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The effect of politician denialist approach on COVID-19 cases and deaths

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A B S T R A C T

Concern over the high rate of contagion of COVID-19 has prompted world authorities to use the strategy of isolation and social confinement as the main non-pharmacological weapon against the disease that has rapidly killed millions of people worldwide. However, there is evidence that the denialist rhetoric of the Brazilian President has negatively influenced people's behavior in relation to obedience to confinement and social isolation measures. The aim of this study is to analyze the correlation between the Brazilian President's denialist rhetoric and the low adherence to social distancing measures and the subsequent increase of new coronavirus cases and deaths. Daily data on the level of contamination by COVID-19, social distancing and information from Brazilian states between the months of February and May 2020 were used. Taking into consideration the differences between the federal government of Brazil and state governors about the severity of the pandemic and the importance of social distancing, the article uses the Instrumented Difference-in-Differences approach, suggested by Duflo (2001), to obtain the causal impact of reduced social distancing, resulting from Presidential denialist rhetoric, in mitigating COVID-19 cases and deaths, taking into account the relationship between the president of the republic and the states as an instrument. The results suggest that the Brazilian average Social Isolation Index increased from 39.77% to 51% between February 1st and May 18th, 2020, the country would have had approximately 318,850.03 fewer cases of COVID-19, and more than 10,000 lives would have been saved.

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1. Introduction

The COVID-19 outbreak is one of the most devastating episodes in the history of public health. According to World in Data, in just one year, this virus led to the deaths of more than 2 million people worldwide, infecting 75 million.

Unfortunately, Brazil became conspicuous for its failure in the fight against the virus and had the highest number of deaths per 1 million inhabitants among the most populous countries (1900 deaths per 1 million inhabitants). In absolute terms, after one year of pandemic in its territory, there were more than 600 thousand fatal victims of COVID-19 and 17 million cases of contamination. Recently, the Brazilian Federal Senate investigation (Senado Federal, 2021) suggested that the incumbent Brazilian President’s denialist behavior is responsible for the national COVID-19 tragedy.

Indeed, at the beginning of 2021, the world observed the second wave of COVID-19 and the emergence of new potential variants of the virus (Sabino et al., 2021; Wang et al., 2021b). Recently published reports on Covid-19 responses in 21 countries (Jasanoff, et. al., 2021) categorized Brazil as one of these “Chaos Countries” because its sanitary policy was unable to conduct effective strategies to mitigate and contain Covid-19. Indeed, novel SARS-CoV-2 found in Manaus (Capital of Brazilian Amazon State) may be 1.4–2.2 times more transmissible compared to previous circulating variants, and it is making people around 25–61% more susceptible to reinfection and death (Faria et al., 2021; WHO, 2021). This new and dangerous strain has spread over all of Latin America and overseas countries, aggravating the global pandemic.

Following Da Silva R.G.L (2021), coronavirus denialist approach could be defined as a range of doubts and skepticism with regards to public health interventions to mitigate and contain the further spread of SARS-CoV-2. This ranges from anti-lockdown protests, conspiracy theories about Covid-19, and skepticism over the need to wear a mask.

In spite of the dramatic increase in the number of deaths by COVID-19 in the country, the President of Brazil adopted a denialist rhetoric in order to encourage the continuity of economic and financial activities in the country and minimizing health risks, contributing significantly to a reduction in social distancing and resulting in higher COVID-19 contamination rates (Ajzenman et al., 2020; Da Silva R.G.L 2021; Faria et al., 2021; WHO, 2021).

The objective of this paper is to evaluate the impact of social isolation on the number of cases and deaths from COVID-19 (Da Silva R.G.L, 2021; Richard and Medeiros, 2020; Malinverni and Brigagão, 2020; Paes-Sousa et. al., 2020), considering the harmful effect of the President’s denialist approach (Gollwitzer et al., 2020; Ajzenman et al., 2020; Adolph et al., 2021; Allcott et al., 2020; Barrios and Hochberg, 2020). The underlying argument is that the behavior of the President of the Brazilian Republic, encouraging social agglomeration, reduced the rates of social isolation and therefore promoted the proliferation of the virus in the country.

Anderson et al., 2020 stated that a high rate of COVID-19 infections in a population with no previous immunity and no vaccine against the virus tends to result in exponential growth in case numbers. Therefore, non-pharmacological actions are needed to reduce transmission and slow the spread of the disease. Among these measures, isolation and social confinement are the main nonpharmacological policies for reducing the transmission of infectious respiratory diseases.

According to Costa et al. (2020), social isolation is a tool that can reduce and flatten the curve of cases and thus protect people at the greatest risk, reducing the chances of serious conditions related to the disease, potential deaths and the collapse of the health system of the country (Van Bavel et al., 2020; Brzezinski et al., 2020). Previous experience with H1N1 in 2009, which had a much lower transmission rate than the new coronavirus, had already shown that, in a globalized world, it is extremely difficult to prevent new diseases from reaching other countries.

Therefore, during the COVID-19 pandemic, most countries have decided to implement social distancing measures, enacting strategies to control population movement and suspend academic activities and nonessential trade (HALE and WEBSTER, 2020). However, despite the WHO recommendation and empirical evidence (Briscese et al., 2020; Douglas et al., 2020; Kraemer et al., 2020; Nicola et al., 2020), some leaders in the US, Europe, and Latin America are skeptical about the effectiveness of social distancing policies. These leaders have criticized these policies, arguing that social distancing aggravates the economic crisis without necessarily alleviating the pandemic.

The purpose of this article is to identify the effects of Social Isolation Index (SSI), in mitigating COVID-19 cases and deaths in Brazil using as identification strategy the fact that the Brazilian President’s denialist rhetoric is an exogenous phenomenon correlated with SSI because it weakened the states social-distancing policy reducing the effectiveness of social distancing. An intriguing aspect of this problem is that, due to omitted variable problems as the number of infections has grown, there has been a natural trend toward self-confinement irrespective of whether social distancing is implemented as a policy. Therefore, social distancing and the number of cases of COVID-19 are simultaneously determined phenomena. To capture the causal effect of social distancing on the COVID-19 pandemic, in this research, we adopt a difference-in-difference instrumented (DDIV) strategy (DUFLO, 2001).

Many studies have argued that the power of political discourse affects decision making and the behavior of society. There are numerous examples in the literature of how political leaders can motivate their followers to behave in certain ways through speeches and behavior (Lazear and Rosen, 1981; Hermailn, 1998; Acemoglu and Jackson, 2015). Political corruption scandals can also render citizens more dishonest (Ajzenman et. al., 2020). In contrast, good examples of care for the public and a perception of effective leadership on the part of elected leaders, encourage widespread appropriate voluntary action (Jack and Recalde, 2015). Recently, Briscese et al. (2020) showed the importance of public authorities in managing people’s expectations during public health emergencies.

This study is divided into 5 sections, including the introduction. The next section provides useful context for the public health situation in Brazil at the time of the COVID-19 pandemic and a discussion of the importance of political discourse to...
social behavior. In the third section, the study describes the database and the empirical strategy used to estimate the causal effects of the lockdown. In the fourth section, we present and discuss the results of the DDIV model. Finally, we offer some concluding remarks and suggestions for future research in the fifth section.

2. Background

Following WHO recommendations, the governors of the 27 Brazilian states, including the Federal District, on different days decreed social-distancing restrictions, with some decrees starting as early as February 29, 2020 (Table 1). Although Brazil’s Ministry of Health declared a Public Health Emergency of National Importance in the country (Ordinance no. 188, BRASIL, 2020) on February 3, 2020, the federal government, represented by the figure of the incumbent Brazilian President of the Republic, encouraged the continuity of commercial activities and advocated for business as usual.

According to the Fiscal Decentralization Theorem (Oates, 1997), local authorities have an advantage over central governments in terms of knowing their citizens’ preferences. In addition, since local governments are closer to society, local processes should take priority over central government bodies. Local governments can obtain better information by interacting more easily with the locality and meeting regional demands more efficiently (Krugman, 1991, Krugman, 1997). Conversely, local governments are not necessarily equipped to address situations that transcend their borders and that require coordination at a higher level of aggregation.

The new public management paradigm developed by the Organization for Economic Cooperation and Development (OECD) in 1995 and suggested replacing centralized management structures with decentralized management models, in which public policy proposals regarding resource management and decision making are built in an environment much closer to the service location and where conditions are created for the return of interest groups.

In spite of social isolation being one of the main non-pharmacological measures to fight COVID-19 contamination and is widely adopted by public policy makers concerned with combating the proliferation of the virus (TOBIAS, 2020) some world leaders have denied the importance of this practices to contain the pandemic.

Indeed, the President of Brazil, in speeches and by modeling behavior, encouraged his supporters not to follow social-distancing restrictions issued by the states. On March 15, 2020, despite general recommendations on self-isolation, demonstrations occurred across the country on behalf of the President that brought thousands of supporters into large agglomerations. The President himself participated in the demonstrations in the Federal District, having contact with the protesters.

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Table 1

| States                | Social Distancing Decree | % of vote | Governors supporting the President* |
|-----------------------|--------------------------|-----------|-------------------------------------|
| Distrito Federal      | February 29, 2020        | 70        | Yes                                 |
| Goiás                 | March 13, 2020           | 65.5      | No                                  |
| Minas Gerais          | March 13, 2020           | 58.2      | Yes                                 |
| Paraíba               | March 13, 2020           | 35        | No                                  |
| Pernambuco            | March 14, 2020           | 33.5      | No                                  |
| Acre                  | March 16, 2020           | 77.2      | Yes                                 |
| Ceará                 | March 16, 2020           | 28.9      | No                                  |
| Espírito Santo        | March 16, 2020           | 63.1      | No                                  |
| Rio de Janeiro        | March 16, 2020           | 68        | No                                  |
| Rio Grande do Norte   | March 17, 2020           | 36.6      | No                                  |
| Santa Catarina        | March 17, 2020           | 75.9      | No                                  |
| Tocantins             | March 18, 2020           | 49        | No                                  |
| Amapá                 | March 19, 2020           | 50.2      | Yes                                 |
| Bahia                 | March 19, 2020           | 27.3      | No                                  |
| Maranhão              | March 19, 2020           | 26.7      | No                                  |
| Mato Grosso do Sul    | March 19, 2020           | 65.2      | No                                  |
| Paraná                | March 19, 2020           | 68.4      | Yes                                 |
| Piauí                 | March 19, 2020           | 23        | No                                  |
| Rio Grande do Sul     | March 19, 2020           | 63.2      | No                                  |
| Alagoas               | March 20, 2020           | 40.1      | No                                  |
| Pará                  | March 20, 2020           | 45.2      | No                                  |
| Rondônia              | March 20, 2020           | 72.2      | Yes                                 |
| Sergipe               | March 20, 2020           | 32.5      | No                                  |
| São Paulo             | March 21, 2020           | 68        | No                                  |
| Roraima               | March 22, 2020           | 71.6      | No                                  |
| Amazonas              | March 23, 2020           | 50.3      | Yes                                 |
| Mato Grosso            | March 23, 2020           | 66.4      | No                                  |

Source: Official Journals of Brazilian States and the Brazilian Electoral Court (Supremo Tribunal Eleitoral -TSE). *States with governors who did not sign a manifesto against the President, Open Letter in Defense of Democracy, on April 19, 2020.

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1 For more details, see https://g1.globo.com/politica/noticia/2020/03/15/cidades-brasileiras-tem-atos-pro-governo.ghtml. Available on April 28, 2020.
2 For more details, see https://agenciabrasil.ebc.com.br/bolsonaro-participa-de-manifestacao-de-simpatizantes-em-brasilia. Available on April 28, 2020.
addition, a statement made on national television on March 24 positioned the President in opposition to most of the state governments in terms of policies for reducing the spread of COVID-19.  

Table 1 shows for each Brazilian State the day on which social distancing measures were decreed, the percentage of the vote for incumbent President in the second round of presidential elections in each state and the states with governors supporting the President. We define “supporting” based on signing a manifesto against the President, called the Open Letter in Defense of Democracy, on April 19th, 2020.

One way to investigate the influence of the President’s denialist rhetoric on compliance with social distancing is to divide Brazilian states by support (states with governors who are pro-President) and nonsupport (otherwise). Since January 2019, when he assumed the Presidency of the Republic of Brazil, the President has lost support from the governors of Brazilian states, including the leaders of the two most important states: Rio de Janeiro and São Paulo. In fact, on April 18, 2020, 20 of the 27 governors signed a document formalizing their discontent (Open Letter in Defense of Democracy⁵). Therefore, this article defines as pro-President (support) the 7 states with governors who did not sign the letter.⁶

Fig. 1 presents the trajectory of the Social Isolation Index (SII) of the states with governors in the support and nonsupport groups. The SII was developed by INLOCO⁷ to assist in combating the COVID-19 pandemic by monitoring the coronavirus in Brazil. It shows the percentage of the population respecting the isolation recommendation. As expected, the SII grew substantially after the isolation decrees for both the President support and nonsupport states.

Fig. 2 describes the growth in COVID-19 infections in the support and nonsupport states during the analyzed period. In every period after state decrees of isolation and social confinement, it is clear that the growth in COVID-19 incidence (number of cases per 100,000 inhabitants) is higher in support states than in nonsupport states.

This evidence goes on to recent papers that correlated the Presidents’ denialist rhetoric with low adhesion to social distancing (Allcott et al., 2020; Gadarian et al., 2021; Barrios and Hochberg, 2020). These authors argue that the denialist discourse about virus dissemination, presented by some authorities, has strongly influenced many people not to obey the isolation and social confinement decrees. Indeed, denialist behavior has hampered the fight against the pandemic and, in general, increased the number of cases and deaths caused by COVID-19 (Faria et al., 2021).

Allcott et al. (2020) aimed to show how the partisan difference between Republicans and Democrats influences the behavior of American citizens in relation to the new coronavirus pandemic. To do this, they applied combined epidemiological models with economic models to optimize behavior for heterogeneous agents. The difference in people’s behavior regarding adherence to social distancing policies may reflect the opportunity costs that distancing imposes. The authors found a statistically significant effect of political party on social isolation index.

Gadarian et al. (2020) investigated how party ideology influences the behavior of the American population regarding the current COVID-19 pandemic. To do this, the authors studied a survey of 3000 adult Americans on March 20–23, 2020, when the pandemic was still in its early stages. Thus, using LASSO regression, they controlled the effects of the individual and geographic characteristics of the study sample. The results indicated that Republicans were less willing to follow health care recommendations and were less concerned about the current COVID-19 pandemic when compared to Democrats.

Barrios and Hochberg (2020) argue that, as Trump voter share rises, individuals search less for information on the virus, and engage in less social distancing behavior, as measured by smartphone location patterns. These patterns persist in the face of state-level mandates to close schools and businesses or to “stay home,” and reverse only when conservative politicians are exposed and the White House releases federal social distancing guidelines. In addition, Ajzenman et al. (2020) and Mariani et al. (2020) found the similar results working with Brazilian data set.

Ajzenman et al. (2020) investigated the impact of the position of the Brazilian President regarding the non-stoppage of services during the Covid-19 pandemic, on the index of social distancing in the Brazilian states. They argued that the actions and words of leaders can influence people’s behavior in several ways. Indeed, due to the asymmetry of information the population may ignorantly overlook recommendations from medical authorities in the event of a pandemic. In this way, the leader’s performance is of paramount importance. Eventually, they show that the social distancing index decreased in all municipalities where the President’s supporters are the majority as a result of his behavior contrary to the social distancing policies recommended by various health agencies.

Mariani et al. (2020) also investigated the influence of the Brazilian President on the number of Covid-19 cases and they concluded that his behavior increases Covid-19’s rate of contagion. More specifically, cities where the majority of voters supported the president in the last election had a 19% increase in the number of Covid-19 cases compared to those where the majority of their voters voted for the opposition party.

In this paper we are showing the impact of social–distancing on COVID-19 no. of cases and death and we are using as an instrument the fact that states that support the president have a population more sympathetic to his denialist behavior and therefore, have a low adhesion to social–distancing policies.

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⁵ For more details, see: https://www1.folha.uol.com.br/equilibrioesaude/2020/03/ao-contrario-do-que-disse-bolsonaro-passado-de-atleta-nao-e-garantia-de- protecao-contra-coronavirus.shtml, Available on April 28, 2020.

⁶ https://g1.globo.com/politica/noticia/2020/04/19/em-carta-governadores-de-20-estados-manifestam-apoio-a-maia-e-alcolumbre.shtml

⁷ Paraná, Minas Gerais, Federal District, Rondonia, Acre, Amazonas and Amapá.

Brazilian Company founded in 2010 and based on the Recife Company founded in Recife, with branches in São Paulo, New York and San Francisco: https://mapabrasileiradaCOVID.inloco.com.br/pt/
As stated, measuring the social-distancing restrictions by a self-reported index (SII) is endogenous because, as the pandemic worsens, self-isolation can take place even in the absence of social distancing policies. Therefore, Ordinary Least Square (OLS) coefficients are biased. To address this problem, we used Two Stage Least Squares (2SLS). In doing so, we follow Duflo (2001) and run a Differences-in-Differences (DID) model in the first stage, in which the outcome is SII, and the treated variable is the interaction between support and decreed (the data for social-distancing restrictions decreed by Brazilian states, Table 1). In the

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second stage, the predicted values of SII from the first stage (which are now exogenous) become the variable of interest in regressions on the outcomes. Our identification hypothesis is that the President’s behavior is able to explain COVID-19 cases and deaths only because it explains the population’s social isolation adherence. This idea is discussed further in the next section.

3. Methods

In this section, the current study presents information from the database used, as well as the empirical strategy Instrumented Difference-in-Differences used to investigate the causal impacts of SII on COVID-19 cases and deaths in Brazil.

3.1. Database

We worked with 27 Brazilian states, including the Federal District, over 108 days between February 1st and May 18th, 2020, checking cases of and deaths from COVID-19 obtained from the Kaggle platform. The choice of this time period for analysis follows the work of Merow and Urban (2020) and Wang et al. (2021a). According to these authors, during the initial stage of the outbreak in America and China there were fewer interventions on the contagion rates of COVID-19, therefore it possible to estimate the effect of public policy.

The influence of climatic factors on contamination with viral respiratory diseases was investigated in the literature. It can be concluded through these studies that the average temperature, the hours of sunshine and the precipitation of rain are important aspects when studying the determinants of the spread of these diseases (Paez et al., 2020; Sun et al., 2020; Kudo et al., 2019; Casanova et al., 2010; Makinem et al., 2009; Liener et al., 2003). To control for these characteristics, we use Brazilian states’ climate daily data for period under analysis from the National Institute of Meteorology (INMET).

To control for greater traffic of people, such as cities with airports, we used information about on the number of people entering the country through airports for each Brazilian state from the National Civil Aviation Agency (ANAC).

Socioeconomics of Brazilian states and characteristics such as population size, average income, proportion of employed persons, life expectancy and births come from the Brazilian Institute of Geography and Statistics (IBGE). In addition, the percentage of votes that the candidate for President of the Republic had received during the second round of the 2018 elections comes from the Superior Electoral Court (TSE).

In addition, the information about mortality rates from COVID-19 comorbidities (respiratory diseases, hypertension and diabetes), the number of hospitalizations in public hospitals and the bed rate per 100 inhabitants came from DATASUS. All of these variables are described in Table 2.

3.2. Empirical strategy

The main study goal is to verify the impact of social isolation and confinement on the contamination rate of COVID-19. It is supported that the results can be displayed with $Y_{it} = F(I_{it})$ and that

$$ F(I_{it}) = \tau_0 + \tau SII_{it} + \eta_{it}, \quad (1) $$

where $Y_{it}$ is our outcome (the COVID-19 confirmed cases and death) in state $i$ on day $t$, and $SII_{it}$ is the social isolation index of state $i$ on day $t$. In addition, $\eta_{it}$ is the error term of state $i$ on day $t$. It is also believed that $\eta_{it}$ is represented by

$$ \eta_{it} = X'_{it} \gamma_1 + W'_{it} \gamma_2 + H'_{it} \gamma_3 + \nu_{it}, \quad (2) $$

where $X_{it}$ is a vector of the socioeconomic characteristics of state $i$ on day $t$, $W_{it}$ is a vector of the climatic characteristics of state $i$ on day $t$, and $H_{it}$ is a vector of health information about state $i$ on day $t$. Finally, $\nu_{it}$ is, by construction, not correlated with $X'_{it}$, $W'_{it}$ and $H'_{it}$. Therefore, it is believed that $E[SII_{it}, \nu_{it}] = 0$. If these vectors are observables, then

$$ Y_{it} = \alpha + \rho SII_{it} + X'_{it} \gamma_1 + W'_{it} \gamma_2 + H'_{it} \gamma_3 + \nu_{it}. \quad (3) $$

Eq. (3) is a version of the linear causal model. The error term, $\nu_{it}$, in the equation is the random portion of the potential results that remains after the inclusion of the three vectors mentioned ($X'_{it}$, $W'_{it}$ and $H'_{it}$). However, a problem arises when resources in $X'_{it}$ or $W'_{it}$ or $H'_{it}$ are not observed. Such state information can determine both $Y_{it}$ and $SII_{it}$ and violate the assumptions that describe the Ordinary Least Squares (OLS) estimator as consistent ($COV(\nu_{it}, SII_{it}) = 0$) and nonbiased ($E[SII_{it}, \nu_{it}] = 0$). Thus, the OLS estimates in Eq. (3), in case these hypotheses are violated, would not provide the correct causal interpretation of the effect of the level of social isolation on the COVID-19 contamination rate.

To address this problem we can apply the Instrumental Variable approach. The instrument is a variable that must be correlated with a causal variable of interest, $SII_{it}$; however, it is not correlated with the dependent variable. The Instrumental Variable literature calls this hypothesis the Exclusion Restriction since the instrument can be excluded from the causal model of interest (Wooldridge, 2010).

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7 Data from http://www.kaggle.com/unaninad/corona-virus-brazil. Accessed on April 28, 2020.

8 $COV(\nu_{it}, SII_{it})$ is the covariance between $\nu_{it}$ and $SII_{it}$ and $E[SII_{it}, \nu_{it}]$ is the mathematical expectation of $SII_{it}$ given $\nu_{it}$.
The instrumental variable used in this study is developed using an Instrumented Difference-in-Differences (DDIV) approach (Duflo, 2001). The analysis treatment group is composed of the states that support the current President of Brazil (state governors who did not sign the Open Letter in Defense of Democracy). The time-related variable is a dummy that assumes a value equal to 1 if the governor of the state supports the president. To be a valid instrument, the variable (Duflo, 2001). The analysis treatment group is composed of the states that support the current President of Brazil (state go
cernors who did not sign the Open Letter in Defense of Democracy). The time-related variable is a dummy that assumes a value equal to 1 if the governor of the state supports the president.

Thus, the instrumental used is the Difference-in-Differences estimator built from the interaction between the treatment dummies and time variable exposed above (DID = support*degree). The specifications of the first and second stage equations follow the empirical strategy of Duflo (2001). To be a valid instrument, the variable $DID_t$ must obey two conditions: first, it must be correlated with the index of social isolation of the Brazilian states; and second, it should not be correlated with the characteristics of the states that determined the incidence of contamination with COVID-19.

Biderman et al. (2010) suggested that, by discarding the purely cross-section and time series variations and controlling for the estimates by the effects of non-observable characteristics invariant in the states’ time, the design of the Diff-in-Diff mitigates problems caused by endogenous adoption, corroborating the suggestion for an instrumental variable in the current study. In addition, according to Angrist and Pischke (2008), the character of gradual adoption ensures the comparison of the first and last adopters, which in fact can reduce endogeneity.

This study works with the belief that, despite the social-distancing restrictions decreed in some states with governors supporting the President, their management and population adherence have had a smaller magnitude. We argue that the Brazilian President’s rhetoric and behavior to minimize the importance of social distancing for the reduction of cases of and deaths due to COVID-19 weakened not only the population’s adherence to social distancing measures but also reduced the efforts of states’ governors who support the President to implement this strategy. Such points explain the strong correlation between the instrumental variable $DID_t$, which represents support of the President, and our interest variable, the Social Isolation Index ($SI_t$).

The second hypothesis for a valid instrument ($\text{COV}(Y_{it}, DID_t) = 0$) is guaranteed by the decision on who the next President of the Republic would be, not being correlated with the determinant aspects of the spread of contamination with COVID-19. The first information about the disease dates from the period after the second round of the presidential election in 2018 in Brazil. It can be said, thus, that $DID_t$ is exogenous in relation to the observable and unobservable characteristics that influenced the number of COVID-19 cases. The current literature on the contagion of communicable respiratory diseases points to temperature, vitamin D concentrations and social agglomerations as the main determinants of these types of diseases. It is certain that such contemporary information did not affect the individuals’ decisions to support the incumbent President in his presidential campaign in 2018. In addition, the control of non-observable characteristics is invariant over time by the Difference-in-Differences approach, and the contingency of the controls used in the analysis contributes to reducing the endogeneity involved in this type of investigation. It follows, from Eq. (3), that

$$\rho = \frac{\text{COV}(Y_{it}, DID_t)}{\text{COV}(SI_{it}, DID_t)} = \frac{\text{COV}(Y_{it}, DID_t)/\text{VAR}(DID_t))}{\text{COV}(SI_{it}, DID_t)/\text{VAR}(SI_{it})},$$

(4)
The coefficient of interest, \( \rho \), is the ratio between the population regression of \( Y_t \) on \( DID_t \) (referring to the reduced form) and the population regression of \( SII_t \) on \( DID_t \) (first stage). The model is called 2-Stage Least Squares (2SLS) because it is performed in two stages. First, \( SII_t \) is estimated using the following equation:

\[
SII_t = X_{it} Y_{t1} + W_{it} Y_{t2} + H_{it} Y_{t3} + \delta_1 Decree_{it} + \alpha_1 President_t + \beta_D DID_t + \epsilon_{it}.
\]

The \( Decree_{it} \) variable is a dummy related to the state \( i \) social isolation decree period on day \( t \), and \( President_t \) is a dummy variable referring to state \( i \) support for the President in the 2018 elections and summarizing the treatment of the specification. Then, in the second stage, the Eq. (5) predicted variable, \( SII_t \), is substituted in Eq. (3), and the following equation is estimated:

\[
Y_t = X_{it} Y_{t1} + W_{it} Y_{t2} + H_{it} Y_{t3} + \delta_2 Decree_{it} + \alpha_2 President_t + \rho SII_t + \epsilon_{2it}.
\]

The interested variable, \( \rho \), represents the impact of social isolation on COVID-19 cases. Thus, the hypotheses of the model are not biased.

### 4. Results and discussion

All of the analyses considered the socioeconomic, climatic, and public health characteristics of the states presented in the previous section. A total of 108 days were investigated between the months of February and May 2020, and a panel was developed with the 26 Brazilian states, plus the Federal District. The level of social isolation and the other control variables of the study determined the contamination rate of subsequent days, given that the virus incubation period varies between 1 and 14 days. Thus, the study uses the contamination rate of 7 days ahead of the independent variables.

Table 3 describes the Difference in Difference estimation corresponding to the first stages of 2SLS. In Table 3, columns (1) to (4), the DID coefficients are negative and significant, meaning that, in states with governors supporting the President, the SII is one percentage point less than SII in states that do not support the President. This result goes on to argue that the President's approach against social isolation weakened the population's willingness to quarantine, converging with Ajzenman et al. (2020) and Mariani et al. (2020). Another important result is that the estimated coefficients do not change substantially with the inclusion of states' characteristics, as described in columns (1) to (4). Table 4 describes the second stage of this strategy. In it, we analyze the impact of SII on COVID-19 cases and deaths.

The second stage of the DDIV specification is described in Table 4, columns (1) to (4). Panels A and B show the impact of the Social Isolation Index on both outcomes, respectively: COVID-19 cases and deaths per 100,000 inhabitants. After controlling for all characteristics (Table 4, Panel A (Panel B), column (4)), we found that increasing social isolation by 1% point reduces the number of cases (deaths) due to COVID-19 by 13.51 (0.42) per 100,000 inhabitants.

To explain the net impact of the President’s speech on outcomes, we can calculate the effect of the SII increase on our outcomes (Table 5). Therefore, we estimated the differences between the state SII (Table 5, column (A)) and a hypothetical ideal value of SII = 51% (Table 5, column (B)). Multiplying column (B) by the estimated coefficient in Table 4, column (4), Panel A (Panel B), we found that the number of cases (deaths) decreased in each state per 100,000 inhabitants, as described in column (C) (column (D)). Table 5, column (E), shows the proportion of COVID-19 cases (deaths) that decreased in relation to the total COVID-19 cases (deaths) by state during the period of analysis.

The results shown in Table 5 suggested that, by increasing the social isolation to 51%, the Brazilian states will have different benefits depending on how far they are from the hypothetical index and on their population. For example, São Paulo, the largest Brazilian state, had an average SII equal to 40.22% between February 1 and May 18, 2020. If its SII increases on average to 51%, the number of COVID-19 cases will be reduced by 5.57%, and the number of deaths will decrease by 2.4%, i.e. around 66,901.02
Table 4
Impact of social isolation on outcomes by Brazilian states. Second stage of ddH.

| Panel A: COVID19 cases rates per 100,000 inhabitants |
|-----------------------------------------------------|
| **Column** | **Brazil** | **Paraná** | **Goias** | **Mato Grosso** | **Rio Grande do Norte** | **Maranhão** | **Acre** | **Amazonas** |
|-------------|------------|------------|-----------|-----------------|----------------------|-------------|---------|------------|
| SII         | -1.39      | -1.24      | -1.26     | -1.26           | -1.26                | -0.26       | -0.19   | -0.19      |
| Decreed     | 2.88       | 2.88       | 2.92      | 2.92            | 2.92                 | -0.05       | -0.05   | -0.05      |
| Support     | 0.06       | 0.06       | 0.06      | 0.06            | 0.06                 | -0.06       | -0.06   | -0.06      |
| Observations| 2727       | 2727       | 2727      | 2727            | 2727                | 2727        | 2727    | 2727       |

| Panel B: COVID19 death rates per 100,000 inhabitants |
|-----------------------------------------------------|
| **Column** | **Brazil** | **Paraná** | **Goias** | **Mato Grosso** | **Rio Grande do Norte** | **Maranhão** | **Acre** | **Amazonas** |
|-------------|------------|------------|-----------|-----------------|----------------------|-------------|---------|------------|
| SII         | -0.276**   | -0.340***  | -0.371**  | -0.425**        | -0.425**             | -0.26       | -0.19   | -0.19      |
| Decreed     | 6.458***   | 7.487***   | 8.092***  | 9.000***        | 9.000***             | 6.458       | 7.487   | 8.092      |
| Support     | 0.486**    | 0.433**    | 0.503**   | 1.459***        | 1.459***             | 0.486       | 0.433   | 0.503      |
| Observations| 2727       | 2727       | 2727      | 2727            | 2727                | 2727        | 2727    | 2727       |

Sources: Kaggle’s database; INLOCO; ANAC; IBGE; INMET; TSE; Official Journals of Brazilian states. ***Statistically significant coefficient at the 1% level. **Statistically significant coefficient at the 5% level. *Statistically significant coefficient at the 10% level. Robust errors in heteroscedasticity were noted. Coefficient standard errors appear in parentheses.

Table 5
The impact of social isolation index increase of up to 51% on COVID-19 cases and deaths in Brazilian states from February 1 to May 18.

| States          | Social Isolation Index (%) | Increase in state SII up to 51% | COVID-19 no. of cases decreased over 100,000 inh | COVID-19 no. of deaths decreased over 100,000 inh | % of reduction in number of COVID-19 cases | % of reduction in number of COVID-19 death |
|-----------------|---------------------------|---------------------------------|-----------------------------------------------|-----------------------------------------------|-------------------------------------------|------------------------------------------|
| Tocantins       | 35.58                     | 15.42                           | -208.34                                       | -6.55                                         | -23.81                                    | -36.69                                   |
| Sergipe         | 37.39                     | 13.61                           | -183.87                                       | -5.78                                         | -12.03                                    | -17.31                                   |
| Goias           | 37.43                     | 13.57                           | -183.36                                       | -5.77                                         | -40.96                                    | -50.16                                   |
| Rio Grande do Norte | 37.95           | 13.05                           | -176.38                                       | -5.55                                         | -11.89                                    | -16.29                                   |
| Mato Grosso      | 38.06                     | 12.94                           | -174.85                                       | -5.50                                         | -41.47                                    | -41.04                                   |
| Roraima         | 38.27                     | 12.73                           | -172.00                                       | -5.41                                         | -3.81                                     | -6.18                                    |
| Mato Grosso do Sul | 38.40              | 12.60                           | -170.24                                       | -5.35                                         | -41.54                                    | -43.39                                   |
| Bahia           | 38.52                     | 12.48                           | -168.63                                       | -5.30                                         | -18.27                                    | -16.43                                   |
| Minas Gerais    | 38.63                     | 12.37                           | -167.13                                       | -5.26                                         | -39.48                                    | -35.40                                   |
| Pará             | 38.78                     | 12.23                           | -165.18                                       | -5.20                                         | -13.00                                    | -6.88                                    |
| Alagoas         | 38.93                     | 12.07                           | -163.10                                       | -5.13                                         | -10.97                                    | -6.33                                    |
| Piauí            | 39.11                     | 11.89                           | -160.60                                       | -5.05                                         | -18.45                                    | -14.65                                   |
| Espírito Santo  | 39.31                     | 11.69                           | -158.01                                       | -4.97                                         | -5.77                                     | -4.78                                    |
| Pará            | 39.44                     | 11.56                           | -156.19                                       | -4.91                                         | -30.32                                    | -17.81                                   |
| Maranhão        | 39.86                     | 11.14                           | -150.51                                       | -4.73                                         | -6.44                                     | -4.05                                    |
| São Paulo       | 40.22                     | 10.78                           | -145.69                                       | -4.58                                         | -5.57                                     | -2.24                                    |
| Para            | 40.38                     | 10.63                           | -143.56                                       | -4.52                                         | -7.52                                     | -2.81                                    |
| Rondônia        | 40.50                     | 10.50                           | -141.87                                       | -4.46                                         | -9.11                                     | -8.58                                    |
| Amapá           | 40.59                     | 10.41                           | -140.65                                       | -4.42                                         | -2.05                                     | -2.24                                    |
| Distrito Federal | 40.62              | 10.38                           | -140.31                                       | -4.41                                         | -5.68                                     | -10.09                                   |
| Santa Catarina  | 40.93                     | 10.07                           | -136.04                                       | -4.28                                         | -10.77                                    | -15.41                                   |
| Rio Grande do Sul | 41.20            | 9.80                            | -132.47                                       | -4.17                                         | -21.00                                    | -19.32                                   |
| Pernambuco      | 41.55                     | 9.45                            | -127.66                                       | -4.02                                         | -4.06                                     | -1.56                                    |
| Ceará           | 42.51                     | 8.40                            | -114.78                                       | -3.81                                         | -2.71                                     | -1.32                                    |
| Rio de Janeiro  | 42.80                     | 8.20                            | -110.82                                       | -3.49                                         | -4.46                                     | -1.46                                    |
| Acre            | 43.00                     | 8.00                            | -108.07                                       | -3.40                                         | -3.38                                     | -3.23                                    |
| Amazonas        | 43.98                     | 7.02                            | -94.85                                        | -2.98                                         | -1.37                                     | -0.57                                    |

Sources: Kaggle’s database; INLOCO; ANAC; IBGE; INMET; TSE; Official Journals of Brazilian states. ***Statistically significant coefficient at the 1% level. **Statistically significant coefficient at the 5% level. *Statistically significant coefficient at the 10% level. Robust errors in heteroscedasticity were noted. Coefficient standard errors appear in parentheses.
and 2104.30 cases of and deaths from COVID-19, respectively, could be avoid if social distance had been respected, between February and May 2020.

Another example, Pernambuco state had one of the higher SII among Brazilian states (41.55%), although if its SII was 51%, the numbers of cases and deaths could be reduced, respectively, on average by 4.6% and 1.5%. It is a mean of approximately 12,000 people without COVID-19, and more than 383 deaths could be avoided, at the same period. Analyzing for Brazil, we can say that, if the Brazilian average SII increased from 39.77% to 51% just between February 1 and May 18, 2020, the country would have had approximately 318,850.03 fewer cases of COVID-19, and more than 10,000 lives would have been saved. Those results suggested that the Brazilian President’s behavior explained the decrease in SII (Table 3) increasing the number of cases and deaths in the country (Table 4).

5. Conclusion

The second wave of COVID-19 infections has been more severe than the first one (WHO, 2021) and the new strain is significantly more contagious than the first one. Evidence from multiple countries has indicated that the implementation of physical distancing and health facilities has been effective in reducing COVID-19 case incidence, which has led to a reduction in hospitalizations and deaths among COVID-19 patients.

However, the success of social distancing policy depends on the awareness of the population and coordinated action by public authorities has proved to be a decisive factor for the engagement of the population. Unfortunately, the Brazilian President has called into doubt the effectiveness of social distancing to mitigate the virus’ consequences (DA SILVA R.G.L, 2021; Richard and Medeiros, 2020; Malinverni and Brigagão, 2020; Paes-Sousa, 2020). Therefore, this paper aimed to measure the impact of the President’s weak social distancing policy in contributing to the increase in COVID-19 cases and deaths.

Our identification hypothesis is based on the idea that the President’s rhetoric negatively affected the respect and obedience to social distancing decreed by governors of Brazilian states, reducing the impact of social distancing on COVID-19 cases and deaths. As an estimation strategy we have applied the Difference-in-Differences Instrumental variable. Since the decree of social isolation and confinement was staggered between the units of the Brazilian Federation, the specification of Difference-in-Differences in the second stage further mitigates the problem of endogeneity caused by endogenous adoption by controlling for non-observable omitted variables.

The results agree with the literature on the topic and with the hypothesis suggested by this study (GOLLWITZER et al., 2020; Ajzenman et al., 2020; Adolph et al., 2020; ALLCOTT et al., 2020; BARRIOS and HOCHBERG, 2020). The estimated coefficients were consistent and significant, although they were controlled by several socioeconomic and climatic characteristics and information about the states’ public health– factors disclosed by previous studies as relevant for determining the rate of contamination of the disease. In addition, we can say that, if the Brazilian average SII increased from 39.77% to 51% just between February 1st and May 18th, 2020, the country would have had approximately 318,850.03 fewer cases of COVID-19, and more than 10,000 lives would have been saved. Those results reveal that support for the President reduced the magnitude of the Social Isolation Index for instance increase the number of cases and death by COVID-19.

Finally, this study reveals the damage of the Brazilian president’s negationist approach to control the health crisis and reduce deaths by COVID-19, and suggests that the alignment between the spheres of government in times of social crisis should be effectively expanded to be implemented as federal public policy.

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