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Economic Evaluation of Housing Policy on Unsold Residential Inventory

– An Application of Computable General Equilibrium Model of Housing Market –

주택 미분양 정책의 경제적 효과 분석

– 주택 · 연산일반균형모형의 적용 –

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농경제사회학부 지역정보전공

문 인 석

Economic Evaluation of Housing Policy on Unsold Residential Inventory

– An Application of Computable General Equilibrium Model of Housing Market –

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Abstract

Economic Evaluation of Housing Policy on Unsold Residential Inventory

– An Application of Computable General Equilibrium Model of Housing Market –

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and Regional Development
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This paper develops a framework for the economic analysis of government policies on unsold residential inventory in Korea. An acquisition tax, a transfer income tax and market interest rates are employed to simulate government policies. The framework is composed of a Computable General Equilibrium (CGE) model integrated with a housing model. The housing model accounts for housing demand, investment, and migration functions to indicate the housing market structure. To incorporate regional heterogeneity of the housing market, the housing model categorized the region into Seoul, Incheon, Gyeonggi, and the rest of Korea. The model measures changes in the housing market driven by policies, whereas the CGE

model estimates the macroeconomic effects of changes in economic growth and housing demand. The analysis is based on thirteen industries that focus on housing construction and housing services for each region. The simulation allows policy makers to determine which measures should be prioritized to manage the amount of unsold residential inventory considering the economic impact. A 10% decrease in the acquisition tax could cause a reduction in GDP by 0.005%, whereas a 10% decrease in the transfer income tax may not affect GDP at all. Additionally, a decrease in the market interest rate could drive an increase in GDP of 0.004%. These differences can be attributed to changes in government revenue, and these changes affect industry value-added. In terms of household expenditures, these policies have a positive impact on housing consumption ranging from 0.061% to 1.338% across the different regions. The regional discrepancy in this effectiveness could be the cause of migration, as indicated by population changes.

Keyword: Unsold residential inventory, Housing policy, CGE model
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Chapter 1. Introduction

Unsold residential inventory is defined as an apartment unit approved for sale by the approval authority (building license) that has not been sold (Bae, 2011). Unsold residential inventory could be interpreted as a special phenomenon based on the supply system of apartments[1] that not only affects fluctuations in market price but also reflects the decisions of market participants. It is a critical issue because an increase in unsold residential inventory is directly related to companies and the regional economy. Specifically, the financial situation of those construction companies that mostly rely on revenue from pre-sales is adversely affected by unsold inventory, and they could potentially face a liquidity crisis[2] (Kim *et al.*, 2010). As a result, the private housing supply is shrinking, further deteriorating local economies and the stability of the housing market. As the influence of unsold inventory on the housing market and the local economy has been increasing (Kim, 2007), it is important to understand the causes

[1] The supply of new apartments in Korea is offered through a pre-sale system. The pre-sale of houses means that they are sold to consumers before the completion of construction. Consumers pay 80% of the housing price when they purchase the home. Therefore, the pre-sale system reduces the financial difficulties of housing construction companies and has introduced an expanded housing supply (Kwon, 2016).

[2] If the amount of unsold residential inventory increases, the rate of return will fall sharply. In this regard, housing construction can be very risky. According to Son (2009), there is a 30~50% limit to the unsold rate to obtain profit by region.

of this imbalance of supply and demand.

As inventories are mostly indispensable in market transactions, it may appear harmless or seem natural to have an appropriate volume of unsold residential inventory. However, the government needs to intervene in the housing market when there is an unusual increase in unsold residential inventory volume due to market failure, for example, because of oversupply or demand reduction. Thus, the government implements policies to maintain an appropriate amount of unsold residential inventory by either increasing demand or limiting supply. The Korean government has implemented fourteen policies since 2013 to revitalize the housing market, all of which could potentially affect the level of unsold residential inventory. However, as these policies aim to achieve various goals, their effectiveness is less than expected[3]. Additionally, one growing concern in the Korean housing market is oversupply driven by some of the policies, such as deregulation of the price ceiling, which would lead suppliers to expect a price increase in the near future. Subsequently, an excessive volume of unsold residential inventory is expected in the next two to three years.

[3] For example, in 2013, the government implemented polices to revitalize the market through temporary tax reductions, the deregulation of the ceiling-price system, and allowing the vertical expansion of remodeling construction. Meanwhile, the government also enforced rent price stabilization policies, such as mortgage support plans and control of the housing supply.

Previous literature on unsold residential inventory focused on its causes or offers empirical studies to estimate its consequences (Kang, 1995; Seo *et al.*, 2010). However, there is a lack of discussion about the role of government policies addressing unsold residential inventory in terms of their economic effect. Therefore, this paper evaluates the efficiency of the current government policies, which supplement market failure and expand the stability of the residential environment. Accordingly, a framework for policy evaluation is developed by integrating a housing model into a Computable General Equilibrium (CGE) model. The housing model employs functions for interregional migration as well as housing demand and investment. The functions examine changes in housing demand stemming from these policies and determine the housing stock. Furthermore, the migration model is constructed to reflect differences in the regional ripple effects. To incorporate the regional heterogeneity of the housing market, this paper classifies the regions into Seoul, Incheon, Gyeonggi, and the rest of Korea (ROK). Additionally, thirteen industry categories are created that contain housing construction and housing service sectors for each region. This paper is structured as follows. Chapter 2 presents the real estate policies of the Korean government and the state of unsold residential inventory in the housing market. In chapter 3, the theoretical background and

previous studies are reviewed. Chapter 4 discusses the framework for the analysis. In chapter 5, the simulation is developed and the empirical results are analyzed. This paper concludes in chapter 6 with a summary and a discussion of further research.

Chapter 2. Housing Market in Korea

This chapter examines government policies on the housing market and the current state of unsold residential inventory in Korea. The government implemented housing policies to either induce transactions in the market or to control prices[4], both of which can potentially affect the amount of unsold residential inventory. Generally, Korean housing policies are categorized into supply-side and demand-side policies. Additionally, in terms of the policy purpose, they can be divided into market revitalization or stabilization (Kwon, 2016). Revitalization policies aim to invigorate the real estate market by increasing demand or expanding the deregulation of supply with policies that loosen tax regulations, expand financial support for construction companies, and provide subsidies for housing expenses. Stabilization policies attempt to stabilize housing prices by decreasing demand or to regulate the supply price through policies that strengthen mortgage eligibility, adjust the ceiling-price system and expand the supply of public housing.

[4] The current government has launched real estate policies every three months on average. Initially, policies for market revitalization were dominant. However, the consequence of these policies, such as increasing house prices and increasing household debt created concern in the market (Mun and Choi, 2016). Thus, in 2016, the government began to issue policies that strengthen regulations.

Table 1. Real Estate Measures taken by the Park Geun-Hye Administration

	Date	Title	Content
2013	01. Apr.	Comprehensive Measures to Normalize the Housing Market	- Exemption from the transfer income tax for 5 years not only on unsold and newly constructed housing but also on existing housing - Reduction of the ceiling-price system, Permission for vertical extension when remodeling apartments
	24. Jul.	Follow up of 01.Apr. policy	- Mortgage guarantee for construction companies - Housing supply regulation over the private sector
	28. Aug.	Stabilization of rental housing market for low-income renters	- Permanent reduction of acquisition tax - Low interest rate mortgage support
	03. Dec.	Follow up of 01.Apr. and 28.Aug. policies	- Revision of the Chonsei support measures, Reduction of public rental housing supply - Provision of low rate shared mortgage system
2014	26. Feb.	Leasing market advancement plan	- Expansion of private sector leased housing, exploiting REITs - Modification of the lease income tax
	24. Jul.	Presentation of the economic policy direction of the new team	- Deregulation of loans (mitigate the LTV, DTI rules to 70%) - Unification of subscription deposit accounts
	01. Sep.	Housing market revitalization	- Deregulation of the reconstruction-required term (40 years → 30 years) - Reduction of the period of qualification for apartment application
	30. Oct.	Reduction of housing expenses for low-income buyers	- Expansion of public rental housing with a variety of supply systems - Provision of semi-public rental housing
2015	13. Jan.	Innovation plan for middle class housing	- Introduction of corporate lease system "New stay" - Introduction of special law on private rental housing
	06. Apr.	Reduction of housing expenses for low-income buyers	- Enhancement of support for the guarantee of rental deposit - Elimination of monthly rent support requirements
	02. Sep.	Strengthening of housing stability for low-income buyers	- Supply of housing for a single-person household with owner remodeling system - Revitalized corporate lease system, Rationalization of maintenance business regulations
2016	28. Apr.	Reduction of housing expenses with customized support	- Expansion of the supply through the public and corporate lease system (300 thousand houses) - Customized public housing for low-income households considering the life cycle
	25. Aug.	Household debt management	- Development site supply reduction, Strengthening PF loan screening - Improvement of loans for the middle payment to purchase new apartments
	03. Nov.	Stability management plan for the housing market	- Prevent overheating in the speculative market - Managing household debt, controlling the apartment pre-sale system

Source: It was revised from Moon and Choi (2016)

To control the quantity of unsold residential inventory, the government can employ various policies. For example, to stimulate demand, it can alleviate tax regulations for the buyers or suppress site development to reduce supply. However, these policies might not necessarily lead to a decrease in unsold residential inventory because housing market policies affect not only unsold residential inventory but also the entire real estate market. Thus, such policies may impact only housing stock or increment unsold residential inventory. Additionally, the market situation can lead to unexpected outcomes from these policies. Hence, it is important for the government to supervise the effects of these policies to ensure that they actually decrease unsold residential inventory. This paper evaluates the effect of policy on the market by exploiting an acquisition tax and a transfer income tax to reflect tax policy and changes in the market interest rate to reflect financial policy.

2.1 Government Policies on Housing Market

In terms of tax policy for the Korean housing market, there are two types: a transaction tax and a possession tax. A transaction tax is imposed on the process of purchasing or selling a home; these have different tax rates – the acquisition tax rate and the transfer income

tax rate, respectively. By contrast, a possession tax[5] is imposed on the homeowner during the ownership period and not on trading activities. This paper uses the transaction tax since, unlike the possession tax, the transaction tax has a direct effect on housing supply and demand by changing the user's cost. In other words, changes in the transaction tax induce changes in the housing price and transaction volume, which are important variables for unsold residential inventory. Furthermore, these taxes comprise a substantial portion of government revenue[6]. Thus, introducing tax policies to the housing market requires an assessment of the overall economic effect.

The acquisition tax is applied to the housing purchase price at a constant tax rate that varies based on the house price and the area. Additionally, it includes a special tax for rural development and a local education tax. The acquisition tax is levied regardless of profit realization and is a local tax, whereas the transfer income tax is imposed on the profit margin realized through the house sale. Thus, the acquisition tax has a lock-in effect, and housing demand increases when the tax is alleviated and decreases with a

[5] There are Property taxes, Comprehensive real estate taxes, and Rental income taxes.

[6] For example, in 2012, the real estate-related tax revenue was 32 trillion won, which accounted for 11.3% of total government tax revenue (Park *et al.*, 2014).

strengthened policy. The government has modified tax policy to stimulate market transactions and has steadily reduced the acquisition tax since 2011. Initially, the reduction was a temporary step to revitalize the housing market. In 2013, however, the government permanently lowered the tax rate. Additionally, the government temporarily exempted home sales from the transfer income tax (five years) except for those occurring in Seoul province. The government then continuously extended the transfer income tax exemption or relaxed the taxpayer requirements considering the volume of unsold residential inventory. These policies aimed to increase housing demand by expanding the owner's capital gains when selling a house or reducing the cost of the housing transaction.

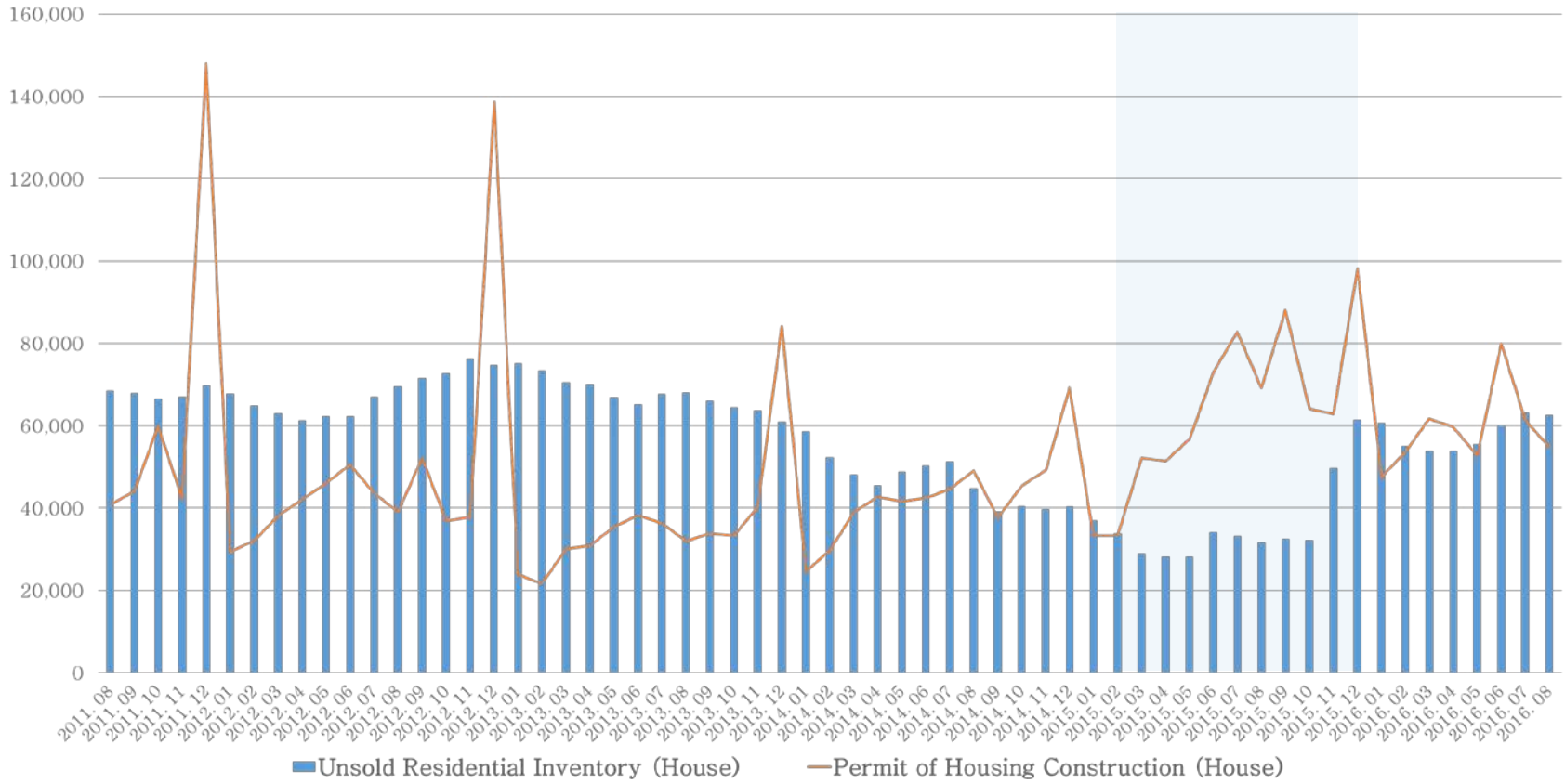
Meanwhile, financial policies include modifying the interest rate, mortgage support, and money supply management. The interest rate is one of the factors determining housing financing cost, and mortgage support is related to regulation of the Loan to Value (LTV) and Debt to Income (DTI) ratios (Kwon, 2016). In this paper, we focus on the market interest rate since the policy related to interest rates has a substantial impact on the overall economy as well as on the housing market. Thus, using interest rate policy is more appropriate for analyzing policy effects on the regional economy and the housing market. A reduction in the interest rate increases the

profit of a housing acquisition by reducing the purchase cost. Thus, the interest rate and house prices have a negative relationship and, consequently, a decrease in interest rates increases housing demand. The government is exploiting this policy to revitalize the housing market. For example, in 2013, the government introduced a mortgage support plan with an intentionally lowered interest rate, which had an impact on housing investment as well as on housing demand. This is because the interest rate can influence not only households but also companies' business loan.

2.2 Current State of Unsold Residential Inventory

Figure 1 shows the variation in the quantity of unsold residential inventory and the number of housing construction permits from August 2011 to August 2016. Since the Korean government has focused on revitalizing the real estate market, unsold residential inventory consistently decreased after a peak of 76,319 houses in November 2012. The declining trend in unsold residential inventory continued until 2015. However, in November 2015, the unsold residential inventory steeply increased to 49,724 houses, which was 54.3% higher than the previous month. This sudden change in the decreasing trend was attributable to a housing supply increase in the first quarter of 2015. The policies to revitalize the market led market

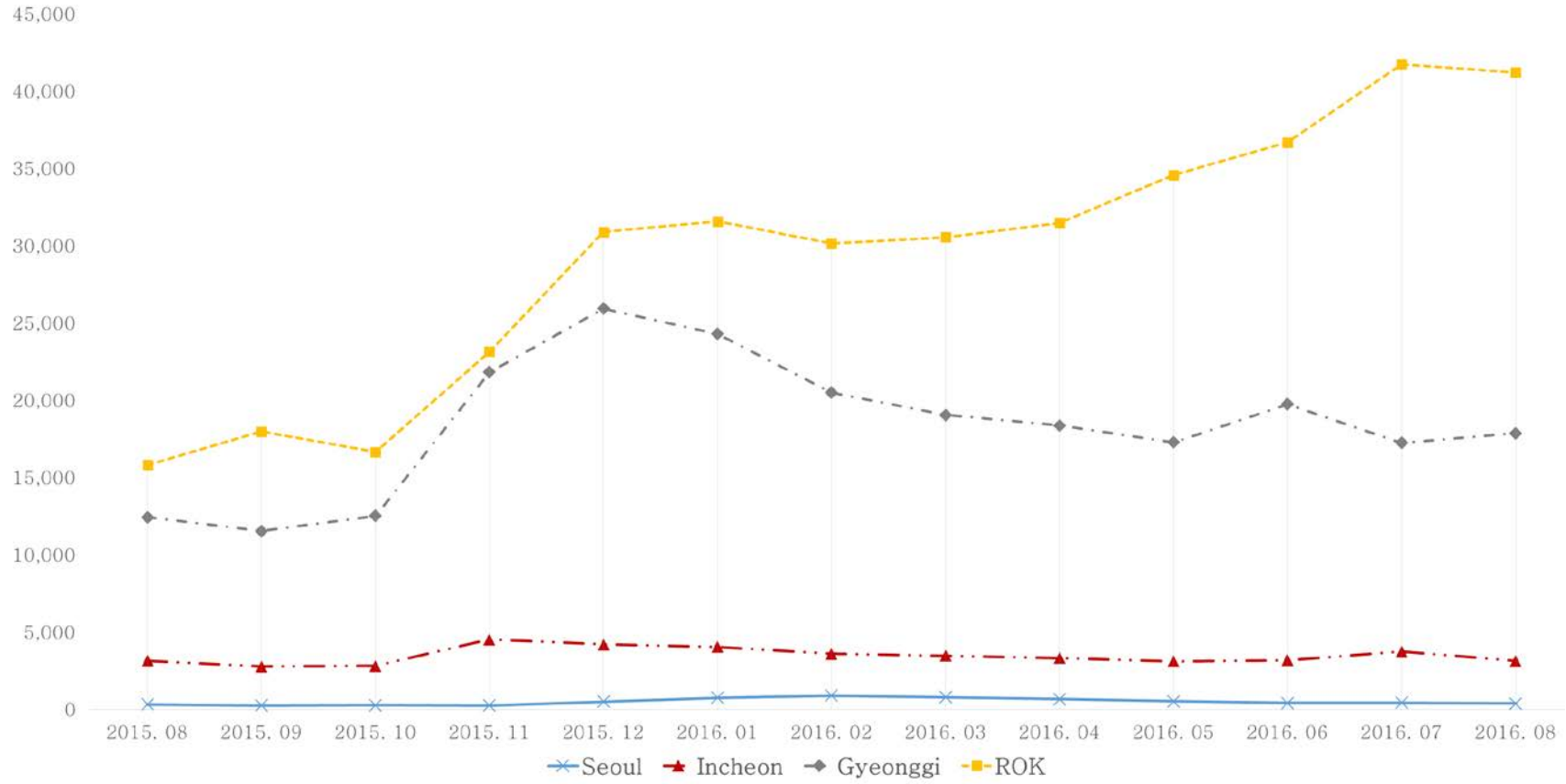
participants to expect a price increase. Accordingly, construction companies increased pre-sale volumes before the positive prospects for the housing market disappeared or the government strengthened regulations. This led to an excess housing supply in the market, which can be explained by a distinctive increase in construction permits in 2015 compared to previous years. In June 2015, there were 72,102 housing construction permits, which is 72% more than in the previous year. In September 2015, permits were granted for 87,955 houses, which represents a major increase over December 2013. The exceptional increase in housing construction permits in 2015 indicated the upcoming risk of unsold residential inventory two or three years later.



Source: Unsold New Housing Statics. Ministry of Land, Infrastructure and Transport

Figure 1. State of Unsold Residential Inventory

Figure 2 illustrates that the fluctuation pattern and volume changes in the unsold residential inventory vary by region between August 2015 and August 2016. For instance, unsold residential inventory in Gyeonggi and the ROK provinces are larger than those in other regions. In December 2015, the amount of unsold residential inventory in Gyeonggi was 25,937 houses, which is 52 times larger than the amount of unsold residential inventory in Seoul. Therefore, the investigation of policy effectiveness should be conducted by region. Even if the same policies are implemented, the distinctive regional attributes can result in different policy effects across different regions, and the economic ripple effect will also be different. Therefore, this paper examines the effects of policies on the four separate regions: Seoul, Incheon, Gyeonggi and the ROK. In particular, we investigated the Seoul Metropolitan Area (SMA) in depth as the SMA is the largest economic area, accounting for 49 percent of the population in Korea and 48 percent of Korean gross domestic product (Kim *et al.*, 2013). Additionally, its residential mobility is more accessible than that of the ROK. Owing to these attributes, housing demand in the SMA can be more sensitive to price fluctuations than that in other regions, and housing investment in the SMA is the most active in Korea. For these reasons, we studied the effectiveness of the policies at the regional level.



Source: Unsold New Housing Statics. Ministry of Land, Infrastructure and Transport

Figure 2. Regional Discrepancy of Unsold Residential Inventory

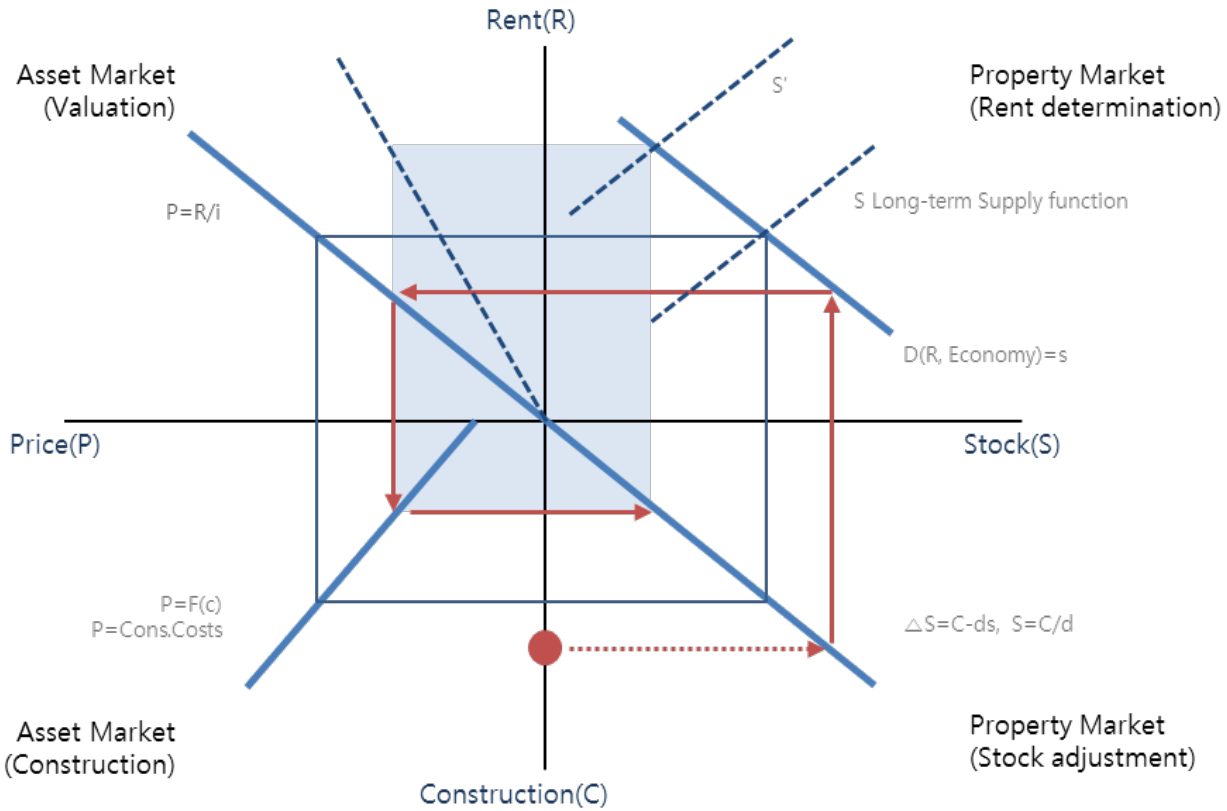
Chapter 3. Theoretical Background

Unsold residential inventory reflects an imbalance caused by a disequilibrium between housing supply and demand. The equilibrium number of new apartments is represented by the intersection between the demand and the supply curves. The housing demand curve shows the number of houses that individual households consume over a period of time. The housing supply curve is determined by the housing stock, which is the total number of houses at a certain point in time. The housing stock remains the same in the short term because of the durability of housing goods and changes only in the long term because the construction of new houses takes a relatively long time (Kim and Seo, 2009).

The construction of new houses is a factor that changes the housing stock and determines the degree of the increase or decrease in the housing supply. An influx in supply adjusts the size of the inventory in the housing market, and a drop in inventory may spur companies to increase supply. This process can be explained by the Dipasquale-Wheaton (D-W) model. The D-W model explains the operation of the real estate market through the interaction between the owner-occupied market and the rental market. Kim and Son (2010) explained that the balance of four intrinsic variables – rent,

asset price, new construction, and housing stock – determine the movables market; Figure 3 illustrates the D–W model. The first quadrant of Figure 3 shows the relationship between housing stock (S) on the horizontal axis and housing rents (R) on the vertical axis in the property market. Demand for housing space is a function of rent and local economic variables and has a negative slope with respect to the rental fee. Household space demand is determined by income, the number of household members, and the relative space cost for use. In the short term, as the available space is fixed given the initial housing stock (S), and rent (R) is determined to match demand. The second quadrant is the market, in which asset prices are determined by the rents in the first quadrant. The rate of return on capital (i = R / P) affects the relationship between rent and asset price. The asset price (P) is decided by the rate of return for the investment, that is, the rate of return on capital becomes equal to the required rate of return. Therefore, if the rate of return on capital rises, the rent should increase or the asset price should drop. The supply curve has a positive slope because the marginal cost increases as the supply increases. The fourth quadrant represents the adjustment of the stock of space. The housing stock is fixed in the short term but increases over time with new supply and decreases because of depreciation or loss. In the long run, new supply is

identical to the depreciation of the existing stock, leading to a long-term balance. To maintain the initial stock, new supplies need to replace the existing depreciating stock. Based on Figure 3, the impact of unsold residential inventory on the housing market is as follows. The amount of new housing construction is determined in the third quadrant by the price of the assets in the second quadrant. Unsold residential inventory units are in an oversupplied state compared to the number of new houses built in the third quadrant, which leads to a decline in rents in the first quadrant. As rents decline, the value of assets in the second quadrant decreases, and the decreased asset value affects the level of new housing construction in the third quadrant, which results in a new balance. Therefore, unsold residential inventory is an important factor in the demand and supply of the housing market, and a volume change affects the market equilibrium. The impact of government policies affects not only unsold residential inventory but also housing construction markets in general and the national economy.



Source: Dipasquale and Wheaton (1992)

Figure 3. Dipasquale–Wheaton model: Property and Asset Market

Research on unsold residential inventory did not receive much attention in the past, as the housing supply was insufficient. Since the 2000s, when the housing supply rate exceeded 100% of demand, the problem of unsold residential inventory has become apparent. In terms of the definition and importance, Jang *et al.* (2010) suggested that unsold residential inventory is an important indicator in the housing market system. It is directly related to the profitability of the construction business and appears to be a result of an imbalance in the demand and supply of houses. Kwoun *et al.* (2013) considered unsold residential inventory to be closely related to housing market fluctuations, which are influenced by macroeconomic conditions. They indicated that these factors influence developers' investment decisions and, thus, housing supply over time.

Previous studies can be classified into analyzing causes or examining differences by region. First, the studies focused on the cause have consisted of theoretical research addressing policies (Kang, 1995; Son, 1995; Kim and Hwang, 2009) and empirical studies to derive determinants (Jung and Kim, 2005; Seo *et al.*, 2010). Kang (1995) identified the oversupply of housing, lack of consumer purchasing power, and inadequate government financial support as the causes of unsold residential inventory. He suggested a revision of government policies through reducing the price for land supply and

improving the housing financing system. Son (1995) indicated that housing oversupply was the primary cause of unsold residential inventory. Thus, he suggested policy directions such as housing demand expansion, assistance for the construction industry, and improvements to the housing supply system as policies to resolve oversupply issues, and he emphasized the importance of economic impacts to policy actions. Kim and Hwang (2009) examined the attributes of government policies to solve the unsold residential inventory problem, such as the reduction of financial regulations and the tax burden, deregulation, and government purchases. They claimed that some effects were obtained by using the policies but that, overall, there was no significant effect. In particular, it is more effective to utilize demand and supply policies together than to apply a single policy, and taxes and financial policies are found to be effective in expanding housing demand. Studies have focused on the causes, showing the possibility that government policies have negative effects on the market. This implies the necessity of conducting a proper economic assessment to examine the appropriateness of policies. Studies also exist that empirically analyze the factors affecting unsold residential inventory. Jung and Kim (2005) explored the market control role of unsold residential inventory. They considered it to be an indicator of current supply and

demand and showed that it is being used as a decision-making index by the market. Accordingly, when interest rates rise, the amount of unsold residential inventory increases owing to an increase in the opportunity cost of housing purchasing. Additionally, currency depreciation also increases the opportunity cost of the housing supply, which leads to a decrease in unsold residential inventory. Seo *et al.* (2010) estimated the determinants of unsold residential inventory and the speed of adjustment. They criticized supply policies that did not take demand into account and emphasized the supply control function of the public sector.

By contrast, other studies analyzed regional issues as they are reflected in the attributes of the housing market. Thus, aspects of unsold residential inventory and policy effects are assessed in these studies, considering interregional variation. Choung (2000) presented a survey showing that the causes of unsold residential inventory are differently recognized by region. The institutional background, such as government regulation and financing services, was the cause and suggested problems with the housing pre-sale system. Jin and Hur (2009) identified the level and causes of supply-demand disequilibria in the regional housing market and suggested alternative policies to control these disequilibria. They emphasized

buyer-centered policies because the average price of deposit rent[7] and the rate of change in the deposit rent had the greatest effect on supply-demand imbalance. Lee and Kim (2011) analyzed the unsold residential inventory in metropolitan areas by city and district and identified the variables affecting the pre- or post-construction inventory. In particular, the previous year's unsold residential inventory after construction, short-term interest rates, and real GDP had significant effects on the amount of unsold residential inventory before construction. Previous studies have analyzed the unsold residential inventory considering policies in terms of causes and regional issues and argue that it is necessary to assess the impact of policies and the indicated determinants. However, these studies take a fragmented point of view of the housing market rather than considering macroeconomic aspects. Thus, this paper concentrates on an economy-wide view in considering the effects of policies to address the limitations of the previous studies. In addition, it considers the attributes of the regional housing market.

[7] Korea real estate market has a unique deposit rent system which is called as Chonsei. It involves the tenant paying a large up-front deposit –often more than 50 percent of the property value– with no requirement for periodic rent payments. The tenant then has the right to reside in the property for, typically, 2 years. (Ronald and Jin, 2015).

Chapter 4. Structure of Model

The CGE model used in this paper explains the economic behavior of the producers and consumers who participate in the real side of the economy. It takes the form of a micro-simulation module that shows the composition of decision makers in the housing market[8]. This approach includes market clearing prices, the maximization of firm profit, and a household's utility. This paper adopted the CGE framework to emphasize the rational behavior of producers and consumers, who select the optimal set of factor inputs and demand commodities under the given constraints.

[8] Robinson (1991) suggested a neoclassical elasticity approach to determine the substitutional relationship of supply and demand and that of price and quantity.

4.1 CGE model

The CGE model is a policy analysis model using general equilibrium theory. This model is based on mathematical analysis and can quantify the impact of external shocks on the behavior of economic agents[9]. By quantitatively analyzing the interrelationships among multiple economic agents, the environmental changes due to government policies and the effects of the implemented policy on the unsold residential inventory can be assessed. The CGE model considers not only independent economic activities such as sectoral supply and demand but also spillover effects on the nationwide economy[10]. As the relationship between the housing market and government policies impacts households, local economies and the housing industry, the CGE model appears to be the most suitable for our analysis.

The CGE model is used to evaluate the growth and distribution

[9] Kim (2000) presented four key features of the CGE model. First, it is a multi-sectoral model that considers the mutual relationship between sectors. Therefore, the model enables examination of the dynamic impact of external shocks. Second, it allows simulation studies to be conducted because it includes the concept of optimality, such as maximizing the profit of producers. Third, it is a micro-macro system based on microeconomic and macro-economic theory. Thus, the result of a shock does not show contradictions. Fourth, quantity and price are determined endogenously. For example, market prices are determined in the process of eliminating excess demand.

[10] For example, an increase in the demand for housing in Seoul affects the construction industry in Seoul and changes the production and price structure of other regions and industries.

effects of policies such as those focused on development, taxes, regional economies and resource allocation as implemented the late 1970s (Kim, 2014). There have also been some housing policy studies conducted. Kim and Ju (2003) used a CGE model to assess the economic effects of the housing supply on urban growth and income distribution in Seoul. The results indicated that housing development on industrial land or green areas increased the Gross Regional Product by approximately 1% under the highest level of income inequality. Bye and Avitsland (2003) estimated an inter-temporal CGE model to analyze the welfare effects of imposing a neutral housing taxation system in Norway. They showed that a neutral housing tax reform leads to intra-temporal efficiency gains. However, there was a simultaneous loss in labor market efficiency based on a decrease in the real wage rate owing to a higher price on housing services. Kim (2008) used the CGE model to evaluate government policies in terms of housing demand. It analyzed the impact of a comprehensive real estate tax and the LTV ratio on five quintiles of income class. The result indicated that housing tax policy and financial regulations are effective in controlling the housing demand of owner-occupied households. Keast (2010) developed the bi-regional CGE model to analyze the regional impacts of housing policies in the South West housing market in the UK. The study

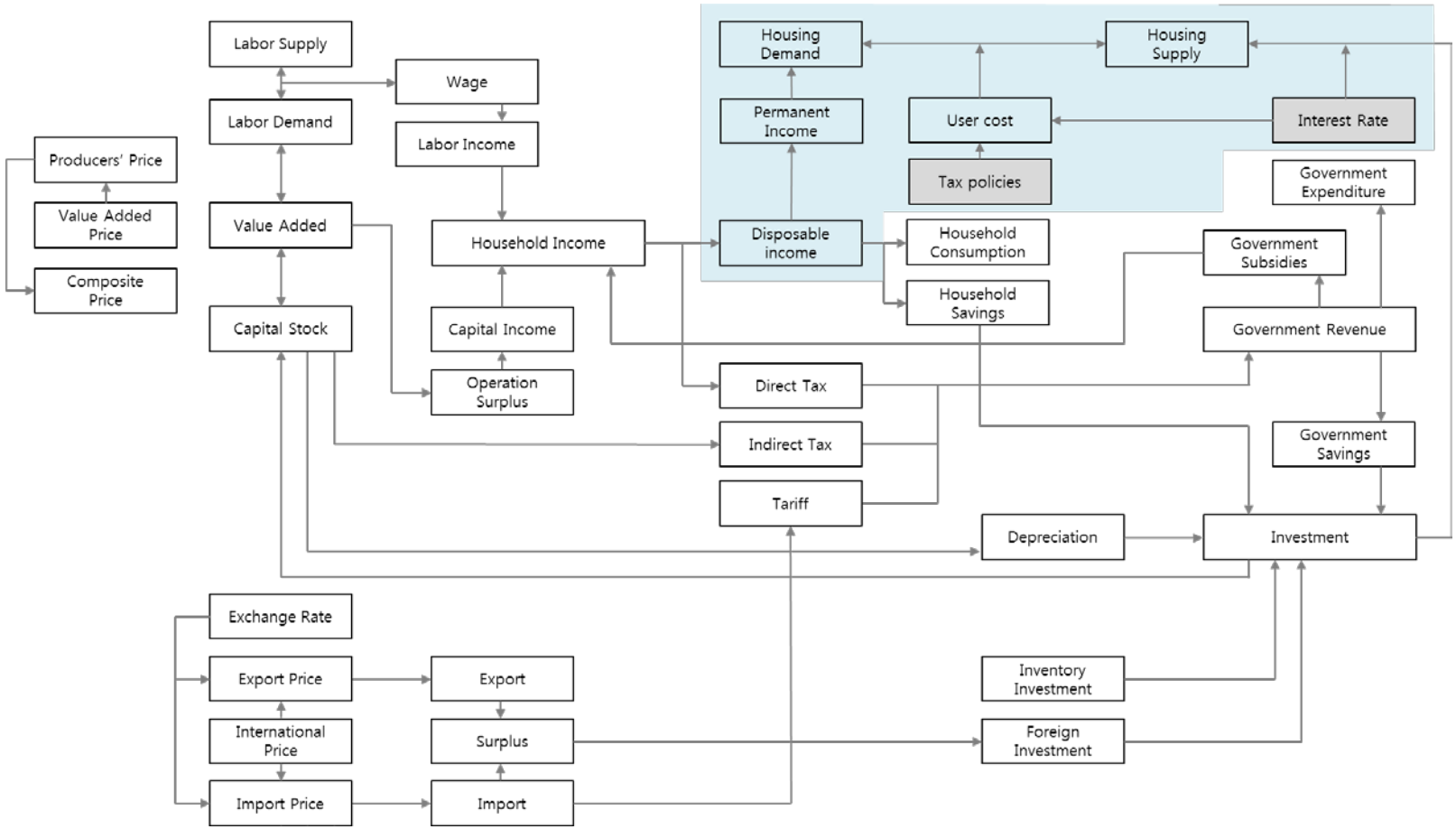
results showed that demographic factors stemming from increased space demands by households put greater pressure on the housing market, leading to a rise in the price of both new housing and housing services. Park *et al.* (2014) used the CGE model with a separately constructed real estate market. They classified households by real estate asset levels to analyze the influence of the economic ripple effect from changes in the real estate holding tax. They found that changes in the real estate holdings tax decreased total disposable income and the social welfare of consumers by 0.1% to 0.3%. This change showed a clear gap between asset classes and confirmed that tax revision affects government revenues. Feltenstein *et al.* (2016) considered a proposal in Georgia that reduces by half the taxes on homesteaded properties and replaces the lost revenue by increasing the base and rate of the state sales tax. The results indicated that the proposed policy has no effect on the distribution of consumption across income classes but increases the percentage of owner-occupied housing. In summary, previous studies on the housing market using the CGE model analyzed the effects of housing policy on social utility considering the demand side. Our model, by contrast, incorporates the differences in unsold housing units due to regional attributes. Therefore, this paper divided households and producers by regions and particularly considered the effect of unsold residential

inventory in the SMA area and the possibility of interregional mobility. We also diversified the analysis by reflecting not only housing demand but also housing supply as factors affecting unsold residential inventory.

The characteristics of the CGE model in this paper are as follows. First, government policies affect the level of housing production because of changes in final demand and capital stock. Second, producers and consumers react instantly to changes in the external environment, so that investment, commodity and factor markets remain balanced. Last, consumers can select the area of housing demand to maximize own utility, which leads to varying levels of migration by region. The structure of the CGE model is based on the model suggested by Kim (2008), but specific settings are modified. The model is designed for thirteen industrial sectors[11] and four household types by region. Therefore, there are thirteen producers, four household types, one government and the rest of world (ROW) agents. The demand sector includes the user cost for housing services, and housing demand is based on the market equilibrium conditions in which oversupply drives convergence to a long-term

[11] Seoul housing construction, Seoul housing services, Incheon housing construction, Incheon housing services, Gyeonggi housing construction, Gyeonggi housing services, ROK housing construction, ROK housing services, agriculture and mining, manufacturing, construction, real estate service, and services

equilibrium price as housing prices decrease. Each sector's supply, demand, and price are associated with the goods, labor and capital markets. The appropriate price levels for goods and production factors are determined by the demand-supply balance conditions of the market. Through the adjustment process, a Walrasian equilibrium condition can be reached, and the market price is thus set for producers and consumers in the housing market. The following CGE model Equations (1)-(16), which explain the specific composition of the model structure, refer to Bae (2010).



Source: It was revised from Kim (2008)

Figure 4. CGE Model Structure

In the production sector, each industry produces a single commodity composed of domestic, imported, and exported commodities. Gross output is determined through a two-level structure on the basis of a Leontief production function. This function is composed of intermediate inputs and value-added, which are determined by fixed proportions. The intermediate inputs are derived from the input-output coefficients. The value-added is generated by the production factors, which have a substitutional relationship through the Cobb-Douglas function between labor and capital. It is assumed that the producer chooses the optimum size of the production factors for profit maximization. The labor market is established by the macroeconomic closure rule. Changes in the employment ratio affect the production amount, and changes in wages are linked to production costs. In this model, based on the neoclassical completion rule, a full employment condition is applied in which wages are determined endogenously.

$$XD_i = \min\left(\frac{VA_i}{a_i}, \frac{IND_{1i}}{io_{1i}}, \cdots, \frac{IND_{ji}}{io_{ji}}\right) \quad (1)$$

$$VA_i = A_i \cdot L_i^{\alpha_i} \cdot K_i^{1-\alpha_i} \quad (2)$$

$$L_i \cdot WA \cdot wdist_i = \alpha_i \cdot PVA_i \cdot VA_i \quad (3)$$

XD_i : Gross output of domestically produced commodities
IND_{ji} : Intermediate inputs
VA_i : Value-added
L_i : Labor input
K_i : Capital stock
WA : Average wage
$wdist_i$: Wage distribution parameter
PVA_i : Value-added price

The prices of imports and exports are determined exogenously, and the producers act as price-takers. This condition is based on the small open economy assumption. For aggregate demand, domestic and imported commodities are consumed in an incomplete substitutional relationship by the Armington function. With relative prices and different qualities, consumers determine their consumption amounts through a process of minimizing the total cost. The level of domestic and exported commodities is determined by the Constant Elasticity of Transformation (CET) function. The decision on the production volume depends on the relative price. The profit maximization of the producers depends on the amount of domestic demand and the elasticity of substitution.

$$min\ \ PM_i \cdot M_i + PD_i \cdot XXD_i \tag{4}$$

$$\text{s.t}\ \ X_i = AC_i \cdot (\delta_i \cdot M_i^{-\rho c_i} + (1-\delta_i) \cdot XXD_i^{-\rho c_i})^{-\frac{1}{\rho c_i}} \tag{5}$$

$$\frac{M_i}{XXD_i} = (\frac{\delta_i}{1-\delta_i} \cdot \frac{PD_i}{PM_i})^{\frac{1}{1+\rho c_i}} \tag{6}$$

$$max\ \ PE_i \cdot E_i + PD_i \cdot XXD_i \tag{7}$$

$$\text{s.t}\ \ XD_i = AT_i \cdot \left(\gamma_i \cdot E_i^{\rho t_i} + (1-\gamma_i) \cdot XXD_i^{\rho t_i}\right)^{\frac{1}{\rho t_i}} \tag{8}$$

$$\frac{E_i}{XXD_i} = \left(\frac{1-\gamma_i}{\gamma_i} \cdot \frac{PE_i}{PD_i}\right)^{\frac{1}{\rho t_i - 1}} \tag{9}$$

XXD_i : Domestically produced and consumed commodities
PM_i : Price of import commodity
PE_i : Price of export commodity
PD_i : Price of domestic commodity
M_i : Import
E_i : Export
X_i : Composite commodity

Households are the subjects of economic activity and affect not only consumption but also investment through savings. The total income of each household is composed of labor and capital income from providing production factors and receiving government subsidies and transfer income from the ROW. Labor income is determined by industry demand and average wage, and capital income is equal to the value-added after subtracting net product tax, employee compensation and depreciation. The disposable income for each household is described by the income after subtracting the direct tax and savings. By the budget constraint, the consumer allocates the consumption amount based on utility maximization, and the household utility function represents societal welfare as expressed by the Cobb-Douglas function.

$$YH_r = YLC_r + YKC_r + YSUB_r + YFC_r \quad (10)$$

$$YD_r = YH_r - YTAX_r \quad (11)$$

$$YSAV_r = YD_r \cdot YSAVP_r \quad (12)$$

$$P_i \cdot PC_i = (YD_r - YSAV_r) \cdot PCES_i \quad (13)$$

YH_r : Household income
YD_r : Disposable income
YLC_r : Labor income
YKC_r : Capital income
$YSAV_r$: Household savings
$YSAVP_r$: Marginal propensity to save
$PCES_i$: Marginal propensity to consume
$YSUB_r$: Government subsidy
$YTAX_r$: Direct tax
YFC_r : Transfer income by the ROW
P_i : Price of commodity
PC_i : Private consumption

There is one government, which is composed of the national and regional governments. Government revenue consists of an indirect tax from producers and a direct tax from households[12]. Government expenditure consists of government consumption expenditure, subsidies to households, and government savings. Except for government consumption expenditure, these variables are determined exogenously. Total savings is equal to the total amount

[12] The direct tax reflects the direct tax rate on household income, and the indirect tax is derived by multiplying the indirect domestic tax rate and the industry domestic production value.

of investment, which is related to the macroeconomic closure rule for the capital market. Total savings consists of depreciation and household, government, and ROW savings. Depending on the structure of the model, ROW savings is equal to the balance of the current account. The ROW conducts trade, and the trade deficit or surplus is defined as the ROW savings.

$$\text{GREV} = \sum_i INDTAX_i + \sum_r YTAX_r + TARIFF \quad (14)$$

$$\text{GUSE} = \sum_i GC_i + \sum_r YSUB_r + GSAV \quad (15)$$

$$SAVINGS = \sum_i DEPR_i + \sum_r YSAV_r + GSAV - FSAV \cdot ER \quad (16)$$

GREV : Government revenue
GUSE : Government expenditure
$INDTAX_i$: Indirect tax
SAVINGS : Savings (=Investment)
$DEPR_i$: Depreciation
$TARIFF$: Tariff
GC_i : Government consumption
$GSAV$: Government savings
$FSAV$: ROW savings
ER : Exchange rate

The base price of the model is the consumer price index. In the CGE model, pricing is an important variable in that it affects the economic agents' decision behavior. The fundamental price and the export, import, producer, composite, and consumer prices are endogenously decided in the model, and these prices refer to relative

prices with the Walrasian equilibrium condition. The model has a square system of equations, with 534 equations and 534 variables. To find a unique solution, the number of equations and the number of variables should be equivalent under convexity.

4.2 Housing model

The housing model estimates the amount of unsold residential inventory with the demand and the investment function. The demand function explains which variable determines the level of residential services that individual households want to consume over a period of time. The most important variables are the relative price of the house, the household real income, and household attributes such as the number of household members (Kim and Seo, 2009). This paper revises a function from Kim (2008) and additionally refers to the function of Chung and Cho (2005) and a modified function of Mankiw-Weil (1989, M-W) that reflects the demographic characteristics of housing demand.

$$\ln(HD_i) = \beta_0 + \beta_1 \ln(UC_i) + \beta_2 \ln(PI_i) + \sum_j \alpha_j X_{ij} + dm_{2010} + \epsilon_i \quad (17)$$

HD_i : Housing demand (Housing area)
UC_i : User cost of housing service
PI_i : Permanent income
X_{ij} : Number of household members i in age cohort j
dm_{2010} : Dummy for the year 2010
i : Household

Table 2 shows the results of the housing demand function, which is estimated based on user cost, permanent income, and number of household members categorized by age cohort. For the analysis, we use the 2014 and 2010 Korea Housing Survey data from the Ministry of Land, Transport and Maritime Affairs and applied the ordinary least squares (OLS) method to estimate the result. To compensate for the shortcomings of the one-year data, which is the biased condition of the corresponding year, this paper employs two-year data. The dependent variable is the area of the house (㎡). Mankiw and Weil (1989) showed that age-specific housing demand differs among the members in each household and that changes in the age structure of the population are the main factors in demand for housing service (Jung, 2008). This paper estimates the age-adjusted regression coefficient with a 10-year age cohort (0-14, 15-24, 25-34, 35-44, 45-54, 55-64, over 65) to reflect life-cycle features.

Table 2. Estimation of Housing Demand Function

$$\ln(HD_i) = \beta_0 + \beta_1 \ln(UC_i) + \beta_2 \ln(PI_i) + \sum_j \alpha_j X_{ij} + dm_{2010} + \epsilon_i$$

Variable	Parameter			
	Seoul	Incheon	Gyeonggi	ROK
β_0	0.040 (0.064)	1.257 *** (0.107)	1.123 *** (0.065)	1.491 *** (0.032)
$\ln(UC_i)$	−0.071 *** (0.005)	−0.092 *** (0.008)	−0.110 *** (0.005)	−0.102 *** (0.002)
$\ln(PI_i)$	0.532 *** (0.009)	0.379 *** (0.016)	0.414 *** (0.010)	0.368 *** (0.005)
X_{i1}	0.086 *** (0.007)	0.084 *** (0.012)	0.066 *** (0.006)	0.056 *** (0.004)
X_{i2}	0.046 *** (0.008)	0.041 *** (0.012)	0.053 *** (0.007)	0.013 *** (0.004)
X_{i3}	−0.002 (0.007)	0.006 (0.013)	0.011 (0.007)	−0.009 *** (0.004)
X_{i4}	0.010 (0.009)	0.011 (0.016)	0.028 *** (0.009)	0.011 *** (0.005)
X_{i5}	0.060 *** (0.009)	0.066 *** (0.014)	0.060 *** (0.008)	0.052 *** (0.005)
X_{i6}	0.167 *** (0.008)	0.167 *** (0.013)	0.148 *** (0.008)	0.134 *** (0.004)
X_{i7}	0.268 *** (0.007)	0.245 *** (0.013)	0.254 *** (0.007)	0.205 *** (0.004)
dm_{2010}	−0.058 *** (0.009)	−0.041 *** (0.015)	−0.115 *** (0.008)	−0.065 *** (0.005)
Number of Obs.	9300	3090	8742	27792
Adj R-Sq	0.433	0.323	0.360	0.355

Note: *, **, and *** mean statistically significant at 10%, 5%, and 1%, respectively

In the demand function, housing price is a user cost that reflects the cost of occupying the housing service for a certain period rather than the housing sale price. The user cost is derived differently depending on the occupancy type, being owner-occupied or renter-occupied. It refers to a utilization concept rather than to ownership or possession. The housing user cost can include the macroeconomic indicators and the tax burden, and it reflects government intervention in the market through policies. Equations (18)-(19) capture the user cost for a household; these functions are revised from Kim (2008). Equation (20) shows the weighted interest rate, which is defined as the weighted housing finance loan and general mortgage (Sohn and Park, 2005). For the estimation, the actual tax rate is derived for each household using the Korean Housing Survey data. The interest income tax rate is applied at 15.4%, which is the rate currently applied in Korea, and the depreciation rate for housing is 2.5%, based on Lee and Chung (2010).

In addition, the growth rate in the housing price is 3.78%[13], and the actual acquisition tax rate is derived following Equation (21)[14]. The property ownership and transfer income tax are also applied with the actual tax rate[15].

$$UC_{own} = \{(1 - t_r)\, r^* + t_a + t_p + m - (1 - t_g)g\}V_h \quad (18)$$

$$UC_{rent} = (1 - t_r)\, r^* V_h + R \times 12 \quad (19)$$

$$r^* = rq + r'(1 - q) \quad (20)$$

$$t_a = t_a'(1 + r')^l / l \quad (21)$$

UC_{own} : User cost for owner-occupied household
UC_{rent} : User cost for rented household
t_r : Interest income tax
r^* : Weighted interest rate
q : Ratio of loan to housing price
r : Housing mortgage loan interest rate
r' : Market interest rate
t_a : Actual acquisition tax
$t_a{}'$: Nominal acquisition tax
t_p : Actual property ownership tax
m : Depreciation rate of housing
t_g : Actual transfer income tax
g : Growth rate of housing price
V_h : Housing price
R : Rental price for each month

[13] Based on the housing sales price index by KB bank (2003.06-2013.06).
[14] The average housing ownership period is 10 years.
[15] The actual transfer income tax rate is calculated with a 10-year ownership period. The required expenses are 3% of the housing price, and a basic deduction is applied of 2.5 million won. The long-term ownership deduction is 30% of the transfer income, and the transfer income tax rate is 20%.

The real income of households is estimated by applying the permanent income rather than the annual income, taking into account durability, as a housing attribute. Household income is determined by the income, assets, consumption and age of the householder, and consumption is the dependent variable. The function is revised from Kim (2008), and Table 3 shows its estimation result.

$$ln(PI_i) = \beta_0 + \beta_1\, ln(prop_i) + \beta_2 ln(inc_i) + \beta_3 age_i + \beta_4 age_i^2 + \epsilon_i \qquad (22)$$

PI_i : Permanent income (Consumption)
$prop_i$: Properties (real estate + finance + others)
inc_i : Income (labor + business + properties + transfer)
age_i : Age of householder

Table 3. Estimation of Permanent Income Function

$$ln(PI_i) = \beta_0 + \beta_1 ln(prop_i) + \beta_2 ln(inc_i) + \beta_3 age_i + \beta_4 age_i^2 + \epsilon_i$$

Variable	Parameter			
	Seoul	Incheon	Gyeonggi	ROK
β_0	1.1237 *** (0.058)	0.9692 *** (0.112)	0.8787 *** (0.068)	1.0080 *** (0.033)
$ln(prop_i)$	0.0768 *** (0.003)	0.0442 *** (0.006)	0.0719 *** (0.004)	0.0454 *** (0.002)
$ln(inc_i)$	0.6170 *** (0.007)	0.6872 *** (0.012)	0.6616 *** (0.008)	0.7048 *** (0.004)
age_i	0.0308 *** (0.002)	0.0262 *** (0.003)	0.0282 *** (0.002)	0.0205 *** (0.001)
age_i^2	−0.0003 *** (0.000)	−0.0003 *** (0.000)	−0.0003 *** (0.000)	−0.0002 *** (0.000)
Number of Obs.	9300	3090	8742	27792
Adj R-Sq	0.694	0.698	0.687	0.760

Note: *, **, and *** mean statistically significant at 10%, 5%, and 1%, respectively

The housing investment function, which consists of income and interest rate, is applied to estimate the housing supply for the current period. Seo (1994) used the number of quarterly construction permits and Gross Domestic Product (GDP) as explanatory variables. In Kim and Jeong (1995), GDP, inflation, and the money supply were used as independent variables. Kim (2000) also used macroeconomic variables, such as GDP and the Consumer Price Index (CPI). In this paper, construction orders are used as a dependent variable. As

construction orders are one of the leading indicators in economics, we choose indexes that predict market conditions as the independent variables. Gross Regional Domestic Product (GRDP), construction material cost, real interest rate, and previous year's supply amount are independent variables. To reflect regional effects, a regional dummy and interaction variables are included in the model. Time series data for 24 years from 1991 to 2014 are used for the analysis. The real interest rate is a three-year corporate bond rate, and the OLS method is estimated.

$$\begin{aligned} ln(HI_{it}) = \beta_0 + \beta_1 ln(grdp_{it}) + \beta_2 ln(defl_t) + \beta_3 ln(rate_t) \\ + \beta_4 ln(supp_{it-1}) + \beta_5 dummy_{01} + \beta_6 dummy_{02} \\ + \beta_7 dummy_{03} + \beta_8 ln(grdp_{it}) * dummy_{01} \\ + \beta_9 ln(grdp_{it}) * dummy_{02} + \beta_{10} ln(grdp_{it}) * dummy_{03} \\ + \beta_{11} ln(rate_t) * dummy_{01} + \beta_{12} ln(rate_t) * dummy_{02} \\ + \beta_{13} ln(rate_t) * dummy_{03} + \epsilon_i \end{aligned} \quad (23)$$

HI_{it} : Total value of order
$grdp_{it}$: Gross regional domestic product
$defl_t$: Construction material cost
$rate_t$: Interest rate
$supp_{it-1}$: Housing supply for previous year
$dummy_{01}$: Seoul dummy
$dummy_{02}$: Incheon dummy
$dummy_{03}$: Gyeonggi dummy
i : Region (Seoul, Incheon, Gyeonggi, and the ROK)
t : Year (1991-2014)

Table 4. Estimation of Housing Investment Function

$$ln(HI_{it}) = \beta_0 + \beta_1 ln(grdp_{it}) + \beta_2 ln(defl_t) + \beta_3 ln(rate_t) + \beta_4 ln(supp_{it-1}) + \beta_5 dummy_{01} + \beta_6 dummy_{02} + \beta_7 dummy_{03} + \beta_8 ln(grdp_{it}) * dummy_{01} + \beta_9 ln(grdp_{it}) * dummy_{02} + \beta_{10} ln(grdp_{it}) * dummy_{03} + \beta_{11} ln(rate_t) * dummy_{01} + \beta_{12} ln(rate_t) * dummy_{02} + \beta_{13} ln(rate_t) * dummy_{03} + \epsilon_i$$

Variable	Parameter	
β_0	5.904 (1.991)	***
$ln(grdp_{it})$	0.457 (0.087)	***
$ln(defl_t)$	−0.416 (0.136)	***
$ln(rate_t)$	−1.041 (0.130)	***
$ln(supp_{it-1})$	0.504 (0.088)	***
$dummy_{01}$	−22.890 (10.886)	**
$dummy_{02}$	−24.650 (9.850)	**
$dummy_{03}$	−17.705 (10.018)	*
$ln(grdp_{it}) * dummy_{01}$	1.088 (0.516)	**
$ln(grdp_{it}) * dummy_{02}$	1.282 (0.505)	**
$ln(grdp_{it}) * dummy_{03}$	0.824 (0.470)	*
$ln(rate_t) * dummy_{01}$	1.371 (0.643)	**
$ln(rate_t) * dummy_{02}$	1.348 (0.637)	**
$ln(rate_t) * dummy_{03}$	1.481 (0.694)	**
Number of Observations	377	
Adj R-Sq	0.742	

Note: *, **, and *** mean statistically significant at 10%, 5%, and 1%, respectively

Table 5. Regional Estimation of Housing Investment Function

$ln(HI_{it}) = \beta_0 + \beta_1\, ln(grdp_{it}) + \beta_2 ln(defl_t) + \beta_3 ln(rate_t) + \beta_4 ln(supp_{it-1}) + \epsilon_i$

Variable	Parameter			
	Seoul	Incheon	Gyeonggi	ROK
β_0	−16.986	−18.746	−11.801	5.904
$ln(grdp_{it})$	1.545	1.739	1.282	0.457
$ln(defl_t)$	−0.416	−0.416	−0.416	−0.416
$ln(rate_t)$	0.331	0.307	0.441	−1.041
$ln(supp_{it-1})$	0.504	0.504	0.504	0.504

Lee (2008) studied interregional migration from a macroscopic perspective. This study found that migrants change regions of residence based on income expectation or other utility factors after migration rather than based on direct benefit. In addition, the fluctuation of the net migration rate is mainly affected by the ratio for the volume of new homes and the variation in the number of employees. The dependent variables for the out−migration function are housing price of the origin and destination regions, the ratio of expected income, and the ratio of the previous year's housing supply. In addition, the number of migrants is the dependent variable. Time series data from 1989 to 2014 are used, and the OLS is estimated. Table 6 summarizes the estimation results. Table 7 shows the dummy and interaction variables with the estimation coefficient for each migration model.

$$ln(MOV_{ij}) = \beta_0 + \beta_1 ln(HP_i) + \beta_2 ln(HP_j) + \beta_3 ln(EI_j/EI_i) \quad (24)$$
$$+ \beta_4 ln(pop_j/pop_i) + \beta_5 dummy_{02} + \beta_6 dummy_{03}$$
$$+ \beta_7 ln(HP_j) * dummy_{02} + \beta_8 ln(HP_j) * dummy_{03}$$
$$+ \beta_9 ln(EI_j/EI_i) * dummy_{02}$$
$$+ \beta_{10} ln(EI_j/EI_i) * dummy_{03} + \epsilon_i$$

MOV_{ij} : Number of migrants from i to j
HP_k : Housing price
EI_k : Expected income (GRDP per capita * Employment rate)
pop_k : Population
$dummy_{01}$: Seoul dummy
$dummy_{02}$: Incheon dummy
$dummy_{03}$: Gyeonggi dummy
i : Origin region
j : Destination region

Table 6. Estimation of Migration Function

$$ln(MOV_{ij}) = \beta_0 + \beta_1 ln(HP_i) + \beta_2 ln(HP_j) + \beta_3 ln(EI_j/EI_i) + \beta_4 ln(pop_j/pop_i) + \beta_5 dummy_{02} + \beta_6 dummy_{03} + \beta_7 ln(HP_j) * dummy_{02} + \beta_8 ln(HP_j) * dummy_{03} + \beta_9 ln(EI_j/EI_i) * dummy_{02} + \beta_{10} ln(EI_j/EI_i) * dummy_{03} + \epsilon_i$$

Variable	Parameter			
	Seoul Destination	Incheon Destination	Gyeonggi Destination	ROK Destination
β_0	30.639 *** (1.125)	25.909 *** (1.492)	17.004 *** (1.498)	19.522 *** (1.540)
$ln(HP_i)$	−0.890 *** (0.065)	0.286 *** (0.088)	0.855 *** (0.091)	−0.946 *** (0.092)
$ln(HP_j)$	−0.309 *** (0.057)	−1.379 *** (0.081)	−1.270 *** (0.083)	0.360 *** (0.056)
$ln\left(\frac{EI_j}{EI_i}\right)$	0.303 *** (0.052)	0.140 ** (0.062)	0.161 ** (0.063)	0.063 (0.071)
$ln\left(\frac{pop_j}{pop_i}\right)$	−0.689 *** (0.039)	−0.698 *** (0.048)	−0.629 *** (0.047)	0.422 *** (0.033)
$dummy_{01}$		−18.025 *** (5.489)	−1.806 (5.525)	2.005 (2.045)
$dummy_{02}$	−11.028 *** (3.878)		−13.326 *** (4.435)	3.427 * (2.033)
$dummy_{03}$	−10.860 *** (4.088)	−14.993 *** (4.486)		
$ln(HP_j) * dummy_{01}$		1.290 *** (0.340)	0.310 (0.336)	−0.137 (0.127)
$ln(HP_j) * dummy_{02}$	0.700 *** (0.229)		0.888 *** (0.266)	−0.337 *** (0.126)
$ln(HP_j) * dummy_{03}$	0.761 *** (0.241)	1.070 *** (0.274)		
$ln\left(\frac{EI_j}{EI_i}\right) * dummy_{01}$		0.623 (0.633)	−1.310 * (0.671)	−0.421 *** (0.102)
$ln\left(\frac{EI_j}{EI_i}\right) * dummy_{02}$	−0.862 * (0.496)		1.371 (1.573)	−0.062 (0.096)
$ln\left(\frac{EI_j}{EI_i}\right) * dummy_{03}$	−0.796 (0.539)	0.749 (1.552)		
Number of Obs.	352	352	352	900
Adj R-Sq	0.897	0.909	0.884	0.784

Note: *, **, and *** mean statistically significant at 10%, 5%, and 1%, respectively

Table 7. Regional Estimation of Migration Function

$$ln(MOV_{ij}) = \beta_0 + \beta_1 ln(HP_i) + \beta_2 ln(HP_j) + \beta_3 ln(EI_j/EI_i) + \beta_4 ln(pop_j/pop_i) + \epsilon_i$$

Variable	Parameter					
Origin	Incheon	Gyeonggi	ROK	Seoul	Gyeonggi	ROK
Destination	Seoul			Incheon		
β_0	19.611	19.779	30.639	7.883	10.915	25.909
$ln(HP_i)$	0.391	0.451	−0.309	1.576	1.357	0.286
$ln(HP_j)$	−0.890	−0.890	−0.890	−1.379	−1.379	−1.379
$ln\left(\frac{EI_j}{EI_i}\right)$	−0.559	−0.494	0.303	0.763	0.889	0.140
$ln\left(\frac{pop_j}{pop_i}\right)$	−0.689	−0.689	−0.689	−0.698	−0.698	−0.698

Variable	Parameter					
Origin	Seoul	Incheon	ROK	Seoul	Incheon	Gyeonggi
Destination	Gyeonggi			ROK		
β_0	15.198	3.679	17.004	21.527	22.949	19.522
$ln(HP_i)$	1.165	1.743	0.855	−1.082	−1.282	−0.946
$ln(HP_j)$	−1.270	−1.270	−1.270	0.360	0.360	0.360
$ln\left(\frac{EI_j}{EI_i}\right)$	−1.149	1.531	0.161	−0.357	0.002	0.063
$ln\left(\frac{pop_j}{pop_i}\right)$	−0.629	−0.629	−0.629	0.422	0.422	0.422

4.3 Benchmark Data

The Social Accounting Matrix (SAM) is used as benchmark data in the CGE model. It can be seen as a statistical system that integrates the input–output table and the national accounts (Kim, 2014). The SAM focuses on production activities, distribution and expenditure relationships. The factor income value–added from the production account is assigned to the household sector, and the household will use it to consume products and services under the assumption that the production factors, production and the household sectors are defined as endogenous parts. The investment sector consists of the depreciation of the production sectors, and household and government savings subtracting expenses for purchasing assets by the production sector (Park *et al.*, 2014). In this paper, the SAM is calibrated using the regional input–output table in 2013 and the national accounts data from the Bank of Korea. It consists of the production factors, four households, thirteen producers, a government, an investment and the ROW. The household sector, which provides resources to the production factors, is divided into four regions. The production sector consists of 1 industries, similar to the CGE model. The government sector refers to the combination of the national and regional governments.

From the benchmark data, the CGE model can use the parameters to reproduce values and assess the effect of policies. Kim (2008) suggested that the CGE model has two types of parameters: structural coefficients and behavior parameters. The structural coefficients are point estimates or non-elastic parameters, and the behavior parameters determine the behavior of agents. In this paper, the parameters are from three sources. The first set of parameters is from the SAM. Some of the shift or share parameters of production belong to this set. The second set of parameters is from previous studies. For example, we bring alternative elasticity and the conversion elasticity of imports and exports from Cheung (2008). In addition to these two sets, we use econometric methods to estimate parameters. For instance, housing demand, investment and migration parameters were estimated by the specified functions.

Table 8. Social Accounting Matrix in 2013

			Production											
			Seoul		Incheon		Gyeonggi		ROK		Nationwide			
			H Cons	H Serv	H Cons	H Serv	H Cons	H Serv	H Cons	H Serv	Agri	Manu	Cons	Esta
Production	Seoul	H Cons	1	20	39	58	77	96	115	134	153	172	191	210
		H Serv	2	21	40	59	78	97	116	135	154	173	192	211
	Incheon	H Cons	3	22	41	60	79	98	117	136	155	174	193	212
		H Serv	4	23	42	61	80	99	118	137	156	175	194	213
	Gyeonggi	H Cons	5	24	43	62	81	100	119	138	157	176	195	214
		H Serv	6	25	44	63	82	101	120	139	158	177	196	215
	ROK	H Cons	7	26	45	64	83	102	121	140	159	178	197	216
		H Serv	8	27	46	65	84	103	122	141	160	179	198	217
	Nationwide	Agri	9	28	47	66	85	104	123	142	161	180	199	218
		Manu	10	29	48	67	86	105	124	143	162	181	200	219
		Cons	11	30	49	68	87	106	125	144	163	182	201	220
		Esta	12	31	50	69	88	107	126	145	164	183	202	221
		Serv	13	32	51	70	89	108	127	146	165	184	203	222
Factor	Labor		14	33	52	71	90	109	128	147	166	185	204	223
	Capital		15	34	53	72	91	110	129	148	167	186	205	224
Household	Seoul													
	Incheon													
	Gyeonggi													
	ROK													
Government			16	35	54	73	92	111	130	149	168	187	206	225
Investment			17	36	55	74	93	112	131	150	169	188	207	226
Rest of world			18	37	56	75	94	113	132	151	170	189	208	227
Total Supply			19	38	57	76	95	114	133	152	171	190	209	228

Abbreviation:
H Cons: Housing Construction, H Serv: Housing Services, Agri: Agriculture and Mining, Manu: Manufacturing, Cons: Construction, Esta: Real Estate, Serv: Services

Table 8. Social Accounting Matrix in 2013 (continued)

				Factor		Household				Government	Investment	Rest of world	Total Demand
			Serv	Labor	Capital	Seoul	Incheon	Gyeonggi	ROK				
Production	Seoul	H Cons	229			258	275	292	309	326	345	360	374
		H Serv	230			259	276	293	310	327	346	361	375
	Incheon	H Cons	231			260	277	294	311	328	347	362	376
		H Serv	232			261	278	295	312	329	348	363	377
	Gyeonggi	H Cons	233			262	279	296	313	330	349	364	378
		H Serv	234			263	280	297	314	331	350	365	379
	ROK	H Cons	235			264	281	298	315	332	351	366	380
		H Serv	236			265	282	299	316	333	352	367	381
	Nationwide	Agri	237			266	283	300	317	334	353	368	382
		Manu	238			267	284	301	318	335	354	369	383
		Cons	239			268	285	302	319	336	355	370	384
		Esta	240			269	286	303	320	337	356	371	385
		Serv	241			270	287	304	321	338	357	372	386
Factor	Labor		242										387
	Capital		243										388
Household	Seoul			248	253					339			389
	Incheon			249	254					340			390
	Gyeonggi			250	255					341			391
	ROK			251	256					342			392
Government			244			271	288	305	322				393
Investment			245			272	289	306	323	343			394
Rest of world			246			273	290	307	324		358		395
Total Supply			247	252	257	274	291	308	325	344	359	373	

Abbreviation:
H Cons: Housing Construction, H Serv: Housing Services, Agri: Agriculture and Mining, Manu: Manufacturing, Cons: Construction, Esta: Real Estate, Serv: Services

Table 8. Social Accounting Matrix in 2013 (continued)

No.	Explanation	Value	No.	Explanation	Value
1	Intermediate use of SEL HC in SEL HC	0	39	Intermediate use of SEL HC in ICN HC	0
2	Intermediate use of SEL HS in SEL HC	0	40	Intermediate use of SEL HS in ICN HC	0
3	Intermediate use of ICN HC in SEL HC	0	41	Intermediate use of ICN HC in ICN HC	0
4	Intermediate use of ICN HS in SEL HC	0	42	Intermediate use of ICN HS in ICN HC	0
5	Intermediate use of GGI HC in SEL HC	0	43	Intermediate use of GGI HC in ICN HC	0
6	Intermediate use of GGI HS in SEL HC	0	44	Intermediate use of GGI HS in ICN HC	0
7	Intermediate use of ROK HC in SEL HC	0	45	Intermediate use of ROK HC in ICN HC	0
8	Intermediate use of ROK HS in SEL HC	0	46	Intermediate use of ROK HS in ICN HC	0
9	Intermediate use of NW Agri in SEL HC	52,234	47	Intermediate use of NW Agri in ICN HC	15,650
10	Intermediate use of NW Manu in SEL HC	3,469,020	48	Intermediate use of NW Manu in ICN HC	1,038,870
11	Intermediate use of NW Cons in SEL HC	3,654	49	Intermediate use of NW Cons in ICN HC	1,095
12	Intermediate use of NW Esta in SEL HC	37,128	50	Intermediate use of NW Esta in ICN HC	11,125
13	Intermediate use of NW Serv in SEL HC	1,341,931	51	Intermediate use of NW Serv in ICN HC	402,100
14	Wage in SEL HC	2,090,122	52	Wage in ICN HC	629,436
15	Profit in SEL HC	12,873	53	Profit in ICN HC	12,325
16	Indirect tax in SEL HC	325,612	54	Indirect tax in ICN HC	97,599
17	Depreciation in SEL HC	192,712	55	Depreciation in ICN HC	58,035
18	Import of SEL HC	429,747	56	Import of ICN HC	129,408
19	Total Supply of SEL HC	7,955,033	57	Total Supply of ICN HC	2,395,643
20	Intermediate use of SEL HC in SEL HS	0	58	Intermediate use of SEL HC in ICN HS	0
21	Intermediate use of SEL HS in SEL HS	0	59	Intermediate use of SEL HS in ICN HS	0
22	Intermediate use of ICN HC in SEL HS	0	60	Intermediate use of ICN HC in ICN HS	0
23	Intermediate use of ICN HS in SEL HS	0	61	Intermediate use of ICN HS in ICN HS	0
24	Intermediate use of GGI HC in SEL HS	0	62	Intermediate use of GGI HC in ICN HS	0
25	Intermediate use of GGI HS in SEL HS	0	63	Intermediate use of GGI HS in ICN HS	0
26	Intermediate use of ROK HC in SEL HS	0	64	Intermediate use of ROK HC in ICN HS	0
27	Intermediate use of ROK HS in SEL HS	0	65	Intermediate use of ROK HS in ICN HS	0
28	Intermediate use of NW Agri in SEL HS	0	66	Intermediate use of NW Agri in ICN HS	0
29	Intermediate use of NW Manu in SEL HS	55,590	67	Intermediate use of NW Manu in ICN HS	5,230
30	Intermediate use of NW Cons in SEL HS	2,116,659	68	Intermediate use of NW Cons in ICN HS	199,124
31	Intermediate use of NW Esta in SEL HS	339,427	69	Intermediate use of NW Esta in ICN HS	31,932
32	Intermediate use of NW Serv in SEL HS	5,290,740	70	Intermediate use of NW Serv in ICN HS	499,916
33	Wage in SEL HS	0	71	Wage in ICN HS	0
34	Profit in SEL HS	25,730,724	72	Profit in ICN HS	1,754,013
35	Indirect tax in SEL HS	2,620,963	73	Indirect tax in ICN HS	201,657
36	Depreciation in SEL HS	11,305,930	74	Depreciation in ICN HS	876,763
37	Import of SEL HS	115,712	75	Import of ICN HS	8,700
38	Total Supply of SEL HS	47,575,745	76	Total Supply of ICN HS	3,577,335

No.	Explanation	Value	No.	Explanation	Value
77	Intermediate use of SEL HC in GGI HC	0	115	Intermediate use of SEL HC in ROK HC	0
78	Intermediate use of SEL HS in GGI HC	0	116	Intermediate use of SEL HS in ROK HC	0
79	Intermediate use of ICN HC in GGI HC	0	117	Intermediate use of ICN HC in ROK HC	0
80	Intermediate use of ICN HS in GGI HC	0	118	Intermediate use of ICN HS in ROK HC	0
81	Intermediate use of GGI HC in GGI HC	0	119	Intermediate use of GGI HC in ROK HC	0
82	Intermediate use of GGI HS in GGI HC	0	120	Intermediate use of GGI HS in ROK HC	0
83	Intermediate use of ROK HC in GGI HC	0	121	Intermediate use of ROK HC in ROK HC	0
84	Intermediate use of ROK HS in GGI HC	0	122	Intermediate use of ROK HS in ROK HC	0
85	Intermediate use of NW Agri in GGI HC	60,156	123	Intermediate use of NW Agri in ROK HC	166,191
86	Intermediate use of NW Manu in GGI HC	3,992,356	124	Intermediate use of NW Manu in ROK HC	11,016,270
87	Intermediate use of NW Cons in GGI HC	4,208	125	Intermediate use of NW Cons in ROK HC	11,632
88	Intermediate use of NW Esta in GGI HC	42,768	126	Intermediate use of NW Esta in ROK HC	118,189
89	Intermediate use of NW Serv in GGI HC	1,545,694	127	Intermediate use of NW Serv in ROK HC	4,271,310
90	Wage in GGI HC	2,425,499	128	Wage in ROK HC	6,788,270
91	Profit in GGI HC	63,278	129	Profit in ROK HC	405,334
92	Indirect tax in GGI HC	375,234	130	Indirect tax in ROK HC	1,037,778
93	Depreciation in GGI HC	223,634	131	Depreciation in ROK HC	625,886
94	Import of GGI HC	498,656	132	Import of ROK HC	1,395,393
95	Total Supply of GGI HC	9,231,483	133	Total Supply of ROK HC	25,836,253
96	Intermediate use of SEL HC in GGI HS	0	134	Intermediate use of SEL HC in ROK HS	0
97	Intermediate use of SEL HS in GGI HS	0	135	Intermediate use of SEL HS in ROK HS	0
98	Intermediate use of ICN HC in GGI HS	0	136	Intermediate use of ICN HC in ROK HS	0
99	Intermediate use of ICN HS in GGI HS	0	137	Intermediate use of ICN HS in ROK HS	0
100	Intermediate use of GGI HC in GGI HS	0	138	Intermediate use of GGI HC in ROK HS	0
101	Intermediate use of GGI HS in GGI HS	0	139	Intermediate use of GGI HS in ROK HS	0
102	Intermediate use of ROK HC in GGI HS	0	140	Intermediate use of ROK HC in ROK HS	0
103	Intermediate use of ROK HS in GGI HS	0	141	Intermediate use of ROK HS in ROK HS	0
104	Intermediate use of NW Agri in GGI HS	0	142	Intermediate use of NW Agri in ROK HS	0
105	Intermediate use of NW Manu in GGI HS	29,637	143	Intermediate use of NW Manu in ROK HS	32,424
106	Intermediate use of NW Cons in GGI HS	1,128,519	144	Intermediate use of NW Cons in ROK HS	1,234,390
107	Intermediate use of NW Esta in GGI HS	180,969	145	Intermediate use of NW Esta in ROK HS	197,943
108	Intermediate use of NW Serv in GGI HS	2,829,452	146	Intermediate use of NW Serv in ROK HS	3,101,011
109	Wage in GGI HS	0	147	Wage in ROK HS	0
110	Profit in GGI HS	11,233,824	148	Profit in ROK HS	10,018,663
111	Indirect tax in GGI HS	1,220,294	149	Indirect tax in ROK HS	1,207,490
112	Depreciation in GGI HS	5,147,132	150	Depreciation in ROK HS	5,480,329
113	Import of GGI HS	53,076	151	Import of ROK HS	51,863
114	Total Supply of GGI HS	21,822,903	152	Total Supply of ROK HS	21,324,113

No.	Explanation	Value	No.	Explanation	Value
153	Intermediate use of SEL HC in NW Agri	0	191	Intermediate use of SEL HC in NW Cons	0
154	Intermediate use of SEL HS in NW Agri	0	192	Intermediate use of SEL HS in NW Cons	0
155	Intermediate use of ICN HC in NW Agri	0	193	Intermediate use of ICN HC in NW Cons	0
156	Intermediate use of ICN HS in NW Agri	0	194	Intermediate use of ICN HS in NW Cons	0
157	Intermediate use of GGI HC in NW Agri	0	195	Intermediate use of GGI HC in NW Cons	0
158	Intermediate use of GGI HS in NW Agri	0	196	Intermediate use of GGI HS in NW Cons	0
159	Intermediate use of ROK HC in NW Agri	0	197	Intermediate use of ROK HC in NW Cons	0
160	Intermediate use of ROK HS in NW Agri	0	198	Intermediate use of ROK HS in NW Cons	0
161	Intermediate use of NW Agri in NW Agri	2,926,785	199	Intermediate use of NW Agri in NW Cons	1,298,693
162	Intermediate use of NW Manu in NW Agri	18,084,404	200	Intermediate use of NW Manu in NW Cons	65,338,606
163	Intermediate use of NW Cons in NW Agri	88,003	201	Intermediate use of NW Cons in NW Cons	66,227
164	Intermediate use of NW Esta in NW Agri	41,419	202	Intermediate use of NW Esta in NW Cons	563,376
165	Intermediate use of NW Serv in NW Agri	4,238,435	203	Intermediate use of NW Serv in NW Cons	21,192,698
166	Wage in NW Agri	5,097,237	204	Wage in NW Cons	38,384,763
167	Profit in NW Agri	20,559,205	205	Profit in NW Cons	5,413,326
168	Indirect tax in NW Agri	1,863,423	206	Indirect tax in NW Cons	2,150,030
169	Depreciation in NW Agri	5,895,087	207	Depreciation in NW Cons	4,570,160
170	Import of NW Agri	1,925,217	208	Import of NW Cons	6,202,275
171	Total Supply of NW Agri	60,719,215	209	Total Supply of NW Cons	145,180,154
172	Intermediate use of SEL HC in NW Manu	0	210	Intermediate use of SEL HC in NW Esta.	0
173	Intermediate use of SEL HS in NW Manu	0	211	Intermediate use of SEL HS in NW Esta.	0
174	Intermediate use of ICN HC in NW Manu	0	212	Intermediate use of ICN HC in NW Esta.	0
175	Intermediate use of ICN HS in NW Manu	0	213	Intermediate use of ICN HS in NW Esta.	0
176	Intermediate use of GGI HC in NW Manu	0	214	Intermediate use of GGI HC in NW Esta.	0
177	Intermediate use of GGI HS in NW Manu	0	215	Intermediate use of GGI HS in NW Esta.	0
178	Intermediate use of ROK HC in NW Manu	0	216	Intermediate use of ROK HC in NW Esta.	0
179	Intermediate use of ROK HS in NW Manu	0	217	Intermediate use of ROK HS in NW Esta.	0
180	Intermediate use of NW Agri in NW Manu	32,449,901	218	Intermediate use of NW Agri in NW Esta.	5,018
181	Intermediate use of NW Manu in NW Manu	707,381,024	219	Intermediate use of NW Manu in NW Esta.	1,485,620
182	Intermediate use of NW Cons in NW Manu	1,612,487	220	Intermediate use of NW Cons in NW Esta.	114,622
183	Intermediate use of NW Esta in NW Manu	3,984,339	221	Intermediate use of NW Esta in NW Esta.	1,173,091
184	Intermediate use of NW Serv in NW Manu	214,271,386	222	Intermediate use of NW Serv in NW Esta.	14,419,072
185	Wage in NW Manu	169,618,902	223	Wage in NW Esta.	10,181,977
186	Profit in NW Manu	111,731,137	224	Profit in NW Esta.	15,223,408
187	Indirect tax in NW Manu	12,056,884	225	Indirect tax in NW Esta.	517,974
188	Depreciation in NW Manu	101,988,752	226	Depreciation in NW Esta.	7,820,476
189	Import of NW Manu	445,172,000	227	Import of NW Esta.	285,720
190	Total Supply of NW Manu	1,800,266,812	228	Total Supply of NW Esta.	51,226,978

No.	Explanation	Value	No.	Explanation	Value
229	Intermediate use of SEL HC in NW Serv	0	267	Private consumption of SEL Household in NW Manu	22,798,481
230	Intermediate use of SEL HS in NW Serv	0	268	Private consumption of SEL Household in NW Cons	0
231	Intermediate use of ICN HC in NW Serv	0	269	Private consumption of SEL Household in NW Esta.	851,191
232	Intermediate use of ICN HS in NW Serv	0	270	Private consumption of SEL Household in NW Serv	80,864,108
233	Intermediate use of GGI HC in NW Serv	0	271	Direct tax in SEL Household	122,002,395
234	Intermediate use of GGI HS in NW Serv	0	272	Savings of SEL Household	37,657,487
235	Intermediate use of ROK HC in NW Serv	0	273	Foreign consumption of SEL Household	12,085,578
236	Intermediate use of ROK HS in NW Serv	0	274	Total expenditure of SEL Household	298,020,856
237	Intermediate use of NW Agri in NW Serv	6,992,983	275	Private consumption of ICN Household in SEL HC	0
238	Intermediate use of NW Manu in NW Serv	164,185,104	276	Private consumption of ICN Household in SEL HS	2,643,645
239	Intermediate use of NW Cons in NW Serv	4,093,589	277	Private consumption of ICN Household in ICN HC	0
240	Intermediate use of NW Esta in NW Serv	33,346,261	278	Private consumption of ICN Household in ICN HS	2,440,429
241	Intermediate use of NW Serv in NW Serv	338,814,603	279	Private consumption of ICN Household in GGI HC	0
242	Wage in NW Serv	394,184,227	280	Private consumption of ICN Household in GGI HS	197,667
243	Profit in NW Serv	168,944,056	281	Private consumption of ICN Household in ROK HC	0
244	Indirect tax in NW Serv	37,638,098	282	Private consumption of ICN Household in ROK HS	17,030
245	Depreciation in NW Serv	134,916,633	283	Private consumption of ICN Household in NW Agri	833,705
246	Import of NW Serv	119,222,372	284	Private consumption of ICN Household in NW Manu	6,554,044
247	Total Supply of NW Serv	1,402,337,926	285	Private consumption of ICN Household in NW Cons	0
248	Labor income of SEL Household	149,257,049	286	Private consumption of ICN Household in NW Esta.	235,417
249	Labor income of ICN Household	30,532,060	287	Private consumption of ICN Household in NW Serv	23,041,985
250	Labor income of GGI Household	138,183,588	288	Direct tax in ICN Household	9,959,399
251	Labor income of ROK Household	311,427,736	289	Savings of ICN Household	6,767,867
252	Total labor income	629,400,433	290	Foreign consumption of ICN Household	1,111,255
253	Capital income of SEL Household	103,074,725	291	Total expenditure of ICN Household	53,802,443
254	Capital income of ICN Household	15,022,020	292	Private consumption of GGI Household in SEL HC	0
255	Capital income of GGI Household	77,688,154	293	Private consumption of GGI Household in SEL HS	6,177,891
256	Capital income of ROK Household	175,317,267	294	Private consumption of GGI Household in ICN HC	0
257	Total capital income	371,102,166	295	Private consumption of GGI Household in ICN HS	102,420
258	Private consumption of SEL Household in SEL HC	0	296	Private consumption of GGI Household in GGI HC	0
259	Private consumption of SEL Household in SEL HS	18,173,768	297	Private consumption of GGI Household in GGI HS	14,937,951
260	Private consumption of SEL Household in ICN HC	0	298	Private consumption of GGI Household in ROK HC	0
261	Private consumption of SEL Household in ICN HS	13,586	299	Private consumption of GGI Household in ROK HS	79,882
262	Private consumption of SEL Household in GGI HC	0	300	Private consumption of GGI Household in NW Agri	3,393,397
263	Private consumption of SEL Household in GGI HS	584,213	301	Private consumption of GGI Household in NW Manu	26,753,151
264	Private consumption of SEL Household in ROK HC	0	302	Private consumption of GGI Household in NW Cons	0
265	Private consumption of SEL Household in ROK HS	34,631	303	Private consumption of GGI Household in NW Esta.	921,935
266	Private consumption of SEL Household in NW Agri	2,955,418	304	Private consumption of GGI Household in NW Serv	91,391,224

No.	Explanation	Value	No.	Explanation	Value
305	Direct tax in GGI Household	76,563,532	343	Government Savings	63,277,100
306	Savings of GGI Household	32,132,092	344	Total government expenditure	458,902,849
307	Foreign consumption of GGI Household	2,505,623	345	Investment in SEL HC	7,955,033
308	Total expenditure of GGI Household	254,959,098	346	Investment in SEL HS	0
309	Private consumption of ROK Household in SEL HC	0	347	Investment in ICN HC	2,395,643
310	Private consumption of ROK Household in SEL HS	20,194,180	348	Investment in ICN HS	0
311	Private consumption of ROK Household in ICN HC	0	349	Investment in GGI HC	9,231,483
312	Private consumption of ROK Household in ICN HS	1,020,344	350	Investment in GGI HS	0
313	Private consumption of ROK Household in GGI HC	0	351	Investment in ROK HC	25,836,253
314	Private consumption of ROK Household in GGI HS	6,062,736	352	Investment in ROK HS	0
315	Private consumption of ROK Household in ROK HC	0	353	Investment in NW Agri	1,204,596
316	Private consumption of ROK Household in ROK HS	21,107,129	354	Investment in NW Manu	37,247,150
317	Private consumption of ROK Household in NW Agri	7,338,420	355	Investment in NW Cons	134,211,445
318	Private consumption of ROK Household in NW Manu	58,253,897	356	Investment in NW Esta.	7,048,225
319	Private consumption of ROK Household in NW Cons	0	357	Investment in NW Serv	86,752,627
320	Private consumption of ROK Household in NW Esta.	1,903,591	358	Investment in Foreign	179,542,708
321	Private consumption of ROK Household in NW Serv	193,475,713	359	Total investment	491,425,163
322	Direct tax in ROK Household	189,064,487	360	Export of SEL HC	0
323	Savings of ROK Household	72,489,088	361	Export of SEL HS	386,261
324	Foreign consumption of ROK Household	3,969,117	362	Export of ICN HC	0
325	Total expenditure of ROK Household	574,878,702	363	Export of ICN HS	556
326	Government consumption in SEL HC	0	364	Export of GGI HC	0
327	Government consumption in SEL HS	0	365	Export of GGI HS	40,336
328	Government consumption in ICN HC	0	366	Export of ROK HC	0
329	Government consumption in ICN HS	0	367	Export of ROK HS	85,441
330	Government consumption in GGI HC	0	368	Export of NW Agri	1,026,068
331	Government consumption in GGI HS	0	369	Export of NW Manu	672,545,934
332	Government consumption in ROK HC	0	370	Export of NW Cons	294,500
333	Government consumption in ROK HS	0	371	Export of NW Esta.	198,652
334	Government consumption in Nat'l Agri	0	372	Export of NW Serv	100,126,672
335	Government consumption in NW Manu	0	373	Total Export	774,704,420
336	Government consumption in NW Cons	0	374	Total demand of SEL HC	7,955,033
337	Government consumption in NW Esta.	0	375	Total demand of SEL HS	47,575,745
338	Government consumption in NW Serv	214,467,249	376	Total demand of ICN HC	2,395,643
339	Government Subsidy to SEL Household	45,689,082	377	Total demand of ICN HS	3,577,335
340	Government Subsidy to ICN Household	8,248,363	378	Total demand of GGI HC	9,231,483
341	Government Subsidy to GGI Household	39,087,356	379	Total demand of GGI HS	21,822,903
342	Government Subsidy to ROK Household	88,133,699	380	Total demand of ROK HC	25,836,253

No.	Explanation	Value	No.	Explanation	Value
381	Total demand of ROK HS	21,324,113	389	Total demand of SEL Household	298,020,856
382	Total demand of NW Agri	60,719,215	390	Total demand of ICN Household	53,802,443
383	Total demand of NW Manu	1,800,266,812	391	Total demand of GGI Household	254,959,098
384	Total demand of NW Cons	145,180,154	392	Total demand of ROK Household	574,878,702
385	Total demand of NW Esta.	51,226,978	393	Total demand of government	458,902,849
386	Total demand of NW Serv	1,402,337,926	394	Total demand of investment	491,425,163
387	Total demand of labor	629,400,433	395	Total demand of Foreign	774,704,420
388	Total demand of capital	371,102,166			

Note: Value is evaluated as Korean million won
Abbreviation:

1) Industry
(HC: Housing Construction, HS: Housing Services, Agri: Agriculture and Mining, Manu: Manufacturing, Cons: Construction, Esta: Real Estate, Serv: Services)

2) Region
(SEL: Seoul, ICN: Incheon, GGI: Gyeonggi, ROK: the Rest of Korea, NW: Nationwide)

Chapter 5. Policy Simulation

This paper assesses the effect of government policies on unsold residential inventory, i.e., tax and financial policy, from a macroeconomic perspective. In 2013, the implementation of two policies clearly demonstrated the government's willingness to increase housing demand to mitigate the effect of unsold residential inventory. In the first policy, the government expanded the number of transactions subject to a decrease in the transfer income tax rate. As the second policy, they decreased the acquisition tax rate and the interest rate for mortgage services. Based on these policies, this paper proposes five options to assess the effectiveness of each measure. The acquisition and transfer income tax could potentially decrease the cost of home sales, and the market interest rate decrease would diminish the cost burden of occupying housing. These policies aim to expand housing demand to reduce the volume of unsold residential inventory.

However, the policies have other positive and negative economic effects. The decline in the user cost from the tax policies changes household consumption because of a subsidy effect from household income. Meanwhile, it also causes a decrease in government revenue and thereby affects government consumption. The market interest

rate has a complex impact on the housing market. A decrease in the interest rate can be seen as a decrease in the opportunity or consumption cost of housing investment. Furthermore, household income will increase because of the increase in housing price stemming from the increased demand. However, an interest rate decrease also affects the profit rate of production activities and household financial income, with negative effects on market and government revenues. The five options based on tax and financial policies employ these market revitalization policies to lower the amount of unsold residential inventory. The results of each option are compared with a base case that reflects business as usual. The options in the simulation reflect the actual tax rate according to the process of user cost derivation, and the market interest rate is adjusted to 3.19%[16].

[16] Yields of Corporate Bonds: O.T.C (3-year, AA-), The Bank of Korea

1. Base case: Business as usual

2. Option 1: Decrease the acquisition tax by 10%

3. Option 2: Decrease the transfer income tax by 10%

4. Option 3: Decrease the market interest rate by 0.25% points

5. Option 4: Decrease the acquisition tax by 10% and the transfer income tax by 10%, simultaneously (Option 1 + Option 2)

6. Option 5: Decrease the transfer income tax by 10% and the market interest rate by 0.25% points, simultaneously (Option 2 + Option 3)

Table 9. Nominal Acquisition Tax Rate

Taxation Standard	Area	Tax Rate
Less than 600 million won	Less than 85㎡	1.10%
	More than 85㎡	1.30%
More than 600 million won – Less than 900 million won	Less than 85㎡	2.20%
	More than 85㎡	2.40%
More than 900 million won	Less than 85㎡	3.30%
	More than 85㎡	3.50%

Source: National Tax Service (2016) Real Estate and Taxes

Table 10. Nominal Transfer Income Tax Rate

Taxation Standard	Accumulate Deduction	Tax Rate
Less than 12 million won	–	6%
Less than 46 million won	1,080,000	15%
Less than 88 million won	5,220,000	24%
Less than 150 million won	14,900,000	35%
More than 150 million won	19,400,000	38%

Source: National Tax Service (2016) Real Estate and Taxes

The results of option 1 indicate that a 10% decrease in the acquisition tax has a negative effect on GDP of 0.005%. This effect is attributed to a decrease in government revenue by 0.099% due to tax revenue reduction. Option 1 has an impact on the overall value-added and on household income owing to the decrease in government expenditure and investment. The CPI, which consists of the production output activities, also varies. This effect is drawn more significantly from the acquisition tax policy than from the transfer income tax policy because acquisition tax revenue accounts for a larger proportion of government revenue than transfer income tax revenue [17]. By contrast, household consumption expenditure increases by between 0.017% and 0.033% because of the increase in disposable income. In particular, the user cost of owner-occupied

[17] In 2013, the acquisition tax revenue was 5.43 times higher than the transfer income tax revenue in terms of nationwide revenue.

housing decreases by 0.621% or more, but there is no effect on renter-occupied housing. Thus, the policy implies a positive impact on demand by stimulating housing purchases through the discrepancy in user costs. Housing investment decreases by between 0.067% and 0.076%, except for Incheon; this decrease is attributed to the reduction in government revenue reduction.

Option 2 shows the effect of the transfer income tax reduction. Even though the government revenue decreases by 0.009%, GDP is constant, and housing investment does not change or increases by 0.011%, except for the ROK. Household consumption expenditure increases by between 0.010% and 0.013%, and the decrease in the user cost is greater than the benefit created by the acquisition tax policy by 1.553% to 2.010%. Therefore, the transfer income tax reduction is considered to be more effective than the acquisition tax policy, as it has a less negative impact on market stability. Additionally, housing consumption increases by between 0.052% and 0.332%, which shows that the effect in Seoul is larger than that in other regions, and thus, the inflow of migrants in Seoul is expected to increase in the future.

In option 3, the market interest rate reduction policy has a positive impact on GDP by 0.004%. In addition, government revenue also increases by 0.031%. In contrast, the CPI decreases by 0.031%,

and this result shows the effect of the product price decrease driven by the policy. The decrease in the market interest rate expands investment in each industry, and it induces an increase in supply. Thus, the product price decreases. The policy affects not only owner-occupied housing but also renter-occupied housing. Thus, it has an impact on housing market stabilization as well as on unsold residential inventory. Option 3 shows that the financial policy has a greater impact than the tax policies on housing investment, which is understood to be the result of a profitability increase. Population increases in Seoul are greater by 0.549% owing to the tax policies. Therefore, the implementation of a market interest rate reduction policy leads to a greater increase in migration to Seoul than the other policies.

In the case of option 4, household consumption increases by between 0.008% and 0.045%. In particular, the cost of using owner-occupied housing decreases by over 2% at the maximum. Housing consumption also increased in Seoul and the ROK by 0.439% and 0.232%, respectively. This result implies that the simultaneous implementation of tax policies is more effective than implementing a single tax policy from the viewpoint of household consumption and housing demand. By contrast, the decrease in government revenue is larger than under the single tax policy. Furthermore, housing

investment decreases by 0.068% to 0.079%, except for Incheon. The exception of Incheon for housing investment is due to the volume of government finance. Incheon has a small level of government revenue through housing taxes compared to the other regions, and as a result, the reduction in the tax rate has a lower impact on government revenue.

Option 5 assumes that both the market interest rate decrease and the transfer income decrease are implemented simultaneously and is based on the current government policies, which eliminated the transfer income tax for a limited period. The effect on the user cost decrease is the largest among the five options. With option 5, the user cost decreases by between 7.184% and 7.879%. Meanwhile, household consumption expenditure increases by 0.035% to 0.043%. The decrease in the user cost was larger than it was with the single financial policy, and the effect on renters is compatible with that of a single policy. Therefore, simultaneously implemented tax and financial policies are appropriate for expanding housing demand.

Table 11. Impact of Policies on Housing Market (Unit: %)

		Option 1	Option 2	Option 3	Option 4	Option 5
Acquisition Tax Rate	Seoul	0.0132	0.0146	0.0146	0.0132	0.0146
	Incheon	0.0107	0.0118	0.0118	0.0107	0.0118
	Gyeonggi	0.0112	0.0125	0.0125	0.0112	0.0125
	ROK	0.0107	0.0118	0.0118	0.0107	0.0118
Transfer Income Tax Rate	Seoul	0.1910	0.1719	0.1910	0.1719	0.1719
	Incheon	0.1806	0.1626	0.1806	0.1626	0.1626
	Gyeonggi	0.1837	0.1653	0.1837	0.1653	0.1653
	ROK	0.1681	0.1513	0.1681	0.1513	0.1513
Interest Rate		0.0319	0.0319	0.0294	0.0319	0.0294
GDP		−0.005	0.000	0.004	−0.005	0.005
Government Revenue		−0.099	−0.009	0.031	−0.108	0.023
Consumer Price Index		0.099	0.009	−0.031	0.108	−0.023
Household Consumption Expenditure	Seoul	−0.003	0.010	0.032	0.008	0.043
	Incheon	0.030	0.012	0.023	0.041	0.035
	Gyeonggi	0.017	0.013	0.028	0.030	0.042
	ROK	0.033	0.012	0.028	0.045	0.040
Housing Consumption	Seoul	0.106	0.332	0.985	0.439	1.338
	Incheon	0.079	0.052	0.609	0.131	0.664
	Gyeonggi	0.061	0.120	0.382	0.181	0.510
	ROK	0.072	0.159	0.515	0.232	0.685
Housing Investment	Seoul	−0.068	0.000	0.045	−0.068	0.046
	Incheon	0.001	0.011	0.039	0.012	0.051
	Gyeonggi	−0.067	0.000	0.044	−0.067	0.045
	ROK	−0.077	−0.002	0.044	−0.079	0.043
Population	Seoul	0.041	0.204	0.549	0.245	0.763
	Incheon	0.005	−0.125	0.084	−0.120	−0.048
	Gyeonggi	−0.016	−0.072	−0.235	−0.088	−0.310
	ROK	−0.009	−0.033	−0.115	−0.042	−0.150

Table11. Impact of Policies on Housing Market (Unit: %) (continued)

		Option 1	Option 2	Option 3	Option 4	Option 5
Acquisition Tax Rate	Seoul	0.0132	0.0146	0.0146	0.0132	0.0146
	Incheon	0.0107	0.0118	0.0118	0.0107	0.0118
	Gyeonggi	0.0112	0.0125	0.0125	0.0112	0.0125
	ROK	0.0107	0.0118	0.0118	0.0107	0.0118
Transfer Income Tax Rate	Seoul	0.1910	0.1719	0.1910	0.1719	0.1719
	Incheon	0.1806	0.1626	0.1806	0.1626	0.1626
	Gyeonggi	0.1837	0.1653	0.1837	0.1653	0.1653
	ROK	0.1681	0.1513	0.1681	0.1513	0.1513
Interest Rate		0.0319	0.0319	0.0294	0.0319	0.0294
User Cost	Seoul	−0.401	−1.602	−5.874	−2.136	−7.477
	Incheon	−0.503	−2.010	−5.779	−2.513	−7.538
	Gyeonggi	−0.388	−1.553	−5.437	−2.136	−7.184
	ROK	−0.606	−1.818	−6.061	−2.424	−7.879
User Cost for Own House	Seoul	−0.705	−2.643	−6.960	−3.348	−9.604
	Incheon	−0.621	−2.692	−6.625	−3.313	−9.317
	Gyeonggi	−0.623	−2.492	−6.698	−3.271	−9.346
	ROK	−0.556	−2.500	−7.500	−3.056	−10.000
User Cost for Deposit Rent House	Seoul	0.000	0.000	−6.604	0.000	−6.604
	Incheon	0.000	0.000	−6.335	0.000	−6.335
	Gyeonggi	0.000	0.000	−6.270	0.000	−6.270
	ROK	0.000	0.000	−7.000	0.000	−7.000
User Cost for Deposit and Monthly Pay Rent House	Seoul	0.000	0.000	−0.756	0.000	−0.756
	Incheon	0.000	0.000	−0.560	0.000	−0.560
	Gyeonggi	0.000	0.000	−0.885	0.000	−0.885
	ROK	0.000	0.000	−0.949	0.000	−0.949
User Cost for Monthly Pay Rent House	Seoul	0.000	0.000	0.000	0.000	0.000
	Incheon	0.000	0.000	0.000	0.000	0.000
	Gyeonggi	0.000	0.000	0.000	0.000	0.000
	ROK	0.000	0.000	0.000	0.000	0.000

As mentioned earlier, the tax policies have a negative impact on GDP, which is attributed to the effect of the housing tax revenue reduction. To understand the effect of a housing tax decrease, this paper analyzed the simulation under the condition that government tax revenue is constant. This condition means that a change in housing taxes has the same level of impact on government revenue even though tax policies are applied. Table 12 shows the impact of the housing tax decrease on GDP, government revenue, and fluctuations in household consumption expenditure. The results show that if housing tax revenue is constant, GDP and government revenue increases. This reflects only one side of the policy of housing demand expansion. However, after employing the housing tax revenue decrease, GDP remains constant or decreases by 0.005%, and government revenue decreases by 0.009% to 0.108%. This difference between each simulation could be interpreted as the effect of the fluctuation in the housing tax revenue. In summary, the GDP decrease could be explained by the household consumption increase. In terms of overall economic effects, the tax revenue decrease can cause a negative effect on value-added and economic growth because of the reduction of government consumption expenditures and investment, even though household consumption increases.

Table 12. Impact of Housing Tax Decrease on Simulation (Unit: %)

	Housing Tax Decrease	Option 1	Option 2	Option 3	Option 4	Option 5
GDP	Not Applied	0.000	0.001	0.004	0.002	0.006
	Applied	−0.005	0.000	0.004	−0.005	0.005
	Tax Effect	0.006	0.001	0.000	0.007	0.001
Government Revenue	Not Applied	0.002	0.009	0.031	0.012	0.041
	Applied	−0.099	−0.009	0.031	−0.108	0.023
	Tax Effect	0.101	0.019	0.000	0.120	0.019
Household Consumption Expenditure	Not Applied	0.008	0.033	0.112	0.042	0.147
	Applied	0.077	0.047	0.111	0.124	0.161
	Tax Effect	−0.069	−0.014	0.001	−0.083	−0.013

Meanwhile, the impact of policies can be assessed by the change in the unsold residential rate; Table 13 shows these results. All options reduce the unsold residential rate significantly because the change in the unsold residential rate reflects the effects of the options that increase housing demand.

Table 13. Impact of Policies on Unsold Residential rate (Unit: %)

	Option 1	Option 2	Option 3	Option 4	Option 5
Seoul	−0.002	−0.007	−0.022	−0.009	−0.030
Incheon	−0.005	−0.005	−0.071	−0.010	−0.077
Gyeonggi	−0.005	−0.016	−0.052	−0.020	−0.069
ROK	−0.002	−0.009	−0.029	−0.011	−0.038

Additionally, this paper assesses the industry-specific impact of the simulation. The value-added of housing services in each region is constant with both the tax and the financial policy. However, housing construction varies by region. In particular, the options including financial policies, option 3 and option 5, show more significant effects than the options that lack these. This difference in the effects stems from the change in housing investment. By contrast, the value-added of agriculture and mining, manufacturing, and services decreases when tax policies are applied. This result can be understood as a decrease in the housing tax revenue affecting other industries in terms of government revenue. Additionally, the housing consumption increase creates an income constraint that affects the consumption of other commodities. Households may tend to reduce other types of consumption even though household disposable income is increased through the housing purchase. However, when the financial policy is applied, the result shows a trend opposite to that with tax policies. This is because the market interest rate has an impact not only on user cost but also on industrial investment, including housing. Thus, the policy promotes expanded investment, which has a positive impact on value-added. Meanwhile, construction and real estate services outside of housing could decrease owing to concentration on the housing industry. In terms of the commodity

price, the housing service price will increase as housing demand expands. However, the prices of other commodities are reduced when the financial policy is applied. This implies a drop in the price due to the investment increase, which induces a supply increase.

Table 14. Impact of Policies on Value-Added (Unit: %)

	Option 1	Option 2	Option 3	Option 4	Option 5
Seoul Housing Construction	-0.078	0.000	0.050	-0.077	0.051
Seoul Housing Services	0.000	0.000	0.000	0.000	0.000
Incheon Housing Construction	-0.009	0.010	0.044	0.001	0.055
Incheon Housing Services	0.000	0.000	0.000	0.000	0.000
Gyeonggi Housing Construction	-0.077	0.000	0.049	-0.077	0.050
Gyeonggi Housing Services	0.000	0.000	0.000	0.000	0.000
ROK Housing Construction	-0.086	-0.002	0.049	-0.088	0.047
ROK Housing Services	0.000	0.000	0.000	0.000	0.000
Agriculture and Mining	-0.011	-0.001	0.003	-0.012	0.002
Manufacturing	-0.091	-0.003	0.050	-0.094	0.049
Construction(without Housing)	0.646	0.045	-0.265	0.690	-0.225
Real estate services(without Housing)	0.075	0.004	-0.034	0.079	-0.030
Services	-0.006	-0.001	-0.001	-0.007	-0.002

Table 15. Impact of Policies on Product Prices (Unit: %)

	Option 1	Option 2	Option 3	Option 4	Option 5
Seoul Housing Construction	0.087	0.003	−0.045	0.090	−0.042
Seoul Housing Services	0.083	0.212	0.676	0.296	0.902
Incheon Housing Construction	0.092	0.004	−0.045	0.097	−0.041
Incheon Housing Services	0.076	0.085	0.575	0.161	0.665
Gyeonggi Housing Construction	0.086	0.003	−0.044	0.090	−0.042
Gyeonggi Housing Services	0.065	0.135	0.434	0.201	0.579
ROK Housing Construction	0.085	0.003	−0.044	0.088	−0.042
ROK Housing Services	0.072	0.158	0.512	0.230	0.680
Agriculture and Mining	0.071	0.000	−0.046	0.071	−0.047
Manufacturing	0.070	0.003	−0.036	0.073	−0.034
Construction(without Housing)	0.165	0.008	−0.078	0.173	−0.071
Real estate services(without Housing)	0.239	0.011	−0.117	0.250	−0.108
Services	0.114	0.004	−0.062	0.117	−0.059

Tables 16 and 17 show the results of option 4 and option 5 when the policies are implemented separately for each region. Even if the same policies are applied in the regions, different results are obtained. In particular, option 4 has various results by region owing to the volume discrepancy in government financing affected by tax revenue. This result implies that policies for unsold residential inventories should consider the features of the regional housing market. In conclusion, the simulation shows that tax and financial policies have an effect on the regional economy as well as on the housing market. To be specific, financial policies not only reduce unsold residential inventory by stimulating housing demand but also stabilize rental households. Additionally, because of the acquisition tax and transfer income tax reduction, the decrease in government revenue has a negative impact on the overall economy. The decrease in government consumption expenditures causes a decrease in investment and value-added. As a result, although housing consumption is expanded, the overall effects are offset across industries as the GDP shows a stagnant or declining trend. In addition, it is necessary to prepare for an increase in housing prices and a fluctuation in industrial value-added as demand and supply change. Therefore, the government should consider the appropriate implementation of unsold residential inventory policies based on an economic evaluation to induce positive

results in terms of macroeconomic effects.

Table 16. Impact of Option 4 applied by region (Unit: %)

Decrease the acquisition tax by 10% and the transfer income tax by 10%

		Seoul	Incheon	Gyeonggi	ROK
GDP		−0.002	0.000	−0.001	−0.002
Government Revenue		−0.032	−0.007	−0.027	−0.042
Household Consumption Expenditure	Seoul	0.044	−0.013	−0.041	−0.023
	Incheon	−0.009	0.051	−0.028	−0.006
	Gyeonggi	−0.026	−0.034	0.107	−0.025
	ROK	0.036	0.003	−0.021	0.071
Housing Consumption	Seoul	−0.208	0.265	0.392	−0.012
	Incheon	0.647	−1.627	1.066	0.052
	Gyeonggi	0.284	0.257	−0.423	0.060
	ROK	−0.041	−0.020	0.057	0.235
Housing Investment	Seoul	−0.018	−0.005	−0.018	−0.027
	Incheon	−0.002	0.032	−0.009	−0.009
	Gyeonggi	−0.022	−0.005	−0.012	−0.028
	ROK	−0.025	−0.006	−0.020	−0.029
Population	Seoul	−0.380	0.264	0.384	−0.024
	Incheon	0.638	−1.850	1.061	0.043
	Gyeonggi	0.275	0.256	−0.671	0.050
	ROK	−0.051	−0.022	0.049	−0.019
User Cost	Seoul	−2.136	0.000	0.000	0.000
	Incheon	0.000	−2.513	0.000	0.000
	Gyeonggi	0.000	0.000	−2.136	0.000
	ROK	0.000	0.000	0.000	−2.424

Table 17. Impact of Option 5 applied by region (Unit: %)

Decrease the transfer income tax by 10% and the market interest rate by 0.25% points.					
		Seoul	Incheon	Gyeonggi	ROK
GDP		0.000	0.000	0.001	0.003
Government Revenue		−0.002	0.000	0.006	0.018
Household Consumption Expenditure	Seoul	0.053	−0.034	−0.114	−0.017
	Incheon	−0.045	0.110	−0.098	−0.008
	Gyeonggi	−0.101	−0.107	0.176	−0.030
	ROK	0.053	0.007	−0.089	−0.181
Housing Consumption	Seoul	−0.809	0.869	1.332	−0.085
	Incheon	2.304	−5.487	3.784	0.152
	Gyeonggi	0.993	0.863	−1.556	0.183
	ROK	−0.182	−0.073	0.176	0.762
Housing Investment	Seoul	0.004	0.000	0.011	0.030
	Incheon	−0.003	0.025	−0.001	0.028
	Gyeonggi	0.001	0.001	0.014	0.028
	ROK	0.002	0.001	0.011	0.028
Population	Seoul	−1.369	0.870	1.332	−0.087
	Incheon	2.305	−6.162	3.789	0.152
	Gyeonggi	0.993	0.863	−2.359	0.182
	ROK	−0.184	−0.074	0.174	−0.069
User Cost	Seoul	−7.477	0.000	0.000	0.000
	Incheon	0.000	−7.538	0.000	0.000
	Gyeonggi	0.000	0.000	−7.184	0.000
	ROK	0.000	0.000	0.000	−7.879

Chapter 6. Conclusion

This paper develops a framework for the economic analysis of government policies on unsold residential inventory in Korea. The framework is composed of a Computable General Equilibrium (CGE) model integrated with a housing model. Decreases in the acquisition tax, transfer income tax and market interest rate are employed to simulate the government's policies. The housing model accounts for housing demand, investment, and migration functions to capture the housing market structure, and it classifies the regions as Seoul, Incheon, Gyeonggi, and the rest of Korea. The housing model measures the change in the housing market attributable to polices, while the CGE model estimates the macroeconomic effects of the changes on economic growth and housing demand. The results of the simulation indicate that tax policies have a negative impact on GDP because they decrease government revenue. The 10% decrease in the acquisition tax could cause a 0.005% and 0.099% reduction in GDP and government revenue, respectively, while the 10% decrease in the transfer income tax may not cause changes in GDP, although government revenue may decrease by 0.009%. Meanwhile, the financial policy positively affects GDP and government revenue by 0.004% and 0.031%, respectively. Positive effects also exist through

the expansion of household consumption expenditures, which increase by between 0.061% and 1.338% because of the user cost decrease. Additionally, the value-added and product price are affected by these policies and offset the positive effects of the housing demand increase. The options with double policies offered better results than those with single options, and regional discrepancies in effectiveness could be the cause of migration as indicated by population changes.

Despite these findings, we need to investigate the problem with a more advanced model to address the following limitations. First, households and housing-related industries are divided into four categorized regions. However, because the current model does not fully reflect interregional trade activities, such as intermediate input and final demand, it is not adequate for examining the economic ripple effects by region. Therefore, by constructing an interregional CGE model, the economic effect of changes in the housing market can be more clearly derived. The regional CGE model reflects regional transactions for the entire industry as well as the housing market. Additionally, this paper needs to employ a more detailed categorization of regions, for instance, analyzing based on the subdivided regional classification, such as the basic administrative district.

Second, this paper examines the effect of policies in 2013. However, considering the durability and supply elasticity of the housing market, which forms a balanced price over a longer period, the application of a dynamic model would be more appropriate. Using a dynamic model, we could assess policy effects over time, and the trend of the ripple effects could be examined in terms of the macroeconomic environment. The static model constructed in this paper has the advantage of overcoming any reliability concerns caused by the data limitation in the empirical analysis. However, our model cannot explicitly show changes due to external shocks occurring over a long period. This is important because it usually takes a long time for economic agents in the housing market to optimize their decisions, and external shocks could occur in the meantime. Additionally, the current model cannot explain phenomena occurring after a time lag, such as investment induced by saving, which affects the capital accumulation of the next period. Additionally, it does not adequately reflect the choice of economic entities that must be selected over a series of timeframes. Therefore, there is a concern that the economic effect may be underestimated because of the application of a static model.

Third, the model in this paper cannot reflect the amount of unsold residential inventory directly. We used price as derived from the

housing demand and investment functions as a proxy for the amount of unsold residential inventory variable. However, depending on various house prices and sizes, the current model cannot reflect the actual volume of unsold residential inventory. Therefore, by applying the amount of unsold residential inventory in the CGE model as a variable, the effect of the government policy could be examined more precisely, and the significance of the other policies could be shown by region.

Finally, based on the findings, we suggest the need for a study that examines the effects of structural changes on the leasing market. The Korean housing leasing market has a unique system, the deposit rent system, which is the result of certain attributes of the market. However, changes in the economic environment are leading to the extinction of this system, and this phenomenon is having a significant impact on renters, especially low-income groups. Based on this change, new policies should be established to stabilize the housing market. This paper proposes a housing CGE model that can elucidate how the development of new policies may be reflected in reality.

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국문초록

주택 미분양 정책의 경제적 효과 분석
- 주택·연산일반균형모형의 적용 -

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본 연구에서는 미분양 주택에 대한 정부 정책의 경제적 효과를 평가하기 위해 분석의 틀을 발전시킨다. 정부 정책으로는 취·등록세 및 양도소득세 인하, 그리고 시장이자율 인하를 반영하며, 분석의 틀은 주택모형을 통합한 연산일반균형(Computable General Equilibrium, 이하 CGE)모형을 이용한다. 주택모형은 주택수요, 주택투자, 인구이동 함수를 통해 주택시장을 반영하고, 주택시장의 지역별 차이를 나타내기 위해 대상 지역을 서울, 인천, 경기, 비수도권 지역으로 구분한다. 주택모형은 정부 정책에 따른 시장의 변화를 나타내며, CGE모형은 주택모형을 통해 살펴본 변화를 통해 거시적 측면에서 경제성장 및 주택수요의 변화를 분석한다. 이러한 분석은 지역별 주택건설과 주택서비스업을 반영한 13개의 산업을 포함한다. 정책 시뮬레이션을

통해 어떤 정책이 미분양 주택 규모를 조절하는데 가장 효율적인지를 살펴볼 수 있으며, 그에 따른 경제적 영향을 확인할 수 있다. 취득세의 10% 감면은 GDP의 0.005% 감소를 유발하는 반면, 양도소득세의 10% 감면은 GDP의 변화를 유발하지 않는다. 또한, 시장이자율의 0.25포인트 인하는 GDP의 0.004% 증가를 야기한다. 이와 같은 차이는 정책별 정부세입의 변화에 의한 것으로 볼 수 있으며, 이는 산업별 부가가치 생성에도 영향을 미친다. 가계지출 측면에서 이러한 정책들은 긍정적인 영향을 미치며 0.061%에서 1.338%에 달하는 가계소비 증가를 유발한다. 정부의 미분양 정책의 효과의 지역별로 다르게 나타나며 이는 인구이동의 원인으로 작용하여 지역별 인구변화를 나타낸다.

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