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Covid-19 vaccination, fear and anxiety: Evidence from Google search trends

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ABSTRACT

Covid-19 vaccination was associated with a general feeling of hesitancy, and its arrival increased fear and economic anxiety. This paper investigates the impacts of Covid-19 vaccination on fear and economic anxiety using a worldwide sample of 194 countries observed from December 1st, 2020 to March 4th, 2021. The difference-in-differences investigation approach shows that with the vaccine’s arrival, the Google search trends measuring fear and anxiety are increasing. The arrival of the vaccine has created a general feeling of fear, and people have a lack of confidence in the vaccine’s efficiency to overcome the Covid-19 crisis. Specifically, anxiety increased when the delta variant was discovered in India. Governments’ interventions must ensure that the Covid-19 vaccine does not have adverse side effects that can harm public health. We suggested that policy makers should focus on increasing the number of older adults willing to receive the vaccine. It can be effective in explaining the benefits of the vaccine, and denying false information about the vaccine and its serious side effects.

1. Introduction

The World Health Organization (WHO) declared the Covid-19 a public health emergency of international concern on 30 January 2020, and a pandemic on 11 March 2020. Since then, scientists worldwide have been trying to produce a vaccine capable of overcoming the crisis and allowing the return to normal life. The Covid-19 vaccination is indeed crucial to overcome the current crisis, and limit the spread of the pandemic. However, the major concern for public health authorities and vaccination strategy is the complex issue of vaccine hesitancy, which makes it difficult to find people willing to get vaccinated. The vaccine’s arrival increased fear and economic anxiety, because of the low rate of acceptance and the rapidity of its development and supply.

Several research papers related to the interaction between social science and medicine have been published to differentiate between the many types of fears and anxiety, and demonstrate the link between vaccine acceptance and fear and anxiety, while considering topics such as survivalism, economic recession and conspiracy theory (see, Bendau et al. (2021a,b); Taylor et al. (2020); Karlsson et al. (2021); Lin et al. (2021); Ran et al. (2020); Bechtel et al. (2020); Yousfi et al. (2021); Managi et al. (2022)).

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This inquiry contributes to the ongoing debate about the relationship between Covid-19 Vaccination and fear and anxiety, through an original investigation based on a worldwide sample of 194 countries. The main concern of this study is to explain and demonstrate the impact of Covid-19 vaccination on fear and economic anxiety, measured by Google search trends for different topics (i.e., economic recession, stock market crash, survivalism, and conspiracy theory). The investigation was empirically performed using difference-in-differences regression.

We show that with the vaccine’s arrival, Google search trends measuring fear and anxiety are increasing. Indeed, the arrival of the vaccine has created a general feeling of fear, and people have a lack of confidence in vaccines’ efficiency to overcome the current crisis. This can explain the positive impact of the arrival of the Covid-19 vaccination on Google research trends relating to economic anxiety. Our results are robust to the alternative representation of the dependent variable in the difference-in-differences regression. In addition, we show that trends related to anxiety increased when the delta variant appeared in India. In contrast, the lowest anxiety levels were associated with the appearance of the Alpha variant in UK.

We find that the initial outbreak severely increases all four measures of fear and anxiety in a scenario where the rate of infections moves from
increasing very slowly to increasing rapidly.

The remainder of the paper is organized as follows. Section 2 describes the research methodology. Section 3 describes our dataset and Section 4 lays out the results. Section 5 summarises and concludes the paper.

2. Methods

We investigated the relationship between Covid-19 vaccination and fear and economic anxiety, using a difference-in-differences regression estimated through panel data. The panel data described a worldwide sample of 194 countries. Following Fetzer et al. (2020), we consider the following difference-in-differences regression:

\[ Y_{c,t} = \alpha_c + \delta_{c,t} + \beta \cdot C_{c,t} + \epsilon_{c,t} \]  

(1)

where \( Y_{c,t} \) denotes the search intensity in country \( c \), on day \( t \), for a specific topic related to fear and anxiety. \( C_{c,t} \) is a dummy variable indicating at least one confirmed case of Covid-19, or having had at least one vaccination in country \( c \) at time \( t \). The difference-in-differences is a quantitative research approach generally used to simulate experimental research. Specifically, it can calculate the treatment effect when certain groups are exposed to a treatment and others are not. This approach is very useful to test the effect of vaccine’s arrival on fear and economic anxiety. The difference-in-differences method was recently used by scholars to investigate several research questions related to social science and medicine (see Groeniger et al., 2021; Nyagwachi et al., 2020; Zhou et al., 2021; Miyawaki et al., 2017).

The regression control for country fixed effects \( \alpha_c \), absorbing different fixed and time-invariant levels of search intensities across countries. The time fixed effects \( \delta_{c,t} \) absorb a level shifter for each day, capturing the global trend. We cluster standard errors at the country level. This analysis intuitively captures the impact of the local arrival of the vaccine, conditional on the global trend.

3. Data description

The data on covid-19 daily reported cases, death and recovered cases was obtained from Dong et al. (2020), via https://github.com/CSSEGISandData/COVID-19. The data on vaccination are based on official reports by the WHO and national authorities.

The level of our analysis is country-day. The included dates range from December 1st, 2020 to March 4th, 2021. The data on Google searches were downloaded from the Google API.

Table 1 provides a descriptive summary statistic of the variables included in the model, across the sample period. In panel A, we reported the basic descriptive statistics of the topics representing fear and economic anxiety, from Google search trends data. The latter is an index consisting survivalism means that the Google search trend on survivalism countries in terms of economic anxiety. The lowest variability characterized by the nature of the correlation between the different measures of fear and economic anxiety and the Covid-19 confirmed cases, deaths, and recovery. The correlation table shows a positive correlation between the variables. The highest correlation is between the Covid-19 confirmed cases and deaths. However, the lowest correlation between Covid-19 recovered and the google search trend related to conspiracy theory. Therefore, people cured of Covid-19 are no longer interested in looking for the evolution of the pandemic. Finally, we noticed the positive correlation between the different measures of anxiety (i.e., recession, survivalism, conspiracy theory and stock market crash).

4. Empirical results

We investigated the impact of Covid-19 vaccination on Google search trends related to different topics representing fear and economic anxiety. We estimated Eq. (1) using the difference-in-differences method and checked the robustness of our results using an additional measure of the dependent variable. Table 3 displays the impact of the vaccine’s arrival on Google searches, for search trends related to economic anxiety. Column 1 shows the results for Google searches related to recessions, Column 2 for those related to stock market crashes, Column 3 for conspiracy topics, and Column 4 for survivalism. The dependent variable measures the Google search intensity for the indicated topics, normalized by the average search intensity in a country prior to the vaccine’s arrival. In panel A, we show the impact of a dummy variable, indicating at least one coronavirus case. In Panel B, we show the impact of having at least one vaccination. The table displays coefficients that are estimated using a linear regression model, with country fixed effects and day fixed effects.

Specifically, for the normalization, we use the mean search intensity between 1st December 2020 and the date of arrival of the vaccine in a given country. This normalization makes the coefficient estimates interpretable as percentage changes relative to the pre-vaccine level, without having to resort to the mean of the dependent variable for interpretation.

As we can see from Table 3, all negative impacts of Covid-19 cases, in a specific country, on Google search trends for economic recession, stock market crash, conspiracy theory and survivalism, become positive impacts when the Covid-19 vaccination arrives in a given country. Intuitively, the arrival of vaccine creates a general feeling of fear, and people have a lack of confidence in vaccines’ efficiency to overcome the health crisis. This can explain the positive impact of the Covid-19 vaccination arrival on Google search trends related to economic anxiety. Search trends on Google, related to all topics (i.e., recession, stock market crash, conspiracy theory and survivalism) have increased after the vaccine’s

Table 1

| Variables                | No of obs. | Mean | St. Dev. | Minimum | Maximum |
|--------------------------|------------|------|----------|---------|---------|
| Panel A                  |            |      |          |         |         |
| Recession                | 17,460     | 6.63 | 13.00    | 0       | 100     |
| Conspiracy Theory        | 17,460     | 5.20 | 11.19    | 0       | 100     |
| Stock Market Crash       | 17,460     | 2.29 | 7.14     | 0       | 100     |
| Survivalism              | 17,460     | 1.90 | 6.06     | 0       | 100     |
| Panel B                  |            |      |          |         |         |
| Covid-19 confirmed cases | 3276       | 605.01 | 6179.41 | 0 | 80,151 |
| Covid-19 deaths          | 3276       | 17.41 | 191.28   | 0 | 2945    |
| Covid-19 recovered       | 3276       | 158.18 | 2133.75 | 0 | 47,404 |
arrival. Specifically, this kind of feeling of insecurity has characterized many people in the post Covid-19 period. Ran et al. (2020); Ward et al. (2020) show a high prevalence of psychological distress among the general population at the peak of the COVID-19 pandemic in China, which is negatively correlated with resilience. The results reported in Table 3 show that fear and anxiety increased with the Covid-19 vaccination. However, the positive impact of Covid-19 vaccination arrival on fear and anxiety is still statistically significant upon including Google search trends related to economic recession and survivalism. This result confirms that fear and anxiety become more important after the vaccine arrival.

To check the robustness of our results, we estimated the same regression without normalization of the dependent variable in Table 4. We can clearly see from this table that the results are robust, and the coefficients have the same positive impacts. Furthermore, the impact of the vaccine’s arrival on public fear and anxiety is significant for all topics.

By deeply investigating the evolution of fear and anxiety related to different topics, and different Covid-19 variants, we produced Fig. 1 and Fig. 2. We used data from 1 December to 18 May 2021. Fig. 1 shows the position of Google search trends on different topics, measuring fear and anxiety, with respect to Covid-19 vaccination and infections.

Notes: Standard errors clustered at the country level are presented in parentheses. ***, **, and * stand for significance at the 1%, 5%, and 10% levels, respectively.

Recession, stock market crash, conspiracy theory and survivalism are represented by the blue, black, purple, and red graphs, respectively. We find that the initial outbreak severity increased all four measures of fear and anxiety, when moving from a scenario where the rate of infections increases very slowly to one where they increase rapidly. In addition, we find similar sensitivities when outbreak severity is conceptualized by the number of infections. However, policy responses, to the outbreak decrease, have caused reductions in fear and anxiety.

In Fig. 2, we plot different Covid-19 variants to see their impacts on anxiety topics. Three variants are represented in Fig. 2. They are Alpha (UK), Beta (South Africa) and Delta (India). The position of the Delta variant is the highest compared to others, for all anxiety topics measure. In contrast, the lowest levels of anxiety are associated with the appearance of the Alpha variant in UK.

The evolution of the Covid-19 confirmed cases and the policy responses represented by the Covid-19 vaccination must be an important tool to detect graphically the direct impacts of countries’ responses to the pandemic. Moreover, the monthly evolution of the Covid-19 vaccination during the period of the study must show the efficiency, as time goes by, of the policy responses to the increase of the Covid-19 confirmed cases. We plotted, in Fig. 3, the policy responses to Covid-19 confirmed cases by Covid-19 variants (i.e., Alpha, Beta, Delta). Fig. 3 shows an upward trend of the Covid-19 vaccination regardless of the Covid-19 variant. In addition, the monthly evolution of the policy

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1 We use Google Trends data of individual well-being.
responses shows the same upward trend of the vaccination with a slight stabilisation after June 2021. This stabilisation can be explained by the worldwide fear of hesitancy regarding the Covid-19 vaccination adverse effects.

5. Conclusion

People experienced fear mostly due to the novelty and uncertainties associated with the disease. Measured using Google search trends on specific topics, fear and economic anxiety are highly influenced by the Covid-19 vaccination arrival. Using a novel difference-in-differences
regression, this paper assessed the impacts of Covid-19 vaccination on fear and economic anxiety. We differentiated economic anxiety by considering four major topics including recession, stock market crash, survivalism, and conspiracy theory. Our results are robust to the change of the dependent variable measure, showing that fear and economic anxiety have increased after the vaccine's arrival. Feeling fearful and being afraid are feelings related to uncertainty and false information spread in the media.

Fear and economic anxiety of Covid-19 vaccination are positively correlated. In addition, most of related research results showed that fear and anxiety related to Covid-19 vaccination are likely to increase with psychological distress. Our findings can be useful for policy makers to take more appropriate actions and decisions. Their interventions can be effectively addressed to ameliorate public awareness of Covid-19 vaccination impacts, and its ability to protect people from infection. Government interventions must ensure that the Covid-19 vaccine does not have severe adverse side effects that can harm public health. We suggest that policy makers focus on increasing the number of older adults willing to receive the vaccine. It can be effective in explaining the benefits of vaccination and deny false information about the vaccine and its serious side effects. In addition, governments can make Covid-19 vaccination compulsory for adults, to ensure protection of public health.

Author statement

Awijen Haithem: Data Collection, modelling, Formal analysis, Younes ben Zaied: Writing final version, interpretation of results, Duc Nguyen: Writing Final version, Supervision, revision.

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