Behavioral economics of the Covid-19 pandemic

We study the Covid-19 pandemic from the point of view of behavioral economics, which combines economics and psychology. We analyze the biases (for example, optimism bias) that may have had a greater impact on decision-making regarding the pandemic, as well as potential public health policies from a behavioral economics perspective. We contrast the use of «nudges» (non-coercive measures that do not use economic incentives) with legislative measures, and we advocate for a comprehensive approach that jointly uses the best interventions available, to generate healthy habits (that reduce the transmission of the virus). Finally, we apply this approach to the promotion of vaccination.

Estudiamos la pandemia de Covid-19 desde el punto de vista de la economía del comportamiento, que aúna economía y psicología. Analizamos los sesgos (por ejemplo, exceso de optimismo) que pueden haber tenido un mayor impacto en la toma de decisiones referentes a la pandemia, así como posibles políticas de salud pública desde el enfoque de la economía del comportamiento. Contrastamos el uso de «nudges» (medidas no coercitivas y que no usan incentivos económicos) con medidas legislativas, y abogamos por un enfoque integral que utilice las mejores intervenciones disponibles en conjunto, para generar hábitos de conducta saludables (que reduzcan la transmisión del virus). Por último, aplicamos este enfoque a la promoción de la vacunación.

Covid-19a jarreraren ekonomiaren ikuspuntutik aztertu dugu, ekonomia eta psikologia uztartuz. Pandemiaren gaineko erabakiak hartzeko orduan eragin handiagoa eduki ahal izan duten ezaugarriak (adibidez, gehiegizko baikortasuna) aztertu ditugu, bai eta osasun publikoko balizko politikak ikertu ere, jarreraren ekonomiaren ikuspegitik. Berariaz egiaztatu dugu «nudges» izenekoen (pizgarri ekonomikorik erabiltzen ez duten neurri ezzuzentzaileak) eta neurri legegileen erabilera. Hartara, eskuragarri dauden esku-hartzeen artetik onenak erabiliko dituen ikuspegi integralaren alde egin dugu, jarrera-ohitura osasuntsuak sortze aldera (birusaren transmisioa murriztuko dutenak). Azkenik, ikuspegi hori aplikatu dugu txertaketaren sustapenera.

* Spanish versión available at https://euskadi.eus/ekonomiaz

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Keywords: Covid-19, behavioral economics, nudging, health behavior change.
Palabras clave: Covid-19, economía del comportamiento, *nudging*, cambio de comportamiento saludable.
JEL codes: D9, I12, I18
Entry date: 2021/06/25 Acceptance date: 2021/07/22

1. INTRODUCTION

The Covid-19 pandemic and its ramifications will undoubtedly mark the first years of the 2020s. Despite being such a recent (and ongoing) phenomenon, there has been an explosion in the number of academic papers devoted to understanding the causes and effects of the pandemic, as well as the impact of lockdowns and other non-pharmaceutical interventions (NPIs) on the spread of the disease: from epidemiological models of Covid19 (Britton *et al.*, 2020; Ferguson *et al.*, 2020; Prem *et al.*, 2020; Abellan-Perpiñan *et al.*, 2021), to macroeconomics models to understand its consequences for the economy (Atkeson, 2020; Guerrieri *et al.*, 2020; McKibbin and Fernando, 2020).

This article, however, addresses the Covid-19 pandemic and the strategies for their mitigation from a behavioral economics (BE) perspective. Such a perspective focuses on how individuals behave when they face the pandemic and react to stimuli and incentives to engage in responsible behaviour. Accordingly, this paper connects to an emerging literature that analyses the interaction between BE and the

Covid-19 pandemic specifically (Halpern and Miller, 2020; Van Bavel *et al.*, 2020; Haushofer and Metcalf, 2020; Soofi *et al.*, 2020).

Even before the novel coronavirus outbreak was characterized as a pandemic by the World Health Organization (WHO), renowned epidemiologists already claimed that «individual behaviour will be crucial to control the spread of Covid-19. Personal, rather than government action, in western democracies might be the most important issue» (Anderson *et al.*, 2020). Unfortunately, this warning has been largely ignored by western governments in their interventions to contain the propagation of the infection.

Paradoxically, the initial response of the UK government to the Covid-19 outbreak, avoiding early lockdown, was presented as being based on behavioral sciences, invoking the idea of «behavioral fatigue», meaning that people will grow tired of the bans and find ways around them. Without doubt the association between this idea and the decision to let the coronavirus spread by refraining from ordering lockdown was a huge mistake, indeed severely criticised in an open letter signed by more than 600 behavioral scientists. Nevertheless, despite this unfortunate association between a phenomenon which has been considered as a «naive construct» or a «myth» (Harvey, 2020) and policy decisions, we firmly think that «it is worth considering the proper place of behavioral insights in the difficult policy choices at hand» (Sibony, 2020).

The aim of this article is twofold. First, to provide a succinct explanation of how BE has influenced the course of the pandemic, through individual and collective behavior. And second, to explain how BE can help analysts and policy-makers to fight the spread of SARS-CoV-2, by «nudging» citizens to take protective measures such as wearing face masks and washing hands regularly and to overcome Covid-19 vaccine hesitancy or reluctance to vaccinate.

The paper organizes as follows: next section briefly describes BE fundamentals and introduces the nudge concept and its application to the health domain. Section 3 explains the different biases underlying the initial response to the pandemic, whereas Section 4 proposes a cohesive framework that combines different specific nudges to fight the Covid-19 pandemic. Section 5 addresses how nudges can affect both demand- and supply-side determinants of vaccines, boosting vaccination coverage. The discussion closes the paper.

2. BEHAVIORAL ECONOMICS AND HEALTH

BE analyses individual behaviour from a more realistic psychological grounds than conventional economics (Kahneman, 2011). It explains a wide variety of decision errors that, because of being systematic, are given the name of cognitive and emotional biases. Most of these biases are indeed related to public health problems (Roberto and Kawachi, 2016). Fortunately, policy interventions based on BE have shown their effectiveness in that context (Kessler and Zhang, 2014; Abellán Per-

piñán and Jimenez-Gomez, 2020), contributing successfully, for example, to obesity prevention (Gittelsohn and Lee, 2013), promotion of physical activity (Milkman *et al.*, 2013), smoking cessation (Giné *et al.*, 2010), and increase of vaccination rates (Chapman *et al.*, 2010), among many other health-related domains. All of these behavioral interventions are known as nudge-type interventions (Perry *et al.*, 2015), that is to say, interventions that change the environment without restricting any options (Thaler and Sunstein, 2008).

There are many biases (see, for a review, Montibeller and Von Winterfeldt, 2015). For example *overconfidence bias* (Moore and Healy, 2008), according to which individuals tend to overestimate their own abilities, suffering from a sort of «illusion of control», undervaluing newly risks they are facing. We will analyze several of them in more detail as they relate to the Covid-19 pandemic, in Section 3.1 below.

As noted above, nudge-type interventions are the way BE guides individuals to make better decisions for their wellbeing and health. This set of interventions encompasses not only nudges in a strict sense (i.e. changes of the «choice architecture»), but also economic (and other type of) incentives that redirect individual choices in a direction compatible with their long run interests (e.g. to quit of smoking). Although there is an ample variety of nudge-type interventions, some examples aimed to improve lifestyles and compliance with medication and vaccination are the following (see also Abellán Perpiñán and Jimenez-Gomez, 2020, for a discussion of nudges applied to health):

- Reminders (i.e. messages that focus individual's attention on the behaviour to be promoted) and implementation intentions (i.e. self-regulatory strategies in the form of an «if-then plan» to get a better goal achievement) were used by Milkman *et al.* (2011) to increase influenza vaccination rates. Employees of a large firm received reminder mailings that listed the times and locations of the relevant vaccination clinics. Mailings to employees randomly assigned to the treatment condition additionally included a prompt to write down the date and time the employee planned to be vaccinated. Employees who received this prompt had a 4.2 percentage point higher vaccination rate than the control group (37.3% vs. 33.1%).
- Default options (i.e. options the decision-maker will obtain if nothing is done) are used in several countries to boost organ donations, in such a way that donations are much higher in those countries (e.g. Austria, France, Belgium) in which consent is presumed (opt-out) than in those others (e.g. UK, Germany, Denmark) in which consent is explicit (opt-in). Effective consent rates are close to 100% in the former, whereas they are lower than 28% in the latter (Johnson and Goldstein, 2003).
- Environmental restructuring (i.e. restructuring the way that choices are delivered to decision-makers) has been extensively used to address obesity, for example, by increasing accessibility to healthy food (Thorndike *et al.*, 2012),

changing the serving utensils (Rozin *et al.*, 2011), reducing portion sizes to eat (Rolls *et al.*, 2006) or rearranging the way healthy foods are placed in the lunchroom (Hanks *et al.*, 2012).

- Social nudges (i.e. interventions to induce voluntary cooperation in social dilemma situations) are based on the idea of social norms, informal agreements that rule behaviour in a society. For example, the use of peer comparison letters targeting high-volume primary prescribers of quetiapine (an antipsychotic agent frequently overprescribed for indications not supported by clinical evidence) meaningfully reduce their prescribing (Sacarny *et al.*, 2018). These nudges will be important when attempting to influence social norms, as we discuss in Sections 4 and 5.
- Incentives to action aim to encourage good habits by paying people (with money or goods). An example of the use of this type of incentives is the study conducted by Charness and Gneezy (2009), who investigated the post-intervention effects of paying people to attend a gym a number of times during a month. They found that those people who received a larger financial incentive attended the gym significantly more times a week than those who were not incentivized at all, once the incentives were removed.
- Lotteries (i.e. incentives payed by means of lotteries) have advantages over direct payments because they do not reduce so much intrinsic motivation and, in addition, use a cognitive bias (overweighting of small probabilities) to nudge the individual. Volpp *et al.* (2008) used a daily lottery-based incentive for warfarin adherence, getting significant improvements in both inappropriate medication dosing (the mean proportion of incorrect pills taken during the intervention was 2.3% incorrect pills compared with a historic mean of 22% incorrect taking) and time out of the international normalized ratio (INR) range (which decreased from 35% to 12.2% during the intervention, before increasing to 42% post-intervention).

3. BEHAVIORAL ECONOMICS AND THE COVID-19 PANDEMIC

In the previous section we have discussed how Behavioral Economics has been used in public health. Of course, as the Covid-19 pandemic progressed, there were behavioral economists that attempted to use BE to understand and fight the pandemic. In this section we will focus in understanding how different BE channels might have contributed to the course the Covid-19 pandemic has followed; in Section 4 below we discuse how we can actually use these insights to fight the pandemic.

3.1. Channels for the contagion of SARS-CoV-2

Several recent articles have emphasized a number of channels through which the initial response to the pandemic, and subsequent measures taken, might have

been suboptimal from a public health point of view (Halpern and Miller, 2020; Van Bavel *et al.*, 2020; Abellán Perpiñán *et al.*, 2020).

- Optimism bias and overconfidence (Halpern and Miller, 2020). Optimism bias happens when someone holds an excessively optimistic belief about the future. Overconfidence, as we discussed in Section 2, happens when a person has excessive confidence in their own beliefs. In the case of Covid-19, these two biases combined to make politicians and citizens alike believe that Covid-19 was probably «not as bad», and moreover be too confident about this mistaken belief.
- Biased judgements caused by the availability heuristic (Tversky and Kahneman, 1974), that lead people to judge an unknown risk (e.g. Covid-19 transmission risk) from another with which they are familiarized (e.g. seasonal flu transmission risk), over/undervaluing the novel risk.
- Innumeracy or mathematical illiteracy (Paulos, 1988), which make that individuals fail to understand the mathematical logic that rules the spread rhythm of infectious diseases. In particular, individuals might fail to understand the explosive nature of exponential growth (associated to a contagion rate larger than 1) for SARS-CoV-2.
- Status quo bias (Tversky and Kahneman, 1991), which means that the current baseline (or status quo) is taken as a reference point, and any change from that baseline is perceived as a loss. This explain why people have a strong tendency to retain the status quo.
- Present bias (O'Donoghue and Rabin, 2015; Halpern and Miller, 2020). As people place a disproportionate amount of weight to the utility of the present moment, they might fail to adequately prepare for future eventualities, even if they could foresee them. In the case of Covid-19, this bias becomes compounded with other biases such as overconfidence, providing even less incentives to individuals to prepare for the pandemic.
- Omission bias (Baron and Ritov, 2004; Halpern and Miller, 2020). Closely related to status quo bias, this describes a bias by which favor lack of action (omission) versus active action (commission), even when they lead to the same outcome. Because of that, in the uncertain times of the beginning of the pandemic, public officials might have chosen more passive courses of action.
- Identifiable lives, also known as, identifiable victim effect (Jenni and Loewenstein, 1997; Halpern and Miller, 2020), that can be considered a type of availability heuristic: people tend to exert more effort to protect the lives of those that they can easily identify (such as family or a patient), rather than «statistical» lives. The bias leads to the so-called «rule of rescue» (Jonsen, 1986), the proclivity to rescue identifiable individuals facing avoidable death, without giving too much thought to the opportunity cost of doing so.

- Biases in risk perception: for example, Van Bavel *et al.* (2020) argue that emotional assessment of risk can bias the perception of the true risks from the pandemic. Moreover, the well-known phenomenon of probability weighting, can lead to a distortion in the perception of risk (Kahneman and Tversky, 1979), so that lower probabilities tend to be over-weighted, while medium to high probabilities are usually under-weighted.
- Fallacy of lack of evidence (Altman and Bland, 1995), that can be summed up in the aphorism «absence of evidence is not evidence of absence», which can be on the basis of the reluctance of experts and institutions to support new ways to fight new threats (such as the Covid-19 pandemic).

4. BEHAVIORAL INTERVENTIONS TO FIGHT COVID-19

Ever since the irruption of Covid-19 in our lives, behavioral economists have proposed ways to fight the spread of the disease. As we discussed in Section 2, *nudges* (interventions that change the environment without restricting any options) have been used to improve health behavior in a variety of contexts, such as: nutrition, exercise, medication adherence, and vaccination (we will talk more of the latter in Section 5). In this section, we review what the literature has proposed and/or what has been implemented by national and local governments.

To provide some structure, we first discuss nudges that have been proposed, classified by their specific mechanism of action. After that, we propose an integral approach to combine those nudges into a cohesive framework, in which the sum would be larger than the parts.

4.1. Specific nudges and their mechanism of action

After having reviewed nudge theory more generally in Section 2, and the channels that affect behavior with respect to SARS-CoV-2 in Section 3.1, we are ready to discuss specific nudges that are relevant for the Covid-19 pandemic.

4.1.1. *Handwashing*

One of the key interventions to fight the spread of SARS-CoV-2 is handwashing. Unfortunately, handwashing behavior is not straightforward to change, as it is part of habitual behavior, which is notoriously difficult to modify Duhigg (2012). However, we can draw insights from interventions that have used nudges to encourage handwashing in the past. For example, capturing attention is key, and this can be accomplished by placing a handwashing station that is physically in the way, and/or increasing the convenience of the locations were handwashing is possible (Lunn *et al.*, 2020). It seems that multiple angles of intervention are required, such as social pressure, an encouraging environment, and reminders or cues (Huis *et al.*, 2012). As we discuss below, these types of interventions can be incorporated into a broader and more integral framework.

4.1.2. *Self-isolation after suspected SARS-CoV-2 infection*

Isolation of (potentially) infected individuals is one of the most fundamental tools in the public health toolkit for controlling pandemic diseases. And yet, despite the obvious benefits of such measures, isolation also has costs, both psychological (in terms of distress for the isolated individual, Holt-Lunstad *et al.* 2015; Cacioppo *et al.* 2014) and economic (as the isolated person's economic activity is drastically reduced). Therefore, one of the most important interventions would be to maintain the benefits the isolation, while reducing its costs. This is especially important given that while the benefit is public, the cost is mostly suffered by the individual, and therefore some individuals might prefer to avoid isolation, even if that means increasing the risk of contagion for others.

While not a nudge, one of the most straightforward measures is to compensate or subsidize individuals who must undergo isolation (Bodas and Peleg, 2020). This of course must be done in an incentive-compatible manner, so as to avoid both voluntary contagions at one extreme, and lack of participation in the program due to insufficient incentives at the other extreme. These types of incentive designs must be informed by behavioral economics, so as to ensure that individuals react to them in the way that is anticipated by the designer.

4.1.3. *Use of face masks and other observable behaviors*

One of the key components of an infectious pandemic, is the public-good nature of reducing contagion. In the context of the Covid-19 pandemic, most articles emphasize this point as one of the most important OECD (2020); Lunn *et al.* (2020). One of the best examples is the use of surgical face masks, that might offer little protection to the wearer, but protects others from contagion if the wearer is infected by SARS-CoV-2. In other words, infected individuals impose negative externalities to others. One of the most established facts in Economics is that public goods will be under-provided in the absence of government intervention (Samuelson, 1954; Olson, 1965). Because of that, there is an opportunity for government intervention. The typical (neoclassical) interventions to reduce externalities and increase public good provision are Pigouvian taxes and mandates. Pigouvian taxes are quite straightforward: subsidizing face masks and alcohol dispensers will increase their usage beyond the point of private benefit, towards the socially optimal point.

4.2. **Mandates**

Nudges have several advantages, including the fact that they can be implemented by all types of private and social organizations. Beyond nudges, governments at all levels can also implement mandates, i.e. regulations that have the force of law.

One important question is: when is it appropriate to use mandates instead of nudges? In our own research (Abellan-Perpiñan *et al.*, 2021), we have developed a

SIR-type epidemiological model in which individuals must (endogenously) decide whether to engage in responsible behavior (such as wearing a facemask and washing hands) or not. When we perform simulations in that model, it is apparent that nudges at the beginning of the pandemic might not have been sufficient, as Covid-19 was not yet salient, and there was no social pressure to uphold such responsible behavior. At that moment, mandates would have been more effective (what form the mandates should have taken is something that escapes our simple framework). However, as the pandemic has progressed, awareness of the disease is widespread and there exists a social conscience that responsible behavior is necessary in order to fight the disease. In that context, our framework predicts that nudges can be as effective as mandates.

4.3. **An integral framework to fight the Covid-19 pandemic**

In the previous section we have analyzed several specific interventions and mechanisms to fight Covid-19 (handwashing, self-isolation, interventions based on altruism). However, it has probably become clear by now that many of these interventions share particular mechanisms of action, as well as drawbacks. We believe therefore that an integral approach that combines all the aforementioned interventions is necessary. Two mechanisms are especially responsible for this. The first is habits: handwashing, wearing a facemask, keeping social distance, etc. are all habitual behaviors that need to be internalized in order to be executed without conscious effort, i.e. to become a habit. Because of that, it seems much more promising to bundle all of them in a single «responsible behavior» habit, in such a way that each action reinforces others (for example, when wearing a facemask, one becomes more aware of washing hands or keeping social distance, Duhigg, 2012). The second important mechanism for integration is prosocial behavior: while some of the behaviors we have described (such as handwashing and wearing a facemask) have a private benefit for the individual, the truth is that their benefit is mostly public (and this is especially true of other behaviors such as self-isolation). Because of that, there is an important prosocial component in responsible behavior, and once again it is useful (perhaps even necessary) to consider these behaviors jointly, so that we can understand how social norms and intrinsic motivation can generate the behavior.

In recent years, economists have paid increasingly more attention to the notion of *identity* (Akerlof and Kranton, 2010, 2005; Huettel and Kranton, 2012; Akerlof and Kranton, 2000). In our integral approach, we would like to emphasize the importance of identity. When an individual is wearing a facemask, washing hands, etc. that person might develop an identity: «I am the type of person that is responsible and that is doing their part to fight Covid-19». Because of that, we believe that all of the nudges we have mentioned can reinforce each other through the formation of a prosocial identity. While some nudges in isolation might not work to engage people in responsible behavior regarding Covid-19, a more «reflexive» intervention (which we argue can enhance the self-image of being a responsible citizen) can be effective (Hume *et al.*, 2020).

Moreover, behavioral economists have also emphasized the habitual nature of most of the behaviors that are being promoted. It is known that generating new habits is difficult, but it becomes easier when there are different behaviors that are integrated in one's identity and that reinforce each other (Duhigg, 2012). For all of these reasons, we believe that it is crucial that governments and other agencies take this integral approach seriously when applying nudges to fight Covid-19.

Finally, in the same way that all nudges should be targeted towards this integral goal, the discussion about mandates is also relevant here. We believe that there is no point in artificially separating the design of mandates from that of nudges. Instead, public organizations (and, to the extent that is possible, private and social organizations too) should coordinate to design a comprehensive list of measures designed to improve compliance to protective and responsible behaviors. When mandates are justified, because they do not excessively restrict private freedom and can be realistically enforced, then behavioral economists can combine them with nudges, to generate as integral an effect as possible.

5. **VACCINATION**

As we write these words (May 2021) several vaccines for Covid-19 have been developed around the world, and it seems that the way forward is to get a substantial fraction of the population vaccinated, in order to achieve herd immunity (Randolph and Barreiro, 2020). Once again, we face the same resistance: the problem is not so much medical or biological, but logistical and behavioral. Even the logistics of purchasing, storing and transporting the vaccines have a behavioral component, but we are not going to delve into that. Instead, we would like to focus on the BE aspects of the *vaccine implementation*, i.e. whether people are actually getting vaccinated, and who and how many are those people. In other words, how BE affects how we go from having a number of vaccines available, to having those vaccines having been used effectively.

As we discussed in Section 2, vaccination rates are lower than optimal, for a number of diseases. There are a number of reasons why people might not vaccinate: because they fear side effects, because they dislike the vaccination process itself, or because the intend to get vaccinated but end up procrastinating, among others. All of the reasons have a behavioral component, that can be analyzed and used to increase the vaccination rate (in Section 2 we discussed some studies that used nudges to increase vaccination rates; Chapman *et al.* 2010; Milkman *et al.* 2011).

Vaccination against SARS-CoV-2 is challenging for several reasons. First, there is an increased concern about potential side effects, given the speed with which clinical trials have taken place (Wadman, 2020). Second, several of the vaccines require at least two doses, what means that individuals need to repeatedly go to get the doses, opening the potential for only partial immunization if people do not receive all the required doses. Note that this can be demand-driven (people fail to attend to the later

vaccination appointments), or supply-driven (governments offer the first doses of the vaccine, but fail to offer later doses). This opens a particular danger that if enough people are partially immunized, the virus might be able to mutate in such a way that the vaccine loses its effectiveness. Both demand- and supply-driven channels can be affected by Behavioral Economics effects, and are therefore susceptible to be influenced by nudge-type interventions.

5.1. **Demand side**

The demand side of the SARS-CoV-2 vaccine refers to those who would ask to be vaccinated, i.e. the public at large. The World Health Organization has written a special report on the «Behavioral considerations for acceptance and uptake of Covid-19 vaccines» (World Health Organization, 2020, WHO 2020 henceforth), and in this section we discuss several of the ideas included in that report. In particular, there are three main categories of drivers of demand-side vaccination that can be identified: an enabling environment, social influences, and motivation.

With regards to having an enabling environment, there are several factors that need to be taken into account (WHO 2020). For example, is the location convenient? Is it costly to become vaccinated, either in terms of money or in terms of time invested? Here there are some opportunities to implement nudges: for example, by making vaccination the default option, as in the study by Chapman *et al.* (2010) we mentioned in Section 2, but also by making the location accessible and welcoming for those who are to be vaccinated. We believe that, in a sense, generating an enabling environment for vaccination can be compared to generating an enabling environment for voting: both are prosocial actions with small private costs and large positive externalities. And, if the literature on voting has reached any consensus, it is that social norms and social pressure are great motivators for going to cast a vote on election day (Gerber *et al.*, 2008; Funk, 2010; Bond *et al.*, 2012; DellaVigna *et al.*, 2017).

It is to the topic of social norms that we turn our attention next. Social norms are of great importance, as they increase the value of becoming vaccinated (praise motive) and the cost for not becoming vaccinated (shame motive, Benabou and Tirole, 2006). Social norms that favor prosocial behavior, will also favor vaccination. When those in a person's social network were skeptical of vaccination, vaccine uptake decreases (Brunson, 2013); conversely, if a person social network is supportive of vaccination, vaccine uptake increases (Bish *et al.*, 2011). In order to generate such social norms, several strategies can be used (WHO 2020): publicizing the fact that people are becoming vaccinated, using the fact that health workers have been vaccinated to increase trust in the vaccine, and communicating endorsements from influential community members. Another strategy consists of listening to the concerns voiced by the communities, and engaging with them in a honest and open manner (WHO 2020): in those countries in which government officials have promoted half-truths or outright lies, it is imperative that they correct their trajectory

by being truthful about the details on the vaccine, in order to recover the trust of the community.

With respect to the topic of motivation, it is important to note that as the more vulnerable populations become vaccinated, those who remain may have less willingness to become vaccinated. This is so because those individuals are healthier, and have the perception that they would benefit less from the vaccine, while suffering any perceived side effects (Rosenbaum, 2021). This might be exacerbated by the fact that most people are ambiguity averse, meaning that they tend to avoid choices with unknown risks (Ellsberg, 1961; Baillon *et al.*, 2018). In this case, individuals might believe that they understand better the consequences of contracting Covid-19 versus those of becoming vaccinated. One possible solution to this is to provide as much clear and trustworthy information as possible about the vaccination process, its benefits, and potential side effects. Having this information would reduce the hesitancy caused by ambiguity aversion, and would allow a more autonomous choice. It is also important to emphasize the social benefits from any individual becoming vaccinated (increased herd immunity and protecting others). Healthy individuals who might not believe the vaccine would benefit them, might nevertheless become vaccinated if they believe that the societal benefit is large enough, as an act of altruism.

As we discussed in Section 4.3, it is crucial to provide a unified strategy that encourages prosocial behavior in all of its components (handwashing, wearing facemasks, maintaining social distance, etc.) in such a way that each person generates an identity of «doing the right thing» to fight the pandemic. We believe that vaccination shows why that integral approach is so valuable: once people identify as prosocial, and doing their part in the collective fight against Covid-19, becoming vaccinated is a logical continuation of this behavior (as long as the person is medically recommended to become vaccinated).

5.2. **Supply side**

The logistical challenge of distributing the vaccine and organizing the vaccination process is probably falling on an already overstretched state and local bureaucracy. At first sight, it might seem that the obvious solution is to provide bonuses for these bureaucrats, in order to improve their performance. However, this is problematic at several levels. The most straightforward problem is that establishing performance bonuses for bureaucracies might be unfeasible for legal or budgetary reasons. But a more subtle reason, that is derived directly from BE, is that using extrinsic incentives to encourage prosocial behavior can actually backfire (Gneezy and Rustichini, 2000).

5.3. **The path ahead**

For future pandemics, a clear and solid protocol for a vaccination should be established. These protocols should be resilient to uncertainty about the availability of

vaccines, disruption in supply, etc. The protocol should also take into account the fact that there might be resistance to vaccination in the population, and should incorporate the measures that we have suggested in Section 5.1, in order to increase the demand for vaccination.

6. **CONCLUSION**

In this paper we have briefly described the field of behavioral economics, its applications to public health, and in particular to the Covid-19 pandemic. We have explained the different channels through which behavioral economics has affected behavior before and during the pandemic. Moreover, we have proposed ways in which behavioral economics can aid in the fight against the disease, through the use of nudges and increased vaccination uptake.

Despite the tremendous success that behavioral economics has had in public health in the last decade (Roberto and Kawachi, 2016), we believe this is actually just the beginning of what will constitute a permanent and fruitful interdisciplinary field, that combines medicine, economics, psychology, and other related disciplines, to provide an integral approach to public health that takes into account actual and realistic human behavior. We believe that integrated behavioral economics into the practice of medicine and public health is only a natural step, that provides a better model of human behavior, and therefore better and more efficient health outcomes.

Behavioral economics can also be incorporated into epidemiological models. In fact, this is precisely what we have done in one of our studies (Abellan-Perpiñan *et al.*, 2021). In that paper, we are able to study how individual behavior, that is affected by cognitive biases, affects the evolution of the pandemic. While we are in the first (to our knowledge) to incorporate behavioral economics into an epidemiological model, we believe that this will become a standard practice in the future, as it will increase the accuracy of such models, by endogenize in human behavior in a way that is realistic.

As we have argued elsewhere (Abellán Perpiñán and Jimenez-Gomez, 2020), we believe that there is still a need in Spain for collaboration between behavioral economics and the health sciences. These can be done both with private collaborations between researchers and practitioners, but perhaps more efficiently by establishing permanent «nudge units» that can provide consulting expertise and eventually become integrated into the decision processes in public health. Our hope is that when the next pandemic happens, we will have learned how to deal with it with all the tools at our disposal, and we believe that behavioral economics is one of the best tools available for policymakers and practitioners alike.

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