Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Pandemics and forecasting: The way forward through the Taleb-Ioannidis debate

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> "In all debates, let truth be thy aim, not victory, or an unjust interest"
>
> [William Penn]

1. The context and the need for a scientific debate

The impact of coronavirus disease-2019 (COVID-19) clearly has serious implications for humanity, and the measures needed to fight the pandemic present a profound challenge to policy makers. The choices are grim. Lockdowns slow the spread of the virus and reduce the pandemic's death toll, but they come at the cost of severe economic consequences. Proceeding with "business as usual" keeps the economy rolling but forces us to endure human suffering and the loss of life on a scale that many feel is totally unacceptable. In a time where data are in abundance and easily accessible, analyzing these data to infer the characteristics of the pandemic, proposing models aimed at forecasting its future course and implications while debating about how such information should be used as inputs to decision-making has not produced any form of consensus. Nassim Taleb and John Ioannidis, two renowned thinkers and academics, have provided opposing views on how to deal with the pandemic. Over the first few months of the pandemic, they have been highly visible in the media, conveying messages that to many have appeared to be in conflict.

This question of how the COVID-19 pandemic should be dealt with is of utmost importance. Whatever course we take will profoundly affect our societies and economies for years and possibly for decades to come. We at the *International Journal of Forecasting* (IJF) believe that a well-organized scientific debate between John Ioannidis and Nassim Taleb is the right approach to alert and inform relevant stakeholders, who can then better appraise their recommendations about what needs to be done. It will also have archival value and give some valuable insight on how to deal with similar situations in the future. We are fortunate that Nassim Taleb and John Ioannidis have accepted our offer to debate, first by posting a blog post and then writing a paper addressing each other's views. Their two papers have been written and peer-reviewed, to be published by the International Journal of Forecasting, with a few coauthors joining them in this scientific debate.

2. Some specific lessons from this debate

After having carefully studied their papers, we can confirm that there is a lot to learn from their views, which are not as far apart as they may seem at first, although there are, no doubt, many differences in their opinions. Unsurprisingly, each of them advocates using a rigorous scientific approach to inform decision makers, based on an understanding of data and of the characteristics of the uncertainties involved. In addition, they both believe that forecasting cannot accurately predict the evolution of the pandemic, or correctly estimate future uncertainty, particularly during the early stages. We, as forecasting experts, agree with such an assessment because forecasting requires (reliable) historical data that do not exist at the start of a pandemic. There are differences, too. On the one hand, Nassim Taleb has clearly expressed that measures to stop the spread of the pandemic must be taken as soon as possible: instead of waiting for data to become available, it is the nature of a pandemic with the possibility of devastating human impact that should drive decisions. On the other hand, John Ioannidis acknowledges the difficulty in having good data while believing

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that eventually any information that can be extracted from such data should still be useful to introduce targeted lockdowns by considering the varying risk for different categories of the population, such as those staying in nursing homes or held in prisons, and by considering age differences. At the same time, John Ioannidis when asked in an interview (Jha, 2020): Did you support the lockdown? He responded "Let me answer, frankly. Yes. But only as a temporary measure," continuing "The biggest lesson from this pandemic is that the costs of delaying controlling the infection can be substantial. Act decisively in haste or repent at leisure."

Nassim Taleb states in his paper that "drastic shotgun measures such as lockdowns are the price of avoiding early traveler quarantines and border monitoring; they can be –*temporarily and cum grano salis*– of help, especially in the very early stages of the new contagious disease, when uncertainty is maximal, to help isolating and tracing the infections, and also buying some time for understanding the disease and the way it spreads. Indeed, such drastic and painful measures can carry long-lasting damages to the system, not counting an excessive price in terms of personal freedoms." Nassim Taleb and John Ioannidis stands do not seem to be far apart, although Ioannidis advocates that "we need models which incorporate multicriteria objective functions. Isolating infectious impact, from all other health, economic and social impacts is dangerously narrow-minded," while Nassim Taleb is mostly concerned with the fat-tail behavior of the pandemic and the application of the extreme value theory to deal with the serious problem of uncertainty.

3. Looking forward

One certainty is that COVID-19 caught humanity off guard and forced many decision makers to act rapidly and take strong measures under high levels of uncertainty. As the pandemic continues to spread, two important actions must now occur. First, as more reliable information is becoming available, we need to stop the blame game and join forces on how to proceed. Second, we must bring together what we have learned from the current pandemic to help future generations face new and potentially more severe ones that epidemiologists believe are waiting in the wings. We expect that this initiative with Nassim Taleb and John Ioannidis will contribute toward guiding us to positive outcomes as their positions, even if not similar, hold useful lessons for the future. Other efforts are also underway, e.g., the special section of the IJF about COVID-19 (covering this scientific debate among other topics) and an open scientific debate at the International Institute of Forecasters' (IIF's) annual International Symposium on Forecasting (in 2020), to further help our society deal not only with the current pandemic but also with future ones.

In an interesting paper "Learning From the COVID-19 Failure—Before the Next Outbreak Arrives" Osterholm and Olshaker (2020) argue that pandemics, such as the COVID-19 or more serious ones, are likely to occur in the future and that we must get prepared to face them the same way we are ready to face earthquakes, hurricanes, and other natural catastrophes. Below are some things we could learn from the current pandemic that may help future generations:

- The most important recommendation for future generations is that decisive actions must be taken as early as possible once a pandemic has been confirmed. Any delay, as Nassim Taleb has forcefully pointed out, will result in disproportional high future costs.
- The current pandemic has not yet run its course. Once this is done, a commission of experts must be appointed to evaluate all its aspects and scrutinize all major decisions made to recommend what went wrong and what could have been done differently, in hindsight, to minimize its negative consequences. In addition, it should propose a number of practical suggestions for facing future pandemics, rationally, with the least damage.
- If we had to choose a single recommendation from those of Nassim Taleb for future generations, it would have been: "having a good coordinated tail risk management in place –to repeat, border monitoring and control of super-spreader events being the very first such measures."
- The corresponding single recommendation from those of John Ioannidis' would have been not believing in the "explosive literature of models and forecasting that will emerge again as soon as a new pandemic is suspected." . . . expecting "we can learn from our current mistakes to be more cautious with interpreting, using, and optimizing these models. Being more cautious does not mean not to act decisively, but it requires looking at the totality of the data."

The current pandemic has greatly affected the social and economic fabric of our societies (Reinhart & Reinhart, 2020). There will be pre- and post-COVID-19 eras as the fear and consequences of a new pandemic will significantly affect future decisions at the level of governments, businesses, and individuals who will have to make decisions having in the back of their minds that another pandemic may strike us in the future.

Declaration of competing interest

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

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Appendix

In practice, the debate was a two-stage process. The authors were first given a 2-week period to write blog posts, which were then simultaneously posted online (forecasters.org, on June 11, 2020). Subsequently, after having reviewed each other's points, they were given another 2 weeks to develop their argument while responding to each other's views. This led to the submission of full papers (on the June 25, 2020), which were then reviewed prior to their publication in the International Journal of Forecasting. These are the 2 papers that follow this introduction. The original blog posts are provided as supplementary material, to allow the reader to have access to the whole process.

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