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RESEARCH ARTICLE



Determinations of strategy responding to COVID-19

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ABSTRACT

This study explores what determines the selection of strategies by governments responding to COVID-19. To answer the question, we propose concepts of individual utility and societal utility and build a simple model. By applying the model, we predict that countries with an individualist culture would adopt more passive strategies while countries with a collectivist culture would adopt more active strategies. The comparison between strategies adopted in China and in the United Kingdom supports the prediction. Furthermore, as the spread of COVID-19 virus continues, governments' response may change and individualist countries may switch to more active strategies. So we extend our model to incorporate the dynamics of strategy selection, and explain the switch between passive and active strategies. We then predict in particular that facing the unexpected infections and deaths, the countries with an individualist culture would temporally adopt a relatively more active strategy responding to COVID-19. The evidence from Spain shows the dynamic feature of strategy selection as predicted by our model.

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Introduction

Public health emergencies usually have severe societal and economic consequences. Dealing with public health emergencies, such as the pandemic of the global COVID-19 outbreak (Ghebreyesus 2020b), governments of various countries may differ in their strategies. Some countries may take active strategies such as lockdown of cities and some countries may take passive strategies such as no restriction on public events with infection risk. The Director-General of the World Health Organisation (WHO) said, '[t]he challenge for many countries who are now dealing with large clusters or community transmission is not whether they can do the same – it's whether they will' (Ghebreyesus 2020b). Therefore, a significant question is: what determines a government's selection of strategies?

To answer the question, this study proposes two concepts, i.e. individual utility and societal utility, and applies isocost lines and marginal rate of substitution of utility in the economics framework. Then it builds a simple model to explain and predict governments' strategies responding to the COVID-19 pandemic. Specifically, we predict

that facing an unexpected serious pandemic, countries with an individualist culture would adopt more passive strategies while countries with a collectivist culture would adopt more active strategies. Using the cases of strategies adopted in China and the United Kingdom (UK) by April 2020, we compare the characteristics of the strategies responding to COVID-19, and illustrate the application of our model.

In the process of fighting against the COVID-19 pandemic, countries have changed their strategies to certain extent in various circumstances. So we extend our model to incorporate the dynamics of strategy selection, and explain the switch between passive and active strategies. And we predict in particular that facing the unexpected infections and deaths, the countries with an individualist culture would temporally adopt a relatively more active strategy responding to COVID-19. We use the case of Spain to illustrate the switch from passive to active strategies in the process of fighting against the COVID-19 pandemic in a short time period.

Concepts and framework of economics

Economically, a utility function maps elements of a choice set to preference ordering (Bernoulli 1738), and we use utility functions to quantify human nature of lust or good virtue and the societal consequences in the process of pursuing the nature of lust or good virtue. Specifically, we define a person's lust utility function as a preference ordering based on the person's nature of lust over the person's choice set. For example, a person is fond of delicious food; a person likes drinking in a bar; a person hates wearing a face mask; watching soccer game is a person's first priority. Accordingly, an individual utility function of an economy is a composite function of every person's lust utility function in the economy. For example, the individual utility function of a country can refer to the disposable income of the country; in the circumstances of the COVID-19 epidemic, the individual utility function of a country can refer to the cumulated number of deaths, infections or the cured in the country. The process to pursue human nature of lust is a process of maximising individual utility. This process motivates human beings to labour, live, multiply, innovate and improve generations after generations.

Similarly, we define a person's good virtue utility function as a preference ordering based on the person's nature of good virtue over the person's choice set. For example, a person may sacrifice the time with family to join some societal projects; a person is willing to stay at home because it can reduce the risk of infection in the community; a person is satisfied when he/she donates money or helps other people. Accordingly, a societal utility function of an economy is the composite function of every person's good virtue utility functions in the economy. For example, the societal utility function of a country can refer to the number of people out of poverty in a country; in the circumstances of COVID-19, the societal utility function of a country can refer to the number of people staying at home, the number of schools closed, the number of citizens affected by the lockdown of cities in the country, or the days to build a hospital for infectious diseases. The process to pursue human nature of good virtue is a process to maximise societal utility. And this process motivates each person in a society to care for, help, and get on with other people appropriately, and this nature helps human

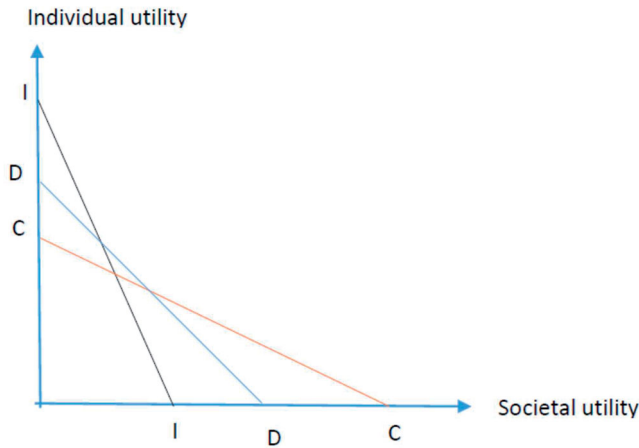


Figure 1. Isocost lines of individualist country versus collectivist country.

beings build and administrate communities/countries, get along with other communities/countries, survive in natural catastrophes, and resolve quarrels or even wars between communities/countries.

We recognise that there is no clear-cut division between individual and societal utility in reality, i.e. individual utility may not always be on the opposite side of the societal utility or there might be activities that produce individual utility and also generate externalities to the societal utility.¹ To eliminate the possible ambiguity or contradiction, it is reasonable to assume minor treatments to these activities whenever necessary. For example, if an activity impacts both individual utility and societal utility in the same direction, we deduct the impact on individual (societal) utility from the societal (individual) utility and the residual societal (individual) utility will be the utility functions used in our model.

A simple model

To answer the question of whether a government takes passive or active strategies, we suggest a simple model as displayed in [Figure 1](#). Assume in an economy, there are two raw materials, i.e. the individual utility and societal utility that can be used to produce various outputs, such as the outputs against COVID-19. As both individual utility and societal utility are costly, the points on the straight line DD (isocost) represent various combinations of individual utility and societal utility with the same total costs. The slope of the line DD represents the usage of individual utility versus societal utility in an economy (or price ratio). The price ratio is determined by the relative advantage of the economy. For example, in [Figure 1](#), the larger slope of the isocost II represents a country in which the individual potential is stronger or more efficient than mobilising societal utility or the price ratio of using individual utility versus that of using societal utility is low. This country would fall into the category of individualist country in the literature (e.g. Greif 1994).² And the smaller slope of the isocost CC represents a country in which the potential of mobilising societal utility is stronger or more efficient than using individual utility or the price ratio of using individual utility versus that of

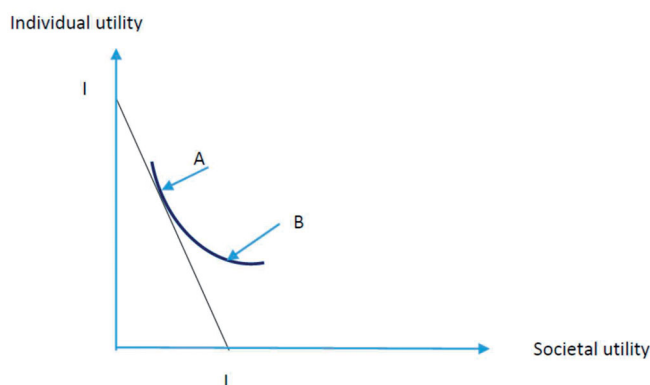


Figure 2. Optimal (passive) strategy for countries with an individualist culture.

using societal utility is high. This country is more like a collectivist country categorised by the collectivist versus individual dimension in the literature.³

Two strategies responding to COVID-19

Handling a serious attack by an unexpected pandemic such as COVID-19, a government can select active or passive strategies. The active or suppression strategy aims to reverse epidemic growth, reduce case numbers and maintain infections at low levels indefinitely. The passive or mitigation strategy aims at slowing but not necessarily stopping epidemic spread – reducing peak healthcare demand while protecting those at most risk from infection (Ferguson et al. 2020). The active strategy incurs relatively large social and economic costs or demands more resources from societal utility. The Director-General of the WHO mentioned ‘that these measures are taking a heavy toll on societies and economies’, and ‘[a]ll countries must strike a fine balance between protecting health, minimising economic and social disruption, and respecting human rights’ (Ghebreyesus 2020b). The active strategy focusses on the protection of individual utility and the target of the active strategy is to reduce the number of infection cases and deaths. In contrast, the passive strategy strives to minimise social disruption and reduce economic costs or demand fewer resources from societal utility, but would have a greater number of infection cases and deaths, or demand more from individual utility. For example, Ferguson et al. (2020) predict that ‘[m]itigation will never be able to completely protect those at risk from severe disease or death and the resulting mortality may therefore still be high’.

If a country is willing to mobilise the resources from societal utility and reduce the costs to individual utility, at any phase of the COVID-19 attack, an active strategy can be effectively used. The Director-General of the WHO said (Ghebreyesus 2020b) that ‘[i]f countries detect, test, treat, isolate, trace, and mobilise their people in the response, those with a handful of cases can prevent those cases becoming clusters, and those clusters becoming community transmission’. In addition, the active strategy prefers to have a pessimistic prediction but the passive strategy prefers to make an optimistic prediction. A pessimistic prediction would motivate the government to mobilise the resources

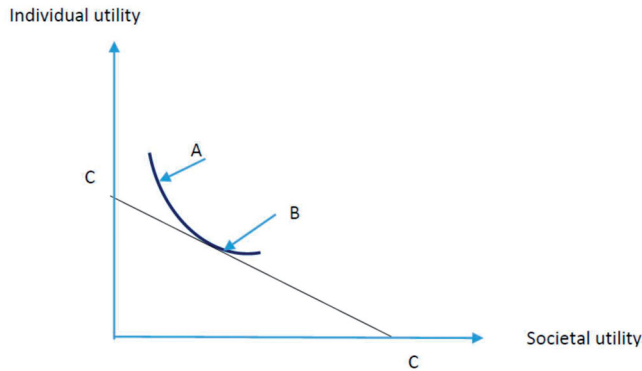


Figure 3. Optimal (active) strategy for countries with a collectivist culture.

from societal utility, while an optimistic prediction will justify the low costs caused by infection cases and deaths. In summary, the active strategy deploys and allocates mainly the resources from societal utility but fewer resources from individual utility, and the passive strategy uses fewer resources from societal utility but more resources from individual utility. In the following section, we use our model to explain what determines the selection of a passive or active strategy.

Selection of strategy based on the model

In our simple model, a strategy responding to COVID-19 can be expressed as a combination of two raw materials, individual utility and societal utility, to produce the output of the disappearance of the virus. Firstly, we consider the strategy selection of an individualist country. Assume all the potential strategies for the country with this output lie on the isoquant curve in Figure 2. Now let us look at which point on the isoquant curve represents the active or the passive strategy. The essential difference between the two strategies is that the active strategy mobilises more societal utility but reduces the costs of individual utility while the passive strategy mobilises less societal utility but costs more from individual utility. In Figure 2, Point A represents a passive strategy in which individual utility bears more costs and less societal utility is mobilised, and Point B represents an active strategy in which individual utility bears less costs and more societal utility is mobilised. The optimal strategy is at the point where the isocost line is tangent to the isoquant curve. The slope of the tangent line to the isoquant curve is a decreasing function of the societal utility, so the passive strategy indicates a larger slope than the active strategy. It follows from the large slope of the isocost line of the individualist country that a passive strategy is optimal for an individualist country with less costs to societal utility but more costs to individual utility (the line II in Figure 2). Therefore, according to our model, facing an unexpected serious pandemic, countries with individualist culture would adopt more passive strategies.

Secondly, we consider the strategy selection of a collectivist country. We apply our model again with similar arguments for individualist countries above and achieve the conclusion that an active strategy is optimal for a collective country with more costs to

societal utility but less costs to individual utility (the line CC in Figure 3). In summary, according to our model, facing an unexpected serious pandemic, countries of collectivist culture would adopt more active strategies. In this way, ‘... [t]he choice of interventions ultimately depends on the relative feasibility of their implementation and their likely effectiveness in different social contexts’ (Ferguson et al. 2020).

To illustrate the application of our model, we compare the two strategies responding to the COVID-19 epidemic in China and in the UK. It is well known that the UK is a developed country with an individualist culture, and China is a developing country with a collectivist culture. Therefore, our model predicts that the UK should select a relatively passive strategy but China should select a relatively active strategy.

China’s strategy

Core principle

China’s strategy is obviously an active/suppression strategy, aiming at reducing the costs to individual utility. This is clearly presented in President Xi’s statement: ‘[L]ife is of paramount importance. When an epidemic breaks out, a command is issued. It is our responsibility to prevent and control it’ (Xinhuanet 2020a). President Xi also mobilised as many resources needed from societal utility as possible by ‘ordering Party committees and governments at all levels take novel coronavirus outbreak prevention and control as the top priority of their work’ (Xinhuanet 2020a).

Measures and implementations

In addition to the measures of non-pharmaceutical intervention commonly used internationally, such as case isolation in the home, voluntary home quarantine, social distancing of those people over 70 years of age, social distancing of entire population, and closure of schools and universities, China has implemented more measures according to the stages of the epidemic and the contexts of various places. For example, in accordance with the principle of territorial management, the emergency response has been launched and the grid management of epidemic prevention and control has been strengthened in urban and rural areas. To follow the requirements of ‘non-proliferation within the city and non-export beyond the city’, traffic restrictions were imposed on the city of Wuhan and its links to surrounding areas. To strengthen the capacity, the central government arranged 19 provinces to support different cities of Hubei province, known as ‘one province helps one city’ (HBTv 2020; Hubei Provincial Development and Reform Commission 2020).

To ensure the effectiveness of prevention, control and medical treatment, more active policies have been issued and implemented such as the policies of ‘four early’ (screening, reporting, quarantine and treatment at early stage) and ‘four concentration’ (concentration of patients, experts, resources and treatment). To improve the patient admission rate, different measures have been carried out according to different situations: (1) the confirmed severely ill patients, including those clinically diagnosed, must be concentrated in designated hospitals for treatment; (2) the patients with mild symptoms must be isolated and treated in the temporary ‘cabin hospitals’; and (3) those suspected patients with mild symptoms must be observed and treated in isolated locations

(Xinhuanet 2020b). In addition, the medical system in Hubei province has been supported by other provinces of China. As of 24:00 on 14 February, a total of 217 medical teams and 25,633 medical staff had been sent from various provinces, not including those provided by the military to Hubei province (HBTv 2020).

The UK's strategy

Core principle

On 6 March, Prime Minister Johnson announced the core principle on COVID-19 as '[k]eeping the British people safe is my number one priority, and that's why I've set out our four-part plan to contain, delay, mitigate and research coronavirus' (Gov.UK 2020a). Compared with China, the UK's principle is relatively 'passive'.

Measures and implementations

On 12 March, Prime Minister Johnson made announcement that '[w]e've done what can be done to contain this disease ...', and started the 'delay' part. It is clear that the UK's strategy is to trade off individual utility for societal utility, as Prime Minister Johnson informed that '... I must level with you, level with the British public, many more families are going to lose loved ones before their time'. The further measures announced by Prime Minister Johnson include: (1) to protect others and help slow down the spread of the disease, people with coronavirus symptoms are required to stay at home for at least seven days; (2) people should use the internet for information, but not call 111; (3) the government is considering the question of banning major public events such as sporting fixtures; (4) the government is not closing schools now; and people are reminded to wash hands frequently (Gov.UK 2020b). These measures clearly show that the UK government gave priority to societal utility until that time.

On 16 March, the measures against COVID-19 were upgraded as follows: (1) the self-quarantine is expanded to members of the household where one has symptoms and the quarantine time is extended from seven days to 14 days; (2) 'now is the time for everyone to stop non-essential contact with others and to stop all unnecessary travel'; (3) 'by this coming weekend – it will be necessary to go further and to ensure that those with the most serious health conditions are largely shielded from social contact for around 12 weeks' (Gov.UK 2020c). Other measures as of 19 March included '[for schools] shut[ting] their gates from Friday afternoon, they will remain closed for most pupils – for the vast majority of pupils – until further notice', 'scal[ing] up our testing capacity in the weeks ahead so we hit 25,000 tests a day', and '... start[ing] trials for the first vaccine within a month' (Gov.UK 2020d, 2020e).

In summary, to fight against the COVID-19 attack, China has selected a relatively active strategy by mobilising more societal utility and reducing the costs to individual utility. The WHO Director-General commented (Ghebreyesus 2020a) that '... the steps China has taken to contain the outbreak at its source appear to have bought the world time, even though those steps have come at greater cost to China itself. But it's slowing the spread to the rest of the world'.

In contrast, the UK has selected a relatively passive strategy by mobilising less societal utility and incurring higher costs to individual utility. Prime Minister Johnson

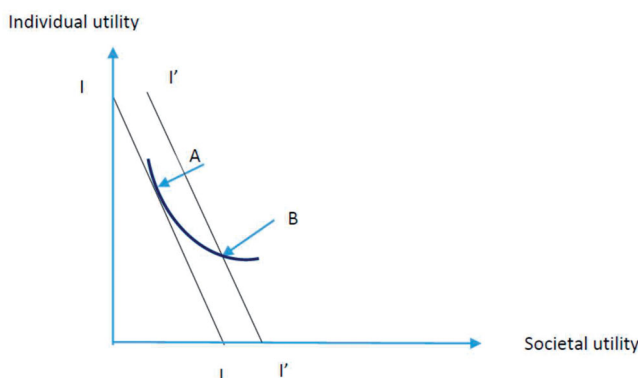


Figure 4. The shift of isocost line and switch from passive strategy to active strategy.

explained that ‘... if you ask, why are we doing this now, why now, why not earlier, or later? Why bring in this very draconian measure? The answer is that we are asking people to do something that is difficult and disruptive of their lives’ (Gov.UK 2020c). Therefore, our simple model well explains the selection of a passive or active strategy responding to COVID-19 by governments of countries with different cultural and institutional backgrounds.

Dynamics of strategy selection in countries with an individualist culture

At the beginning of COVID-19, an individualist country would adopt a relatively passive strategy and a collectivist country would adopt a relatively active strategy, which might be optimal in that time period. If the COVID-19 virus disappeared quickly when the temperature rises, both active and passive strategies would be considered successful in achieving the optimal result in the circumstances of respective countries. Then our simple model works well, we can stop here and there is no need to consider the dynamics of strategy selection. But the reality is much crueller: the COVID-19 virus spreads quickly, the attack of the COVID-19 pandemic is incredibly hard and the potential costs to individual utility have become major concerns for all countries. As results, the passive strategy that individualist countries have taken would no longer be optimal and we have to consider the dynamics of strategy selection. Individualist countries have to switch to more active strategies to fight against COVID-19. We apply our model again in the new situation to understand the process of strategy change and provide a qualitative prediction.

As indicated in Figure 4, the isocost line would shift from II to $I'I'$ and intersect with the isoquant curve at Point B. In other words, the strategy would leave the optimal position (Point A represents the passive strategy) and change to a more active strategy at Point B. As the switch from passive to active strategy is no longer optimal for an individualist country, they will encounter great resistant forces. Therefore, the following features will manifest in the process of dynamic strategy selection: (1) a passive strategy will not be switched to an active strategy instantly, it takes time and will be implemented gradually, step by step, and the process can stop at any step; (2) this

switch to active strategy is temporary or will be reversed back quickly; and (3) the dynamic switch between strategies is sensitive to the daily trend of the statistics and various forecasts, such as the statistics or forecast on the growth rate of infections and deaths, and it is especially sensitive to optimistic forecasts. Spain is a developed country with an individualist culture (Hofstede 2001). Below we briefly summarise the dynamics of strategy switch responding to COVID-19 in Spain with the application of our model.

Passive strategy at the beginning

To maintain the societal and economic activities as normal as possible, the Spanish government held an optimistic view that ‘Spain will only have a handful of cases’ and adopted a passive strategy at the beginning of the outbreak of the COVID-19 pandemic. It is reported that although the virus hit other countries very badly and Italy already announced the initial lockdown, ‘Spain was still operating with “business as usual”. This means hugging, kissing and mass gatherings –including stadiums full of supporters and mass demonstrations to mark International Women’s Day (8 March) all across the country’ (Nicolás 2020c).

Dynamics of strategy switch: multi-steps rather than one step to active strategy

The first step

As of 12 March, the diagnosed cases reached 2,968 with 84 deaths, so Spanish Prime Minister Sánchez announced the state of emergency on 13 March, which placed tight restrictions on movement with exceptions for primary needs or professional requirements. Prime Minister Sanchez said in a nationally-televised conference that ‘[w]e will eventually return to the routine of our jobs and again visit our friends and loved ones’. He urged all to stay at home and said that ‘[u]ntil that time comes, let’s not waste energies that are essential now. Let’s not lose our way’. The detailed measures include that those disobeying the conditions of the state of alert could face fines starting from €100 or imprisonment should they ‘resist or seriously disobey the authorities or officers when they are carrying out their functions’. Two days later, Spain’s Health Minister, Salvador Illa, announced that all private health providers and infrastructure would be temporarily taken over in the interest of the national healthcare system (Nicolás 2020a).

To guarantee the ‘existence of professionals to attend all of those who have been affected by this virus’, the Spanish government mobilised retired doctors, all last-year medical students who are carrying out residencies and physicians who have not yet completed their specialty to join the medical system. Given the current shortages of anti-virus gear, the Spanish government also warned that any company that can produce diagnosis material and protective equipment, such as masks, glasses or gloves, must contact the authorities within 48 hours. Military forces are prepared to deploy and operate emergency health facilities, such as field hospitals, in the most affected areas of the country. Additionally, all educative centres, non-essential shops, bars, cafes, restaurants, stadiums, cinemas and museums have been closed since 14 March 2020 (Nicolás 2020a).

The second step

As of 19 March, the diagnosed cases and death tolls climbed further to 17,147 and 767, so on the following weekend (21–22 March), Spain announced a near-total lockdown in order to slow down the spread of COVID-19. Specifically, Spanish Prime Minister Sánchez announced the halt of all non-essential business activities, as well as a prohibition of layoffs, under the state of emergency (Nicolás 2020c). About the situation of the pandemic in Spain, Prime Minister Sánchez said on Sunday that the number of diagnosed cases would rise in the coming days ‘pushing capacities to the limit’, and ‘the worst is yet to come’ (Nicolás 2020b).

The third step

On 22 March, Spain closed all airports and seaports for 30 days with certain exceptions (Nicolás 2020b). As of 23 March, the diagnosed cases increased to 33,089 with 2,182 deaths. In summary, the great number of infections and deaths forces the Spanish government to give up the passive strategy and seek a more active strategy to combat COVID-19, or to shift the isocost line to the right as expressed in our model. Because of the great costs, the switch from passive to active strategy by the Spanish government is not kicked off in one step but ongoing through three steps. Also the active strategy is temporary, e.g. announcing the initial lockdown of 15 days, then extending the lockdown for another 15 days.

Great resistant forces to active strategy

The active strategy responding to COVID-19 has created tremendously extra difficulties for the Spanish government. For example, the nationwide lockdown would lead to workers’ layoff and affect people’s well-being. It is commented that ‘[t]he total number of people unemployed in the country officially rose to 3.5 million in March – the highest level since April 2017, with March the worst single month in history for unemployment’ (EUOBSERVER 2020a). Bloomberg reports that the Spanish government has to ‘roll out a universal basic income as soon as possible, as part of a number of measures aimed at containing the economic fallout from the coronavirus pandemic’ (EUOBSERVER 2020c).

When Spain closed all airports and seaports for 30 days from 23 March 2020 with certain exceptions (Nicolás 2020b), the head of the opposition party warned that these new initiatives could destroy ‘the entire productive system’ of the country which has been already ‘very affected’. In fact, it is estimated that ‘many companies in Spain have already temporarily suspended their workers’ jobs – affecting over 500,000 employees. Additionally, it is estimated that the economy will lose around €49bn this month alone due to the coronavirus’ response’ (Nicolás 2020c).

When Spanish Prime Minister Sánchez said on 9 April 2020 that he would have to ask to extend the state of emergency two more weeks when the current deadline for the lockdown ends (26 April), the opposition threatened to stop supporting further extensions to the lockdown (EUOBSERVER 2020b).

To retreat to passive strategy at anytime

This active strategy soon worked out and the pandemic in Spain slowed down roughly three weeks after lockdowns and restrictive measures entered into force. The Spanish Health Ministry reported on 6 April 2020 that ‘637 registered coronavirus deaths in previous 24 hours – which marks the fifth consecutive-day decline in deaths since a peak of 950 fatalities recorded on 2 April’. Facing the good news, we can have a look at the different opinions from the WHO officials and Spanish authorities.

World Health Organisation

When speaking about the situation in Spain, the WHO director for Europe, Hans Kluge, recently referred to ‘careful optimism’ (Nicolás 2020d). On 8 April, the European branch of the WHO urged countries (including Spain) not to lift restrictions prematurely, and Hans Kluge said in a news conference that ‘[n]ow is not the time to relax measures’, but ‘[i]t is the time to once again double and triple our collective efforts to drive towards suppression with the whole support of society’ (Nicolas 2020e).

Spanish authorities

The President of the Spanish Society of Epidemiology, Pere Godoy, said that ‘I think that, for instance, it would be possible to start allowing sports very soon. Going out running, individually and in a controlled way, or allowing parents to walk with their children while complying with social distancing measures’. And Spanish Finance Minister, María Jesús Montero, said on 7 April that ‘citizens will be able to get back to their normal life starting April 26 – when lockdown measures would expire...’ (EUOBSERVER 2020b). Although the opposition threatened to stop supporting further extensions to the lockdown, Spanish Prime Minister Sánchez warned on 9 April that ‘he will have to ask to extend the state of emergency two more weeks when the current deadline for the lockdown ends (26 April)’ (EUOBSERVER 2020b).

In summary, with the decline in the number of infections and deaths, the Spanish government would like to exit from the active strategy because this active strategy is the result of the right shift of the isocost line and is not an optimal strategy in the social and institutional contexts of Spain. With the advice of the WHO regional director, Prime Minister Sánchez may be cautious about relaxing measures, so it is more likely for Spain to retain the current active strategy in a foreseeable future.

Conclusion

This study hopes to enhance the understanding on governments’ selection of strategies responding to the COVID-19 pandemic. By building and applying a model, we predict that countries with an individualist culture would adopt more passive strategies while countries with a collectivist culture would adopt more active strategies. The comparison between strategies adopted in China and in the UK supports the prediction. Furthermore, as the spread of the COVID-19 virus continues, governments’ response may change and individualist countries may switch to more active strategies. So we

extend our model to incorporate the dynamics of strategy selection, and explain the switch between passive and active strategies. The evidence from Spain shows the dynamic feature of strategy selection as predicted by our model.

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Notes

1. The authors are very grateful to an anonymous referee for pointing out the issue.
2. Indeed, societal organisation is highly correlated with per capita income in contemporary societies: most of the developing countries are collectivist, and the developed countries in the west are individualist (Greif 1994).
3. Although a culture pursuing more societal utility and less individual utility can be categorised as ‘collectivist’, the concept of societal utility or pursuing human nature of good virtue is different from collectivism. For example, collectivism is limited to a specific religious, ethnic, or familial group, but pursuing societal utility exceeds the limitation.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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