

PERSISTENT PATTERNS OF BEHAVIOR: TWO INFECTIOUS DISEASE OUTBREAKS 350 YEARS APART

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Outbreaks of infectious diseases bring behavior and policy responses into sharp focus since societies face acute constraints and uncertainties. This paper compares two infectious disease outbreaks: the Covid-19 pandemic and the 1665 London plague outbreak described by Daniel Defoe in A Journal of the Year of the Plague published in 1722. We compare three aspects: individual behavior, social behavior, and governance and find striking similarities in behavior in spite of these events being separated by 350 years. We contend that the same models of behavior can be used to explain human responses during such outbreaks regardless of when they occur. (JEL A10, B52, Z11)

All that a man could win in the game of plague and life was knowledge and memory.

-Albert Camus, The Plague

I. INTRODUCTION

Pandemics are outbreaks of infectious diseases that spread rapidly and effectively to large sections of the world. Like the current Covid-19, they have the potential to continue unabated for a considerable time paralyzing human interaction and economic activity with long-lasting effects (Alfani and Murphy 2017; Cummins, Kelly, and Ó Gráda 2016; Meyers and Thomasson 2020). They not only cause death, but also affect the living by creating an atmosphere of fear and uncertainty along with suffering due to prolonged economic deprivation. These aspects and the paucity of human interaction typically

have serious consequences on health and well-being. Consequently, by sharply emphasizing the constraints on human activity, along with the inherent inability to predict future outcomes and policy responses, pandemics afford a unique lens to study human behavior. In this essay, we compare two infectious disease outbreaks—the current Covid-19 and the 1665 plague outbreak of London as described by Daniel Defoe in his book *A Journal of the Year of the Plague* published in 1722.¹ Undoubtedly a lot has changed since 1665. While we live in a more interconnected world, enabling a faster transmission of the disease, it is possibly compensated by strident advances in human physiology and medical science. Today, population density, another contributing factor toward the propagation of a pandemic is higher, but other factors such as institutions and human rights are also considerably better. Yet, when comparing our current events with Defoe's writing about the London outbreak we find that human behavior, especially the aspects driven by economic motives is quite

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1. A caveat is important here. Most scholars believe that while Defoe's account is fictional but grounded in reality, albeit the connections might be somewhat tenuous at times. In fact, Anthony Burgess while writing the Introduction to the Penguin edition of 1966 (Defoe, 1966) wrote: "*Defoe was our first great novelist because he was our first great journalist.*" Note that the we also used a copy of Defoe's book (1722) available from the Project Gutenberg site.

ABBREVIATIONS

PDS: Public Distribution System
POW: Prisoners of War

robust and does not seem to have changed in the last 350 years.² Our goal in this paper is to illustrate this point by comparing three things: (1) individual behavior, (2) social behavior, and (3) the behavior of those involved in governance and policy making. In that sense, our paper can be seen as an exercise that documents the robustness of the economic way of thinking even in extreme circumstances and is in the same vein as papers that explore the economics of prisoners of war (POW) camps (Radford 1945), and other such phenomena like earthquakes (Anbarci, Escaleras, and Register 2005) or hurricanes (Shughart 2006).

Human history is replete with catastrophic events such as financial crises, natural disasters, wars, and pandemics. Although we often speak of them in the same breath, pandemics are significantly different from these other crises in important ways. For instance, a fiscal stimulus package along with bailouts for the especially vulnerable is generally adequate for financial crises or recovery from war. This will simply not suffice for a pandemic as economic activity will not resume unless there is a cure at hand or communities develop herd immunity. In other words, the health dimension sets pandemics apart from financial disasters. When comparing with natural disasters, there is an obvious duration difference: unlike a pandemic, a natural disaster lasts for a brief period and recovery can begin almost immediately, through appropriate fiscal interventions. Catastrophes like wars have a location dimension, that is, where the war is being fought matters. For instance, compared to residents of war-torn countries, most people residing in the North American continent did not have to alter their lives in any significant way in spite of their country being involved in many different wars. Infrastructural casualties are borne by the hosting nations where the war is being physically fought, and loss of life is restricted to those in the armed forces out in the battlefield. Hence the general public's involvement in the United States is largely restricted to arm-chair discussions. In contrast, risk to life in a pandemic, by its very definition, is not location specific. Even remote

2. Although there have been more recent epidemics like the influenza epidemic of 1918, our goal was to show that human behavior remains unchanged in such events even when compared to one that took place a long time ago. Moreover, today we are much better off in terms of technology and institutions which makes the exercise attempting to show similarity in behavior a more challenging task and therefore the better one to verify our assertion.

places such as Greenland and French Polynesia have not been immune to Covid-19; almost every country, including researchers in Antarctica, have implemented some form of lockdown to combat this menace. Human behavior matters for the spread of the disease and social interactions create an externality that can propagate or curb the pathogen. Moreover, the extent of economic deprivation in a war depends on its duration while in a pandemic it begins almost as soon as the infectious nature of the disease becomes apparent. In fact, a pandemic reminds us that global economic activity is more interconnected than ever and we will suffer its consequences together and solutions must take everyone's behavior into account.

Before proceeding further, we also want to briefly explain the structure of the paper. In the three sections below that examine individual, social, and policy responses, we compare events in Defoe's London with the current pandemic. Since our objective is to demonstrate that the present self of *Homo economicus* would relate to their past self of 350 years ago, we have chosen to ignore unusual contemporary events. Instead we have chosen to compare with events that are commonplace today, and therefore have not always provided sources. However, we have been always careful to provide precise quotes from Defoe's *Year of the Plague*. Another point that is worth reiterating is the fact that we are limited in our comparisons to what Defoe has chosen to document in his book.

Sections II, III, and IV constitute the main body of the paper, which compare the plague of 1665 with Covid-19 through the lens of individual behavior, social interactions, and governance. Section V concludes.

II. INDIVIDUAL BEHAVIOR

In this section, we will explore how both these outbreaks affected individual behavior. To begin with, we will show how lack of knowledge about the disease helped its spread and hindered preparedness. Then we will examine how uncertainty and resource scarcity tend to exacerbate extreme behaviors both by individual buyers and sellers. Next, we examine the rise of opportunism afforded by lack of cure associated with the disease. We end this section on a positive note where we argue that such outbreaks also drive new innovations.

Possibly the single most important factor driving individual behavior in both outbreaks was

the fact that there was lack of adequate medical knowledge about the disease, especially in the early days. Defoe says, "*Here also I ought to leave a further remark for the use of posterity, concerning the manner of people's infecting one another; namely, that it was not the sick people only from whom the plague was immediately received by others that were sound, but the well* (emphasis added) ... By the well I mean such as had received the contagion, and had it really upon them, and in their blood, yet did not show the consequences of it in their countenances: These breathed death in every place, and upon everybody who came near them; ..." Truer words could not have been spoken about Covid-19! Given the asymptomatic nature of the disease in both cases neither the spread of the plague (as Defoe notes) nor the spread of Covid-19 was avoidable at least in the early days. Those with the infection went about their ordinary business infecting many others. Once people became aware of their sickness, they were required by law to isolate then and now, and by and large individuals complied. Defoe does wonder about the motivations of those who did not knowingly comply. This has also occurred during the current pandemic, though some such individuals have claimed that they underestimated the nature of the disease.

An important consequence of this lack of proper understanding of the disease and its infectious nature was that insufficient individual preparedness for dealing with the outbreak. Given their relative disbelief in the severity of the outbreak, in the early days people in every country or borough of London believed that there really was no cause for concern. Those in London believed it might affect other parts and maybe it existed in the outskirts but had not arrived in the city. For Covid often people believed it to be no more fatal than the flu or an infection that was present elsewhere. As a result, they did not take adequate measures to protect themselves. Defoe says, "I must here take further notice that nothing was more fatal to the inhabitants of this city than the supine negligence of the people themselves, who, during the long notice or warning they had of the visitation, made no provision for it by laying in store of provisions, or of other necessaries, by which they might have lived retired and within their own houses, as I have observed others did, and who were in a great measure preserved by that caution". Interestingly, the rich avoided going to stores in Defoe's London but they did not have online delivery either, Therefore they

resorted to using their servants as their online delivery mechanisms and sometimes these people brought the disease into their house along with their purchases.

This story of provisioning has other comparable parallels as well. Given the possible risk of infection from outside, many people these days are revisiting the concept of kitchen gardens. Social media feeds are filled with pictures of appetizing homemade food items. Similarly, the number of news stories about stocking up on food and hoarding are dime a dozen. Defoe records this contemporary behavior using himself as an example saying, "I went and bought two sacks of meal, and for several weeks, having an oven, we baked all our own bread; also I bought malt, and brewed as much beer as all the casks I had would hold, and which seemed enough to serve my house for five or six weeks; also I laid in a quantity of salt butter and Cheshire cheese". Again, given uncertainty about the end of the outbreak, coupled with fear of shortages, such preparation and preemptive behavior are not unusual. Defoe mentions that there was a shortage of meat given how the butcher's shops were ravaged by the plague, which has also been the case during the current pandemic (Cowley 2020).

Such uncharacteristic behavior is not restricted only to consumers; sellers too react to such episodes in very predictable ways. A very pointed instance of hoarding that Defoe describes in the book is when trying to escape the city to Lincolnshire, he witnesses an acute shortage of horses for hire even though most people were not moving around the city. There are other instances where he talks about theft—for instance of an unnecessary item like women's hats from an unguarded warehouse in London, as well as frequent descriptions of food shortages. Similar instances of opportunistic market behavior can be found in the current pandemic. The New York Times reported in one of its March articles that a seller in Florida was offering 15 N95 face masks on Amazon for \$3,799, milk was being sold at \$10 per gallon in a convenience store in Massachusetts, and of course the most curious of case where toilet rolls were vanishing from stores and being offered at exorbitant prices (Levenson 2020).

The basic model of crime and punishment (Becker 1968) can easily explain such behavior. The benefit of engaging in such illegal activity is higher during a pandemic and the costs are either the same or lower than during normal times (a point which is made very well in the

popular television series Foyle's War set in World War II Britain). Hari (2016) provides striking evidence for this in times of disasters. He studies leakages from the Public Distribution System (PDS) in India that provides food grains to eligible households at a subsidized price. He argues that climate-related events, like adverse rainfall shocks, increase the market price of grains due to lower rice production. This increases the gains from the corrupt activities leading to more leakage from the PDS. Thus, such opportunistic selling increases during pandemics.

Another type of opportunism that Defoe mentions in his book is the rise of charlatans and religious healers offering "...infallible preventive pills against plague," and all kinds of potions and "Incomparable drink against the plague, never found before". It is easy to find examples of such behavior right now: from vendors hawking colloidal silver as a treatment, to various "holistic" practitioners suggesting oil of oregano and "Spirit Dust," an "adaptogenic" concoction of powdered mushrooms and roots from the LA cult brand Moon Juice. Hossein Ravazadeh, a well-known Iranian quack and conspiracy theorist, recommends putting bitter gourd oil in the ears twice a day to keep the virus away. Of course there is no cure so far, and following such prescriptions has only made the situation worse in Iran, including deaths of some of the top clerics, while some others have been arrested. Again in Defoe's description we see "One thing I could not help observing: what befell one of the quacks, who published that he had a most excellent preservative against the plague ... this man ... was taken by the distemper, and carried off in two of three days." While wondering what happened to the flourishing number of quacks and religious healers at the beginning of the plague, he pointed out that "... for two years after the plague I scarcely saw or heard of one of them about town." adding that "Some fancied they were all swept away in the infection to a man ..."

Fear of the disease coupled with the lack of a cure leads to this increased faith in miraculous cures. As Defoe notes "... they were as mad upon their running after quacks and mountebanks, and every practicing old woman, for medicines and remedies." Models of herding behavior of the type developed by Banerjee (1992) and Bikhchandani, Hirshleifer, and Welch (1992) can be used to explain such behavior. Imagine that each person receives a private signal about the effectiveness of the miracle cure. However,

if they observe other people believing in such a cure (since there is no known cure), an individual might ignore their private signal and follow the herd. Note that in these models, the order in which agents move is fixed. Subsequent papers by Gul and Lundholm (1995) and Chamley and Gale (1994) study endogenous timing and strategic delay. These models are even better at explaining why people believe in such miracle cures. Waiting to learn about the effectiveness of a cure during a pandemic can be costly (strategic delay), and this in itself can lead to herding. No wonder then quackery flourishes during pandemics.

The pandemic, however, is not just a prophet of doom. It can also usher in new innovations in a Schumpeterian way and open up new profit opportunities. For instance, moving to online instructions in a matter of weeks in the midst of the academic session instead of shutting down was a significant improvisation that will have a lasting impact on the education industry. As demand for contact-less services, online interactions skyrocketed, we saw an increase in grocery delivery apps which brick and mortar stores readily embraced. Video conferencing softwares like Zoom led the path for others such as Cisco Webex, Google Meet, and WhatsApp to follow suit. Defoe notes the example of a waterman who took up the job of delivering water when he realized that there was a huge demand for such basic necessities stuck in the anchored ships in the nearby docks, which in turn provided him "... a great sum, as things go now with poor men" in addition to payments in kind such as "... a bag of bread too, and a salt fish and some flesh." Clearly by emphasizing that some constraints are binding tightly, such disease outbreaks lead to the of new and creative solutions.

III. SOCIAL BEHAVIOR

In the early stages of such outbreaks (especially because of their contagious nature), infected people try to hide their infections to the extent possible from others or suggest that their symptoms are those of a more common, well understood disease. Defoe mentions that "... the articles of the fever, spotted-fever, and teeth began to swell; for all that could conceal their distempers did it, to prevent their neighbours shunning and refusing to converse with them". In current pandemic, reports have appeared about Covid-19 positive people being shunned and mistreated. In fact, a recent paper by Sotgiu

and Dobler (2020) argues that people have changed their behavior to avoid discrimination for example by avoiding testing for SARS-CoV-2 which they label anticipated stigma. The authors also identify other types of stigma like perceived stigma which says that patients and their families may feel judged by others and experienced stigma which says that infected or exposed persons may even be excluded, isolated, and discriminated against by their own household and/or community members. This has been noted to be true about migrant communities by the United Nations (UN) in Latin America. Numerous newspapers stories about hate crimes against people of Chinese ethnicity have appeared in the United States and Indian newspapers have reported villages blocking entry for their own members if they were migrants returning from urban areas. Sadly, even the healthcare workers such as nurses and doctors, who are leading the war against the disease from the front, are not absolved from such discrimination as the Washington Post reported from countries as disparate as Mexico, Colombia, India, the Philippines, and Australia (Sheridan, Masih, and Cabato 2020).

Another strikingly common observation is that communities do not take the pandemic and its infectious nature seriously until it arrives in their midst. During the London plague, the neighborhoods where the plague or distemper had not yet reached, people went about their lives relatively unconcerned. The same has been observed during the current pandemic. In the United States, for example, while some states like New York, New Jersey, and Massachusetts were severely affected with a few thousand deaths on a daily basis, people in some other states like Florida and Texas were partying, ignoring the advice of the World Health Organization and the Center for Disease Control, flaunting social distancing rules and other preventive measures. The same is true of Europe—while Italy was strongly in the grip of the pandemic, things were relatively normal in most of France during the first part of March 2020.³ Not surprisingly, it is interesting that during such outbreaks people try to flee the affected regions and often in the process introduce the disease to places where it did not exist earlier. Just like in London's affected neighborhoods from where "the richer sort of people, especially the nobility and gentry from the west part of the city, thronged out of town with their families

and servants in an unusual manner", people tried to flee from most affected areas in the current pandemic—perhaps the most notable being people fleeing away from the northern part of Italy that was to be quarantined as authorities tried to stop the spread of the virus to other regions. The fact that the family members always find out about someone in the household being infected allows them to leave before their house is quarantined that can spread the disease to other areas, which has been observed in the current pandemic as well as during London plague as "many did thus [left their houses for somewhere else] after they were really infected themselves, and so carried the disease into the houses of those who were so hospitable as to receive them ...".

Another intriguing aspect of social behavior is that in times of such outbreaks, people tend to be more religious. Defoe notes "It is true the people showed an extraordinary zeal in these religious exercises, and as the church-doors were always open, people would go in single at all times, whether the minister was officiating or no, and locking themselves into separate pews, would be praying to God with great fervency and devotion." A study by Bentzen (2020) shows that Internet searches for prayer in 75 countries have gone up. In fact, she goes on to note that the searches apparently double for every 80,000 new Covid-19 cases. The paper also argues that Internet searches quite possibly underestimate the demand of prayers because many people may not have easy access to the Internet.

Closely related to the notion of increase in faith is the idea of charity and altruistic behavior. Defoe noted that "the inhabitants of the villages adjacent to the city would, in pity, get food and set it at a distance, so that the infected individuals and families might fetch it, if they were able; and sometimes they were not able, and the next time they went they should find the poor wretches lie dead and the food untouched." We keep reading about such small acts of kindness from all over the world both by government workers and ordinary people. Nurses after a grueling day's work in overcrowded hospitals played musical instruments to put patients at peace and help them relax. Stories of young neighbors buying groceries for their elderly neighbors to shield them from the exposure abound. Of course the "father" of behavioral economics, Smith (2010, original publication date 1790) noted in 1790 "How selfish soever man may be supposed, there are evidently some principles in his nature, which interest him in the fortune of others, and render their

3. Personal observation by one of the authors who was in Paris during the second week of March 2020.

happiness necessary to him, though he derives nothing from it except the pleasure of seeing it.” In fact, behavioral economics in its focus on more descriptive models of human behavior have identified other-regarding motives, altruism, and moral motives in explaining kind and helping behavior. Such models suggest behavior based on the warm glow of giving that cannot be captured by the narrow lens of strategic behavior or models of reputation or repeated interactions solely (Charness and Dufwenberg 2006; Fehr and Fischbacher 2005). Perhaps as psychologist Michael Tomasello and his coauthors have argued cooperation (Hamann et al. 2011; Tomasello 2009), and not competition is our basic instinct.

IV. GOVERNANCE AND POLICY-RELATED BEHAVIORS

In this section, we start by examining the similarity in policies to contain the spread of the disease given the prevalence of asymptomatic carriers in both instances. We identify other common policies that were aimed at providing relief to the poor and ensuring that practices like price gouging did not occur. Interestingly, we find that manipulation of statistics relating to fatalities from the disease occurred for both outbreaks. While there are several examples of good policies, we also find that incorrect or bad policies were followed in both instances. Given the lack of experience with the disease, we relate this to decision-making under procedural rationality.

The first confirmed official deaths due to the plague in London were recorded in December 1664 and over the next few months thousands perished. However, it was only effective the beginning of July, that the authorities began taking actions like restricting movements to prevent the spread of plague. Defoe notes, “... on which Act of Parliament the Lord Mayor and aldermen of the city of London founded the order they made at this time, and which took place the 1st of July 1665, ...”. Notably, these actions were initially limited to only parts of the city and not the entire city. Although the responses to Covid-19 have been remarkably different in different countries, a common denominator of policy response around the world has been denial in the early stages of the outbreak—just like the authorities in London took more than 6 months to respond. And even then, a large number of countries imposed restrictions selectively by dividing the country into zones based on the outbreak. Italy, for instance, instituted a national lockdown

only when it became imperative; it was initially imposed only in certain sections of the economy and in selected parts of the country.

What explains such striking similarities in the responses to these two outbreaks that occurred 350 years apart? A simple economic explanation is that the primary objective of those in power, whether it is monarchy or democracy, has always been to stay in power.⁴ And, therefore, we believe that the actions of the government have been centered on ensuring reelection or their ability to continue in power. Since economic hardship makes reelection more difficult for the incumbent (going back to the seminal work of Fair 1978), governments against the advice of health experts, kept businesses running until it was necessary to impose a lockdown.⁵ Even when a lockdown was imposed, the governments tried to put the blame on others rather than taking the responsibility for their late and/or inadequate actions. Defoe notes that in the early stages, the plague in London was attributed to the Dutch and the authorities in London felt that its border controls would keep them safe. Later in the book he laments about the loss of British trade as many countries would not allow British ships into their ports. Chinese products are facing a similar situation in many parts of the world today. In some instances, domestic industry is stepping in to fill this void and in other instances this trade gap is benefitting other countries. In his book Defoe claims that the Dutch were the biggest beneficiaries of these policies against British imports.

With the beginning of lockdown, both in the plague of 1665 and Covid-19, one of the most common strategies for containment was contact tracing and isolation. Given the level of technology available in 1665, this was done through human labor. Every parish appointed *Examiners*, whose duty was “to inquire and learn from time to time what houses in every parish be visited, and what persons be sick, and of what diseases” and “if they find any person sick of the infection, to give order to the constable that the house be shut up”. The job of ensuring that no one entered or exited the house of the infected during the plague in London was entrusted to individuals called *Watchmen*. Burial instructions were

4. Interestingly, Defoe writes that the scared of the plague, the King fled to the countryside and did not bother to address the problem at all. The city of London was looked after by its Lord Mayor and the aldermen who were certainly more replaceable than the king.

5. Brender and Drazen (2008) for instance find that in developing countries economic growth is positively associated with the likelihood of reelection.

issued, and parties and events were prohibited, to prevent the spread of the plague. For Covid-19, contact tracing is done largely through cell phone apps, though in developing countries humans are frequently being used as substitutes. This similarity in response is not surprising because it is the only solution once authorities realize that they are dealing with an infectious disease. Remarkably Defoe also makes this observation in his book. He argues that given the asymptomatic nature of the disease, once a person is identified as being infected then contact tracing is a must to contain the spread. Implementation is a different issue since we live in a world with very different institutions. Most people in the world today enjoy more civil liberties than ever before. Unlike London of 1665, modern concerns over privacy and freedom necessitates varied levels of implementation across countries despite the obvious benefits of contact tracing in stymying the progression of the pandemic. On one hand, we have authoritarian regimes like China and Singapore which have managed successful lockdowns and on the other hand we have countries like the United States where each state has been allowed to issue its own directives.

Defoe also mentions that some of the measures instituted to contain the plague were not well-thought out. For instance, the one that he is most critical of involved completely shutting up infected houses by preventing anyone from entering or exiting. Often this meant that healthy members of the family eventually got sick and even died. He writes, "... many people perished in these miserable confinements which, 'tis reasonable to believe, would not have been distempered if they had had liberty, though the plague was in the house..." Instead, the sick could have been sent to designated houses, known as pest-houses, saving thousands of lives. A contemporary case in point perhaps is India's shutting down of the economy without any advance notice leading to mass migration of workers back to their home states. This is supposed to have been a major reason for the failure of India's lockdown strategy. Another similar ill-conceived strategy was England's plan to end lockdown early and then reinstitute it at short notice. This led to significant travel disruption and those traveling outside made every attempt to make it back to the United Kingdom to beat the lockdown. The same happened when President Donald Trump ordered the travel ban that would go into effect on midnight March 13 with a 2-day notice. However, in the context of Covid-19, one of Defoe's recommendation is

being practiced by most countries—many countries have set up special Covid designated hospitals to contain the spread of the disease.

At the same time, numerous other policies seem to be in common—and we believe this is predictably so. In both outbreaks, it seems that those responsible for governance recognized the need for designating essential individuals who were allowed to engage in jobs related to the disease outbreaks and this was not restricted to only those working in healthcare. Not surprisingly, many of these essential workers came from the more economically depressed sections of society since they were willing to expose themselves to the risk in order to earn money. During the plague, the poor were supported by the Lord Mayor and magistrates "by relieving the most desperate with money, and putting others into business, and particularly that employment of watching houses that were infected and shut up" and "the women and servants that were turned off from their places were likewise employed as nurses to tend the sick in all places." Similarly, during the current COVID-19 outbreak, various governments have provided their citizens with financial assistance and many have been employed as essential workers with several sectors of the economy being labeled as essential sectors providing them with greater flexibility to operate. One could easily argue that such policies are an obvious part of modern welfare states and are intended to keep the social fabric in place. Economic history is replete with how tales of extreme inequality and scarcity lead to social unrest. Moreover, during the London plague, the supply of provisions were always maintained and "the price not much raised neither". The same has been mostly true during the current pandemic in which the governments have placed particular emphasis on providing the necessities and price gouging is outlawed in most countries.

Another interesting feature that is common to both these outbreaks is the manipulation of statistics. There have been numerous reports that in Asia and Africa the actual mortality rates are much higher. Partly it is claimed this is due to lower testing and bad data collection, and partly by design. In developed countries it has been argued that possibly with the exception of the United States where testing is low, in many cases governments deliberately report lower numbers of fatalities with the aim of preventing panics. Official statistics either attribute Covid-19 deaths to other diseases or possibly even misreport actual mortality numbers. In fact,

a recent study by Jagodnik et al. (2020) using predictive analytics argues that the actual number of cases in most countries is substantially underreported in the official statistics. Moreover, this sort of under-reporting is true of most low- and middle-income countries as well as several advanced economies (Cornish, Jerving, and Ravelo 2020; Michaels 2020). Defoe argues that the same was happening in London 350 years ago where people were often reported "... as having died of other distempers." Similarly, Defoe says that many parishes under-reported the number of deaths. The need to manipulate numbers of deaths arises from the need to suppress outcomes that may be viewed as a consequence of inadequate or bad policies. In Defoe's London this was largely the consequence of a bad policy. Given that houses with infected members were completely boarded up and no one including the healthy were not allowed outside. He writes, "... as it was of the utmost consequence to families not to be known to be infected, if it was possible to avoid it, so they took all the measures they could to have it not believed, and if any died in their houses, to get them returned to the examiners, and by the searchers, as having died of other distempers." Similarly, several states in the United States like Florida and Georgia are known to have manipulated death numbers given their policies of opening up the economy.

One question that comes up is why is decision-making less than perfect in such times? This is not surprising when dealing with a pandemic with unprecedented uncertainty. Ignorance about the disease creates health-related uncertainty while uncertainty about the behavior of other human beings and events like lockdowns creates economic uncertainty. Not surprisingly, these sorts of outbreaks lead to Knightian uncertainty where *Homo economicus* may not be able to carry out the necessary cost-benefit calculus. As Simon (1957) observed, in such situations "we should shift our focus from the outcome of the decision-making process to the process itself" and called this type of behavior procedural rationality. Given the complexity of the problem, the possibility of errors can be directly related to the magnitude of the deliberation costs needed to evaluate all possible alternatives (Conlisk 1988, 1995). Pingle (2006) provides an example that might explain some of the heterogenous suboptimal policy reactions of different governments: "If you slip and start to fall off a cliff, which branch, do you grab to try to save yourself? Do you consider

all alternatives? Do you take the time to decide how to decide?" Clearly, the context influences the set of alternatives one would consider or have time to consider. Additionally, the heuristic and biases program of Kahneman and Tversky and others (Gilovich, Griffin, and Kahneman 2002; Kahneman, Slovic, and Tversky 1982; Tversky and Kahneman 1974) all in line with Simon's view provide evidence that when it comes to dealing with uncertain environments decision-makers often succumb to various fallacies and biases rely on cognitive heuristics that may produce suboptimal decisions in certain cases. Thus decision-makers whether in plague-struck London in 1665 or those dealing with Covid-19 today may end up with some suboptimal decisions. In fact, a recent paper by Dasgupta, Jha, and Sarangi (2020) explicitly explains this in terms of procedural rationality.

V. CODA

Daniel Defoe was definitely ahead of his times. In this concluding section we illustrate this by citing some of his insights regarding infectious disease outbreaks to demonstrate this. Defoe realized that the death tolls being reported for different parishes in the "Weekly Bills" were inaccurate. We have already discussed the reason behind this misreporting/underreporting. Defoe says that by looking at the weekly bills one could actually predict and detect the spread of the plague because in many parishes one suddenly saw the rise of deaths not due to plague but quite possibly diseases that would be similar or related. On under-reporting he notes "Likewise, as I observed before, the burials increased weekly in that particular parish and the parishes adjacent more than in any other parish, although there were none set down of the plague; all of which tells us, that the infection was handed on, and the succession of the distemper really preserved, though it seemed to us at that time to be ceased, and to come again in a manner surprising." Clearly, we had in predictive analysis in mind and even an algorithm for detecting statistical anomalies in way that are prescient even today.

Given the uncertain times we are passing through and the difference in exposure to different members of the labor force we wish to draw attention to the following remarkable quote from Defoe, "I cannot but leave it upon record that civil officers, such as constables, head-boroughs, Lord Mayor's and sheriff's-men, as also parish officers, whose business it was to take charge of

the poor, did their duties with as much courage as any, and perhaps with more, because their work was attended with more hazards, and lay more among the poor, who were more subject to be infected, and in the most pitiful plight when they were taken with infection. But then it must be added, too, that a great number of them died; indeed it was scarce possible it should be otherwise." It was evident to Defoe that there were those who were putting themselves in harm's way to a greater extent than others and these individuals needed to be appreciated explicitly. This continues to be true in the times of Covid-19 as well and almost all governments across the world have done something special to recognize these individuals.

Defoe was not happy with policies followed in London and had incredibly modern policy recommendations for us. He says, "... duly considered by the people on any future occasion of this or the like nature, I am persuaded it would put them upon quite different measures for managing the people from those that they took in 1665, or than any that have been taken abroad that I have heard of. In a word, they would consider of separating the people into smaller bodies, and removing them in time farther from one another—and not let such a contagion as this, which is indeed chiefly dangerous to collected bodies of people, find a million of people in a body together, as was very near the case before, and would certainly be the case if it should ever appear again." Defoe did not know the term social distancing (which by all accounts seems to have been coined in the 21st century) but he certainly had the notion in mind.

To sum up, Daniel Defoe was a keen observer of human behavior and many of his insights about behavior during the year of the plague continue to be relevant today. Indeed, if *Homo covidicus* (assuming such a being exists) were to meet his or her ancestor from those days of the London plague, the two would have a lot in common!

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