

Are Housing Mortgage Loan Restrictions Effective for Housing Price Stabilization?*

주택담보대출규제는 아파트가격 안정화에 효과적인가?

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〈 Abstract 〉

The purpose of this paper is to examine the effects of housing mortgage loan regulations (LTV and DTI) on housing price appreciation in Korea. The applied areas of the regulations were altered when the policies were implemented and the regulations vary from areas to areas. I classify the areas into regulated and non-regulated regions. Then selection bias is corrected with propensity score matching considering that the housing market is localized, and next the policy effect is analyzed with difference-in-differences. The findings indicate that (i) stricter mortgage loan regulations in 2007 and 2009 decrease the housing price growth rate; (ii) the tightening of regulations in 2011 and 2017 brings down housing price appreciation in the short term; (iii) after the global financial crisis, the magnitude of the policy effect has steadily diminished. Even though the direction of the policy is frequently changed, the trend implies that the tightening of mortgage loan regulations effectively stabilize housing price appreciation as borrowing constraints restrict the possibility of speculative demand.

Keyword : Housing Price Stabilization, Mortgage Loan Regulation, DTI, LTV, Difference-in-Differences, Propensity Score Matching

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I. Introduction

The Korean government has frequently intervened in the real estate market through various policies such as increasing the housing supply, regulations on transactions and housing finances, and reforming the tax system during booms and recessions. Since these policies are based on the current situation rather than forecasting the future market, housing prices often react contrarily to what the government intended for the market. Nevertheless, the government's intervention is required to correct market failure in the real estate market, and studies for the effectiveness of policy should be essential to prevent market inefficiency and execute the policy successfully.

Previous studies have investigated whether housing policies affect housing prices by treating the policy with dummy variable or index. Oh (2005) and Kim (2012) find that a price-stabilization policy brought a rise in housing prices in the early 2000s. Chung (2007) also concludes, with logit analysis, that the intentions of the policy and prices move in opposite directions but housing prices reacted to the policy with several lags under impulse response analysis from 2003 to 2006. Ham and Son (2012) state that the housing policy has little influence on the real estate market in the short term. Choi (2010) confirms that housing prices generally move in the intended direction of the policy except for the Rho administration and that the housing market rapidly conforms to mitigations of regulations with lags rather than utilizing reinforcement. Jo and Kim (2012) argue that stability (activation) policies have an effect on decreasing (or increasing) housing prices in an area where the average growth rate of housing prices is lower (or higher).

Unlike the abovementioned studies, this paper focuses on housing mortgage loan regulations (Loan to Value and Debt to Income) because these immediately affect the real estate market through the borrowing constraints. Almeida et al.

(2006) confirm that a higher LTV ratio amplifies fluctuations in housing prices. Igan and Kang (2011) provide evidence to show that financial constraints that are associated with a decrease in housing price appreciation and restrictions alter expectations. Hwang and Park (2015) explore the effect of differences in DTI by 10 percent on changes in housing prices with the difference-in-differences method in Seoul and the Seoul metropolitan area. Kwon and Bang (2016) examine whether the loosening of DTI and LTV has brought about a rise in housing prices in Seoul. Almeida et al. (2006), Igan and Kang (2011), Hwang and Park (2015) and Kwon and Bang (2016) present consistent results indicating that financial constraints have a meaningful impact on housing prices. However, Hwang and Park (2015) do not consider alternative housing mortgage loan regulations such as LTV and the difference between regulated and non-regulated areas. Igan and Kang (2011) and Kwon and Bang (2016) overlook the fact that LTV and DTI are maintained at different levels in some districts of Seoul.

Given the limitations of previous scholarship, I investigate whether the strengthening of financial regulations (LTV and DTI) is effective for the stabilization of housing prices using the difference-in-differences method. For the analysis, I stratify areas since policies refer to only a district from time to time and apply propensity score matching to correct selection bias in the housing market. I compare the periods shortly before and a few months after the announcement of four policies: February 2007, from July 2009 to October 2009, March 2011, and August 2017. The contents of the financial regulations are described in <Table 1>. I find that stricter mortgage loan regulations decrease housing price appreciation, but the effects do not last for the long term, and the intensity of the effects is weaker whenever the direction of policy is changed.

The rest of this paper is organized as follows. Section II offers an empirical

model, and Section III describes the data. Section IV presents the scope and period of analysis and discusses empirical findings. Concluding remarks are presented in Section V.

II. An Empirical Model with Difference-in-Differences

The difference-in-differences method is frequently employed to analyze the effect of policies (Card and Kruger, 1994; Girma and Görg, 2007; Hwang and Park, 2015; Slaughter, 2001). I also apply the difference-in-differences method to investigate the influence of the policy on housing price changes.

I define the treatment as the tightening of loan restrictions and assume that two periods exist, before and after the treatment (t_0 and t_2). I also define the treatment group as a district treated at some point in time ($t = t_1$), the control group as a district never treated at any time, and the treatment qualification variable is one if a district belongs to the treatment group and zero if not. The econometric equation of changes in housing prices on related variables for all districts at the time $t_0(t_2 > t_1 > t_0)$ can be expressed in the following:

$$\Delta p_{it_0} = c + \beta_q \times Q_i + \epsilon_{it_0} \quad (1)$$

where Δp_{it_0} denotes the log housing price changes before the treatment, β_q is the difference between the two groups, and $Q_i = 1$ [district belongs to treatment group] is the qualification dummy.

After the treatment, the regression equation for the treatment group is as follows:

$$\Delta p_{it_2}^1 = c + \delta + \beta_q \times Q_i + \epsilon_{it_2} \quad (2)$$

where $\Delta p_{it_2}^1$ denotes the log housing price changes for the treatment group

after the treatment, and δ is the treatment effect.

If the effect of treatment takes a long time or if I verify an effect after a long time, there is a time effect, which is an effect of time change on housing price changes regardless of the treatment, and the equation (2) can be expressed as follows:

$$\Delta p_{it_2}^1 = c + \delta + \beta_\tau + \beta_q \times Q_i + \epsilon_{it_2} \quad (3)$$

where β_τ is the time effect.

The subtraction of equation (1) from equation (3) for the treatment group gives us the effect, $\delta + \beta_\tau$, which compares before and after the treatments and is known as the before and after (BA) method. I cannot identify the time effect and the treatment effect from BA method. To overcome this problem, I assume that the control group and the treatment group encounter the same environment except in the treatment. The regression equation for the control group after the treatment is as follows:

$$\Delta p_{it_2}^0 = c + \beta_\tau + \beta_q \times Q_i + \epsilon_{it_2} \quad (4)$$

where $\Delta p_{it_2}^0$ denotes the log housing price changes for the control group after the treatment.

The subtraction of equation (1) from equation (4) for the control group provides us with the time effect, β_τ . I identify the treatment effect, δ , by comparing the differences of the BA treatment between the treatment and control groups. I take the treatment effect from the analysis described by equation (1), (3), and (4) but cannot derive standard errors. From equations (1), (3), and (4), I construct the following regression equation:

$$\Delta p_{it} = c + \delta \times Q_i \times Time_t + \beta_r \times Time_t + \beta_q \times Q_i + \epsilon_{it} \quad (5)$$

where $Time_t = 1$ [district sampled at t_1]

I take group effect, time effect, and treatment effect with standard errors from equation (5).

As mentioned above, the difference-in-differences method assumes that two groups have the same market environment except for the treatment. This study does not satisfy this assumption and encounters selection bias in the treatment and control group since housing markets are very localized. To correct this selection bias, I apply kernel propensity score matching, estimate the propensity score with covariates across the two groups, and match a sample in treatment group with one in the control group with the closest propensity score.

III. Data

I employed the housing price index and the price index of key-money leases extracted from Kookmin Bank (KB) on a monthly basis since the price index is based on prices from a representative sample of apartments. I adjusted the seasonality of the housing price index and the price index of key-money leases with census X-12-arima and converted the nominal housing prices to real housing prices with the consumer price index. I used LTV and DTI as the instruments of the regulations on housing mortgage loans and obtained LTV and DTI information from the Financial Supervisory Service. I compared shortly before and a few months after the announcement of the policy and describe a concrete analysis period in the next section. Regulation areas occasionally changed and were classified by housing speculation zones, speculation-prone areas, and the Seoul metropolitan area (Gyeonggi). A date

of designation and cancellation for those criteria was provided by the Ministry of Strategy and Finance and by the Ministry of Land, Infrastructure, and Transport, respectively. The number of unsold apartments and sales transaction volume of apartments are collected from the Ministry of Land, Infrastructure, and Transport and from the Korea Appraisal Board, respectively. Finally, I used the number of households residing in apartments from the Population Census of Statistics Korea.

IV. Empirical Analysis

1. Range and period of analysis

As presented in <Table 1>, LTV for apartments varies while the ratio for single-family houses has never changed according to both banks and insurance companies since May 2003. The regulations of non-bank financial institutions after the introduction of LTV are similar to those of bank and insurance companies except that LTV for single-family houses changed once. Based on the history of LTV and DTI in <Table 1>, I limit the scope of houses to apartments and examine the effect of strengthening the LTV and DTI on housing price changes.

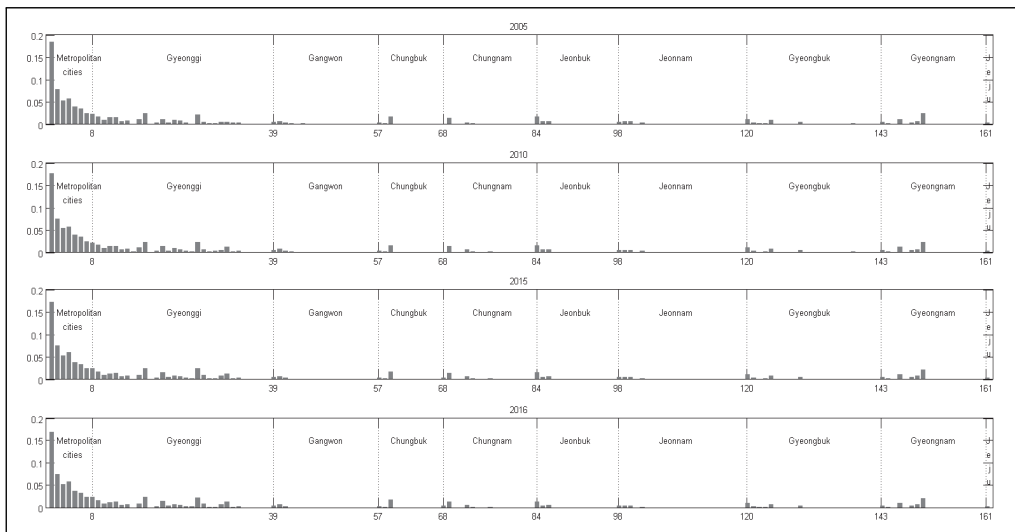
I use the number of households that resided in apartments as a proxy for the number of apartments throughout the country. I construct the ratio of the number of households living in apartments in each region to total number of households residing in apartments nationwide and display them in <Figure 1>. Those in metropolitan cities are 1-7, those in Gyeonggi are 8-38, those in Gangwon are 39-56, those in Chungbuk are 57-67, those in Chungnam are 68-83, those in Jeonbuk are 84-97, those in Jeonnam are 98-119, those in Gyeongbuk are 120-142, those in Gyeongnam are 143-160, and those in Jeju

〈Table 1〉 The history of LTV and DTI

Date	Institution	Details
November 2006	Banks and Insurance Companies	Applied DTI at 40% for apartments that cost more than 600 million won in speculation-prone areas of Seoul, Incheon, and Gyeonggi
	Non-bank Financial Institutions	Reduced LTV to 60% for apartments that cost less than 600 million won and have maturities greater than 10 years maturity in housing speculative areas; otherwise, tighten LTV to 50% for apartments in housing speculative areas
February 2007	Banks and Insurance Companies	Applied DTI to 40-50% for apartments that cost less than 600 million won in housing speculative areas and in speculation-prone areas Seoul, Incheon, and Gyeonggi
August 2007	Non-bank Financial Institutions	Applied DTI to 40-70% for apartments in speculation-prone areas and in housing speculative areas of Seoul, Incheon, and Gyeonggi
November 2008	All financial institutions	Removed all areas except Gangnam, Seocho, and Songpa from housing speculative areas. That is, LTV was loosened to 60% (bank and insurance) and to 70% (non-bank) for apartments and DTI was discontinued.
July 2009	Banks and Insurance Companies	Reduced LTV to 50% for apartments that have maturities less than 10 years or cost more than 600 million won over 10-year maturities in non-speculative zones of Seoul, Incheon, and Gyeonggi
September 2009	Banks and Insurance Companies	Applied DTI to 50% for apartments in non-speculative areas of Seoul and 60% for apartments in Incheon and Gyeonggi
October 2009	Non-bank Financial Institutions	Applied DTI to 50% for apartments in non-speculative areas of Seoul and 60% for apartments in Incheon and Gyeonggi
		Reduced LTV from 70% to 60% for apartments in non-speculative areas of Seoul, Incheon, and Gyeonggi
September 2010	All financial institutions	Temporary liberalization of DTI until March 2011
March 2011	All financial institutions	Applied DTI to 50% for apartments in non-speculative areas of Seoul and 60% for apartments in Incheon and Gyeonggi
August 2014	All financial institutions	Applied LTV to 70% to the whole country and DTI to 60% in Seoul, Incheon, and Gyeonggi
August 2017	All financial institutions	Reduced both LTV and DTI to 40% in housing speculative areas and speculation-prone areas

Island are 161-162. I find that apartments are mostly distributed in the first two areas, which are metropolitan cities and Gyeonggi in all periods, and I confine the range of the regions to those areas. Because LTV and DTI restrictions are applied by districts, I use the data by districts in metropolitan cities and by cities in the Seoul metropolitan area due to the limitations of data collection. I exclude the Gangnam, Seocho, and Songpa districts where LTV and DTI did not change; those districts are classified as housing speculation zones until May 2012. To sum up, I investigate housing price appreciation rates with LTV and DTI in sixty-eight districts and twenty-six cities.

As previously mentioned, I define the treatment as reductions in LTV and DTI, and I choose four different terms: February 2007, July to October 2009, March 2011, and August 2017. The treatment group also varies since regulation regions are different during each term; those are housing speculation zones and speculation-prone areas located in Gyeonggi in February 2007, Seoul, Incheon, and Gyeonggi in July to October 2009 and March 2011 and housing speculation zones and speculation-prone areas in August 2017. In the appendix,



<Figure 1> The distribution of households residing in apartments throughout the country

the complete list of regulated and non-regulated regions is provided.

2. Results

In order to see whether the effect of housing mortgage loan regulations on housing price changes follows the intention of the policy, I conduct the difference-in-differences analysis described by equation (5) and compare right before the announcement of the regulations and after one, two, three, and four months, respectively. This paper specifies the regression equation in terms of the price growth rate since the designation of regulated areas is based on the price appreciation rate and a slowdown in price growth rate implies price stabilization. First, I apply the difference-in-differences method in terms of the difference in the log housing price. Next, I conduct kernel propensity score difference-in-differences with the price growth rate of key-money leases, the number of unsold apartments, and sales transaction volume to correct selection bias. In August 2017, a district in Seongnam was regulated, but I collected only aggregate data from Seongnam. For this reason, I analyzed two cases that treat Seongnam as a regulated area and a non-regulated area, respectively.

The empirical results of the policy effect on changes in apartment prices are presented in <Table 2> to <Table 6>. Each table corresponds to the policy in February 2007, July to October 2009, March 2011, and August 2017. In columns (a)-(d) of each table, I compare right before an announcement month with one-, two-, three-, four-month intervals, respectively. Column (d) in <Table 5> and <Table 6> is deleted due to the limitation of data. The left and right panels of each table respectively show the results of difference-in-differences and kernel propensity difference-in-differences. I concentrate the coefficient on the cross-product of the time and qualification dummies so that it has a significantly negative sign if the direction of housing price changes is consistent with the intention of the policy after the policy is implemented;

〈Table 2〉 The effects of the policy in February 2007

	Before propensity score matching				After propensity score matching			
	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)
Constant	-0.0676 (0.153)	-0.0676 (0.157)	-0.0676 (0.158)	-0.0676 (0.158)	0.860*** (0.126)	0.860*** (0.125)	0.860*** (0.125)	0.860*** (0.128)
Regulated area	1.310*** (0.180)	1.310*** (0.185)	1.310*** (0.185)	1.310*** (0.186)	0.382** (0.169)	0.382** (0.167)	0.382** (0.167)	0.382** (0.171)
Time	-0.411* (0.217)	-0.460** (0.223)	-0.125 (0.223)	0.017 (0.224)	-0.853*** (0.179)	-1.105*** (0.177)	-0.815*** (0.177)	-0.470** (0.182)
Treatment	-1.055*** (0.255)	-1.042*** (0.262)	-1.207*** (0.262)	-1.025*** (0.263)	-0.613** (0.238)	-0.397* (0.237)	-0.518** (0.236)	-0.538** (0.242)
R-squared	0.466	0.464	0.401	0.328	0.373	0.420	0.340	0.204

Notes: This table shows estimation results for the policy in February 2007 under the difference-in-differences specification in Equation (5). Numbers in parentheses are the standard errors. '*' and '**' denote the significance level at the 5% and 1% level for a one-tail test, respectively.

otherwise, the sign is positive.

〈Table 2〉 shows the results of the policy effect in February 2007. I notice that housing price appreciation in regulated areas is higher than price growth rate in non-regulated areas by 0.38%-1.31%. Treatment effects are significantly negative in all cases, implying that the reduction of LTV and DTI brings down the housing price appreciation rates of regulated areas by 0.39%-1.2% although the price growth rates of regulated areas are higher.

The effects of the policy from July to October 2009 are presented in 〈Table 3〉. The signs of the price growth rate of regulated areas are contingent on kernel propensity scores; the housing price appreciation of regulated areas without matching are higher by 0.06%, but those with matching are lower by 0.15%. Treatment effects are significantly negative for all cases, implying that strengthening regulation mitigates the housing price appreciation of regulated areas by 0.54%-0.88%.

〈Table 3〉 The effects of the policy from July to October 2009

	Before propensity score matching				After propensity score matching			
	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)
Constant	0.259*** (0.067)	0.259*** (0.070)	0.259*** (0.056)	0.259*** (0.070)	0.478*** (0.066)	0.478*** (0.064)	0.478*** (0.052)	0.478*** (0.066)
Regulated area	0.062 (0.087)	0.062 (0.090)	0.062 (0.073)	0.062 (0.090)	-0.157* (0.091)	-0.157* (0.088)	-0.157** (0.072)	-0.157* (0.091)
Time	0.170* (0.095)	0.013 (0.099)	-0.552*** (0.080)	0.112 (0.099)	0.378*** (0.093)	-0.0572 (0.090)	-0.575*** (0.074)	0.0539 (0.093)
Treatment	-0.680*** (0.123)	-0.642*** (0.128)	-0.565*** (0.103)	-0.641*** (0.128)	-0.887*** (0.129)	-0.572*** (0.125)	-0.541*** (0.102)	-0.583*** (0.129)
R-squared	0.266	0.294	0.660	0.247	0.433	0.369	0.683	0.322

Notes: This table shows estimation results for the policy from July to October 2009 under the difference-in-differences specification in Equation (5). Numbers in parentheses are the standard errors. '*' and '**' denote the significance level at the 5% and 1% level for a one-tail test, respectively.

〈Table 4〉 The effects of the policy in March 2011

	Before propensity score matching				After propensity score matching			
	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)
Constant	0.836*** (0.110)	0.836*** (0.104)	0.836*** (0.092)	0.836*** (0.087)	0.886*** (0.110)	0.886*** (0.101)	0.886*** (0.090)	0.886*** (0.084)
Regulated area	-1.376*** (0.142)	-1.376*** (0.134)	-1.376*** (0.119)	-1.376*** (0.112)	-1.426*** (0.155)	-1.426*** (0.143)	-1.426*** (0.127)	-1.426*** (0.119)
Time	0.949*** (0.155)	0.787*** (0.147)	0.506*** (0.130)	0.0643 (0.123)	0.965*** (0.155)	0.712*** (0.143)	0.438*** (0.127)	0.0115 (0.119)
Treatment	-0.429*** (0.201)	-0.472** (0.190)	-0.154 (0.168)	-0.0277 (0.159)	-0.445** (0.220)	-0.396* (0.202)	-0.0853 (0.179)	0.0251 (0.169)
R-squared	0.623	0.638	0.638	0.625	0.600	0.611	0.610	0.605

Notes: This table shows estimation results for the policy in March 2011 under the difference-in-differences specification in Equation (5). Numbers in parentheses are the standard errors. '*' and '**' denote the significance level at the 5% and 1% level for a one-tail test, respectively.

In 〈Table 4〉, the price appreciation of Seoul, Incheon, and Gyeonggi is lower by 1.37%-1.42% and treatment effects are negative except in the last column.

In this analysis period, the reduction of DTI is noticed since the Financial Supervisory Service announced temporary liberalization of DTI from September 2010 to March 2011. Also, the government implemented rescue policies such as the abolition of the two-year residency requirement for non-taxable transfer income and shortening the period of limitation of purchase right resale; those policies might have reinforced an effect on the decrease in housing price changes. I constructed the districts with similar environments through propensity score matching, and positive treatment effects on changes in housing prices after four months resulted.

As previously mentioned, I have aggregated city data in Gyeonggi, but policies are applied to a district in Seongnam in August 2017. I implement the empirical analysis in two ways; in one analysis Seongnam is classified as a regulated area while in the other, Seongnam is treated as a non-regulated area. The results are displayed in <Table 5> and <Table 6>, respectively.

The treatments effects applied kernel propensity score matching are negative values for one and two months later but are changed to positive values for

<Table 5> The effects of the policy n August 2017: Seongnam is classified as regulated area

	Before propensity score matching			After propensity score matching		
	(a)	(b)	(c)	(a)	(b)	(c)
Constant	-0.008 (0.025)	-0.008 (0.025)	-0.008 (0.031)	0.183*** (0.050)	0.183*** (0.052)	0.183*** (0.056)
Regulated area	0.485*** (0.048)	0.485*** (0.048)	0.485*** (0.060)	0.294*** (0.069)	0.294*** (0.071)	0.294*** (0.077)
Time	-0.061* (0.035)	0.194*** (0.035)	0.646*** (0.044)	-0.186** (0.071)	0.097 (0.073)	0.499*** (0.079)
Treatment	-0.385*** (0.067)	-0.197*** (0.068)	-0.105 (0.084)	-0.260*** (0.098)	-0.100 (0.100)	0.042 (0.108)
R-squared	0.428	0.462	0.675	0.396	0.211	0.570

Notes: This table shows estimation results for policy in August 2017 with included Seongnam in the regulated area under the difference-in-differences specification in Equation (5). Numbers in parentheses are the standard errors. '*' and '**' denote the significance level at the 5% and 1% level for a one-tail test, respectively.

〈Table 6〉 The effects of the policy in August 2017: Seongnam is classified as non-regulated area

	Before propensity score matching			After propensity score matching		
	(a)	(b)	(c)	(a)	(b)	(c)
Constant	0.0002 (0.025)	0.0002 (0.026)	0.0002 (0.031)	0.228*** (0.053)	0.228*** (0.054)	0.228*** (0.060)
Regulated area	0.473*** (0.050)	0.473*** (0.050)	0.473*** (0.062)	0.245*** (0.072)	0.245*** (0.074)	0.245*** (0.082)
Time	-0.0631* (0.035)	0.191*** (0.036)	0.646*** (0.044)	-0.189** (0.074)	0.066 (0.076)	0.515*** (0.085)
Treatment	-0.393*** (0.070)	-0.196*** (0.071)	-0.111 (0.088)	-0.267** (0.102)	-0.070 (0.104)	0.020 (0.116)
R-squared	0.399	0.430	0.658	0.371	0.155	0.524

Notes: This table shows estimation results for policy in August 2017 with excluded Seongnam in the regulated area under the difference-in-differences specification in Equation (5). Numbers in parentheses are the standard errors. '*' and '**' denote the significance level at the 5% and 1% level for a one-tail test, respectively.

three months later. Those without the matching are negative signs. The results are similar to those of 〈Table 4〉 in that the tightening of LTV and DTI brings down the housing price changes in regulated areas for the short term. Although a district in Seongnam is designated a regulated area and I cannot separate this area from Seongnam, results suggest that strengthening the policy still stabilizes the housing prices.

In summary, tightening regulations on housing mortgages is effective for housing price stabilization. After the global financial crisis, the magnitude of the policy effect has steadily diminished as the policy has been repeated, and the effects with matching do not last long.

V. Conclusion

The Korean government enforces various policies to boost or stabilize the real estate market. I applied the housing mortgage loan regulations (LTV and

DTI) rather than other policies (e.g., increasing the housing supply, reforming the tax system) since the policy immediately affects the real estate market through borrowing constraints. I stratified areas and examined whether reinforcement of the regulations of housing mortgage loans in specific areas has an effect on housing price stabilization under difference-in-differences and kernel propensity score difference-in-differences, respectively.

I report that the tightening of mortgage loan regulations in 2007 and 2009 brings down the housing price appreciation of regulated areas by 0.39%-1.2% in all cases and that the strengthening of those in 2011 and 2017 decreases price growth rate in regulated areas for the short term. These findings imply that mortgage loan restrictions are effective for housing price stabilization as tightening regulations on mortgage loans restricts the possibility of speculative demand through borrowing constraints. Our results are consistent with the findings of Hwang and Park (2015) and Kwon and Bang (2016). I also find that the magnitude of the regulation effect has steadily diminished after the global financial crisis, suggesting that households might have learned that strengthening regulations is not sustained in the long term since the government repeatedly alters the direction of the policy. Ultimately, consistency in carrying out a policy is needed to sustain housing price stabilization in the long term.

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Appendix

〈Appendix Table 1〉 Complete list of regulated and non-regulated areas: February 2007

	Regulated areas	Non-regulated areas
Busan	-	Buk, Busanjin, Dong, Dongnae, Geumjeong, Gijang, Haeundae, Jung, Nam, Saha, Sasang, Seo, Suyeong, Yeongdo, Yeonje
Daegu	Dong, Buk, Dalseo	Dalseong, Jung, Nam, Seo, Suseong
Daejeon	Daedeok, Jung, Seo, Yuseong	Dong
Gwangju	Gwangsan	Buk, Dong, Nam, Seo
Gyeonggi	Ansan, Anseong, Anyang, Bucheon, Dongducheon, Gimpo, Goyang, Gunpo, Guri, Gwacheon, Gwangju, Gwangmyeong, Hanam, Hwaseong, Icheon, Namyangju, Osan, Paju, Pyeongtaek, Seongnam, Siheung, Suwon, Uijeongbu, Uiwang, Yangju, Yongin	-
Incheon	Bupyeong, Dong, Gyeyang, Jung, Nam, Namdong, Seo, Yeonsu	-
Seoul	Dobong, Dongdaemun, Dongjak, Eunpyeong, Gangbuk, Gangdong, Gangseo, Geumcheon, Guro, Gwanak, Gwangjin, Jongno, Jung, Jungnang, Mapo, Nowon, Seodaemun, Seongbuk, Seongdong, Yangcheon, Yeongdeungpo, Yongsan	-
Ulsan	Buk, Dong, Jung, Nam	Ulju

〈Appendix Table 2〉 Complete list of regulated and non-regulated areas:
July to October 2009 and March 2011

	Regulated areas	Non-regulated areas
Busan	-	Buk, Busanjin, Dong, Dongnae, Geumjeong, Gijang, Haeundae, Jung, Nam, Saha, Sasang, Seo, Suyeong, Yeongdo, Yeonje
Daegu	-	Buk, Dalseo, Dalseong, Dong, Jung, Nam, Seo, Suseong
Daejeon	-	Daedeok, Dong, Jung, Seo, Yuseong
Gwangju	-	Buk, Dong, Gwangsan, Nam, Seo
Gyeonggi	Ansan, Anseong, Anyang, Bucheon, Dongducheon, Gimpo, Goyang, Gunpo, Guri, Gwacheon, Gwangju, Gwangmyeong, Hanam, Hwaseong, Icheon, Namyangju, Osan, Paju, Pyeongtaek, Seongnam, Siheung, Suwon, Uijeongbu, Uiwang, Yangju, Yongin	-
Incheon	Bupyeong, Dong, Gyeyang, Jung, Nam, Namdong, Seo, Yeonsu	-
Seoul	Dobong, Dongdaemun, Dongjak, Eunpyeong, Gangbuk, Gangdong, Gangseo, Geumcheon, Guro, Gwanak, Gwangjin, Jongno, Jung, Jungnang, Mapo, Nowon, Seodaemun, Seongbuk, Seongdong, Yangcheon, Yeongdeungpo, Yongsan	-
Ulsan	-	Buk, Dong, Jung, Nam, Ulju

〈Appendix Table 3〉 Complete list of regulated and non-regulated areas: August 2017

	Regulated areas	Non-regulated areas
Busan	-	Buk, Busanjin, Dong, Dongnae, Geumjeong, Gijang, Haeundae, Jung, Nam, Saha, Sasang, Seo, Suyeong, Yeongdo, Yeonje
Daegu	Suseong	Buk, Dalseo, Dalseong, Dong, Jung, Nam, Seo
Daejeon	-	Daedeok, Dong, Jung, Seo, Yuseong
Gwangju	-	Buk, Dong, Gwangsan, Nam, Seo
Gyeonggi	Gwacheon, Seongnam(Bundang)	Ansan, Anseong, Anyang, Bucheon, Dongducheon, Gimpo, Goyang, Gunpo, Guri, Gwangju, Gwangmyeong, Hanam, Hwaseong, Icheon, Namyangju, Osan, Paju, Pyeongtaek, Seongnam(Jungwon, Sujeong), Siheung, Suwon, Uijeongbu, Uiwang, Yangju, Yongin
Incheon	-	Bupyeong, Dong, Gyeyang, Jung, Nam, Namdong, Seo, Yeonsu
Seoul	Dobong, Dongdaemun, Dongjak, Eunpyeong, Gangbuk, Gangdong, Gangseo, Geumcheon, Guro, Gwanak, Gwangjin, Jongno, Jung, Jungnang, Mapo, Nowon, Seodaemun, Seongbuk, Seongdong, Yangcheon, Yeongdeungpo, Yongsan	-
Ulsan	-	Buk, Dong, Jung, Nam, Ulju

국문요약

주택담보대출규제는 아파트가격 안정화에 효과적인가?

본 논문은 전국의 특별시 및 광역시, 경기도를 대상으로 하여 주택담보대출 (LTV 및 DTI) 규제가 아파트 가격 안정화에 미치는 효과를 분석하였다. 주택담보대출은 정책이 시행되는 시점마다 투기지역, 투기과열지구, 서울 및 수도권 등으로 나뉘어 지역마다 다르게 적용되었다. 이에 대상 지역을 대출규제가 강화되는 지역과 종전과 동일하게 유지되는 지역으로 구분하였으며, 국내주택시장이 지역에 따라 상이한 특성을 가진다는 점을 고려하여 성향점수매칭으로 선택편의를 보정한 후 이중차분법을 이용하여 가격상승률에 대한 규제 강화효과를 분석하였다. 분석결과에 따르면, 2007년과 2009년에 시행된 주택담보대출 규제 강화는 가격상승률을 0.39% ~ 1.2% 만큼 하락시키는 효과가 있는 것으로 나타났으며, 2011년과 2017년에 시행된 대출규제 강화는 단기에만 가격상승률을 하락시키는 효과가 있는 것으로 나타났다. 또한, 세계금융위기 이후에는 주택담보대출규제에 따른 가격상승률 하락효과의 크기가 점점 감소하는 경향을 보였다. 이는 규제방향의 잦은 변경에도 불구하고, 주택담보대출 규제강화로 인한 차입제약이 투기수요 가능성을 제한함으로써 가격 안정화에 효과가 있음을 시사한다.