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The COVID-19 pandemic, consumption and sovereign credit risk: Cross-country evidence

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ABSTRACT

Many recent studies investigate the economic effect of the COVID-19 pandemic in multiple aspects, while whether and how the sovereign credit risk reacts to the shock is still underexplored. Using a sample of forty developed and developing countries and employing staggered difference-in-differences models, we find that the sovereign credit risk measured by sovereign credit default swap spreads significantly increases after the COVID-19 pandemic outbreak, and the adverse effect is more pronounced for short-term credit risk. The reason is that the pandemic causes severe concerns about aggregate consumption contraction in addition to the fiscal capacity and the volatility of exports. We also find that fiscal stimuli stabilizing consumer spending alleviate the adverse effect of the COVID-19 pandemic, while debt relief does not matter. Overall, practitioners and policy makers should attach more importance to consumption and its recovery during the pandemic when making decisions.

1. Introduction

According to the World Health Organization (WHO) report, the new coronavirus pneumonia (COVID-19) broke out in early 2020 and rapidly developed into a global epidemic that infected more than 80 million people in over 200 countries and regions by the end of 2020, causing severe economic contraction.¹ The COVID-19 pandemic has inspired a large body of literature to investigate its comprehensive effects on economic uncertainty (Altig et al., 2020), unemployment, consumption (Cox et al., 2020a; Chetty et al., 2020), and the stock market (Baker et al., 2020a; Ding et al., 2021; Liu et al., 2021b), as well as the effect of governments’ policy responses. The deterioration of economic development also arouses concerns about sovereign credit risk, yet only a few studies have explored the reaction of sovereign credit risk to the pandemic (Augustin et al., 2021).

Although the extant literature stresses the role of fiscal capacity or resilience to economic shock (Augustin et al., 2021), we focus on the role of consumption in explaining the effect of the COVID-19 pandemic on sovereign credit risk for two reasons. First, consumption is one of the important determinants of sovereign credit risk (Augustin and Tedongap, 2016; Chernov et al., 2020) and declines sharply during the global epidemic. As consumption is a driver of economic growth, its contraction may further undermine a country’s creditworthiness and hence trigger debt default in extreme cases. Baker et al. (2020b) argue that the COVID-19 pandemic-induced economic downturn is greatly different from the 2008 financial crisis because the pandemic shock hits households’ income and spending much more quickly. Theoretically, consumption contraction impairs a country’s economic health and amplifies the reaction of sovereign credit risk to the COVID-19 pandemic. Second, most countries have implemented stimulus packages to weather the pandemic shock on household spending, but their effects are still unclear in the literature on sovereign credit risk. Specifically, we ask three

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questions in this study: does the outbreak of the COVID-19 pandemic significantly increase sovereign credit risk? Does the pandemic shock undermine sovereign creditworthiness through the consumption contraction? Can fiscal stimuli aimed at stabilizing consumer spending mitigate the adverse effect of the global pandemic on sovereign credit risk?

This paper studies the above questions using weekly data from forty countries over the period from January 2019 through November 2020. Following previous studies, we use sovereign credit default swap (CDS) spreads to measure sovereign credit risk. Given that the consumption recovery of a country usually takes time after a negative shock (Augustin, 2018), we also explore the changes in the spreads of 6-month and 1-year sovereign CDS respectively in addition to the spreads of 5-year sovereign CDS. This allows us to investigate the differential effects of the COVID-19 pandemic on a country’s short-term and long-term credit risks.

Our major findings are threefold. First, both the short-term and long-term sovereign credit risks of a country significantly rise after the outbreak of the COVID-19 pandemic, especially the former. Specifically, 5-year CDS spreads increase by 4.2% on average, while 1-year and 6-month CDS spreads increase by 8.7% and 13.5%, about 2.1 and 3.2 times of 5-year CDS spreads’ change, respectively. The results suggest that the adverse impact is more pronounced for the short-term sovereign credit risk than for the long-term credit risk. In other words, the market is more concerned about the deterioration of sovereign credit risk in the short run. Second, using retail sales growth rate and pre-pandemic saving rate to measure the consumption shock, we find that a country’s sovereign credit risk rises tremendously if it suffers a severe consumption contraction. The amplification effect of consumption still exists after controlling for the potential effects of fiscal capacity and trade volatility. Finally, the effect of income support policy depends on its coverage on income losses of the unemployed. Specifically, the adverse effect of the pandemic on sovereign credit risk is less pronounced in countries implementing a more generous income support policy.

Our study mainly contributes to the literature in three aspects. First, we extend the literature by exploring the differential effects of the COVID-19 pandemic on long-term and short-term sovereign credit risks. The existing literature widely explores the effect of the COVID-19 pandemic on macroeconomic downturns (Baker et al., 2020b; Bartik et al., 2020; Chetty et al., 2020; Cox et al., 2020; Fosythe et al., 2020; Karger and Rajan, 2021) and financial markets (Baker et al., 2020a; Fahlenbrach et al., 2021; Ramelli and Wagner, 2020; Delis et al., 2021; Ding et al., 2021; Fitil et al., 2021), while only a few studies explore the effect on sovereign credit risk (Daelehr et al., 2021). Unfortunately, most previous studies focus on the long-term sovereign credit risk measured by the 5-year CDS spreads. However, Augustin (2018) stresses that a negative country-specific shock increases sovereign credit risk more for short maturities and less for long maturities. Thus, we extend the literature and provide effective evidence to Augustin (2018) by examining the adverse effect of the COVID-19 pandemic.

Second, we document that the outbreak of the COVID-19 pandemic affects sovereign credit risk through consumption contractions in addition to limited fiscal capacity and export volatility. The limited literature seldom investigates how the COVID-19 pandemic affects sovereign credit risk, except for Augustin et al. (2021), who investigate the role of fiscal capacity. They argue that limited fiscal capacity impairs resilience to economic shocks and increases a country’s default risk during the pandemic. However, in addition to fiscal capacity, country-specific fundamentals such as consumption are also important determinants of sovereign credit risk (Augustin, 2019). Furthermore, regarding the pandemic shock, consumption recovery is important for economic growth (Baker et al., 2020b) and hence one of the focuses of fiscal relief policies (Chetty et al., 2020; Cox et al., 2020). All these results suggest that consumption is important to understand the relationship between the COVID-19 pandemic and sovereign credit risk, while its role during the pandemic is still underexplored. Thus, we complement Augustin et al. (2021) by adding a new explanation of how the COVID-19 pandemic affects sovereign credit risk, which is useful for practitioners and policy-makers to optimize their decisions.

Finally, considering that the pandemic does not break out at the same time across countries, we construct a staggered difference-in-differences (DID) model to address endogeneity issues and use econometric methods developed recently by Borusyak et al. (2021), Callaway and Sant’Anna (2021) and Goodman-Bacon (2021) to address the timing heterogeneity issues of the treatment effect. The staggered DID model is widely used in economic studies, while recent advances in econometric theory question its robustness and develop different modified econometric methods. To our knowledge, our study is one of the early to introduce them in economic studies.

The rest of the paper proceeds as follows. Section 2 reviews the related literature. Section 3 presents our methodology, including the econometric models, the sample construction, the data sources and summary statistics. Section 4 presents the regression results and analyses, and Section 5 concludes.

2. Literature review

In the wake of the COVID-19 pandemic outbreak, a great number of studies have examined its economic effects at both the macrolevel and microlevel in the past one and a half years. This paper only focuses on studies that explore the effects on consumption and financial market risk.

Regarding the effect on consumption, the literature finds that the COVID-19 pandemic causes severe consumption contraction worldwide. Although using different datasets, Baker et al. (2020b), Chetty et al. (2020), and Cox et al. (2020) all find that the overall consumption in the United States during the early stage of the pandemic decreases significantly, and they report several different findings. Chetty et al. (2020) find that the consumption contraction in the early month mainly relates to high-income households and then spreads to low-income households due to the consequent large job losses, while Baker et al. (2020b) and Cox et al. (2020) find that both the consumption contraction and its recovery are more significant for low-income households than for high-income households. Cox et al. (2020) also find that the spending decline is especially significant for nonessential items, namely, restaurants, hotel accommodations, and clothing and department stores. Using transaction data from UnionPay cards and QR scanners, Chen et al. (2021) find that daily offline spending on both goods and services in China declines by more than 40% in the early stage. Likewise, using bank accounts, Andersen et al. (2020) and Kubota et al. (2021) report that household spending falls significantly during the pandemic in Danish and Japan, respectively.

However, the existing literature reports mixed evidence of the effectiveness of fiscal stimulus payments. Regarding the 2020 CARES Act and its follow-on policies in the United States, most studies find that stimulus payments to low-income households are useful to reverse consumption contractions sharply (Baker et al., 2020b; Chetty et al., 2020; Cox et al., 2020; Karger and Rajan, 2021). Kubota et al. (2021) find that spending increases exclusively in the first month after the Japanese government launches a universal cash entitlement program. Liu et al. (2021a) find that the large-scale digital coupon program issued by the

3 Chetty et al. (2020) obtain consumer spending data from Affinity Solutions and CoinOut, small business revenue data from Womply, employment data from Intuit, Earmin, and Kronos, job posting data from Burning Glass, respectively. In contrast, Baker et al. (2020b) and Cox et al. (2020) rely on transaction data from SaverLife and Chase, respectively.

4 Cox et al. (2020) find that consumption expenditure in the United States decreases by more than 35% in the second half of March.
Chinese government effectively stimulates household consumption. However, Chetty et al. (2020) stress that although stimulus payments to low-income households are useful to reverse consumption contraction sharply, only a tiny proportion of the increased spending flows to businesses most affected by the pandemic shock, suggesting that the recovery of overall consumer benefits economic sectors asymmetrically. Karger and Rajan (2021) find that consumer spending falls to normal two weeks after receiving fiscal stimulus payments.

The literature on the effect of the COVID-19 pandemic on financial market risk extensively investigates the stock market's response. First, the literature studies financial factors that amplify or mitigate the effect of the pandemic on stock price volatility at the firm level. Using a sample of 61 economies, Ding et al. (2021) find that the supply chain's exposure to the COVID-19 pandemic and financial conditions (such as cash holdings and corporate debt) are key determinants of stock price reactions. Ramelli and Wagner (2020), focusing on firms in the United States, find that the major concern of the stock market is firms' supply chain exposure in the early stage of the pandemic and then turns to that the major concern of the stock market is firms' supply chain exposure in the early stage of the pandemic and then turns to

Furthermore, Fahlenbrach et al. (2020) find a smaller stock price volatility for firms with less short-term debt in the United States. Xue et al. (2021) find that firms' stock prices in China fall significantly after the COVID-19 pandemic except those in the information technology and health care sectors.

Second, the existing literature examines the market-level and sector-level reactions of the stock market. Focusing on the U.S. case, Baker et al. (2020a) find that the COVID-19 pandemic leads to unprecedented stock market uncertainty compared to other epidemics. Using S&P 500 Index returns, Delis et al. (2021) also document that the pandemic generates a significant negative impact on market return volatility, which is even greater than the global financial crisis. Focusing on the Chinese stock market, Ftiti et al. (2021) find that news about the number of deaths and cases related to COVID-19 leads to an increase in stock market volatility and a decrease in liquidity. In addition, Haddad et al. (2021), Kargar et al. (2021), and O'Hara and Zhou (2021) find that the price and liquidity of corporate bonds decline significantly during the pandemic, and the transaction cost increases as well.

A growing number of studies investigate the response of the financial market to the COVID-19 pandemic by focusing on sovereign and firm credit risks, which are usually measured by CDS spreads. Using the spreads of 5-year sovereign CDS, the existing literature finds that sovereign credit risk is positively correlated with the number of confirmed cases or deaths (Daehler et al., 2021) and the adverse effect is more pronounced in countries with small fiscal capacity and strong relief policies (Augustin et al., 2021) and is stronger before the European Central Bank's intervention (Ortmans and Tripper, 2021). Regarding corporate CDS spreads, the literature also reports an adverse effect of the pandemic, and it is more significant for nonfinancial firms, especially for firms with severe financial constraints, high stock volatility, low credit rating and profitability (Hasan et al., 2021; Liu et al., 2021b). The extant literature also explores the effect of public containment measures on the reaction of sovereign credit risk to the pandemic. For instance, Andrés et al. (2021) find that stringent nonpharmaceutical measures amplify the erosion of sovereign creditworthiness under the pandemic shock.

Taken together, the existing literature has examined the effect of the COVID-19 pandemic in multiple aspects and provides rich evidence and explanations. Although a few studies examine the response of sovereign credit risk, none study how the pandemic shock undermines sovereign credit worthiness, except for Augustin et al. (2021). They argue that limited fiscal capacity impairs resilience to economic shocks and increases a country's default risk during the pandemic. Using data from thirty developed countries, they find that sovereign CDS spreads increase with the growth rate of COVID-19 infections, and the effect is more significant for fiscally constrained countries, suggesting that the pandemic affects sovereign credit risk through the fiscal channel. However, the literature on sovereign credit risk premiums stresses that economic growth and consumption are also important determinants of CDS spreads in addition to fiscal capacity (Augustin, 2018), but both are underexplored. Recently, Baker et al. (2020b), Chetty et al. (2020), Cox et al. (2020) and other studies also find that consumption stabilization is the key to economic recovery from the epidemic. Thus, it is valuable to study the role of consumption in explaining the response of sovereign credit risk to the COVID-19 pandemic shock.

3. Methodology

3.1. Econometric models

To examine the effect of the COVID-19 pandemic on sovereign credit risk, we rely on a general DID model rather than examining the relationship between the number of COVID-19 cases and sovereign credit risk for two reasons. First, the number of COVID-19 confirmed cases highly depends on testing capability and accuracy, especially in the early stage. Second, slowing down the growth of COVID-19 cases may not alleviate the concern about the effect of the COVID-19 pandemic on sovereign credit risk because the effect may still exist but not disappear immediately. Following Beck et al. (2010) and other studies, our general DID model is as follows:

\[ \text{Ln}(\text{Spread}_{i,t}) = \alpha + \beta \text{COVID19}_{i,t} + \gamma X_i + C_i + Q_i + \epsilon_{it} \]  

\[ \text{Ln}(\text{Spread}_{i,j}) = \text{logit of sovereign credit risk, measured by sovereign CDS spreads of country i in week t. Prior studies suggest two major advantages of using sovereign CDS spreads as proxies for sovereign credit risk. First, sovereign CDS spreads reflect sovereign credit risk more adequately since the sovereign CDS market is usually more liquid than the sovereign bond market (Longstaff et al., 2011). Second, CDS spreads on different sovereign entities are comparable due to their consistent maturity, restructuring clauses, and currency denomination. We use the spreads of 6-month (Spread6m), 1-year (Spread1y) and 5-year sovereign CDS (Spread5y) to capture the effect of the COVID-19 pandemic on both short-term and long-term sovereign credit risks. \]

\[ \text{COVID19}_{i,t} \] is a dummy variable that captures whether the COVID-19 pandemic breaks out in country i. Specifically, if country i reports the first confirmed case in week t, COVID19_{i,t} equals 1 in week t and consequent weeks and otherwise 0. The coefficient of COVID19_{i,t}, \( \beta \), the DID estimator, is our focus. If \( \beta \) is positive and significant, the COVID-19 pandemic increases sovereign credit risk and vice versa. As suggested by prior studies, X is a vector of control variables, including local and global factors that affect sovereign CDS spreads (Aizenman et al., 2013; Jeanneret, 2018; Longstaff et al., 2011). Local economic variables include the ratio of quarterly foreign debt to GDP (External debt), quarterly international reserve-to-GDP ratio (Reserve), percentage changes in monthly real exchange index (\( \Delta(\text{Exchange}) \)), monthly CPI change rate (\( \Delta(\text{CPI}) \)), and the logarithm of quarterly GDP (\( \text{Ln}(\text{GDP}) \)). Regarding global factors, we consider the logarithm of weekly volatility of the S&P 500 index (\( \text{Ln}(\text{VIX}) \)) and weekly 5-year U.S. treasury rate (\( \text{Ln}(\text{Treasurer5y}) \)). C_i and Q_i control for country and quarter fixed effects that absorb the unobservable country characteristics and time variation in sovereign CDS spreads, respectively.

Next, to examine the role of consumption, following Ding et al. (2021), we extend the general DID model by including the interaction term of the consumption variable and COVID-19 as follows:

\[ \text{Ln}(\text{Spread}_{i,t}) = \alpha + \beta \text{COVID19}_{i,t} + \theta \text{CONSUM}_{i,t} \times \text{COVID19}_{i,t} + \alpha \text{CONSUM}_{i,t} + \gamma X_i + C_i + Q_i + \epsilon_{it} \]  

where CONSUM_{i,t} is the consumption change of country i in week t. Following previous studies, we measure consumption change in two ways:

5 Nonetheless, in the robustness checks we regress sovereign credit risk on the growth of COVID-19 confirmed cases, and report consistent evidence.
ways. First, we consider the real change in consumption using the year-on-year changes in monthly total retail sales of consumer goods (Retail sales). Second, we use the saving rate in 2019 (Savings) as another proxy for consumption change since savings can function as a cushion for the abrupt income losses associated with the pandemic and hence alleviate the decline in household spending (Baker et al., 2020b; Cox et al., 2020; Kubota et al., 2021). That is, unlike Retail sales, Savings is an indirect measure or expectation of future consumption change. We incorporate the interaction term between CONSUM and COVID-19 into Equation (1) and focus on the coefficient of the interaction term \( \theta \). If \( \theta \) is negative and significant, we can conclude that the consumption contraction amplifies the adverse effect of the COVID-19 pandemic.

Regarding the effectiveness of fiscal stimuli in restraining the adverse effect of the pandemic, we construct a new variable, Income, which is calculated by the weekly average of the income support index released by the Oxford Coronavirus Government Response Tracker (OxCGRT). The value of Income ranges from 0 to 2, with higher values related to more generous income support for unemployed individuals. We incorporate the interaction term of Income and COVID19, Income \times COVID19, into Equation (1) and construct the following extended model:

\[
\ln(\text{Spread}_{it}) = \alpha + \beta \text{COVID19}_{it} + \phi \text{Income}_{it} \times \text{COVID19}_{it} + \gamma X_{it} + C + Q_{t} + \epsilon_{it}.
\]

(3)

In addition to the control variables in X, we also control for the effect of other fiscal policies on debt relief by adding the interaction term of the weekly average of Debt Relief Index obtained from OxCGRT (Relief) and COVID19, namely, Relief \times COVID19 in X. We focus on the coefficient of the interaction term \( \phi \) and expect that income support for unemployed individuals is effective for weathering the pandemic shock if \( \phi \) is significantly negative.

3.2. Sample, data and summary statistics

Our sample consists of all countries and regions with data available from 1 January 2019 to 30 November 2020. We obtain data from multiple sources. First, we obtain the spreads of sovereign CDS from Markit. Markit provides the pricing data of sovereign CDS contracts for which the reference obligation is designated foreign debt of the sovereignty. We use sovereign CDS data denominated in the euro in the robustness checks to ensure that our results are consistent. Second, we obtain the data of both new and total confirmed COVID-19 cases for each country with sovereign CDS data available on the WHO website and the data of macroeconomic factors from the CEIC database and Bank for International Settlements (BIS) database. Finally, we obtain financial market data from the Chicago Board Options Exchange and Federal Reserve Bank and winsorize them at the 1% level on each tail to control for the effect of outliers. Then, after merging the above data and keeping all observations with data available, we construct a sample that covers 40 developing and developed countries. Table 2 reports the sample distribution.

We present summary statistics in Panel A of Table 3. The mean (median) values of 6-month, 1-year, and 5-year sovereign CDS spreads are 0.22% (0.10%), 0.27% (0.11%) and 0.67% (0.43%), with standard deviations of 0.40%, 0.48% and 0.79%, respectively. These statistics suggest an upwards sloping term structure of sovereign CDS spreads. The sample average and median value of COVID-19 are 0.31 and 0, respectively. The mean values of Retail sales, Savings and Income are 0.36%, 24.52% and 0.45, respectively.

Regarding the control variables, the mean values of External debt, Reserve, Δ(Exchange) and Δ(CPI) are 157.72%, 16.34%, −0.07% and 1.93%, respectively. On average, quarterly GDP is 434,992.2 million in U.S. dollars, and the weekly VIX index and the 5-year U.S. treasury rate are 21.08 and 1.46%, respectively. We also report the mean values of sovereign CDS spreads by country in Panel B of Table 3. The statistics show that the spreads with a tenor of six months, one year and five years for Demark are lower than those for any other country, while the spreads for Turkey are the highest regardless of the maturity of CDS contracts.

4. Empirical results

4.1. The effect of the COVID-19 pandemic on sovereign credit risk

4.1.1. Basic results

Table 4 reports the regression results of Equation (1). The coefficients of COVID19 are all positive and statistically significant, at least at the 10% level, suggesting that sovereign credit risk increases significantly after the pandemic outbreak. Regarding economic magnitudes, the spreads of 6-month, 1-year, and 5-year sovereign CDS contracts increase...
The basic regression results of the effect of the COVID-19 pandemic outbreak on sovereign credit risk are presented in Table 3. The logarithms of weekly spreads of 6-month, 1-year, and 5-year sovereign CDS, respectively, are the logarithms of spreads. The results show that the spread of COVID-19 equals one for observations after the COVID-19 pandemic spreads to a country. See definitions of other variables in Table 1. The t-statistics inferred by robust standard errors are reported in parentheses. ***, ** and * stand for the significance at the 1%, 5%, and 10% levels, respectively.

### Table 3
Summary statistics.

| Variable | Observations | Min | Mean | median | Max | Std. Dev. |
|----------|--------------|-----|------|--------|-----|-----------|
| Spread (%) | 3926 | 0.01 | 0.22 | 0.10 | 2.90 | 0.40 |
| Spread1y (%) | 3926 | 0.01 | 0.27 | 0.11 | 3.29 | 0.48 |
| Spread5y (%) | 3926 | 0.07 | 0.67 | 0.43 | 4.36 | 0.79 |
| COVID19 | 3926 | 0.00 | 0.31 | 0.00 | 1.00 | 0.46 |
| Retail sales (%) | 3802 | -47.96 | 0.36 | -1.82 | 23.46 | 8.30 |
| Savings (%) | 3926 | 9.89 | 24.52 | 25.30 | 44.18 | 7.19 |
| Income | 3926 | 0.00 | 0.45 | 0.00 | 2.00 | 0.76 |
| External debt (%) | 3926 | 0.09 | 157.72 | 99.43 | 885.01 | 175.14 |
| Reserve (%) | 3926 | 0.53 | 16.34 | 10.57 | 134.63 | 20.54 |
| Δ(Exchange) (%) | 3926 | -15.11 | -0.07 | -0.02 | 7.06 | 1.76 |
| Δ(CPI) (%) | 3926 | -3.44 | 1.93 | 1.54 | 20.35 | 2.52 |
| GDP (million dollars) | 3926 | 5346.47 | 434,992.20 | 105,786.40 | 5,517,583.00 | 969,381.80 |
| VIX | 3926 | 11.97 | 21.08 | 16.25 | 67.55 | 11.26 |

### Table 4
Basic regression results of the effect of the COVID-19 pandemic outbreak on sovereign credit risk.

| Variables | Ln (Spread1y) | Ln (Spread5y) |
|-----------|---------------|---------------|
| COVID19   | 0.135***      | 0.003***      |
| External debt | -0.003***    | -0.003***     |
| Reserve   | -0.027***     | -0.026***     |
| Δ(Exchange) | -0.015***    | -0.012***     |
| Δ(CPI)    | 0.046***      | 0.031***      |
| Ln (GDP)  | -0.663***     | -0.605***     |
| Ln (VIX)  | 0.526***      | 0.505***      |
| Ln (Treasury) | -0.037        | -0.021        |
| Constant  | 5.020***      | 4.584***      |
| Country/Quarter FE | Yes          | Yes           |
| Observations | 3926         | 3926          |
| R²        | 0.388         | 0.392         |

Notes: Ln (Spread1y) and Ln (Spread5y) are the logarithms of weekly spreads of 6-month, 1-year, and 5-year sovereign CDS, respectively. COVID19 equals one for observations after the COVID-19 pandemic spreads to a country. See definitions of other variables in Table 1. The t-statistics inferred by robust standard errors are reported in parentheses. ***, ** and * stand for the significance at the 1%, 5%, and 10% levels, respectively.

by an average of 13.5%, 8.7% and 4.2%, respectively, after the outbreak of the new coronavirus disease. Furthermore, these results also show that the adverse effect of the pandemic shock is more pronounced for short-term credit risk than for long-term credit risk, suggesting that the market is more concerned about sovereign credit risk deterioration in the short run. This is consistent with Augustin (2018), who predicts that the negative country-specific shock affects credit risk more for the short term and less for the long term.

In addition, most regression results of our control variable are consistent with prior studies (Aizenman et al., 2013; Jeanneret, 2018). For instance, sovereign credit risk is lower for a country with more international reserves, higher GDP, and lower currency depreciation and inflation.

4.1.2. The effect of timing heterogeneity

It is worth noting that the general DID model we construct is staggered since the date of the first confirmed case varies across countries. Recent econometric theories point out that timing heterogeneity may bias the two-way fixed effect estimate of the DID model (Borisyuk et al., 2021; Callaway and Sant’Anna, 2021; Goodman-Bacon, 2021). Thus, it is necessary to address whether and how our estimates of the general DID model are biased. We introduce three new methods developed by recent literature, while their common requirement on balanced panel data results in excluding three countries from the sample. We also focus on a DID model without control variables because the conclusion remains unchanged even when incorporating control variables into the model (Callaway and Sant’Anna, 2021).

First, we use Goodman-Bacon (2021) diagnostic to decompose the aggregate estimate into two components, i.e., the portion related to the
Comparison between countries early reporting COVID-19 cases and control countries later reporting COVID-19 cases and the portion related to the comparison between countries later reporting COVID-19 cases and control countries early reporting COVID-19 cases. Panel A of Table 5 reports the decomposition for three spreads. In Panel A1, the comparison between countries early reporting COVID-19 cases and control countries later reporting COVID-19 cases suggests that sovereign CDS spreads increase significantly along with the COVID-19 pandemic outbreak, namely, the sovereign credit risk increases, and this treatment effect accounts for 69%. In contrast, the comparison between countries later reporting COVID-19 cases and control countries early reporting COVID-19 cases suggests that sovereign CDS spreads decrease significantly. Since the later observations account for 31%, they finally underestimate the aggregate estimate. The biases for short-term spreads in Panel A2 and Panel A3 of Table 5 are the opposite. Nonetheless, regardless of the direction and the degree of potential biases from timing heterogeneity, the aggregate estimate presents a consistent relationship between the COVID-19 pandemic and sovereign CDS spreads, i.e., sovereign CDS spreads increase after the COVID-19 pandemic outbreak.

Second, we follow Callaway and Sant’Anna (2021) to calculate an overall group-time average treatment effect to correct for potential biases. Initially, we divide the sample countries into different groups based on whether a country reports the first COVID-19 case. Then, we calculate the average treatment effect for each group. Finally, we average the treatment effects of all groups with the weight of group size to obtain the overall group-time average treatment effect. In Panel B of Table 5, the Callaway and Sant’Anna estimates of the overall group-time average treatment effect are 0.12, 0.19 and 0.17 for long-term and short-term CDS spreads, respectively. These results further suggest that the two-way fixed effect estimates of the DID model are systematically underestimated, but our conclusions from Table 4 remain unchanged.

Third, we conduct an event study DID with a window of 21 weeks, i.e., starting from 10 weeks prior to the week when the first COVID-19 case is reported and ending 10 weeks after that. Following Callaway and Sant’Anna (2021), the econometric model is as follows:

\[ \text{Ln(Spread}_i) = \alpha + \sum_{i=-10}^{10} \beta_i D_{it} + \sum_{i=0}^{10} \beta_i D_{it} + C_i + \Omega_i + \varepsilon_{it} \]  

where \( w \) is the relative week, and \( D^+ \) are dummy variables equal to one for observations in the \( w \)th week. To avoid multicollinearity, \( D^-1 \) is excluded. The Callaway and Sant’Anna (2021) estimators are plotted in Panels A, B, and C of Fig. 1 for long-term and short-term sovereign CDS spreads, respectively. The coefficients of dummy variables before the first COVID-19 case is reported are all close to zero and statistically insignificant, suggesting that the parallel trend assumption holds. In contrast, the coefficients of dummy variables after the COVID-19 pandemic outbreak grow fast and become statistically significant eight weeks later, suggesting a prominent posttreatment change in sovereign CDS spreads. On average, sovereign CDS spreads increase by at least 29% for short-term credit risk and by 54% for long-term credit risk. Even for those insignificant coefficients, their standard errors notably increase, presenting a different pattern after the COVID-19 pandemic outbreak.

Borusyak et al. (2021) argue that Callaway and Sant’Anna (2021) and other recently developed methods do not separate testing of the assumptions about pre-trends from the estimation of dynamic treatment effects under those assumptions and hence cause lower estimation efficiency and higher pretesting bias. Following their method, we further calculate Borusyak et al. ‘s (2021) estimators and plot the coefficients in Panels D, E, and F in Fig. 1 for long-term and short-term sovereign CDS spreads. The pre-trend coefficients seem to be greater than the Callaway and Sant’Anna (2021) estimators, while they are all statistically insignificant, suggesting that the parallel trend assumption holds. The post-treatment coefficients are greater than the Callaway and Sant’Anna (2021) estimators and statistically significant, with the highest increase of over 65%. All these results provide consistent evidence of the treatment effect of the COVID-19 pandemic outbreak on sovereign credit risk. Furthermore, the increasing posttreatment coefficients also show that the treatment effects grow over time. In sum, the event study DID analyses demonstrate that the parallel trend assumption is effective, and the treatment effects are significant and grow over time.

4.1.3. Further robustness checks

We conduct six additional robustness checks. First, we examine whether the effect is different between developing and developed countries. Panel A and Panel B of Table 6 report the regression results for developed and developing countries, respectively. In Panel A, the results for developed countries are very similar to those for the whole sample in Table 4. In Panel B, most coefficients of COVID19 are significant, and their values are also close to those in Table 4. It seems that the COVID19 coefficients for developed countries are greater than those for developing countries, while the \( \chi^2 \) statistics are 0.32, 0.94 and 0.21, respectively, suggesting that there is no systemic difference between the adverse effects for these countries.

Second, we use two alternative proxies for sovereign credit risk. One is the spreads of sovereign CDS contracts denominated in the euro, and the other is the change in spreads of sovereign CDS contracts denominated in the United States dollar. Panel A and Panel B of Table 7 report the regression results of the two alternative proxies. The results show that almost all coefficients of COVID19 are significantly positive, suggesting that our main results are robust.

Third, we employ three groups of alternative proxies for the COVID-19 pandemic shock. Following Augustin et al. (2021) and other studies, we first replace COVID19, the dummy variable, with the logarithm of the number of new COVID-19 confirmed cases (NumCases) plus one. Next, we use the weekly average of the Stringency Index (Stringency) released by OxfGRIT as the second alternative proxy. Stringency ranges from 0 to 100, with higher values related to stricter travel restriction measures in

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6 More details see Callaway and Sant’Anna (2021).

7 We thank an anonymous reviewer for the valuable suggestions.
Fig. 1. Event study DID of COVID-19 pandemic on long-term and short-term sovereign credit risk. Plots in Panel A, B and C are based on Callaway and Sant’Anna (2021) (CS) estimators with a simultaneous confidence interval at the 95% level, while plots in Panel D, E and F are based on Borusyak et al. (2021) (BJS) estimators with a point confidence interval at the 95% level. The vertical axis presents the CS and BJS coefficients, and the horizontal axis presents the relative weeks.
response to the COVID-19 pandemic. Finally, using the weekly averages of Google mobility trend data, we construct six additional variables: Residential, Workplace, Transit, Outdoor, Grocery, and Retail. These represent the changes in the number of visitors to residential areas, workplaces, transit stations, parks and outdoor spaces, grocery and pharmacy stores, and places of retail and recreation, compared to the number of visitors before the pandemic, respectively. Residential is positively associated with the intensity of the pandemic shock, while the other five variables are negatively associated. The regression results in Table 8 show that the coefficients of Num_Cases, Stringency and Residential are positive, and the coefficients of Workplace, Transit, Outdoor, Grocery and Retail are negative, all more statistically significant and with absolute values decreasing over maturities.

Fourth, we investigate the potential impact of the sovereign CDS contract liquidity. Since detailed sovereign CDS volume data are not available, we use changes in sovereign CDS spreads as the dependent variable. The results in Table 7 show that the proportion varies little across maturities, the statistics show that the proportion decreases over maturities.

We thank an anonymous reviewer for the valuable suggestions. Besides results in Table 9, we also collect the data of all sovereign CDS contracts during the sample period from Markit, and summarize the distribution of their maturities. The statistics show that the proportion varies little across maturities, providing supplemental evidence to save space, we do not report the statistics.

### Table 6
The robustness check on the effect of developed and developing countries.

| Variables | Panel A: Developed countries | Panel B: Developing countries |
|-----------|-------------------------------|-------------------------------|
|           | Ln (Spread6m) | Ln (Spread1y) | Ln (Spread5y) | Ln (Spread6m) | Ln (Spread1y) | Ln (Spread5y) |
| COVID19   | 0.144*** (3.498) | 0.101*** (2.640) | 0.053* (1.867) | 0.121* (1.849) | 0.064* (1.035) | 0.066* (1.005) |
| External debt | -0.003*** (-3.984) | -0.003*** (-3.252) | -0.001*** (-2.711) | -0.010*** (-4.838) | -0.009*** (-4.766) | -0.003*** (-2.584) |
| Reserve | -0.010 (-1.088) | -0.003 (-1.272) | 0.018*** (3.483) | -0.034*** (-3.965) | -0.024** (-2.383) | -0.031*** (-4.569) |
| Δ(CPI) | 0.041** (-2.729) | 0.055*** (3.823) | 0.052*** (2.718) | 0.020*** (5.294) | 0.096*** (4.264) | 0.005*** (3.995) |
| Δ(Exchange) | 0.030*** (3.662) | 0.029*** (3.632) | 0.031*** (3.227) | -0.001*** (-2.783) | -0.010** (-2.268) | -0.005* (-1.786) |
| Ln(GDP) | 0.0288 (1.316) | 0.0502*** (2.282) | 0.0484*** (3.955) | -0.010 (5.014) | -0.0086 (5.073) | -0.0466*** (5.631) |
| Ln(Treasure5y) | 0.312*** (6.040) | 0.318*** (6.450) | 0.160*** (5.392) | 0.471*** (6.041) | 0.410*** (5.696) | 0.200*** (4.713) |
| Constant | -5.175** (-1.974) | -7.801*** (-2.974) | -6.626*** (-4.503) | -0.191 (0.095) | 0.011 (0.006) | 6.609*** (6.598) |
| Country/Quarter FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2195 | 2195 | 2195 | 1288 | 1288 | 1288 |
| R² | 0.352 | 0.567 | 0.431 | 0.457 | 0.455 | 0.471 |

Notes: Ln (Spread6m), Ln (Spread1y) and Ln (Spread5y) are the logarithms of weekly spreads of 6-month, 1-year, and 5-year sovereign CDS, respectively. COVID19 equals one for observations after the COVID-19 pandemic spreads to a country. See definitions of other variables in Table 1 t-statistics inferred by robust standard errors are reported in parentheses. *** and * stand for the significance at the 1%, 5%, and 10% levels, respectively.

### Table 7
The robustness check on alternative proxies for sovereign CDS spreads.

| Variables | Panel A: Using spreads of sovereign CDS contracts denominated in the euro as the dependent variable | Panel B: Using changes in sovereign CDS spreads as the dependent variable |
|-----------|--------------------------------------------------|--------------------------------------------------|
|           | Ln (Spread6m) | Ln (Spread1y) | Ln (Spread5y) | Δ(Spread6m) | Δ(Spread1y) | Δ(Spread5y) |
| COVID19   | 0.127*** (3.183) | 0.069* (1.811) | 0.014 (0.559) | 3.564* (1.828) | 4.082** (2.405) | 2.613*** (3.132) |
| External debt | -0.002*** (-3.041) | -0.003*** (-3.530) | -0.003*** (-4.368) | 0.021 (0.584) | 0.010* (0.279) | 0.015 (1.101) |
| Reserve | -0.035*** (-7.926) | -0.028*** (-7.019) | -0.013*** (-6.054) | 0.476 (1.314) | 0.215 (0.646) | 0.134 (0.949) |
| Δ(CPI) | -0.012*** (-2.615) | -0.012*** (-2.935) | -0.007*** (-2.779) | -0.078 (0.116) | -0.052* (0.040) | -0.018 (0.053) |
| Δ(Exchange) | 0.053*** (5.742) | 0.034*** (4.188) | 0.009* (1.819) | -0.766** (-2.516) | -0.785*** (-2.650) | -0.399*** (-2.253) |
| Ln (GDP) | -0.392*** (-2.979) | -0.503*** (-6.915) | -0.469*** (-6.915) | 3.520 (0.672) | 1.390 (0.988) | 1.392 (0.561) |
| Ln (Treasure5y) | 0.548*** (11.898) | 0.539*** (13.030) | 0.339*** (12.490) | 25.482** (9.182) | 23.671*** (9.119) | 13.398*** (9.837) |
| Constant | 1.692 (1.104) | 2.035** (2.420) | 4.307*** (5.464) | 17.341*** (4.265) | 17.287*** (4.560) | 8.328*** (3.969) |
| Country/Quarter FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 3364 | 3364 | 3364 | 3414 | 3414 | 3413 |
| R² | 0.921 | 0.941 | 0.969 | 0.161 | 0.164 | 0.224 |

Notes: Ln (Spread6m), Ln (Spread1y) and Ln (Spread5y) are the logarithms of weekly spreads of 6-month, 1-year, and 5-year sovereign CDS, respectively. Δ(Spread6m), Δ(Spread1y) and Δ(Spread5y) are the percentage changes in weekly spreads on 6-month, 1-year, and 5-year sovereign CDS, respectively. COVID19 equals one for observations after the COVID-19 pandemic spreads to a country. See definitions of other variables in Table 1 t-statistics inferred by robust standard errors are reported in parentheses. *** and * stand for the significance at the 1%, 5%, and 10% levels, respectively.
available publicly, we rely on Pan and Singleton (2008) who show that liquidity distribution varies across CDS contracts for different maturities. They find that sovereign CDS contracts at maturity points between 1 and 10 years are all traded actively, while the trading of non-sovereign CDS contracts on a 5-year contract. The more even distribution of sovereign CDS contracts suggests that its potential impact is less likely to change our main findings. Nonetheless, we further provide additional regression results of 3-year and 10-year sovereign CDS contracts. The results in Table 9 show that the coefficients of COVID19 for 3-year and 10-year sovereign CDS spreads are significantly positive and greater for short-term contracts, suggesting that our results are robust.

Fifth, the COVID-19 pandemic may increase firms’ liquidity and credit risks, especially those in industries exposed to the shock, thereby exacerbating sovereign credit risk. This indicates that the impact of the COVID-19 pandemic may vary in countries with different liquidity risks and credit risks. To capture the differential impacts, we compare the regression results of subsamples based on different risk measures. First, we use the ratio of current liabilities to total liabilities, and Altman Z score in 2019 at the country level to measure liquidity risk and credit risk before the pandemic, respectively. Second, we use the proportion of the GDP share in 2019 at the country level to measure liquidity risk and credit risk. To capture the differential impacts, we compare the regression results of subsamples after the COVID-19 pandemic spreads to a country. See definitions of other variables in Table 1 t-statistics inferred by robust standard errors are reported in parentheses. ***, ** and * stand for the significance at the 1%, 5%, and 10% levels, respectively. To save space, results of control variables and statistics are not reported.

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Table 9
The regression results of 3-year and 10-year sovereign CDS spreads.

| Variables       | Ln (Spread3y) | Ln (Spread10y) |
|-----------------|---------------|----------------|
| COVID19         | 0.052***      | 0.045**        |
| External debt   | –0.002***     | –0.002***      |
| Reserve         | –0.069***     | –0.013***      |
| Δ(Exchange)     | –0.011***     | –0.006***      |
| Δ(CPI)          | –0.007        | –0.000         |
| Ln (GDP)        | –0.668***     | –0.423**       |
| Ln (Treasury5y) | –0.052        | –0.007         |
| Constant        | 6.606***      | 4.656***       |
| Observations    | 3926          | 3960           |
| R²              | 0.479         | 0.401          |

Notes: Ln (Spread3y) and Ln (Spread10y) are the logarithms of weekly spreads of 3-year and 10-year sovereign CDS contracts. COVID19 is the weekly average of Stringency Index released by Oxford. Stringency is the weekly average of Stringency Index released by OxCGRT. Stringency is the weekly average of Stringency Index released by Oxford. Stringency is the number of weekly new COVID-19 cases for each country. Num_Cases is the number of weekly new COVID-19 cases for each country. They are the weekly averages of the changes in the number of visitors to residential areas, workplaces, transit stations, parks and outdoor spaces, grocery and pharmacy stores, and places of retail and recreation compared to the number of visitors before the outbreak of the pandemic, respectively. COVID19 is replaced with one of the alternative proxies each time. See definitions of other variables in Table 1 t-statistics inferred by robust standard errors are reported in parentheses. ***, ** and * stand for the significance at the 1%, 5%, and 10% levels, respectively. To save space, results of control variables and statistics are not reported.

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|-----------------|---------------|----------------|
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| External debt   | –0.002***     | –0.002***      |
| Reserve         | –0.069***     | –0.013***      |
| Δ(Exchange)     | –0.011***     | –0.006***      |
| Δ(CPI)          | –0.007        | –0.000         |
| Ln (GDP)        | –0.668***     | –0.423**       |
| Ln (Treasury5y) | –0.052        | –0.007         |
| Constant        | 6.606***      | 4.656***       |
| Observations    | 3926          | 3960           |
| R²              | 0.479         | 0.401          |

Notes: Ln (Spread3y) and Ln (Spread10y) are the logarithms of weekly spreads of 3-year and 10-year sovereign CDS contracts. COVID19 is the weekly average of Stringency Index released by Oxford. Stringency is the weekly average of Stringency Index released by OxCGRT. Stringency is the number of weekly new COVID-19 cases for each country. Num_Cases is the number of weekly new COVID-19 cases for each country. They are the weekly averages of the changes in the number of visitors to residential areas, workplaces, transit stations, parks and outdoor spaces, grocery and pharmacy stores, and places of retail and recreation compared to the number of visitors before the outbreak of the pandemic, respectively. COVID19 is replaced with one of the alternative proxies each time. See definitions of other variables in Table 1 t-statistics inferred by robust standard errors are reported in parentheses. ***, ** and * stand for the significance at the 1%, 5%, and 10% levels, respectively.

results in Table 10 show that the COVID-19 pandemic has led to a larger increase in sovereign CDS spreads for high-risk-exposure countries than for other countries. That is, liquidity and credit risks, especially of specific industries, play an important role in pushing the increase of sovereign credit risk after the pandemic outbreak.

Sixth, the standard errors of CDS spreads may be correlated because many countries are affected, either directly or through the negative spillover due to the interconnectedness of the economies. To control for the potential correlation, we adjust for t-statistics by clustering standard errors by group. Countries are divided into six groups, namely, Africa, Asia, Europe, the Middle East, North America, and South America, since countries geographically close are usually in the same trading block or share close economic relationships. The results in Table 11 show that the coefficients of COVID19 are all positive and significant at least at the 10% level, suggesting that our results remain unchanged.

4.2. Analyses on the role of consumption

Panel A of Table 12 reports the estimation results of Equation (2). In Columns (1) to (3), the coefficients of Retail sales × COVID19 are all statistically negative, suggesting that when retail sales do not contract, namely, Retail sales is zero, the spreads of sovereign CDS on average increase by 11.7%, 7.4% and 3.7% for Spread0, Spread1y and Spread5y, respectively. In contrast, when retail sales contract most, namely, Retail sales is –47.9%, the spreads of sovereign CDS on average increase by 23.95%, 23.95% and 38.32% for Spread0, Spread1y and Spread5y, respectively. These results mean that, on average, the increase in sovereign CDS spreads in the worst case is two to ten times the increase without consumption contraction. In Columns (4) to (6) of Panel B, given that savings rates at the country level are predetermined, Savings is dropped in a country-fixed effect model due to multicollinearity. The results show that sovereign CDS spreads increase more for countries with lower savings rates during the pandemic. To address the risk of spurious correlation by including the interaction term, we further conduct regressions by group. We define countries in the top quartile of Retail sales or Savings as countries suffering small consumption shocks and others suffering big consumption shocks. The results in Panel B show that the adverse effect of the pandemic is more significant in countries with large

We thank an anonymous reviewer for the valuable suggestions on liquidity and credit risks as well as standard errors correction.
Table 10: The regression results of countries with different risks.

| Variables | Countries with low-risk-exposure before the pandemic | Countries with high-risk-exposure before the pandemic |
|-----------|-----------------------------------------------------|-----------------------------------------------------|
|           | Ln (Spread6m) | Ln (Spread1y) | Ln (Spread5y) | Ln (Spread6m) | Ln (Spread1y) | Ln (Spread5y) |
| Solar     |             |             |             |             |             |             |
| COVID19   | 0.078**     | 0.051       | 0.060*      | 0.530***    | 0.372***    | 0.133***     |
|           | (1.798)     | (1.221)     | (1.912)     | (6.665)     | (5.724)     | (3.802)      |
| Panel B: Credit risk measured by Altman Z-score in 2019 |             |             |             |             |             |             |
| COVID19   | 0.117***    | 0.072*      | 0.039       | 0.214***    | 0.165**     | 0.076*       |
|           | (2.862)     | (1.842)     | (1.983)     | (2.720)     | (2.337)     | (1.782)      |
| Panel C: Risk measured by the proportion of the output of industries exposed to the pandemic |             |             |             |             |             |             |
| COVID19   | 0.105**     | 0.042       | 0.017       | 0.208***    | 0.190***    | 0.144***     |
|           | (2.463)     | (1.050)     | (0.640)     | (3.068)     | (2.866)     | (3.015)      |

Notes: Ln (Spread6m), Ln (Spread1y) and Ln (Spread5y) are the logarithms of weekly spreads of 6-month, 1-year, and 5-year sovereign CDS, respectively. COVID19 equals one for observations after the COVID-19 pandemic spreads to a country. See definitions of other variables in Table 1. Countries with low risk exposure and countries with high risk exposure are defined based on the ratio of current liabilities to total liabilities, Altman Z-score and the proportion of the output of hotel, accommodation, and transportation industries to the GDP in 2019, respectively. t-statistics inferred by robust standard errors are reported in parentheses. ***, ** and * stand for the significance at the 1%, 5%, and 10% levels, respectively. To save space, results of control variables and statistics are not reported.

4.3. The effectiveness of fiscal stimuli related to consumption recovery

In this section, we investigate whether fiscal stimuli aimed at consumption recovery, namely, income support for unemployed individuals, can mitigate the adverse effect of the pandemic on sovereign credit risk. Panel A of Table 13 reports the regression results of Equation (2). The coefficients of COVID19 are still statistically positive, and the coefficients of the interaction term Income × COVID19 are significant and negative at the 1% level regardless of what sovereign CDS spread is used, suggesting that fiscal stimuli alleviate the adverse effect of the pandemic shock. In addition, we also find the coefficients of the interaction term Relief × COVID19 are all positive, suggesting that debt relief package exacerbates rather than mitigates the adverse effect, in particular for long-term sovereign CDS spreads. Likewise, we also address the risk of spurious correlation by conducting regressions by group. We first calculate the sample average of Income for each country. Then, we define countries in the top quartile of income support as high coverage countries and others as low coverage countries. The results in Panel B of Table 13 suggest that countries offering more generous income support for unemployed individuals suffer less from the erosion of sovereign creditworthiness, suggesting that our results remain unchanged.

We further identify whether the relief on income losses eases the pandemic-induced erosion of sovereign creditworthiness by stabilizing consumption shocks, suggesting that our results are robust.

However, the findings above have to exclude alternative channels through which the pandemic shock affects sovereign credit risk. On the one hand, Augustin et al. (2021) propose a fiscal channel and argue that sovereign CDS spreads are more sensitive to COVID-19 cases for financially constrained governments. On the other hand, given that trade volatility is one of the important determinants of sovereign credit risk (Hilscher and Nosbusch, 2010), the COVID-19 pandemic inevitably damages international trade and may affect sovereign CDS spreads through the trade channel. To exclude these two potential explanations, we construct two new variables. One is Fisconstraint, measured by the difference between revenues and expenditures as a percentage of GDP of a given country in 2019, namely, the fiscal balance. Generally, Fisconstraint is negatively associated with financial constraints. The other is Export, measured by the percentage changes in monthly exports. Then, we incorporate them and the interaction term between them and COVID19 into Equation (2). Likewise, since Fisconstraint is also predetermined during the sample period, the estimation is also dropped.
consumer spending. Generally, the relief on income losses is greater, and the consumption contraction is less. Thus, if consumption matters, the marginal effect of consumption contraction on sovereign CDS spreads is weaker for countries with more generous coverage on income losses.

Table 14 reports the regression results of two subsamples using Retail sales and Savings as proxies for the consumption change, respectively. Overall, the results in Table 14 show that income support for unemployed individuals better mitigates the adverse effect in countries with lower coverage of income support than in other countries.

5. Conclusion

This paper studies the effect of the COVID-19 pandemic on sovereign credit risk measured by sovereign CDS spreads, and examines whether the COVID-19 pandemic affects sovereign credit risk through the consumption channel. Using data from forty developing and developed countries and constructing staggered DID models, we find that the COVID-19 pandemic shock leads to a significant rise in sovereign credit risk. Averagely, after the report of the first confirmed case, 6-month, 1-year, and 5-year sovereign CDS spreads rise by 0.005***, 0.004**, and 0.005***, respectively. To save space, results of control variables and statistics are not reported.

Table 12
Analyses on the role of consumption and alternative explanations.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------|-----|-----|-----|-----|-----|-----|
| Ln (Spread6m) | | | | | | |
| COVID19 | 0.137*** | 0.074** | 0.037 | 0.211*** | 0.185*** | 0.156*** |
| Retail sales × COVID19 | –0.005* | –0.005* | –0.008*** | –0.002* | –0.004** | –0.005*** |
| Savings × COVID19 | | | | | | |
| Panel A: Tests of the role of consumption | | | | | | |
| Panel B: Regression results by group | | | | | | |
| Countries with big consumption shock | Countries with small consumption shock | | | | | |
| Panel C: Tests of alternative explanations: the fiscal capacity and the trade volatility | | | | | | |
| COVID19 | 0.016*** | 0.064* | 0.175*** | 0.070* | 0.005** | 0.173* |
| Retail sales × COVID19 | –0.005* | –0.005** | –0.009*** | –0.003* | –0.003** | –0.003*** |
| Savings × COVID19 | | | | | | |
| Fiscal constraint × COVID19 | –0.008 | –0.008 | –0.017*** | –0.017*** | –0.017*** | –0.017*** |
| Export × COVID19 | –0.001 | –0.001 | –0.001* | –0.001 | –0.001 | –0.001*** |

Notes: Ln (Spread6m), Ln (Spread1y) and Ln (Spread5y) are the logarithms of weekly spreads of 6-month, 1-year, and 5-year sovereign CDS, respectively. COVID19 equals one for observations after the COVID-19 pandemic spreads to a country. Retail sales is calculated by the monthly growth rate of social retail sales. Savings is the saving rate in 2019 for each country. Fiscal constraint equals fiscal surplus/GDP in 2019 for each country. Export is the percentage changes in monthly exports. See definitions of other variables in Table 1. Countries in the top quartile of Retail sales or Savings are countries with small consumption shock and others are countries with big consumption shock. t-statistics inferred by robust standard errors are reported in parentheses. *** and * stand for the significance at the 1%, 5%, and 10% levels, respectively. To save space, results of control variables and statistics are not reported.

Table 13
Analyses on the role of income support policy in mitigating the adverse effect of the COVID-19 pandemic.

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------|-----|-----|-----|-----|-----|-----|
| Ln (Spread6m) | | | | | | |
| COVID19 | 0.246*** | 0.196*** | 0.110*** | 0.024 | 0.079*** | 0.025 |
| Income × COVID19 | –0.263*** | –0.250*** | –0.214*** | (5.468) | (5.608) | (6.692) |
| Relief × COVID19 | 0.030 | 0.021 | 0.079*** | (0.692) | (0.551) | (2.847) |
| Panel A: Analyses on the role of income support policy | | | | | | |
| Panel B: Regression results of income support policy by group | | | | | | |
| Low cover | High cover | Low cover | High cover | Low cover | High cover |
| COVID19 | 0.204*** | 0.015 | 0.139*** | –0.025 | 0.080*** | –0.024 |

Notes: Ln (Spread6m), Ln (Spread1y) and Ln (Spread5y) are the logarithms of weekly spreads of 6-month, 1-year, and 5-year sovereign CDS, respectively. COVID19 equals one for observations after the COVID-19 pandemic spreads to a country. Income and Relief range from 0 to 2, with higher value representing for more generous income support and debt relief, respectively. See definitions of other variables in Table 1. Countries in the top quartile of Income or Relief are high coverage countries and others are low coverage countries. t-statistics inferred by robust standard errors are reported in parentheses. *** and * stand for the significance at the 1%, 5%, and 10% levels, respectively. To save space, results of control variables and statistics are not reported.
year and 5-year CDS spreads increase by 13.5%, 8.7% and 4.2%, respectively, presenting a descending trend over maturities of sovereign CDS contracts. Further analyses show that the sovereign credit risk rises more if a country suffers greater negative growth of retail sales during the pandemic or has a lower aggregate savings rate before the pandemic outbreak. These results show that the consumption contraction is important to explain the effect of the COVID-19 pandemic in addition to the fiscal capacity and the volatility of exports. We also find that the adverse effect is less significant for countries with high coverage of income support for the unemployed, and hence add new evidence of the effectiveness of consumption-stabilized fiscal stimuli.

Our results demonstrate that the pandemic-induced macroeconomic shock significantly damages a country’s creditworthiness through the consumption contraction. It implies that the aggregate consumption recovery plays a crucial role in weathering the crisis associated with the COVID-19 pandemic. Furthermore, the increase of sovereign CDS spreads is more likely to push up the borrowing cost in the international financial markets, and thereby damage the financing capacity of a country. In addition, the fiscal stimulus policy is a double-edged sword, and its impact on sovereign credit risk is complicated. Fiscal stimuli may increase sovereign credit risk by adding more debt burden, but those related to income support for the unemployed may alleviate the adverse effect of the COVID-19 pandemic because they accelerate the recovery of consumer spending. Overall, practitioners and policy makers should realize the complexity of the effect of the COVID-19 pandemic when optimizing their decisions.

Declaration of conflicting interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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