

Sentiment Effect of House Prices on Household Consumption Expenditure: Evidence from Housing Regulation During Pandemic*

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Abstract

We investigate the sentiment effect of house prices on household consumption expenditure by utilizing the ideal natural experiment setup in South Korea with large-scale household-level data from the Korea Credit Bureau. Specifically, we use the government regulations on a housing market that would directly affect expectations or sentiment on house prices as an identification strategy. In mid-June 2020, the Korean government designated Daejeon, one of the metropolitan cities in South Korea, as the regulated area. As the neighboring Chungnam province was not designated as the regulated region, we employ a difference-in-difference approach to compare household consumption in two regions within short periods before and after the regulation. We find that the sentiment on changes in house prices causes positive changes in household consumption. Overall, monthly consumption per person increased by approximately 50 thousand KRW (or 40 USD) immediately after the regulation. Also, our results provide empirical evidence of the sentiment effect of house prices by considering heterogeneity in household groups and estimating the evolution of treatment effects. Homeowners holding outstanding mortgages with relatively expensive houses tend to present substantial sentiment impacts immediately due to the sentimental wealth effect. For renters, responses tend to be delayed by 1-2 months because it takes time to form particular sentiments.

Keywords: Household Consumption, Sentiment Effect, House Prices, Housing Regulation, Difference-in-Difference

JEL Classification: D12, E21, E71, R28

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1 Introduction

In aggregate, house prices and consumption tend to have a positive correlation, and how they are related, especially how house prices affect consumption, has been broadly discussed in the literature in that non-financial assets account for a substantial proportion of household assets and that housing service expenditure and payment to mortgages are non-negligible in household expenditure (Case et al. 2005, Campbell and Cocco 2007, Ludwig and Sloek 2002, etc.).¹ Apart from business cycle factors or forecasting on income flows that function as common factors in consumption and house prices, housing price changes affect household consumption through various channels. One well-known channel is the housing wealth effect which arises from the increases in the household's wealth followed by the increases in housing prices, stimulating positive effects on household consumption (Berger et al. 2017, Kaplan et al. 2020, Aladangady 2014, etc.).² Another well-established channel is the housing collateral effect which arises from the increases in the value of housing collateral, relaxing household's budget constraint for consumption. The collateral effect is also known as a credit market effect (Aoki et al. 2004, Aladangady 2017, Iacoviello 2005, Shin 2022, etc.). Also, changes in house prices can affect household consumption through changes in current rents or housing purchase cost, which means the substitution effect (Chamon and Prasad 2010, Berger et al. 2017, etc.).

When categorizing the above effects based on homeownership status, there exists the positive wealth effect and collateral effect in response to changes in house prices, leading household consumption to react positively for homeowners. For renters, on the other hand, the substitution effect matters, causing household consumption to react negatively. However, in the short run, when

¹The share of non-financial assets to household assets is 28.5% for the United States, 37.0% for Japan, 46.2% for the United Kingdom, 61.2% for Australia, and 64.4% as of 2021. South Korea's share of non-financial assets is relatively high (64.4% as of 2021) compared to other advanced economies. Also, the share of housing service expenditure in South Korea is 16.7% as of 2022 Q2, and outstanding mortgage amounts account for 53.6% of household liabilities. (Sources: national central banks)

²We interpret that the housing wealth effect encompasses the traditional wealth effect, endowment effect, and balance sheet effect. In Berger et al. (2017), the authors define the house price effect on consumption through its pure dollar effect on the current budget constraint as the endowment effect. Kaplan et al. (2020) names the same effect as the balance sheet effect. In the case of Aladangady (2014), the author clarifies that the balance sheet effect arises from the improvement of household cash flows followed by an increase in house prices.

the liquidity of housing assets is not sufficiently high, and rental prices remain inflexible due to factors such as rent regulations, the abovementioned mechanisms may not operate immediately.³ Therefore, if changes in housing prices affect household consumption in the short run, it can be understood as a sentiment effect resulting from changes in expectations or sentiments regarding housing prices. For instance, if expectations and sentiments regarding rising housing prices are formed in the short run, the wealth effect may lead to an increase in the consumption of homeowners and a decrease in the consumption of renters. Accordingly, in this study, empirical analysis is conducted to answer the question of whether there is a sentiment effect of housing prices on household consumption; in other words, whether changes in sentiments regarding housing prices lead to changes in household consumption in response to housing price changes.

There is relatively little empirical research on the sentiment effect of house prices. Among them, Hui et al. (2018) used big data, including news data, to construct a housing market sentiment index and estimated the impact of sentiment on household consumption in response to changes in housing prices. They identified high-sentiment periods in the data based on the sentiment index and conducted estimations by creating dummy variables for those periods.⁴ However, their method has limitations in adequately accounting for confounding factors such as economic outlook, which is due to the ambiguity of whether housing market sentiment can be solely linked to house prices. With these concerns in mind, we employ the identification strategy of direct regulations on the housing market, which has a direct impact on expectations and sentiments regarding housing prices.⁵ Following the announcement of housing regulation in June 2020, which designated Daejeon Metropolitan City (hereafter, Daejeon) as a regulated area, regional disparities emerged between Daejeon and its neighboring region, Chungnam Province (hereafter, Chungnam). The strategy of this paper is to establish a natural experimental setting based on the difference and

³In an economy where high liquidity is imparted to housing assets, even in the short term, through financial instruments, wealth effects, and credit market effects can work. For instance, in the United States, HELOC (home equity lines of credit) allows homeowners to utilize the equity in their homes, excluding the balance of home mortgage loans, as collateral for periodic borrowings and repayments. Substitution effects can also be effective in the short run when rental prices are less rigid and there are low search costs associated with house purchases. However, it generally takes time for rental prices to respond to changes in housing prices, often due to regulations such as rent control. Additionally, unless there is speculative demand, it can be difficult to attribute short-term price changes in home purchases solely to factors like contract terms, the age of children, and neighborhoods.

then utilize it to estimate how significant changes in consumption among households in Daejeon can be attributed to the sentiment effect.

Specifically, we established a double difference (DD) model and conducted household-level microdata estimations. The empirical analysis utilized monthly panel data provided by the Korea Credit Bureau (hereafter, KCB). The analysis contributes due to its use of detailed data with representativeness and accuracy to perform an ideal natural experiment. According to the estimation results, comparing consumption in Daejeon and Chungnam over a short period, we found that expectations and sentiments regarding housing price changes significantly caused a positive change in consumption, regardless of homeownership status. It could be interpreted as the sentiment effect of house prices working in different directions for the two household groups. Homeowners may have interpreted the designation of a regulated area as a signal of expected additional price increases, leading to increased consumption due to the sentimental wealth effect. In contrast, renters may have increased consumption due to sentimental substitution effects, driven by expectations of housing price declines due to regulations. However, it cannot be ruled out that renters also formed expectations of house price increases. They may have foregone home purchases in anticipation of continued housing price rises and increased their consumption accordingly. In addition to these findings, this study presents empirical evidence on the sentiment effect of house prices through short-term trends of estimates, consideration of household heterogeneity in estimates, and robustness tests.

This paper is structured as follows. Section 2 provides background information regarding the housing regulation in South Korea and our identification strategy, and describes the data used in this paper. Section 3 presents the empirical model and the main results. Finally, after presenting the robustness results in Section 4, Section 5 concludes the paper.

⁴Hui et al. (2018) applied the methodology used by Stambaugh et al. (2012) and Kim et al. (2014) to analyze the impact of sentiment on consumption in the housing market, following their approach to studying the influence of sentiment on the stock market.

⁵McCullough and Karani (2014) and Stuart N. Soroka (2015), among others, have addressed how news related to the housing market can influence perceptions and expectations regarding house prices and can impact actual changes in housing prices.

2 Identification and Data

In this section, we present an identification strategy to estimate the sentiment effect of house prices on household consumption expenditure and introduce the data for analysis. Housing price changes can affect household consumption through diverse channels, but considering that housing is an illiquid asset, especially when financial instruments like HELOC (home equity lines of credit) that provide high liquidity to housing asset values, as is the case in the United States, are not readily available, a short-run impact housing prices on the consumption of homeowners, this can be attributed to sentimental wealth effects. Furthermore, suppose housing price changes impact renters' consumption when rental prices, which represent the price of housing services provided by homeowners, are relatively rigid in the short run due to regulations such as rent controls. In that case, this can also be interpreted as a sentiment effect based on expected changes in long-term rent or future home purchase plans. Therefore, in this paper, we attempt to estimate the sentiment effect using a natural experimental setting that arises from direct regulations in the housing market to estimate those effects rigorously.

2.1 Background and Identification Strategy

On June 17, 2020, the Korean government announced unprecedented strict housing regulations for stabilizing the overheated housing market (hereafter, the June Plan), involving all relevant government ministries.⁶ In particular, in the June Plan, the government substantially adjusted the previously regulated areas (“modification target zones” and “overheated speculative zones”) with the aim of preventing speculative demand. In the case of the modification target zones (hereafter, MTZ), households applying for loans will be subject to a debt-to-income (DTI) limit of 50%, a loan-to-value (LTV) limit of 50% for houses valued at 0.9 billion KRW (or 0.7 million USD) or less, and an LTV limit of 30% for houses valued at over 0.9 billion KRW. Additionally, restrictions on the transfer of pre-sale rights and increased property taxes for multiple homeowners will apply. The overheated speculative zones (hereafter, OSZ), mainly a subset of the areas designated for

regulation, impose additional restrictions beyond those applied to the MTZ. For instance, in the case of household loans, a DTI limit of 40% will apply, along with an LTV limit of 40% for houses valued at 0.9 billion KRW or less, an LTV limit of 20% for houses valued at over 0.9 billion KRW but less than 1.5 billion KRW (or 1.2 million USD), and an LTV limit of 0% for houses valued at over 1.5 billion KRW. While previously, Seoul Metropolitan City and some metropolitan areas were designated as regulated regions, the distinguishing feature of the June Plan is the inclusion of most of the metropolitan areas, as well as several provincial areas like Daejeon, as regulated regions.⁷ Therefore, this paper focuses on the newly included Daejeon as a regulated region under the June Plan, aiming to create a natural experimental environment associated with the policy implementation.⁸

⁶ The Ministry of Land, Infrastructure and Transport, the Ministry of Economy and Finance, and the Financial Services Commission, while facing ongoing concerns in the housing market, including upward pressure on high-priced houses in Seoul Metropolitan City and continued market instability in Seoul's middle- and low-priced houses and deregulated areas in the Seoul Capital Area and local provinces, have expressed concerns about the potential for speculative demand to persist due to record-low interest rates and ample liquidity, resulting in reduced opportunities for actual homebuyers. In response, they announced the the June Plan. The key components of the June Plan include designating overheated speculative zones and modification target zones, strengthening regulations on mortgages and housing-related loans, refining regulations on redevelopment projects, and tax supplements for corporations, among others. (Source: Korean Ministry of Land, Infrastructure and Transport)

⁷ The areas that were previously designated for the modification target zones (MTZ) and the overheated speculative zones (OSZ) and those that have been newly designated are as follows. (Source: Ministry of Land, Infrastructure and Transport)

- Previous MTZ: Seoul Metropolitan City, several cities and counties in Gyeonggi Province (Gwacheon, Gwangmyeong, Seongnam, Goyang, Namyangju, Hanam, Dogntan area in Hwaseong, Guri, Anyang, Suwon, Sujigu and Giheunggu districts in Yongin, Uiwang), and administrative regions in Sejong Special Self-Governing City
- New MTZ: Seoul Metropolitan City, all cities and counties in Gyeonggi Province (excluding Gimpo, Paju, Yeoncheon-gun, Dongducheon, Pocheon, Gapyeong-gun, Yangpyeong-gun, Yeosu, and Icheon), Incheon Metropolitan City (excluding Ganghwa-gun and Ongjin-gun), administrative regions in Sejong Special Self-Governing City, one city in Chungbuk Province (Cheongju), and Daejeon Metropolitan City
- Previous OSZ: Seoul Metropolitan City, several cities and counties in Gyeonggi Province (Gwacheon, Bundanggu district in Seongnam, Gwangmyeong, and Hanam), Suseonggu district in Daegu Metropolitan City, administrative regions in Sejong Special Self-Governing City
- New OSZ: Seoul Metropolitan City, several cities and counties in Gyeonggi Province (Gwacheon, Bundanggu district and Sujeonggu district in Seongnam, Gwangmyeong, Hanam, Suwon, Anyang, Danwongu district in Anyang, Guri, Gunpo, Uiwang, Sujigu district and Giheunggu district in Yongin, Dongtan area in Hwaseong, Yeonsugu district, Namdonggu district, Seogu district in Incheon Metropolitan City, Suseonggu district in Daegu Metropolitan City, administrative regions in Sejong Special Self-Governing City, and Donggu district, Junggu district, Seogu district, Yuseonggu district in Daejeon Metropolitan City

⁸ In order to complement the June Plan, the government introduced follow-up plans in July and August 2020, known as the "July Plan" and the "August Plan." However, considering that these policies primarily focused on expanding opportunities for privileged subscriptions for newly constructed houses and increasing property tax rates for multiple homeowners, as well as increasing housing supply centered around the Seoul Capital Area, it is hard to see that these policies would have had the same sentiment effects in the Daejeon as the designation of regulated regions under the June Plan.

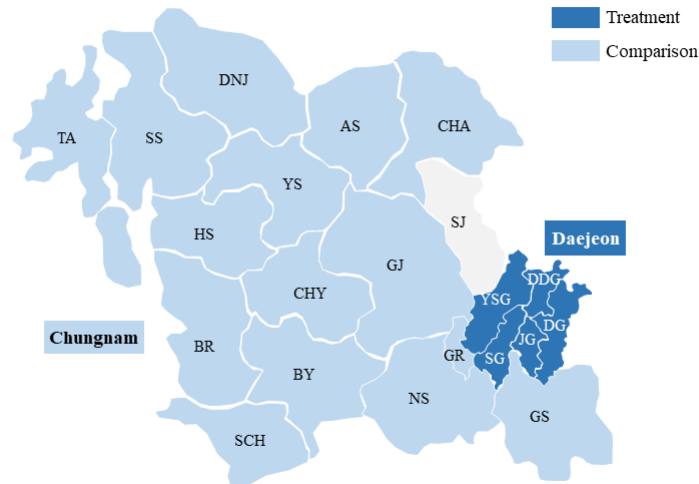


Figure 1: Treatment and control regions

¹ SJ (Sejong Special Self-Governing City) is excluded from the analysis because administrative regions of the city has already been regulated.
² DNJ: Dangjin, AS: Asan, CHA: Cheonan, YS: Yesan-gun, GJ: Gongju, SS: Seosan, TA: Taean-gun, HS: Hongseong-gun, CHY: Cheongyang-gun, BR: Boryeong, BY: Buyeo-gun, GR: Gyeryong, NS: Nonsan, GS: Geumsan-gun, SCH: Seocheon-gun, DG: Donggu district, SG: Seogu district, JG: Junggu district, YSG: Yuseonggu district, DDG: Daedeokgu district, SJ: Sejong Special Self-Governing City

Specifically, in this paper, we utilize the natural experiment setting created by housing market regulations; we designate Daejeon (comprising five districts) under regulation as the treatment group and Chungnam (consisting of 16 cities and counties) without regulation as the comparison group, as shown in Figure 1.⁹ Daejeon and Chungnam are geographically adjacent regions classified in the same metropolitan area, making them suitable for comparisons between the treatment and control groups in this natural experimental context.¹⁰ Moreover, considering the external factor of the COVID-19 pandemic in the first half of 2020, the cumulative number of infections in Daejeon was 256 (17.1 per 100 thousand persons), and in Chungnam, it was 333 (15.2 per 100 thousand persons) as of August 2020. These numbers were relatively low compared to Seoul Metropolitan City’s 3,861 cases (40.1 per 100 thousand persons). Therefore, it is expected that

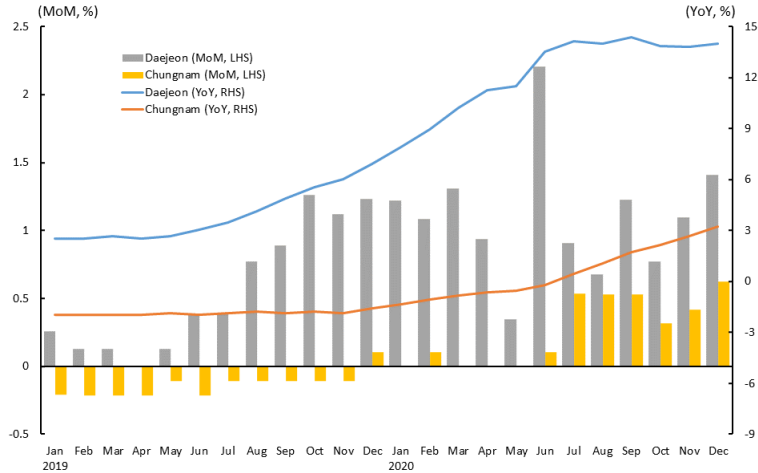


Figure 2: Housing prices in Daejeon and Chungnam

Source: Korea Real Estate Board

both regions experienced similar effects of reduced consumption due to the pandemic.¹¹

When examining the trends in the housing market directly targeted by the June Plan (Figure 2), it is observed that the rate of housing price increase in Daejeon, which had shown high growth rates before the June Plan. While the growing pace was slightly stabilized after the June Plan, the house prices in Daejeon still exhibited a relatively high growth rate until the end of 2020. In the case of the housing price increase rate in Chungnam, where there were no regulations, it turned positive from the end of 2019 and continued to show a high growth rate until the end of 2020. For the analysis in this paper, considering the similarity in the housing market situations between Daejeon and Chungnam during the immediate aftermath of the June Plan, April 2020 is chosen

⁹ The local government system in South Korea consists of two tiers: the upper level, which includes metropolitan cities (*teug-byeol-si* and *gwang-yeok-si*) and provinces (*do*), and the lower level, which includes cities (*si*), counties (*gun*), and districts (*gu*). For example, Daejeon is an upper-level local government, and it supervises 5 districts that are lower-level local governments. Another example of an upper-level local government is Chungnam, which consists of 16 lower-level local governments (that are cities or counties).

¹⁰ As of 2020, the size of the economy of Daejeon and Chungnam was 2.5% and 4.9% of the national GDP, respectively. Moreover, over the past decade, the correlation coefficient of the Gross Regional Domestic Product (GRDP) growth rates in these two regions was 0.73. Regarding per capita regional gross income as of 2020, Daejeon had 32 million KRW, while Chungnam had 42 million KRW. (Source: Statistics Korea)

¹¹ The trend in the newly confirmed cases of COVID-19 during the analysis period of this study, which covers the months from April to September 2020, exhibited a high degree of similarity between the two regions, except for the period at the end of February when a cluster outbreak occurred in Cheonan, resulting in around 50 confirmed cases. (Source: Statistics Korea)

as the reference period for the short-term effects analysis, with estimations made up to September 2020. Although May 2020 is a month just before the June Plan so it may be a more appropriate reference period, there exists a critical confounding factor in May 2020. Worried about a COVID-19-induced economic recession, the Korean government provided universal stimulus payments in May 2020.¹² Also, it is worth noting that there do not exist non-trivial policy implementations except the June Plan in Daejeon or Chungnam during the analysis period with the prevalent concerns of the pandemic, which contributes to forming an ideal natural experiment setting.¹³

In summary, this paper adapts a difference-in-differences methodology to analyze whether there were significant changes in household consumption expenditure between Daejeon, which became a regulated area in June 2020, and Chungnam, an area without regulation. It leverages regional variation and time variation before and after the regulations. If significant changes are observed, it can be interpreted as evidence of a sentiment effect of housing price changes on household consumption in Daejeon. The key idea behind this identification strategy is that, in a controlled environment where other factors are held constant, only the treatment group subject to direct housing market regulation presents a significant change in consumption. Therefore, this change in consumption is a result of the impact of housing price changes on household sentiments and expectations.

The identification strategy used in this paper resolves the endogeneity issue of housing price changes raised in previous studies such as Hui et al. (2018) by utilizing housing market regulation. However, since the aim here is to estimate the short-term sentiment effects on household consumption, the strategy lacks persuasiveness if housing market regulations do not immediately lead to housing price changes at the treatment point. In reality, fluctuations in housing sales prices are

¹² Households could apply and receive one-time stimulus payments from May 4 up to 1 million KRW according to the number of household members in the form of cash, direct deposits to credit card accounts, or vouchers. The payments could be used only at small-sized merchants in the recipient's neighborhoods before September 1. The Korean Ministry of the Interior and Safety reported that approximately 82% of the stimulus payments were used within one month.

¹³ One candidate that can cause bias is the introduction of local currency (named "Ontong Daejeon" in Daejeon in May 2020 because it could lead to an increase in credit card spending by Daejeon households. However, this factor is controlled in that the Ontong Daejeon was not issued exclusively for Daejeon citizens, and several regions in Chungnam had already been issuing local currency.

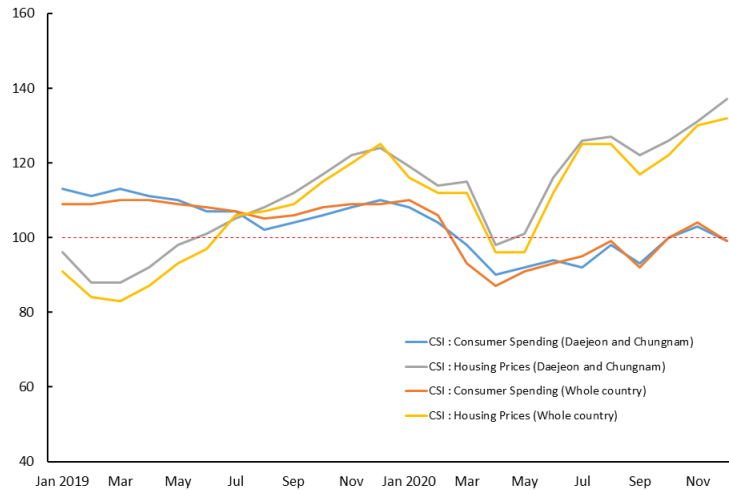


Figure 3: Expectations of Consumer Spending and Housing Prices

¹ The Consumer Survey Index (CSI) is a statistical data that quantifies the results of surveys on consumers' perceptions of the economic situation and their future spending expectations. When the index exceeds 100, it means that more consumers provided positive responses compared to those who provided negative responses, while a value below 100 indicates the opposite.
Source: Bank of Korea

observed through concluded transactions, so there may be a time lag in the impact of regulations on housing prices. This paper overcomes this concern by using the intermediary of expectations regarding housing prices. Housing market regulations are likely to influence people's expectations about housing prices, and the analysis here examines whether household consumption moves in response to these expectations. For instance, if the household consumption of homeowners decreases after housing market regulations, it can be seen as a result of the sentimental wealth effect due to the expectation of a decline in housing prices. Therefore, the estimation in this paper not only empirically assesses the existence of sentiment effect of house price changes on household consumption but also provides additional significance by allowing us to gauge the direction in which households form expectations about housing prices after regulation.

Before diving into the main analysis, we examine changes in housing price and consumption expenditure sentiment before and after the June Plan using available data. Figure 3 illustrates the trends in the housing price outlook and consumption spending outlook items from the Consumer Survey Index (CSI) compiled by the Bank of Korea. Even after the announcement of the June

Plan in June 2020, the proportion of respondents in the Daejeon and Chungnam regions who expected housing prices to continue rising remained consistently high. It suggests that, contrary to the intentions of the policy, housing market regulations may not have fostered expectations of a decline in housing prices.¹⁴ Next, the consumption spending CSI in the Daejeon-Chungnam region has shown a rising trend despite a majority of negative outlooks around the regulation period. However, the consumption expenditure sentiment is influenced by a wide range of factors beyond housing market regulations, so it is premature to interpret it as a meaningful movement related to the regulations.¹⁵ Nevertheless, it is worth noting that until the first half of 2019, the housing price CSI and consumption spending CSI moved in opposite directions. In contrast, since the second half of 2019, these two items have been trending in the same direction.

2.2 Data

This paper conducts empirical analysis using individual credit information data provided by KCB. KCB possesses all the information related to credit card transactions and loans for the entire population in South Korea, where credit information exists. Therefore, the analysis in this paper, utilizing this dataset, has significant advantages in terms of representativeness and accuracy. Specifically, this paper utilizes monthly panel data for 1,307,940 individuals randomly selected by KCB from the entire population.¹⁶ Due to KCB's sampling method being conducted at the district (or city or county) level, the provided data only contains district codes for individual residential addresses.

¹⁴ We want to clarify that the data does not allow us to distinguish between Daejeon, a regulated area, and Chungnam, an unregulated area, due to data availability issues. Additionally, due to the regional classification in the statistics, the Daejeon-Chungnam region also includes Sejong Special Self-Governing City. Therefore, we cannot definitively determine how the regulations in Daejeon may have affected the expectations of households in Daejeon. Furthermore, the housing price CSI in the Daejeon-Chungnam region exhibits a similar trend to the national average, and the proportion of respondents anticipating an increase in housing prices had already been growing before the regulations, suggesting a momentum effect. Therefore, it may not be appropriate to discuss the impact of the June Plan solely in terms of its influence on expectations.

¹⁵ This issue is addressed through the identification strategy employed in this paper. Therefore, the estimation results in this paper hold significance in purely indicating the impact of housing market regulations on household consumption by altering expectations regarding housing price changes.

¹⁶ It should be noted that the data used in this analysis were obtained from KCB through the Data Voucher Support Program by the Korea Data Agency in the second half of 2020. KCB employed AI techniques to target all households with available credit information throughout the entire period, conducted random sampling at the district level, and

Table 1: Summary Statistics of Selected Variables (as of July 2020)

Panel A. Daejeon, 23,416 households [<i>homeowners: 6,896 (29.4%), renters: 16,520 (70.6%)</i>]				
Variable (unit: 1,000 KRW)	Mean	(Std. Err.)	Min.	Max.
Monthly card use	2,183.0	(2,107.2)	51	30,797
Annual income	49,730.8	(32,560.7)	10,550	352,000
Housing asset	443,832.8	(330,974.2)	6,150	4,004,790
Total debt	60,516.9	(81,884.9)	1,012	922,864
Panel B. Chungnam, 29,802 households [<i>Homeowners: 8,871 (30.5%), Renters: 20,931 (69.5%)</i>]				
Variable (unit: 1,000 KRW)	Mean	(Std. Err.)	Min.	Max.
Monthly card use	2,122.7	(2,202.0)	51	32,943
Annual income	49,297.6	(30,131.0)	10,010	342,240
Housing asset	288,983.7	(240,313.2)	2,050	3,061,950
Total debt	58,552.3	(79,446.1)	1,001	1,008,327

Notes: The annual income is an estimated annual income by KCB, and the housing asset value represents the appraisal amount for the owned property. The statistics for housing asset value are calculated based on homeowners, and those for outstanding amount of household debt are calculated based on the households with debts of more than 1 million KRW (including all types of loans such as mortgage loans and credit loans).

As mentioned in the previous section, this study focuses on Daejeon and Chungnam. Consequently, it utilizes a sample of individuals residing in the five districts of Daejeon and the 16 cities and counties of Chungnam from the provided KCB data based on their residential addresses. Additionally, to conduct household-level analysis, individual-level data is aggregated into household units. A household is defined as individuals residing at the same residential address.¹⁷ In this analysis, monthly household consumption is represented by the amount of credit card and debit card spending (hereafter, “credit card” refers to both credit and debit cards). This is because KCB, which collects credit transaction information, cannot track cash-based consumption.¹⁸ Here, in cases where credit cards are not the primary means of payment for households, the credit card usage amount cannot be considered an appropriate proxy variable for household consumption expenditure. Therefore, households with a per capita card usage amount of less than 50 thousand KRW (or 40 USD) are excluded from the sample. Additionally, households in the bottom 20% income quantile are also excluded. This is because during the COVID-19 pandemic period, other financial supports to low-income households, such as emergency relief aids provided in the

provided anonymized data at the individual level. The provided dataset consists of monthly panel data spanning 24 months from October 2018 to September 2020.

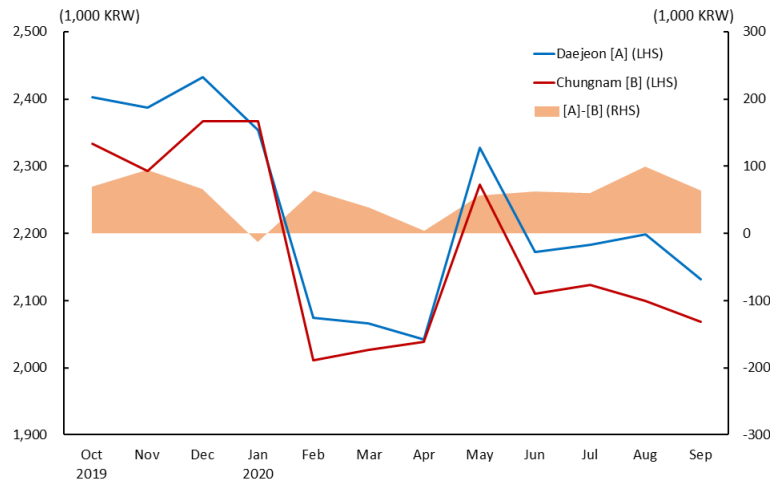


Figure 4: Credit Card Spending in Daejeon and Chungnam (Oct. 2019 - Sep. 2020)

¹ The one-year trend of the average credit card spending amount for the sample households used in the analysis described in the main text
Source: Author's calculation using KCB data

form of debit cards or coupons, could have a significant impact on credit card usage amounts of those households. Ultimately, the final sample considered for empirical analysis consists of 23,416 households in Daejeon and 29,802 households in Chungnam as of July 2020.

Table 1 provides summary statistics for Daejeon and Chungnam as of July 2020. Similarities between the two regions are observed in terms of monthly credit card usage amount, annual income, and household debt balance. In the case of the value of housing assets, Daejeon is, on average, about 150 million KRW higher than Chungnam. The one-year trend in the average monthly credit card usage amount (Figure 4) also shows a high correlation coefficient of 0.97 between the two regions. The average per capita credit card expenditure for both regions experienced a sharp decline from February to April 2020 due to reduced consumption amid COVID-19. It temporarily increased in May 2020 when stimulus payments were distributed.¹⁹

¹⁷ For cases where households have relocated to a different area, if the household notifies the financial institution of their previous address information, KCB will possess this information. This allows for tracking and classification of the same household in such instances.

¹⁸ As of 2019, South Korea's credit card usage amount (excluding business credit cards and cash advances) accounted for 85% of the nominal household consumption, amounting to 7,605 trillion KRW out of a total of 8,972 trillion KRW. (Source: Bank of Korea)

¹⁹ The difference in average per capita credit card expenditure between the two regions generally ranged from

3 Model and Results

In this section, we establish an econometric model based on the identification strategy presented in the previous section to estimate the sentiment effect of house price changes on household consumption expenditure. We then present the estimation results.

3.1 Econometric Model: DD Analysis

Following the estimation strategy outlined in the previous section regarding the June Plan designating Daejeon as a regulated area, this study conducts a double difference (DD) analysis using regional variation between Daejeon (a regulated area) and Chungnam (an unregulated area) as well as time variation before and after the regulation. Specifically, we consider the estimation equation as follows, similar to Baek et al. (2023):²⁰

$$Y_{it} = \beta_0 + \beta_1 Treat_i \cdot Post_t + \beta_2 Treat_i + \beta_3 Post_t + \gamma X_{it} + \delta_i + \varepsilon_{it}, \quad (1)$$

where Y_{it} , the outcome variable, denotes the monthly consumption per person for household i at time t , $Treat_i = 1$ for households in Daejeon and $Treat_i = 0$ for households in Chungnam in 2020, $Post_t = 1$ for July 2020 and $Post_t = 0 = 0$ for April 2020, X_{it} includes the time-varying controls, and δ_i is the household fixed effect. The reason we choose July 2020 as the treatment period is that the housing regulation was implemented shortly after the announcement of June 17th. As for the comparison period, April 2020 is chosen, considering the anticipation of the regulation immediately before the announcement and the distribution of universal stimulus payments in May 2020. Also, while we select July as the baseline treatment period, we want to note that we also analyze the effects for the two months before and after the baseline period, *i.e.*, May to September 2020, in order to estimate the trend of sentiment effects.²¹ As consumption decisions are typically

approximately 40 to 100 thousand KRW, with the largest difference being 99 thousand KRW in August 2020. Considering that the expenditure difference between the two regions existed even before the introduction of the Ontong Daejeon, or Daejeon's local currency, except for May 2020 when stimulus payments were distributed, it implies that more rigorous analysis is required beyond a simple expenditure difference (for example, the difference was 94 thousand KRW in November 2019).

made at the household level, we include the fixed effect and time-varying controls at the household level for the benchmark model. The controls include households' income, debt (credit loan and mortgage), housing assets, delinquent debt, and family size. The standard errors are clustered at the household level.

3.2 Sentiment Impact of Housing Regulation

3.2.1 Overall effect, and effects by homeownership status

In the estimation model, the coefficient of the interaction term between the two dummy variables is the primary focus of this DD analysis. The coefficient of the interaction term compares the consumption changes between April and July in Daejeon with those between the same periods in Chungnam. In this DD analysis, common factors affecting consumption in both regions, such as seasonal factors, are eliminated. Consequently, the effect of housing market regulation between April and July is identified. Therefore, if both regions have parallel trends, the DD estimate reflects the sentiment effect of housing regulation on household consumption. To verify the parallel trends hypothesis, the same model is used to compare the two regions in 2019. In 2019, neither Daejeon nor Chungnam was subject to regulation. In other words, a placebo test was conducted to analyze the consumption changes between April and July in both regions in 2019. If the DD estimate in the placebo test is statistically significant, the parallel trends hypothesis is rejected.

Panels A and B in Table 2 present the estimation results for 2020 and 2019, respectively. The first two columns represent estimates using data for all households, while the remaining four columns present results after classifying all households according to homeownership status: the third and fourth columns for homeowners and the fifth and sixth columns for renters. In each

²⁰ Baek et al. (2023) conducted a DD analysis to analyze the effects of stimulus payments provided for consumption support following the COVID-19 pandemic. While nationwide universal stimulus payments were planned to be distributed in May 2020, Gyeonggi Province proactively distributed the payments in April 2020. Consequently, a DD analysis was performed using the regional variation between Gyeonggi Province and adjacent Incheon Metropolitan City, as well as the time variation before and after the distribution of Gyeonggi Province's payments. The study found that the universal stimulus payments led to an increase in consumption of approximately 30 thousand KRW per person, with a marginal propensity to consume (MPC) of approximately 0.4.

²¹ For example, when we estimate the effect in September, $Post_t = 1$ for September 2020, holding the comparison period April 2020.

Table 2: DD estimates for the sentiment impact of housing regulation

Dependent variable: monthly consumption per person (unit: 1,000 KRW)						
<i>Panel A. Treatment group = Daejeon, 2020</i>						
<i>Control group = Chungnam, 2020</i>						
	All		Homeowners		Renters	
	(1)	(2)	(1)	(2)	(1)	(2)
Daejeon × July	48.31*** (18.16)	49.01*** (18.21)	54.19** (25.04)	55.02** (25.09)	52.25** (25.32)	51.55** (25.40)
Daejeon	-351.83 (264.90)	-352.59 (265.81)	82.31 (78.33)	64.81 (90.20)	-268.87 (253.87)	-268.99 (252.98)
July	111.44*** (11.94)	111.89*** (12.50)	91.12*** (18.02)	85.06*** (19.03)	119.91*** (15.75)	123.89*** (16.65)
Household controls	No	Yes	No	Yes	No	Yes
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
# of observations	71,455	71,455	19,557	19,557	32,635	32,635
# of groups	44,841	44,841	9,779	9,779	16,325	16,325
<i>Panel B. Treatment group = Daejeon, 2019</i>						
<i>Control group = Chungnam, 2019</i>						
	All		Homeowners		Renters	
	(1)	(2)	(1)	(2)	(1)	(2)
Daejeon × July	-0.90 (16.14)	0.20 (16.11)	11.71 (24.56)	7.80 (24.62)	-6.32 (21.39)	-4.38 (21.33)
Daejeon	377.00 (446.57)	401.24 (448.88)	-55.90** (25.09)	-13.26 (24.17)	270.92 (499.09)	302.52 (504.02)
July	75.29*** (11.68)	78.09*** (11.79)	58.21*** (18.42)	47.74*** (18.36)	78.46*** (15.06)	82.19*** (15.09)
Household controls	No	Yes	No	Yes	No	Yes
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
# of observations	71,339	71,339	20,740	20,740	35,170	35,170
# of groups	42,243	42,243	10,370	10,370	17,594	17,594

Notes: Panel A uses household consumption panel data for Daejeon and Chungnam for the treatment period (July) and the comparison period (April) of 2020. Panel B uses household consumption panel data for Daejeon and Chungnam for the treatment period (July) and the comparison period (April) of 2019. The DD estimates compare the consumption change from April to July in Daejeon to that in Chungnam for the given year. Homeowners and Renters respectively refer to households that owned house(s) and those that did not own a house from April to July in the given year. The household controls include households' income, debt (credit loan and mortgage), housing assets, delinquent debt, and family size. Standard errors are clustered at the household level (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

household category, model (1) includes household fixed effects (δ_i) but does not consider household control variables (X_{it}), while model (2) includes both fixed effects and control variables. The results, according to the model specification, appear to be robust, and this paper adopts model (2) as the benchmark model.

According to the estimation results, after housing regulations, household consumption in Dae-

jeon increased significantly by approximately 49 thousand KRW (or 40 USD) per capita compared to Chungnam. The result can be interpreted as there is a significant sentiment effect of housing regulations, indicating the empirical evidence for the existence of a sentiment pathway through which changes in housing prices affect consumption. However, as previously established in research, the mechanism through which housing prices affect household consumption can vary depending on the homeownership status. Therefore, there is a need to distinguish and analyze households with housing and those without housing in order to gain a more specific understanding of the sentiment effects and further discussion.²²

According to Table 2, we can observe a significant increase in household consumption for both homeowners and renters. In the case of homeowners, considering the wealth effect, it appears that there was a significant increase in consumption due to the anticipation that housing market regulations would lead to additional price increases. Looking beyond the long-term policy effects on housing prices and the housing market due to regulatory area designation, in the short term, homeowners may have perceived the regulatory area designation itself as a signal that the area is one of the hottest housing markets. This could explain the formation of such sentiment. For renters, when considering the substitution effect, it seems that there was a significant increase in consumption due to the perception that housing prices would stabilize as a result of housing market regulations. It leads to the conclusion that housing price expectations formed in response to housing regulation may have operated in opposite directions depending on homeownership status. However, it is also possible that renters were influenced by sentiment in the same direction as homeowner households. Engelhardt (1996) introduced the concept of a “desperation consumption effect,” where when housing prices skyrocket, individuals may abandon efforts to save for homeownership and instead increase consumption of other goods. In other words, renters, like homeowners, may have anticipated housing market regulations as a signal of additional housing

²² Furthermore, considering the possibility of changes in homeownership status, such as disposing or acquiring a house during the analysis period, it is also necessary to distinguish between homeowners and renters. Therefore, in this study, we re-define the sample by categorizing the group that owned a house during the period as homeowners and the group that did not own a house during the period as renters. However, it should be noted that this analysis did not account for cases where individuals moved within the same region, resulting in a change in their primary residence or owned property.

Table 3: Trend of the sentiment impact of housing regulation: Homeowners

Dependent variable: monthly consumption per person (unit: 1,000 KRW)					
<i>Panel A. Treatment group = Daejeon, 2020</i>					
<i>Control group = Chungnam, 2020</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
Daejeon × Post	42.81 (27.05)	80.69*** (27.45)	55.02** (25.09)	62.31** (27.43)	59.13** (26.40)
Daejeon	-30.31 (26.05)	73.50 (196.09)	64.81 (90.2)	-33.08 (259.02)	43.71 (115.35)
July	178.33*** (19.46)	83.76*** (20.19)	85.06*** (19.03)	103.67*** (21.31)	63.63*** (20.58)
# of observations	22,668	19,729	19,557	19,437	18,663
# of groups	11,334	9,865	9,779	9,719	9,332
<i>Panel B. Treatment group = Daejeon, 2019</i>					
<i>Control group = Chungnam, 2019</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
Daejeon × Post	2.54 (24.68)	18.04 (22.95)	7.80 (24.62)	29.13 (22.82)	27.49 (23.56)
Daejeon	-10.22 (23.63)	-6.82 (24.01)	-13.26 (24.17)	-16.21 (23.73)	-22.78 (23.73)
July	80.08*** (17.28)	-56.80*** (15.65)	47.74*** (18.36)	-9.03 (16.27)	-43.17** (17.41)
# of observations	23,316	20,864	20,740	20,588	19,344
# of groups	11,658	10,432	10,370	10,294	9,672

Notes: Panel A uses household consumption panel data for Daejeon and Chungnam for the treatment period (May to September) and the comparison period (April) of 2020. Panel B uses household consumption panel data for Daejeon and Chungnam for the treatment period (May to September) and the comparison period (April) of 2019. Homeowners refer to households that owned house(s) from April to the respective treatment period. The DD estimates compare the consumption change from April to the respective treatment period in Daejeon to that in Chungnam for the given year. The estimated model includes both household controls and household fixed effects. The household controls include households' income, debt (credit loan and mortgage), housing assets, delinquent debt, and family size. Standard errors are clustered at the household level (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

price increases and increased their consumption spending accordingly.

Panel B in Table 2 presents the results of placebo tests conducted to verify the parallel trends hypothesis between the treatment group, Daejeon, and the control group, Chungnam. If the housing market regulation in June 2020 affected household consumption in Daejeon, there should not have been a significant difference between the two regions in 2019. In the full-sample analysis in Panel B, the coefficient of the interaction term exhibits estimates close to zero, accompanied by a large standard deviation. We fail to reject the hypothesis that the coefficients of the interaction

Table 4: Trend of the sentiment impact of housing regulation: Renters

Dependent variable: monthly consumption per person (unit: 1,000 KRW)					
<i>Panel A. Treatment group = Daejeon, 2020</i>					
<i>Control group = Chungnam, 2020</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
Daejeon × Post	20.24 (20.79)	17.10 (23.42)	51.55** (25.40)	83.75*** (24.04)	70.93*** (26.20)
Daejeon	41.40* (22.17)	-490.35 (435.29)	-268.99 (252.98)	-447.37 (344.84)	-466.28** (191.28)
Post	154.08*** (13.78)	111.74*** (15.10)	123.89*** (16.65)	91.04*** (14.85)	71.26*** (17.91)
# of obs.	44,898	32,725	32,635	32,531	28,443
# of groups	22,449	16,370	16,325	16,273	14,228
<i>Panel B. Treatment group = Daejeon, 2019</i>					
<i>Control group = Chungnam, 2019</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
Daejeon × Post	16.49 (19.12)	0.87 (19.88)	-4.38 (21.33)	0.85 (20.18)	16.46 (21.91)
Daejeon	21.85 (20.09)	855.97* (510.36)	302.52 (504.02)	1,009.76* (532.58)	1,076.09** (541.87)
Post	57.29*** (12.73)	-22.30* (13.19)	82.19*** (15.09)	55.14*** (13.83)	11.20 (14.83)
# of obs.	47,290	35,344	35,170	35,021	28,979
# of groups	23,645	17,681	17,594	17,519	14,503

Notes: Panel A uses household consumption panel data for Daejeon and Chungnam for the treatment period (May to September) and the comparison period (April) of 2020. Panel B uses household consumption panel data for Daejeon and Chungnam for the treatment period (May to September) and the comparison period (April) of 2019. Renters refer to households that did not own a house from April to the respective treatment period. The DD estimates compare the consumption change from April to the respective treatment period in Daejeon to that in Chungnam for the given year. The estimated model includes both household controls and household fixed effects. The household controls include households' income, debt (credit loan and mortgage), housing assets, delinquent debt, and family size. Standard errors are clustered at the household level (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

terms for both homeowners and renters are not significantly different from zero. These results support the notion that the parallel trends hypothesis holds between the two regions before the treatment. While the results in Panel B do not yield statistically significant estimates, the observation of different interaction coefficients for homeowners and renters suggests that considering the situation in 2019 when housing prices in Daejeon were rising while those in Chungnam were falling (refer to Figure 2), wealth effect operated for homeowners, while substitution effect worked for renters. In addition, the observation of a larger significant effect in July 2020 compared to July

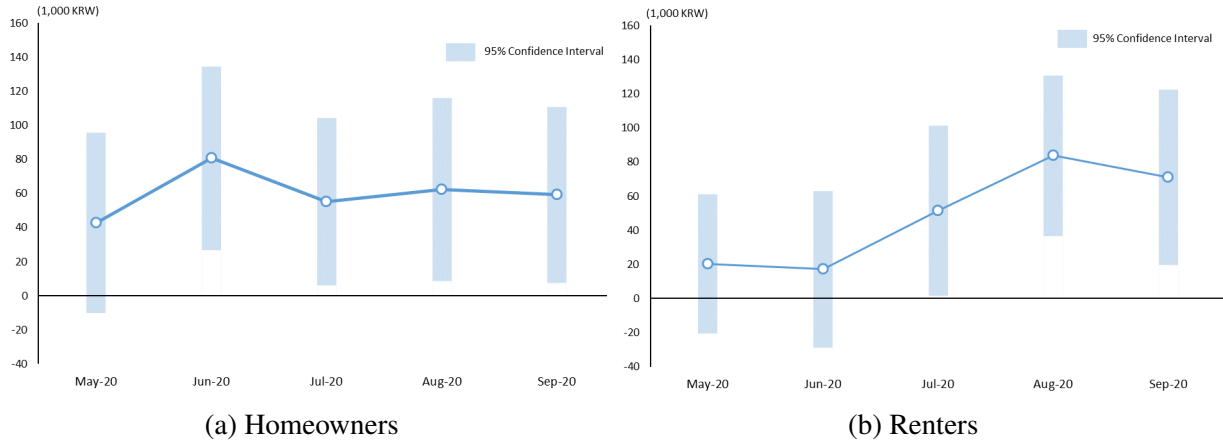


Figure 5: DD estimates: Trend of the impact of housing regulation

Note: The regression results including estimates and standard errors can be referenced in Tables 3 and 4.

2019 may be interpreted as an increase in consumption due to the effects of stimulus payments.

Tables 3 and 4 depict the trend of sentiment effects of the housing price changes for homeowners and renters in the two months before and after the benchmark treatment period. In both household groups, the lack of significant effects in May can be attributed to the fact that the expectations regarding housing price changes had not yet fully developed as housing market regulations were announced and implemented in June. For homeowners, significant sentiment effects are observed from June to September immediately after the regulation, and for renters, significant effects are estimated from July to September. Panel B in Tables 3 and 4, using 2019 data to verify parallel trends between Daejeon and Chungnam, confirms that the estimated coefficients of the interaction terms are not statistically significant in all cases.

To facilitate a comparison of consumption changes over time, the estimated values are visualized as shown in Figure 5. Homeowners exhibited a substantial increase in household consumption in June, the month of regulation implementation, which is attributed to the immediate manifestation of sentiment effect alongside the announcement of the regulation designation as a stimulus. Subsequently, the sentiment effect remains significant but decreases in magnitude compared to the immediate effect. In contrast, renters do not show a sentiment effect immediately after the regulation but experience the most significant increase in consumption two months after the regulation,

Table 5: Sentiment effect of housing regulation, by mortgage loan status

Dependent variable: monthly consumption per person (unit: 1,000 KRW)
Treatment group = Daejeon, 2020; Control group = Chungnam, 2020

Panel A. Homeowners without mortgage loans

	(1) Post = May	(2) Post = Jun.	(3) Post = Jul.	(4) Post = Aug.	(5) Post = Sep.
Daejeon × Post	61.87* (35.79)	103.88*** (37.28)	58.14* (32.80)	51.31 (36.86)	77.57** (36.84)
# of obs.	12,884	11,330	11,248	11,192	10,740
# of groups	6,442	5,665	5,624	5,596	5,370

Panel B. Homeowners with outstanding mortgage debt A

	(1) Post = May	(2) Post = Jun.	(3) Post = Jul.	(4) Post = Aug.	(5) Post = Sep.
Daejeon × Post	14.79 (40.52)	43.60 (40.91)	38.96 (38.11)	66.74 (41.79)	31.11 (37.41)
# of obs.	9,784	8,399	8,309	8,245	7,923
# of groups	4,892	4,200	4,155	4,123	3,962

Panel C. Homeowners with outstanding mortgage debt B

	(1) Post = May	(2) Post = Jun.	(3) Post = Jul.	(4) Post = Aug.	(5) Post = Sep.
Daejeon × Post	21.10 (44.34)	49.10 (45.81)	60.71 (42.56)	71.37 (46.29)	54.61 (40.82)
# of obs.	8,236	7,069	6,989	6,935	6,661
# of groups	4,118	3,535	3,495	3,468	3,331

Notes: The DD estimates are obtained from a regression with the monthly household consumption panel of Daejeon and Chungnam for the treatment period (May to September) and the comparison period (April) of 2020. For Panel A, “homeowners without mortgage loan” refer to homeowners with mortgage loan balance of 0 during the analysis period. In Panel B, “homeowners with outstanding mortgage debt A” refer to homeowners with a mortgage loan history during the analysis period. In Panel C, “homeowners with outstanding mortgage debt B” refer to homeowners with positive(or non-zero) outstanding amount of mortgage loan at the comparison period. The DD estimates compare the consumption change from April to the respective treatment period in Daejeon to that in Chungnam. The estimated model includes both household controls and household fixed effects. The household controls include households’ income, debt (credit loan and mortgage), housing assets, delinquent debt, and family size. Standard errors are clustered at the household level (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

suggesting that if these households had a sentimental inclination toward stabilizing housing prices due to the housing market regulation, it may have been confirmed by the government’s subsequent policies announced in July and August. However, if the regulation had induced a sense of desperation in renters, they may have become more convinced over time that government policies were not very effective in the short run, leading to the significant increase in consumption observed in August.

3.2.2 Sentiment effects of homeowners, by mortgage status

To delve deeper into the sentiment effects on homeowners, we further analyze them by categorizing homeowners into those with and without mortgage loans. Homeowners without mortgage loans are defined as those without any history of mortgages and a balance of 0 between the treatment and comparison periods (as shown in Panel A of Table 5). Homeowners with outstanding mortgage debt are considered in two scenarios. Firstly, homeowners with a non-zero balance of mortgage loans during any month between the treatment and comparison periods are categorized as group A in Panel B of Table 5. Secondly, homeowners with a non-zero outstanding amount of mortgage loans only during the comparison period (April) are defined as group B in Panel C.²³

From the results in Table 5, it can be observed that the sentiment effect experienced by homeowners is solely derived from households without mortgage loans (Panel A). In the case of households that own houses but have non-zero outstanding amounts of mortgages, the sentiment effect resulting from housing regulation is not significant (Panels B and C). This can be interpreted as the absence of sentiment effects concerning unrealized gains when one has to continue repaying the principal and that there may have been no incentive for a sentimental response to government policies aimed at stabilizing home prices. On the other hand, individuals who own their houses without any mortgage debt appear to have exhibited a sentiment effect of increasing consumption after receiving the signal that Daejeon might experience additional house price increases.

3.2.3 Sentiment effects of homeowners, by housing asset value

It can be expected that there would also be differences in sentiment effects of homeowners depending on the value of the owned homes. As of the comparison period in April 2020, the average house price for homeowners in the sample was 484.79 million KRW in Daejeon and 313.76 mil-

²³ In the sample used in the analysis in this subsection, there were 5,841 households in Daejeon and 7,799 households in Chungnam that owned houses from April 2020 to the benchmark treatment period in July 2020. During this period, households without mortgage loans accounted for 3,443 households (58.9%) in Daejeon and 5,009 households (64.2%) in Chungnam. On the other hand, households that had a mortgage balance for at least one month during this period were 2,398 households (41.1%) in Daejeon and 2,790 households (35.8%) in Chungnam. In April 2020, the households with mortgage loans were 2,016 in Daejeon and 2,334 in Chungnam.

Table 6: Sentiment effect of housing regulation, by value of owned house

Dependent variable: monthly consumption per person (unit: 1,000 KRW)					
<i>Treatment group = Daejeon, 2020; Control group = Chungnam, 2020</i>					
<i>Panel A. Homeowners with relatively high-price houses (> average value)</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
Daejeon × Post	73.98*	72.08*	65.09*	89.50**	75.15*
	(38.90)	(37.33)	(37.74)	(37.46)	(41.32)
# of obs.	9,048	8,158	8,094	8,042	7,788
# of groups	4,524	4,079	4,047	4,021	3,894
<i>Panel B. Homeowners with relatively high-price houses (> median value)</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
Daejeon × Post	68.59*	75.25**	65.81**	85.12**	72.07*
	(36.78)	(32.98)	(33.22)	(35.09)	(36.95)
# of obs.	11,436	10,250	10,174	10,112	9,798
# of groups	5,718	5,125	5,087	5,056	4,899
<i>Panel C. Homeowners with relatively low-price houses (≤ average value)</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
Daejeon × Post	21.80	84.50**	40.69	35.63	39.22
	(36.88)	(39.18)	(33.58)	(39.39)	(34.54)
# of obs.	13,620	11,571	11,463	11,395	10,875
# of groups	6,810	5,786	5,732	5,698	5,438
<i>Panel D. Homeowners with relatively low-price houses (≤ median value)</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
Daejeon × Post	15.40	82.92*	35.27	27.31	35.99
	(39.77)	(45.06)	(38.05)	(43.64)	(37.91)
# of obs.	11,232	9,479	9,383	9,325	8,865
# of groups	5,616	4,740	4,692	4,663	4,433

Notes: The DD estimates are obtained from a regression with the monthly household consumption panel of Daejeon and Chungnam for the treatment period (May to September) and the comparison period (April) of 2020. Homeowners refer to households that owned house(s) from April to the respective treatment period. The average price of houses in the sample is calculated as of April 2020, with it being 487,787.6 thousand KRW for Daejeon and 313,755.8 thousand KRW for Chungnam. The mean price of houses in the sample is calculated as of April 2020, with it being 412,635 thousand KRW for Daejeon and 235,500 thousand KRW for Chungnam. The DD estimates compare the consumption change from April to the respective treatment period in Daejeon to that in Chungnam. The estimated model includes both household controls and household fixed effects. The household controls include households' income, debt (credit loan and mortgage), housing assets, delinquent debt, and family size. Standard errors are clustered at the household level (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

lion KRW in Chungnam, and the median house price was 412.64 million KRW in Daejeon and 253.50 million KRW in Chungnam. Table 6 presents the estimates for homeowners divided into

two groups based on the average house price (Panels A and C) and median house price (Panels B and D) in the comparison period.²⁴

Households that owned relatively high-priced houses showed a significant sentiment effect on consumption, which was most pronounced in August, two months after the regulation (Panels A and B in Table 6). In contrast, households owning relatively low-priced homes exhibited a significant consumption increase effect only in June when the regulation is announced (Panels C and D in Table 6). It implies that among the sentiment effects of housing market regulation identified in Table 3 for homeowners, the immediate effect is primarily driven by households with lower-priced houses, while subsequent effects are more influenced by households with higher-priced houses.²⁵

4 Robustness

In this section, we examine the robustness of the empirical results estimating the sentiment effects of housing price changes on household consumption. We test the robustness of the estimation results by applying different settings or conditions to the identification strategy and model specifications to ensure the reliability of the findings. This analysis aims to provide a thorough understanding of the sentiment effects.

²⁴ In the sample used for the analysis in this subsection, there were 5,841 households in Daejeon and 7,799 households in Chungnam that owned houses from April 2020 until the benchmark treatment point in July 2020. Among these households, in the comparison period of April, 2,102 households in Daejeon (36.0%) and 2,708 households in Chungnam (34.7%) had houses with prices above the average. Additionally, in the comparison period, 2,625 households in Daejeon (44.9%) and 3,540 households in Chungnam (45.4%) had houses with prices above the median.

²⁵ In Panels A and B of Table 6, households that owned relatively high-priced houses showed significant estimates indicating an increase in consumption in May, even before the announcement of the June Plan. Considering that until May 2020, Chungnam presented negative year-on-year housing price growth rates, while Daejeon was experiencing a steep increase in prices (Figure 2), it is possible to interpret that even before the regulations, the changes in housing prices in Daejeon may have had an impact on consumption, especially among high-priced homeowners.

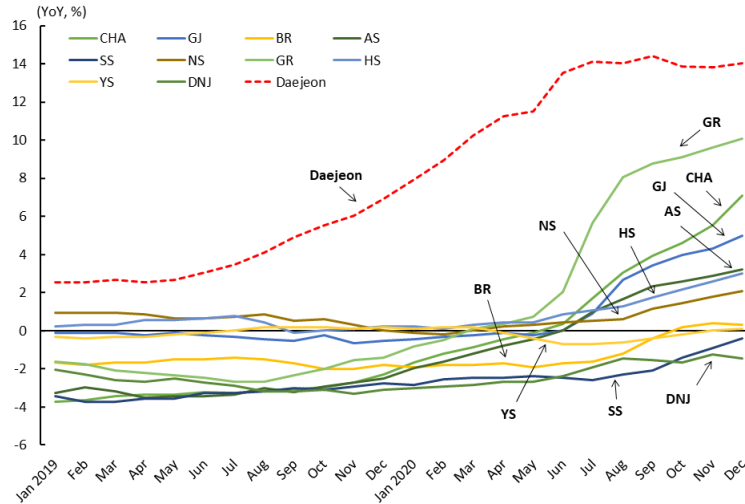


Figure 6: Housing prices in Daejeon and Chungnam (district-level)

¹ The year-on-year growth rates of housing prices in Chungnam (district-level) and Daejeon, excluding regions not surveyed at the district level (Tae'an-gun, Cheongyang-gun, Buyeo-gun, Seocheon-gun, and Geumsan)

² DNJ: Dangjin, AS: Asan, CHA: Cheonan, YS: Yesan-gun, GJ: Gongju, SS: Seosan, HS: Hongseong-gun, BR: Boryeong, GR: Gyeryong, NS: Nonsan

Source: Korea Real Estate Board

4.1 Alternative Comparison Group

While it is reasonable to consider Daejeon and Chungnam as the treatment and control groups, respectively, taking into account factors such as population and economic size, it is necessary to also consider the heterogeneity among different cities and counties within Chungnam, given that Chungnam is 15.3 times larger in terms of land area are compared to Daejeon (refer to Figure 1).²⁶ While it is expected that household control variables in the estimation model would control for heterogeneity between regions, in this section, we aim to test the robustness of the results from the previous section by adjusting for the comparison group.

²⁶ As of 2020, Daejeon had a real Gross Regional Domestic Product (GRDP) of 41.2 trillion KRW, while Chungnam had a real GRDP of 112.8 trillion KRW. The population in these two regions in 2020 was 1.464 million for Daejeon and 2.121 million for Chungnam. Additionally, in terms of land area, Daejeon covers 539.5 square kilometers, while Chungnam is 15.3 times larger than Daejeon, covering 8,245.5 square kilometers. (Sources: Statistics Korea, Korea Land and Geospatial Informatics Corporation)

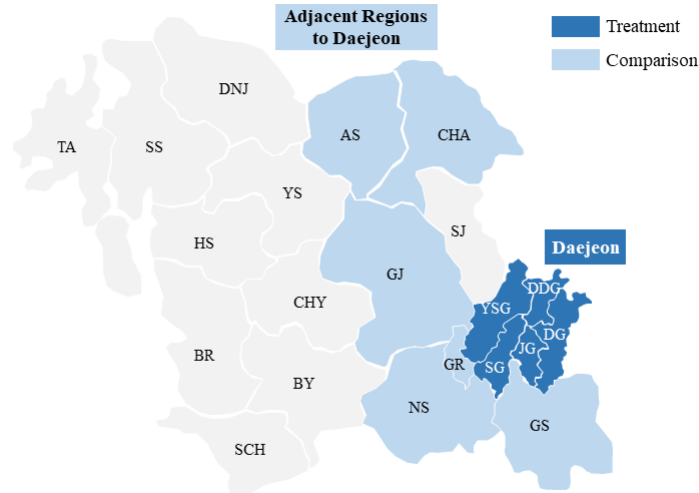


Figure 7: Treatment and control regions : Adjacent regions to Daejeon and Sejong

¹ The comparison group encompasses Asan, Cheonan, Gongju, Gyeryong, Nonsan, and Geumsan-gun. Asan is not geographically adjacent, but it is classified as a neighboring region due to its high accessibility to Daejeon based on transportation conditions.

² DNJ: Dangjin, AS: Asan, CHA: Cheonan, YS: Yesan-gun, GJ: Gongju, SS: Seosan, TA: Taean-gun, HS: Hongseong-gun, CHY: Cheongyang-gun, BR: Boryeong, BY: Buyeo-gun, GR: Gyeryong, NS: Nonsan, GS: Geumsan-gun, SCH: Seocheon-gun, DG: Donggu district, SG: Seogu district, JG: Junggu district, YSG: Yuseonggu district, DDG: Daedeokgu district, SJ: Sejong Special Self-Governing City

4.1.1 Comparison with adjacent regions to Daejeon

Looking at the trend of housing price increases by city and county in Chungnam in Figure 6, we can observe heterogeneity even within Chungnam. Specifically, regions adjacent to Daejeon and Sejong Special Self-Governing City (hereafter, Sejong) designated as regulated regions, such as Gyeryong, Cheonan, and Gongju, exhibit higher housing price increases. In order to secure similarity between the comparison group and the treatment group, we choose to restrict the estimation to adjacent areas of Daejeon and Sejong as the comparison group considering commuting accessibility to Daejeon and Sejong, as shown in Figure 7.²⁷

The DD estimates with the comparison group being the adjacent areas of Daejeon and Sejong are presented in Table 7. The sentiment effects of housing market regulations for both homeowners and renters show a similar trend to the baseline results presented in Tables 3 and 4. In other words, for homeowners, an immediate sentiment effect is significantly more pronounced right after the

²⁷ The adjacent regions to Daejeon and Sejong include Asan, Cheonan, Gongju, Gyeryong, Nonsan, and Geumsan-gun. Asan is not geographically adjacent, but it is classified as a neighboring region due to its high accessibility to Daejeon based on transportation conditions, such as rapid transit.

Table 7: DD estimates: Daejeon vs. adjacent regions to Daejeon

Dependent variable: monthly consumption per person (unit: 1,000 KRW)
Treatment group = Daejeon, 2020; Control group = Adjacent districts of Chungnam to Daejeon and Sejong, 2020

Panel A. Homeowners

	(1) Post = May	(2) Post = Jun.	(3) Post = Jul.	(4) Post = Aug.	(5) Post = Sep.
Daejeon × Post	39.49 (30.11)	98.35*** (31.41)	81.79*** (28.31)	66.70** (32.36)	83.01*** (30.69)
# of obs.	18,152	15,651	15,551	15,411	14,811
# of groups	9,076	7,826	7,756	7,706	7,406

Panel B. Renters

	(1) Post = May	(2) Post = Jun.	(3) Post = Jul.	(4) Post = Aug.	(5) Post = Sep.
Daejeon × Post	34.18 (23.18)	14.07 (26.27)	50.90* (28.03)	90.01*** (25.88)	49.48 (30.52)
# of obs.	35,586	25,392	25,322	25,246	21,932
# of groups	17,793	12,708	12,673	12,635	10,978

Notes: The comparison group encompasses Asan, Cheonan, Gongju, Gyeryong, Nonsan, and Geumsan-gun. Asan is not geographically adjacent, but it is classified as a neighboring region due to its high accessibility to Daejeon based on transportation conditions. The DD estimates are obtained from a regression with the monthly household consumption panel of Daejeon and adjacent districts for the treatment period (May to September) and the comparison period (April) of 2020. Homeowners and Renters respectively refer to households that owned house(s) and those that did not own a house during analysis periods. The DD estimates compare the consumption change from April to the respective treatment period in Daejeon to that in adjacent regions. The estimated model includes both household controls and household fixed effects. The household controls include households' income, debt (credit loan and mortgage), housing assets, delinquent debt, and family size. Standard errors are clustered at the household level (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

regulation, and for renters, there is no immediate effect, with the most significant effect occurring in August after some time has passed. Among these estimates, the sentiment effect on homeowners is slightly higher in July and September compared to the baseline results. Additionally, the sentiment effect on renters disappears in September when the comparison group is set to adjacent areas. It implies that due to the spillover effect of the regulations causing rapid increases in housing prices in adjacent areas, there are differences in house price expectations between the two regions depending on homeownership status.

4.1.2 Comparison with northern Chungnam

The heterogeneity between the northern and southern regions of Chungnam is also a noteworthy factor. Northern region of Chungnam accounts for approximately 73% of the regional gross do-

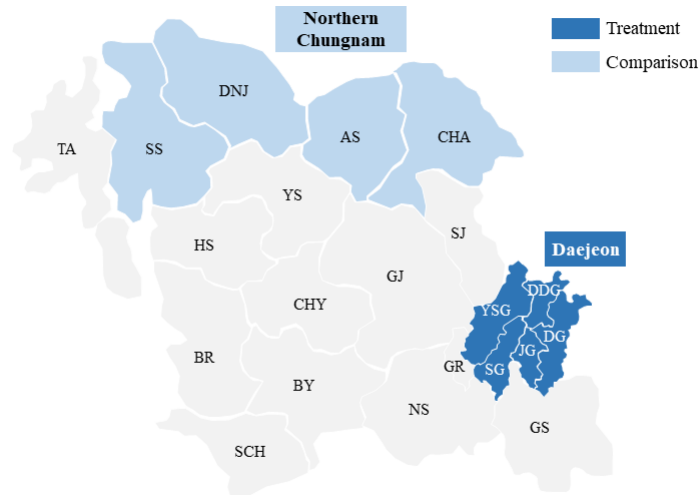


Figure 8: Treatment and control regions : Northern Chungnam

¹ The comparison group encompasses Seosan, Dangjin, Asan, and Cheonan.

² DNJ: Dangjin, AS: Asan, CHA: Cheonan, YS: Yesan-gun, GJ: Gongju, SS: Seosan, TA: Taejeon-gun, HS: Hongseong-gun, CHY: Cheongyang-gun, BR: Boryeong, BY: Buyeo-gun, GR: Gyeryong, NS: Nonsan, GS: Geumsan-gun, SCH: Seocheon-gun, DG: Donggug district, SG: Seogu district, JG: Junggug district, YSG: Yuseonggu district, DDG: Daedeokgu district, SJ: Sejong Special Self-Governing City

mestic product (GRDP) within Chungnam, indicating a significant difference in economic scale compared to the southern region. The northern region of Chungnam includes cities such as Cheonan, Asan, Dangjin, and Seosan, and it has played a vital role in the economic development of Chungnam, thanks to its favorable geographical location and proximity to the Seoul metropolitan area. As observed in Figure 6, the housing price increase rates of cities in northern Chungnam were relatively high. Therefore, as shown in Figure 8, we set up the treatment and comparison groups accordingly to conduct the DD estimation.

Table 8 presents the results of the estimation with the comparison group being the northern Chungnam. The estimated values and trends for homeowners do not significantly differ from the baseline results. In the case of renters, there is a slight difference in that the sentiment effects are not observed in July and September compared to the baseline results. However, the estimates still add robustness to the baseline findings, indicating that it takes some time for the sentiment effect of housing regulation on renters to emerge.

Overall, based on the results from Subsections 4.1.1 and 4.1.2, the baseline results are robust

Table 8: DD estimates: Daejeon vs. Northern Chungnam

Dependent variable: monthly consumption per person (unit: 1,000 KRW)
Treatment group = Daejeon, 2020; Control group = Northern Chungnam, 2020

Panel A. Homeowners

	(1) Post = May	(2) Post = Jun.	(3) Post = Jul.	(4) Post = Aug.	(5) Post = Sep.
Daejeon × Post	36.69 (31.19)	78.31** (31.00)	53.58* (27.10)	64.71** (30.38)	50.61* (30.14)
# of obs.	18,416	15,944	15,796	15,700	15,092
# of groups	9,208	7,974	7,900	7,852	7,548

Panel B. Renters

	(1) Post = May	(2) Post = Jun.	(3) Post = Jul.	(4) Post = Aug.	(5) Post = Sep.
Daejeon × Post	14.30 (23.52)	0.19 (26.08)	29.12 (28.20)	65.82** (26.27)	36.33 (29.67)
# of obs.	36,506	26,199	26,131	26,043	22,609
# of groups	18,253	13,111	13,077	13,033	11,315

Notes: The comparison group encompasses Seosan, Dangjin, Asan, and Cheonan. The DD estimates are obtained from a regression with the monthly household consumption panel of Daejeon and Northern Chungnam for the treatment period (May to September) and the comparison period (April) of 2020. Homeowners and Renters respectively refer to households that owned house(s) and those that did not own a house during analysis periods. The DD estimates compare the consumption change from April to the respective treatment period in Daejeon to that in Northern Chungnam. The estimated model includes both household controls and household fixed effects. The household controls include households' income, debt (credit loan and mortgage), housing assets, delinquent debt, and family size. Standard errors are clustered at the household level (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

in terms of the choice of the comparison group. However, it is important to note that for renters, the sentiment effect in September may disappear due to housing price increases in the comparison group by spillover effect after the regulation.

4.2 Triple Difference Analysis

While the identification strategy in Section 3 provides empirical evidence of the treatment effects of housing market regulation, there is a concern about confounding factors that may have differential impacts on trends between Daejeon and Chungnam. For instance, differences in industrial structure, age distribution, regional characteristics, climate, and other factors between the two regions could lead to divergent trends. To address this concern, we aim to assess the robustness of the baseline results by implementing a triple difference (DDD) method.

Table 9: DDD estimates for the sentiment impact of housing regulation

Dependent variable: monthly consumption per person (unit: 1,000 KRW)					
<i>Treatment group = Daejeon; Control group = Chungnam</i>					
<i>Panel A. Homeowners</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
2020 × Daejeon × Post	45.58 (38.31)	74.73** (37.28)	47.32 (38.07)	75.73** (37.79)	43.32 (37.35)
# of obs.	34,022	30,572	30,288	30,120	29,072
# of groups	8,506	7,643	7,572	7,530	7,268
<i>Panel B. Renters</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
2020 × Daejeon × Post	15.74 (35.28)	45.11 (39.91)	42.47 (41.36)	102.92** (41.12)	44.64 (44.17)
# of obs.	45,654	35,095	34,971	34,867	31,174
# of groups	11,434	8,789	8,758	8,732	7,806

Notes: The regression uses Daejeon and Chungnam's household consumption panel for the four periods; treatment period (May to September) and comparison period (April) of 2019, treatment period (May to September) and comparison period (April) of 2020. The DDD estimates compare the difference in the consumption change from April to the treatment period between 2019 and 2020 in Daejeon to that in Chungnam. Homeowners and Renters respectively refer to households that owned house(s) and those that did not own a house during analysis periods. The estimated model includes both household controls and household fixed effects. The household controls include households' income, debt (credit loan and mortgage), housing assets, delinquent debt, and family size. Standard errors are clustered at the household level (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

$$\begin{aligned}
 Y_{it} = & \beta_0 + \beta_1 Treat_i \cdot Post_t \cdot 2020_{it} + \beta_2 Treat_i \cdot 2020_{it} + \beta_3 Post_t \cdot 2020_{it} + \beta_4 Treat_i \cdot Post_t \\
 & + \beta_5 Treat_i + \beta_6 Post_t + \beta_7 2020_{it} + \gamma X_{it} + \delta_i + \varepsilon_{it}, \quad (2)
 \end{aligned}$$

where the dependent variable Y_{it} represents monthly consumption per person, $Treat_i$ represents the dummy variable for the treatment group, and $Post_t$ denotes the dummy variable for the treatment period. Compared to the baseline estimation model in the previous section, the additional dummy variable is 2020_{it} , which takes the value of 1 in 2020 and 0 in 2019. Additionally, the coefficient of the triple interaction term $Treat_i \cdot Post_t \cdot 2020_{it}$ compares the changes in consumption in Daejeon between the comparison period and the treatment period in 2020 with the changes in consumption in Chungnam between the comparison period and the treatment period in 2019. By employing the

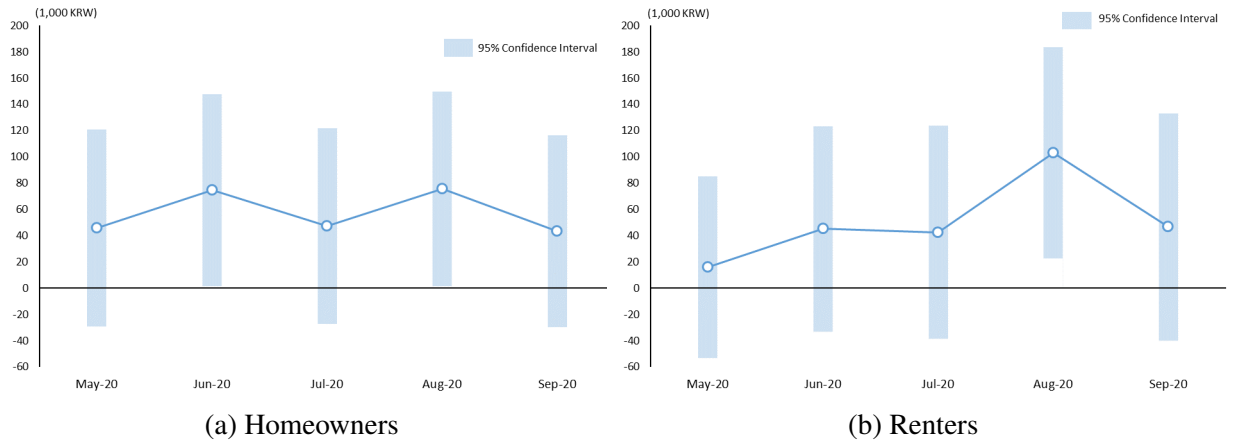


Figure 9: DDD estimates: Trend of the impact of housing regulation

Note: The regression results including estimates and standard errors can be referenced in Table 9.

triple difference methodology, we can control for confounding factors that may affect the difference in consumption between the treatment and control groups in 2020, which may also influence the difference in consumption between the two regions in 2019. X_{it} and δ_i represent household controls and household fixed effects, respectively. The standard errors of the estimates are clustered at the household level, as in the previous section.

The results of the DDD estimation (Table 9) show that, for homeowners, significant effects are observed only in June and August, with the magnitude of the significant sentiment effects appearing at a similar level. When compared to the baseline results obtained from the DD estimation, the immediate sentiment effect is substantial, but there is a difference in that the effect disappears in July, reappears in August, and then disappears again in September. For renters, there was a significant increase in consumption in August, two months after the regulation, which differs from the baseline results. As in the previous section, we visualize the patterns in Figure 9.

In the DDD estimation, there is a concern that significant changes between 2019 and 2020, such as the COVID-19 shock, could act as additional confounding factors. Therefore, for the purposes of this study, it is considered that the DD estimation is more appropriate. However, when considering the results of both DDD and DD estimations, the following conclusions appear robust; firstly, there is a significant sentiment effect of housing price changes on household consumption;

Table 10: DD estimates: Sentiment impact on consumption growth (MoM) of housing regulation

Dependent variable: growth rate of monthly consumption per person (unit: %, MoM)					
<i>Treatment group = Daejeon, 2020; Control group = Chungnam, 2020</i>					
<i>Panel A. Homeowners</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
Daejeon × Post	1.46	8.70***	0.51	1.66	0.60
	(4.33)	(3.35)	(3.28)	(3.58)	(3.22)
# of obs.	22,668	19,729	19,557	19,437	18,663
# of groups	11,334	9,865	9,779	9,719	9,332
<i>Panel B. Renters</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
Daejeon × Post	2.93	5.76**	6.90**	8.90***	2.26
	(3.53)	(2.91)	(3.17)	(2.98)	(3.15)
# of obs.	44,898	32,725	32,635	32,531	28,443
# of groups	22,449	16,370	16,325	16,273	14,228

Notes: The DD estimates are obtained from a regression with the monthly household consumption panel of Daejeon and Chungnam for the treatment period (May to September) and the comparison period (April) of 2020. Homeowners and Renters respectively refer to households that owned house(s) and those that did not own a house during analysis periods. The DD estimates compare the change in consumption growth from April to the respective treatment period in Daejeon to that in Chungnam. The estimated model includes both household controls and household fixed effects. The household controls include households' income, debt (credit loan and mortgage), housing assets, delinquent debt, and family size. Standard errors are clustered at the household level (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

secondly, for homeowners, an immediate sentiment effect in a positive direction is significant; thirdly, for renters, a sentiment effect in a positive direction becomes significant after a certain period has passed.

4.3 Alternative Dependent Variable: Consumption Growth

This paper aims to empirically demonstrate the sentiment effects of housing price changes on household consumption expenditure. Given this objective, there may be concerns that the use of the level of household consumption as the dependent variable in the estimation model may not be appropriate. The reason is that if housing prices in Daejeon were significantly higher than those in Chungnam, there could be differences in the level of consumption that can respond to housing price changes between the two regions.²⁸ Consequently, we intend to change the dependent variable to

Table 11: DD estimates: Sentiment impact on consumption growth (YoY) of housing regulation

Dependent variable: growth rate of monthly consumption per person (unit: %, YoY)
Treatment group = Daejeon, 2020; Control group = Chungnam, 2020

Panel A. Homeowners

	(1) Post = May	(2) Post = Jun.	(3) Post = Jul.	(4) Post = Aug.	(5) Post = Sep.
Daejeon × Post	4.57 (3.46)	8.39** (4.14)	0.40 (3.73)	7.59 (5.69)	4.69 (3.66)
# of obs.	18,380	16,889	16,822	16,735	16,431
# of groups	9,190	8,636	8,637	8,593	8,558

Panel B. Renters

	(1) Post = May	(2) Post = Jun.	(3) Post = Jul.	(4) Post = Aug.	(5) Post = Sep.
Daejeon × Post	4.18 (4.27)	8.44* (4.89)	3.76 (5.17)	12.77** (5.17)	10.70* (5.55)
# of obs.	23,526	20,196	20,343	20,285	19,571
# of groups	11,763	10,818	10,993	10,961	11,094

Notes: The DD estimates are obtained from a regression with the monthly household consumption panel of Daejeon and Chungnam for the treatment period (May to September) and the comparison period (April) of 2020. Homeowners and Renters respectively refer to households that owned house(s) and those that did not own a house during analysis periods. The DD estimates compare the change in consumption growth from April to the respective treatment period in Daejeon to that in Chungnam. The estimated model includes both household controls and household fixed effects. The household controls include households' income, debt (credit loan and mortgage), housing assets, delinquent debt, and family size. Standard errors are clustered at the household level (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

the consumption growth rate to examine whether the baseline results remain robust.

Table 10 presents the results estimated by using the month-on-month growth rate of monthly credit card expenditure per capita as the dependent variable, while Table 11 shows the results by using the year-on-year growth rate of it as the dependent variable.²⁹ Even when changing the dependent variable to consumption growth rate, it can be observed that the sentiment effects are estimated in the same direction as the baseline results. However, we want to note that there is an immediate sentiment effect for renters, which is different from the baseline results, similar to what is observed for homeowners.³⁰ However, the results show that there are robust effects in response to the change in the dependent variable, with an immediate sentiment impact observed

²⁸According to Table 1 in Section 2.2, the average housing asset values in Daejeon are approximately 1.5 times higher than those in Chungnam. However, there is not a significant difference in the average consumption and debt balance among households in the sample. Therefore, it does not appear that the consumption level that can respond to housing price changes would differ significantly between the two regions.

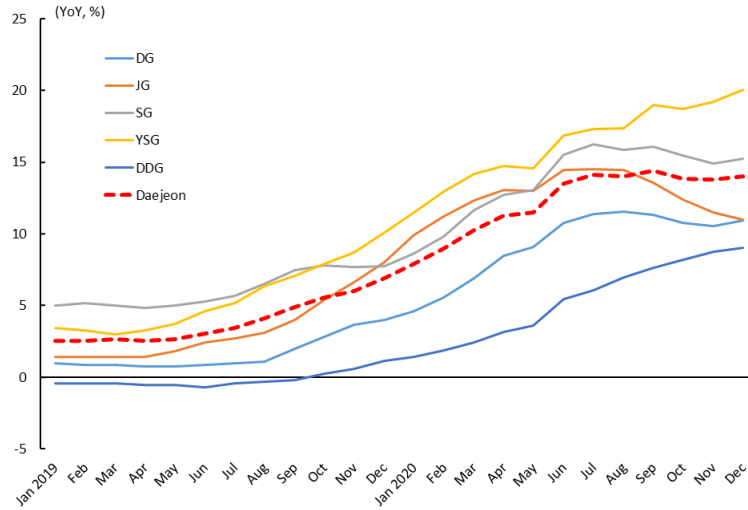


Figure 10: Housing prices in Daejeon (district-level)

¹ DG: Donggu district, SG: Seogu district, JG: Junggu district, YSG: Yuseonggu district, DDG: Daedeokgu district
 Source: Korea Real Estate Board

for homeowners and a significant effect detected for renters after a two-month period.

4.4 Comparison between OSZ and MTZ

According to the June Plan, the entire Daejeon region was designated as MTZ, and, taking into account the heterogeneity in district-level housing price increases (see Figure 10), all districts except for Yuseonggu district were designated as OSZ. If housing market regulations act as signals and change expectations regarding housing price fluctuations, impacting consumer spending, it is worth examining whether this sentimental channel remains effective when comparing regions with strong regulations to region with relatively weaker ones. Specifically, as shown in Figure 11, we

²⁹ Using the year-on-year consumption growth rate as the dependent variable can be interpreted as controlling for factors such as seasonal fluctuations in consumption. In this regard, the model that performs double-difference analysis with the year-on-year consumption growth rate as the dependent variable serves a similar purpose to the model that conducts triple-difference analysis with consumption levels as the dependent variable (as discussed in Subsection 4.2).

³⁰ The significant difference in consumption growth rates for Daejeon’s renters and Chungnam’s renters in June 2020 implies the possibility of factors that led to increased consumption in Daejeon, particularly for renters, in June 2020. Ontong Daejeon, a local currency in Daejeon, could potentially be one factor in this context. While Ontong Daejeon began to be issued in May 2020, renters might not use it in the month of issuance because the stimulus payments were distributed in early May. If renters started to use Ontong Daejeon in June, it may have influenced consumption growth rates.

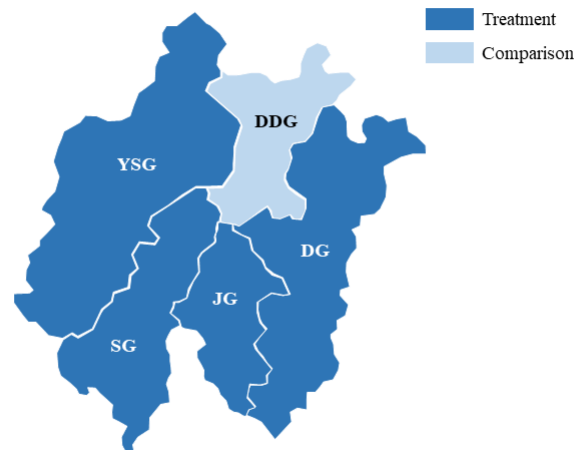


Figure 11: Treatment and control regions : OSZ vs. MTZ

¹ OSZ refers to the overheated speculative zone and MTZ refers to modification target zone. Please refer to the subsection 2.1 for the details.

² The treatment group encompasses four districts in Daejeon; Junggu district (JG), Donggu district (DG), Seogu district (SG), and Yuseonggu district (YSG). The comparison group is the other district in Daejeon; Daedeokgu district (DDG).

conduct a DD analysis by setting the treatment group as the districts of Donggu district, Junggu district, Seogu district, and Yuseonggu district, which were designated as OSZ, and the comparison group as Daedeokgu district, which was designated as MTZ.

Table 12 presents the DD estimates. The changes in consumption due to the sentiment effects of housing market regulations still appear in the positive direction for both homeowners and renters. However, unlike the baseline results, homeowners show a stronger response in July than in June, and the sentiment effect becomes insignificant after August. Considering that the Daedeokgu district, designated as MTZ, catches up with the districts of Junggu district and Donggu district, designated as OSZ, in terms of housing price growth rate after June 2020, it is presumed that homeowners formed sentiments that there would be no significant difference between MTZ and OSZ after August. The more notable difference from the baseline is a significantly large immediate sentiment effect for renters in OSZ. Note that a primary difference between regulations in OSZ and MTZ is the intensity of lending regulations. Therefore, it is reasonable to argue that renters, like homeowners, interpreted housing regulations as a signal for additional house price increases, increasing their consumption. In other words, the desperation consumption effect works for renters.

Table 12: DD estimates : OSZ vs. MTZ

Dependent variable: monthly consumption per person (unit: 1,000 KRW)					
<i>Treatment group = overheated speculative zone (OSZ) in Daejeon, 2020</i>					
<i>Control group = modification target zone (MTZ) in Daejeon, 2020</i>					
<i>Panel A. Homeowners</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
Overheated × Post	-1.69	64.06*	133.61***	-7.18	-30.73
	(46.84)	(49.49)	(42.96)	(54.00)	(61.24)
# of obs.	9,828	8,412	8,342	8,292	7,956
# of groups	4,914	4,208	4,173	4,148	3,980
<i>Panel B. Renters</i>					
	(1)	(2)	(3)	(4)	(5)
	Post = May	Post = Jun.	Post = Jul.	Post = Aug.	Post = Sep.
Overheated × Post	80.37	117.93**	166.88***	66.37	-78.01
	(54.72)	(54.46)	(58.55)	(68.21)	(70.75)
# of obs.	19,482	13,574	13,530	13,488	11,626
# of groups	9,741	6,798	6,776	6,755	5,820

Notes: Within Daejeon, Donggu district (DG), Junggu district (JG), Seogu district (SG), and Yuseonggu district (YSG) were designated as “overheated speculative zone (OSZ)”, and Daedeokgu district (DDG) was designated as “modification target zone (MTZ)”. The DD estimates are obtained from a regression with the monthly household consumption panel of Daejeon for the treatment period (May to September) and the comparison period (April) of 2020. Homeowners and Renters respectively refer to households that owned house(s) and those that did not own a house during analysis periods. The DD estimates compare the consumption change from April to the respective treatment period in the overheated speculative zone to that in the modification target zone. The estimated model includes both household controls and household fixed effects. The household controls include households’ income, debt (credit loan and mortgage), housing assets, delinquent debt, and family size. Standard errors are clustered at the household level (* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$).

However, starting from August, there is no significant difference between OSZ and MTZ for renters as well.

5 Conclusion

This paper conducted estimations in a natural experimental setting using detailed microdata to figure out the sentiment effects of housing prices on household consumption expenditure and provided empirical evidence for the existence of the effects. Specifically, after controlling for heterogeneous factors at the household level, we compared the consumption in the region with housing regulation with the consumption in the region without the regulation over a short period before and after

the announcement of regulation. As a result, we confirmed that the expectations or sentiments regarding housing price changes significantly led to positive consumption changes, regardless of homeownership status. It implies the possibility that regulation-induced sentiment on the housing market is formed in different directions depending on the homeownership status; the sentimental wealth effect works for homeowners, and the sentimental substitution effect works for renters. Another interpretation is that while the sentimental wealth effect works for homeowners, the desperation consumption effect works for renters, implying the sentiments on the housing market are formed in the same direction across the two household groups.

However, the regulation may have affected not only expectations regarding housing prices but also sentimental or anticipatory factors related to consumption and other factors. Therefore, there may be some limitations in the quantitative interpretation of the estimates. From this perspective, this paper focused on the trends in the estimates rather than the absolute magnitudes, aiming to discuss the relative size of impacts and significance over time. For homeowners, the sentimental changes following the introduction of regulations were immediate, leading to a significant increase in household consumption shortly after the regulation was implemented. Then, the magnitude of this increase gradually diminished over time, and its significance disappeared. Additionally, it was found that households with higher-priced houses and those without mortgage loans experienced more significant sentiment effects. On the other hand, for renters, we found that a certain amount of time was required for significant consumption changes to occur after the regulation, considering the most substantial change happened after some period had passed.

Based on this paper's analysis, the following policy implication can be derived. When introducing policies, it is essential to implement the policy based on comprehensive expectations on policy effects rather than solely focusing on the direct and one-dimensional impacts of the policy. For instance, we showed that the June Plan aimed at stabilizing the housing market, but it also had short-term effects on household consumption through sentiment channels. While general equilibrium effects often require transmission lags, sentiment effects can operate even in the very short term. Therefore, it seems necessary to consider those effects appropriately.

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