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Exploring the impact of social distance in the fight against COVID-19

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Abstract

The social distancing measures imposed in some European countries had significant effects on the behaviour of the evolution curves of the number of cases and deaths due to COVID-19. This study addresses the case of Portugal and Sweden because they have imposed quite heterogeneous social distancing measures. The study adopts a quantitative methodology through the correlational analysis between the measures of mobility restriction and their effects on the number of patients and deaths with COVID-19 during the period from the beginning of March to the end of May 2020. The findings indicate that although the number of confirmed cases is similar in both countries, the number of deaths recorded in Sweden was three times higher than in Portugal. This is mainly due to the higher number of tests carried out in Portugal and the strong measures to restrict mobility implemented mainly during the state of emergency, which has slowed the growth rate of the contagion curve. Nevertheless, in both countries, the elderly population was strongly affected with around 40% to 50% of deaths being registered in homes.

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1 Introduction

The spread of COVID-19 is having a big impact all over the world. Despite this, government responses to this crisis have been quite heterogeneous. In most countries, the new coronavirus has left public spaces silenced and businesses shut down. However, in other countries (e.g. Sweden, Brazil, United Kingdom) this response has been more restrained and social distancing measures arrived later or were not imposed by governments. It was not only young people who found it difficult to adjust to the new reality of social isolation, but also older populations were reluctant to adopt some of these measures (Almeida, 2020). Henriques (2020) reports that in the USA, Australia, Spain, and Italy there were episodes where the younger population did not want to leave the beaches, social coexistence, and the older population wanted to maintain their normal daily lives. This led in some situations to a generational reversal of roles, as it was often the sons who imposed restrictions on their parents' movement.

The World Health Organization (WHO) states that there are effective ways to delay the spread of COVID-19 by avoiding close contact with other people (WHO, 2020). Therefore, social distance emerges as the main measure to combat the spread of COVID-19. However, these measures, despite being widely accepted in society, become difficult to implement if not imposed at the government level. People have very diverse ways of dealing with this crisis. Some people ignore the problem, some only act when faced with the situation, and others have a feeling of anxiety all day long. According to de Pedraza et al. (2020) and Rajkumar (2020), coronavirus pandemic has triggered a common sense of anxiety that can only be compared to war situations.

One of the major challenges to be followed from the public health guidelines is the invisible and intangible nature of the spread of the virus (Gandhi et al., 2020; Li et al., 2020). People tend to be more fearful and cautious when there is immediate evidence of the outcome of a given action. However, because the incubation period is so long, and because many people become asymptomatic at first, people tend to devalue social distance. Another reason for the difficulty of operationalizing these measures is that many of the decisions made by people are carried out in real-time and involuntarily. Small gestures that people were used to doing without hygiene care now become high-risk behaviour.

To reduce people's risk behaviours, governments have come forward with several social distancing measures. According to the Institute for Health Metrics and Evaluation (HMEI) from the University of Washington School of Medicine, social distancing measures can be organized into six major initiatives: (i) educational facilities closed; (ii) any gathering restrictions; (iii) stay-at-home order; (iv) any business closure; (v) all non-essential businesses closed; and (vi) travel severely limited. This study seeks to explore the impact of these social distancing measures in the fight against COVID-19, using data from two European countries: Portugal and Sweden. These two countries were selected for having different views on the social distancing measures adopted in this period. Portugal has adopted from the beginning the six measures outlined by the HMI, while Sweden only promoted social distancing without imposing other complementary measures. Furthermore, Portugal and Sweden, despite having similar populations, had until May 2020 a very distinct impact on the number of cases and deaths related to COVID-19. On 22th May 2020, Portugal recorded 1.292 deaths, while in the same period there were 3.925 deaths in Sweden. In this sense, it is pertinent to explore the behaviour of these two countries and analyze the impact of social distance measures in determining the success in combating COVID-19.

2 Literature Review

The high transmission and contagion capacity of the coronavirus known as SARS-CoV-2, combined with the absence of previous immunity in the human population and the inexistence of vaccine, has resulted in an exponential growth in the number of cases worldwide. In this context, it is important to find non-pharmacological measures to reduce the sources of contagion. These measures include hand washing, surface cleaning, and social distancing (Güner et al., 2020). Meanwhile, several services have been closed down, such as schools, universities, community gatherings, and businesses (Viner et al., 2020).

Social distancing is a measure that has the fundamental objective of limiting social coexistence to reduce the spread of a contagious disease. According to Prem et al. (2020), the adoption of this kind of measures is essential to avoid increasing the number of sick people. However, these measures must be adopted as soon as possible to maximize their effectiveness. According to Sen-Crowe et al. (2020), these measures, when adopted at the beginning of an epidemic period, help to prevent transmission, reduce the spread of the disease, and consequently contribute to flattening the epidemic curve. Therefore, it becomes possible to reduce the demand for health care and mitigate the consequences of the disease for the population. This double effect is even more relevant in large continental countries, where the population is high, there are huge social inequalities, and health resources are chronically deficient and unevenly distributed (Shamasunder et al., 2020). In this context, the adoption of stricter social distancing measures will be crucial to minimize the imminent collapse of health services and prevent thousands of deaths due to the lack of care for severe cases of the disease.

Social distancing can be implemented according to an extended or selective model (Block et al., 2020). In the extended social distancing, there is an application of the policy for all citizens regardless of their age, professional, or risk group. Associated with this policy, schools, companies are closed, and events are cancelled. Combined with this policy, teleworking by public organizations and private companies should be encouraged (Belzunegui-Eraso & Erro-Garcés, 2020). In selective social distancing, specific measures are imposed on individuals belonging to the risk group. The objective of this flexibility is to reduce economic losses, also making the experience less traumatic for the population (Fitzgerald et al., 2020).

Social distancing is included in public health measures taken by international bodies, and national and local governments to reduce the spread of COVID-19. However, three relatively close concepts become relevant for clarification. Social distancing is the measures applied to specific society or social groups to reduce the risk of propagation of COVID-19; isolation of people is the separation of sick or contaminated people to prevent the spread of an infection; while quarantine of people is the separation or restriction of activities of people who are not sick to prevent the potential spread of infection (Lewnard & Lo, 2020; Suppawittaya et al., 2020).

One of the best-known measures in social distancing was the creation of restrictions on the free movement of persons. This action had the fundamental objective of reducing transmission and flattening the epidemic curve, thus relieving the pressure on health services (ECDC, 2020). Especially in large countries, different transmission scenarios may be present in non-contiguous geographical areas. Furthermore, delimited areas experiencing high transmission scenarios may require the establishment of a health cordon, mobilizing security forces to ensure its implementation. Measures to severely restrict international mobility have also been implemented, such as entry barriers, voluntary quarantine, or compulsory quarantine (Parmet & Sinha, 2020).

The isolation of suspected cases is another key element in controlling the spread of the virus. Therefore, individuals with mild symptoms should be self-isolating at home and not overload health systems. This measure has been complemented in several countries with the establishment of dedicated telephone lines that give instructions on how to proceed and enable the screening of patients (Portnoy et al., 2020; Wosik et al., 2020). On the opposite side, individuals with severe symptoms should be hospitalized and have access to intensive care (Phua et al., 2020).

Quarantine is another complementary measure of social isolation. According to Tang et al. (2020), quarantine should be applied when an individual has been in contact with a suspicious case. Given the incubation period of the virus, the suggested period for quarantine is 14 days (Wamsley & Simmons-Duffin, 2020). Quarantine should be carried out in person at home, but when it is not possible, other facilities previously identified by the government and health services may be used.

The limitation of agglomerations is another key element to prevent the spread of the virus. In this sense, several recurrent and planned local events of a sporting, religious, cultural or political nature have been suspended (McCloskey et al., 2020). Likewise, social gatherings in restaurants and bars have been prohibited. The number of people who can participate in a social meeting may vary depending on the context and there must be a minimum distance of two meters between participants (Nunan & Brassey, 2020).

The suspension of classroom educational activities was a widely applied measure that covered all levels of education, from nurseries, primary schools, and universities. This measure should be combined with a social protection policy that allows parents to stay with their children (Hidrobo et al., 2020). In parallel, teleschool was encouraged to ensure that even the youngest have access to education for those without Internet access (Coffey, 2020). The suspension of classroom academic activities also had the effect of displaced students returning to their places of origin. In this sense, government authorities had to define mechanisms to facilitate travel in an orderly manner to minimize the risk of contagion.

The closure of companies in non-core activities has stimulated teleworking (Belzunegui-Eraso & Erro-Garcés, 2020). However, as not all activities are compatible with the teleworking model, social support-to-support employees' income has also been defined as layoff (Zadikian, 2020). It was necessary to ensure financial protection for workers and tax protection for companies to ensure compliance and to mitigate the financial impact for workers and companies. However, at the same time as a large number of companies closed down, it was necessary to maintain the operations of industry and distribution of elements, as well as other essential products and services to support the response interventions and to sustain communities. Supermarkets and food stores continued to operate with implemented public control measures (e.g., maximum number of customers, safety distance, and hand hygiene). According to Smereka & Szarpak (2020), one of the initial difficulties in this process was the provision of personal protection equipment for all workers and customers. This situation meant that the widespread use of protective facemasks had not been implemented since the beginning of the pandemic. However, studies conducted by Cheng et al.

(2020) and Esposito et al. (2020) indicate that face masks, when properly adapted, effectively stop the dispersion of particles expelled through coughing or sneezing, preventing the transmission of respiratory diseases.

Finally, home confinement was applied to the entire population or to specific segments of this population, such as the elderly population whose incidence and lethality rate of COVID-19 was higher (Applegate & Ouslander, 2020; Morrow-Howell et al., 2020). In this sense, support has emerged from civil society and municipalities in organizing themselves to make purchases of essential goods and pharmacy medicines for this more vulnerable population (Gorman, 2020). People's movements have been restricted only to a predetermined limited radius and are limited to activities related to medical care and subsistence goods.

Through the literature review, it becomes evident that there is not a single model for the implementation of social distancing. Each country, and according to its political guidelines, health system, and incidence rates, has adopted distinct and sometimes contradictory measures. In this sense, this study seeks to explore this phenomenon in the practical dimension considering the effects of social distancing measures on the incidence and spread of COVID-19.

3 Methodology

This study aims to explore and quantify the impact of social distancing measures in the fight against COVID-19 in the countries of Portugal and Sweden. These two European countries were chosen because they present very heterogeneous social distancing measures in the fight against COVID-19. In this study, quantitative methods were adopted for data analysis. Harkiolakis (2017) states that quantitative research is a statistical study that aims to describe the characteristics of a given situation by numerically measuring the hypotheses raised regarding a research problem. Furthermore, Queirós et al. (2017) consider that quantitative analysis enables exploring the causality relationship between the variables under study.

Quantitative data were obtained from HMEI considering the period 26th February 2020 and 20th May 2020. This period was considered, as it was on 26th February 2020 that the first confirmed case of COVID-19 contagion occurred in these two countries. Daily analysis of the following indicators was carried out: (i) confirmed daily infections (CDI); (ii) estimated daily infections (EDI); (iii) daily deaths (DD); and (iv) change in mobility (CM). The mortality and lethality rate of COVID-19 during this period was also calculated. The case fatality rate (CFR) considers the number of deaths in relation to the diagnosed cases, while the infection fatality rate (IFR) is the proportion of deaths concerning all cases of infected persons regardless of having been diagnosed (Verity et al., 2020). The calculation of this second indicator considered the average of the projection with a 95% confidence interval for the interval estimate of the number of people infected daily al throughout the period under analysis. For this purpose, the study adopted the HMEI projections.

The measures imposed by governments to limit mobility have been implemented in stages, as shown in Table 1. Social distancing recommendation was only taken among people in Sweden on 11th March 2020 and is still in force. In Portugal, all other measures have been taken, although in different stages. The period from 19th March 2020 to 4th May 2020, which coincided with the period of the state of emergency in Portugal, is noteworthy. Limitations of circulation, especially outside the municipality, were mainly taken on weekend days and with religious holidays. This measure was taken to avoid the movement of people in a period without work that could be used by families to move to other regions. Finally, it should be noted that many of these measures are still active, even though levels of decontrol are gradually being reduced. For example, in schools in Portugal, pupils with national secondary school exams have returned to school, while other pupils continue in distance learning (Goulao, 2020).

Table 1. Social distance measures

Measure	Country	Begin date	End date
Educational facilities closed	Portugal	16th March 2020	In force
Any gathering restrictions	Portugal	19th March 2020	In force
	Sweden	11th March 2020	In force
Stay-at-home order	Portugal	19th March 2020	4th May 2020
Any business closure	Portugal	16th March 2020	In force
All non-essential businesses closed	Portugal	19th March 2020	4th May 2020
Travel severely limited	Portugal	9th April 2020	4th May 2020

The following statistical techniques were used to analyze the data: (i) descriptive analysis to allow characterizing the evolution of registered infections and deaths; (ii) inferential analysis to allow determining a confidence interval for the estimated number of deaths in each period; (iii) regression analysis to assess the impact of social distancing measures on the number of infected people and deaths; (iv) F statistic to analyze whether the behaviour between the two populations (Portugal and Sweden) is statistically significant; and (v) the Durbin-Watson statistic to test the presence of autocorrelation in the regression model errors.

4 Results

4.1 Analysis of daily infections and deaths

Table 2 shows the distribution of confirmed daily infections (CDI) and estimated daily infections (EDI). The data were organized weekly and calculated as a percentage value per 100k of the population. The EDI was estimated by HMEI and considers the proportion between the number of tests performed and the percentage of positives obtained. In this sense, a country with a low number of tests performed is also the one with the greatest difference between CDI and EDI values. It is expected that there will be a greater difference between these two variables, since the number of tests performed on 20th May 2020 in Sweden was 89.73 per 100,000 inhabitants, while in Portugal this value was 146.10. The highest values of CDI were recorded in both countries in the period from 1st April 2020 to 8th April 2020. Although Portugal has higher CDI values, the EDI values are higher for Sweden.

Table 2. Evolution of daily infections

Date	Portugal		Sweden	
	CDI	EDI	CDI	EDI
February 26, 2020	0	0.08	0.01	1.07
March 04, 2020	0.02	4.46	0.15	4.75
March 11, 2020	0.12	16.45	1.12	19.80
March 18, 2020	1.24	21.64	1.10	51.38
March 25, 2020	4.84	25.68	2.35	54.10
April 01, 2020	7.67	21.90	4.64	84.42
April 08, 2020	7.28	20.89	5.73	65.45
April 15, 2020	5.19	13.92	5.18	55.67
April 22, 2020	4.87	9.43	6.23	56.27
April 29, 2020	2.78	10.27	6.08	43.15
May 06, 2020	3.54	9.81	5.82	50.19
May 13, 2020	1.92	7.75	5.74	43.33
May 20, 2020	2.20	6.92	5.40	37.15

The evolution of the number of deaths by COVID-19 between Portugal and Sweden was also comparatively investigated. Figure 1 shows the evolution of the number of deaths (daily deaths per 100,000 inhabitants) from the beginning of February 2020 until 20th May 2020. After this period, all values are projected. From the end of March 2020, a larger number of deaths are registered in Sweden with strong oscillations after this date. The highest number of deaths in Sweden was 1.23 on 22nd April 2020, while in Portugal the maximum value was 0.30 between 12th and 14th April 2020. The growth in the number of deaths curve in Portugal tends to be more uniform, with no significant peaks.

Finally, the mean (avg.) and standard deviation (std. dev) of CFR and IFR were determined for both countries. The data in Table 3 indicate that by 20th May 2020, Sweden's CFR is approximately three times higher than Portugal's. There is also a larger standard deviation in Sweden, which stems from the large fluctuation in the number of recorded cases. However, the CFR in both countries is relatively similar, having been slightly higher in Portugal.

Figure 1. Comparative analysis of daily deaths

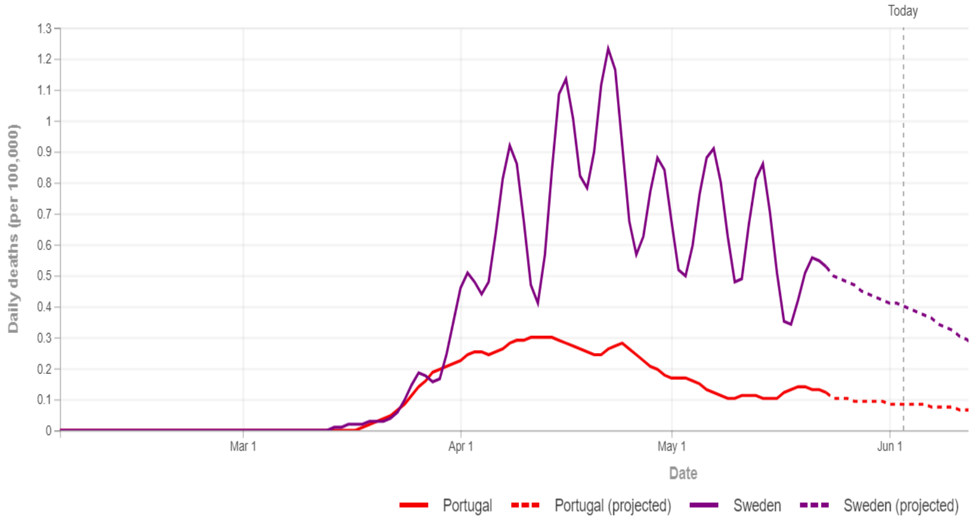


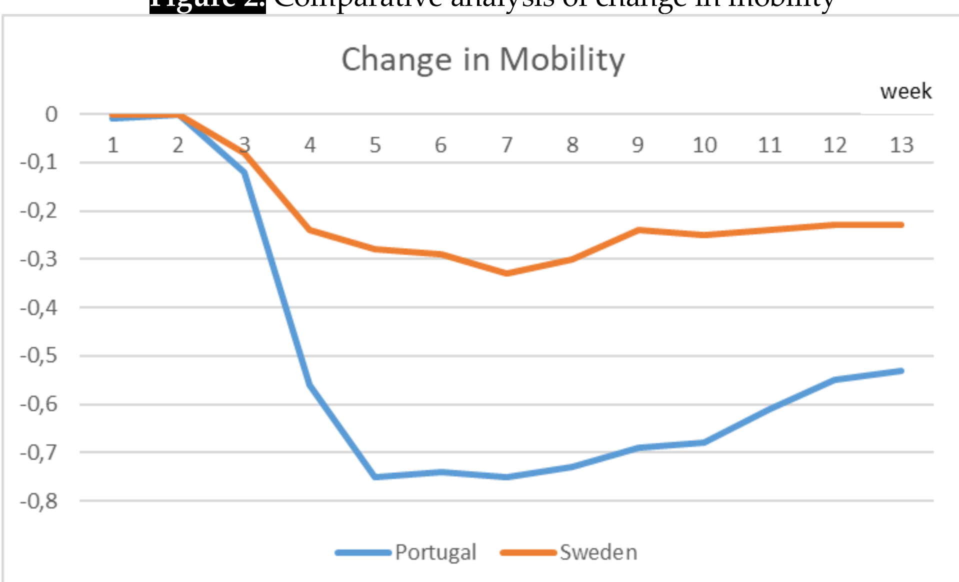
Table 3. Social distance measures

Country	CFR		IFR	
	Avg.	Std. dev.	Avg.	Std. dev.
Portugal	0.03457	0.02616	0.01141	0.0096
Sweden	0.09854	0.07620	0.01034	0.0090

4.2 Change in mobility analysis

Figure 2 shows the evolution of the reduction in mobility recorded in each country over the 13 weeks. The reduction in mobility in Portugal was clearly higher because of the imposed measures of social distancing which strongly restricted the mobility of people. Between 25th March and 15th April 2020, the reduction of mobility was more than 70%. The reduction in mobility in Sweden was mainly between 25% and 30% over most weeks. On 20th May 2020, the reduction of mobility in Portugal is 53% and in Sweden is 23%.

Figure 2. Comparative analysis of change in mobility



4.3 Social distance and the evolution of daily infections and deaths

In the first phase, it was sought to determine whether there are significant differences in the behaviour of the number of infected and deaths by COVID-19 in Portugal (PT) and Sweden (SW). For this purpose, a hypothesis test was carried out in the difference between the two means considering the confirmed number of infections (CINF), the estimated number of infections (EINF), and the number of deaths (DET). The results of Table 4 indicate a strong correlation between the three variables in both countries, which suggests that in the considered period the recorded behaviour of the two variables was similar, despite the different impact. The number of registered cases of infection is not significant due to the much lower number of tests performed in Sweden.

Table 4. Difference in behavior between countries

Variable	Mean	Std. dev.	Std. err. mean	Correl.	Sig	t	Sig (2-tailed)
CINF (SW) – CINF (PT)	0.6062	2.1759	0.6035	0.634	0.020	1.004	0.335
EINF (SW) – EINF (PT)	30.579	18.866	5.2320	0.697	0.008	5.844	$1*e^{-3}$
DET (SW) – DET (SW)	0.3962	0.3650	0.1012	0.886	$1*e^{-3}$	3.914	0.002

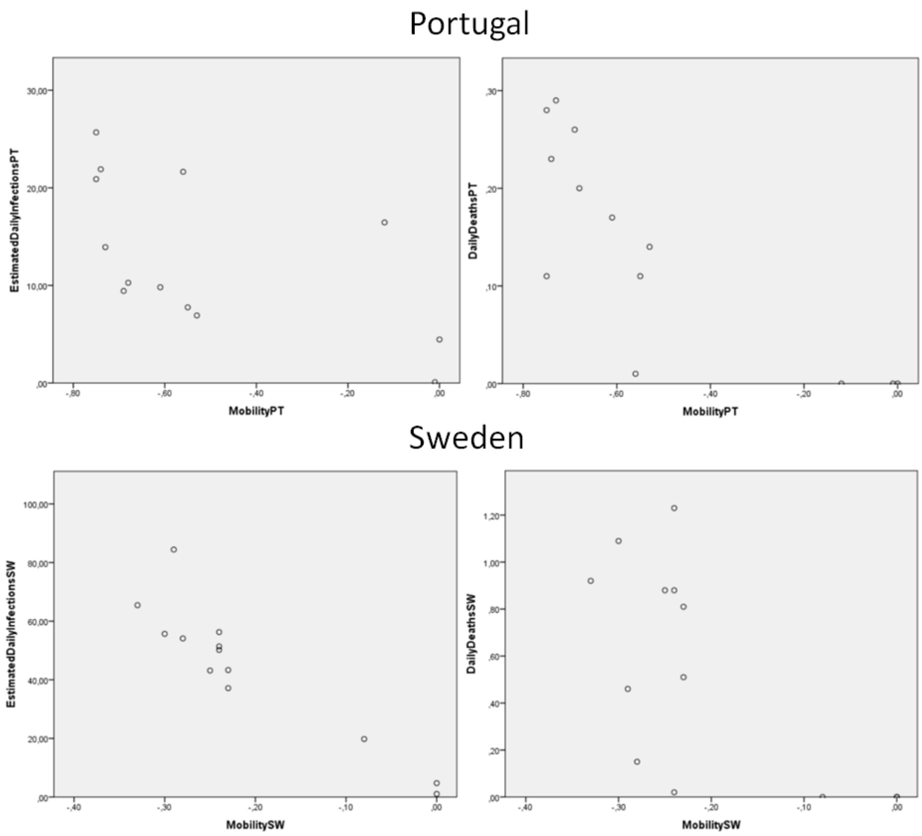
Furthermore, to explore the relationship between the social distancing measures adopted by each country and the evolution of the number of infected and deaths, a linear correlational analysis between these indicators was carried out (Table 5). Two models were considered for this purpose: (i) Model A - evaluates the existing linear correlation between the reduction of mobility and the estimated number of infected people; and (ii) Model B - evaluates the existing linear correlation between the reduction of mobility and the number of deaths. The findings reveal distinct behaviours of both countries. In Portugal, the linear correlation in model A is weak (Adjusted R Square < 0.30) which indicates that social distancing measures were significant to reduce contagion but did not have a determinant effect in reducing the number of deaths. On the contrary, in Sweden, the high infection rate was determined by the mobility variable (Adjusted R Square > 0.80), but the same did not occur for the number of deaths.

Table 5. Correlational analysis

Measure	Portugal		Sweden	
	Model A	Model B	Model A	Model B
R	0.583	0.811	0.927	0.649
R Square	0.340	0.658	0.859	0.422
Adjusted R Square	0.280	0.627	0.846	0.369
Std. Error of the Estimate	6.592	0.068	9.187	0.365
F Change	5.669	21.177	67.091	8.019
Sig F. Change	0.036	0.001	$1*e^{-3}$	0.016
Durbin-Watson	0.424	0.881	2.273	0.556

Finally, Figure 3 shows a scatter plot between the reduction in mobility recorded in each country and the number of infections and deaths. In Portugal, due to the weight of the measures of strong mobility restriction, most of the registered values are on the left of each graph. In Sweden, there is a greater dispersion of values in the number of deaths due to mobility fluctuations.

Figure 3. Mapping the social distance and the number of infections and deaths



5 Discussion

Portugal and Sweden had very different approaches concerning the adoption of social distancing measures that had an impact on the evolution curve of COVID-19. The number of deaths recorded from early April until the end of May 2020 indicates that although the IFR is similar, the CFR was approximately three times higher in Sweden. The low number of tests performed in Sweden can explain this behaviour. The latest data available from HMEI for 17th May 2020 indicate that by that date 142.58 tests were performed per 100,000 inhabitants, whereas this value is only 87.29 in Sweden. In other words, approximately 40% fewer tests have been carried out in Sweden than in Portugal. According to Sanchez (2020) and Winter & Hegde (2020), the tests are fundamental in the fight against a highly infectious disease because they allow a rapid identification of cases and isolation of people. This has reduced the rate of spread of the disease. Furthermore, rapid early detection of the disease helps to start treatments more quickly at an early stage and to restrict the progression of the disease to more severe cases.

The difference in the number of tests performed between the two countries also helps to explain the big difference between CDI and EDI. The most critical period in the number of infections carried out occurred approximately in the same period in both countries (between the last week of March and the first week of April 2020). However, the difference between the CDI and EDI in this period was approximately six times greater in Sweden than in Portugal. Indeed, the number of infected people in Sweden in that period was much higher than the number of confirmed cases, which also had the effect of containing the evolution of the curve in the following weeks, as infected people continued to do their normal lives without having the perception that they might be infecting other people. The effects on the spread of COVID-19 on asymptomatic people are still under investigation, but preliminary studies conducted by Ye et al. (2020) indicate that these people are a source of contagion primarily to those closest to them (e.g., relatives). Moreover, Gandhi et al. (2020) state that in epidemics of respiratory viral diseases, most infections do not reach the health authorities. At this time, the real incidence of COVID-19 in asymptomatic people is unknown because most of them have not been tested. It is known that some patients diagnosed during the asymptomatic period progressed to symptomatic illness, while others remained symptom-free. However, asymptomatic people are individuals who can infect others. In Japan, this number is estimated to be at 30 percent, while in Italy it stands at 43% (Petri, 2020).

The social distancing measures imposed in Portugal have led to a major drop in people's mobility. Portugal declared a state of emergency between 19th March and 2nd May to face the COVID-19 (ACM, 2020). During this period, the drop in mobility in Portugal reached 75% in the period 25th March and 15th April 2020 but recovered about 10% in the mobility of people until the end of the state of emergency. This apparently contradictory situation arises due to the fatigue that the state of emergency causes in people. In this sense, and as WHO warns, the state of emergency is only effective if people behave with a high degree of civic confidence (LUSA, 2020). In Sweden, the reduction in mobility was smaller, having exceeded 30% in the first half of April, and was mainly motivated by the strong drop in international mobility due to entry restrictions imposed by several European countries (Dahlberg et al., 2020). In general terms, the mobility drop in Portugal was approximately three times higher than in Sweden.

The behaviour of the number of estimated infections and deaths recorded between both countries showed significant differences, which were not found for the number of confirmed cases. This is because the number of confirmed cases of COVID-19 in both countries was relatively the same, although the number of estimated cases in Sweden was on average 3 times higher. The relationship between the social distancing measures and the estimated number of infected has led to the conclusion that the growth in the number of infected has been progressively lower with the implementation of social distancing measures in Portugal. However, the same effect did not occur when considering the number of deaths. According to DGS (2020), the average age of people who died in Portugal due to COVID-19 is 81.4 years. Furthermore, 40% of the deaths occurred in people who also had other associated pathologies (DGS, 2020). This information is relevant to understand the causes for the measures restricting mobility not having had a positive effect on the number of deaths since these people were quite vulnerable. Additionally, the number of deaths that occurred in home residences in Portugal was particularly critical. Data for 15th May 2020 indicate that 477 individuals died in Portuguese home residences (Balança, 2020). In Sweden, as mobility restrictions were reduced, the infection rate was also clearly higher. According to Perper (2020), Sweden recorded the highest number of deaths in Europe per capita in the week of 13th May 2020. However, the proportion of deaths was not significantly higher considering the total number of estimated infections. This means that the high number of deaths recorded was mainly due to the much higher number of infected individuals. In addition, in Sweden, the elderly in home residences were a rather vulnerable risk group because nearly half of the deaths occurred in care home residents (Savage, 2020).

6 Conclusions

Although Portugal and Sweden have approximately the same number of confirmed cases of COVID-19 between the beginning of March and the end of May 2020 there are very significant differences in the number of deaths in Sweden. The CFR in Sweden was three times higher in that period than in Portugal. Two reasons justify this behaviour. On the one hand, Sweden performed 40% fewer tests on COVID-19 than Portugal, which means that the number of confirmed cases is underestimated. Data released by HMEI indicate that the potential number of people infected by COVID-19 in Sweden was approximately 12 times higher than the number of confirmed cases, while in Portugal it is reduced to 4 times. On the other hand, the social distancing measures imposed in Portugal caused a strong restriction of mobility reaching 75% during the period of emergency. This situation reduced the sources of contagion and relieved the national health system of possible exponential growth in the number of cases that would jeopardize patient care.

The social distancing imposed in Portugal was determinant in reducing the number of contagions, but it did not have the same determining effect in reducing the number of deaths. The strong incidence that COVID-19 had on the elderly population, who already had vulnerable health conditions and other associated pathologies, made the proportion of the number of deaths registered considering the total potential of infected individuals identical to Sweden. In both countries, the elderly population was particularly vulnerable, with an incidence for the elderly in home residences. In both countries, the number of deaths registered in home residences represented between 40%-50% of the total number of deaths due to COVID-19.

This study offers both theoretical and practical contributions. From a conceptual perspective, this study is relevant in exploring the relationship between social distancing measures and the number of infected and deaths with COVID-19. From a practical standpoint, this relationship has been applied in two countries (i.e. Portugal and Sweden) that have implemented very heterogeneous social distancing measures. This dichotomous approach is important to understand the rate of propagation of COVID-19 in these two countries. At this stage of the spread of COVID-19, it is evident that measures restricting social mobility to the entire population are most effective at an early stage of the spread of the disease, while selective control measures should be applied when there are localized outbreaks. Equally important is the existence of a high percentage of tests in the population to mitigate the spread of the disease early and to prevent its spread throughout the community. Three relevant limitations can be noted in this study. First, social distancing measures are grouped, and it was not possible to isolate the individual impact of each of these measures. Secondly, the number of infected and deaths in each country does not characterize the impact of the age group. In this sense, and as future work, it is relevant to explore the impact of social distancing measures within each age group. It would also be relevant to explore the economic and social effects of social distancing measures. Finally, the study does not estimate the effects of a possible second wave of OVID-19, which does not allow an unambiguous assessment of the effectiveness of the measures imposed by each government to control the spread and effects of the pandemic.

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