How effective are universal payments for raising consumption? Evidence from a natural experiment

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Abstract

We investigate the impact of the universal stimulus payments (100–350 thousand KRW per person) distributed by the largest Korean province of Gyeonggi during the COVID-19 pandemic on household consumption using large-scale credit and debit card data from Korea Credit Bureau. As the neighboring Incheon metropolitan city did not distribute stimulus payments, we employ a difference-in-difference approach and find that the stimulus payments increased monthly consumption per person by approximately 30 thousand KRW within the first 20 days. The overall marginal propensity to consume (MPC) of the payments was approximately 0.40 for single families. The MPC decreased from 0.58 to 0.36 as the transfer size increased from 100–150 to 300–350 thousand KRW. We also found that the effects of universal payments were very heterogeneous across different groups of people. The MPC for liquidity-constrained households, which account for 8% of all households, was close to one, but the MPCs of the other household groups were not significantly different from zero. The unconditional quantile treatment effect estimates reveal that there was a positive and significant increase in monthly consumption only in the lower part of the distribution below the

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median. Our results show that a more targeted approach may more efficiently achieve the policy goal of boosting aggregate demand.

Keywords COVID-19 · Stimulus payments · Consumption · Marginal propensity to consume · Difference in difference

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1 Introduction

The household consumption response to a stimulus payment has long been an important subject for both economists and policy makers. However, the opportunity for an economy-wide empirical study has been rather limited because few governments can afford universal transfer payments. The serious economic downturn induced by the COVID-19 pandemic ironically provides an opportunity for an economy-wide empirical study of this topic, as countries such as the United States, Hong Kong, Singapore, and South Korea distributed universal stimulus payments directly to all households (IMF 2020). However, there are several challenges in studying the direct impact of stimulus payments on household consumption during the COVID-19 pandemic. First, it is difficult to identify the pure effect of the payments on consumption when the use of payments was not restricted to consumption. Second, it is difficult to set a distinct comparison group when the one-time payments were distributed to all households on a national basis. Third, the consumption response could be restricted by stay-at-home orders or the lockdown of businesses. We overcome these challenges by utilizing the ideal natural experiment setup in South Korea with novel microlevel data, which enables us to more accurately evaluate the policy effect.

The stimulus payments distributed in South Korea are ideal for analyzing the policy effect because the use of payments was restricted to consumption, whereas most countries distributing universal payments provided a lump-sum transfer of cash without any restriction on its usage. We adopt the difference-in-difference (DiD) methodology to identify the causal effect of stimulus payments on household consumption by focusing on the universal payment distributed in the Gyeonggi Province of South Korea in April 2020. The policies and the regional aspect of Gyeonggi provide ideal natural experimental conditions. First, Gyeonggi is the only region that provided universal stimulus payments to all residents in April, which was before the universal payment plans of the central government or any other local governments were implemented. Second, there was district-level variation in the size of transfers within Gyeonggi, ranging from 100 to 350 thousand KRW per person, which provides room for further analysis of policy implications. Third, Gyeonggi's experience can be considered representative in South Korea. It is included in the Seoul Capital Area (SCA), where 50.0% of the population and 52.0% of GDP (as of 2019) are concentrated. In fact, it is the largest province by population as well as by regional GDP in South Korea. We choose Incheon, which is another member of the SCA bordering Gyeonggi, as the comparison group. Another important fact is that there were no stay-at-home orders or lockdowns of businesses in

these regions in April because the COVID-19 pandemic in South Korea was restricted to the city of Daegu, which is far from the SCA.

We use individual-level monthly panel data that track a random sample of more than 200,000 households in Gyeonggi and Incheon from January 2019 to June 2020 provided by Korea Credit Bureau (KCB). Compared to other datasets used in previous studies, such as the KDI (2020) and Chetty et al. (2020), our dataset is the most representative in terms of sample coverage and payment methods. It is selected from the entire population and covers all types of credit cards and debit cards used in Korea. Furthermore, total personal card spending amounts to 85% of household consumption in the 2019 GDP. This implies that our research can provide the most accurate picture available to us to better understand the consumption effects of COVID-19 emergency transfers.

Using household consumption data, rather than merchant sales data, is crucial for estimating the causal effect of stimulus payments on consumption, given that the use of stimulus payments was restricted to some industries and within three months. This is because households can substitute their income with transfers and adjust their consumption behavior to circumvent the restrictions. For example, households can save their income to spend in the future or to increase consumption in industries in which the use of stimulus payments was not allowed. In an extreme case, the marginal propensity to consume (MPC) can be zero for the payments. At the other extreme, the MPC can be as large as one if households do not adjust their original consumption plans and then additionally spend the entire transfer payment. Therefore, we cannot measure MPC or the effectiveness of stimulus payments precisely if we compare sales between allowed and disallowed industries or observe only where people use the stimulus payments. The panel data of household consumption allow us to overcome this problem by observing the evolution of total household consumption.

We exploit the spatial and temporal variation in the stimulus payments with the DiD identification strategy. Roughly speaking, we estimate the causal treatment effect by comparing monthly consumption in Gyeonggi (treatment group) with that in Incheon (comparison group) around April 2020, which is the period in which only the Gyeonggi households received the stimulus payments. Considering that these two regions are neighbors and are both included in the SCA, they are subject to similar regulations and policies that could confound our estimation. We find that most policy actions by the central government to fight against COVID-19 and the economic downturn were implemented in both regions. Nevertheless, we use various specifications to check the reliability of our empirical strategy and to reveal the heterogeneous impact of stimulus payments on different groups of households.

We first demonstrate how COVID-19 impacted consumption by comparing consumption between 2019 and 2020 in each region. We find that monthly consumption decreased by approximately 200 thousand KRW (approximately 200 USD) until April in 2020 compared to the same period in 2019. When we compare the change in consumption from January to April 2020 in the two regions, monthly consumption per person was 27 thousand KRW higher in Gyeonggi than in Incheon. This difference indicates the impact of Gyeonggi's stimulus payments, as there was no significant difference in consumption between the two regions in 2019, prior to the existence of COVID-19. We then estimate the effect of stimulus payments using the DiD method

to remove possible confounding factors that affect the two regions differently. When we compare the change in consumption from January to April in 2019 and the same period in 2020 across the two regions, we find that the stimulus payments increased monthly household consumption by approximately 30 thousand KRW in Gyeonggi. The estimated MPC of stimulus payments is approximately 40%.

We also explore the transmission mechanism and heterogeneous effect of stimulus payments. We find that the MPC of the liquidity-constrained households, which account for 8% of residents, was close to one, but the MPCs of the other groups of households were not significantly different from zero. This implies that stimulus payments have an economic impact by easing the liquidity constraint. This result is consistent with previous studies, such as Baker et al. (2020). In addition, we find that MPC decreases from 0.58 to 0.36 as the size of stimulus payments increases from 100–150 to 300–350 thousand KRW. This implies that the cost-effectiveness decreases as the size of the stimulus payments increases by increasing the portion of savings among stimulus payments.[1]

Furthermore, we investigate the distributional effects of the stimulus payments on consumption. Theoretical models with incomplete markets suggest that individuals who have received negative income shocks respond more strongly to transient stimulus payments (Deaton 1991; Carroll and Kimball 1996). There have been efforts to address this issue empirically (Jappelli and Pistaferri 2014; Karger and Rajan 2020). Unlike the previous literature, we investigate the heterogeneity in households' responses to stimulus payments using the unconditional quantile regression (UQR) method (Koenker and Bassett 1978). The UQR has gained increasing popularity, as it facilitates interpretation of a policy treatment effect in the presence of multiple control variables.

We complement our baseline analyses using the UQR method to estimate how the stimulus payments affected the expenditure distribution of exposed households. The estimated quantile treatment effects allow us to evaluate the impacts of the stimulus payments on the lower, middle, and upper parts of the expenditure distribution. We find significant heterogeneity in the effects of the stimulus payments. While the payments had a significant mean impact on expenditures in line with our baseline results, the UQR estimates are highest in the lowest percentile and decline in the upper part of the distribution. The policy effects are close to 0 and become insignificant above the 50th percentile. These estimates are consistent with those economic theories assuming that the level of expenditure is a good indicator of income or cash-on-hand; constrained households show excess sensitivity to a transient income shock. Our results show that a more targeted approach may be more efficient in achieving the policy goal of boosting the aggregate demand of the economy.[2]

This paper relates to two strands of the literature. First, we add to the literature studying how one-time universal payments affect household consumption. For example, Johnson et al. (2006) and Parker et al. (2013) estimated the change in consumption expenditure caused by tax rebates in the USA in 2001 and 2008, respectively. Johnson et al. (2006) showed that households spent 20 to 40 percent of their rebates, and

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[1] Cost-effectiveness here means the effectiveness in increasing consumption while incurring the same amount of government transfer payment.

[2] With near-zero policy effects in increasing consumption above the 50th percentile, universal payments lead to inefficiency compared to payments allocated more toward lower-income households.

responses were larger for low-income households. The estimated result of Parker et al. (2013) was slightly smaller (12–30 percent on average) using the 2008 tax rebates, and the authors noted that the difference might be due to sampling error or the differences between the policy details and economic circumstances in 2008 and those in 2001. Our estimation result is in line with previous works, showing that an individual spends 27–30 thousand KRW more when she receives 100 thousand KRW as a stimulus payment. More importantly, we highlight that our analysis is based on detailed and comprehensive credit card spending data and financial information collected by credit rating agencies, whereas Johnson et al. (2006) and Parker et al. (2013) used consumption expenditure survey data. While Agarwal et al. (2007) analyzed the consumption response to the 2001 tax rebates using a panel dataset of credit card accounts, its data source is one credit card issuer. Our data cover all credit card spending of each individual, which guarantees more accurate results in terms of evaluating policy effects. Our analysis also highlights the heterogeneous effect of stimulus payments based on the level of liquidity, the transfer size, recipients' age, and total expenditures. Governments can use this information to organize stimulus payments more effectively. Jappelli and Pistaferri (2014) also studied the heterogeneity in the MPC, but they used survey data. Karger and Rajan (2020) provided separate estimates for consumers who received four different amounts of stimulus payments, using microdata at the transaction level, but analyzed the policy effect within only two weeks. Our paper complements their research by showing the policy effect for a longer period of 3 months.

Second, our study directly contributes to the recent literature investigating the effects of COVID-19 stimulus payments. For instance, Baker et al. (2020), Chetty et al. (2020), Coibion et al. (2020), Karger and Rajan (2020), Carroll et al. (2020), Casado et al. (2020), Kubota et al. (2021), Kim and Lee (2020), and Kim et al. (2020) estimate the spending impact of the stimulus payments distributed considering the economic recession induced by COVID-19. We join this emerging literature by providing clean evidence using detailed individual-level panel data. Kubota et al. (2021) study the effect of COVID-19 payments in Japan assuming unexpected delays in the timings of cash deposits as natural experiments. Our study uses regional variations in payments as natural experiments. Additionally, the nature of payments in our study is different in that they were required to be used within 3 months. Baker et al. (2020) investigated household consumption responses using transaction data and found that households respond rapidly—during the first 10 days—to the receipt of stimulus payments. In line with their findings, we found that stimulus payments in Gyeonggi increased monthly consumption per person by 30 thousand KRW within the first 20 days. Additionally, we found that the effect of stimulus payments quickly disappeared in the following month. Additionally, as the authors highlighted the role of liquidity in spending responses, our study discusses it by providing empirical evidence. In particular, we focus on the responses of liquidity-constrained households, suggesting that the easing in the constraint is the main mechanism of the policy impact, which is consistent with the evidence in Coibion et al. (2020). In addition to confirming and reinforcing the arguments in the related studies by exploring the case of South Korea, our paper esti-

mates the pure effect of universal payments due to the ideal natural experiment setup of one representative metropolitan region of South Korea.[3]

This paper is structured as follows. Section 2 provides background information regarding the stimulus payments in South Korea and our identification strategy. Section 3 describes the data used in this paper. Sections 4 and 5 present the empirical models and the main results. Section 6 discusses heterogeneity, and Sect. 7 shows the results from the distributional analysis. Finally, after presenting the robustness results in Sect. 8, Sect. 9 concludes the paper.

2 Background

This section provides an overview of the COVID-19 outbreak in South Korea, reviews the institutional background of the Korean government's response policies implemented in the form of stimulus payments, and discusses the identification strategy based on them.

2.1 COVID-19 outbreak in South Korea and stimulus payments

The first case of COVID-19 in South Korea was detected on January 20, 2020. Figure 1a presents the spread of COVID-19 in South Korea from the date of the first confirmed case to the end of July 2020. This figure shows the number of newly confirmed cases daily and their accumulated number. The initial situation seemed to be under control, with fewer than 30 new cases of COVID-19 occurring daily, but in mid-February, an explosive outbreak began, especially in the Daegu metropolitan city and its neighboring area, North Gyeongsang (Fig. 1b).[4] In March 2020, there were more than 7000 confirmed patients in this area. In other regions, such as the SCA, which includes the metropolitan area of Seoul, Gyeonggi, and Incheon, the caseloads were much smaller than in Daegu and its adjunctive province (Fig. 1c, d, e). The peak of crisis then passed, and the number of daily new cases reached fewer than 100 for four months in a row.[5] As of July 31, 2020, 14,311 confirmed total cases were reported in

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[3] Both Kim and Lee (2020) and Kim et al. (2020) used the universal stimulus payments distributed by the Korean government in May 2020 as their event. Because this stimulus payment was given to every household in Korea, there was no real control group. Compared to their works, we utilize the stimulus payment given in Gyeonggi in April 2020, which lets us use Incheon, where no stimulus payment was given, as an ideal control group. See Sect. 2.2 for more details.

[4] The explosion of confirmed cases in early March 2020 was the first wave in South Korea. There was a second wave at the end of August 2020 (the peak number of new cases was 441 on August 27) and a third wave occurred between December 2020 and January 2021 (the peak number of new cases was 1241 on December 25, 2020). This paper focuses on the postfirst-wave period to analyze the effect of stimulus payments transferred in April 2020.

[5] There were 101 new cases on April 1, 2020, and the number of daily new cases did not exceed 100 from then until July 31, 2020, except for on July 25. On July 25, 113 new cases were detected, but most of the confirmed cases did not originate from regional infection (local transmission: 32 cases, imported cases: 81 cases). The monthly averages of the numbers of daily new cases were 32.6 for April, 22.7 for May, 44.5 for June, and 48.7 for July. (Sources: Korea Disease Control and Prevention Agency, Statistics Korea)
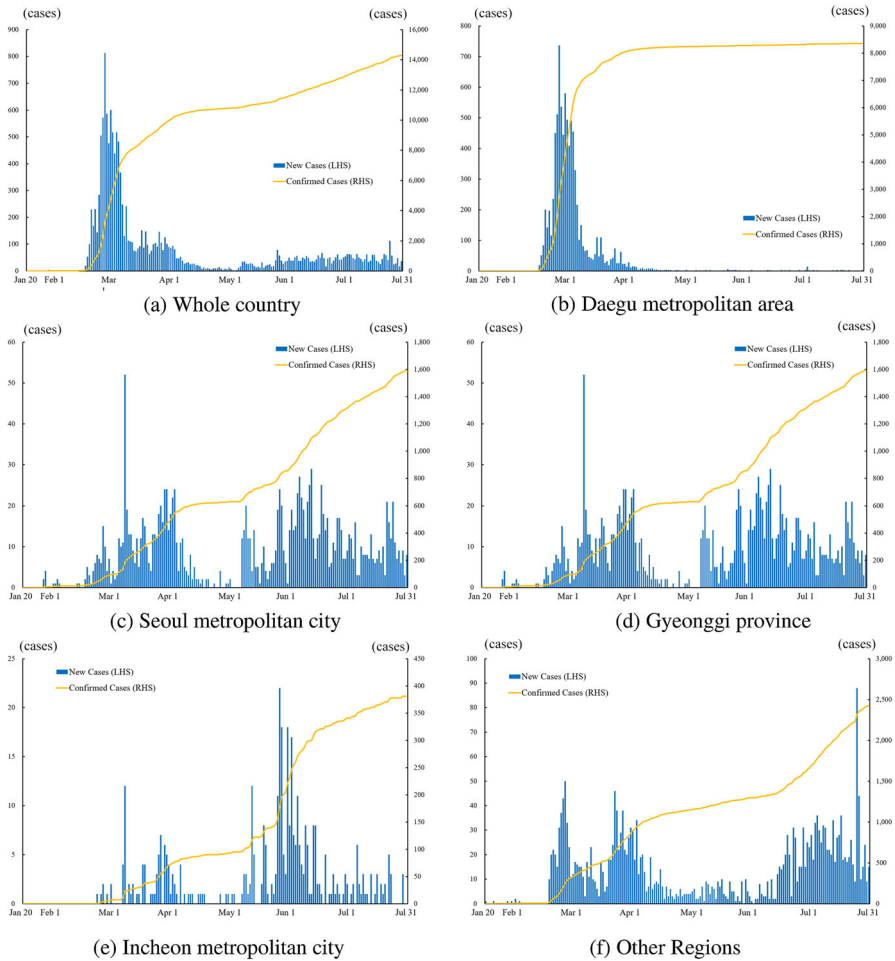
Fig. 1 COVID-19 outbreak in South Korea (January–July, 2020). Notes: South Korea saw its first confirmed COVID-19 case on January 20, 2020. The Daegu metropolitan area includes the Daegu metropolitan city and its neighboring province (North Gyeongsang) where an explosive outbreak began. The Seoul metropolitan city, Gyeonggi Province, and Incheon metropolitan city compose the Seoul Capital Area (SCA). Other regions include the metropolitan cities and provinces in South Korea except the Daegu metropolitan area and SCA. The scales of the vertical axes of the panels are different from each other. *Sources*: Korea Disease Control and Prevention Agency, Statistics Korea

South Korea (27.6 confirmed cases per 100 thousand population in South Korea as of July 31, 2020).

Although South Korea did not impose a shutdown at either the national or the regional level, concerns over the COVID-19 pandemic were significant enough to generate an economic downturn after the COVID-19 outbreak in South Korea (see KDI (2020), BOK (2020), Aum et al. (2020), among others). For example, Fajgelbaum et al. (2021) and Argente et al. (2022) showed that there were significant declines in consumption activities and movements of people, even with the small number of

confirmed cases in Seoul. Worried about a COVID-19-induced economic recession, especially consumption shrinkage, the Korean government began to introduce various stimulus packages. We are particularly interested in the universal stimulus payments in Gyeonggi, which is the largest province by population and regional GDP in South Korea. Gyeonggi provided a universal payment to all residents in an amount ranging from 100 thousand to 350 thousand KRW (approximately 100–350 USD) per person in the form of cash, statement credits to credit or debit card accounts (hereafter, "credit card" denotes both credit and debit cards), or vouchers.[6] The payments were distributed starting in early April 2020 and had to be used in the recipient's neighborhood before the end of August 2020.[7] In this paper, we investigate how this universal payment affected household consumption by providing empirical evidence under the identification described in detail below.

2.2 Identification

Starting with the initial outbreak of COVID-19, several local governments established individual emergency aid schemes for local residents.[8] Among them, Gyeonggi is the only region that provided universal stimulus payments to all residents in April 2020, before the central government's universal payment plan was implemented in May.[9] This is a crucial condition because it is difficult to set a distinct control group in the case of nationwide universal payments because, first, the universal payments were paid to all households in South Korea, and second, the payment amounts were identical across households of the same family size. Therefore, this paper focuses on the period prior to May, and Gyeonggi is the only local government that introduced the universal payment scheme in that period. In addition, only those who had continuously registered as a resident of Gyeonggi from the day before the date of announcement to the date of application were eligible for the payment. This implies that people could not receive the payment by moving to Gyeonggi after the announcement.

To identify a group to compare to Gyeonggi, we focus on the SCA, which is located in northwestern South Korea. Covering only approximately 12% of the country's area, its population is 25.9 million (50.0% of total population, as of 2019), and its GDP

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[6] This paper uses the terminology "vouchers" for transfers distributed in the form of consumption vouchers, coupons, or local money cards. Here, a local money card is a type of gift card that a recipient can use in affiliate stores in the issuing region.

[7] To receive the stimulus payment, individuals needed to apply for it and confirm their eligibility to regional governments in Gyeonggi. However, this issue is not important because Gyeonggi announced that it had made stimulus payments to 97.4% of the eligible households. Such a high payment rate implies that a potential downward bias related to a compliance issue is arguably small.

[8] South Korea is a unitary state in which governmental power is delegated by the central government to local governments.

[9] The central government announced a plan for universal stimulus payments to all households, which provoked academic and policy makers' interest in studying the impact of the transfer on household consumption (Kim and Lee 2020; Kim et al. 2020). Specifically, beginning on May 4, households could apply for and receive one-time stimulus payments 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.
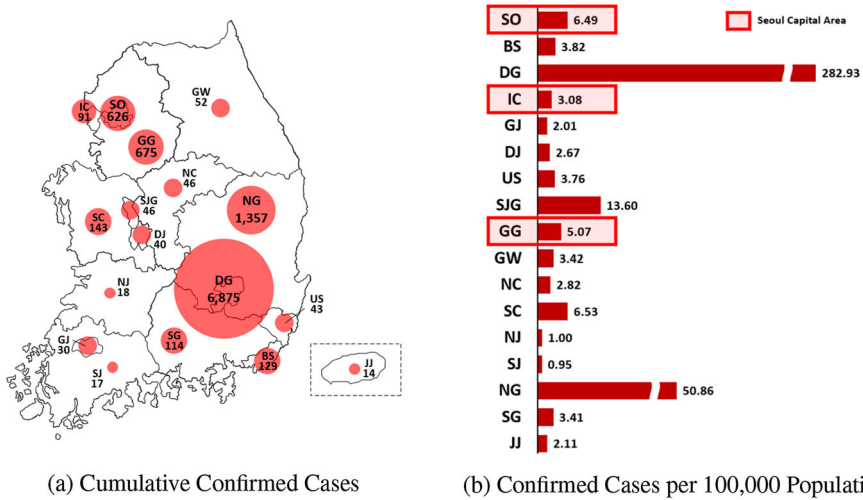
(a) Cumulative Confirmed Cases   (b) Confirmed Cases per 100,000 Population

Fig. 2 Regional Distribution of confirmed cases in South Korea. Notes: The number of cumulative confirmed cases by each province at the end of April 2020 (*Sources*: Korea Disease Control and Prevention Agency, Statistics Korea) The rates of confirmed cases were calculated based on the regional population collected by Statistic Korea as of 2019. *SO*: Seoul, *BS*: Busan, *DG*: Daegu, *IC*: Incheon, *GJ*: Gwangju, *DJ*: Daejeon, *US*: Ulsan, *SJG*: Sejong, *GG*: Gyeonggi, *GW*: Gangwon, *NC*: North Chungcheong, *SC*: South Chungcheong, *NJ*: North Jeolla, *SJ*: South Jeolla, *NG*: North Gyeongsang, *SG*: South Gyeongsang, *JJ*: Jeju

is 1.0 quadrillion KRW (52.0 % of total GDP, as of 2019).[10] Therefore, we zoom in on Seoul and Incheon as candidates for the comparison group considering their geographical closeness and similarity, as they both fall within the SCA. In regard to the COVID-19 outbreak, the three regions of Seoul, Incheon, and Gyeonggi show similar patterns. Figure 2 presents the regional distribution of total confirmed cases at the end of April 2020. Except for the Daegu metropolitan city and its neighboring area of North Gyeongsang province, where explosive outbreak occurred in February and March, the other regions in South Korea were not significantly affected by the virus directly (especially considering the number of confirmed cases per 100 thousand population in Fig. 2b). Taking the fear of transmission and its social and economic impacts into account, we argue that the three regions in the SCA shared similar circumstances in April 2020 (see Fig. 1c, d, e).

Among the regions in the SCA, Seoul is excluded from our consideration since Seoul provided stimulus payments in April, which is the period of interest, to only low-income households in the form of cash or vouchers. Because these were not universal and consumption through cash or vouchers was not captured in our dataset of credit card spending, Seoul is not appropriate as the comparison group against Gyeonggi. Compared to Gyeonggi and Seoul, Incheon did not have large-scale fiscal programs to support consumption. Incheon also provided transfers to specific groups in April, but

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[10] As of 2019, the total population of South Korea was 51,779,203, and the regional population was 9,639,541 (18.6%) for Seoul, 2,952,237 for Incheon (5.7%), and 13,300,900 for Gyeonggi (25.7%). The total GDP of South Korea is 1,924.0 trillion KRW, and the regional GDP is 433.5 trillion KRW (22.5%) for Seoul, 89.6 trillion KRW for Incheon (4.7%), and 478.3 trillion KRW for Gyeonggi (24.9%). (Source: Statistics Korea)

Fig. 3 Treatment and control regions. Notes: The SCA includes Seoul, Incheon, and Gyeonggi. PC, GY, YP, ASN, and SW are excluded from the analysis because those cities provided stimulus payments in the form of cash transfer. *SW*: Suwon, *BC*: Bucheon, *ASN*: Ansan, *SN*: Seongnam, *YI*: Yongin, *AY*: Anyang, *SH*: Siheung, *GY*: Goyang, *GIP*: Gimpo, *YC*: Yeoncheon-gun, *PC*: Pocheon, *DDC*: Dongducheon, *PJ*: Paju, *YAJ*: Yangju, *OS*: Osan, *UJB*: Uijeongbu, *NYJ*: Namyangju, *GR*: Guri, *HN*: Hanam, *YP*: Yangpyeong-gun, *GM*: Gwangmyeong, *GJ*: Gwangju, *GUP*: Gunpo, *UW*: Uiwang, *HS*: Hwaseong, *IC*: Icheon, *YEJ*: Yeoju, *PT*: Pyeongtaek, *ASG*: Anseong, *GAP*: Gapyeong-gun, *GC*: Gwacheon

the transfers were negligible in terms of the total amounts, which were as follows: 180 million KRW in Incheon compared to 2.1 trillion KRW in Gyeonggi.[11] There were also other types of selective payments to specific groups, such as freelancers, unpaid leavers, or low-income households, in the form of cash or vouchers. However, these transfers were paid on a national basis both in Gyeonggi and Incheon, so that their effects on consumption would be canceled out when we compared the two regions. Therefore, we adopt the DiD identification strategy with Gyeonggi as the treatment group (or groups of lower-level regions in Gyeonggi) and Incheon as the control group, as Fig. 3 shows.[12]

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[11] Incheon provided a total of 180 million KRW to 600 low-income artists, 300 thousand KRW each, in April. The budget information of Incheon and that of Gyeonggi were publicly released to the press by each local government office. (Sources: Incheon Metropolitan government, Gyeonggi Provincial government)

[12] The local government system in South Korea consists of the following 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, Seoul is governed by an upper-level local government that supervises 25 districts that are governed by lower-level local governments. Another example of an area governed by an upper-level local government is Gyeonggi, which consists of 31 lower-level local government-ruled cities and counties.
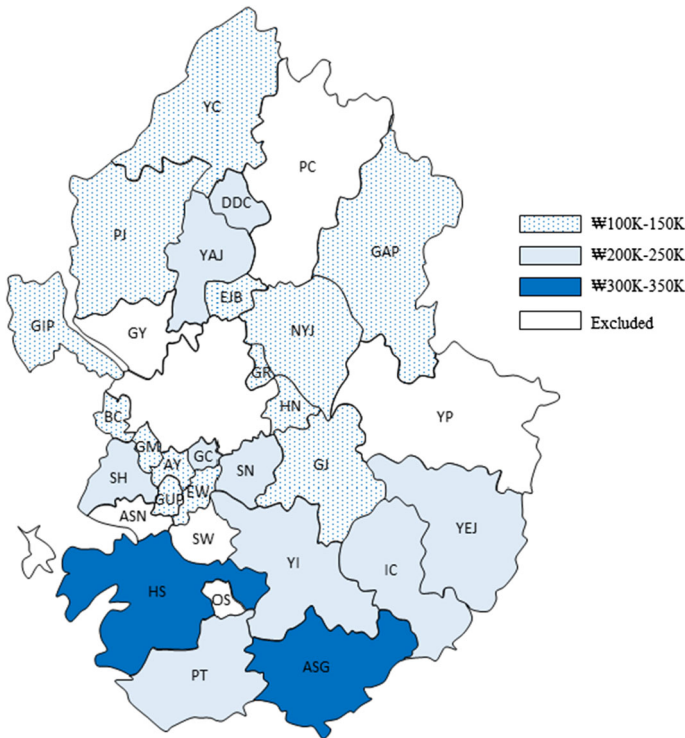
Fig. 4 Stimulus payments in Gyeonggi (in credit card). *Sources*: Local municipal offices (as of April 2020) *SW*: Suwon, *BC*: Bucheon, *ASN*: Ansan, *SN*: Seongnam, *YI*: Yongin, *AY*: Anyang, *SH*: Siheung, *GY*: Goyang, *GIP*: Gimpo, *YC*: Yeoncheon-gun, *PC*: Pocheon, *DDC*: Dongducheon, *PJ*: Paju, *YAJ*: Yangju, *OS*: Osan, *UJB*: Uijeongbu, *NYJ*: Namyangju, *GR*: Guri, *HN*: Hanam, *YP*: Yangpyeong-gun, *GM*: Gwangmyeong, *GJ*: Gwangju, *GUP*: Gunpo, *UW*: Uiwang, *HS*: Hwaseong, *IC*: Icheon, *YEJ*: Yeoju, *PT*: Pyeongtaek, *ASG*: Anseong, *GAP*: Gapyeong-gun, *GC*: Gwacheon

Additionally, there are variations in the size of stimulus payments across the lower-level local governments in Gyeonggi. We found that the payment amount was not significantly affected by political inclination or financial status of the local government.[13] Figure 4 presents 31 cities and counties in Gyeonggi, categorized into four groups by the payment size in April. The amount of each region's stimulus payment

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[13] To determine the existence of any structural cause of variation in the size of stimulus payments across the lower-level local governments, we regress the stimulus payment amount on a measure of political inclination, a measure of local government financial status, and population one by one. For political inclination, we considered the following three variables: an indicator variable of which party a mayor is affiliated with, the Democratic (The Minjoo Party of Korea and others) or the Republican (People Power Party and others); an indicator variable of which party is the majority party in the region; and the proportion of Democratic members in the local council. For local government financial status, we considered the following two variables: the financial independence ratio and revenue. We found that no variable had a statistically significant effect on the amount of stimulus aid. The lowest p-value is observed for the financial independence ratio variable (0.12), and the second-lowest p-value is for the indicator variable of the majority party. The other regressors present high p-values ranging from 0.51 to 0.98. Hence, we regard the variation in the payment size as an independent variation that is appropriate for natural experiments.

covers a payment of 100 thousand KRW provided by the Gyeonggi local government, as well as an additional payment distributed by the corresponding lower-level government. First, the 100–150 thousand KRW group includes 14 regions; in particular, 8 regions in this group fall into the 100 thousand KRW regions, which implies that these regions' lower-level local governments did not distribute their own stimulus payments in April.[14] Second, the 200–250 thousand KRW group includes 9 regions. Third, the 300–350 thousand KRW group includes 2 regions. Finally, the remaining 6 regions are excluded from our analysis because their lower-level local governments provided their own payments in the form of cash or vouchers in April, so we cannot identify the pure effect of the stimulus payments given by the Gyeonggi local government. As a result, Gyeonggi provides the ideal natural experiment setup to investigate how the effect of stimulus payments on household consumption varies according to the payment size.

3 Data

The primary data we use are Korea's consumer credit data provided by KCB. The strength of this dataset is its coverage and accuracy. First, as the official credit rating agency, KCB has credit data for South Korea's entire population, namely all transactions made by credit cards and debit cards and loans and liabilities. KCB keeps track of every individual with any credit history, and we use panel data containing 1.3 million individuals randomly sampled from the population. Second, compared to other macroeconomic variables or survey data, KCB provides high-quality, individual-level microdata. The KCB data for each person are collected in almost real time directly from the transaction records of banks and card companies. This guarantees the highest accuracy compared to any survey-based data.[15] Its timeliness and detailedness are also superior to those of official macroeconomic statistics such as GDP, which is available at only a low frequency at a widely aggregated level.

As explained in the previous section, we focus on Gyeonggi and Incheon. In our sample, there are 173,976 households in Gyeonggi and 42,306 households in Incheon randomly selected from the population in April 2020. A household is defined as the individuals, up to six, living at the same address and is constructed from the individual credit record maintained by KCB.[16] Because households are the basic units of economic activity, such as consumption, we aggregate individual data at the household level for this analysis.

The key variable of interest is card use, which is the total monthly amount of credit card and debit card spending in the units of thousand KRW. Household card use is constructed by summing the card uses of individual members of the household. In

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[14] The 8 regions distributed their own stimulus payments in May in the form of cash or vouchers, so they would not directly affect the credit card spending in April, which is our main focus.

[15] KCB compares the average values of all variables in the sample with those in the population and guarantees that the ratio for each variable is close to one for every district. One caveat is that KCB does not have information about children below the age of eighteen due to legal constraints.

[16] When households move to other addresses and if this information is reported to financial institutions, KCB can use this information to track these households.

Table 1 Household monthly card use and other characteristics, April 2020

Variable (in 1000 KRW)	Gyeonggi + Incheon		Gyeonggi		Incheon	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
monthly card use	1933	(2179)	1977	(2205)	1753	(2062)
annual income	53,376	(34,411)	54,028	(34,986)	50,694	(31,796)
housing asset	353,935	(376,083)	370,530	(394,194)	285,693	(279,791)
total debt	38,242	(78,782)	38,897	(80,094)	35,547	(73,077)
delinquent debt	58	(886)	56	(879)	65	(914)

the Gyeonggi and Incheon areas, the average monthly household card use was 1933 thousand KRW in April 2020. In South Korea, the vast majority of consumption is transacted through cards, allowing us to study consumption behavior with card payment data. Total personal card spending amounts to 85% of household consumption in the 2019 GDP.[17]

We also utilize many household-level control variables constructed from individual-level financial data provided by KCB. KCB estimates an individual's annual income every quarter using all financial records, and we define household income as the summation of each household member's estimated income. The average annual household income in our sample, as estimated in April 2020, is 53,376 thousand KRW in the Gyeonggi and Incheon areas. This sample average is close to the average household income from the national survey, which adds to the credibility of our data.[18]

KCB also provides records of housing assets and total debt. KCB does not collect individual-level total financial asset data, but the housing value should be relatively accurate due to mortgage contracts and can work as a good proxy for the total wealth of each household. The total debt data are the most accurate records available in Korea. It is the principal function of KCB to keep track of every loan contract, as this is the essential input in constructing individual credit ratings. For the entire sample including both Gyeonggi and Incheon, the average housing assets were 353,935 thousand KRW, and the average debt was 38,242 thousand KRW in April 2020. We also use the outstanding delinquent debt amount as a control variable. Table 1 summarizes the descriptive statistics of the household variables we use for the analyses.

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[17] The total value of credit card and debit card transactions, except for corporate cards and cash advances (i.e., card loans), was 760.5 trillion KRW in 2019, while the nominal household consumption in the national accounts was 897.2 trillion KRW. (Source: Bank of Korea)

[18] The Survey of Household Finances and Living Conditions is the official national-level monthly survey conducted by Statistics Korea. When we combined labor income and business income from this survey, the average annual household income in 2019 was 56,040 thousand KRW and 50,490 thousand KRW in Gyeonggi and Incheon, respectively. When we also include capital income and transfer income, which may be more difficult to detect, the annual average of total household income from the survey is approximately 17% larger than the household income estimated by KCB.

4 The impact of COVID-19

The impact of the COVID-19 pandemic on household consumption was so great that many countries offered direct stimulus payments to households. Therefore, to understand the effect of stimulus payments on consumption, we first need to investigate the impact of the COVID-19 outbreak. We use the following model to describe how consumption evolved differently after the COVID-19 outbreak in 2020.

$$Y_{it} = \beta_0 + \beta_1 1_{\{APR\}} \cdot 1_{\{2020\}} + \beta_2 1_{\{APR\}} + \beta_3 1_{\{2020\}} + \gamma X_{it} + \delta_i + \varepsilon_{it}, \quad (1)$$

where Y_{it}, the outcome variable, denotes the monthly consumption per person for household i at time t, $1_{\{APR\}} = 1$ for April and $1_{\{APR\}} = 0$ for January, $1_{\{2020\}} = 1$ for 2020 and $1_{\{2020\}} = 0$ for 2019, X_{it} includes the time-varying controls, and δ_i is the household (or subdistrict) fixed effect.[19] As consumption decisions are typically made at the household level, we include the fixed effect and time-varying controls at the household level for the benchmark model.[20] The controls include household income, wealth, total debt, delinquent debt, and the number of family members. The standard errors are clustered at the household level.[21]

Given that the full-fledged spread of COVID-19 started in the middle of February in Korea, monthly consumption in January has become a good comparison target to investigate the effect of COVID-19 on consumption. The coefficient β_1 compares the consumption change between January and April in 2019 to that in 2020 for the given region. This model will remove the effect of common factors affecting both years similarly, such as seasonal variation within a year, by comparing the change from January to April, but will capture the effect of factors that change significantly between January and April and that exist only in 2020, such as the outbreak of COVID-19.[22]

Table 2 shows the estimates for the impact of the COVID-19 outbreak. Panel A shows the impact of COVID-19 in Gyeonggi, where universal stimulus payments were distributed to all citizens in April 2020, while Panel B shows the impact of COVID-19 in Incheon, where there were no universal stimulus payments. Columns (1) and (2) show the results with district fixed effects, column (1) without household controls and column (2) with household controls, such as income, wealth, total debt, delinquent debt, and the number of family members. Columns (3) and (4) show the

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[19] We drop observations in other months for this part of the analysis.

[20] In all regressions, we exclude households if their minimum monthly card usage per person is below 50 thousand KRW (approximately 50 USD) and if their income per person is in the bottom 20%. The bottom income group is excluded because most of them received stimulus payments in the form of vouchers that are used to receive Basic Livelihood Security Program benefits.

[21] We also show the results with district fixed effects instead of household fixed effects. In this case, the standard errors are clustered at the district level. Furthermore, we checked the two-way clustering according to the idea in Cameron and Miller (2015), considering the concern that the residuals might be correlated across households in the same districts. Specifically, we tested the two-way clustering at the household and district-year levels using the methodology suggested by Gu and Yoo (2019), which provided robustness to all the statistical inferences in our paper.

[22] Here, we do not try to capture the causal effect of COVID-19. Although COVID-19 is the main difference between early-2019 and early-2020, there might be other factors affecting household consumption. Additionally, we do not try to capture the causal effect of universal payments in this section. The causal effect of universal payments will be investigated in later sections.

Table 2 Impact of COVID-19

Dependent variable: monthly consumption per person				
	(1)	(2)	(3)	(4)
Panel A. Gyeonggi				
2020 × April	−225.88***	−194.26***	−190.02***	−188.44***
	(6.36)	(6.39)	(6.77)	(6.81)
2020	145.97***	30.39***	66.36***	61.95***
	(9.59)	(7.84)	(5.88)	(5.98)
April	0.11	−34.15***	−14.33***	−15.77***
	(7.24)	(6.49)	(4.47)	(4.56)
Household controls	No	Yes	No	Yes
Household fixed effects	No	No	Yes	Yes
District fixed effects	Yes	Yes	No	No
# of observations	381,245	381,245	381,245	381,245
Panel B. Incheon				
2020 × April	−269.53***	−226.79***	−220.72***	−217.20***
	(8.32)	(6.81)	(11.67)	(11.78)
2020	127.88***	1.45	34.11***	28.43***
	(19.06)	(14.07)	(10.64)	(10.82)
April	9.99	−31.94***	−13.02	−16.36**
	(9.50)	(8.91)	(8.01)	(8.18)
Household controls	No	Yes	No	Yes
Household fixed effects	No	No	Yes	Yes
District fixed effects	Yes	Yes	No	No
# of observations	121,246	121,246	121,246	121,246

The sample used here covers household consumptions in Jan. 2019, Apr. '19, Jan. '20, and Apr. '20. Panel A uses Gyeonggi's data, and Panel B uses Incheon's. The interaction terms compare the consumption change from January to April in 2020 to that in 2019 for the given region. The constant term is not displayed. The household controls include household income, housing assets, total debt, delinquent debt, and family size. Standard errors are clustered at the district level for columns (1) and (2), and at the household level for columns (3) and (4). *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

results with household fixed effects, column (3) without household controls and column (4) with household controls. The estimated coefficients of the interaction term are quite robust to the changes in the specification, although their absolute values decrease with household fixed effects and household controls. We take regressions with the household fixed effects and controls as the benchmark model, i.e., column (4), and focus on the results from the benchmark specification.

The coefficients of the interaction term in Panels A and B demonstrate that the decrease in monthly consumption was larger in Incheon than in Gyeonggi after the COVID-19 outbreak. For example, Column (4) shows that monthly consumption per person decreased by 217,200 KRW in Gyeonggi and 188,440 KRW in Incheon. This large decrease is noteworthy since the infection rate was very low and there was
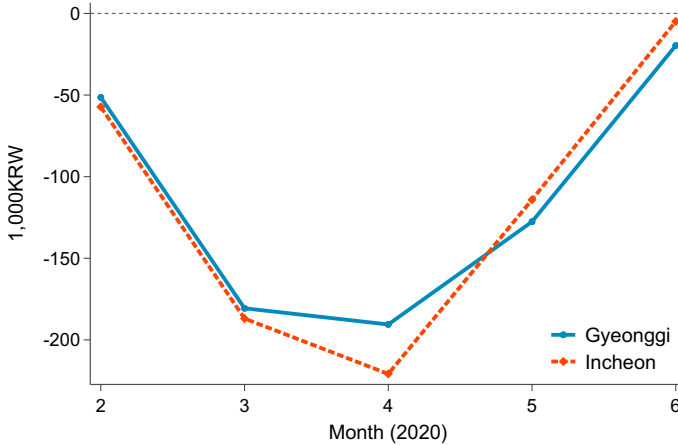
Fig. 5 Impact of COVID-19. Notes: This figure shows the evolution of monthly consumption per person from January to the specified month in 2020 compared to that in 2019 for the given region. The estimation includes the household fixed effects and control variables, including household income, housing assets, total debt, delinquent debt, and family size

no lockdown in the two regions.[23] The coefficient of the 2020 dummy shows that in January, before the proliferation of COVID-19, monthly consumption was higher than in January 2019, probably due to economic growth. The negative coefficient of the April dummy means that consumption was lower in April than in January 2019, probably for seasonal reasons. The regression removes these seasonal effects. Therefore, the estimates show that consumption was severely affected by COVID-19 in 2020, so monthly consumption decreased considerably even with economic growth and stimulus payments.

To further investigate the evolution of monthly consumption before and after the COVID-19 outbreak in 2020, we add both leads and lags running from February to June in the equation. Figure 5 depicts the coefficients of the interaction terms with the month dummies from February to June according to the benchmark specification in Table 2. Figure 5 demonstrates that there were few differences in the two regions in February and March even after the outbreak of COVID-19. Therefore, we can consider the large difference in April as representing the effect of stimulus payments in Gyeonggi. However, it is still possible that Incheon experienced a more severe shock from COVID-19 than Gyeonggi or some other types of shocks. Thus, we attempt to estimate the causal effect of universal stimulus payments in the next section.

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[23] Only 5.1 and 3.1 confirmed cases per 100,000 population until April in Gyeonggi and Incheon, respectively. COVID-19 infections were limited to Daegu and North Gyeongsang until April, as explained in Sect. 2.1.

5 The impact of universal stimulus payments

In this section, we estimate the effect of stimulus payments on consumption using the following equation:

$$Y_{it} = \beta_0 + \beta_1 1_{\{APR\}} \cdot 1_{\{GG\}} + \beta_2 1_{\{APR\}} + \beta_3 1_{\{GG\}} + \gamma X_{it} + \delta_i + \varepsilon_{it},$$

where $1_{\{GG\}} = 1$ for households in Gyeonggi and $1_{\{GG\}} = 0$ for households in Incheon in 2020. This setup constructs the DD estimate comparing the consumption change from January to April in Gyeonggi and that in Incheon for 2020. If the two regions possess parallel trends, the DD estimate will capture the causal treatment effect of stimulus payments. Using this setup, we also examine the parallel trend assumption by comparing the two regions in 2019. Because there were no stimulus payments in 2019, we can conduct a placebo test by comparing Gyeonggi and Incheon in 2019. If the DD estimate for 2019 is significant, we reject the parallel trend hypothesis.

In Table 3, the change in consumption from January to April in Gyeonggi is compared to that in Incheon for 2020 in Panel A and for 2019 in Panel B. The interaction term in Panel A shows the causal effect of stimulus payments on consumption. The estimates are robust to changes in the specification. Column (4), the benchmark model, shows that monthly consumption per person was 27,640 KRW higher in Gyeonggi than in the control group. This implies that the decrease in consumption from January to April was smaller in Gyeonggi than in Incheon. If this is truly the causal effect of stimulus payments, there should be no meaningful differences between the two regions in 2019. Panel B provides the results of this placebo test. The coefficient of the interaction term is close to zero, with large standard errors, as expected. This result supports the parallel trends assumption before the treatment in the two regions.

Although the results in Table 3 provide evidence for the causal treatment effect, it is still possible that there are some confounding factors that affect the time trends of the two regions differently. For example, the two regions could have different trends because of possible differences in industrial compositions, age distributions, neighborhood characteristics, weather, etc. If omitted, this difference in trends can be partially captured as our treatment effect. Therefore, we fully utilize the data from January 2019 to June 2020 and include heterogeneous time trends for each subdistrict on top of month and year fixed effects.

$$Y_{it} = \beta_0 + \beta_1 \text{Post}_t \cdot 1_{\{GG\}} + \beta_2 \text{Post}_t + \beta_3 1_{\{GG\}} + \gamma X_{it} + \delta_i + \delta_k + \delta_m + t \cdot \delta_s + \varepsilon_{it},$$

where $\text{Post}_t = 1$ for April, May, and June in 2020 and $Post_t = 0$ for other time periods, δ_k is the year fixed effect, δ_m is the month fixed effect, and δ_s is the subdistrict fixed effect.[24] In this setup, we use all data from January 2019 to June 2020. With this approach, we can control for the effect of economic growth that can be compounded in the above DD estimate.

Columns (1) and (2) in Table 4 present the estimation results using this standard DiD specification with heterogeneous linear trends across districts and fixed effects for

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[24] We scale $Post_t$ to obtain the effect on monthly consumption per person, which is consistent with previous results.

Table 3 DD estimates for the impact of universal stimulus payments

Dependent variable: monthly consumption per person				
	(1)	(2)	(3)	(4)
Panel A. Treatment group = Gyeonggi, 2020				
Control group = Incheon, 2020				
Gyeonggi × April	33.63***	32.70***	27.61***	27.64***
	(10.33)	(11.07)	(10.16)	(10.15)
Household controls	No	Yes	No	Yes
Household fixed effects	No	No	Yes	Yes
District fixed effects	Yes	Yes	No	No
# of observations	243,078	243,078	243,078	243,078
Panel B. Treatment group = Gyeonggi, 2019				
Control group = Incheon, 2019				
Gyeonggi × April	−10.21	3.48	0.01	0.37
	(11.73)	(8.48)	(9.20)	(9.19)
Household controls	No	Yes	No	Yes
Household fixed effects	No	No	Yes	Yes
District fixed effects	Yes	Yes	No	No
# of observations	259,413	259,413	259,413	259,413

Panel A uses Gyeonggi and Incheon's household consumption panel in Jan. and Apr. 2020. Panel B uses Jan. and Apr. 2019's data from these two provinces. The DD estimates compare the consumption change from January to April in Gyeonggi to that in Incheon for the given year. The household controls include households' income, housing assets, total debt, delinquent debt, and family size. Standard errors are clustered at the district level for columns (1) and (2) and at the household level for columns (3) and (4). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

districts and households, respectively. Different from previous results, the estimated effect of stimulus payments is negative. This is because the COVID-19 shock, which is not captured by the linear time trend from January 2019 to June 2020, biases the treatment effect. As we explored above, monthly consumption decreased considerably in 2020 after the COVID-19 outbreak. When we allow a structural break in the linear time trend between two years, the estimated treatment effect becomes similar to the results in Table 3 but only weakly significant even in the benchmark specification, Column (4), with household fixed effects.[25]

Therefore, we use triple interactions to avoid the need to include time trends and to control for other possible confounding factors, such as different seasonal consumption patterns in Incheon and Gyeonggi.

---

[25] We add $t \cdot \delta_s \cdot \delta_k$ in the equation to allow a structural break in the linear time trend between the two years. It might be the case that the consumption patterns among the households located in the same district are similar, so we tried district-level fixed effects. However, we believe that it is ideal to control for the fixed effects at the household level, which allows every household to have different consumption levels without the stimulus payment. Therefore, we choose Column (4) as our benchmark specification. It turns out that the magnitudes of the estimated treatment effects are comparable to each other, with stronger significance in the case of household fixed effects.

Table 4 DD estimates with time trends

| Dependent variable: monthly consumption per person | | | | |
| Treatment group = Gyeonggi | | | | |
Control group = Incheon	(1)	(2)	(3)	(4)
Gyeonggi × Post	−69.89***	−38.60**	29.45	34.03*
	(21.26)	(19.60)	(22.79)	(20.23)
Household controls	Yes	Yes	Yes	Yes
Month and year fixed effects	Yes	Yes	Yes	Yes
District fixed effects	Yes	No	Yes	No
Household fixed effects	No	Yes	No	Yes
Het. linear trends (districts)	Yes	Yes	No	No
Het. linear trends (districts×years)	No	No	Yes	Yes
# of observations	2,244,028	2,244,028	2,244,028	2,244,028

The DD estimates are obtained from a regression with the monthly household consumption panel of Gyeonggi and Incheon from January 2019 to June 2020. Columns (1) and (2) include heterogeneous linear trends for each district over the whole period. Columns (3) and (4) include heterogeneous linear trends for each district and year. The household controls include household income, housing assets, total debt, delinquent debt, and family size. Standard errors are clustered at the district level for columns (1) and (2) and at the household level for columns (3) and (4). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

$$
\begin{aligned}
Y_{it} = {} & \beta_0 + \beta_1 1_{\{GG\}} \cdot 1_{\{2020\}} \cdot 1_{\{APR\}} + \beta_2 1_{\{2020\}} \cdot 1_{\{APR\}} + \beta_3 1_{\{GG\}} \cdot 1_{\{2020\}} \\
& + \beta_4 1_{\{APR\}} \cdot 1_{\{GG\}} + \beta_5 1_{\{2020\}} + \beta_6 1_{\{APR\}} \\
& + \beta_7 1_{\{GG\}} + \gamma X_{it} + \delta_i + \varepsilon_{it},
\end{aligned}
\tag{2}
$$

where $1_{\{GG\}} = 1$ for Gyeonggi and $1_{\{GG\}} = 0$ for Incheon, $1_{\{APR\}} = 1$ for April and $1_{\{APR\}} = 0$ for January, and $1_{\{2020\}} = 1$ for households observed in 2020 and $1_{\{2020\}} = 0$ for households observed in 2019. The coefficient β_1 compares the difference in the consumption change from January to April between Gyeonggi and Incheon for 2019 with that for 2020. This regression only includes data for January and April in 2019 and 2020. As Eq. (2) effectively includes every month and year dummy and compares consumption changes within a short period from January to April, there is little need to be concerned about time trends. Additionally, this setup can control for confounding factors that affect the two regions or two years differently. For example, the two regions might have different seasonal patterns from January to April. These types of confounding factors can bias the treatment effect from Equation (1). By using the DDD approach, we can remove the effect of these confounding factors.

Table 5 presents the DDD estimates. The coefficient of the triple interaction term in the benchmark model, Column (4), shows that the stimulus payments increased monthly consumption per person in Gyeonggi by 29,540 KRW. This is very similar to the DD results in Table 3. Column (3) shows that the estimated value of the main coefficient is not affected significantly by the household-level control variables, given the household fixed effect. We use the district fixed effect in Columns (1) and (2) instead of the household fixed effect. In these cases, the inclusion of household controls causes

Table 5 DDD estimates for the impact of universal stimulus payments

Dependent variable: monthly consumption per person Treatment group = Gyeonggi Control group = Incheon	(1)	(2)	(3)	(4)
2020 × April × Gyeonggi	43.65***	28.42***	30.76**	29.54**
	(10.20)	(10.03)	(13.50)	(13.49)
Household controls	No	Yes	No	Yes
Household fixed effects	No	No	Yes	Yes
District fixed effects	Yes	Yes	No	No
# of observations	502,491	502,491	502,491	502,491

The regression utilizes Gyeonggi and Incheon's household consumption panel for the four months—Jan. and Apr. 2019, Jan. and Apr. 2020. The DDD estimates compare the difference in the consumption change from January to April between 2019 and 2020 in Gyeonggi to that in Incheon. The household controls include households' income, housing assets, total debt, delinquent debt, and family size. Standard errors are clustered at the district level for columns (1) and (2) and at the household level for columns (3) and (4). $*p < 0.1, **p < 0.05, ***p < 0.01$

larger changes in the main estimate. These results show the importance of controlling for the heterogeneous characteristics across households to estimate the policy effect.[26]

Figure 6 presents the treatment effects using DD and DDD equations as in Autor (2003). Panel A of Fig. 6 extends the results in Column (4) in Table 3 by adding leads and lags, whereas panel B of Fig. 6 adds leads and lags in the DDD specification of Column (4) in Table 5. Both panels of Fig. 6 demonstrate the significant treatment effect in April. Before the treatment, no significant differences in the two regions anywhere observed in either panel. However, it seems that there is an increasing trend in panel A and consumption diverges again in June. This increasing trend disappears in panel B, which implies that the DDD effectively removes the effects of confounding factors that are not captured by the DD equation.

It is worth noting that the policy worked very quickly. Given that the application period for the stimulus payments started on April 9, the result implies that the payments significantly increased consumption within 20 days.[27]

It is also worth noting that the treatment effect quickly disappeared starting in May. This suggests that the unused portion of the payments in April was not saved for use

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[26] When we run the same regression with the aggregated data by summing up the dependent variable across households within districts, the estimated coefficient divided by the number of average households within each district is 45.6. This is very similar to the estimate in Column (1), which uses only district-level independent variables with the district fixed effect. This implies that the difference between Column (1) and the other columns in Table 5 mostly represents the effect of data aggregation, ignoring the heterogeneity across households.

[27] In Gyeonggi and Incheon, it does not seem that the universal stipend program substantially affected economic performance, such as unemployment rates. The aggregate indicators did not show sufficient short-run differences around the payment date. Even if there were some changes during the sample period, they were too small to lead to the multiplier effect. Furthermore, our analysis focuses on the direct and immediate effects of universal payments on household spending, so we are not concerned about general equilibrium effects in our short-run analysis. However, we would like to note that the estimation is a rigorously partial equilibrium and might omit any multiplier or crowding-out effects from the policy. In fact, our study suggests that the payment would have a multiplier effect to an extent in the medium or long run, according to the Keynesian view, given our MPC estimate of 0.4.
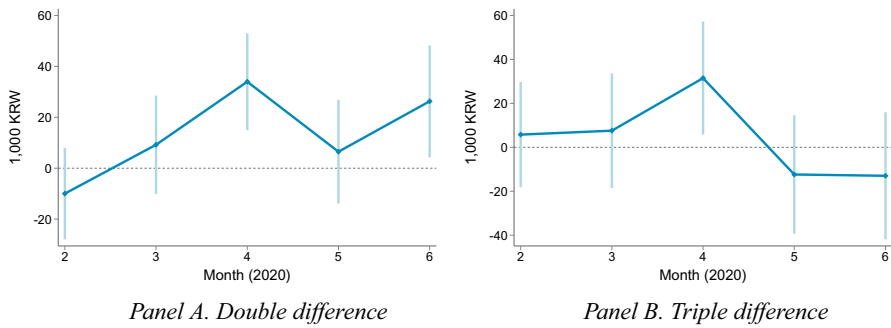
Panel A. Double difference   Panel B. Triple difference

Fig. 6 DD and DDD estimates with leads and lags. Notes: This figure shows the effect of stimulus payments on monthly consumption per person. The left panel shows the result from the DD estimates, while the right panel shows the result from the DDD estimates. The vertical lines are 95% confidence intervals. Both include household fixed effects and control variables, including household income, housing assets, total debt, delinquent debt, and family size

within two or three months but saved from a longer-term perspective.[28] In addition, given that the government started providing stimulus payments to all households in South Korea in May, the insignificant differences in May and June imply that our method effectively removes the effect of policy changes common to both the treatment and control groups.

6 Heterogeneity

In this section, we investigate the MPC to reveal the effectiveness of stimulus payments for different groups of people. Because our data do not have information about children below the age of eighteen, we include only single-person households for the MPC calculation. It is less likely that these households will include children.

6.1 MPC and cost-effectiveness

We also estimate MPC by changing the Gyeonggi indicator in Eq. (2) to the stimulus payment amount (Baker et al. 2020). That is, we use the following specification:

$$
\begin{aligned}
Y_{it} =& \beta_0 + \beta_1 AMT_i \cdot 1_{\{2020\}} \cdot 1_{\{APR\}} + \beta_2 1_{\{2020\}} \cdot 1_{\{APR\}} \\
& + \beta_3 AMT_i \cdot 1_{\{2020\}} + \beta_4 1_{\{APR\}} \cdot AMT_i \\
& + \beta_5 1_{\{2020\}} + \beta_6 1_{\{APR\}} + \beta_7 AMT_i + \gamma X_{it} + \delta_i + \varepsilon_{it},
\end{aligned} \tag{3}
$$

where AMT_i denotes the stimulus payment amount provided to household i. The other variables are specified in the same way as in the benchmark DDD model. The

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[28] We run the regression after replacing the dependent variable with income and debt after removing the household controls. The results show that income and debt were not significantly affected by the treatment, with p values equal to 0.681 for income and 0.251 for debt. This suggests that most of the stimulus payments not used to support consumption were saved rather than being used to reduce debt.

Table 6 DDD estimates for the MPC and transfer size

Dependent variable: monthly consumption per person
Treatment group = Gyeonggi
Control group = Incheon

Panel A. Overall MPC	
	0.40***
	(0.13)
Panel B. MPC by transfer size (unit: 1,000KRW)	
100–150	0.58**
	(0.24)
200–250	0.45***
	(0.16)
300–350	0.36**
	(0.16)

One indicator variable for Gyeonggi is included in the regression for Panel A as the benchmark model, whereas two indicator variables for districts with different sizes of transfers are included for Panel B. The regressions include the household fixed effect and control variables, including household income, housing assets, total debt, and delinquent debt. Standard errors are clustered at the household level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

coefficient β_1 represents the portion of stimulus payments used to increase monthly consumption per person, i.e., the marginal propensity to consume (MPC).

When we earmarked the stimulus payments, the earmarked money was almost completely spent, since there was a time limit for spending this money.[29] This, however, does not mean that monthly consumption increased by this amount because households could reduce consumption from their own income. Our MPC estimate from Eq. (3) measures the net response of monthly consumption to the stimulus payments.

Panel A of Table 6 shows that the overall MPC is 0.40. This implies that 60% of payments were saved for future consumption or used to repay debt. We found no significant changes in the amount of household debt with the DDD equation in which the outcome variable is changed from consumption to debt. This suggests that 60% of payments were saved for future consumption.

Panel B presents the MPC for different sizes of stimulus payments. The MPC decreases from 0.58 to 0.36 as the payment size increases from 100–150 to 300–350 thousand KRW.[30] This implies that stimulus payments were more cost-effective when the payment size was small. In other words, a higher portion of stimulus payments was saved in regions with larger stimulus payments even though the increase in the level of consumption was larger in these regions.

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[29] The Korean Ministry of the Interior and Safety reported that approximately 82% of the stimulus payments provided by the central government in May were used within one month. It can be inferred that the pattern of using the stimulus payments provided by Gyeonggi in April would be similar to that of the central government because they used a similar online (and offline) system to provide these payments.

[30] The estimated values in Panel B are not significantly different from each other. However, the significant coefficients imply that each group with a different transfer size has significantly different responses compared

Table 7 DDDD estimates for the MPC and liquidity

Dependent variable: monthly consumption per person *Treatment group = Gyeonggi* *Control group = Incheon*	
Panel A. MPC by liquidity (unit: million KRW)	
<0	1.05*
	(0.60)
0–1	0.23
	(0.40)
1–2	0.25
	(0.23)
≥2	0.07
	(0.29)
Panel B. MPC by age of recipients	
20–30	0.85***
	(0.19)
40–50	0.19
	(0.20)
60–70	−0.28
	(0.38)

This table shows the heterogeneous effects of stimulus payments using the DDDD estimates specified in Eq. (4). In each panel, the first row reports β_1 for the base group, the second row reports $\beta_1 + \beta_2$ for the second group, the third row reports $\beta_1 + \beta_3$ for the third group, and so on. The regression includes the household fixed effect and control variables including household income, housing assets, total debt, and delinquent debt. Standard errors are clustered at the household level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6.2 The role of liquidity

We further explore the heterogeneous effect of stimulus payments on households with different levels of liquidity. The theory of consumption predicts that the effect of stimulus payments should be stronger for households under liquidity constraints (e.g., Deaton 1991; Carroll and Kimball 1996). In incomplete markets where households are not fully insured against adverse shocks, the theoretical model predicts that poorer household consumption responds more to a transitory income shock. It is important to test the model prediction empirically because the model helps us not only to understand the causal effect of a fiscal transfer on consumption but also to design a more effective fiscal policy. By testing this prediction, we can understand the extent to which the mechanism of stimulus payments can be attributed to the easing of liquidity constraints. We therefore use the DDDD equation as follows:

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to the districts with no stimulus payments, which is the group omitted from the regression to constitute the base.

$$Y_{it} = \beta_0 + \beta_1 1_{\{GG\}} \cdot 1_{\{2020\}} \cdot 1_{\{APR\}} + \sum_{g=2}^{4} \beta_g 1_{\{APR\}} \cdot 1_{\{GG\}} \cdot 1_{\{2020\}} \cdot LC_{gi}$$

$$+ (Other\ Triple\ Interaction\ Terms) + (Double\ Interaction\ Terms)$$

$$+ (Linear\ Terms) + \gamma X_{it} + \delta_i + \varepsilon_{it}, \tag{4}$$

where LC_{2i}, LC_{3i}, and LC_{4i} are indicators for households with different amounts of liquidity. We define liquidity as monthly income minus consumption divided by family size. We split the households into the following four groups based on the average amount of liquidity from January to March 2020: less than zero (the base group), from zero to 1 million KRW, from 1 to 2 million KRW, and more than 2 million KRW.[31] Baker et al. (2020) use account balances at the beginning of treatment as a measure of liquidity. Our measure gauges saving capacity before the treatment and is similar to theirs in the sense that unspent income is saved. The other variables are specified in the same way as in the DDD equation.

The treatment effect is measured as β_1 for the base group, $\beta_1 + \beta_2$ for the second group, $\beta_1 + \beta_3$ for the third group, and $\beta_1 + \beta_4$ for the fourth group. If the DDD estimate using Eq. (2) demonstrates a causal effect, we should expect to see a greater treatment effect for households with less liquidity.

Table 7 shows the coefficients of the quadruple term in Eq. (4).[32] The results suggest that the increase in consumption in response to the stimulus payments was mainly driven by households under liquidity constraints, which have expenditures greater than their incomes. The estimated MPC is 1.05 for households with liquidity values below zero, but is not significantly different from zero for other households that have an income greater than expenditures.[33]

This result has two important implications. First, it suggests that the easing of liquidity constraints is the main mechanism for the policy impact. Given that the portion of households with liquidity values of less than zero is approximately 8%, the results imply that the stimulus payments were not effective in increasing the net consumption amounts for most households with sufficient income for their consumption. Second, the large difference in the estimated coefficients between constrained and unconstrained households implies that our results in the previous section using DDD are not confounded by omitted variables that may have differently affected consumption in Gyeonggi and Incheon. If we had an omitted variable bias, that would lead to a significant positive impact on both constrained and unconstrained households (Muralidharan and Prakash 2017).

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[31] To avoid reverse causality, we exclude April from the calculation of the average liquidity.

[32] We exclude households with extreme values for liquidity, which is defined as monthly income minus consumption divided by family size, below the 1st percentile (approximately -2 million KRW) or above the 99th percentile (approximately 4.3 million KRW) of the distribution.

[33] The estimated MPC is greater than one because several districts in Gyeonggi provided additional stimulus payments to targeted households, such as small business owners or low-income households below the median. Compared to the 1.4 trillion KRW used for the universal stimulus payments, these additional payments, ranging from 2.5 to 100 billion KRW, were small in scale. Because the consumption boost was mainly driven by the liquidity-constrained households, not by others, the overall amount of extra consumption was moderate.

Panel B shows the MPC values for recipients of different ages. The MPC is 85% for those in their 20 s and 30 s but is not significantly different from zero for those who are older. It seems that this result is related to the fact that the young usually possess less liquidity. The average liquidity level was the smallest for those in their 20 s; it was 0.9 million KRW for those in their 20 s, 1.3 million KRW for those in their 30 s, 1.6 million KRW for those in their 40 s, 50 s, and 70 s, and 1.4 million KRW for those in their 60 s. Additionally, the application method used to apply for stimulus payments could affect the results for older people. Applicants had to use an online application system to receive stimulus payments to their credit cards. The offline application was used only for other payment methods, such as cash or vouchers, which are not captured by our data. If older people preferred the offline application method, our estimates could underestimate the policy impact for older recipients.

7 Distributional analysis

We next assess the impact of the stimulus payments on the lower, middle, and upper parts of the consumption distribution. Economic theories (e.g., consumption in incomplete markets) suggest that the effect of stimulus payments on consumption would be larger for lower-income households. This means that the consumption function is concave (Carroll and Kimball 1996).[34]

The distributional analysis figures out the shape of the consumption function and determines whether it is consistent with the theory. One way to achieve this goal would be to estimate the effects on each quantile conditional on the control variables (Koenker and Bassett 1978). This conditional quantile regression method is used to assess the impact of a covariate on a quantile of a dependent variable conditional on specific values of the other covariates. In the presence of multiple covariates, however, conditional quantile regression may generate results that are not interpretable in a policy context. To overcome this limitation, the UQR method can be used. Firpo et al. (2009) shows how to implement UQR with the recentered influence function (RIF) regression approach.

The recentering in the RIF approach involves adding the statistic to the influence function, IF, which measures the influence of a specific observation on a distributional statistic. For a quantile τ, we have IF $\left(y; q_\tau, f_y\right) = \left(\tau - 1\left\{y \leq q_\tau\right\}\right) / f_y\left(q_\tau\right)$, where q_τ denotes the τth quantile of the distribution of consumption, and f is the empirical density function evaluated at q_τ. Then, we have RIF $\left(y; q_\tau, f_y\right) = $ IF $\left(y; q_\tau, f_y\right) + q_\tau$. Then, the marginal effect of the unconditional quantile can be estimated by modeling the conditional expectation of RIF $\left(y; q_\tau, f_y\right)$ as a function of a set of explanatory variables X. These estimates, which are in terms of probabilities, correspond to marginal effects on the cumulative distribution function of consumption, and they need to be divided by a kernel estimate of the density of the consumption distribution at that point to arrive at the associated quantile treatment effects, which for consumption should be in monetary amounts.

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[34] As the average level of consumption is an increasing function of income, the level of consumption can be used as a proxy for the level of income. Individuals with lower income levels are closer to their borrowing constraints or have greater precautionary motives.
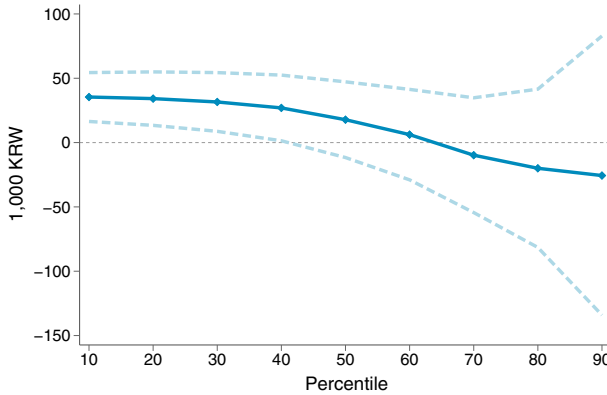
Fig. 7 Quantile treatment effect estimates on expenditure. Notes: The treatment effect indicates a triple-difference estimate ($2020 \times April \times Gyeonggi$). Treatment effect estimates are at each tenth percentile. The dotted lines are 95% confidence intervals. The specification includes household control variables such as income, the total amount of debt, the amount in arrears, the asset value of housing, and family size

We define the series of consumption cutoffs q_τ by every 10th quantile of the empirical consumption distribution. We follow the RIF-OLS approach of Firpo et al. (2009). The identifying assumption underlying the RIF estimator is that without treatment, the change in population shares around a given level of consumption would be the same in the treatment group as in the comparison group. The estimated distributional effects are presented graphically in terms of monetary amounts at each quantile. The treatment variable here is constructed as a three-element vector containing separate treatment indicators for different groups.

Figure 7 shows the unconditional quantile treatment effect estimates on consumption. The effect of the stimulus payments is positive and significant only in the lower part of the consumption distribution at the 10th-40th percentiles. Households with low consumption levels tend to have relatively low incomes, and the theory of consumption in incomplete markets suggests that the MPC values of these households are likely to be high (e.g., precautionary savings (Zeldes 1989), borrowing constraint (Deaton 1991)). Hence, it is reasonable that the estimated effects will be larger at the lower end of the distribution.

Consistent with economic theories, the estimated effects decline in the upper part of the distribution. The treatment effect is highest at the 10th percentile, which is approximately 35,000 KRW. The estimated QTEs above the 50th percentile decline from 17,780 KRW to -25,620 KRW but are not significantly different from zero. The estimated QTEs imply that the government policy affects the spending of low-income households to some extent, but the policy may be ineffective in inducing middle-income and high-income households to spend more. Our results show that a more targeted approach is more efficient in achieving the policy goal.[35]

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[35] Few OECD countries made direct cash transfers to individuals regardless of their employment status. The Japanese government launched the Special Fixed Benefits program, which paid 100,100 yen to any resident of Japan. Israel also disbursed universal transfers to its citizens. The US CARES Act also disbursed direct fiscal transfers to individuals, but it targeted lower-income individuals as only individuals with incomes less

Table 8 MPC estimates in the inner- and outer-ring districts

Dependent variable: monthly consumption per person *Treatment group = Gyeonggi* *Control group = Incheon*	
Inner-ring	0.42**
	(0.19)
Outer-ring	0.39***
	(0.14)

Indicator variables for the inner-ring and outer-ring districts of Gyeonggi are included in the regression as the benchmark model. The regressions include the household fixed effect and control variables including household income, housing assets, total debt, and delinquent debt. Standard errors are clustered at the household level
$*p < 0.1, **p < 0.05, ***p < 0.01$

8 Robustness

8.1 Inner-ring and outer-ring districts

Gyeonggi is in the regional outskirts of Seoul, the capital city of South Korea, and we can decompose Gyeonggi into the following two subgroups according to geographical proximity to Seoul: inner-ring districts, most of which neighbor Seoul, and outer-ring districts.[36] Since the Seoul neighboring districts may be different from the outer-ring districts in terms of consumption pattern, local industry, or urbanization—for example, a large portion of residents in the inner-ring districts commute to Seoul so most of the inner-ring districts are commuter towns—we investigate whether the baseline result is robust to subgroups or not.

Table 8 presents the MPC values for the inner- and outer-ring districts. Comparing the baseline result of 0.4, which is the overall MPC estimated in Eq. (3), we found that the MPC results for both subgroups are robust. This result confirms that our results are robust to the possible differences between the inner- and outer-ring districts of Gyeonggi.

8.2 Comparing districts near the border

Incheon is a gateway city to Seoul and has the largest international airport in Korea and many harbors. In contrast, Gyeonggi surrounds Seoul and has many satellite cities

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than a certain threshold received full payment. Our analysis suggests that targeted transfers would more effectively support aggregate demand.

[36] The inner-ring districts of Gyeonggi include the districts bordering Seoul and the districts designated as overheated speculative zones, as follows: Seongnam, Uijeongbu, Anyang, Bucheon, Gwangmyeong, Gwacheon, Guri, Namyangju, Gunpo, Uiwang, Hanam, Yongin (Suji-gu, Giheung-gu) and Gimpo. The outer-ring districts include the districts of Gyeonggi other than the inner-ring districts, as follows: Pyeong-taek, Dongducheon, Siheung, Yongin (Cheoin-gu), Paju, Icheon, Anseong, Hwaseong, Gwangju, Yangju, Yeoju, Yeoncheon-gun and Gapyeong-gun. Note that Pocheon, Goyang, Yangpyeong-gun, Ansan and Suwon are excluded, as discussed in Sect. 2. For graphical understanding, please refer to Fig. 3 or Fig. 4 in Sect. 2.
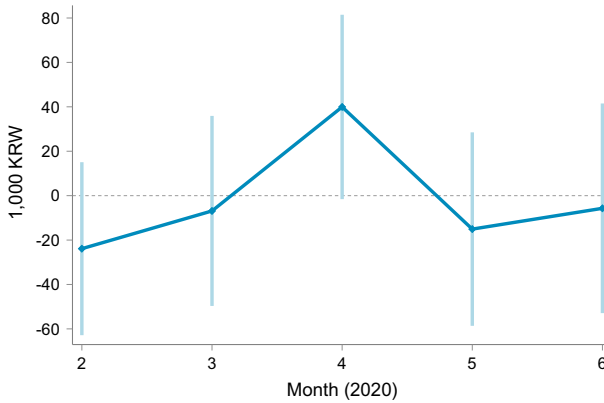
Fig. 8 DDD estimates with the nearby districts between Incheon and Gyeonggi. Notes: This figure shows the effect of stimulus payments on monthly consumption per person, using only the nearby inland districts in Incheon and Gyeonggi. The vertical lines are the 95% confidence intervals. The estimation includes the household fixed effects and control variables, including household income, housing assets, total debt, delinquent debt, and family size

with residents commuting to Seoul, as mentioned above. Because of the differences in locations and relationships with Seoul, Incheon and Gyeonggi have taken different paths in the process of industrial development. Our estimates could suffer from omitted variable bias if Incheon and Gyeonggi have different time-varying characteristics due to geopolitical differences. We examine this issue by comparing the eastern districts of Incheon bordering Gyeonggi to the western districts of Gyeonggi near Incheon. These districts are all inland and located near each other, sharing a border.[37]

Figure 8 shows a result similar to the benchmark model. The average treatment effect is approximately 40 thousand KRW, slightly higher than the benchmark result, but with wider confidence intervals due to the loss of observations. This result demonstrates that our results are not driven by the geopolitical differences between the two regions.

8.3 Endogenous policy change

While the results in the previous sections provide evidence of a positive causal impact of stimulus payments on consumption, there is still one further concern. If the size of stimulus payments was determined endogenously by unobservable time trends in different districts (e.g., economic growth), our DiD estimates might be biased.[38] We address this concern by testing the parallel trend assumption using Eq. (2). We include the indicator "Before" for February and March instead of the indicator for April. Then, we run the regression with different districts grouped by the size of stimulus payments as well as with all districts in Gyeonggi. If the coefficient of the DDD term is

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[37] Bucheon, Siheung, Gimpo, and Gwangmyeong are included for Gyeonggi, and Gyeyang-gu, Bupyeong-gu, and Namdong-gu are included for Incheon.

[38] Note that regional characteristics that do not vary over time are removed by the household fixed effects.

Table 9 DDD estimates to test parallel trends

Dependent variable: monthly consumption
Treatment group = Gyeonggi grouped by the size of stimulus payments (unit: 1000 KRW)

Control group = Incheon	All	100–150	200–250	300–350
2020 × Before × Gyeonggi	3.85	12.17	−5.11	−12.45
	(11.04)	(12.12)	(13.09)	(21.79)
HH controls	Yes	Yes	Yes	Yes
HH fixed effects	Yes	Yes	Yes	Yes
# of observations	748,694	479,948	393,336	236,514

The household control variables include household income, housing assets, total debt, delinquent debt, and family size. Standard errors are clustered at the household level. $*p < 0.1, **p < 0.05, ***p < 0.01$

significant, the implication is that there are regional characteristics that vary between 2019 and 2020, and we reject the parallel trend assumption.

Table 9 shows the results. The coefficient of the DDD term is not significantly different from zero for all districts in Gyeonggi or for the subgroups of Gyeonggi receiving different stimulus payment sizes. Therefore, we cannot reject the parallel trend assumption for any of the groups of districts in Gyeonggi and conclude that our results in the previous sections are not confounded by the conditions of the districts.

9 Conclusion

This paper studies the impact of universal stimulus payments on household spending under the COVID-19 pandemic using large-scale panel data from KCB. Specifically, we utilize the ideal natural experiment setup with a DiD approach to explore the effects of stimulus payments distributed by the largest Korean province, Gyeonggi, in April 2020. After investigating the effect of the COVID-19 outbreak on consumption, which is significantly negative, we find that the stimulus payments quickly increased monthly consumption per person by approximately 30 thousand KRW within the first 20 days. We estimate that the overall MPC of the payments was approximately 0.40. We show that the main mechanism driving this result is the role of liquidity-constrained households, as their MPC was close to one, while the MPC values of other groups of households were not significantly different from zero. Furthermore, we show that heterogeneity matters. The MPC decreases from 0.58 to 0.36 as the transfer size increases from 100–150 to 300–350 thousand KRW, and the effect of stimulus payments is more significant in the younger age group. Finally, the unconditional quantile treatment effect estimates reveal that there was a positive and significant increase in consumption only in the lower part of the distribution below the median.

Our empirical results suggest that a more targeted approach may more efficiently achieve the policy goal of boosting aggregate demand. However, a general equilibrium approach with a structural model could yield different policy implications in terms of social welfare. Moreover, we focused here on the relatively short-run impact of the policy and the resulting implications. However, the policy could also have long-run

effects if we consider the long-lasting and mixed effects of other policies, such as monetary policy, and expectations about future policies, such as additional stimulus payments. We leave these interesting and important questions for future research.

Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

Ethics approval This study uses deidentified confidential data collected and approved by Korea Credit Bureau. No ethical approval is required.

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