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Research article

Framing bias on COVID-19 pandemic decision-making in Greece

Dimitris Zavras*

Laboratory for Health Technology Assessment, Department of Public Health Policy, School of Public Health, University of West Attica, 196 Alexandras Avenue, 11521 Athens, Greece

* **Correspondence:** Email: dzavras@uniwa.gr, Tel: (+30)2105385978.

Abstract: Background: Decision-making is subject to mistakes. Framing bias is a common error in decision-making that occurs when decision-makers select and highlight certain aspects of a situation while excluding others. Since framing bias has been only conceptually defined, our objective of this study was to develop and present, for the first time, an index that describes this bias using COVID-19-related data from Greece leading up to the second lockdown. **Methods:** To analyze which aspects should be focused on and emphasized by the Greek authorities during the early phase of the COVID-19 pandemic, we use monthly data for the following: (i) The World Uncertainty Index (WUI), (ii) the World Policy Uncertainty Index (WPUI), (iii) the World Sentiment Index (WSI), (iv) the number of newly reported COVID-19 cases, and (v) the number of newly reported COVID-19 deaths. Using the proposed index, the analysis was based on not emphasizing all aspects (one at a time). **Results:** Without knowledge of which aspects were focused on by the Greek authorities, we investigated, through the proposed index, which aspects should be emphasized more. The framing bias indices indicate that the Greek authorities should emphasize more aspects related to the epidemiological characteristics of the pandemic. Since framing bias and trade-offs are relatively low, they indicate decisions in the right direction. **Conclusions:** The need for emergency action was evident in September 2020. The Greek government's decisions were made without suitable alternatives. Thus, decision-making focused on the weaknesses of the health care system, and the absence of effective medications or a vaccine.

Keywords: data-driven decision-making; health policy; framing bias; COVID-19 cases and deaths; uncertainty indices

1. Introduction

Data-driven decision-making (DDDM) bases decisions on information extracted from data analysis rather than on intuition [1,2]. In other words, DDDM refers to the systematic process of making strategic, operational, or policy-level decisions based on empirical evidence derived from data analysis [3].

In complex systems such as the health care system, where decisions are strongly influenced by uncertainty [4,5], information reflects the degree to which uncertainty is reduced [6].

Beyond its positive impacts on clinical outcomes, operational efficiency, and financial performance in health care [7], DDDM is fundamental to managing public health crises [8]. For instance, the coronavirus disease 2019 (COVID-19) pandemic represents a turning point in the use of DDDM by governments for public health emergencies [9]. Because governments use data to formulate policies, allocate resources, and monitor progress, data played a crucial role during the pandemic in tracking the spread of the virus and allocating medical resources [10]. Thus, DDDM contributed to the containment of infection rates and reported cases [11].

DDDM is becoming a common practice in policy-making because data analytics enable policy-makers to assess the success of social programs, track economic indicators, and react to crises such as natural disasters or pandemics [12]. DDDM enhances the effectiveness of interventions by providing policy-makers with real-time information on health outcomes and areas requiring targeted interventions [13]. Therefore, good decisions regarding effective policies depend on timely, accurate, and relevant information. Additionally, health information is necessary for the detection and control of emerging and endemic diseases. At the international level, this information is essential for addressing transnational needs, such as detecting and controlling the consequences of epidemics and infectious diseases [14].

However, because decision-makers may make mistakes [15], identifying these errors and investigating their underlying causes is necessary. For example, during the COVID-19 pandemic, the effectiveness of the measures implemented to curb the spread of the virus was questioned [16]. This uncertainty is justified by the fact that the disease was new [17]; among other reasons, mistakes can be viewed as decisions to act or not act without thoroughly assessing the known evidence [18]. However, even now, such mistakes have not been measured.

Greece represents an important case study on this topic because the pandemic found the Greek health care system ill-prepared and poorly resourced [19], and the Greek economy had previously experienced a significant decline in production and deterioration in almost all of its macroeconomic variables during the 2008 economic crisis [20]. The economy had not been able to return to its pre-2008 production levels before the onset of the COVID-19 pandemic, which served as another external shock to the Greek economy and society [21].

Because of the rapid influence of the pandemic on all aspects of human life [22], one of its key properties, i.e., timeliness in DDDM [23], was made more crucial. The Greek government immediately adopted preventive measures against the spread of the virus [24]. The first nonpharmaceutical interventions (NPIs) were announced before the WHO declared COVID-19 a pandemic on March 11; i.e., the closure of schools and universities occurred on March 10, and the Patras carnival was canceled on February 27.

Thus, since February 2020, the Greek government has aligned with other governments worldwide and adopted a mix of restrictions, such as lockdowns, quarantines, school and university closures, workplace and retail shop closures, the cancellation of public events, gathering restrictions, travel restrictions, restrictions on commercial activities, and social distancing and mask requirements [25,26].

Governments worldwide faced a myriad of multidimensional effects from the pandemic, including direct effects on public health systems and population health, as well as indirect socioeconomic effects, such as disruption to every sector of the economy and mass unemployment [27].

At the individual level, the COVID-19 pandemic has been labeled a black swan event that caused a ripple effect on every aspect of human life [28]. Thus, based on its multidimensional influence (i.e., social, economic, and health influences) [29], a critical question arises regarding the extent to which the decision-making process was subject to framing bias. Framing bias is a common error in decision-making that occurs when decision-makers select and highlight certain aspects of a situation while excluding others. By focusing on certain aspects of a situation and emphasizing them while downplaying or omitting others, they distort their perspective and establish false reference points [30].

Because framing bias has been only conceptually defined, our objective of this study is to develop and present, for the first time, an index that describes this bias. Additionally, the trade-off between health and the economy during the COVID-19 pandemic in Greece can be examined through the lens of the framing bias index.

Without knowledge of which aspects were focused on by the Greek authorities, we attempt to investigate, through the framing bias index, which aspects should be emphasized more. Since the Greek healthcare system was tested during the pandemic, as was the Greek economy, this investigation answers questions related to pandemic management.

2. Materials and methods

The index $I_{\text{Framing Bias}}$, i.e., the framing bias in the decision-making problem, is based on the core assumption that the time t_{initial}, which corresponds to the start of the decision-making process, and the time t_{end}, which corresponds to the end of the decision-making process, should be considered.

Because some aspects involved in the analysis are not emphasized in the decision-making process, we define $i = 1, \dots, n$ as the emphasized aspects and $j = 1, \dots, k$ as the total aspects with $i \in j$, and $n < k$. Thus, the numerator of $I_{\text{Framing Bias}}$ includes the emphasized aspects, whereas the denominator includes the total aspects, as follows:

$$I_{\text{Framing Bias}} = \frac{\sum_{t_{\text{initial}}}^{t_{\text{end}}} \sum_{i=1}^{i=n} q_{ti}}{\sum_{t_{\text{initial}}}^{t_{\text{end}}} \sum_{j=1}^{j=k} q_{tj}}. \tag{1}$$

The index mirrors two decision-making processes: One not emphasizing some aspects of the studied problem and one emphasizing all aspects of the studied problem.

However, because the aspects involved in the decision-making problem correspond to various disciplines, scales, or significance, normalization and weighting must be applied. Although a full presentation of normalization and weighting methods is beyond the scope of this paper, we present the most widely used methods, i.e., the max-min method and the mean weight method. Thus, to normalize the various aspects by applying the max-min method, for benefit q_{tl}s values, we use the following formula:

$$n_{tl} = \frac{q_{tl} - q_{tmin}}{q_{tmax} - q_{tmin}}, \tag{2}$$

whereas for cost q_{tl}s, we use the following formula:

$$n_{tl} = \frac{q_{tmax} - q_{tl}}{q_{tmax} - q_{tmin}}. \tag{3}$$

In addition, for weighting, the mean weight method takes the form

$$w_{tl} = \frac{1}{m}, \tag{4}$$

where m is the number of aspects used, with

$$\sum_{l=1}^{l=m} w_{tl} = 1. \tag{5}$$

Finally, the normalized weighted scores are calculated as follows:

$$s_{tl} = n_{tl} w_{tl}. \tag{6}$$

Based on the normalized weighted scores, $I_{\text{Framing Bias}}$ is written as follows:

$$I_{\text{Framing Bias}} = \frac{\sum_{t_{\text{initial}}}^{t_{\text{end}}} \sum_{i=1}^{i=n} n_{ti} w_{ti}}{\sum_{t_{\text{initial}}}^{t_{\text{end}}} \sum_{j=1}^{j=k} n_{tj} w_{tj}} \tag{7}$$

with $I_{\text{Framing Bias}} > 0$ because of normalization.

The threshold $I_{\text{Framing Bias}} = 1$ indicates that all aspects are emphasized, i.e., there is no framing bias. Thus, the higher the index, the more favorable the condition and the less significant the aspects that are not emphasized. In this study, we use the terms "significance" and "significant" in relation to the other aspects of the problem; namely, they are relative concepts. This relativity is also true for framing bias. By comparing $I_{\text{Framing Bias}}$s values, we gain a picture of the existence of a trade-off between the analyzed aspects, distinguishing significant and nonsignificant aspects.

To analyze which aspects should have been focused on and emphasized by the Greek authorities during the COVID-19 pandemic, we use monthly data for the following: (i) The World Uncertainty Index (WUI), (ii) the World Policy Uncertainty Index (WPUI), (iii) the World Sentiment Index (WSI), (iv) the number of newly reported COVID-19 cases, and (v) the number of newly reported COVID-19 deaths.

We use the WUI and the WPUI [31,32] because uncertainty is well known to reduce the willingness of firms to hire and invest and of consumers to spend. However, uncertainty is a nebulous concept because it reflects uncertainty in the minds of consumers, managers, and policy-makers about future events (that may or may not happen). It is also a broad concept because it relates to macro phenomena, such as gross domestic product (GDP) growth, and micro phenomena, such as the growth rate of firms. In addition, WSI is about economic prospects and mirrors an economy's underlying resilience [33]. The aforementioned indices are related to the economy.

The numbers of newly reported COVID-19 cases and deaths were the indices that must be controlled and they were epidemiological characteristics of the pandemic.

In our analysis, the level of the Stringency Index is considered as the decision that was made [34], because countries with lower health system capacities, in terms of monetary inputs (i.e., public health expenditure and total health expenditure) and real inputs (i.e., hospital beds and acute beds), had higher levels of restrictions [35]. In addition, according to the World Health Organization (WHO) as mentioned by Jalloh et al. [36], measures' stringency should be based primarily on a situational assessment of the intensity of transmission and the capacity of the health system to respond but must also be considered in light of the effects these measures may have on the general welfare of society and individuals.

The time frame of our analysis was from February 2020, when the first COVID-19 case was diagnosed (i.e., February 26, with the first death reported on March 12), to October 2020, as the second lockdown in Greece commenced in early November 2020 (i.e., November 7).

The source of the data on monthly confirmed COVID-19 cases and deaths is the European Centre for Disease Prevention and Control (ECDC) [37].

The analysis was based on not emphasizing all aspects (one at a time), despite the significance of the epidemiological condition. Thus, w_{tj}s $= 0.2$, assuming equal weights is natural and minimizes errors; in addition, we assume that no reason existed to prefer one weight vector over another [38] when no further information existed [39].

However, we must highlight that the inclusion of additional aspects may alter the relative significance of the aspects. Since the conclusions are dependent on the aspects used in the analysis, by using more aspects, one may study more dimensions of a problem.

Furthermore, we note that the WUI, the WPUI, newly reported COVID-19 cases, and newly reported COVID-19 deaths, are associated with all cost $q_{tl}s$ values; thus, Eq. 3 for normalization must be applied. The WSI is associated with all benefit $q_{tl}s$ values; thus, Eq. 2 for normalization must be applied.

Notably, we refer to country-wide data for all five aspects.

Thus, by using the indices mentioned above, we study the relationships among economic uncertainty, virus dynamics, and health system capacity.

The analysis is conducted using STATA 19.5 and Microsoft Excel.

3. Results

Although our strategy for not emphasizing certain aspects could be informed by the measures implemented during the early phase of the pandemic, we did not emphasize all aspects (one at a time), nor solely those directly related to the spread of the virus.

According to the analysis**,** when newly reported COVID-19 cases are not emphasized, $I_{\text{Framing Bias}} = 0.73$, whereas when the WUI is not emphasized, $I_{\text{Framing Bias}} = 0.85$ (Table 1). When newly reported COVID-19 deaths are not emphasized, $I_{\text{Framing Bias}} = 0.76$. In addition, when we did not emphasize the WPUI, $I_{\text{Framing Bias}} = 0.77$ (this finding is related to the Greek government's effort to maintain control over COVID-19 crisis management). Furthermore, when we did not emphasize the WSI, $I_{\text{Framing Bias}} = 0.89$.

Table 1. Results.

Aspect Not Emphasized	$I_{\text{Framing Bias}}$
Newly reported COVID-19 cases	0.73
Newly reported COVID-19 deaths	0.76
WUI	0.85
WPUI	0.77
WSI	0.89

Since $I_{\text{Framing Bias}} = 1$ indicates that there is no framing bias, according to the findings, newly reported COVID-19 cases and deaths should be emphasized more. The same also holds for WPUI.

However, from an epidemiological perspective, as of mid-September 2020, Greece was not defined as a country with a trend of concern according to the ECDC criteria [40] but had a strong increasing trend in intensive care unit (ICU) admissions. The ECDC model also highlighted Greece as having the potential for a large resurgence. Therefore, because the number of COVID-19 cases increased starting in October 2020, although the upward trend was clear in August [41] meaning that relaxing the stringency of measures during the summer of 2020 was catalytic for the disease dynamics, a second national lockdown in November 2020 became unavoidable. In addition to the experience of the first lockdown, the epidemiological picture laid the groundwork for the implementation of the nationwide lockdown soon after Thessaloniki's second lockdown in late October 2020 [42].

4. Discussion

The Greek government implemented strict measures during the first two pandemic waves to curb the spread of the virus, even though their appropriateness was a subject of international debate. To some extent, this debate arose from the multidimensional uncertainty caused by the pandemic. This uncertainty was primarily due to the clinical characteristics of COVID-19, the perceived risk and susceptibility to COVID-19, the uncertainty regarding personal and national finances, and the costs and benefits of the restriction measures and their lifting [43].

In general, governments worldwide have adopted a "mix" of tools across policy areas (i.e., health, economic, and social) rather than a single tool [44]. The Greek government aligned with this trend. Therefore, it focused on strengthening the health care system to address the growing demands resulting from the pandemic; in response to the challenges posed by the COVID-19 crisis, Greece enhanced its laboratory and intensive care unit (ICU) bed capacity, increased its health care workforce and disease surveillance, and implemented income and employment protection measures to mitigate the economic impact of the pandemic [45,46].

In 2020, the Greek government's fiscal package of measures amounted to approximately 13.7% of the gross domestic product (GDP) (€23.5 billion) and incorporated loan guarantees backed by national and European Union (EU) resources (some of the latter involved reprogrammed funds). Key measures included (i) health expenditures for hiring doctors and nurses, acquiring medical supplies, and offering cash bonuses to health care workers; (ii) temporary financial aid for vulnerable populations, such as cash grants and the full coverage of pension and health benefits for employees in severely affected companies and self-employed individuals, extended unemployment benefits, assistance for temporary jobs, and subsidies for individuals with school-aged children; (iii) liquidity assistance for distressed businesses via loan guarantees, subsidies for loan and interest payments, refundable advance payments, rent concessions, and postponed tax and social security payments; and (iv) reductions in value-added tax (VAT) rates for essential goods necessary for COVID-19 protection, research funding, and the transport and hospitality industries [47].

Although DDDM, as mentioned in the Introduction, refers to the practice of basing decisions on information rather than purely on intuition, it can be argued that the manner in which decisions were made during the pandemic should be at the forefront of the discussion.

Based on the availability of data regarding newly reported monthly cases and deaths (i.e., at a given time point, only past data are available), one may argue that the need for emergency action was evident in September (the cases and deaths in August were 4.67 and 3.92 times higher than in July, respectively). On the other hand, from February to November (when cases and deaths were 2.51 and 6.33 times higher than in October, respectively), the health care system seemingly could not manage COVID-19 patients effectively. These points may justify why WPUI was included among the factors that should be emphasized more. Due to the high number of COVID-19 cases and deaths in combination with the inefficiencies of the healthcare system, the Greek government may not have persuaded the public regarding its policies since, during the second pandemic wave the health care system was characterized as inefficient [48].

An advantage of this study is that we analyze nationwide data rather than public opinion data. A limitation could be the small number of aspects considered; however, there are no additional data with the characteristics of the data used in the study (i.e., monthly nationwide data).

5. Conclusions

The framing bias indices indicate that the Greek authorities should emphasize aspects related to the epidemiological characteristics of the pandemic.

However, since framing bias and trade-offs are relatively low, they indicate decisions in the right direction. For those arguing that the Greek government failed in balancing health and the economy during the period under study, we may counterargue that these decisions were made without suitable alternatives. Thus, DDDM focused on the weaknesses of the health care system, the high levels of cases and deaths, and the absence of effective medications or a vaccine.

Use of AI tools declaration

The author declares he has not used Artificial Intelligence (AI) tools in the creation of this article

Conflict of interest

The author declares no conflicts of interest in this paper

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