More than Words: Leaders' Speech and Risky Behavior During a Pandemic*

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Abstract

How do political leader's words and actions affect people's behavior? We address this question in the context of Brazil by combining electoral data and geo-localized mobile phone data for more than 60 million devices throughout the entire country. We find that after Brazil's president publicly and emphatically dismisses the risks associated with the COVID-19 Pandemic and advises against isolation, social distancing measures of citizens in pro-government localities reduce relative to those places in which his support is weaker, while pre-event effects are insignificant. The impact is large and robust to different empirical model specifications. We also find suggestive evidence that this impact is driven by localities with relatively higher levels of media penetration.

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I Introduction

Leadership is a powerful tool to influence human behavior. From Plato to the modern literature in economics (e.g. Hermalin, 1998), sociology of organizations (e.g. Weber, 1947) and management (e.g. Burns, 1978), there is a widespread consensus that leadership matters. Leaders can have an effective role in affecting people's beliefs and behavior by different channels: by reducing information asymmetries and thus reducing coordination problems (e.g. Dewan and Myatt, 2008), by setting a social norm (e.g. Acemoglu and Jackson, 2015) or, simply, by transmitting a message symbolically and emotionally (e.g. Hermalin, 2017; Antonakis et al., 2014).

A growing empirical literature (in the field or in the lab) has recently shown that leaders have the power – with their actions and with their words – of persuading people in a variety of relevant contexts, such as behaving more or less honestly (e.g. Ajzenman, 2018; d'Adda et al., 2017), increasing their contributions to public goods (e.g. Güth et al., 2007; Andreoni, 2006); and increasing their productivity at work (e.g. Brandts and Cooper, 2007). A crucial yet virtually unexplored domain in which leaders may potentially have a relevant impact is in health-related risky behavior. Information on recommended prevention practices is typically asymmetrical between governments and citizens, and the problem becomes even more stringent during a public health emergency, such as a pandemic. Not only regular citizens may ignore the best practices from a medical point of view but, more importantly, they are likely to be unaware of the global spread of the disease (and ignore negative externalities) and thus the urgency of the situation. The role of leaders in this context is, therefore, crucial.

In this paper, we aim at bridging this gap in the literature by exploring the effect of a high-profile political leader's behavior and public speech on the citizens' preventive and risky behavior. We focus on the recent outbreak of the COVID-19 Pandemic in Brazil, a particularly suitable setting to address our research question.[1] Since the beginning of the pandemic, the official response was notably heterogeneous among the different governments at the state and federal levels. While many sub-national governments declared non-pharmaceutical interventions with different levels of strictness (e.g. Anderson et al., 2020) and recommended adherence to social distancing, President Bolsonaro has minimized the effect of the disease to the point of explicitly and publicly contradicting the instructions communicated by governors. In a number of different events (that even reached the international media — see, for instance, (e.g. FT, 2020; The Economist, 2020), Brazil's President publicly motivated citizens to go out and thus break the social isolation policies.

The framework is thus ideal for testing if the speech of a public leader (in this case, the head of state) could induce certain types of behavior that can lead or not to perceptible risks for individuals with potential negative externalities to communities. Brazil is a highly polarized country in which the President has an almost equal level of strong approval and strong disapproval (e.g. Hunter and Power, 2019). We hypothesize that the President's supporters are significantly more prone to be persuaded by his words than his critics, even in a context of high-stake decisions, such as adherence (or not) to preventive measures during the pandemic, which were recommended by the World Health Organization, Brazil's sub-national governments, and also endorsed by the national Ministry of Health.[2]

In order to address our research question we use several datasets. We first deploy a social distancing index at the municipal-day level constructed by In Loco (a technology company with

[1]Brazil is a three-tiered federation with 26 states, a Federal District and 5,571 municipalities.

[2]On 16 April 2020, Bolsonaro sacked his ministry of health after weeks of public conflicts on their different views on social distancing policies and the effectiveness of treatments based on anti-malaria drugs to fight critical cases of the novel coronavirus.

offices in Brazil and in the United States), based on granular location data from tens of millions of anonymous mobile devices across Brazil. The index is defined as the proportion of mobile phones in a given municipality that stayed within a radius of 450 meters from their habitual home during a day. We then combine this with municipal data from the 2018 presidential election and conduct a event-study type of analysis at the day-municipality level. In our setting, the "intervention" is defined by the interaction of a "pro-government" dummy (based on the average municipal support to the current President in the 2018 elections) and the dates corresponding to the events in which the President publicly challenged the social distancing policies.

We show that, following public and prominent speeches of the President against social isolation policies, the average social distancing index immediately falls in those municipalities with a majority of supporters. The effect is significant, it persists for at least a week and it is robust to several specifications and definitions of political support. We also show insignificant pre-event effects. Moreover, we present suggestive evidence of a larger effect being present in municipalities with a higher presence of local media or internet penetration among households, a result consistent with other papers that have emphasized the role of local media disseminating political news in Brazil (see Ferraz and Finan (2008)).

We complement the empirical analysis with a simple theoretical model to rationalize how differences in perceived expected loss of being infected by the virus (likely to be affected by the presidents' words and actions) affect equilibrium social distancing. In our model, individuals are willing to self-isolate voluntarily when the probability of contracting the disease is tangible. However, people also weigh the contagion risk against losses of income and the inconvenience of living in isolation. As a consequence, voluntary social distancing can start to keep people at home only when the infection risk becomes visible, which is unlikely in the initial stages of the pandemic. Individuals might overexpose themselves to infection.

Our paper relates to several strands of the literature. First, it builds on the literature on the role of leaders in shaping people's beliefs and behavior. Although the traditional approach of economics has focused on transactional leadership (e.g. Burns, 1978) – incentives as the main channel through which the principal can induce behavior among the agents (see for instance Lazear and Rosen (1981), Holmstrom and Milgrom (1991) or Holmstrom and Milgrom (1994)) –, there is a growing theoretical (such as Hermalin (1998) or Acemoglu and Jackson (2015)) and empirical literature studying how leaders can motivate followers to voluntarily behave in certain ways, with their speeches and their exemplar behavior. Using Mexican data, Ajzenman (2018), for example, shows that when a corruption scandal by a political leader is revealed, citizens become more dishonest and adopt more corrupt beliefs (results consistent with those of d'Adda et al. (2017), tested in the lab). Jack and Recalde (2015), in a field experiment in Bolivia, find that voluntary contributions to a public good rise when an elected leads by the example. In a different setting, Antonakis et al. (2014) show in field and lab experiments that listening a charismatic speech from a leader can induce prosocial behavior among workers (results in line with the in-the-lab findings of Gächter and Renner (2018)). Two papers are particularly related to ours: Bassi and Rasul (2017) show that the Papal's visit to Brazil in 1991 had a significant effect on beliefs and behavior related to fertility, among those directly exposed to his speech; while Stroebel and van Benthem (2012) show that the public approval of the use of condoms to fight HIV by an influential Catholic archbishop in Kenya, caused a significant increase on its use among unmarried Catholics in the diocese. Our study contributes to this literature, and complements these papers, by focusing on a particularly relevant type of leader – the head of state – and showing how his speech affects citizens' risky health-related behavior.

Second, and related to the effects of a leader's speech on behavior, our paper contributes

to the general literature on persuasion. DellaVigna and Gentzkow (2010) present a complete empirical review of the effect of persuasion on consumers, donors, voters, and investors. We contribute to this literature by providing a novel piece of evidence on how political leaders can persuade citizens to adopt a risky behavior amidst the most disruptive and widespread pandemic of a century.

Third, our paper relates to the recent literature on the COVID-19 Pandemic and social distancing compliance. Barrios and Hochberg (2020) document a partisan divide in compliance with social distancing. In particular, the paper shows that pro-Trump counties are more prone to keep social distancing, a result consistent with the findings of Allcott et al. (2020) and Kushner Gadarian et al. (2020). In a paper closer to ours, Painter and Qiu (2020) show that state-level "stay-at-home" orders in the US are more likely to be abided by democrats when the governor is a democrat. Our paper contributes to this growing literature by showing how the actions and words of the political leader can affect the behavior of the followers, regardless of the legal or official policies (such as "stay-at-home" orders) put in place.

Finally, and more generally, our paper contributes to the literature on behavioral change promotion in public health through opinion leaders. Most of the papers in this field focuses on the identification of efficient channels/agents to spread a positive change/innovation in health behavior, such as celebrities, community leaders or peer leaders (see Valente and Pumpuang (2007) for a comprehensive review). Kalichman and Hunter (1992), for instance, show significant changes in HIV-related beliefs after professional NBA star "Magic" Johnson's disclosure of his HIV infection; La Ferrara et al. (2012) show how a popular soap opera in Brazil caused a significant reduction in fertility, induced by the behavior of the main characters of the TV show. In a similar paper, Kearney and Levine (2015) show that a popular MTV show ("16 and Pregnant") reduced teen births in the US. In a context similar to ours, Bursztyn et al. (2020) show that prevention (or anti-prevention) messages broadcasted through TV shows had a significant impact on viewers' behavior and downstream outcomes during the COVID-19 Pandemic in the US. We contribute to this literature by showing that the head of state can be an effective agent of behavioral change. In our case, to promote or not a lessening in preventive health behavior.

The paper is structured as follows. Section II describes the context and the chronology of events in Brazil. Section III presents a theoretical model of social distancing compliance. Section IV describes the data. Section V presents the empirical model and the main results and Section VI, concludes.

II Context and Chronology

The COVID-19 Pandemic has claimed many lives and is causing widespread disruption to the world economy. Since its outbreak, most countries are reporting exponential growth in the incidence of reported COVID-19 cases. Several countries started to actively implement non-pharmaceutical interventions with different levels of stringency to mitigate the spread of the virus: ranging from traveling restrictions,[3] school closings, bans on public gatherings to home isolation or even mandatory quarantines. The mitigation strategy, as it was popularized by the Imperial College Report, aims at "flattening the curve", in order to keep the number of critic cases at a manageable level and thus avoid a collapse of the health system. Although some of these rules are, by definition, abided by the citizens (for instance, school closings), the level

[3] The Stringency Index, produced by the Oxford Blavatnik School of Government contains an up-to-date summary of the containing measures implemented by each country. It is available at https://www.bsg.ox.ac.uk/research/research-projects/oxford-covid-19-government-response-tracker.

of compliance of many others depend on their goodwill (and, naturally, their socio-economic status), especially in countries in which isolation is recommended but not legally enforced.

Some countries have reacted more moderately, either by deliberate choice or due to implementation constraints (say, in places, with many slums and people living on the streets) leaving individuals to choose for themselves an appropriate degree of self-isolation.

As we show in our theoretical framework presented in Section III, individuals are willing to self-isolate voluntarily when the perceived expected loss of being infected is high. Individuals weigh the risk and the loss of getting the virus against losses of income, employment and the inconvenience of social distancing. Critics of voluntary social distancing believe that relying on individual choice can lead to people to self-isolate only when the infection risk becomes visible, and the epidemic has already taken off with no major effects on flattening the curve.

In Brazil, and similar to what was experienced in other countries such as the United States, the official response to the outbreak was not clear. In addition, being a federal country where state governments have real power to implement their own social distancing policies, the actions in the country were spatially heterogeneous and uncoordinated. Figure I shows that every single state ended up adopting mandated measures of social distancing policies, closing schools and some public spaces, although the timing varied across states.

As novel coronavirus cases and fatalities started to rise in the country, the Brazilian President Jair Bolsonaro minimized the pandemic and has not endorsed strict quarantine and social distancing measures, some implemented by Brazilian sub-national governments. Bolsonaro has encouraged people to go out and even making public appearances in stores, markets and public demonstrations on the streets contradicting his own health ministry,[4] while dismissing the effects of the virus as "just a little dose of flu" (see The Wall Street Journal, 4/2) and calling the disease a "media trick" (see The Guardian, 3/23). His behavior was so controversial that it rapidly made it to dozens of international media outlets, such as The Times of India ("Brazil president takes selfies, cheers demonstrators despite virus warnings", 3/16), The Economist ("BolsoNero: Brazil's president fiddles as a pandemic looms", 3/26), BBC ("Coronavirus: Brazil's Bolsonaro in denial and out on a limb", 3/29),The New York Times ("Bolsonaro, Isolated and Defiant, Dismisses Coronavirus Threat to Brazil", 4/1), The Wall Street Journal ("'Go Back to Work': Bolsonaro Dismisses Risks of Deadly Coronavirus in Brazil", 4/2), and The Washington Post ("Bolsonaro may be the world's coronavirus skeptic in chief", 4/7), among many others.

Despite his opposition to drastic social distancing measures and his denial regarding the health severity of the novel coronavirus, his messages on the issue were not always uniform and clear. We summarize some of his speeches and public demonstrations on COVID-19 Pandemic. We show that there were two key events in which his critiques were particularly focused on condemning the social distancing policies and, unlike other days, made to the front pages of the main national media outlets. The dates were March 15$^{\text{th}}$ and March 24$^{\text{th}}$.

(i) In a neutral position regarding the severity of the pandemic, Bolsonaro first mentioned the virus in his twitter account on 31 January 2020.

(ii) In a televised presidential statement on 6 March, Bolsonaro stated that people "must strictly follow the experts' recommendations as the best protective measure". However, there was no clear recommendation on social distancing measures.

[4] On 16 April 2020, Bolsonaro fired his health ministry after weeks of public confrontation on their opposing views on governors' policies to shut down schools and businesses and on the effectiveness of antimalarial medications to fight the disease.

(iii) In an official visit to the United States on 10 March 2020, Bolsonaro recognized that there was a world crisis related to the coronavirus, but it was probably not as strong as the mainstream media reported. On 12 March 2020, Bolsonaro appeared with his health ministry Mandetta on television, both wearing face masks, and the president monitored by doctors, since some members of his cabinet, who also went to the United States in the presidential mission, tested positive for COVID-19. Due to the risk of contagion, the health minister recommended to postpone the public protests against the Congress and the Federal Supreme Court (STF) scheduled for Sunday 15 March 2020. On an official pronouncement on 12 March, Bolsonaro stated that these public marches should be "reconsidered" given the "current events".

(iv) **March 15th - Demonstration:** The marches on 15 March went on despite official messages of calling them off. Then, unexpectedly, Bolsonaro, still on suspicion of being infected with COVID-19, joined one of the demonstrations in Brasilia. He took selfies and distributed fist bumps with several supporters and during that day posted the largest number of tweets since he became the president (47 tweets), most of them with videos showing the rallies in different cities of the country.

His behavior rapidly captured the attention of national and international media. On the 16th, Bolsonaro's picture in the march appeared in the front page of the three largest newspapers in Brazil (Folha de Sao Paulo, O Globo and Estadao) with headlines directly alluding to his behavior in relation to the prevention of the virus. Folha's headline, for example, stated that "Bolsonaro ignores the virus and shows up in a march against the Congress and the STF". Estadao's headline pointed towards the same direction "Infectologists criticize Bolsonaro for giving a bad example to the nation", similar to O Globo's headline: "Don't do what I do, bad examples threaten the fight against Coronavirus" (see Figure II as an example). Other newspapers had similar headlines. On March 16, Gazeta do Povo, a conservative newspaper in the state of Paraná show a picture of Bolsonaro taking selfies in one of the rallies.

(v) On 18 March 2020, Bolsonaro and several of his ministers, all wearing face masks, spoke with the press and presented policies to mitigate the economic and health impacts of the pandemic. There was no clear message on social distancing.

(vi) **March 24th - Presidential official pronouncement:** Since the beginning of the outbreak, until April 14th, there were five presidential official pronouncements. This type of pronouncements is particularly relevant because they are simultaneously broadcast by every TV or radio station in the country. Broadcasting is mandatory and, thus, these types of messages are scarce and reserved for especially relevant communications from the president (in 2019, for instance, there were five official pronouncements throughout the entire year).[5] In the first two communications (March 6th and 12th), the president gave short speeches and the messages were not very specific on social distancing. He emphasized the work of the federal government and tried to bring calm and encouraged people to follow the prevention measures recommended by the specialists. The tone of these messages were completely reverted in the speech of March the 24th.

Doubling the length of his discourse, in this one Bolsonaro directly referred to the social distancing policies implemented by the sub-national governments. He first emphasized that the risk group was mainly the elderly and, thus, suggested there was no point in closing schools. He also emphasized that jobs had to be maintained and criticized the

[5] The text of each of these speeches can be accessed publicly in this website: https://www.gov.br/planalto/pt-br/acompanhe-o-planalto/pronunciamentos.

media for spreading the news of Italy ("a country with a large elderly population and a completely different weather").

He referred to his personal situation and said that, because of his athletic historical condition, he would not need to worry even if he got infected: "I would feel nothing or, in the worst case, it would be like a little flu."

He finally mentioned the effectiveness of antimalarial medications based on hydroxychloroquine (HCQ) in fighting the disease caused by COVID-19.

As in the case of the public protests on 15 March (and unlike any of the previous or posterior official communications), his speech made it again to the front pages of the main national newspapers the following day. Folha's headline, for example, stated that "Bolsonaro criticizes school closures and attacks the press"". Estadao's headline stated that "Bolsonaro criticizes the quarantine and wants stores and schools to open", similar to O Globo's headline: "Bolsonaro ignores the world's trends and criticizes isolation and school closures" (see Figure III as an example).

(vii) The next official pronouncement was on March 31st and Bolsonaro toned down his speech. Citing the World Health Organization he highlighted the need of saving jobs as much as possible "If we prevent people from moving, what would happen to those who have to work in order to get their daily bread?" He praised the policies implemented by the federal government to mitigate the effects of the epidemic together with sub-national governments but was clear to state that the side effects of the measures should not be worse than the disease.

(viii) Finally, in the April's 8th official pronouncement, Bolsonaro kept the tone of the previous one, praising his policies, the coordination of the federal government with the states, but continued emphasizing the need to keep jobs and the effectiveness of HCQ in treating patients with COVID-19. If any, media's interpretation was that Bolsonaro's was toning down his message (Folha, for example stated on April the 1st that "Bolsonaro change his tone, and speaks about a pact and a challenge for this generation",[6] while O Globo stated that "Cases in the country hit a record, and Bolsonaro, isolated, moderates his tone"[7]).[8]

Therefore, two events were very strong and outliers in spreading a message against social distancing. The first is his personal demonstration on 15 March by joining the crowd with a non-negligible risk of being infected and breaking public health guidelines to avoid contagion. The second event is his official pronouncement on 24 March in which he pushed to end social distancing measures implemented by some sub-national governments. Since 24 March there were public demonstrations of Bolsonaro against measures of social distancing.

III Theoretical Model

In this section we present a simple model to understand how differences in perceived expected loss of being infected by the virus affect equilibrium social distancing and the dynamics of infection. This is a stylized model which is used only for qualitative and positive analysis. We do not implement any normative or quantitative analysis.[9] The background of environment is

[6]See https://www.vercapas.com.br/edicao/capa/folha-de-s-paulo/2020-04-01/

[7]See https://www.vercapas.com.br/edicao/capa/o-globo/2020-04-0

[8]Each of the main newspapers' front pages can be downloaded from https://vercapas.com.br.

[9]See Greenwood et al. (2019) for a quantitative model of HIV/AIDS epidemic and Toxvaerd (2019) for an analysis of optimal policy in an epidemic model with costly preventive behavior.

the basic SIR (Susceptible (S), Infected (I) and Recovered(R)) model presented by Kermack and McKendrick (1927). Here we briefly describe this model and then extend it to an environment with heterogeneous agents and equilibrium social distancing.[10]

Time is continuous and the population size in normalized to one such that $S_t + I_t + R_t = N = 1$. At the initial period the number of recovered or deceased (or immune) individuals is $R_0 = 0$ and a small measure of individuals get infected such that S_0 is just below 1 and I_0 is just above zero. At each instant, individuals match randomly. Susceptible individuals S_t might be contaminated at rate β once they match with infected individuals I_t. Infected individuals recover from the disease at rate γ and then become immune to the disease. The dynamics of infection is described by the following system of differential equations

$$\dot{S}_t = -\beta I_t S_t, \tag{1}$$
$$\dot{I}_t = \beta_t I_t S_t - \gamma I_t, \tag{2}$$
$$\dot{R}_t = \gamma I_t. \tag{3}$$

During the epidemic the measure of infected individuals initially rises and peaks at $S = \frac{\gamma}{\beta}$ and it then decreases. In the literature, the ratio $r = \frac{\beta}{\gamma}$ is defined as the basic reproduction number. It is the average number of people infected from one other person. The solid line of Figure IV(a) illustrates the dynamics of the SIR model.

A lockdown can be thought as a reduction on β, the passage rate and it flattens the infection curve out. This typical model can be extended in many dimensions. One of them is to introduce congestion in hospitals.[11] Since the measure of fatalities relative to total infection is, for most of the epidemic, small, then the dynamics for the susceptible, infected and recovered individuals are similar to those reported in Figure IV and therefore we will abstract from deaths here and explore the equilibrium social distancing dimension.

Now, let's still assume that there is a continuum of individuals of measure one, but consider the case in which there are $n \in \{1, 2..., N\}$ types of individuals. The share of type-n agents is $\pi_n \in [0, 1]$ with $\sum_{i=1}^{N} \pi_n = 1$ and their expected perceived loss of being infected is $L_n > 0$. Without loss of generality assume we let $0 \leq L_1 < L_2 < ... < L_N$.[12] Agents can take actions to avoid contagion by being vigilant. The social distancing effort of an agent n is v_n and this decreases the infection rate, as it will be described below. This can be thought as avoiding going out or visiting relatives, working from home, using masks, more hand washing and cleaning, self isolation and so on. The social distancing effort v_n to avoid infection comes with a cost described by the function $c(v_n) = \frac{v_n^2}{2}$. This can be interpreted as the foregone income of working

[10] For models with equilibrium social distancing see Toxvaerd (2020). Based on Keppo et al. (2020), we introduce heterogeneity in the perceived expected loss of being infected.

[11] For instance, let C_t denote sick individuals in critical state. A typical equation describing the dynamics of individuals in the critical state is

$$\dot{C}_t = \gamma \chi I_t - \lambda C_t.$$

The number of fatalities is given by:

$$\dot{D}_t = \lambda C_t \left(1 - \left((1 - \delta) + \frac{\theta_1}{(1 + C_t)^{\theta_2}}\right)\right).$$

The change in the number of fatalities has two terms. The first one corresponds to the fact that some people would naturally die from the disease. The second component depends on the amount of people being treated (a congestion problem). The higher the number of individuals in the intensity unit, the higher will be the number of fatalities due to a problem of a congestion in hospitals.

[12] We live in households and maybe, for an epidemic, household heterogeneity is more important than individual heterogeneity. Therefore, we could interpret L_n as the perceived loss of household type-n.

from home, employment loss and non-monetary stress and illness of being deprived of a social life.

As previously, at each instant, the population matches randomly and susceptible individuals S_t might be contaminated once they match with infected individuals I_t. The rate at which infection is transferred to an individual n is

$$\beta f(v_n)\left[\sum_{i=1}^{N}\pi_n f(\bar{v}_n)\right] \quad \text{with} \quad f(v_n) = 1-\zeta v_n,$$

where $\zeta > 0$ is a parameter describing the effectiveness of how individual's own vigilance avoids infection and $\bar{v}_n$ is the social distancing taken by the other agents. Clearly, if v_n is equal to zero for all n, then the infection rate is β. Therefore, the aggregate rate at which a susceptible individual becomes infected is given by

$$x_t(v_n/\bar{\mathbf{v}}) = \beta f(v_n)\left[\sum_{i=1}^{N}\pi_n f(\bar{v}_n)\right] S_t I_t.$$

Given the other players strategy $\bar{\mathbf{v}}$, an Individual choose social distancing v_{nt} to minimize the perceived expected total loss, such that:

$$v_{nt}^* = \arg\min_{v_n \geq 0}\left\{x_t(v_n/\bar{\mathbf{v}})L_n + \frac{v_n^2}{2}\right\}.$$

In a Nash equilibrium of this contagion game, it can be shown that

$$v_{nt}^* = \frac{\zeta\beta I_t S_t L_n}{1+\zeta^2\beta I_t S_n[\sum_{i=1}^{N}\pi_i L_i]} > 0 \quad \text{and} \quad f(v_{n,t}^*) = (1-\zeta v_{n,t}^*) \in (0,1). \tag{4}$$

Therefore, the lower the agent-n perceived expected loss L_n, then the less caution of getting the virus the agent is and the lower is her vigilance. In addition, the lower is the perceived expected loss of the other agents, $\bar{L} = \sum_{i=1}^{N}\pi_i L_i$, the higher is her vigilance. Clearly, social distancing rises with contagion $\beta I_t S_t$. The dynamics of the system is given by:

$$\begin{aligned}
\dot{S}_t &= -\beta\left[\sum_{i=1}^{N}\pi_i(1-\zeta v_{it}^*)\right]\left[\sum_{i=1}^{N}\pi_i(1-\zeta v_{it}^*)\right] S_t I_t, && (5)\\
\dot{I}_t &= \beta\left[\sum_{i=1}^{N}\pi_i(1-\zeta v_{it}^*)\right]\left[\sum_{i=1}^{N}\pi_i(1-\zeta v_{it}^*)\right] S_t I_t - \gamma I_t, && (6)\\
\dot{R}_t &= \gamma I_t. && (7)
\end{aligned}$$

Figure IV(a) shows the dynamics (solid line) of a typical epidemiological model without endogenous social distancing and the dynamics of a model with equilibrium social distancing (dotted line).

As the number of infected people increases and contagion rises, then individuals become more vigilant, equilibrium social distancing rises and therefore the number of infected people is reduced relative to the typical epidemiological model. As we can see, equilibrium vigilance flattens the infection curve out but quantitative it can be very different from a change in β. Individuals are willing to self-isolate voluntarily when the probability of contracting the disease is tangible. However, people also weigh the contagion risk against losses of income and the inconvenience of living in isolation. As a consequence, voluntary social distancing can start to keep people at home only when the infection risk becomes visible, and the epidemic has already taken off. This can be very different from a policy that enforces a lockdown.

Figure IV(b) shows the equilibrium vigilance for 3 different individuals (agent with highest ($v^*_{N,t}$), median ($v^*_{m,t}$) and lowest ($v^*_{2,t}$) perceived expected loss) who are heterogeneous in their perceived expected loss of infection. The highest curve is associated with the individual with the highest perceived expected loss of infection.

What are the effects on the infection rate of a rise in the share of individuals who perceive the infection to be a minor health problem (or the lowest value of L_n)? There are two opposing effects. The first effect is a composition effect since there will be more individuals with the lowest equilibrium vigilance, i.e. with v^*_{1t}, and therefore the infection rate should rise. But the average perceived expected loss $\sum_i^N \pi_i L_l$ in society falls and vigilance and alertness to avoid infection of all agents rise, which decrease the infection rate. With two types of individuals, the following proposition shows that the former effect dominates the second and a rise in the share of individuals with the lowest perceived loss of infection increases the infection rate.

Proposition 1. *Assume that there are two type of individuals $n \in \{1,2\}$ with $\{L_1 < L_2\}$ and the share of type-1 individuals is π. Denote the society infection rate by β_t where*

$$\beta_t = \beta\left[\pi(1-\zeta v^*_{1,t}) + (1-\pi)(1-\zeta v^*_{2,t})\right]^2, \text{ with } v^*_{n,t} = \frac{\zeta\beta I_t S_t L_n}{1+\zeta^2\beta I_t S_n[\pi L_1 + (1-\pi)L_2]}.$$

Then a rise in π increases the society infection rate β_t; and a fall in L_1 and/or in L_2 increases the society infection rate β_t

Proof. Taking derivatives of β_t with respect to π yields:

$$\frac{\partial\beta_t}{\partial\pi} = 2\beta\left[\pi(1-\zeta v^*_{1,t}) + (1-\pi)(1-\zeta v^*_{2,t})\right]\zeta(v^*_{2,t} - v^*_{1,t})(1-\zeta(\pi v^*_{1,t} + (1-\pi)v^*_{2,t})) > 0.$$

Similarly, taking derivatives of β_t with respect to L_1 and L_2 imply that $\frac{\partial\beta_t}{\partial L_1} < 0$ and $\frac{\partial\beta_t}{\partial L_2} < 0$, as required. □

Figure V shows that as the share of individuals with lower perceived expected loss increases then the infection curve becomes steeper with a higher peak. If fatalities are positively related to the peak of the curve due to congestion of critical patients in hospitals, then a rise in the share of individuals with lower perceived loss would lead to a rise in fatalities from the epidemic. A similar effect can be found if, for some individuals in society, the perceived expected loss from the disease falls.

IV Data

Our unit of analysis is the municipality. We use four sources of data to conduct our empirical analysis. In order to measure social distancing, we use an index created and developed by In Loco (https://inloco.com.br/), a Brazilian technology company that provides intelligence based on mobile location data. In Loco collects anonymized[13] location data from 60 million devices, enabling mobile apps to provide location-aware services while securing the privacy of their users. Using Bluetooth, Wi-Fi and GPS, In Loco can track the most likely devices' locations across the country and their movement when mobile apps are used in different locations during a day, with a precision of three meters.[14]

[13] No name, social security number or mobile number are provided.

[14] See Peixoto et al. (2020) for a complete description of how the data is collected and computed.

The social distancing index measures the percentage of devices in a given municipality, which remained within a radius of 450 meters of the location identified as home. The index is computed on a daily basis, and goes from zero to one. Figure VI shows the evolution of this daily social distancing index for the states of Sao Paulo and Rio de Janeiro from 1 February to 14 April 2020 (the entire period of time for which we got access to the data). As we can see, social distancing in both sates started to rise once the states introduced non-pharmaceutical interventions, such as school and non-essential store closure. Figure VII shows the map of Brazil and the social distancing index for all municipalities on Tuesday, 4 February 2020, and on Tuesday, 7 April 2020. Therefore, the aggregate evidence shows that social distancing has risen nationally, but the changes were not homogeneous, with some municipalities increasing more social distancing than others. The mean of the social distancing index for the total period is 0.37 (0.25 in February, 0.41 in March and 0.53 from the 1st to the 14th of April).

To measure support for the President, we use electoral data provided by the Superior Electoral Court (TSE — "Tribunal Superior Eleitoral"). We collect data on vote counts of the 2018 Presidential Election in Brazil aggregated at the municipality level to match the geographical unit of our social distancing outcome. Since these data contain vote totals for each candidate by municipality, we use several vote-related measures as a proxy for the President's local support.

The Population Census of 2010 collected by the Brazilian Bureau of Statistics (IBGE) provides data on population size, income, poverty and consumption of durable goods (such as TVs and computers) at the municipal level. We also collect data from IBGE's MUNIC ("Perfil dos Municipios Brasileiros") in 2018 related to local-level media presence, such as the presence of local TV broadcasters.

V Empirical Model and Main Results

In order to identify the causal effect of Bolsonaro's public demonstrations and speech against social distancing on behavior, we estimate the following empirical model:

$$SocialDistancing_{md} = \sum_{l=-10}^{+10} \alpha_l Treated_{md-l} + \alpha Treated_{md} + \phi_d + \rho_m + \lambda X_{md} + \delta Z_{sd} + \epsilon_{smd},$$

where $SocialDistancing_{md}$ is the social distancing index for the municipality m, in day d; and $Treated_{md}$ is a dummy that takes a value of 1 if two conditions are fulfilled: the municipality m is defined as "pro-government" (voting for Bolsonaro was above 50% in the first round of the 2018 election) and the day d corresponds to one of the two events that we defined: March 16th and March 25th (it takes a value of zero, otherwise). We define t=0 (treatment) the first day after the march that took place on the afternoon of the 15th and the first day after the official speech pronounced by Bolsonaro at night on the 24th. These are also the dates in which the news reached the front pages of the main Brazilian newspapers. We include ten leads and ten lags of this variable to detect pre-treatment and post-treatment effects. ρ_m and ϕ_d are municipality and day fixed effects, respectively.

We control for a number of relevant time-varying characteristics at the municipality-day and state-day levels. First, we control for a series of dummies indicating the type of non-pharmaceutical intervention in place in a given state (s) and day (d). These dummies (Z_{sd}) cover three categories: a school ban only, a school ban plus a general ban for non-essential activities or no ban at all. Also, to account for the fact that the support for the government is strongly correlated with variables such as poverty and condition of rurality (both time-

invariant), we control for the interaction between day fixed effects and a poverty dummy at the municipality level, and fixed effect and a rurality dummy at the same level (Z_{md}). In our main specification we also include a state-specific linear trend. To account for the plausible temporal correlation of policies within states, we cluster the standard errors at the state-day level and we weight the municipal observations by their population in 2019.

The results of our baseline model are presented in Figure VIII. As expected, all except one leads (t = -9) are indistinguishable from zero. On the contrary, every single starting on day 1 is negative, and all of them starting from day 2 are significantly different from zero. As a robustness check, we estimate the same model but changing the definition of "pro-government" support. As the two graphs in Figure IX show, there is a clear regional divide in the support for Bolsonaro. When classifying municipalities were Bolsonaro obtained more than 50% of the votes in the first round of the 2018 presidential election as "pro-government", we are losing within state variability in our treatment variable in around 14% of the observations, as there were some states where every single municipality were either anti-Bolsonaro or pro-Bolsonaro. Because most of the social distancing policies were implemented at the state level, having within state variability is important for our empirical analysis.

To address this potential problem, we estimate the same model, but we alternatively define that a municipality is "pro-Bolsonaro" if the votes for Bolsonaro in the first round were above the median observed in the state. In Figure X we show that the results, if any, are more pronounced. A concern with this specification could be that, in those extremely "anti-Bolsonaro" states (e.g. the median vote for Bolsonaro in the first round was around 15%), a municipality would be considered as a "pro-Bolsonaro" unit, when the support for the President is actually very low. To account for this problem, we re-estimate the equation, but now restricting the municipalities to the states in which there were at least a third of the municipalities where Bolsonaro obtained more than 50%. We then define a "pro-government" municipality as those where the president obtained more than the state median within the restricted sample. This model could be thus interpreted as the effect of the treatment within the most pro-Bolsonaro states. The results are presented in Figure XI. Again, if any, the effect seems to be more pronounced. The magnitude of the effect seems to be large, close to 0.2, on average (compared to a mean of around 0.5 in April and 0.37 for the entire period).

Finally, in order to provide some suggestive evidence on the mechanisms underlying our results, we explore the potential role of the local media presence in each municipality. Although we cannot present conclusive results, Figures XII, XIII and XIV document some interesting patterns. In Figure XII we estimate the baseline model for two sub-samples: municipalities where there is no presence of local TV broadcasters (left) and those where there is at least one (right). In Figure XIII, we run a similar regression but now dividing the sample into groups according to the households' average internet penetration per municipality. A municipality is defined as having "low internet penetration" (left) if it is below the top 25% of the distribution of this variable according to the census, or "high internet penetration" (right), otherwise. Finally, in XIV we show the results of estimating the same model but now combining the definitions of the previous two. A municipality is defined as having "low media penetration" (left) if it is below the top 25% of the distribution of this variable according to the census AND there is no local TV broadcaster in the municipality, or "high media penetration" (right), otherwise. In all three graphs a pattern emerges: the effects seems to be driven by those municipalities with higher level of media penetration.Data on internet penetration was obtained from the last Census (2010). Data on local media presence at the municipality level was obtained from the "Perfil dos Municípios Brasileiros" in 2018.

VI Conclusion

Studying the effects of leadership is particularly relevant during a crisis, such as a pandemic, as leaders behavior and attitudes can have a significant impact on individual health and the healthcare systems. Information on recommended prevention practices is typically asymmetrical between governments and citizens, and the problem becomes even more stringent during a public health emergency. Citizens may ignore the best practices from a medical point of view but, more importantly, they are likely to be unaware of the global spread of the disease (and ignore negative externalities) since their perceived expected loss of getting the virus are heterogeneous. The role of leaders in this context is, therefore, crucial.

In this paper we focused in Brazil during the COVID-19 pandemic. Brazil is a politically polarized country in which the President Bolsonaro has been actively and publicly spreading an anti-isolation message, thus encouraging people to challenge the regulations imposed by the sub-national governments, the advises of the World Health Organization and even the recommendations of his own minister of health (finally dismissed). Brazil is a federal country and the institutional reaction of each state and the federal government was notably heterogeneous. Thus, the setting is particularly suitable to explore the effect of a high-profile political leaders' words and actions on the behavior of his followers, beyond the legal enforcement of the official social distancing measures.

To address our research question, we deploy a social distancing index at the municipal-day level constructed by In Loco (a technology company with offices in Brazil and the United States), based on granular location data from tens of millions of anonymous mobile devices across Brazil. We found a strong persuasion effect of Bolsonaro on the behavior of his supporters. In particular, we document a significant decrease in social distancing following the most visible events of the President against self-isolation behavior and policies in pro-Bolsonaro municipalities. We also present suggestive evidence of the message being more effective among those municipalities with a higher presence of local media and internet penetration.

Our empirical results emphasize the behavioral change among citizens induced by political leaders' examples - and not only through the design of incentives, regulations and institutions, but also through persuasion, motivation and leadership.

The article is still a working in progress, we plan to update our estimates with new waves of data points and investigate the effects of individual behavior on outcomes related to public health (such as hospital congestion).

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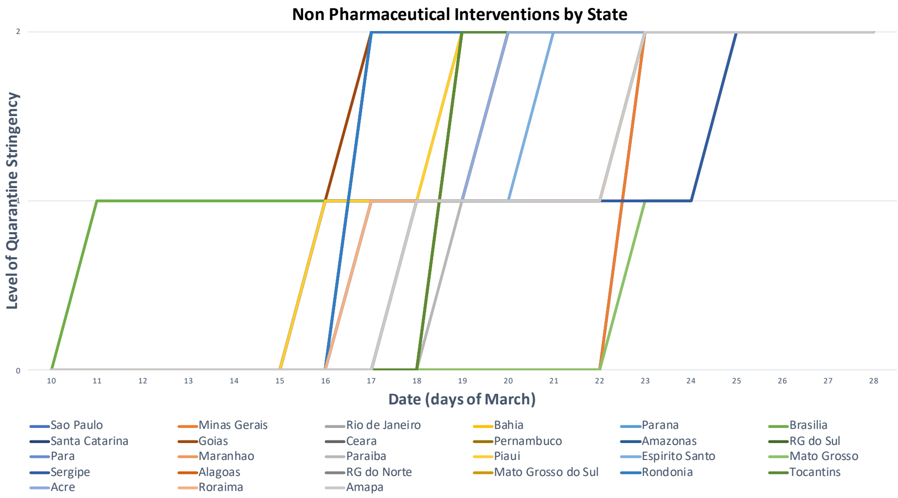
VII Figures

Figure I. Policies implemented by each state



Note: Stringency Level defined as follows. 0: no closure. 1: schools closure, 2: schools + stores closures. Days: from March 10$^{\text{th}}$ to March 28$^{\text{th}}$

Figure II. Media on March 16^{th}

O ESTADO DE S. PAULO

FUNDADO EM 1875 — JULIO MESQUITA (1862 - 1927)

Segunda-feira 16 DE MARÇO DE 2020 R$ 5,00 ANO 141 Nº 46171 estadão.com.br

Infectologistas criticam Bolsonaro por dar mau exemplo à Nação

Presidente ignorou recomendação de médicos para manter isolamento contra o coronavírus, foi a ato e teve contato físico com 272 apoiadores

Contra recomendações. Bolsonaro desrespeitou isolamento que deveria cumprir, teve contato físico com apoiadores, usou os celulares deles para fazer selfies e colou rosto para tirar fotos

Jair Bolsonaro ignorou orientação de sua equipe médica e diretrizes do Ministério da Saúde para tratar a pandemia do coronavírus e participou, ontem, de ato a favor do seu governo e com críticas ao Congresso e ao STF. Ele deixou o isolamento que deveria fazer por ter tido contato com pelo menos 11 pessoas que estão infectadas. Análise feita pelo **Estado** do vídeo da participação de Bolsonaro no ato mostra que ele teve contato físico com 272 pessoas em cerca de 58 minutos. Médicos disseram que o fato de o presidente ter tocado as mãos e os celulares dos manifestantes expôs todos à contaminação, caso Bolsonaro esteja com o vírus. O diretor-presidente substituto da Anvisa, Antonio Barra Torres, foi ao ato. Rodrigo Maia (DEM-RJ) e Davi Alcolumbre (DEM-AP) criticaram o presidente. Bolsonaro os desafiou a ir às ruas para ver "como serão recebidos" e chamou de "extremismo" e "histeria" as medidas de combate à pandemia. POLÍTICA / PÁGS. A4 a A7

"O presidente da República deveria estar no Palácio coordenando um gabinete de crise."
RODRIGO MAIA
PRESIDENTE DA CÂMARA

"Com essa pandemia, é inconsequente estimular a aglomeração de pessoas nas ruas."
DAVI ALCOLUMBRE
PRESIDENTE DO CONGRESSO

NOTAS & INFORMAÇÕES

Escassez de estadistas

No Brasil, o cargo de estadista está vago, pois temos um presidente que não está à altura nem do cargo nem dos desafios que se lhe apresentam. PÁG. A3

Análises

Eliane Cantanhêde

Brincadeira de vida ou morte. PÁG. A4

J. R. Guzzo

Ele parece satisfeito com reprovações. PÁG. A6

Casos chegam a 200 no País, salto de 65%

SP tem 136 registros; Argentina e Colômbia fecham fronteiras

Os casos confirmados de infecção por coronavírus passaram de 121 para 200, aumento de 65% em um dia no País. Estados com transmissão comunitária, São Paulo e Rio são os que têm mais registros, com 136 e 24 pacientes, respectivamente. Há outros 1.915 casos em investigação. Em toda América Latina há 612 infecções confirmadas. Países-membros do Mercosul decidem hoje medidas para barrar a propagação do coronavírus. O bloco deve determinar o fechamento parcial de fronteiras. Argentina – que registrou duas mortes – e Colômbia fecharam as suas. METRÓPOLE / PÁG. A10

AUSTIN BOSCHEN/AP

Caos nos EUA Passageiros enfrentaram filas de até 7h e aglomerações em aeroportos nos Estados Unidos por causa de restrições de voos impostas por Trump. METRÓPOLE / PÁG. A10

Mesmo com sintomas, teste só deve ser feito se médico pedir METRÓPOLE / PÁG. A12

Alemanha fecha fronteiras e Itália tem mais 369 mortos METRÓPOLE / PÁG. A10

Tensão com surto é 'tática de satanás', diz Edir Macedo POLÍTICA / PÁG. A7

Doria fecha museus, teatros e bibliotecas por 30 dias METRÓPOLE / PÁG. A11

Moisés Naím
Os populistas convivem mal com os especialistas e com os dados que contradizem os seus interesses. INTERNACIONAL / PÁG. A9

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Fed corta os juros e pressiona Brasil

O Federal Reserve (Fed, o banco central americano) anunciou ontem um novo corte de juros e participação em uma ação coordenada com outros bancos centrais para aumentar a liquidez do mercado, diante do risco de uma retração global por conta da pandemia do coronavírus. As taxas passaram de um intervalo entre 1% e 1,25% ao ano para zero a 0,25%. Foi a segunda redução no mês aprovada em reunião extraordinária. A decisão do Fed deve aumentar, no Brasil, a pressão para que o Comitê de Política Monetária do Banco Central (Copom) mantenha o ciclo de redução da taxa básica, a Selic. A decisão do órgão vai sair na quarta-feira. ECONOMIA / PÁG. B1

Afonso Arinos Filho
1930 – 2020

Membro da ABL e diplomata, Afonso Arinos de Mello Franco, conhecido como Afonso Arinos Filho, morreu na manhã de ontem, no Rio de Janeiro, aos 89 anos. Na política, foi deputado da Assembleia Constituinte, entre 1960 e 1961. POLÍTICA / PÁG. A7

NOTAS & INFORMAÇÕES

A saúde na década de 20
Há os desafios genéricos e perenes de aprimoramento dos sistemas de saúde, como por exemplo a valorização dos profissionais de saúde e investimentos em saneamento básico. PÁG. A3

Note: Cover of the newspaper O Estado de Sao Paulo - Monday, March 16^{th} of 2020

Figure III. Media on March 25$^{\text{th}}$

O ESTADO DE S. PAULO

FUNDADO EM 1875 — JULIO MESQUITA (1862-1927)

Quarta-feira 25 DE MARÇO DE 2020 R$ 5,00 ANO 141 Nº 46180 — estadão.com.br

A CIDADE EM QUARENTENA

'Cebolinha' da região do Ibirapuera com pouco movimento após governo de São Paulo decretar quarentena até 7 de abril. Para ministro da Saúde, restrições impostas nos Estados, como fechamento de comércio, são 'péssimas' para o setor de saúde. PÁG. A11

Bolsonaro critica confinamento e quer lojas e escolas abertas

Presidente reprova restrições como suspensão de aulas e a adoção de isolamento, cita cloroquina como remédio contra coronavírus e acusa imprensa de espalhar histeria

O presidente Jair Bolsonaro fez pronunciamento em rede nacional de TV no qual criticou o fechamento de escolas, voltou a citar a cloroquina, remédio que ainda não tem eficácia contra o coronavírus confirmada, criticou a imprensa que, segundo ele, dissemina "histeria" e disse que, por seu histórico de atleta, não sentiria nenhum efeito caso pegasse o coronavírus. "Quando muito, seria acometido de uma gripezinha, ou resfriadinho." O presidente afirmou que autoridades estaduais e municipais "devem abandonar o conceito de terra arrasada, a proibição de transporte, o fechamento dos comércios e o confinamento em massa". Segundo ele, não há motivo para fechar escolas, uma vez que o grupo de risco é composto por pessoas com mais de 60 anos. Moradores de pelo menos nove capitais fizeram um panelaço. O presidente do Senado, Davi Alcolumbre (DEM-AP), afirmou que o pronunciamento foi grave e cobrou uma liderança "séria, responsável e comprometida com a vida e a saúde da sua população". POLÍTICA / PÁG. A5

Governo muda tática e prevê 22,9 milhões de testes

O Ministério da Saúde pretende aplicar 22,9 milhões de testes do novo coronavírus no País. A promessa envolve produção acima da capacidade da Fiocruz e a compra de kits de diagnóstico no mercado internacional. O foco inicial serão cidades com mais de 500 mil habitantes. O Brasil já registra 46 mortes e 2.201 casos confirmados pela doença. METRÓPOLE / PÁG. A9

Presidente restringe Lei de Acesso à Informação

Medida provisória editada pelo presidente Jair Bolsonaro desobriga órgãos públicos de prestar informações pedidas durante o enfrentamento da crise causada pelo coronavírus. O Hospital das Forças Armadas, onde o presidente passou por exames para checar se está com o vírus, omitiu os nomes de duas pessoas contaminadas. POLÍTICA / PÁG. A4

Sob pressão, Japão adia Olimpíada para 2021

Definido ontem, o adiamento dos Jogos Olímpicos e da Paralimpíada de Tóquio de julho e agosto de 2020 para 2021, ainda sem data definida, vai mudar o ciclo de preparação e de competições de milhares de atletas e o trabalho dos organizadores. O Japão preferiu o adiamento a cancelar a Olimpíada, na qual já investiu R$ 56 bilhões. ESPORTES / PÁG. A14

Artigo

Fernando Reinach

No pico da crise, não haverá respiradores

● Todos os países enfrentam esse problema e conosco não vai ser diferente, mas o governo não sabe sequer de quantos respiradores vai precisar. Descobrir é tarefa urgente para que a sociedade possa ajudar. PÁG. A11

NOTAS & INFORMAÇÕES

O valor estratégico da ajuda ao trabalhador

Mais do que questão humanitária, proteger o poder de compra das famílias tornará menos difícil o início da recuperação quando a tormenta amainar. PÁG. A3

O Mercosul e o ensino superior

Decreto assinado no último dia 20 engloba medidas previstas há 30 anos para área educacional. PÁG. A3

Itália pede e Brasil libera lote de máscaras retidas

Dois milhões de unidades compradas da China pelos italianos estavam em Guarulhos. INTERNACIONAL / PÁG. A7

EUA rumam para ser centro de pandemia

INTERNACIONAL / PÁG. A7

JornaldoCarro

Carro vira super-herói

NA QUARENTENA

Solidariedade. Na cidade de Palhoça (SC), família recebe cesta básica do Projeto Cidades Invisíveis

VISÃO DA PERIFERIA

Moradores de favelas usam carros de som e letras de funk adaptadas para espalhar informação sobre o vírus. PÁG. H1

ALBERT UDERZO, 1927 ● 2020

ASTERIX E OBELIX FICAM ÓRFÃOS

Enfarte mata pai da dupla gaulesa aos 92 anos. PÁG. H3

O AMANHÃ NO EXÍLIO ESPANHOL

Guilherme Arantes quer, mas não pode voltar ao País. PÁG. H10

IDOSOS, ISOLADOS E FELIZES

Como superar a pressão de correr maior risco. PÁG. H6

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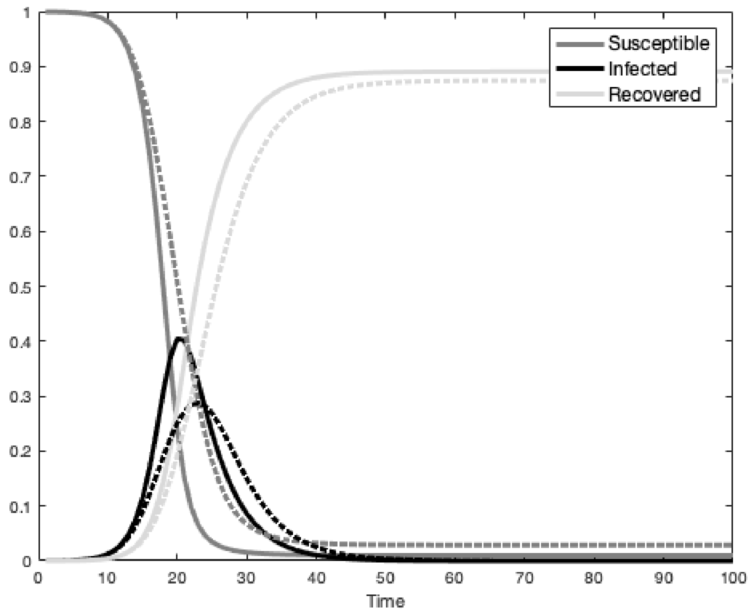
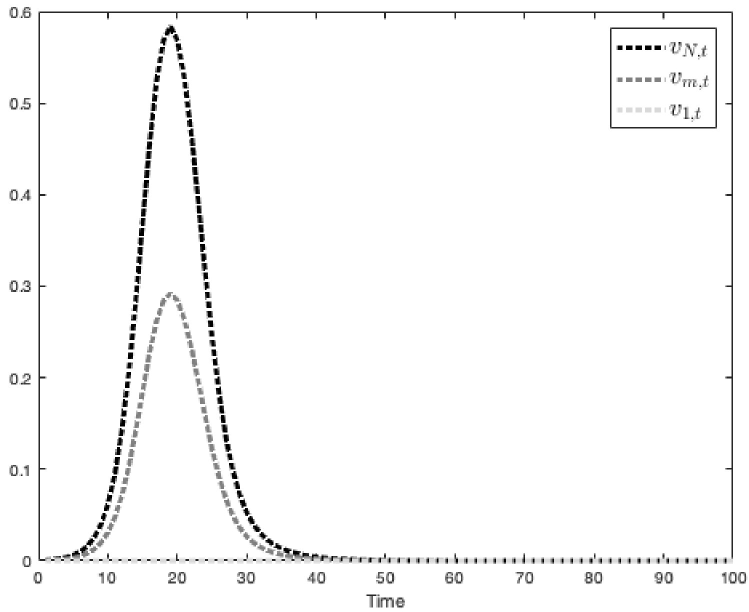
Note: Cover of the newspaper Estado de Sao Paulo - Tuesday, March 25$^{\text{th}}$ of 2020

Figure IV. SIR model with social distancing.



(a) Dynamics of the SIR model without (solid) and with (dashed) social distancing.



(b) Social distancing by different agents who are heterogeneous in their perceived expected loss.

Figure V. SIR model with social distancing and with an increase in the share of individuals who believe the infection has minor health effects.

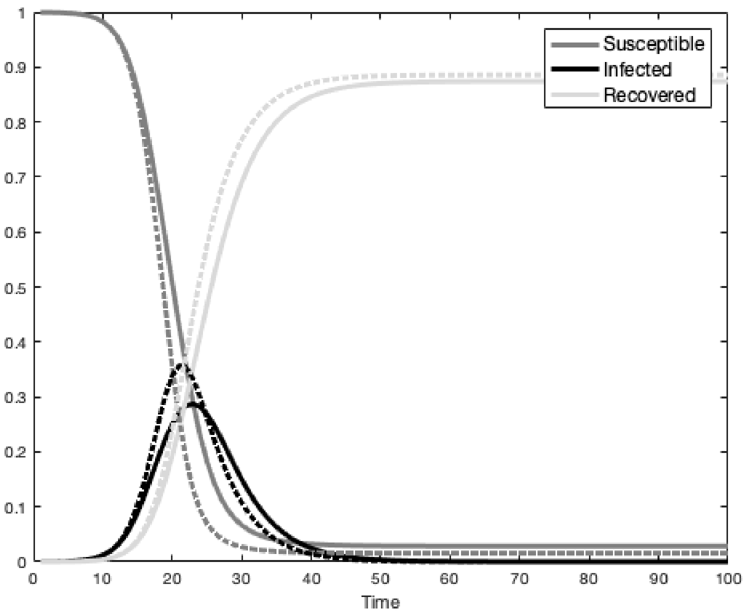
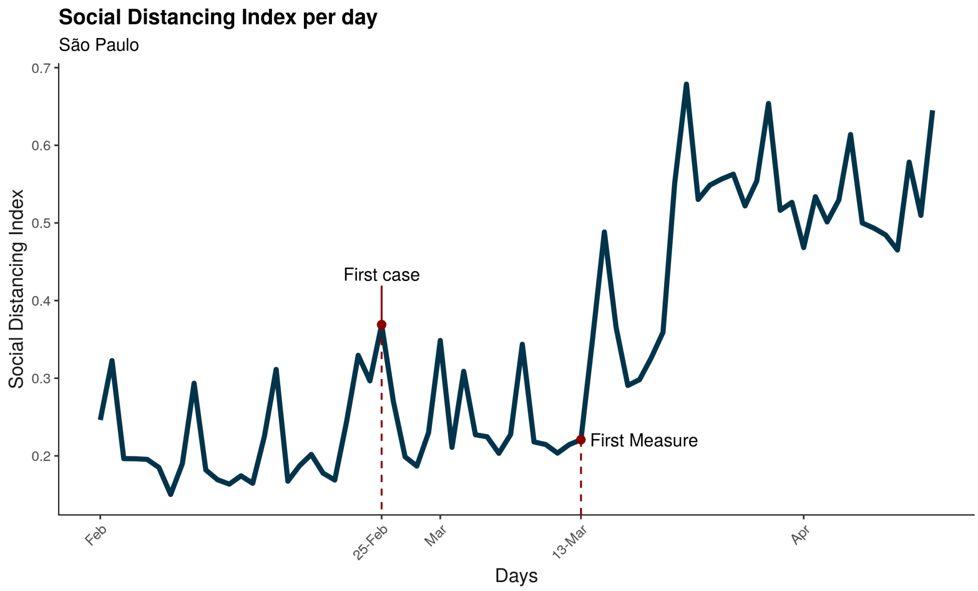
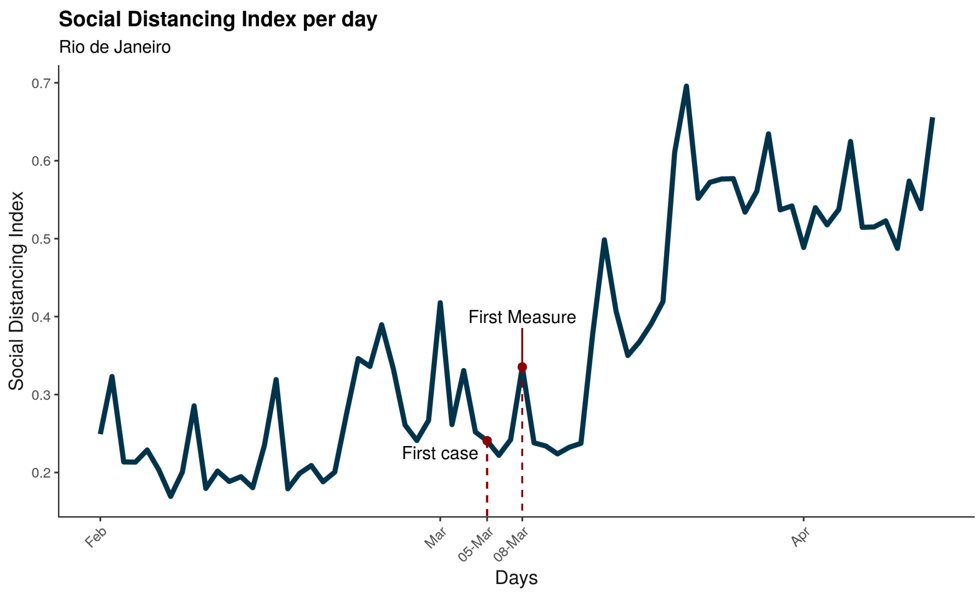


Figure VI. Evolution of Social Distancing in Sao Paulo and Rio de Janeiro.



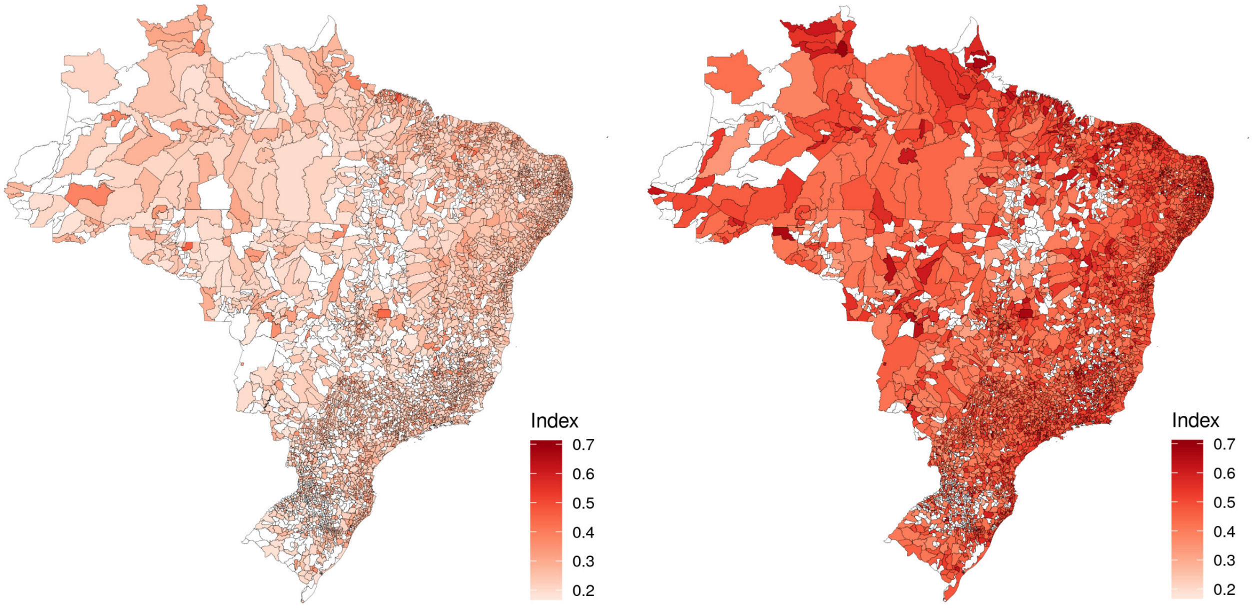
(a) Sao Paulo.



(b) Rio de Janeiro.

Notes. The figures show the daily social distancing index for the state of Sao Paulo and Rio de Janeiro from 1 February to 14 April 2014. The social distancing index is calculated by the technology company In Loco using location data from mobile devices.

Figure VII. Social Distancing Index: Before and After

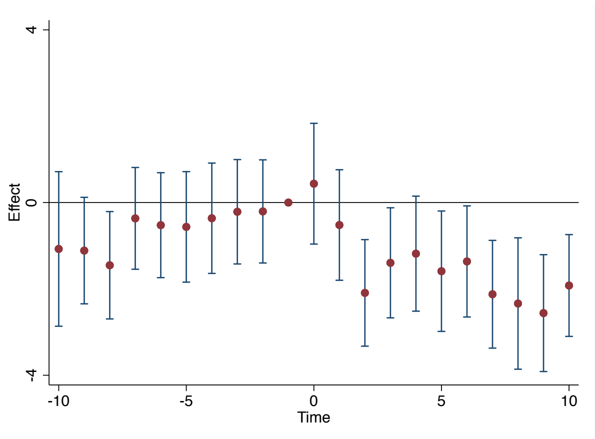


(a) Social Distancing Before: Feb 4

(b) Social Distancing After: Apr 7

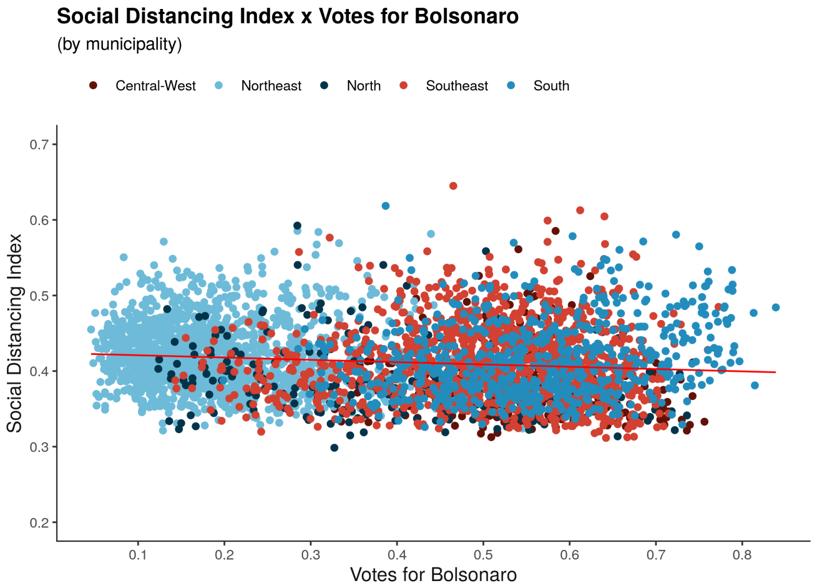
Notes. The figures show the social distancing index for all municipalities in Brazil on 4 February and 7 April 2020. Municipalities in white are those without data on social distancing. The social distancing index is calculated by the technology company In Loco using location data from mobile devices,

Figure VIII. Average Effect on Social Distancing

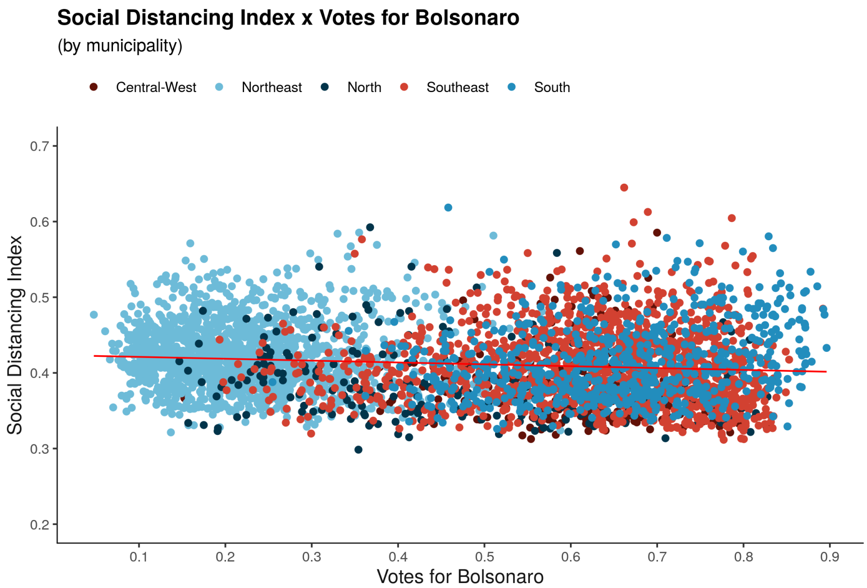


Note: CI: 90%. Standard Errors clustered at state day level. Estimations normalized to 0 at t=-1

Figure IX. Voting 2018 Election



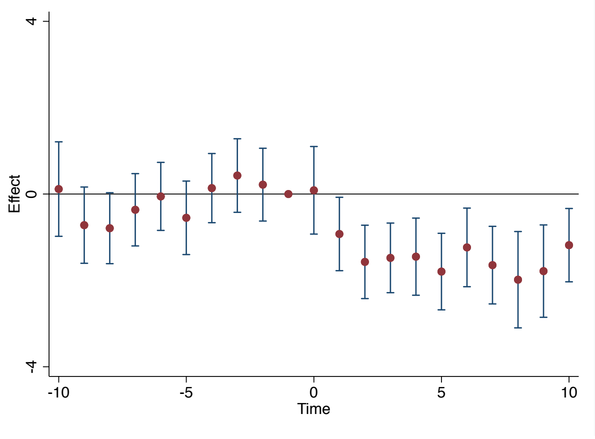
(a) 1st



(b) 2nd

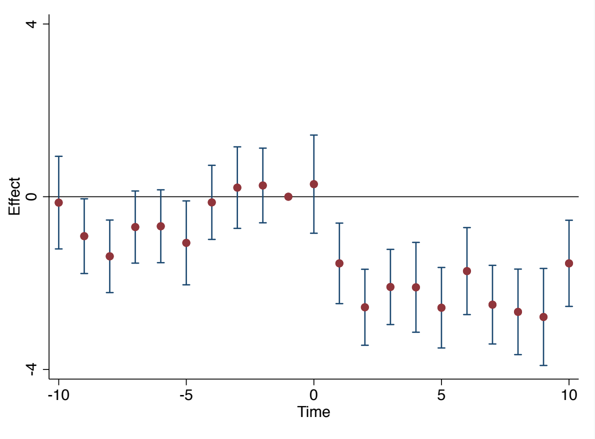
Note: The figures show the association between social distancing and votes in the 2018 election.

Figure X. Average Effect on Social Distancing - Support for Bolsonaro: above state median



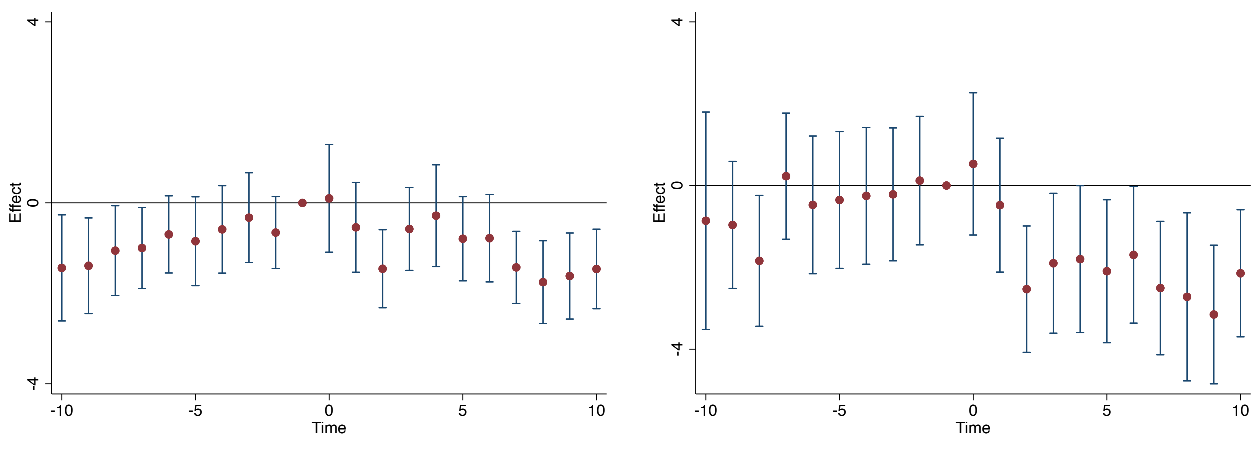
Note: CI: 90%. Standard Errors clustered at state day level. Estimations normalized to 0 at t=-1

Figure XI. Average Effect on Social Distancing - Support for Bolsonaro: above state median in Pro-Bolsonaro states



Note: CI: 90%. Standard Errors clustered at state day level. Estimations normalized to 0 at t=-1

Figure XII. Average Effect on Social Distancing - By presence of local TV broadcaster

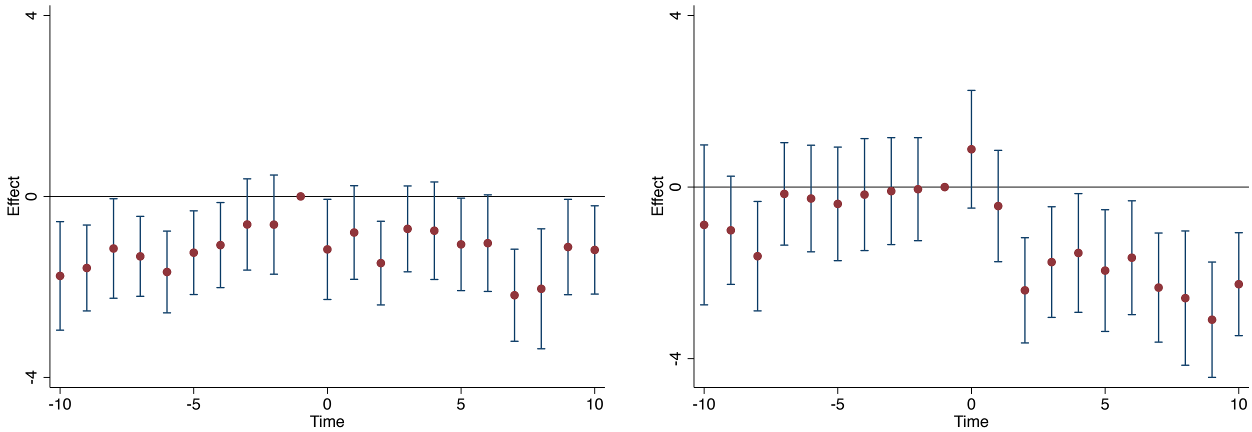


(a) No local TV broadcaster in the municipality

(b) At least one local TV broadcaster in the municipality

Note: CI: 90%. Standard Errors clustered at state day level. Estimations normalized to 0 at t=-1

Figure XIII. Average Effect on Social Distancing - By household's internet penetration

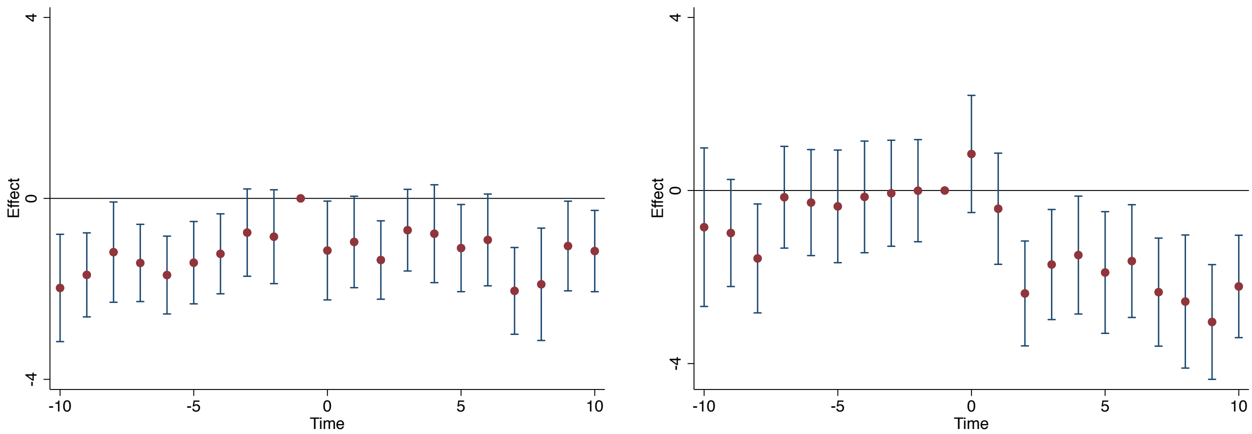


(a) Below p75 of Internet penetration

(b) Below p75 of Internet penetration

Note: CI: 90%. Standard Errors clustered at state day level. Estimations normalized to 0 at t=-1. Internet data comes from the 2010 Census. Internet penetration is defined as the proportion of households with internet at home in the municipality

Figure XIV. Average Effect on Social Distancing - By household's internet penetration and local TV broadcaster



(a) Below p75 of Internet penetration AND no local TV broadcaster

(b) Above p75 of Internet penetration OR at least one local TV broadcaster

Note: CI: 90%. Standard Errors clustered at state day level. Estimations normalized to 0 at t=-1. Internet data comes from the 2010 Census. Internet penetration is defined as the proportion of households with internet at home in the municipality