Korean Real Estate Market Mechanisms and Deregulation of Mortgage Loans: Qualitative Analysis

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Abstract

   The Korean real estate market is currently experiencing a slowdown due to the global economic crisis which has resulted from subprime mortgage lending practices. In response, the Korean government has enforced various policies, based on intend to deregulate real estate speculation, such as increasing the Loan to value ratio (LTV) in order to stimulate housing supply, demand and accompanying housing transactions. However, these policies have appeared to result in deep confusion in the Korean housing market. Furthermore, analyses for housing market forecasting—particularly those which examine the impact of the international financial crisis on the Korean real estate market—have been partial and fragmentary. Therefore, a comprehensive and systematical approach is required to analyze the real estate financial market and the causal nexus between market determining factors. Thus, with an integrated perspective and applying a system dynamics methodology, this paper proposes Korean Real Estate and Mortgage Market dynamics models based on the fundamental principles of housing markets, which are determined by supply and demand. As well, the potential effects of the Korean government's deregulation policies are considered by focusing on the main factor of these policies: the mortgage loan.

Keywords: System Dynamics, Real Estate Market, Mortgage Loan, LTV

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Introduction

   In the past three years, the subprime mortgage crisis, caused by an increase in mortgage delinquencies particularly among riskier loans, has resulted in the international financial crisis. Consequently, homeowners, lenders, financial institutions, and investors have become anxious that an economic recession similar to the Great Depression could occur (Lander et al. 2009). Korea is no exception to this rule. In fact, the Korean real estate market has also experienced a cooling down of business because of the global economic crisis that has resulted from subprime mortgages.

   However, from the beginning of 2000, housing values in the Korean real estate market sky-rocketed, and the Korean government accordingly regulated speculative demand in order to burst the housing price bubble (Cho & Ma 2006). Particularly from early 2005 to late 2007, the Korean government adopted policies, which restrained housing loans, such as increasing interest rates and limiting the amount of loans (i.e., Loan to value Ratio decrease or Debt to Income decrease). Furthermore, as the Korean secondary mortgage market has not been activated, it has been assumed that a real estate market crisis such as the subprime mortgage crisis, would not occur in Korea. Yet, as a result of this subprime mortgage crisis, the Korean real estate market has suffered from a decrease in house values and housing transactions. Consequently, in the second half of 2008, the Korean

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government was forced to adopt boosting policies, based on deregulating real estate speculation, such as increasing the Loan to Value ratio (LTV) and Debt to Income (DTI) in order to stimulate housing transactions and boost house prices. However, these policies could potentially bring about a second subprime mortgage crisis in Korea because the over-collateralized, high risk securities, which are circulated in a secondary mortgage market, would be disastrous to the market, as no one would be able to determine the true value or risk of these derivatives (Lander et al. 2009).

Therefore, utilizing an integrated point of view and applying system dynamics modeling, this paper aims at proposing several Korean real estate and mortgage market dynamics models based on the fundamental principles—determined by supply and demand—of housing markets. First, a universal real estate and mortgage market model is developed and the impact of the Korean government's deregulation policies is analyzed while focusing on mortgage loan expansion, which is the main factor of these policies. Second, a systematic approach is used to comprehensively analyze the Korean real estate market and the causal nexus between market determining factors.

Overview of Korean Real Estate Market
Korean Housing Market Structure

In general, house price is determined by the supply and demand function, which is an acknowledged market principle. As illustrated by Fig.1, *Housing Supply* includes *Newly-Built Housing* and *Existing Housing for Sale*. *Housing Demand* is derived from the sum of both *Actual Demand* and *Investment Demand*. *Actual Demand* represents a means of living and *Investment Demand* refers to the demand for property accumulation.
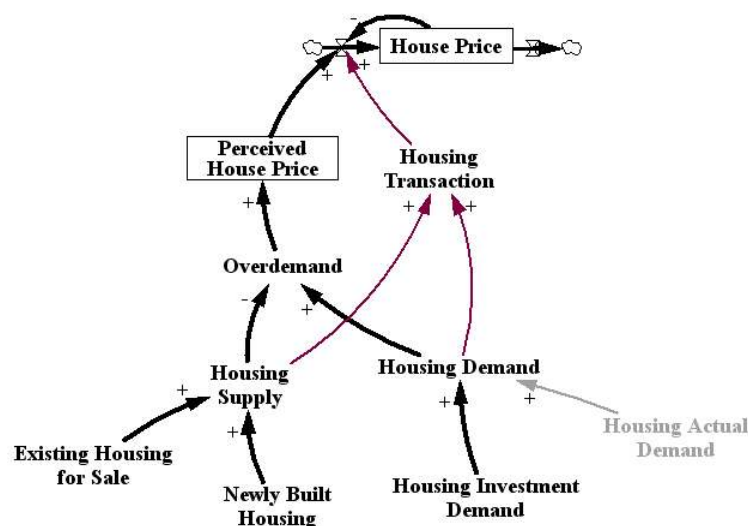

Fig. 1. House Price Determinants

Then, *Perceived House Price* (which is defined as the consumer's perception of the possibility of price volatility before *House Price* is determined) is derived from *Overdemand*, which subtracts *Housing Demand* and *Housing Supply*. This *Perceived House Price* is transformed into actual *House Price*, when supply and demand are converted into Housing Transactions.

On the other hand, this model is based on the assumption that *Housing Actual Demand* cannot play an important role, as the KB Bank, which is the leading private bank in Korea, finds that most consumers (who make up housing demand) perceive the house as a means of property accumulation (KB Bank 2006).

Real Estate Financial Market

Real estate finance plays an important role in the housing market. While customers borrow money and credit for the purpose of developing or acquiring real estate property, financial agencies (e.g., commercial banks, mutual saving banks, other lending institutions) make profits through mortgage loans.
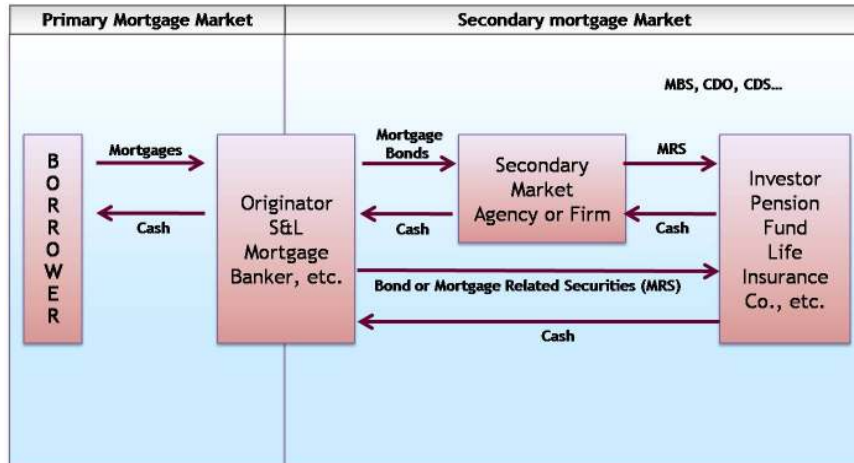
Fig. 2. Mortgage Market Structure [Clauretie & Sirmans 2003]

As demonstrated in Fig.2, mortgages originate from initial lenders such as thrifts of mortgage bankers in the primary mortgage market, while some thrifts and all mortgage bankers sell these loans in the secondary market. Agencies and firms that purchase mortgages in the secondary market most often raise the funds required for such purchases by issuing bonds or other types of debt instruments (Clauretie & Sirmans 2003).
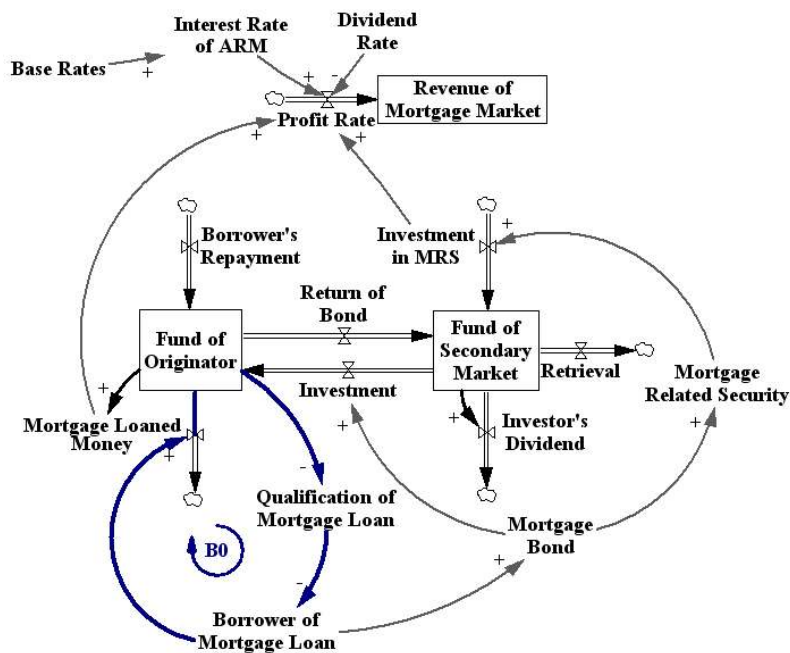

Fig. 3. Real Estate Financial Market Structure

This study expresses the general real estate financial market structure, with a focus on the mortgage market, using System Dynamics (SD) modeling, as illustrated by Fig.3.

The *Fund of Originator* refers to the cash liquidity of primary mortgage agencies. Similarly, *the Fund of Secondary Market* signifies the cash liquidity of secondary mortgage markets (e.g., Freddie Mac and Fannie Mae, Investment Banks). A *Mortgage bond*, which is defined as the bond secured by a mortgage on a property, is backed by real estate or physical equipment that can be liquidated. *Mortgage Related Securities* (MRS) refers to the sum of mortgage-backed security (MBS) and its derivatives. An MBS is an asset-backed security whose cash flows are backed by the principal and interest payments of a set of mortgage loans. Payments are typically made on a monthly basis over the life time of the underlying loans (Clauretie & Sirmans, 2003). Also, a derivative security derives its value from another security, index, or financial claim. Because the value of

mortgage-backed securities (MBS's), such as MPTs and CMOs, are based on pools of mortgages, both are referred to as "derivatives". There are many other derivatives such as options, swap, and so forth (Fischer 2005)

Furthermore, the mortgage market earns profits by establishing a commission fee between the *Borrower of Mortgage Loan* and *Investment in Mortgage Related Securities*. In other words, the financial market lends a mortgage loan to the borrower at the interest rate on loan (i.e., the interest rate on loan is represented by the *Interest of ARM* because the *Adjustable Rate Mortgage* is in common use in the mortgage market) related to the *Base Rate*, while issuing the securities at *Dividend Rates* lower than the interest rate on loan. Therefore, the more financial agencies lend mortgage loans and issue mortgage related securities, the more profits these agencies make. Thus, financial agencies continue to lend mortgage loans until they lack fund liquidity (Loop B0). However, if financial agencies issue MRS to ensure fund liquidity and investors buy these securities, financial agencies will lend mortgage loans and issue MRS much more frequently.

Current Real Estate Policies in Korea

Currently, the Korean economy is suffering from a business recession resulting from the international financial crisis. In particular, the Korean real estate market is being negatively impacted by the decrease in housing transactions, the fall of house prices, and by the continuous occurrences of unsold apartments. In response, to revitalize the real estate market, the Korean government has adopted boosting policies which are based on the deregulation of real estate speculation.

On October 21, 2008, the Korean government announced a comprehensive real estate program which removed the Excessive Real Estate Investment Areas (i.e., the areas where a housing price bubble may occur due to high speculative attractiveness). In the Excessive Real Estate Investment Areas in Korea, 40% of the Loan to Value Ratio (i.e., the amount of a first mortgage lien as a percentage of the total appraised value of real property; LTV is one of the key risk factors that lenders assess when qualifying borrowers for a mortgage) and 40% of Debt to Income (i.e., the percentage of a consumer's monthly gross income that goes toward paying debts) are applied to mortgage loans which are below or above the 10-year-stipulated time and 6 billion won.

However, when an Excessive Real Estate Investment Area is transformed into a general area, the LTV will be increased to 60% and the DTI will be removed.

System Dynamics

System Dynamics is a modeling tool that provides an understanding of strategic problems in complex dynamic systems.

Table 1. Causal Loop Diagram [Sterman 2000]

Causal relationship	Relationship between effective factors	
A ——+——→ B	When another conditions are same	When Factor A increases (decreases), Factor B increases (decreases)
A ——-——→ B		When Factor A increases (decreases), Factor B decreases (increases)
A ——⊢——→ B	Including weighted delayed time between two factors	

An SD model provides system users with insight into the feedback processes and dynamic behavior of a system. Also, this model is made up of feedback loops and their variables, which are known as causal loop diagrams or influence diagrams. Feedback loops can be divided into two categories: (1) a balancing loop which is a goal seeking structure of the system that causes balance and stability, and (2) a reinforcing loop which generates a growth process in which action builds a result that generates still greater action (Ahmad & Simonovic 2000)

System dynamics modeling enables a comprehensive solution and systematic approach to analyze the impact of Korean real estate policies

Policy Model

Housing Investment Demand & House Price

According to general market principles, there is a significant causal relationship between *Housing Investment Demand* and *House Price*. As shown in Fig.4, the *Expected Profit from Trading* is an essential factor to explain this relationship. *Expected Profit from Trading* is defined as the expectancy of householders' profit production when trading houses. Also, *Expected Profit from Trading* is determined by time variations of *Perceived House Price* and *House Price* formed by *Housing Transactions*.

In the housing market, when *Housing Investment Demand* is high, customers expect future house prices to increase (i.e., *Perceived House Price* increases). Therefore, more powerful speculative demand will drive the market (Loop R1).
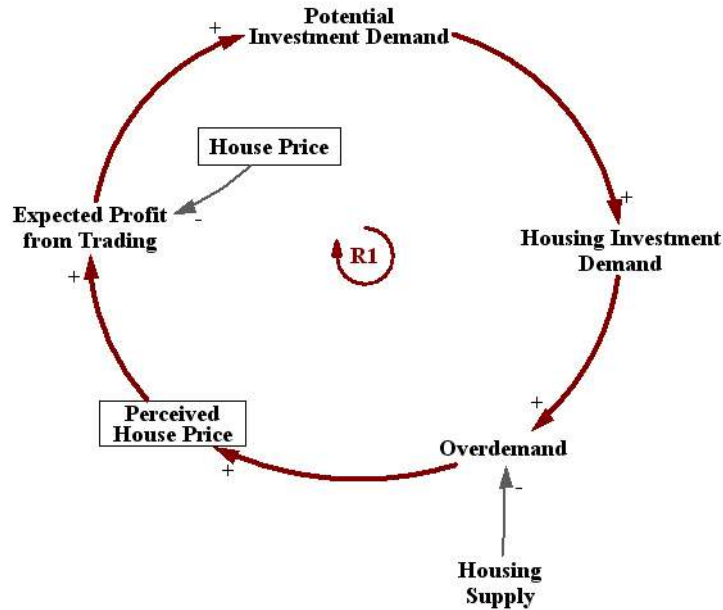

Fig. 4. Housing Investment Demand and Expectancy of House Price Rising

However, as shown by Fig.5., if *Perceived House Price* is transformed into *House Price* as a result of *Housing Transactions* being activated, *Expected Profit from Trading* decreases (Loop B1-a, B1-b). Accordingly, *Investment Demand* is controlled because investors do not expect future prices to increase when *House Price* seems to have arrived at a definite point.
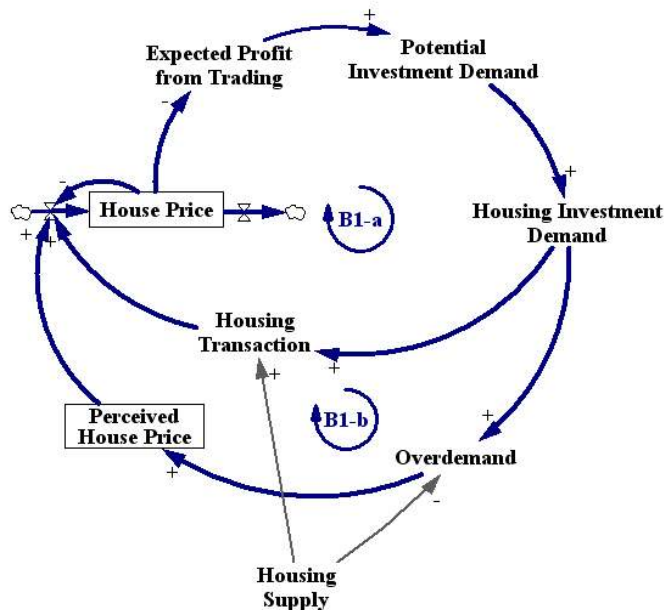

Fig. 5. Housing Investment Demand & House Price self-control

Mortgage Market Behaviors

In mortgage markets, primary financial agencies lend borrowers mortgage loans to make profits. As illustrated by Fig.6., primary mortgage agencies (i.e., *Fund of Originator*) lower the *Qualification of Mortgage Loan* (i.e., the amount of loans and credit rating which is possible to lend), so that they can lend more loans and make more profit. This means that while these agencies begin to acquire more mortgages, they also experience actual money shortage. To solve this problem, primary mortgage agencies create mortgage bonds and sell these to secondary mortgage agencies or other private investors in order to ensure fund liquidity (Loop R2-a). Consequently, they are able to continue lending more mortgage loans and subsequently obtain more profits.
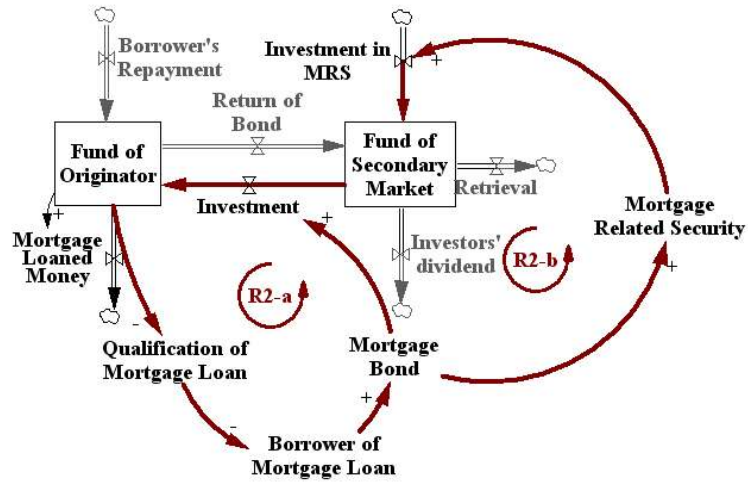

Fig. 6. Investment in Mortgage Related Securities

On the other hand, after secondary mortgage agencies and other private investors invest in *Mortgage Bonds*, they desire to solve their lack of fund liquidity and make more profits. So, secondary mortgage agencies place *Mortgage Bonds* into a pool of similar mortgages and make *Mortgage Backed Securities* and new derivatives (i.e., a component of *Mortgage Related Securities*) through a process called "securitization." After this, secondary mortgage agencies sell MRS to investors such as private investors or investment banks (Loop R2-b). Like the primary agencies, they are able to keep investing in more mortgage bonds and make other derivatives.
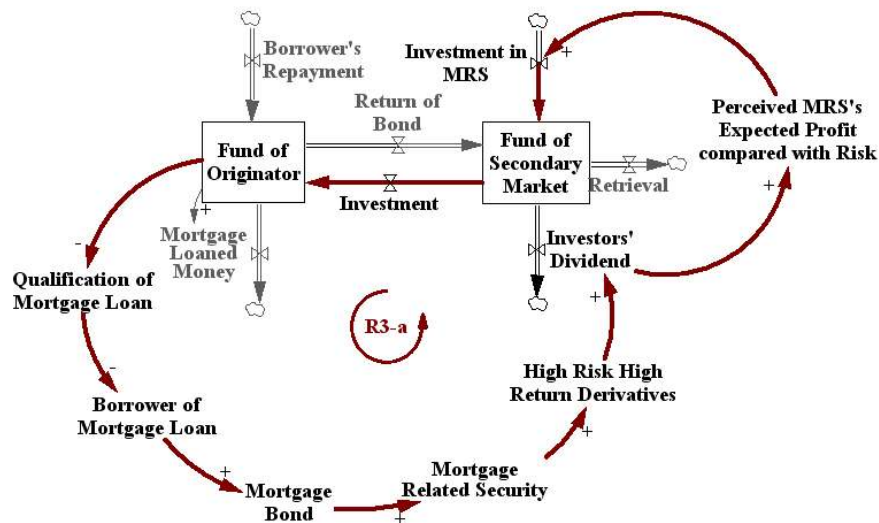

Fig. 7. Mortgage Market Activation

The process of securitization has a positive effect on the components of the real estate market associated with house holding because potential housing demand can make up a sum of money to get a house through a mortgage loan. Likewise, as shown in Fig.7., the R3-a Loop represents the process of a mortgage loan being activated by mortgage securitization. To obtain more profits, secondary mortgage agencies make more *Mortgage Related Securities*. In this process, mortgage derivatives (e.g., Collateralized bond Obligations, Collateralized Debt Obligations, Credit Default Swap, and etc.) derived from *Mortgage Backed Securitie*s are diversified and transformed into highly profitable, but also highly risky, financial products. As these seem to bring such high dividends, so that investors expect more profit from these derivatives (i.e., *Perceived MRS' Expected Profit compared with Risk increases*), investors will attempt to invest in derivatives more and more. Consequently, primary agencies will obtain considerable fund liquidity to lend mortgage loans (Loop R3-a).

On the other hand, as illustrated by Fig.8., the more investors buy mortgage derivatives, the more mortgage agencies make profits through a commission fee (i.e., *Investment in MRS* increases; then, *Revenue of Mortgage Market* increases). Before long, the mortgage market becomes a highly profitable investment market, so competition for an earning rate of mortgage derivatives deepens because the number of market participants increases (i.e., *High Risk High Return Derivatives* increases). Accordingly, MRS become more popular because of high returns; therefore, mortgage agencies issue more high profit, but more risky and fluctuating, derivatives. In other words, derivatives become so transformed through frequent securitization processes that investors are unable to recognize the origin of these derivatives. Thus, no one can determine the true value or risk of these derivatives.
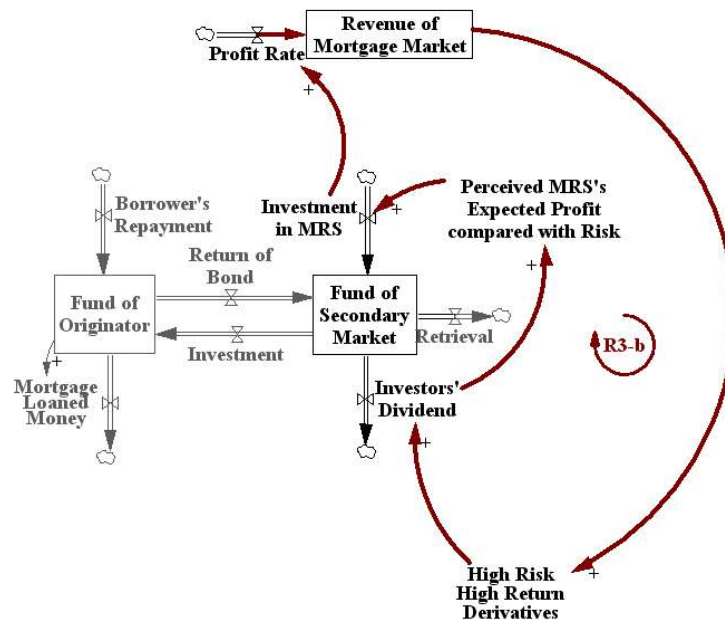

Fig. 8. Amplification of Derivatives Generation by Mortgage Agencies

However, as shown in Fig.9., while the number of *High Risk High Return Derivatives* increases, the associated risk, which investors are unable to recognize, also increases. As soon as investors recognize the *MRS' Risk*, the *Perceived MRS' Expected Profit compared with Risk* decreases; as a result, investors attempt to retrieve invested funds from the mortgage market (Loop B2). Particularly if *Personal Default Rate* increases, the depreciation of the worth of mortgage bonds leads to the MRS derivatives' risk increasing derived from mortgage bonds risk. Consequently, mortgage agencies reduce high risk derivatives because investors recognize their investment risk.
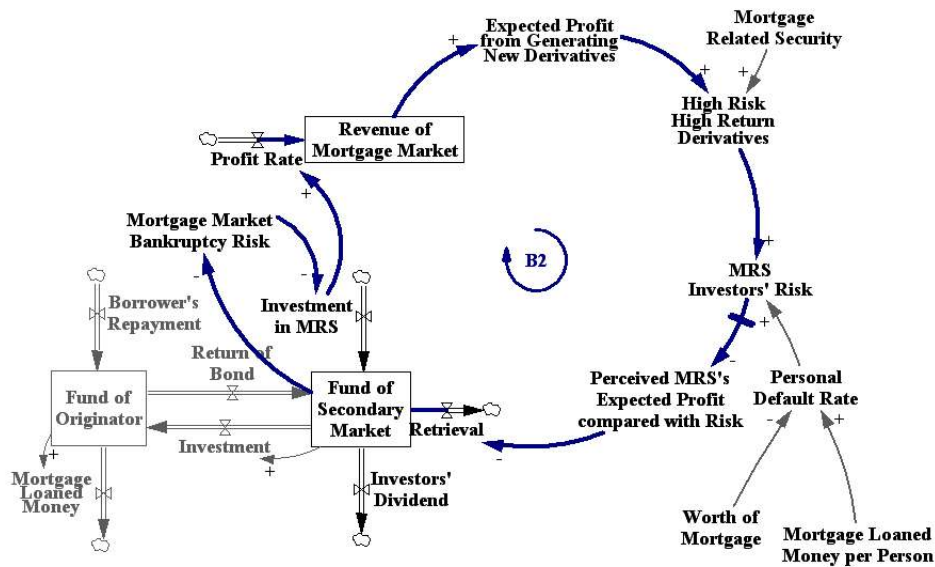
Fig. 9. Adjustment of Derivatives Generation by Mortgage Agencies

As represented by Fig.10., there is a reinforcing relationship between *House Price* and *Mortgage Loan*. If *House Price* increases, householders obtain more Rental Profit, and their mortgages become more valuable. This result in householders repaying their mortgage loans much more sincerely, and mortgage agencies attempting to lend mortgage loans because of borrowers' credit. Conversely, if *House Price* decreases, householders could potentially default on their obligation to repay their mortgage loans because they simply fail to pay back their financial debt or because their *Personal Default Rate* increases (i.e., after borrowers compare the remainder of their mortgage loans with their house value, they could default on their obligation to repay their mortgage loan). Consequently, mortgage agencies would experience fund liquidity shortage, and housing transactions and housing demands would subsequently decrease (Loop R4-a, R4-b).
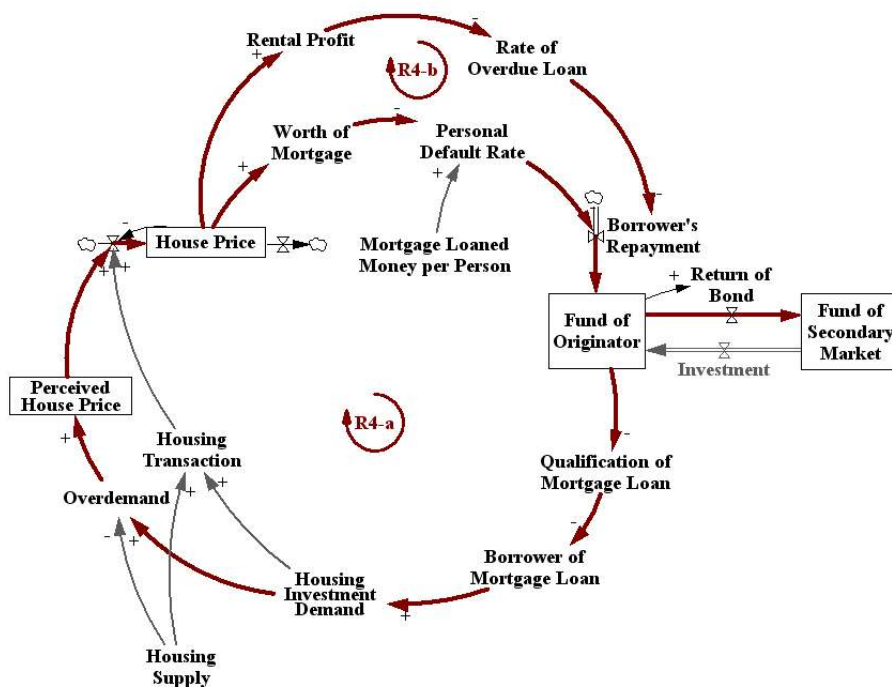

Fig. 10. Relationship between House Price and Mortgage Loan

Policy Analysis

This study has attempted to analyze the fundamental structure of the Korean housing and mortgage market with a focus on the profit-seeking behaviors of borrowers, lenders, and investors. Based on the results of system dynamics modeling and analysis, the Korean government's current deregulation policies will now be further discussed.

The Korean government has adopted policies to activate housing transactions and prevent a sudden drop in house price. These policies have particularly aimed at removing part of the Real Estate Investment Area, which has been accompanied by the deregulation of mortgage loans. In other words, the LTV of this area has been increased to 60%, and the DTI has been removed.
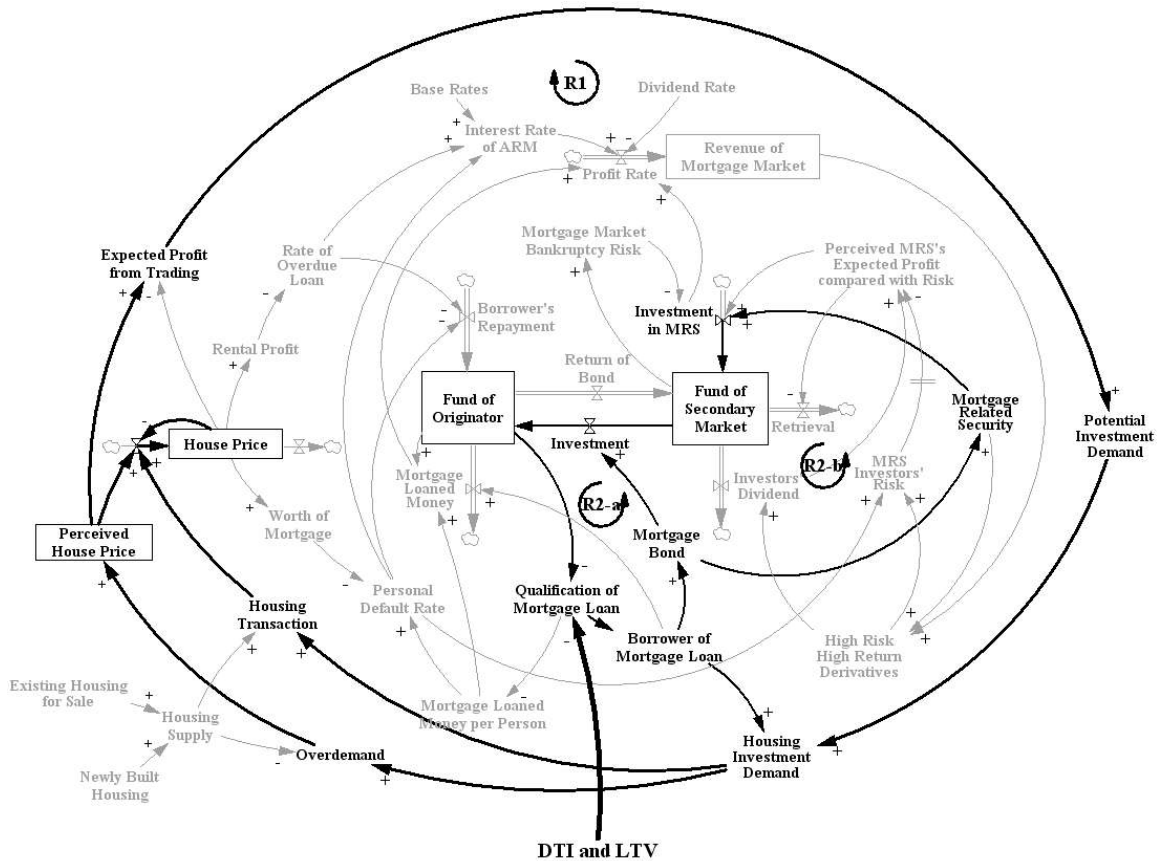

Fig. 11. Government Expectation of Policies' Effects

Fig.11. represents the effect of these policies desired by the Korean government. The Korean government increased LTV and DTI to expand housing demand by lending considerable amounts of capital to borrowers with aspirations to own their homes. The government expects that this will activate the function of Loop R1. In other words, after raising *Perceived House Price* by increasing *Housing Investment Demand*, it is expected that it will be possible to activate *Housing Transactions*. As well, it is expected that this will activate the mortgage market by operating loop R2-a and loop R2-b, thus continuing to stimulate housing demand in order to maintain adequate house prices.
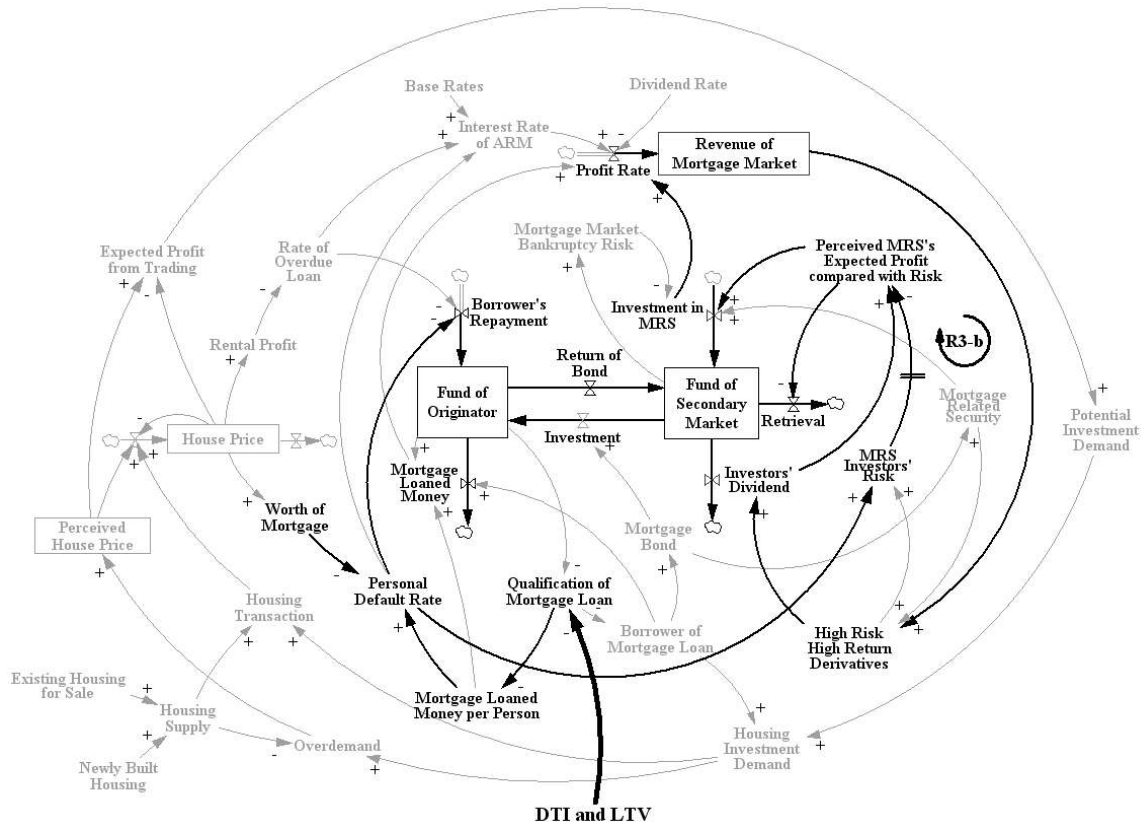
Fig. 12. Forecasted Side Effects of Policies

However, as illustrated by Fig.12., excessive and indiscreet mortgage lending can generate malignant transformed derivatives such as the function of the R3-b loop, which could result in a second subprime mortgage crisis. Similarly, if mortgage agencies lend mortgage loans to individuals with low credit rating, high risk derivatives, accompanied by an increasing Personal Default Rate, could be increased. Consequently, this situation could cause defaults on the debts of mortgage loan borrowers and the *Fund of Originator*. Then, as a result, the primary and secondary mortgage agencies could be in danger of going bankrupt due to a lack of fund liquidity, as has occurred in the recent subprime mortgage crisis.

On the other hand, mortgage agencies can self-adjust the *Qualification of Mortgage Loan* in the case of perceiving default risk. In this situation, the proposed government policies would be meaningless, as these cannot stimulate *Housing Investment Demand* and *Housing Transactions*.

Conclusions

Utilizing qualitative system dynamics modeling, this study attempted to analyze the Korean government's deregulation policies targeting housing demand. A causal loop analysis of these deregulation policies explains that such policies will have little effect on the real estate market in the currently depressed market situation.

First, depending on the market structure and its responses, rather than yielding a positive effect, these policies could potentially have damaging side effects. That is, deregulation of mortgage loans could be the beginning of another subprime mortgage crisis. Second, in the Korean real estate financial market, in which the secondary mortgage market has been inactive, the primary mortgage market cannot be accommodated with capital supplied by mortgage investors, even though the government intends mortgage agencies to lend more mortgage loans. Furthermore, if mortgage agencies tend to restrain excessive lending because of the current economic slump, these policies will have little impact on the stimulation of housing demand.

On the other hand, if the government decides to activate the secondary mortgage market, the risky derivatives' generation will have to be cut off through related policies.

This study found policies' effect on real estate market logically using system dynamics, through understanding causal relationship between real estate market factors. In future research, the financial behavior of a construction company related to housing supply will be examined. Consequently, this system dynamics model

will be examined, not from the perspective of house price, supply, and demand, but with a particular focus on the relationship between the real estate market and the construction industry. Also, attempt at validation should be made using national data on housing policies.

References

Clauretie, T. and Sirmans, G. (2003). *Real Estate Finance: Theory and Practice 4th edition*, South-Western/Thomson Learning, pp.189-195.

Fisher, J. (2005). *Real Estate Finance and Investment*, McGraw-Hill/Irwin, pp. 495-540.

Sterman, J. (2000). *Business Dynamics: System Thinking and Modeling for a Complex World*, Boston: Irwin Mcgraw-Hill, pp.191-232.

Lander, G., et al. (2009). "Subprime Mortgage Tremors: An International Issue", *International Advances in Economic Research*, Vol. 15(1), pp. 1-14.

Cho, D. and Ma, S. (2006). "Dynamic Relationship between Housing Values and Interest Rates in the Korean Housing Market", *The Journal of Real Estate Finance and Economics*, Vol. 32, pp.180-183.

Ahmad, S. and Simonovic, S. (2000). "System Dynamics Modeling of Reservoir Operations for Flood Management" *Journal of Computing in Civil Engineering*, Vol. 14, pp.191.

The KB Bank (2006). The Present Condition of House Price in the country