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International taxation sentiment and COVID-19 crisis

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ABSTRACT

Investigating public sentiment regarding tax policy during the COVID-19 pandemic could be useful for understanding the experiences across societies. Using Linguistic Inquiry and Word Count to investigate and quantitatively measure the pandemic’s effect—from January 25 to April 9, 2020—on the sentiment regarding possible tax policies throughout the world, thereby determining that, overall, taxation sentiment is reduced as the number of confirmed COVID-19 cases grows. Further investigation reveals that, as COVID-19 spreads, the sentiment for raising taxes decreases and that for reducing taxes increases, and this effect is mitigated by countries’ democracy. We further find that news sentiment in unofficial media and in countries with low social trust is more significantly affected by COVID-19. Robustness tests performed using different subsamples of developed and developing countries and different pandemic circumstances validate our findings. This research has crucial implications for policy evaluation and development.

1. Introduction

The outbreak of the novel coronavirus 2019 (COVID-19) had an unprecedented influence on the daily lives of people worldwide. COVID-19 is said to be the most severe pandemic in the past 100 years and the first infectious disease outbreak that has forcefully impacted the stock market (Baker et al., 2020). To slow the rapid spread of COVID-19, numerous countries and regions have implemented a series of administrative restrictions, such as lockdowns, social distancing, closure of public places, and study or work at home. The monetary fallout from these administrative restrictions is enormous. In response to the negative impact of COVID-19 on the economy, from the beginning of the outbreak, countries have introduced tax relief policies. According to OECD data updated on July 31, 2020, 62 countries adopted tax policies for personal income taxes, 82 countries adopted tax policies for corporate income taxes, 45 countries adjusted social insurance tax policies, 26 countries adopted measures for property taxes, 72 countries adopted measures for value added taxes (VATs), 35 countries adopted measures for other consumption taxes, and 74 countries adopted measures for tax administration.

The opportunity costs of the governments’ needed massive spending in response to the pandemic are significant forgone future benefits (Karnon, 2020). Moreover, governments must balance budget deficits as well as possible; thus, raising taxes during the pandemic may be a logical policy option (Craig and Hines, 2020) for two reasons. First, the disutility of taxation during COVID-19 is
reduced compared to the disutility of taxation in normal times due to the public health-related constraints on individuals’ consumption ability and economic activity during the pandemic. Second, the economic impact of COVID-19 is primarily felt by low-income groups, further exacerbating inequality and social differentiation. However, COVID-19 also provides an opportunity for governments to reduce social divisions through taxation. Such taxation could be temporary and withdrawn after restoration.

Prominent discussions regarding potential tax measures to help control the COVID-19 pandemic and reduce the economic fallout continue in the media, and they convey different thoughts and opinions, such as “Coronavirus pandemic, rescue bills wreak havoc on already growing federal deficit” from correiodopovo.com.br; “Guest opinion: Tax reform – Myths, misunderstandings and falsehoods” from utahpolicy.com; “Build a new model of foreign trade development with the help of ‘Internet Plus’” from sina.com.cn; and “In 2019, the scale of Shanghai’s tax refunds reached 10.7 billion yuan” from sina.com.cn.

The COVID-19 pandemic is a very rare global event that has significantly shocked the international economic system. Given this impact, the effective response is an existing challenge faced by governments and must be addressed. Tax policy is a common government measure used worldwide; however, what policy should be chosen? Whether to raise or lower taxes is a key government consideration. Therefore, governments and regulators must comprehensively assess policy impacts in a timely and accurate manner. We collect and organize 523,627 pieces of news data on taxation in the global media and quantify the sentiment score in news reports using Linguistic Inquiry and Word Count (LIWC). We further analyze the impact of the pandemic on taxation sentiment, the research object. By examining changes in taxation sentiment, we can expediently capture taxpayers’ attitudes regarding existing tax policies. Our research findings have important implications for policy development and evaluation.

We further exploit our cross-country setting to examine whether democracy mitigates public taxation sentiment-fueled reactions to the spread of the COVID-19 pandemic. In democratic countries, the open media and the opposition ensure that information flows from the public to the government and vice versa (Kavanagh and Singh, 2020), thereby improving the quality and expediency of the information available to governments, which may enable a quicker response (Kahn, 2005; Cronert, 2020). The relationship between taxation sentiment and the COVID-19 pandemic may be mitigated in democratic countries.

To examine the aforementioned hypothesized relationships, we use a panel dataset of 78 countries over the period January 25 to April 9, 2020. We use the LIWC method to filter tax-related news from country-level media data to quantitatively measure taxation sentiment across countries, thereby separating news related to reducing and raising taxes. The sentiment of reducing taxes is called “negative taxation sentiment,” and the sentiment of raising taxes is called “positive taxation sentiment.” We find that an increase in confirmed COVID-19 cases has a negative impact on taxation sentiment. Countries with higher democratic accountability experience less of a decrease than do otherwise similar countries. Our results remain robust against alternative sample compositions.

Our study contributes to at least two strands of the literature. First, we are the first to investigate taxation sentiment during the COVID-19 pandemic. Substantial research exists on taxation policies across countries. In this regard, scholars engage in the heated debate over tax policy (Coffey et al., 2020; Clemens and Veuger, 2020; Karnon, 2020; Craig and Hines, 2020). Existing studies have certain deficiencies that are primarily based on survey data, minimal coverage and a lack of cross-country comparative analyses. Survey data do not have time-varying characteristics and cannot dynamically reflect the actual changes in an economic system. In view of the shortcomings of existing research, we collect and process global news media data to analyze taxation sentiment at the cross-country level in a time-varying manner. We examine the relationship between COVID-19 and public taxation sentiment and how democracy interacts with COVID-19 outbreaks to affect taxation sentiment. Second, we add to the emerging COVID-19 literature that examines the impact of COVID-19 on financial sector outcomes (e.g., Corbet et al., 2020; Sharif et al., 2020), financial markets (e.g., Baker et al., 2020; Zhang et al., 2020; Alfaro et al., 2020), and government intervention (Duan et al., 2020, 2020). The studies have comprehensively analyzed the impact of the pandemic on various economic sectors. The impact of the pandemic is significant worldwide, and effective responses are a crucial challenge. From the perspective of taxation, if governments can accurately and expeditiously assess taxpayers’ tax awareness, such information will be conducive to the formulation and evaluation of appropriate and effective taxation policies. We add to this literature by determining that taxation sentiment decreases with increases in confirmed COVID-19 cases.

The remainder of this paper proceeds as follows. Section 2 presents an overview of the related literature. Section 3 introduces the data and key variables. Section 4 outlines our empirical methodology, empirical results, and robustness tests. Section 5 concludes.

2. Literature review

2.1. COVID-19 and taxation policy

Through public health policy responses to the COVID-19 pandemic, the global economy has been enormously affected by the heightened uncertainty and the shutdown of business activities (Ozili and Arun, 2020), including economic activities, such as public demand, supply, supply chains, trade, investments, price levels, exchange rates, financial stability, risk, economic growth, and international cooperation (Barua, 2020; McKibbin and Fernando, 2021). Shortfalls in demand in previous regional epidemics have been broadly investigated, whereas the COVID-19 crisis manifests at the firm level as a simultaneous shock to both demand and supply (Hassan et al., 2019). Fernandes (2020) examines the potential global economic costs of COVID-19 under different scenarios. Relevant research points out that the impact of COVID-19 on the economy cannot be ignored, and analysis from multiple perspectives helps us deeply understand the impact of the epidemic. This paper takes the public’s sentiment toward tax policy as the research object and finds that the intensification of the epidemic has significantly reduced the public’s emotional response to tax policy.

The stock market has been seriously damaged by the pandemic. Focusing on stock market returns, Alfaro et al. (2020) demonstrate that equity market value declined in response to COVID-19. The reaction may be milder among firms with better finances, less...
exposure to COVID-19 through global supply chains and customer locations, more corporate social responsibility activities, and fewer entrenched executives (Ding et al., 2021). Moreover, compared with domestic companies, multinational enterprises suffer significantly higher stock price declines during the pandemic period (Guedhami et al., 2021). Chee-Fox et al. (2021) study companies’ heterogeneous responses during COVID-19 and find that a more positive sentiment around a company’s response results in less negative returns for the company.

Stock market volatility has further increased significantly because of the pandemic (Zhang et al., 2020). Baek et al. (2020) examine data from the US and find that total and idiosyncratic risk significantly increased across all industries. In contrast, societal trust and trust in a country’s government significantly reduce uncertainty among investors. Under the same conditions, stock market volatility is significantly lower in high-trust countries (Engelhardt et al., 2020). Against this background, some studies discuss safe-haven assets (Goodell and Goutte, 2021).

As we noted previously, a global pandemic and its impact are not an ordinary health crisis. The economic impact is massive. Governments must take relevant measures to respond, and tax policy is an extremely critical aspect of these considerations. Clemens and Veuger (2020) note that the pandemic caused a significant decline in tax revenue, which affects governments’ public spending. Craig and Hines (2020) confirm that tax policy could be effective in limiting the spread of communicable diseases and in managing the economic fallout of a pandemic. It can further be noted that some corporations, such as large technology companies, have profited dramatically from the pandemic as the majority has suffered. Avi-Yonah (2020) argues that it is necessary to leverage this opportunity to reinstate excess profit taxes on profits gained entirely from the pandemic, thereby supplementing governments’ public expenditures in response to tax revenue losses related to the pandemic. Similarly, Karnon (2020) analyzes a temporary COVID-19 income tax levy as a potential policy option in terms of the aspects of constrained consumption, externalities, and solving social problems.

Nevertheless, in the face of the impact of the pandemic, whether the government should reduce or increase taxes remains a controversial issue. Hannan et al. (2022) used Mexico as an example and asserted that a moderate fiscal policy to navigate the impact of the pandemic means that the government will not issue excessive debt; however, such a fiscal policy is not necessarily optimal because if it is unable to properly manage the economic impact, a larger economic downturn may result in the future. Subsequently, the public may support the existing tax reduction and the government’s choice of a tax increase to maintain social stability and normal economic operations.

It is apparent that valid reasons exist for both tax increases and tax reductions during the pandemic. We attempt to answer this question by observing how taxation sentiment changes with the number of confirmed COVID-19 cases. Based on the above theoretical analysis and existing research conclusions, we propose Hypothesis 1:

**H1:** The impact of the number of confirmed COVID-19 cases on the taxation sentiment is negative.

### 2.2. Sentiment analysis

Public sentiment has a substantial impact on markets, national and regional issues, and policy design; therefore, studying sentiment is significant for untangling the rationales behind different demands and requests. Many papers document the relationship between sentiment and stock returns (e.g., Fisher and Statman, 2000; Frieder and Subrahmanyam, 2004; Baker and Wurgler, 2006, 2007; Edmans et al., 2007). For example, stock returns could be associated with the weather (Hirshleifer and Shumway, 2003), nonsecular holidays (Frieder and Subrahmanyam, 2004), and sporting event outcomes (Edmans et al., 2007), and sentiment can have a more important influence during recessionary periods (Garcia, 2013).

Scholars have used various methodologies to measure sentiment. Zhou (2018) reviews various investor sentiment measures and applications based on market data, surveys, text, and news media. A strand of the literature constructs sentiment indices that examine different aspects. Using LIWC text analysis software, Tumasjan et al. (2010) demonstrate that political sentiment could be accurately reflected on Twitter during the German federal election. Da et al. (2011) propose a direct measure of investor attention using an aggregate search frequency on Google called the Search Volume Index (SVI) and find that the SVI could expediently capture investor attention. An increase in SVI is found to be predictive of stock prices in the following two weeks and an eventual reversal within the year, thereby offering a new explanation of why IPO stocks have large first-day returns and long-run underperformance. Using queries related to household concerns, Da et al. (2015) construct the Financial and Economic Attitudes Revealed by Search (FEARS) index to measure investor sentiment. Similar to Baker and Wurgler (2006, 2007), Huang et al. (2015) propose the aligned investor sentiment index by eliminating a common noise component in sentiment proxies extracted using the partial least squares (PLS) method. Shapiro et al. (2020) apply text sentiment analysis to Federal Open Market Committee meeting transcripts to estimate the US central bank’s preferences. Barkur and Vibha (2020) analyze the sentiment of Indians after lockdown announcements were made because of COVID-19.

There are two basic approaches to measuring public sentiment, namely, machine learning and lexicon-based analysis (Taboada et al., 2011; Balage Filho et al., 2013). Gonçalves et al. (2013) and Ribeiro et al. (2016) offer thorough comparisons of multiple methods for measuring sentiment. Kim and Hovy (2004) present a system that can automatically identify people with opinions about a given topic and the sentiment regarding each opinion. Buckman et al. (2020) provide an overview of the computational methods for sentiment analysis, thereby constructing a “News PMI model” to calculate the daily news sentiment index in real time. The decline in news sentiment is found to coincide with the increased coverage of COVID-19 (Buckman et al., 2020). Calomiris and Mamaysky (2019) develop a classification methodology for the context and content of news articles to predict risk and return in stock markets across countries. T. Duan et al. (2020) and Y. Duan et al. (2020) constructed COVID-19 sentiment indices by using the machine learning method.
2.3. Democracy and sentiment

Democracy is primarily studied as a component of political risk. Previous research has investigated the effects of political uncertainty on economic growth, asset prices, international capital flows, capital investments, employment, and business cycles (Pástor and Veronesi, 2012, 2013; Belo et al., 2013; Gourio et al., 2015; Acemoglu et al., 2019). According to the logic of political survival (Mesquita et al., 2003), democratic leaders are more likely to expediently adopt preventive strategies in the face of national crises, particularly when elections are imminent (Cronert, 2020). In democratic countries, freedom of expression means that information flows from the public to the government and vice versa (Kavanagh and Singh, 2020), enabling more responsive and expedient government action (Kahn, 2005; Cronert, 2020).

In terms of the impact of the pandemic, the effect of democratic accountability cannot be ignored. Frey et al. (2020) note that cultural factors and democratic systems have an impact on the response to COVID-19. People in countries with strong democratic responsibility systems are more likely to observe relevant arrangements and more readily accept policies, which may be beneficial to public health protection. The general belief is that centralized systems are more quickly at policy implementation, but this does not mean that the efficiency under a nondemocratic accountability system is lower. Chiplunkar and Das (2021) compare general public health protection. The general belief is that centralized systems are more quickly at policy implementation, but this does not mean that the efficiency under a nondemocratic accountability system is lower. Chiplunkar and Das (2021) compare general centralism and democratic accountability and find that countries with nondemocratic accountability have more stringent policies in response to crises than do those with democratic accountability; however, democratically responsible countries subsequently implement more effective measures in a short period. The reason may be that a timelier response policy can make people more trusting, which is conducive to the prevention and control of the pandemic. In contrast, Fisman et al. (2021) note that the government of a country with democratic accountability may react more expediently to social needs in response to the voices of the people to alleviate the adverse impact of tension. Therefore, we can expect a more moderate sentiment in democratic countries because of democratic governments’ quicker responses. In particular, we examine whether democracy mitigates the effects of the COVID-19 pandemic.

We expect a more moderate sentiment in democratic countries due to democratic governments’ more expedient responses and examine whether democracy mitigates the effects of the COVID-19 pandemic. Thus we propose the Hypothesis 2:

H2: The moderating effect of democratic accountability between the growth rate of confirmed COVID-19 cases and the taxation sentiment is positive.

3. Data and methods

In this section, we describe our data sources, including (1) country-specific daily confirmed COVID-19 case data from the Center for Systems Science and Engineering (CSSE), (2) daily taxation sentiments from the LIWC, and (3) country level characteristics from the World Development Indicators (WDI), the International Country Risk Guide (ICRG) and the Heritage Foundation database of economic freedom (Heritage Foundation 2020).

3.1. COVID-19 cases

We obtained confirmed COVID-19 cases from the CSSE. This database is an online interactive dashboard hosted by the CSSE at Johns Hopkins University, was developed by Dong, Du, and Gardner (2020), and tracks reported cases of COVID-19 in real time. The dashboard, first shared publicly on January 22, 2020, presents the location and number of confirmed COVID-19 cases, deaths, and recoveries for all affected countries.

Referencing Ding et al. (2021), we define the daily growth rate of COVID-19 cases using the number of confirmed cases. More specifically, we compute Confirmed as follows:

\[
\text{Confirmed}_{i,t} = \ln(1 + \text{Confirmed Cases}_{i,t}) - \ln(1 + \text{Confirmed Cases}_{i,t-1})
\]

where \(i\) and \(t\) represent country and day, respectively. Confirmed Cases_{i,t} represents the cumulative number of confirmed COVID-19 cases in country \(i\) on day \(t\).

3.2. Taxation sentiment

We use LIWC to quantitatively measure taxation sentiment. LIWC is an advanced software that can quantify verbal expressions of sentiment. This method has been gradually applied in finance research. Ahn and Kim (2020) use LIWC to investigate sentiment regarding the cryptocurrency market. Hsieh and Vu (2021) use the software to analyze the sentiment of backers’ comments. The system provides information on the percentage of words per text that are covered by its internal dictionary and the percentage of words per text in each of the 80 categories on which it reports (Crossley et al., 2017). Related research supports the validity and reliability of the application of this method.

LIWC primarily includes the two aspects of program body and dictionary. The dictionary is the key consideration and defines the category name and word list to which words belong, comparing the words in the text with the dictionary by importing the dictionary and text and producing the word frequency results for various words. We first collect news on taxation from the global online media. Specifically, we obtain 523,627 pieces of news from more than 200 countries from January 25 to April 9, 2020. We then constructed a dictionary aligned with taxation to enable LIWC to conduct category analysis of news text vocabulary. For example, we consider tax
cuts, tax break, sales taxes, income tax credit, tax evasion, and other related terms. The LIWC analysis enables a count of the proportions of nouns, modal verbs, and conjunctions in the text and produces sentiment scores. Depending on the content, we identify the country in which each piece of news is covered. Second, we exploit LIWC to analyze the tone of each piece of news, including comprehensive, positive, and negative sentiments. Positive taxation sentiment means raising taxation, while negative taxation sentiment means reducing taxation. For one piece of news, the value of comprehensive sentiment, which we call “taxation sentiment” for short, is equal to the positive sentiment’s value minus the negative sentiment’s value. We then group news by country, aggregating individual news sentiment into daily time-series sentiment indices. Finally, we obtain each country’s daily taxation sentiment.

3.3. Country characteristics

We also select variables to control for country characteristics. The selected variables include DemAcc, GDP growth, GDP per capita, InvFre, and Age. DemAcc represents democratic accountability from the ICRG database and is “a measure of how responsive government is to its people, on the basis that the less responsive it is, the more likely it is that the government will fall, peacefully in a democratic society, but possibly violently in a non-democratic one.” This variable’s value ranges from 1 to 6, where autocracy receives the lowest point of 1 and alternative democracy receives the highest point of 6. GDP growth is defined as the 2019 GDP growth rate (annual %). GDP per capita is defined as the natural logarithm of 2019 GDP per capita (current US$). These two variables are obtained from the WDI. InvFre represents stock market liberalization from the Heritage Foundation Index of Economic Freedom (Heritage Foundation 2020). Age, obtained from the WDI, is defined as the proportion of the population aged 65 and older in 2019 (% of the total population).

3.4. Summary statistics

We exclude countries with missing country characteristics. Our final sample consists of 78 countries from Jan. 25th to Apr. 9th, 2020. Table 1 presents our variable definitions. The key dependent variables are Tone, Pos, and Neg. Tone represents a country’s daily taxation sentiment, Pos represents a country’s daily positive taxation sentiment, and Neg represents a country’s daily negative taxation sentiment. The key independent variable is Confirmed, which represents a country’s growth rate of the number of confirmed COVID-19 cases. We also control for the country characteristics previously introduced.

Table 2 presents the summary statistics. All continuous variables are winsorized at the 1% level. As demonstrated in Table 2, the mean and median of Confirmed are 0.162 and 0.091, respectively, suggesting that less than half of the countries have a greater than average number of confirmed cases. In addition, the average value of Tone is less than zero (-1.800). Because the taxation sentiment value is equal to the positive sentiment value minus the negative sentiment value, this implies that taxation sentiment was pessimistic for the countries in our sample. The average value of DemAcc is 4.836 on a scale from 0 to 6. The average value of GDP growth is 2.449%, GDP per capita is 9.630, investment freedom (InvFre) is 4.181, and population aged 65 and older (age) is 14.101%.

Table 3 presents the correlation coefficients between the key variables. The correlation coefficient of Tone and Confirmed is -0.073, with high significance, indicating that the growth rate of confirmed cases is negatively correlated with taxation sentiment. Similarly, Pos is negatively correlated with Confirmed and consistent with our assumptions, and Neg is positively correlated with Confirmed.

Fig. 1 illustrates the simple relation between Tone and Confirmed. Tone is taking the average at the country level. Confirmed is taking the average over the sample period at the country level. The fitted line indicates a downward-sloping trend, suggesting a negative correlation between taxation sentiment and COVID-19. We select some countries for the timing diagram; Fig. 2 presents Germany. The images also reveal a negative correlation between Tone and Confirmed.

4. Empirical design, results, and discussion

4.1. Empirical design

To empirically evaluate the impact of the development of confirmed COVID-19 cases on taxation sentiment across countries, we use the following basic regression model:

$$
\text{Tone}_{i,t} = \alpha_i \cdot \text{Confirmed}_{i,t-1} + \sum_{k=1}^{K} \theta_k \text{X}_{i,t}^{k,2019} + \delta_i + \tau_t + \epsilon_{i,t}
$$

Where $i$ and $t$ are country and day, respectively. Tone represents taxation sentiment. Confirmed is the growth rate of the cumulative number of confirmed cases in country $i$ on day $t$. $\text{X}_{i,t}^{k,2019}$ stands for the $k$th control variable, including GDP growth, GDP per capita, DemAcc, InvFre, and Age. With a fixed year of 2019, these country characteristics are constant in our sample. $\delta_i$ is the country fixed effect, and $\tau_t$ is the day fixed effect.

We consider the influence of democratic accountability and are interested in the moderating effect of DemAcc between Tone and Confirmed; therefore, we use the following regression model:

$$
\text{Tone}_{i,t} = \alpha_i \cdot \text{Confirmed}_{i,t-1} + \sum_{k=1}^{K} \theta_k \text{X}_{i,t}^{k,2019} + \delta_i + \tau_t + \epsilon_{i,t} + \delta_{i,t} \cdot \text{DemAcc}_{i,t}
$$

\footnote{https://www.prsgroup.com/wp-content/uploads/2022/04/ICRG-Method.pdf}
Table 1
Variable Definitions.

| Variables     | Definition                                                                 | Source                                                                 |
|---------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Tone          | The taxation sentiment of a country on day t                              | Linguistic Inquiry and Word Count (LIWC)                               |
| Pos           | The positive taxation sentiment of a country on day t                     |                                                                       |
| Neg           | The negative taxation sentiment of a country on day t                      |                                                                       |
| Official      | The taxation sentiment of a country from official media on day t           |                                                                       |
| Unofficial    | The taxation sentiment of a country from unofficial media on day t        |                                                                       |
| Confirmed     | The growth rate of confirmed COVID-19 cases in a country                  | Center for Systems Science and Engineering at Johns Hopkins University  |
| DemAcc        | Democratic accountability                                                 | International Country Risk Guide                                       |
| GDP growth    | The growth rate of 2019 GDP (annual %)                                    | World Development Indicators (WDI)                                     |
| GDP per capita| The natural logarithm of 2019 GDP per capita (current US$)                 | The Heritage Foundation Index of Economic Freedom (Heritage Foundation 2020) |
| InvFre        | Stock market liberalization                                               |                                                                       |
| Age           | Proportion of the population aged 65 and older in 2019 (% of total population) | World Development Indicators (WDI)                                     |

Table 2
Summary statistics. This table presents the summary statistics for the taxation sentiment of each country, the growth rate of confirmed COVID-19 cases, democratic accountability, and control variables in the main regression. All data are from LIWC, CSSE, WDI, and ICRG. The sample period is January 25–April 9, 2020, and includes 78 countries. Tone refers to a country’s daily taxation sentiment, Pos is daily positive taxation sentiment, and Neg is daily negative taxation sentiment. Official is the taxation sentiment from a country’s official media. Unofficial is the taxation sentiment from a country’s unofficial media. Confirmed is the growth rate of a country’s confirmed COVID-19 cases. DemAcc represents a country’s democratic accountability. GDP growth is the growth rate of 2019 GDP (annual %). GDP per capita is the natural logarithm of 2019 GDP per capita (current US$). InvFre is obtained from the Heritage Foundation database of economic freedom (Heritage Foundation 2020) and controls for stock market liberalization. Age is the proportion of a country’s population aged 65 and older in 2019 (% of the total population).

| Variables     | N  | Mean | StDev | 25th Percentile | Median | 75th Percentile |
|---------------|----|------|-------|-----------------|--------|-----------------|
| Tone          | 3487 | -1.800 | 1.137 | -2.429          | -1.768 | -1.131          |
| Pos           | 3487 | 2.739  | 0.560 | 2.386           | 2.685  | 3.050           |
| Neg           | 3487 | 4.539  | 0.923 | 3.965           | 4.501  | 5.032           |
| Official      | 920  | -1.660 | 2.043 | -2.646          | -1.649 | -0.548          |
| Unofficial    | 3038 | -1.790 | 1.438 | -2.506          | -1.742 | -0.997          |
| Confirmed     | 3038 | 0.162  | 0.213 | 0.000           | 0.091  | 0.217           |
| DemAcc        | 3487 | 4.836  | 1.372 | 4.000           | 5.000  | 6.000           |
| GDP growth    | 3487 | 2.449  | 2.101 | 1.195           | 2.164  | 3.930           |
| GDP per capita| 3487 | 9.630  | 2.043 | 8.769           | 9.789  | 10.739          |
| InvFre        | 3487 | 4.181  | 0.328 | 4.094           | 4.317  | 4.443           |
| Age           | 3487 | 14.101 | 6.494 | 7.554           | 15.094 | 19.694          |

Table 3
Correlation matrix. All data are from LIWC, CSSE, WDI, and ICRG. The sample period is January 25–April 9, 2020, and includes 78 countries. Tone refers to a country’s daily taxation sentiment, Pos is daily positive taxation sentiment, and Neg is daily negative taxation sentiment. Official is the taxation sentiment from a country’s official media. Unofficial is the taxation sentiment from a country’s unofficial media. Confirmed is the growth rate of a country’s confirmed COVID-19 cases. DemAcc represents democratic accountability.

|         | Tone     | Pos      | Neg       | Official  | Unofficial | Confirmed  | DemAcc  |
|---------|----------|----------|-----------|-----------|------------|------------|---------|
| Tone    | 1.000    | 0.579**  | -0.866*** | 0.316***  | 0.610***   | -0.073***  | 0.069*** |
| Pos     | 0.579**  | 1.000    | 0.116***  | 0.000     | 0.000      | 0.000      | 0.000   |
| Neg     | -0.866***| 0.116***  | 1.000     | 0.302***  | 0.000      | 0.000      | 0.000   |
| Official| 0.316***  | 0.000    | -0.302*** | 1.000     | 0.000      | 0.000      | 0.000   |
| Unofficial| 0.610*** | (0.000) | 0.329***  | 0.269***  | 1.000      | 0.000      | 0.000   |
| Confirmed| -0.073***| (0.000) | -0.053*** | 0.054**   | -0.029     | -0.045**   | 1.000   |
| DemAcc  | 0.069***  | (0.000) | 0.041**   | 0.045     | 0.015      | 0.084**    | 1.000   |

This table presents the Pearson correlation coefficients for the key variables. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.
where \( \text{DemAcc} \) represents democratic accountability from the ICRG database. As shown in Table 1, it is a measure of how responsive the government is to its people.

### 4.2. Main results

Table 4 presents the regression results of the growth rate of the number of confirmed COVID-19 cases and country characteristics on taxation sentiment. As a preliminary benchmark, we first examine the relationship between COVID-19 and taxation sentiment. In
column 1, we exclude country characteristics, include country fixed effects, and estimate the basic model. In column 2, we include country characteristics and exclude country fixed effects.

From columns 1 and 2, we find a consistently negative relationship between taxation sentiment and confirmed COVID-19 cases. The results are economically significant. Based on column 1,Confirmed is negative (-0.174) and significant (t=-1.72), indicating that the increased growth rate of the number of confirmed COVID-19 cases is correlated with an increased decline in a country’s taxation sentiment. To illustrate the estimated economic magnitudes, the coefficient estimates indicate that if the number of confirmed COVID-19 cases grow at the sample average value (the mean of Confirmed is 0.162), taxation sentiment would fall by approximately 0.028 (-0.174 *0.162). This is equivalent to 1.56% of the sample average of taxation sentiment. Column 2 provides estimates of country characteristics. Regarding country characteristics with statistically significant results, democratic accountability (DemAcc) is negatively associated with taxation sentiment, and GDP per capita is positively associated with taxation sentiment.

In addition, to examine the mitigating effect of democracy on the relationship between COVID-19 and taxation sentiment, we add an interaction term to the model. Similarly, column 3 of Table 4 presents the result when we exclude country characteristics and include country fixed effects. In column 4, we include country characteristics and exclude country fixed effects. As demonstrated, the interaction item between democratic accountability and Confirmed is positive and significant. The results hold when we include country characteristics, indicating that democratic countries’ taxation sentiment declines less in response to COVID-19. The higher the value of democratic accountability, the lower is the decline taxation sentiment in the event of COVID-19. To illustrate the estimated economic magnitudes, we consider the specification that controls country fixed effects (column 3). The estimate indicates that a one standard deviation increase in democratic accountability decreases the negative reaction of taxation sentiment to COVID-19 by 0.31 (=-0.228 *1.372).

### 4.3. Alternative estimation metrics or samples

The source of media reports is a critical factor. We reorganize the data and collected the domain name keywords of the official media in various countries. We also classify and judge each article according to the domain name, dividing them into official and unofficial media. We then conduct empirical analysis on the divided sample, and the results are presented in Tables 5–1. We find that the reporting sentiment of state and unofficial media responds differently to the impact of the pandemic. In particular, the reporting sentiment of official media is more stable, and the impact of the pandemic is not significant; however, the reporting sentiment of unofficial media is negatively impacted by COVID-19 and significant at the 10% level. We further relax the individual fixed effects and introduce more control variables, and the results still hold. Compared with official media, the mood of unofficial media is more vulnerable to the impact of the pandemic.

### Table 4

COVID-19 and daily taxation composite sentiment. This table demonstrates how COVID-19 affects the taxation sentiment using all samples between January 25 and April 9, 2020. All data are from LIWC, CSSE, WDI, and ICRG. The dependent variable is Tone. The key independent variable is Confirmed. Tone is a country’s daily taxation sentiment and Confirmed represents the growth rate of a country’s confirmed COVID-19 cases. The control variables are country characteristics, including 2019 GDP growth, GDP per capita, DemAcc, InvFre, and Age. GDP growth is the growth rate of 2019 GDP (annual %). GDP per capita is the natural logarithm of 2019 GDP per capita (current US$). DemAcc represents democratic accountability. InvFre is taken from the Heritage Foundation database of economic freedom (Heritage Foundation 2020) and controls for stock market liberalization. Age is the proportion of a country’s population aged 65 and older in 2019 (% of the total population). We include Country (three-digit ISO) and Time daily fixed effects. Country-level clustered standard errors are reported in parentheses. ***, **, and * denote 1%, 5%, and 10% significance levels, respectively.

|              | (1)       | (2)       | (3)       | (4)       |
|--------------|-----------|-----------|-----------|-----------|
| Dependent Variable: Tone |           |           |           |           |
| Confirmed    | -0.174 *  | -0.187 ** | -1.286 *** | -1.900 *** |
|              | (-1.72)   | (-2.67)   | (2.54)    | (-3.51)   |
| Confirmed*DemAcc | 0.228 *** | 0.331 *** |           |           |
|              | (2.38)    | (3.24)    |           |           |
| DemAcc       | -0.142 ** |           |           |           |
|              | (-3.00)   |           |           |           |
| GDP growth   | 0.022     |           |           |           |
|              | (1.00)    |           |           |           |
| GDP per capita | 0.161 **  |           |           |           |
|              | (2.40)    |           |           |           |
| InvFre       | 0.287     |           |           |           |
|              | (1.33)    |           |           |           |
| Age          | 0.003     |           |           |           |
|              | (0.21)    |           |           |           |
| Cons         | -1.772 ***| -3.347 ***| -1.776 ***| -3.596 ***|
|              | (-107.92) | (-3.41)   | (-115.75) | (-4.47)   |
| Country FE   | Yes       | No        | Yes       | No        |
| Time FE      | Yes       | Yes       | Yes       | Yes       |
| Observations | 3487      | 3487      | 3487      | 3487      |
| Adj. R2      | 0.199     | 0.068     | 0.201     | 0.073     |
Alternative estimation: official and unofficial news. This table demonstrates how COVID-19 affects the taxation sentiment using a subsample based on the nature of media between January 25 and April 9, 2020. All data are from LIWC, CSSE, WDI, and ICRG. The first and the third columns represent unofficial media groups and the second and the fourth columns are the official media groups. *Official is taxation sentiment from a country’s official media. Unofficial is the taxation sentiment from a country’s unofficial media. The key independent variable is Confirmed. Confirmed is the growth rate of a country’s confirmed COVID-19 cases. Tone is a country’s daily taxation sentiment. The control variables are country characteristics, including GDP growth, GDP per capita, DemAcc, InvFre, and Age, measured in 2019. GDP growth is the growth rate of GDP in 2019 (annual %). GDP per capita is the natural logarithm of GDP per capita in 2019 (current US$). DemAcc represents Democratic Accountability. InvFre is taken from the Heritage Foundation database of economic freedom (Heritage Foundation 2020) and controls for stock market liberalization. Age is the proportion of a country’s population aged 65 and above in 2019 (% of the total population). We include Country (three-digit ISO) and Time daily fixed effects. Country-level clustered standard errors are reported in parentheses. *** , **, and * denote 1%, 5%, and 10% significance level, respectively.

|        | Unofficial | Official | Unofficial | Official |
|--------|------------|----------|------------|----------|
| Confirmed | -0.230 *  | -0.085  | -0.306 **  | -0.198  |
| DemAcc  | -0.062  | -0.057  | (0.91)  | (0.56)  |
| GDP growth | 0.008  | 0.013  | (0.24)  | (0.27)  |
| GDP per capita | 0.054  | 0.235  | (0.57)  | (1.63)  |
| InvFre  | 0.248  | -0.371  | (1.15)  | (-0.95)  |
| Age    | -0.003  | 0.001  | (-0.21)  | (0.03)  |
| Cons   | -1.752 *** | -1.673 *** | -2.973 *** | -2.757 |
| Country FE | Yes  | Yes  | No  | No  |
| Time FE | Yes  | Yes  | Yes  | Yes  |
| Observations | 3038  | 920  | 3048  | 920  |
| Adj. $R^2$ | 0.140  | 0.078  | 0.027  | 0.018  |

In Tables 5–2, we use subsamples as robustness checks. First, we use different subsamples of countries. In Tables 5–2, columns 1 and 2 indicate groups of countries according to economic development status. The regression coefficients of Confirmed are both negative and significant. The interaction item of Confirmed and DemAcc is positive and significant in the group of developed countries but has no significance in the group of developing countries. The results indicate that the taxation sentiment of developed countries with a higher value of democratic accountability is less sensitive to COVID-19. The HConf and LConf groups (columns 3 and 4) are formed by sorting all countries according to the number of confirmed COVID-19 cases on April 9, 2020. The sample with a higher number of confirmed COVID-19 cases than the median was defined as the HConf group, and the other sample was defined as the LConf group. The estimated coefficients of Confirmed enter negatively into both the HConf and LConf groups, although they have differing levels of significance. The interaction items remain negative and significant. In addition, the results suggest that the taxation sentiment of countries with fewer confirmed COVID-19 cases and higher democratic accountability declines less in response to COVID-19. Moreover, the differences in the estimated coefficients between the HConf and LConf groups are significant. Overall, for developed countries and those with fewer confirmed COVID-19 cases, the taxation sentiment of democratic countries is more sensitive to the impact of COVID-19.

### 4.4. Other robustness tests

First, we separate news related to reducing taxes and news related to raising taxes. The sentiment of reducing taxes is called “negative taxation sentiment,” and the sentiment of raising taxes is called “positive taxation sentiment.” Tables 6–1 reports the related regression results. Pos is the daily positive taxation sentiment, and Neg is the daily negative taxation sentiment. Columns 1 and 2 show that democratic countries tend to experience less decline in positive taxation sentiment during the COVID-19 crisis. Columns 3 and 4 suggest that democratic countries’ negative taxation sentiment increases less in response to COVID-19. These results are consistent with our results, indicating that democracy could mitigate the taxation sentiment reaction in response to COVID-19.

Second, Tables 6–2 presents related results excluding observations with a maximum value for confirmed cases or democratic accountability. Columns 1 and 2 exclude the countries with the maximum number of confirmed COVID-19 cases. In particular, the country with the maximum number of confirmed COVID-19 cases is the US. Columns 3 and 4 exclude countries with the maximum democratic accountability value. These results indicate that although we exclude the highest valued observations, our results remain consistent.
Table 5–2
Alternative estimation: different countries. This table demonstrates how democratic accountability moderates the relationship between confirmed COVID-19 cases and daily taxation sentiment using a subsample between January 25 and April 9, 2020. All data are from LIWC, CSSE, WDI, and ICRG. The Developed and Developing groups are formed according to countries’ development levels. The HConf and LConf groups are formed by sorting all countries according to confirmed COVID-19 case numbers on April 9, 2020. The dependent variable is Tone. Tone is a country’s daily taxation sentiment. The key independent variable is Confirmed. Confirmed represents a country’s growth rate of confirmed COVID-19 cases. We also include the interactive item Confirmed*DemAcc. We include Country (three-digit ISO) and Time daily fixed effects. Country-level clustered standard errors are reported in parentheses. ***, **, and * denote 1%, 5%, and 10% significance level, respectively. Empirical p-values are determined using Fisher’s permutation test.

| (1) | (2) | (3) | (4) |
|-----|-----|-----|-----|
| **Dependent variable: Tone** | **Dependent variable: Tone** | **Dependent variable: Tone** | **Dependent variable: Tone** |
| **Developed** | **Developing** | **HConf** | **LConf** |
| Confirmed | -7.740 *** | -0.951 ** | -0.640 * | -1.985 *** |
| (5.97) | (-2.01) | (-1.79) | (-2.63) |
| Confirmed*DemAcc | 1.325 *** | 0.177 | 0.114 * | 0.373 ** |
| (5.94) | (1.64) | (1.70) | (2.32) |
| Cons | -1.114 ** | -0.728 | -0.967 * | -1.382 * |
| (2.50) | (-1.11) | (-2.56) | (-1.66) |
| Country FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Observations | 1665 | 1667 | 2105 | 1382 |
| Adj. R2 | 0.043 | -0.009 | 0.015 | -0.023 |
| **Empirical p-values** | 0.000 *** | 0.009 *** | | |

Table 6–1
Robustness test: positive sentiment and negative sentiment. This table presents how democratic accountability (DemAcc) moderates the relationship between a country’s confirmed COVID-19 cases and daily taxation sentiment using all samples between January 25 and April 9, 2020. All data are from LIWC, CSSE, WDI, and ICRG. The dependent variables are Pos and Neg sentiment. Pos is a country’s daily positive taxation sentiment, Neg is a country’s daily negative taxation sentiment. The key independent variable is Confirmed and DemAcc, respectively. We also include interactive items Confirmed*DemAcc. Confirmed represents the growth rate of a country’s confirmed COVID-19 cases. DemAcc represents democratic accountability. The control variables are country characteristics, including GDP growth, GDP per capita, InvFre, and Age, measured in 2019. GDP growth is the growth rate of 2019 GDP (annual %). GDP per capita is the natural logarithm of 2019 GDP per capita (current US$). InvFre is taken from the Heritage Foundation database of economic freedom (Heritage Foundation 2020) and controls for stock market liberalization. Age is a country’s proportion of population aged 65 and older in 2019 (% of the total population). We include Country (three-digit ISO) and Time daily fixed effects. Country-level clustered standard errors are reported in parentheses. ***, **, and * denote 1%, 5%, and 10% significance levels, respectively.

| (1) | (2) | (3) | (4) |
|-----|-----|-----|-----|
| **Dependent Variable: Tone** | **Dependent Variable: Tone** | **Dependent Variable: Tone** | **Dependent Variable: Tone** |
| **Pos** | **Pos** | **Neg** | **Neg** |
| Confirmed | -0.503 *** | -0.487 *** | 0.690 ** | 0.738 *** |
| (3.00) | (-2.89) | (2.55) | (2.75) |
| Confirmed*DemAcc | 0.102 *** | 0.0995 *** | -0.110 ** | -0.118 ** |
| (3.09) | (2.99) | (-2.06) | (-2.22) |
| DemAcc | -0.118 *** | -0.118 *** | 0.054 | (0.88) |
| (5.38) | (-5.38) | | |
| GDP growth | 0.031 *** | 0.031 *** | 0.011 | 0.011 |
| (3.26) | (3.26) | | |
| GDP per capita | 0.005 | 0.005 | -0.162 ** | (-2.22) |
| (0.19) | (0.19) | | |
| InvFre | 0.001 | 0.001 | 0.013 | -0.246 |
| (0.02) | (0.02) | | |
| Age | 0.009 ** | 0.009 ** | 0.013 | -0.246 |
| (2.02) | (2.02) | | |
| Cons | 2.737 *** | 3.306 *** | 4.516 *** | 6.402 *** |
| (249.04) | (255.44) | (7.10) | (7.10) |
| Country FE | Yes | No | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Observations | 3487 | 3487 | 3487 | 3487 |
| Adj. R2 | 0.239 | 0.038 | 0.275 | 0.057 |
5. Conclusions

In this paper, we first construct a country-level taxation sentiment index using LIWC and data from January 25 to April 9, 2020, to empirically investigate the relationship between COVID-19 and taxation sentiment and to examine how democratic accountability affects the sensitivity of taxation sentiment to the COVID-19 pandemic. We find that taxation sentiment is negatively correlated with COVID-19 and that democracy mitigates the influence of COVID-19 on taxation sentiment. When we use positive taxation sentiment and negative taxation sentiment as alternative dependent variables, the results are robust. Moreover, for developed countries and countries with fewer confirmed COVID-19 cases, the taxation sentiment of democratic countries is less sensitive to the pandemic. Compared with unofficial media sentiment, official media sentiment is more stable and therefore less affected by COVID-19. We further find that the impact of the pandemic on taxation sentiment was more pronounced in countries with low levels of trust. Overall, these results indicate that the effect of COVID-19 on sentiment, particularly taxation sentiment and democratic accountability, could mitigate the sensitivity of sentiment to COVID-19.

This study has important implications for policymakers. In the face of the impact of COVID-19, how to alleviate the adverse impact and restore economic vitality is the key task of the governments of all countries. News published by state media has a weaker impact on social sentiment. This study extends existing studies that mainly focus on analyzing the impact of COVID-19 on the economic entity. From a sentiment perspective, this study broadens the research horizon and contributes to a better understanding of the impact of COVID-19. The research in this paper may also provide new perspectives for future research. Emotions can reflect the psychology and behavior of the public. In-depth research on emotions will help us understand the impact of the epidemic.

Data Availability

No data was used for the research described in the article.

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