of Chonseil is more sensitive than price increase because of those variables. Even though house price does not decrease, house demander and investor will not buy a house because of none EPIH. Therefore, the demand of Chonseil will increase and Supply of Chonseil will decrease due to the lack of both new house build and Investor demand.

The model had been verified in three steps. The price model of domestic housing market and Chonseil market were verified by validation method with expert panel statistics.

8. CONCLUSIONS

This research analyzed the Korean Chonseil market and housing market as a structural conceptual model including several stakeholders and their interests using system dynamics method. In this research, we defined that soaring Chonseil price was due to several reasons, which is hard to estimate its behavior: the homeostasis of PCHI, leverage effects of Chonseil deposit and autonomy of the housing market. With the developed model, we evaluated the governments past measures for Choseil.

Although developed models were based on real market sequences, the models cannot represent the entire

complexity of the market (Limitation of each model has been described above specifically). In addition, due to its limitation, the model could not estimate future prices, but only takes into account of relative price behavior in regard to housing price. Plus, demographic change in Korea was not considered in the model as well as significant changes in Korean economy.

In spite of these limitations, we suggested price stabilization method which is from the point of housing autonomy rehabilitating by encouraging Chonseil demand to buy new houses. In addition, we provided divided market diagram in regard to feedback interactions, in order to understand market mechanism and policy impacts. For the future study, we will develop quantitative models by improving previous models to make a more secure and reliable model.

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