



The impact of the removal of Zero-COVID policies on subjective well-being: Evidence from a digital world

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ABSTRACT

Administrative restrictions on public mobility may impose significant well-being impacts on society. For instance, there has been a wide discussion on the psychological effects of lockdown policies during the pandemic. However, there is limited knowledge regarding the consequences of the policy transition and the uncertainty that arises from shifting from tight to loose regulations. The unexpected removal of Zero-COVID policies in China provides a special opportunity to study how policy uncertainty may affect mental health or subjective well-being. We use the Baidu Index data to test the effects of switching toward a “live-with-COVID” policy and the consequent rapid COVID spread on the frequency of well-being related search terms in China. Through a three-phase difference-in-differences approach with multiple years to check parallel sentiment trends, we find a substantial increase in fear and social dysfunction during the Transition Period when COVID-related restrictions were not fully lifted, as well as in the following Free-Spread Period. In comparison, the increase of anxiety mainly took place in the Transition Period. However, searches for anger and negative behaviors stayed relatively stable. Our results suggest that the removal of Zero-COVID policies, especially the Transition Period that generated policy uncertainty, significantly affected people's mental health.

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1. Introduction

The winter of 2022 was a watershed of China's COVID response: China turned from a stringent Zero-COVID policy to a Live-with-COVID strategy that almost allowed free spread of COVID-19. By December 8th, 2022, all provinces had removed nucleic acid test requirements for entering public space and transportation, signaling the “full removal” of Zero-COVID policies and the completion of this policy transition. A research team at Peking University showed that this sharp change caused a rapid spread of the disease, with some provinces reaching an infection rate of over 90% within a month (Yong, 2023). Research has been conclusive about the direct impacts of this policy removal on physical health, but less about the subjective well-being (SWB) or mental health impacts. Besides, the four-week transition in between provides us an opportunity to study the impacts of uncertainty: previously on November 11th, 2022, the Chinese government released a notice of 20 Measures to “optimize” COVID prevention and control (including reducing

quarantine time for travelers and canceling quarantine for secondary contacts of patients), signaling the policy transition. This immediately incurred significant uncertainty about the direction of China's future COVID response: to further remove all restrictions, preserve low-level control, or resume stringency after tentative changes? People with heterogeneous socioeconomic backgrounds, political values, and health beliefs bear different, or even opposite, expectations and attitudes, causing intensive disputes in the public cyber space. This leaves the net SWB effect of lifting restrictions an empirical question: overall, in which direction did the removal of Zero-COVID policies impact public SWB?

In this paper, we aim to provide an answer by analyzing online search trends. As suggested by Brodeur et al. (2021) and Zhou et al. (2023), search data is a reliable source for studying public well-being and mental health. Upon the occurrence of an important event, one can easily observe changes in search frequencies of emotion-related words, which could proxy SWB. For example, Brodeur et al. (2021) used Google Trends data to investigate the SWB effects of COVID lockdowns in the Western world.

We can distinguish the effects in two post-20 Measures phases, i.e., during the four-week transition (Transition Period) and after fully removing Zero-COVID policies (Free-Spread Period). This

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makes a three-phase difference-in-differences (DiD) approach necessary, and we follow the strategy that Albuquerque et al. (2020) took in studying the effects of COVID-19 shocks on stock markets. The Transition Period provides a special setting where China moves from a most stringent pandemic policy to a least stringent one, enabling us to discuss a less explored topic in the literature—policy uncertainty and SWB change (Tafere et al., 2019). The investigation of transition differentiates our research from past studies on COVID policies per se and SWB (Fancourt et al., 2021; Clark and Lepinteur, 2022). The Free-Spread Period allows us to explore the SWB change after the full removal of COVID restrictions, along with skyrocketing COVID cases and deaths.

Our DiD approach reveals that people's SWB was compromised in both periods, especially in the Transition Period, compared to the pre-treatment period, after differencing out the general trend in the control year. Different SWB measures provide a rich understanding of the policy effect, with some aspects of SWB (e.g., anxiety reflected by the word “trouble” and fear by “panic”) being particularly salient.

The rest of our paper is structured as follows. We introduce data and empirical strategy in Section 2, demonstrate estimation results in Section 3, and discuss further implications and limitations in Section 4.

2. Data and empirical strategy

2.1. Baidu index data

Baidu is the primary search engine in China with a market share of over 70%. Therefore, we can study the overall SWB change through investigating the search frequencies of SWB-related words on the platform. This practice has been documented effective by several epidemiological studies amid COVID-19 lockdowns (Chen and Zhang, 2020; Zhou et al., 2023).

A search-term query on Baidu Index depicts searches for that exact search term. We designed our query strategy by including all words in Brodeur et al. (2021) and adding 11 SWB-related words which potentially fit Chinese contexts better. We then submitted 24 search-term queries (full bilingual list in the Appendix) to Baidu Index between October 7th and December 31st,¹ in both 2021 and 2022. For robustness, we also investigated the same time period in 2019 (DiD results in the Appendix), which is right before the pandemic. Results are largely consistent for most search items, but effect sizes for fear and negative behaviors are slightly larger with 2019 instead of 2021 as the control.

Unlike the Google Trends dataset that normalizes the number of searches using different denominators for different geographic and time ranges, the numbers of Baidu Index reflect a monotonic mapping to actual searches across all periods and regions. Thus, we followed Brodeur et al. (2021) and normalized the numbers (S) on each day i in each province p between 0 and 100 by:

$$S_{i,p,2021-2022}^* = \frac{S_{i,p,2021-2022}}{\max_{i,p,2021-2022}(S_{i,p,2021-2022})} \times 100$$

with “ $\max_{i,p,2021-2022}$ ” being the global maximum of a search query across all days and provinces within the selected periods.

¹ We excluded January when defining the Free-Spread Period due to different holiday schedules across years and the early development of the pandemic in January 2020. We excluded October 7th–13th to balance the pre-treatment and free-spread lengths as a robustness check (see Figure A3).

2.2. Empirical strategy

We use a three-phase DiD strategy that compared SWB-related searching behaviors in three time periods: (1) the Pre-treatment Period before 20 Measures (between October 7th and November 11th for all provinces), (2) the Transition Period after 20 Measures but before the removal of nucleic acid test requirements, and (3) the Free-Spread Period after fully removing nucleic acid test requirements (starting from Dec. 2 to Dec. 8 for different provinces), in 2022, to the same queries during the same periods in 2021,² minimizing the potentially confounding seasonal effects. Our DiD regression model is as follows:

$$S_{i,p}^* = \alpha T_{i,p} \times Year_i + \alpha' F_{i,p} \times Year_i + \beta T_{i,p} + \beta' F_{i,p} + \gamma X_{i,p} + \mu_i + \rho_p + \epsilon_{i,p}$$

where α indicates the effect of the policy transition on search term $S_{i,p}^*$ on day i in province p , and α' reflects the effect of fully removing Zero-COVID policies. $T_{i,p}$ and $F_{i,p}$ represent the dummy variables taking value one during the policy transition and the post-removal periods, respectively. The year of policy change, 2022, compares with 2021 when Zero-COVID policies were sustained throughout the year. Province, year, week, and day fixed effects are all included.

The vector $X_{i,p}$ controls for the same-day searches of keywords related to pandemic severity, such as symptom-related queries (e.g., fever, cough) and death-related queries (e.g., crematorium, funeral parlor). We refrain from using official reports for severity control because the data had turned highly incomplete since late November 2022. We determine that our results are consistent and reliable, regardless of whether these controls are included.³

3. Results

3.1. Graphical analysis

To visualize our identification strategy and check parallel trends, we compare the national searches in the three phases in 2022 with the same periods in 2021 and 2019. Fig. 1 plots seven of the daily searching topics (others are available upon request due to space limit). The 2021 comparison worked for all topics, in the sense of parallel trends, except for “wellbeing” where the comparison is to 2019.

3.2. DiD estimation results

Fig. 2 gauges the size of the estimated effects on the 24 queries in six categories. The top and the bottom graphs respectively demonstrate the transition and full-removal periods. During the Transition Period, the search levels of *social dysfunction* (2 of 4), *anxiety* (2 of 5) and *fear* (3 of 4) all experienced considerable increases. Interestingly, the search level of *happiness* (2 of 6) had some positive changes (“suicide” decreased by 0.35 standard deviation [SD] and “wellbeing” increased). The net effect size for the word “trouble” was enormous, with a 1.35 SD change, comparable to the largest detected effect in Brodeur et al. (2021). Also, the query of “divorce” had a significant (at 5% level) increase.

In the full-removal period, queries about *fear* and *social dysfunction* still experienced an increase, with “panic” (0.56 SD)

² It is arguably a better control year than 2019 given the structural changes of economic activities during 2019–2021, and 2021 provides potentially more parallel trends in technology, income, inequality, and “pre-treatment” policy conditions (e.g., COVID-19 related policies before November 11th in each year).

³ The results show minimal changes even when excluding this vector. As shown by the time trends of these controls, the rapid spread of COVID-19 has not allowed for significant regional differences. Detailed regression results are available upon request.

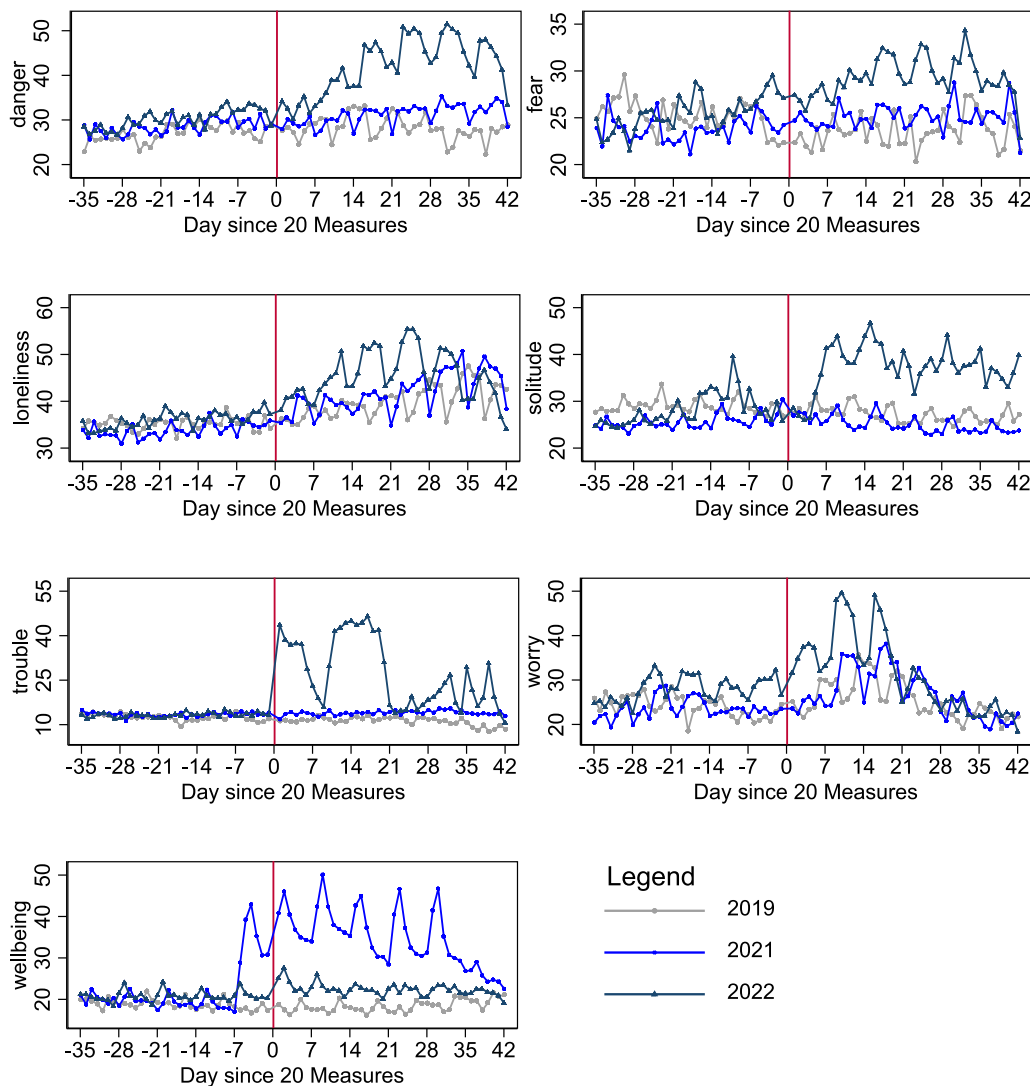


Fig. 1. National Baidu indices for selected words before and after the release of 20 Measures.

and “solitude” (0.40 SD) having the largest effect sizes. However, the effect on *anxiety* mostly faded away. The only query that increased in this category during the Free-Spread Period is “trouble” (0.41 SD) while others all experienced a decrease, counteracting the effect driven by “trouble” and potentially leading to a null net effect of this category. The increase in *happiness* was driven by a decrease in “depression”, but counteracted by a drop in “contentment”.

Combining the two analyses (Figure A1), we concluded that the effects on *fear* were persistent in both periods. The *social dysfunction* effect was salient based on “solitude”, but the evidence for the group’s persistence was marginal. The *anxiety* and *happiness* effects were mainly prevalent when deregulation was still in uncertainty.

4. Discussion

Our results suggest that most search terms for negative emotions had increased during the two stages of deregulation, indicating a negative net effect of Zero-COVID policy removal on Chinese internet users’ mental health. Yet surprisingly, the peak of SWB loss (9 negative and 2 positive changes in the Transition Period versus 7 negative and 9 positive changes in the Free-Spread Period) was inconsistent with the peak of infection in mid- and late-December. Why?

We argue that one key mechanism might be policy uncertainty. During the Transition Period, Chinese residents were facing multiple information sources regarding future policies and conflicting opinions about whether and when the COVID restrictions would be lifted. This may cause extra mental workload and increase anxiety (for related literature, see [Kominers et al., 2018](#)) for individuals to update their policy belief and prepare for personal COVID responses accordingly. Nevertheless, anxiety mostly faded when a “live-with-COVID” state was finally realized, with four related search items falling below the baseline. The SWB loss during the Free-Spread period was mainly due to the *social dysfunction* and *fear* rather than *anxiety*, coherent with past findings on the effects of lockdowns ([Brodeur et al., 2021](#)); the fact that *anxiety* did not stand out might link to [Fancourt et al. \(2021\)](#) and [Clark and Lepinteur \(2022\)](#)’s findings on the negative correlations between lockdowns and SWB.

The relationship we detected between policy uncertainty and anxiety is not uncommon. Past studies also found political changes like Brexit ([Ruiz and Vargas-Silva, 2021](#)) and Trump election ([Hoyt et al., 2018](#)) accountable for anxiety. Because anxiety may not only significantly harm mental health and SWB, but also impair cognitive performance and productivity ([Ruiz and Vargas-Silva, 2021](#)), it is worth a larger audience in economics. This paper adds an insight that transition between political states

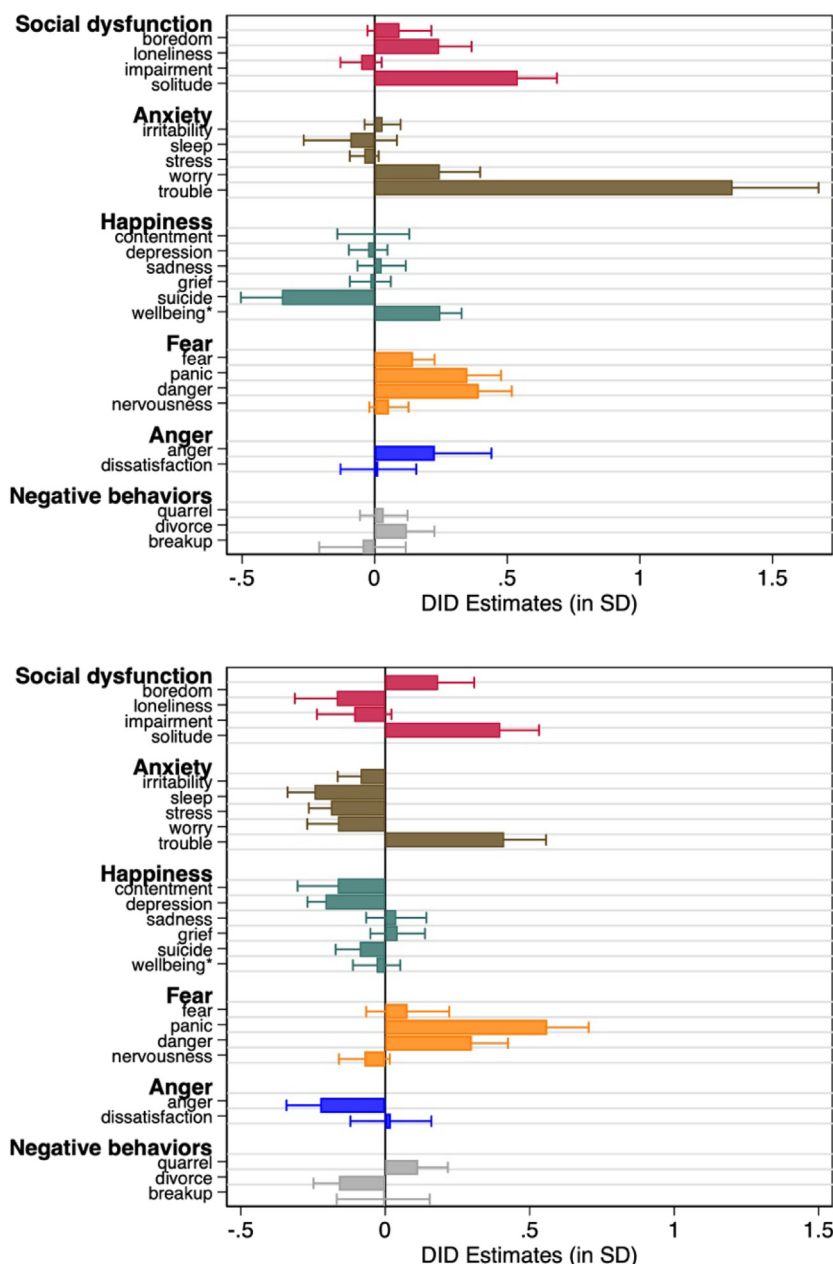


Fig. 2. The effects of Transition Period (top panel, from November 11th to the removal of nucleic test requirements, varied across provinces) and Free-Spread Period (bottom panel, from the removal of nucleic test requirements to the end of 2022) on SWB-related searches. Each bar represents a DiD estimate with 2021 as the control year (except for wellbeing using 2019), controlling for the pandemic severity, province, year, week, and day of the week fixed effects. We use robust standard errors clustered at the day level. The effect sizes are in terms of the SD of each search term across days and provinces. The lines refer to 95% confidence intervals.

can particularly arouse anxiety, highlighting the importance of carefully scheduling policy transition. Moreover, misinformation and public dispute may aggravate this effect.

Apart from this study, it may be intriguing to investigate whether our findings and proposed mechanisms work robustly in different political and economic environments. Another direction for next steps is to extend data sources: since online searches are asymmetrically frequently used by younger and richer socioeconomic groups, who are arguably less vulnerable to COVID-19 infections, future studies could benefit from directly investigating more vulnerable social groups during policy transition and compare it with results based on searching trends. Finally, it is interesting to note that during the Transition Period, in the happiness domain, “wellbeing” searches increased and “suicide” searches decreased, indicating a “positive” SWB change, deviating from the general pattern. We argue that this pattern might be a

result of gaps in shaping the preference among different social groups. It will be particularly interesting for future researchers to investigate the socioeconomic and ideological foundation of this preference gap.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary material related to this article can be found online at <https://doi.org/10.1016/j.econlet.2023.111189>.

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